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JUNE 1956

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(see page 40)

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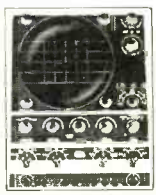

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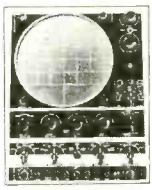

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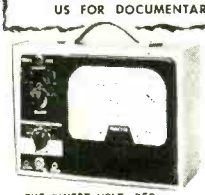

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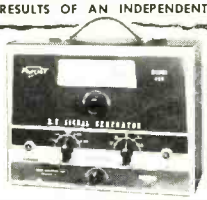

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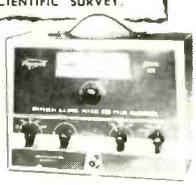

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SUBSCRIPTION RATES: One year U.S. and possessions, and Canada $3.00; Pan-American Union Countries $3.50; all other foreign countries $4.00.

POPULAR ELECTRONICS

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Average Net Paid Circulation 205,193

JUNE 1956

VOL. 4—NUMBER 6

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ITEMS OF INTEREST

NEW PRODUCTS

See also page 52 (What's New in Hi-Fi)

COMING NEXT MONTH

POPULAR ELECTRONICS

Two-Penny Direction Finders

Simple ideas on how to use a regular AM portable receiver as a temporary direction finder. Especially slanted towards readers going on hunting parties or boating trips.

Workbench Power Supply

There's no use getting involved in a "big" wiring project during the hot summer months. But this easily assembled power supply will prove its weight in gold next fall. Why not put it together on a rainy day?

Single Transistor Megaphone

Look for the blue sky cover of POP'tronics with the girl holding the single transistor megaphone. Handy electronic "talker" can be built in a few hours using only SEVEN components. The secret is in the transistor!

Robots Behind Your Phone

What happens when you dial? A few finger flicks pick your party among millions. Here is everyday automation at work.

IN THIS MONTH'S

RADIO & TELEVISION NEWS

(JUNE)

Person-to-Person Communications
Simplified Preamp
Marine Radio
Construction of a Wrist Radio
Buying a Loudspeaker?
A 50-Watt Power Amplifier

By JOHN T. FRYE

Geniuses at Work

FOR AN HOUR Carl and Jerry had been working away on separate projects at opposite ends of the workbench in their basement laboratory. Each was too stubborn to ask what the other was doing, but the puzzled glances each of them sneaked at the other's equipment from time to time revealed how great was the strain. Finally Jerry cracked.

"So, okay; I give up. What are you doing with that timer clock, making a time bomb?"

"Not at all," Carl answered, taking off his horn-rimmed glasses and wiping them with a very dubious-looking handkerchief. "You know what a large charge I get out of these bright, warm, sunny, sparkling summer mornings. I don't want to miss a single one of them, and this timer clock I built from that article in the May, 1955, issue of POPULAR ELECTRONICS will make sure that I won't. A 110-volt a. c. electric gong that used to be in a fire station is plugged into the 'turn on' outlet on the back of the timer and converts it into an electric alarm clock that nobody, but *nobody,* can ignore."

"At the same time," Carl continued, "you know that my second love is sleeping, and nothing gripes me quite so much as to have that gong bounce me out of bed only to discover it's a cloudy or rainy morning good only for staying in the sack. What I'm doing now is taking out insurance against such a revolting development. This sun-battery photocell will be mounted outside my window where the rays of the rising sun can shine directly on it. Leads will go from the cell to a sensitive relay whose contacts close only when direct sunlight falls on the cell. These contacts are inserted in one of the leads going to the gong, and—"

"I get it," Jerry broke in, admiringly. "If it's a cloudy day, the relay contacts will stay open and keep the timer from ringing the gong; but if the sun is shining, then the timer clock will wake you—and doubtless the rest of the household—at the time for which it is set. My boy, you're a real brain!"

"Really nothing," Carl said, with airy

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CARL & JERRY (*Continued from page 8*)

modesty. "What are you doing there?"

"Well," Jerry said hesitantly, "I guess you might say I was making a mug-trap."

"You're not getting through to me. Try another wavelength."

"IT'S THIS WAY," Jerry explained. "My Uncle Walter, who lives on a farm just south of town, has something very funny going on in his henhouse. About every other night, something or somebody —probably the latter—goes into the henhouse, tears up the hens' nests, and scatters them all over the floor."

"Why do you say it's probably 'somebody'?"

"Because my uncle thinks that only a human being would be able to unfasten the rather complicated latch on the door. He says, too, that if it were a fox or a skunk or a weasel, such an animal would kill the chickens and eat them; but all the mysterious visitor does is scare heck out of the hens. They're so nervous that their egg-laying is falling off."

"A hen with a nervous breakdown is something I've got to see," Carl said with a grin; "but where do you fit into all this?"

"Uncle Walt, who realizes I'm an electronic genius, wants me to help him catch the critter, or at least to find out what it is. He doesn't want to use any ordinary kind of trap because he suspects that maybe kids are doing the mischief, and naturally he wouldn't want to hurt them. At the same time, he doesn't want just to sit around and have his prize hens scared silly."

"What've you got in mind?"

"I can show you a lot easier than tell you. Why don't you go out to Uncle Walt's with me and stay all night? You can tell your mom I invited you."

"It's a deal! Wait until I get my leg-power hot rod, and I'll be right with you. I've got to see this *Strange Case of the Harassed Hens* to a finish."

Carl's mother had no objection, and soon the boys were riding their bikes toward the farm. As was always the case when something interesting was in prospect, they didn't use the seats of the bicycles much, and they soon arrived at the prosperous-looking farm of Jerry's uncle. Uncle Walt was a tall lean man with bright blue eyes set deep in a lined and weathered face. After Jerry had introduced Carl and explained that he was going to stay all night, the man turned to his nephew and said, "Well, how about it, Marconi? Are you all set to give our mysterious visitor his comeuppance?"

"I think so, Uncle Walt. If you don't

CARL & JERRY (*Continued from page* 10)

mind, Carl and I will get busy right away setting up the—the—the device."

"Be my guests, boys!" Uncle Walt said with a grin, waving toward the neat, well-painted chicken house. "I'll go and start the milking."

"FIRST," Jerry said, as he started unloading the cardboard box he had brought along, "we'll mount this normally closed Microswitch on the door jamb so that its contacts are held open by the closed door, and so that the contacts will close just as soon as the door starts to open. As you can see, the switch is inserted in one wire of this line cord, which will go from an outlet socket inside the chicken stable to the rotary solenoid fastened to this board with the camera."

"Hold it! What exactly *is* a rotary solenoid?"

"It's a solenoid that twists a shaft through an arc of several degrees when current is applied to it, instead of moving a plunger as the ordinary solenoid does. The little arm fastened to the rotating shaft connects through this small spring to the shutter release of the camera. And notice that at the end of the little arm's

"First," Jerry said, "we'll mount this normally closed Microswitch on the door jamb so that its contacts are held open by the closed door . . ."

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CARL & JERRY (*Continued from page 12*)

travel it flips this toggle switch from *on* to *off*."

"Two questions: why use the spring, and what does the toggle switch do?"

"The first thought of any experimenter or technician worth his salt is to protect his equipment against possible damage, and that's the function of both the spring and the switch. This rotary solenoid is very fast-acting, and I was afraid it might injure the camera unless a shock-absorbing linkage was used between the arm and the shutter release. Also, this solenoid is intended only for intermittent use and would overheat and be destroyed if current were allowed to remain on it for a long period of time, as would happen if the door of the chicken house were left ajar. The switch is in series with the Microswitch and takes the voltage off the solenoid after it has done its job of tripping the camera. What's more, with this switch in the *off* position, the door can be opened without tripping the camera—an important factor in setting things up, testing, or using the door during daylight hours when we don't need to have the trap set."

"Where will the camera be placed?"

"Back inside this box to protect it from the weather. The lens will be focused on the door, and when the solenoid trips the shutter, the synchronized flash will light up the whole area, providing us with a fine 'mug-shot' of whoever or whatever is fooling with the door."

Carl walked slowly around, studying the layout from all angles.

"I see only one thing wrong," he finally remarked. "If the prowler is human, the firing of the flash bulb is bound to show him where the camera is. What's to prevent his taking camera, evidence, and all along with him?"

"That's using the old hat-rack!" Jerry applauded. "Since it's my camera, that worried me, too. But I've got the solution right here." As he said this, he reached down into the cardboard carton and pulled out an electric bell. "This bell will be connected across the line cord going to the solenoid. It'll be behind the Microswitch but ahead of the toggle switch. That way it'll start to ring as soon as the door is opened, and will keep on ringing until the door is closed or until we come out and shut it off. Beast or human, it would have to be an iron-nerved character to stick around with this bell clanging away."

WITH THE PLAN clearly in mind, the boys set to work and completed the installation in short order. They put the box

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CARL & JERRY (*Continued from page* 14)

housing the camera at one side of the door where it would be most likely to get a good profile shot of anyone looking down at the latch. When everything was in place, Jerry flipped the toggle switch on the camera mounting board to *off* and plugged the line cord into a receptacle inside the building. Instantly the electric bell began to ring loudly; but it stopped when the door was closed. Jerry thrust a bulb into the flash gun mounted on the camera and called to his uncle who was just going to the house with a brimming bucket of milk dangling from each arm:

"Uncle Walt, will you want to go into the chicken house any more during the evening?"

"Nope, I'm all through in there; so you can set your trap. Then you boys come on up to the house and wash up for supper. It ought to be about ready."

After one more final inspection of the wiring, Jerry flipped the toggle switch to *on* and the boys followed Mr. Bishop to the house. There, Mrs. Bishop, who looked a lot more like a club woman than a "typical" farm wife, served a fine country meal consisting of golden-brown store-dressed fried chicken, ready-mixed light biscuits covered with plenty of good yellow margarine, and a dessert of commercially quick-frozen strawberries spread over large mounds of luscious vanilla ice cream from the local ice cream plant.

This huge meal and the outdoor exercise the boys had had made them so sleepy that they were barely able to stay awake until nine o'clock. Right after that, they all went to bed.

IT SEEMED to Jerry that his head had barely touched the pillow before he found himself sitting bolt-upright in bed, staring into the darkness, while the distant ringing of a bell came through the open window. Nimbly he hopped out on the floor and switched on the light, only to discover that Carl was already tugging his pants on over his pyjamas.

"Sounds like we got a rat in our trap," Carl grunted, as he tried to wriggle a bare foot into his shoe.

The boys pounded down the stairs and out into the barnyard. The bobbing circle of light from Mr. Bishop's flashlight guided them to the hen house where Uncle Walt, a double-barreled shotgun cradled in the crook of his arm, stood looking at the open door of the building.

"Whatever the thing was, it took off when the bell started to ring," he told the wide-eyed youths; "but if your contraption

CARL & JERRY (*Continued from page* 16)

worked, you should have his calling card inside the camera."

An examination with the aid of the flashlight revealed that the toggle switch had been flipped to *off,* indicating that the camera shutter had been tripped. Jerry removed the camera from the board and advanced the film to the next exposure.

"It's only two a. m.; so we may as well go back to bed," Uncle Walter suggested, as he closed and latched the door. "I'll see you young buckeroos at breakfast."

For a few minutes after getting back in bed, Carl and Jerry were too excited to go to sleep. But they soon calmed down and drifted off into slumber. They knew nothing more until Jerry's Aunt Enid knocked at their door and told them that breakfast was ready.

THE BOYS bolted their breakfast pancakes and sausage in short order. They paused only long enough to take a couple of pictures of Mr. and Mrs. Bishop, "just to finish off the roll" as they unflatteringly put it, before they hopped on their bicycles and headed back for town and the darkroom Carl had fixed up in a corner of his basement.

Inside this room, with the safelight turned on, Jerry removed the roll of Verichrome film from the camera, stripped off the backing paper, and attached clips to the ends while Carl filled one tray with developing solution, another with clear water, and a third with hypo. A quick check with a thermometer showed that by

"By golly, it's a midget burglar!" Jerry declared, looking over at the negative which was third from one end of the strip of film Carl had developed.

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CARL & JERRY (*Continued from page* 18)

one of those happy coincidences that *do* happen occasionally, the solutions were exactly at 68 degrees. Carl passed the strip of film through the clear water a couple of times and then began to seesaw it gently and methodically through the tray of developing solution. After a couple of minutes, Jerry, whose head had been bobbing up and down with the movement of the film as he tried to make out the emerging negative pictures, muttered:

"We didn't draw a blank, anyway; there's something on every frame."

After a couple more minutes of passing the film through the developer, Carl transferred it to the clear water for a few passes and then began to seesaw it through the tray of hypo. When he had done this for several minutes, he stopped and turned on the white light.

"By golly, it's a midget burglar!" Jerry declared, looking over at the negative which was third from one end of the strip of film Carl had developed.

"Burglar, my eye!" Carl said with a grin. "That's a coon, and a big fat one at that. All coons have that distinctive mask-marking around the eyes. There's something around his neck I can't make out on the negative. Let me finish fixing, washing, and drying the film. Then we'll make a print so that we can really see the details."

AN HOUR LATER both boys were examining a fine large print of the raccoon, which must have been staring directly at the camera when the flash bulb went off. It was standing on its hind legs, and its little paws still had hold of the latch. Around its neck was a leather collar with a metal plate fastened to it.

"That must be a pet coon," Jerry said. "I'll run upstairs and tell Uncle Walter, and see what he knows about it."

In a few minutes, he came back into the darkroom with a broad grin on his face.

"The mystery is solved. Uncle Walt says that the coon is a pet of a boy who lives on the next farm. It's so tame that they just let it run loose like a dog. It must have been prowling around Uncle Walt's farm when it discovered how to open the chicken house door—coons are very clever about things like that—and then had itself a real ball scaring the hens. This was so much fun, evidently, that the coon came back and did it again every night or so. Uncle Walt called the boy, and he promised to keep Mr. Coon tied up at night.

"Another victory for the electronic coon hunters!" Carl remarked, starting to put away the developing materials. —30—

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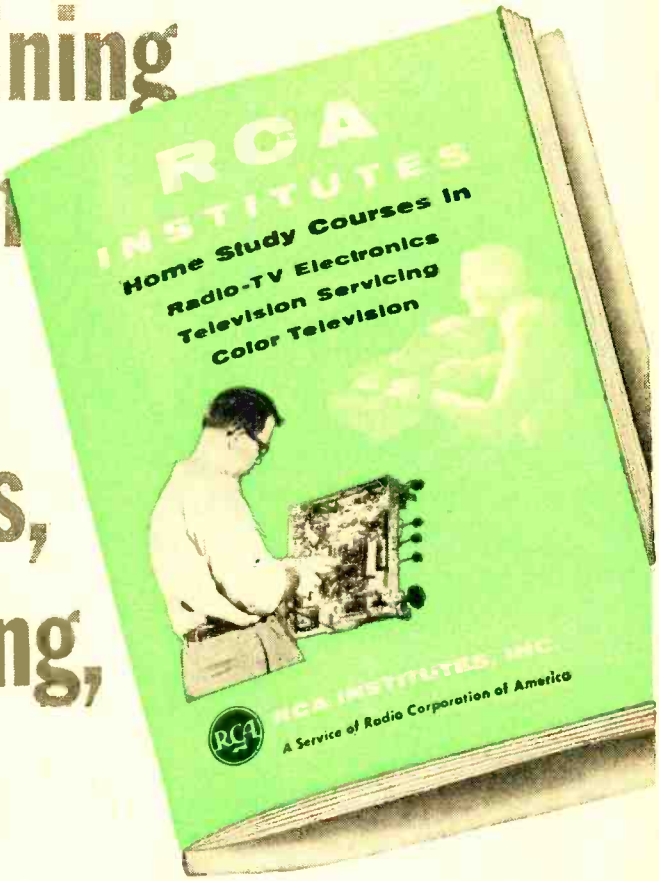

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"THE RADIO AMATEUR'S HANDBOOK" (33rd Edition, 1956), published by the American Radio Relay League, 38 La Salle Rd., West Hartford 7, Conn. 760 pages. Paper bound. Price, $3.00 in U. S.; $3.50, U. S. Possessions and Canada; and $4.00 elsewhere.

If you are an old-timer, little need be said about this latest edition of the "Handbook." If you are a newcomer to electronics or ham radio, one of your first investments should be in this "handbook." It is a composite volume of valuable schematics, construction features, and theory on antennas, transmitters, receivers, converters, and test equipment. This new edition contains additional material on simpler designs, with the Novice especially in mind.

The "Handbook" is also a storehouse for information on tubes, transistors, and other miscellaneous data. Over 1350 illustrations have been used, plus 122 basic formulas. The index alone consumes 13 pages.

Recommended: For every electronics experimenter and budding ham who wants to "get his feet wet."

"THE RADIO HANDBOOK" (14th Edition), published by Editors & Engineers, Ltd., Summerland, Calif. 745 pages. Cloth bound. Price, $7.50 in bookstores (add 10% if ordered directly from publisher).

There is a great tendency among radio technicians and hams to compare this "Handbook" with the "Handbook" published by the American Radio Relay League. Inevitably, a comparison has established that both books are valuable; and although they appear to cover similar fields, they are often worlds apart. This book is a true "Californian" approach to ham radio and practical electronics. The ideas and circuits it presents are vital and unusual.

Unlike the ARRL "Handbook" (which is revised yearly and brought up to date), the previous edition of this volume appeared in 1951. All topics are new, and practically every single design will be food

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for thought. We are particularly impressed with the clear-cut drawings, captions that say things, and the concise, tight, information-packed pages.

Recommended: For all hams, engineers, and technicians.

"ELECTRONICS FOR EVERYONE" by Monroe Upton. Published by The Devin-Adair Co., 23 East 26th St., New York 10, N. Y. 370 pages. Cloth bound. Price, $6.00.

Electronics, in its countless applications, has become so important and universal in modern life that it is a subject no longer in the exclusive domain of the technician and engineer. As the title of this book suggests, it is for everyone. The author, who operated his own ham station in 1914, is eminently qualified to develop this theme, having practically grown up with the industry and served personally in many capacities—from building a broadcast station in Shanghai to acting as a disc jockey.

Assuming no electrical knowledge on the part of the reader, this book takes its audience from the very simple to the more complex phases of electronics. The text is engagingly written and amply illustrated. Much of it is genuinely stimulating, such as the chapter entitled "Do We Inhabit a Magnet?" While this volume is no substitute for a more technical groundwork in electronics, it will certainly put the beginner on speaking terms with most electronic terms and phenomena.

Recommended: For the general reader interested in electronics; for the more advanced technician as a stimulating summary of the field.

"ELECTRONIC CIRCUITRY FOR INSTRUMENTS AND EQUIPMENT" by Milton H. Aronson. Published by Instruments Publishing Co., 845 Ridge Ave., Pittsburgh 12, Pa. 315 pages. Cloth bound. Price, $4.00.

Most of the basic concepts, terms, components, and circuitry that are used in electronics are discussed in this information-crammed volume. Readers casting about for a technically written "first" book might do well to consider this one. It opens with a discussion of the "Electrical Nature of Matter" and concludes with "Military Electronics." Between these two sections, it touches on vacuum tubes, amplifiers, transistors, oscillators, test equipment, television, and several other subjects.

This is a heavy order for one book, and this volume is by no means the last word

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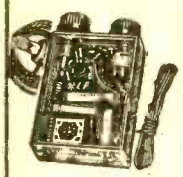

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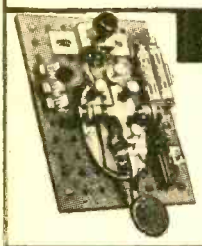

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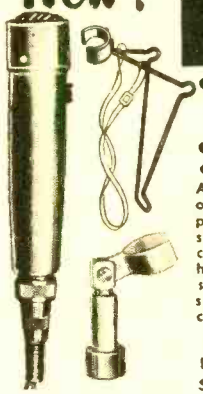

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on all the topics mentioned—but it certainly is a worthy "first word." Its use in electronics courses is suggested by the avenues of exploration and further development of themes that are opened to seasoned instructors, as well as by the series of carefully worded test questions included.

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"SCOPE CONNECTIONS" by V. L. Walker. Published by The Triplett Electrical Instrument Co., Bluffton, Ohio. 29 pages. Paper bound. Price, $2.00.

Basically an instruction booklet for use with Triplett's Model 3441-A oscilloscope, this volume may have wider value as a general introduction to the use of oscilloscopes for test purposes. It contains several examples of how to check a variety of typical circuits.

Recommended: to all 'scope users.

"MULTIVIBRATORS" by A. Schure. Published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N.Y. 52 pages. Paper bound. Price, 90 cents.

The multivibrator is a fairly recent development in electronic circuitry. Variations of this "relaxation oscillator" are to be found in television, radar, oscilloscopes, and dozens of other types of equipment. The unique design and functioning of these circuits are explained in this little volume, which is designated as No. 166-7 in the publisher's "Review Series." Its four chapters are devoted to basic principles and the three main types of multivibrators; the bi-stable, the mono-stable, and the a-stable. Circuit action and practical uses are given for each type.

Recommended: for the serious student or technician whose work involves contact with these circuits.

Free Literature Roundup

AN ATTRACTIVE little volume entitled "High Fidelity Especially For You" is available on request from The Heath Co., Benton Harbor, Mich.

PLANNING A CAREER as a TV service technician? A booklet called "Suggested Accreditation Program for TV Receiver Service Technicians" should interest you. Standards for accrediting servicemen, tools and test equipment, and educational requirements are discussed. Free copies are available from Radio - Electronics - Television Manufacturers Association (RETMA), 777 14th Street, N.W., Washington 5, D. C.

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LETTERS FROM OUR READERS

What Happened to R/C?

■ I recently became interested in R/C, and a friend of mine gave me some old issues. Really swell reading, but what happened to the great plans you apparently had on editorializing this field?

E. C. WESLEY
Katonah, N. Y.

■ What has happened to your R/C Notes column? It did not appear in the March or April issues.

KENNETH ROONEY
Chicago, Ill.

Readers Wesley and Rooney (plus many others) will be pleased to know that the R/C column will be back in an early issue. At the same time, we hope to publish at least one feature a month on novel R/C installations, new receiver and transmitter designs, and equipment tests.

Mobile Telephone

■ How about publishing an article on how the telephone companies install and maintain mobile private telephones? I think it would be very interesting.

NORVAL YERGER
Greenville, Miss.

This task has been assigned to a staff writer and he reports being hard at work (probably to impress the editor). However, a story is scheduled and we are sure that many readers will be surprised at the radiotelephone services now available to the general public.

Can Anyone Help?

■ I am in need of information on plastic lamination of the type used to preserve documents. There must be electronic methods in use, but I've been unable to uncover any sources of information. Could your readers give me a helping hand?

J. JECMEN
Memphis, Tenn.

Still They Come

■ How about plans for a long-wave converter? I would like to receive the 200- to 400-kc. band where the CAA offers weather broadcasts every 30 minutes.

R. D. BRIGHAM
Ames, Iowa

■ I have been reading POP'tronics since it started, but have yet to see anything on the subject that interests me most—long-wave DX. I've seen a few high-priced sets, but really want either a converter or a 4-tube receiver. Also, could you give us a log of possible DX stations below 400 kc.?

C. K. FRENCH
Louisville, Ky.

As mentioned in our May issue (page 20), we will be publishing some material on long-wave DX and equipment in the early fall issues. A staff

writer has been assigned this project, while one of our Contributing Editors is working up several designs for converters. Keep watching—it's coming around the corner!

Oabt Oabt Oabt

■ Tuning down to the low end of the broadcast band on my portable, I found someone sending "OABT OABT OABT" over and over in Morse code. Could anyone enlighten me as to what this station was doing? I last heard it on March 30th from about 7:30 until 8:15.

S. SWERLING
Chelsea, Mass.

Any volunteers?

HI-FI—Speakers, Enclosures, etc.

■ The bargain speaker idea described by Jack Coriell (December, 1955) really works! I've built three of these setups. How about some more dope on mounting more than one speaker in the cabinet?

DON VAN METRE
Ventura, Calif.

■ Just finished making the bargain speaker arrangement described by Coriell in your December issue. The results were nothing short of amazing. I never saw or heard a 5-tube superhet issue such sounds. Even with the volume very low, I heard every bass note.

HAROLD R. PLUE
Hamilton, Ont.

■ I built the $2 speaker baffle in your November, 1955, issue. I used two scrapped Celotex bulletin boards; and since Army barracks have studs on the interior, I added two pieces for sides. The enclosure can be placed just about anywhere and sure does a fine job.

ROBERT J. FEWKES
Aberdeen, Md.

■ I became interested in electronics about the same time that you began publishing POP'tronics. I especially enjoy the hi-fi antics of Carl Kohler. Will you people see about a construction article on a good hi-fi AM tuner?

BROOKS ROGERS
Amarillo, Texas

■ The $2 speaker baffle with an 8" Electro-Voice speaker gives results as good as I have heard from speakers in the most expensive wooden cabinets. I'm sold. I see no reason for a fancy enclosure.

ROY POULSEN
Kingston, R. I.

Our hi-fi audience seems to be growing by leaps and bounds. Look to POP'tronics for the latest dope on new components and money-saving ideas.

Fumalux Lighter Data

■ In response to the question posed by Mr. Mochar (April, 1956, page 12), I have found that the lighter is marketed in the United States under the name "Magna Lux." It uses a single lead-acid battery cell at 2 volts. It can be recharged if the sealed case is punctured to permit the hydrogen to escape. I also used this small puncture to add water with a hypodermic needle. The charger

Men with mechanical skills:

measure yourself against this yardstick

Mechanics Creed

Upon my honor I swear that I shall hold in sacred trust the rights and privileges conferred upon me as a certified mechanic. Knowing full well that the safety and lives of others are dependent upon my skill and judgment, I shall never knowingly subject others to risks which I would not be willing to assume for myself, or for those dear to me.

In discharging this trust, I pledge myself never to undertake work or approve work which I believe to be beyond the limits of my knowledge; nor shall I allow any superior to persuade me to approve aircraft or equipment as airworthy against my better judgment; nor shall I permit my judgment to be influenced by money or other personal gain; nor shall I pass as airworthy aircraft or equipment about which I am in doubt, either as a result of direct inspection or uncertainty regarding the ability of others who have worked on it to accomplish their work satisfactorily.

I realize the grave responsibility which is mine as a certified mechanic, to exercise my judgment on the airworthiness of aircraft and equipment. I, therefore, pledge unyielding adherence to these precepts for the advancement of aviation and for the dignity of my vocation.

This challenging creed has made the U. S. Air Force the finest technical service in the world. If you are a man who feels a deep sense of satisfaction from the knowledge of a job well done, the U. S. Air Force offers you a rewarding and exciting life. Skills you acquire in the Air Force will help you choose and succeed in your future career.

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Name.....

Address..... Age.....

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

can be a simple selenium rectifier working from the 6-volt side of a filament transformer. Charge it at 90 ma. and 2.2 volts until the current drops to 10 ma.

ARTHUR L. HEILING
Port Lavaca, Texas

"Proximity Detector" Works

■ The "Proximity Detector" by Paul Harvey (April, 1956) was terrific. For a long time I've been looking for a device of this type. It's extremely sensitive. I built the simpler version and it works very well.

ROGER R. MURRAY
Los Altos, Calif.

Thermistor Fire Alarm

■ I was quite surprised that you would recommend a fire alarm system that operates from the a.c. power lines. This leads to a false sense of security, as in many homes fires start in the power lines and the fuses immediately blow.

BURT GASTEN
Madison, Wis.

Good point, Burt, but we feel that batteries would be even worse. It is far simpler to let batteries run down and not replace them. All in all, the a.c. line-operated device is safer, although Mr. Pollack is working on a modification which may provide a foolproof solution to this problem.

Tachometer Completed

■ I recently completed building the portable tachometer described in the May, 1955, issue. I want to thank you and your staff for making the diagram so clear and easy to follow. This was my first attempt at any electrical work and I'm pleased with the results. So far it has checked out perfectly.

R. W. LORTHRIDGE
Chicago, Ill.

Tape Correspondence Clubs

■ I own a tape recorder and in the past few months have become deeply interested in tape correspondence. Are there any other readers of POP'tronics interested?

HOWIE FISHER
Syracuse, N. Y.

Yes, Howie, there are, and a feature article is scheduled for an early issue on just this fascinating hobby. We will publish addresses of all the leading tape correspondence clubs at that time.

Out of Tune

Signal Tracing on a Low Budget (*March*, 1956, *page* 56). In the wiring diagram, remove the jumper between pins 2 and 3 of the magic eye tube *V3*. The connections from pin 2 to the B+ line (at *R7*) should be removed and a line substituted from pin 4 to *R7*. The pictorial diagram does not include the jumper, but does show the B+ line improperly connected. —30—

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...build radios, using regular schematics; how to wire and solder in ...w to service and trouble-shoot radios. You will work with the ...metal chassis as well as the latest development of Printed Cir-...

...basic principles of radio. You will construct, study and work with ...rs and oscillators, detectors, rectifiers, test equipment. You will learn ...e, using the Progressive Code Oscillator. You will learn and practice ...g. Using the Progressive Signal Tracer, the Progressive Signal Injector, ...ive Dynamic Radio & Electronics Tester and the accompanying instructional ...

...ill receive training for the Novice, Technician and General Classes of F.C.C. Radio ...ur Licenses. You will build 16 Receiver, Transmitter, Code Oscillator, Signal ...er and Signal Injector circuits, and learn how to operate them. You will receive an ...cellent background for Television.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $19.95. The Signal Tracer alone is worth more than the price of the entire Kit.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future you will find the "Edu-Kit" a worth-while investment.

Here is an excerpt from a letter that we received from Loren DePriest, 1496 4th St., Mansfield, Ohio: "I have spent many pleasant hours in constructing the radios from the schematics in your book, and have learned a great deal from them. Being as I am interested in Radio, I consider the money spent for your course as a wise investment. I have learned more from your course by actually doing than I did from an expensive course."

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

The "Edu-Kit" is also used for courses of study, extra-curricular activities, industrial personnel training and rehabilitation. The "Edu-Kit" is used by Jr. High Schools, High Schools, Technical Schools, Jr. Colleges, Colleges, Universities, Industrial firms, Rehabilitation Hospitals, Boards of Education, U.S. Govt. agencies, United Nations Educational, Scientific and Cultural Organizations (UNESCO), and numerous adult, radio and young peoples groups and clubs. The "Edu-Kit" is also popular with servicemen and veterans throughout this country and abroad.

Designed for universal use, the "Edu-Kit" operates on any voltage from 105 to 125 volts, AC and DC. For use in countries employing higher line voltages, a 210-250 Volt AC/DC model is available.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble-shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build 16 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing punched metal chassis, Instruction Manuals, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio & Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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Hi-Fi, Radio & TV Servicing Manuals on request
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SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of troubles in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

FROM OUR MAIL BAG

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

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

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material, which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

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High Selectivity and Rejectivity
Precisely tunes the signals you want, even at high frequencies. Rejects unwanted signals and undesirable noise.

Easy Tuning and Smooth Operation
Unique two-speed control knob provides smoother, accurate tuning and scanning.

Mechanical and Thermal Stability
Highly stable components and construction prevent frequency shift or drift.

Structural Rigidity and Strength
Heavy steel chassis, cast aluminum panel and rugged steel cabinet assure stable, long-life service.

This completely new receiver includes many deluxe features usually found only in higher priced models. It provides injection control of the beat frequency oscillator. Particularly useful for CW and SSB reception.

Large, evenly graduated, illuminated dial covers all six amateur bands from 1.76 mc to 29.8 mc (160 thru 10 meters). Unique differential 75:1 or 1:1 ratio tuning control. Plates in tuning condenser are triple-spaced to reduce drift and microphonics. Selectivity control with four positions. IF curve is 2.8 kc wide without crystal filter, attenuation 60 db down at 7 kc above or below the desired frequency. Crystal filter has phasing control for variable rejection of unwanted adjacent signals. Excellent image rejection. High sensitivity of 2 microvolts for 10 db signal-to-noise ratio. Temperature-compensated. Drift is negligible after 20-minute warm-up. Extreme stability permits single sideband reception with or without adapter. ANL. Antenna trimmer permits peak adjustment. 4-position function switch. Two coaxial jacks for SSB adapter. 4-ohm speaker terminals. Transmitter relay control.

Controls include: Dual-speed tuning, AF gain, BFO pitch, BFO injection, antenna trimmer, calibration adjust, band selector, RF gain on-off, function switch, 3-position receive—standby—transmit switch, 4-position crystal selectivity control, crystal phasing-rejector control, ANL. Size: 10 in. high, 16½ in. wide, 10 in. deep. Finished in attractive instrument-gray. 117 volts, 50-60 cycle AC.

To own the 4300 means more QSO's!
See your EV-RME distributor or write for Bulletin No. 240-E66.

MODEL 4301 SIDEBAND DETECTOR-SELECTOR

New RME 4301 provides easy-to-tune, stable SSB reception of both carrier present and carrier suppressed types. Plugs directly into the RME Model 4300 receiver or easily connects between IF and audio stages in any other communications receiver. Built-in power supply. Size: 10 in. high, 8½ in. wide, 10 in. deep. Net $75.00

Model 4302—Matching Speaker in enclosure. Net $17.50

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RADIO MFG. ENGINEERS, INC.
DIVISION OF
Electro-Voice® INC.
BUCHANAN, MICHIGAN

MAXIMUM FI... ...minimum $$$

Photos by Maynard Frank Wolfe
Equipment Courtesy Lafayette Radio, N.Y.C.

Mild chaos prevails before assembling components into "system." The only real work, however, is mounting the record player. Instruction sheets make this easy and foolproof. Wiring is simple. Job takes a screwdriver and 30 minutes.

By NORMAN EISENBERG
Feature Editor

For the non-technical and budget-minded: an easily assembled low-cost music system

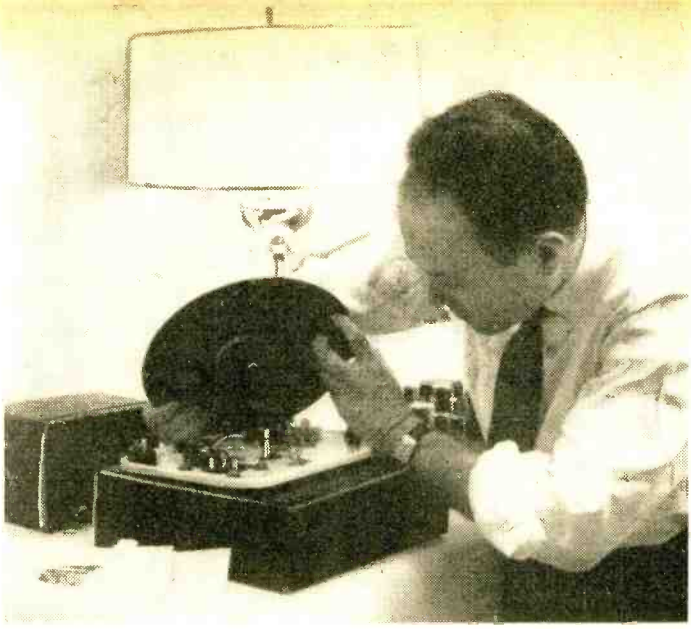
WITH PRICES on most consumer items steadily rising, and interest in hi-fi doing the same, there is—in many quarters—a mistaken notion that unless you're prepared to spend upwards of $250, you can't have hi-fi. Fortunately for the budget-minded, this is not so. To be sure—the more you spend, the better equipment you are likely to get. However, components are available for a complete radio-phono system costing less than many people spend on a phonograph alone.

This is no theoretical pipe-dream. It's something you can pick up and carry home from the audio shop. Each component has been studied by impartial experts. The system has been assembled, played, and tested. It works.

Another thing: the components are finished units, not kits. They require no real effort or technical skill to set up. For those who can do their own carpentry, or have the skill to build tuners, amplifiers, and speaker systems—kits are fine, and provide remarkable hi-fi values. But there are millions of music lovers who have neither the skill nor the inclination to get involved with soldering iron and schematic. What they want is a system that will enable them to hear their favorite radio programs—or listen to records—with good audio quality but a minimum of fuss and bother. Almost equally as many might like to hear their tapes—either home-recorded or commercially produced—played with a measure of fidelity not afforded by the low-priced "all-in-one" tape recorder. And some, perhaps, are fed up with the hash

EDITOR'S NOTE: This story is presented in response to numerous requests for a hi-fi system that sounds good, costs little, and requires no technical skill to set up. The components comprise a possible "first" system which will meet those demands. For many who have a hi-fi system, or aspire to costlier systems, the one described may have value too—as a "second" hi-fi system for a rumpus room, school or clubhouse, or dormitory room at college, etc.

Record player fits onto base by means of three spring-mounted bolts. Screwdriver adjustment permits exact leveling for best operation. Instructions enclosed with player explain clearly how to do this as well as how to affix the small belts that link the drive and idler wheels. Turntable fits readily onto center spindle. Plug-in cartridge head fits onto tone arm. Shielded cable feeds signal to amplifier.



Ordinary "lamp cord" — two lengths—may be used for connection to speaker terminals. Other ends of these wires connect to proper output terminals on back of amplifier. This speaker calls for connection to 4-ohm terminals, clearly labeled on amplifier.

that the audio sections in their TV sets make of what is potentially top-rate FM sound. They might actually want to hear what their favorite singers or pianists really sound like. The system described here is the ready-made, low-cost, no-trouble answer to all these demands.

If you compare the performance of this system to that of a rig costing three to four times as much, you *may* hear the reason for the difference in price . . . or maybe not, depending on your own hearing tastes. Not everyone has the kind of hearing that responds favorably to 20,000 cycles at 80-db level. For people with less demanding ears, it would be nonsense to spend hundreds of dollars to capture such audio in the living room, where it might do little more than titillate one's pet spaniel.

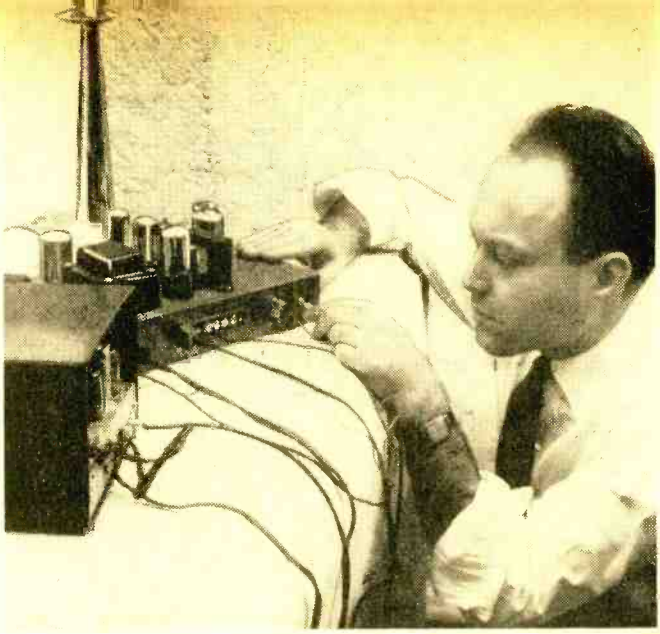
In any event, there is no doubt that the system will not capture the deepest bass and the highest treble. Also, its power capacity will be limited to normal listening level in a normal-sized room. At that, this system outperforms most of the radio-phono "combinations" of a few years back, and will equal—if not surpass—the performance of many current consoles that are now touted with blatant and, often, misleading claims.

Total cost of the system is $140.00—give or take a few—and the price includes the furniture-finished speaker enclosure. If you want the system for records only, without the FM tuner, drop $35. The components used are sold at most dealers, and specifications are available from the respective manufacturers (listed in the table on page 38).

Hi-Fi Standards Met. Cost was not the sole factor in selecting this system. The following standards also apply:

1. The system, as a whole, must be versatile and flexible, with inputs for both radio tuner and high-quality phono. Components should be compatible with each other as well as with additional program sources that may be added later (AM tuner, TV sound, and tape playback). As someone's "first hi-fi," this system might use a speaker whose performance is adequate but which can readily become part of a larger multiple speaker system if and when the owner decides on "speaker expansion."

2. The record player must have provisions for shock-mounting, leveling, adjusting stylus pressure, and simple interchanging of cartridges. The turntable should run off a 4-pole motor and be reasonably free of annoying rumble. The pickup must have high compliance and a frequency response from about 40 to 12,000 cycles; a "dual purpose" type is recommended (with two styli—one for microgroove and one for 78-rpm discs) as an economy measure.

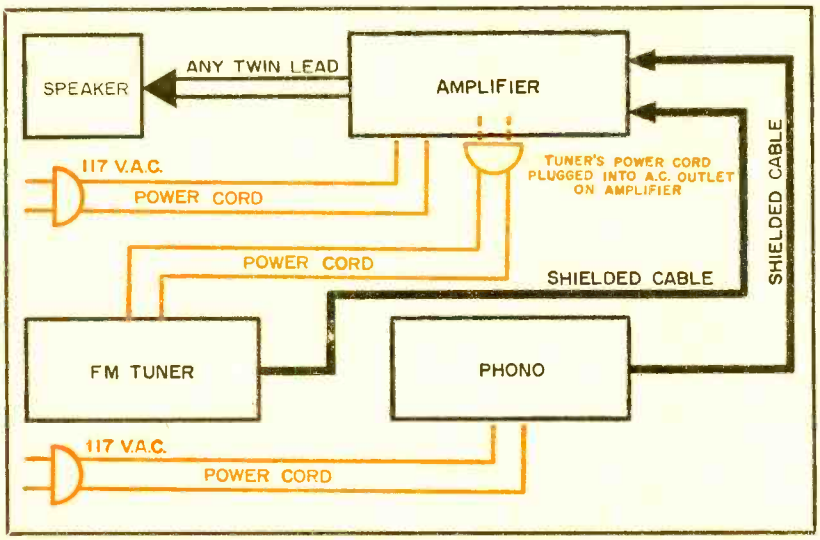


Input and output jacks on both tuner and amplifier are clearly marked. Signal connections are made with standard phono plugs fitted to shielded cables. Amplifier has "convenience a.c. outlet" on rear of chassis, for plugging in power line of one other component. It is a good idea to plug the tuner's power cord into this outlet, thus assuring that the tuner will be shut off when the amplifier is turned off. The record player shuts off automatically at the end of a record, so no such precautions need be taken with it.

3. To meet adequate standards of power ratings, the amplifier should have 10-watts output. Circuit design features, such as negative feedback, should be used to assure a flat response up to at least 15,000 cycles, with distortion not more than 3% at full output. The amplifier should include a built-in preamplifier-equalizer for magnetic phono pickups. Multiple inputs should permit several program sources to remain permanently plugged in. Output terminals must accommodate speakers at impedance ratings of 4, 8, and 16 ohms. Front panel controls should provide for an input selector and record equalizer, volume, treble, and bass controls.

4. The tuner must have enough sensitivity to receive local stations with a simple external antenna. Provisions for connecting such an antenna should be easy and accessible. Some kind of stabilizing feature should assure against drift. This need not be automatic frequency control (a.f.c.) but its effect should be similar. Since the amplifier has its own audio controls, the only controls needed on the tuner are an off-on switch and a station selector.

5. The speaker system's response must be wide in range and low in distortion to match the potentialities of the rest of the system—and still fall within the over-all price range. In this respect, it is only fair to point out that a better speaker system than the one listed here would probably make the system sound better. This, of course, can be said about most any audio system, regardless of cost. The one chosen is admittedly a compromise in terms of extreme frequencies. But it will sound clean and well-balanced over the vital part of



Block diagram of the complete system shows correct connections for all signal leads and power cords. Arrows represent direction of signals from tuner and phono, into amplifier, and then into the speaker.

Components for the "minimum $$$" hi-fi system, and suggested alternates, are listed in this table. No alternates for the tuner and speaker could be found in the same price range.

COMPONENT	MAKE AND MODEL	COST	ALTERNATE CHOICE	COST
Record Player	Garrard "Model T" (Garrard Sales Corp., Port Washington, N. Y.)	$32.50	Collaro AC-3/554 (Rockbar Corp 215 E. 37 St. N. Y. 16, N. Y.)	$26.00
Pickup	G. E. RPX 050A (General Electric Co. Electronics Park Syracuse, N. Y.)	8.20	Recoton 500SS (Recoton Corp. 52-35 Barnett Ave. Long Island City 4, N. Y.)	9.70
FM Tuner	Granco T-160 (Granco Products, Inc. 36-07 20th Ave. Long Island City 5, N. Y.)	35.00		
Amplifier	Bogen "Challenger" HHF-10 (David Bogen Co., Inc. 29 Ninth Ave. N. Y. 14, N. Y.)	40.00	Grommes LJ-4 (Precision Electronics, Inc. 9101 King Ave., Franklin Park, Ill.	39.00
Speaker System	Lang BL-10 (Lang & Taylor Inc. 100 Felton St., Waltham, Mass.)	25.00		

When cartridge has been installed in tone arm, use knurled knob at arm's other end to adjust for correct pickup pressure, as recommended by manufacturer (in this case, 6 to 8 grams). To start a record, or cue it at any point, use the finger-lift provided on the shell to lift the arm and lower it gently to the record, as shown in the photo.

This layout of components shows how they may be placed on open bookshelves for proper installation without the need for expensive cabinetry. Units are spaced close enough to each other for convenience, but far apart enough to insure against mutual inductance hum, acoustic feedback, and overheating. Speaker sounds best in corner position. Wiring is hidden behind back panel of bookcase. Hint: a piece of low-cost Masonite fitted to the top shelf converts the shelf to a neat cabinet!

the audio spectrum. Another point: more speakers can be added later to create a multiple speaker system.

There is also such a thing as using "too good" a speaker for a given array of components. For example, a $600 Klipschorn used in this system would probably reproduce as much hum and noise as music in the low-frequency area.

In any event, the speaker itself must be adequately baffled and physically separated from the housing used for the rest of the system.

The System. So, we are compromising — but not beyond the limits of good judgment, or decent audio standards. Ours is not the fabulous "dream system" of the millionaire. But neither is it the complete nightmare of a system that could, perhaps, be assembled for "just a little less" money. We like to think of this rig as a down-to-earth hi-fi system, both in its ability to furnish entertainment in the home as well as in its cost to the consumer. The components, and their suitable alternates, are listed above.

Prices shown are approximate net prices, based on prevailing averages at representative dealers. Slight variations may be expected, depending on where you live, and possibly too on how much of a "break" your particular dealer can give you for buying everything all at once. The listing does not include a base or mounting board

(*Continued on page* 112)

Typewriter with a Memory

Phrases to be "memorized" by typewriter are stored in plugboard. Secretary can switch plugboard assemblies to change typewriter memory from business to Latin to medical phrases.

INTERNATIONAL BUSINESS MACHINES CORPORATION

October 21, 1955

Mr. George Enwright
Enwright Manufacturing Company
Martinsville, Iowa

Dear Mr. Enwright:

In response to your request of October 20, we have enclosed literature concerning the IBM Electric Typewriter. We hope you will find the booklets of interest.

The brochure titled, "The Secret of the 'Letter Perfect' Letter", describes the IBM Executive Electric Typewriter which features a revolutionary typing principle, exclusively IBM's, giving each character the amount of space it requires according to its width.

From a wide variety of specially-designed type styles, you may choose the one best suited to express the personality of your company.

If we can be of further assistance, please do not hesitate to contact us.

Yours truly,

H. W. Wilson
Sales Department

IN YEARS to come a secretary reaching the phrase "in accordance with" in a letter she is typing may simply press a foot pedal, strike the correct key, and the machine will rapidly type the phrase by itself. An experimental electric typewriter with a "memory" of 42 phrases has been in existence for some time.

When patents on the machine, which is called the "Wordwriter," were issued recently, the International Business Machines Corporation let the press take a look at it. Since the operator selects the phrases to be memorized, the machine makes every secretary a potential legal or medical stenographer, both scarce skills. The operator can set the machine to memorize those long Latin or scientific words and phrases she cannot spell.

There are two main parts to the Wordwriter. A standard electric typewriter modified with a solenoid attached to each key is one part. The memory apparatus fits inside the space occupied by the drawers in one side of a standard office desk. It consists of the plugboard memory, relays and crystal diodes, a voltage reference tube, and a selenium rectifier.

The typewriter portion can still be employed in the usual way. In use, paper is slipped into the Wordwriter and the operator types away until she comes to a frequently used phrase, one that has been memorized by the machine. After depressing the foot pedal that connects the memory to the typewriter, the typist strikes the key coded to the phrase. The memory apparatus then operates the Wordwriter at the rate of 150 words per minute, writing out the phrase and inserting a hyphen if a word breaks at the end of a line.

The Wordwriter was initially developed five years ago by a group of scientists working under R. R. Seeber, Jr. A pioneer computer designer, Mr. Seeber constructed the Wordwriter as a side-line. He works at IBM's Watson Computing Labora-

(*Continued on page* 106)

New Life for Citizens Band

Cover Photo by Maynard Frank Wolfe
Equipment Courtesy of Abercrombie & Fitch

WOULD YOU be interested in a radio-telephone to call the wife, boy friends, or neighbor a couple of miles down the road? If so, a Citizens band radio transceiver may be just the answer. Various electronics manufacturers are becoming aware of this huge potential market and are striving to put personalized radio-transmitting equipment on the market.

First salvo has been fired by the Vocaline Company of America, Old Saybrook, Conn. with the introduction of its model JRC-400 transceiver. This combination receiver and transmitter operates in the Class B portion (around 465 mc.) of the Citizens radio band. As illustrated on this month's cover, the transceiver is self-contained and may be plugged into either the 117-volt a.c. house wiring line or into the 6-volt d.c. system of some automobiles. Twelve-volt models are also being made available to the public by the manufacturer.

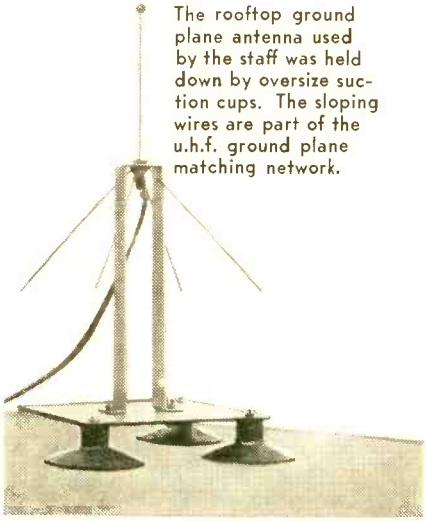
A short antenna can be plugged directly into the transceiver, or the Vocaline company will supply a special ground plane antenna. Photos on this page show the transceiver being tested by the POP'tronics staff under license 2A1402.

Field tests proved conclusively that even the very low power of the transceiver could insure 100% reliable two-way communication in metropolitan areas for distances of 1½ miles. In favorable locations—where large buildings did not confine or screen off the signal—the communication range was extended to 3 miles. Tests in open country showed that weak signals at distances of 6 miles were fully readable without difficulty.

The Class B portion of the Citizens radio band is reserved for use by private citizens for short-range personal radio communications. Equipment for the Citizens band (radio-telephone) must meet specifications set forth by the Federal Communications Commission. To pass these specifications, the equipment must be examined and approved by the FCC in its laboratories. Because of this cumbersome arrangement (although fully justified), the design of Citizens radio equipment has for a number of years taken a back seat. The ice has been broken by the Vocaline transceiver, which brings Citizens band communication facilities within the reach of everyone's pocket.

After a manufacturer secures FCC approval, he may then produce identical units on an assembly line basis. The purchaser simply fills in Form 505 supplied with the transceiver, sends it to the FCC, and a station license is issued within a week or ten days. A license may be obtained by anyone over the age of 18.

Look for more reports on Citizens band equipment in early issues of POP'tronics. —30—



The rooftop ground plane antenna used by the staff was held down by oversize suction cups. The sloping wires are part of the u.h.f. ground plane matching network.

Ham-Built R/C Tricycle Runs on Six-Meter Signals

BACK FROM A RIDE in which he did nothing but relax and enjoy the fun is five-year-old Mark Behrens of Sheboygan, Wisconsin. The ride was given by Shirley Eggert, who operated the control box for the homemade tricycle. The vehicle, and its radio-control system, were designed and built by Robert Harkness, W9GZR. An electrical engineer with the Briggs Stratton Corp., Harkness exhibited his ingenious device at a "Do It Yourself" show sponsored by the Milwaukee Journal, a Wisconsin daily. Three controls, producing different tones, can be used individually or in combination to get the tricycle to go forward, turn left, turn right, back up, or honk its horn. The transmitter, which operates on six meters, has a range of up to two miles. It runs about 10 watts input to the final stage. Power for both the transmitter and control equipment comes from a six-volt dynamotor which is energized by an automobile-type storage battery. The receiver is a six-tube superheterodyne type. Other equipment used includes a thyratron tube, elaborate relay system, filter networks, a propulsion motor, steering mechanism, and a two-stage roller chain drive. The tricycle is made of wood.

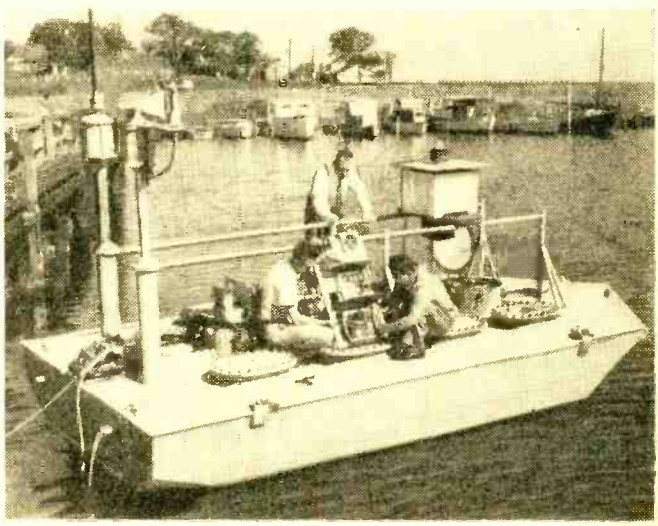
Milwaukee Journal Photo

Unmanned Weather Station Radios Data from Mid-Ocean

EARLY STORM WARNINGS as well as more reliable data on general weather conditions are foreseen as a result of a prototype marine weather station developed by the National Bureau of Standards. Built into a buoy that can be anchored at sea and left unattended for months, the device senses atmospheric changes, translates them into electrical signals, and broadcasts reports to authorities who may be located more than 800 miles away.

Completely automatic, the station uses five sensing elements for gathering information on air temperature, water temperature, barometric pressure, wind speed, and wind direction. Literally picking the air around it for data, the equipment then converts these impressions into three-letter groups of code. Coded signals are transmitted on a pulse-modulated carrier frequency of about 6 mc. These signals can be received on standard communications receivers. Each transmission lasts three minutes and is preceded by a three-letter group identifying the station.

Made of aluminum and other non-magnetic alloys to avoid ill effects on the compass, the vessel carrying the rig is 20′ long.



Last-minute check is made before the ocean-based weather station is put into use. Data is broadcast automatically at regular intervals during the day. Equipment is turned on and off by electronic timers. Primary power comes from 180 4FH dry cells connected in series-parallel to give 13.5 volts at 15 amperes. A rotary converter changes the low-voltage d.c. to 120 volts at 60 cycles to operate the power supply for the electronic components. Future models may employ a gasoline-powered generator and storage battery. The device is currently being used by the U.S. Navy Bureau of Aeronautics.

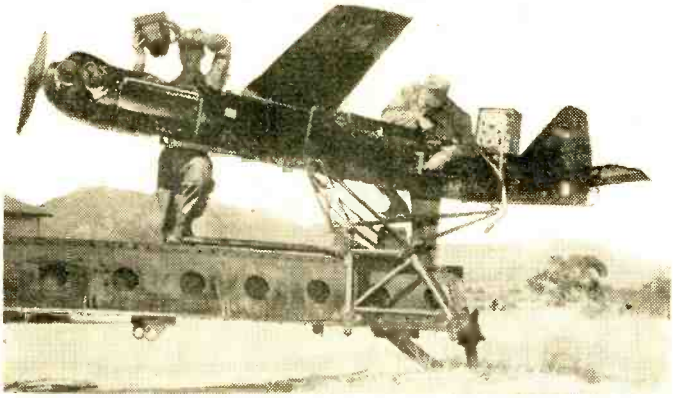
R/C Drone Spots Troop Movements

(A) Get a close look at the enemy.

(B) Don't stick your neck out.

BETWEEN THESE TWO motives lies the crucial conflict of a soldier on reconnaissance. On his mission, valor is no better than caution, for neither succeeds without the other. The closest view of the enemy is futile if he fails to report.

The Army recently revealed a way to sidestep this dilemma. Enemy positions are photographed by a pilotless aircraft small enough to be carried along by ground troops. Unlike conventional observation planes, this R/C aerial "photographer" is always under direct control of the men who need the information it gathers.



Catapulted aloft by compressed air, this transportable pilotless photo reconnaissance plane buzzes off at better than 200 mph. Photo above shows camera being mounted in nose of plane directly behind motor. Technician near tail is checking R/C receiver.

No landing strip is needed. The plane is jet-launched from a catapult. Then the ground operator guides the "drone" by radio control over the area to be surveyed. When the mission is completed, the drone is returned to the launching site, the engine stops, and a parachute lowers the plane gently to the ground. The exposed films are ready for immediate processing.

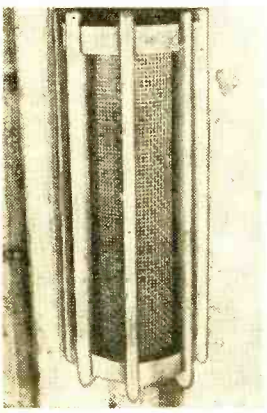
The drone has a wing span of 12 feet, can fly 228 miles per hour and climb at the rate of 3060 feet per minute. After the jet-assisted launching, it is propeller-driven by a gasoline motor. The camera can take either still photos or motion pictures from the air. Its photographic range is variable between a few hundred feet and several miles.

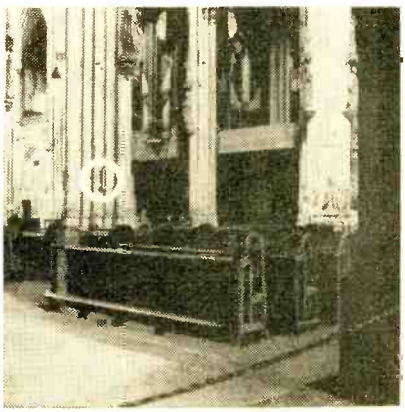
This new technique provides tactical commanders with aerial surveillance photographs in less than an hour's time. The officers can then deploy their troops on the basis of this up-to-date information. All personnel is saved for tactical missions. No lives are risked in reconnaissance. —30—

New P. A. System Eliminates Double Hearing

ALL OF US have at times been annoyed by "double talk" in a large hall or in a church where public address systems are used for amplifying sound. Since electricity travels much faster than sound in air, the voice from the nearest loudspeaker reaches us sooner than the actual voice from the speaker's rostrum or the pulpit.

Cologne Cathedral, one of the world's largest churches, now has a sound system that slows up the passage of the signal from one speaker to the next. As a result, the real sound and the amplified sound from any of the many speakers arrive at the listeners' ears simultaneously. This gives the impression that there are no loudspeakers at all, and all the sound seems to be coming directly from the pulpit. The illusion is enhanced by styling the loudspeakers (at the right of the photo) to blend into the cathedral's Gothic nave (at left). The circle marks the inobtrusive location of one of these speakers.





By ROBERT B. COOPER, Jr.

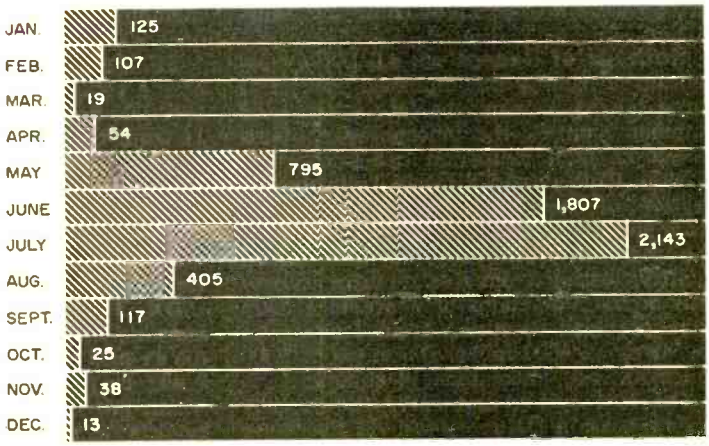
DX TV Reception Makes New Hobby

WOULD YOU be astounded to turn on your TV receiver and see a program from a station half-way across the continent? Probably not, because present-day TV relays provide daily entertainment in this fashion. But what would you think if you discovered that there were no relays involved—the program was really coming from that station hundreds of miles away.

Many viewers outside the metropolitan New York and Los Angeles areas have been treated to this thrilling experience. Distant (DX) television reception is now an accepted fact. No longer do viewers call the repairman and complain. They sit back and enjoy one of nature's most unusual freaks—TV reception where TV re-

Two TV stations logged from Fresno, Calif. WJBK, Channel 2, Detroit, Mich., 2145 miles to the east, was received by means of sporadic E skip. KRLD, Channel 4, Dallas, Texas, 1350 miles southeast, was seen on 26 days in 1955.

Seen only during unusual lower atmosphere weather conditions, KHSL, Channel 12, Chico, Calif., which is 265 miles to the north of Fresno, can be logged 75% of the time in the summer



Sporadic E skip loggings reported per month (right) from January through December, 1955, show frequency of DX TV reception. Such reception usually lasts from about five minutes to several hours (AIPA data).

Meteoric effects on long-range TV reception are being studied at Stanford University with the assistance of this huge TV-type antenna.

ception is not supposed to be possible.

Engineers and scientists are alarmed over the increase in DX TV reception. The chart on the preceding page may give you some idea of how frequently TV stations are seen hundreds and thousands of miles from their so-called "service areas."

Standardization of TV equipment in North and South America has permitted viewers to see stations outside of their own continent. Scientists at the National Bureau of Standards and the Federal Communications Commission have predicted that sunspots will again affect TV reception. Increasing numbers of sunspots has been found to mean increased DX TV beyond 2000 miles from the transmitter.

Methods of Reception. All DX TV reception is usually accomplished by one of three means. During the late spring and summer months, the ionosphere contains clouds of high ionization called sporadic E skip. This provides fairly frequent reception of the low-band channels (2-6) from stations 500 to 1500 miles away from the receiver. Such reception is of good quality, lasting from five minutes to several hours. Variations of sporadic E skip have provided reception from stations as far away as 6600 miles. Distances of 2000 miles are not uncommon in summer.

The late spring and early fall usually finds a peak in DX reception via the lower atmosphere (up to 30,000 feet in altitude). Unlike sporadic E skip, where the wave is reflected from a thin cloud of electrons in the ionosphere high above the earth, this form of DX TV follows the curvature of the earth. It is due to the distribution of large masses of hot, humid and cool, dry air throughout the continent. TV viewers near lakes and oceans are generally the first to notice this "extended service area" DX. Weather effects on DX TV are noticed on all channels. The v.h.f. channels (2-13) are frequently extended to 300 or 400 miles, while the u.h.f. channels (14-84) may go as far as 250-300 miles.

Recently, TV DX'ers have observed "bursts" of reception over distances of 200 to 1000 miles. Scientists now think these bursts are due to meteors. Considerable research is taking place in an effort to track down the true cause of this peculiar effect. TV pictures in these bursts are generally good, but last from 2 to 15 seconds —often too short for positive identification.

Individual Results. No article on DX TV reception would be complete without a resume of some results of the individual DX'ers. One of the foremost is Robert Seybold of Dunkirk, New York. Bob's location provides him with an over-water path towards the midwest. He is able to see upwards of 35 stations every day at distances up to 350 miles on v.h.f. channels and 150 miles on u.h.f. channels. Bob has seen 270 stations in 44 states!

Another powerful DX'er is Bedford Brown of Hot Springs, Arkansas, who boasts of having seen 234 stations in 40 states. Bedford has seen 76 stations in a single day. His log includes visual identification of stations in Brazil, Argentina, and Venezuela.

Dick Lowry of Temple, Texas, has been DX'ing seriously for just over a year. His TV screen has been illuminated by 179 stations in 39 states. Also included are many stations on the high band (Channels 7-13) including Channel 9, XEQ, Mexico City, over 900 miles distant.

Ed Sparks of Odessa, Texas, also has seen a total of well over 150 stations. Ed's best DX haul included Channels 7, 9, and 11 from Cuba, across the Gulf of Mexico.

The author has seen 128 stations in nine countries. I think I hold the world's record for distance on both Channels 2 and 4, having logged Channel 2 from Rio de Janeiro, Brazil, in 1954, and Channel 4, Boston, WBZ, on June 5, 1955.

DX TV Club. Readers interested in learning more about DX TV may write to me at 4832 North Fruit Ave., Fresno, Calif. I will be pleased to tell you about a club which has been formed to collect DX TV reports for scientific purposes. —30—

"MISSILE MASTER"

A SUPER-BRAIN for controlling America's super-weapons, the "Missile Master" is the country's first electronic system designed specifically for coordinating the use of NIKE antiaircraft missile batteries and other advanced Army weapons as they become available.

Built by Martin, the system can be used independently, or in conjunction with units of the recently announced Air Force semiautomatic ground environment area defense system (SAGE). Reliable and versatile, the Missile Master is the first integrated system for tying together all elements of antiaircraft missile defense—from target detection to target destruction. It consists primarily of an automatic data communications network and automatic data processing and display equipment.

The system locates and identifies aircraft, displays this data on giant-size screens, and sends instructions to the firing line. What's more, Missile Master operators observe what the weapons and men on the firing line are doing—and can correct errors, direct concentrated fire on a particular target, and prevent friendly aircraft from being hit by our own weapons.

The Missile Master relies heavily on intricate and ingenious electronic circuits to handle information and solve complex problems almost instantaneously. Combined with the judgment of trained operators, a single installation can weld a number of widely scattered guided missile batteries into a formidable defense force. Each system is housed in a two-story building. Nerve-center is the operations room where Army personnel at radar-type display consoles have a view of the over-all air situation for a given area.

Target information passes into a tracking system and is displayed on the consoles. Targets are selected and assigned to missile commanders for firing action. A special operator, known as the "friendly protector," assures that friendly targets are not fired upon.

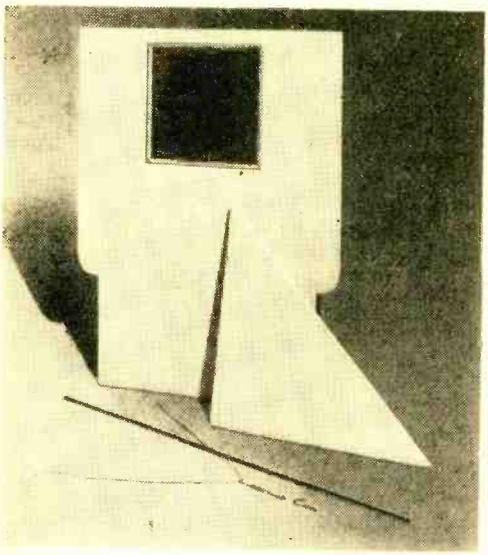
Efficient use of each firing battery is assured by a target assignment system which avoids duplicating firing commands. Another part of the system makes sure that any data received by SAGE corresponds to the position of the targets as actually seen on the local radar. If SAGE data are not available, the tracking operators can spot their own targets.

The Missile Master was built by the Martin Company, Baltimore, aided by Airborne Instruments Laboratory of Mineola N. Y., and the American Machine & Foundry Company of N. Y. —30—

Each operator has his own display console. These men are using photoelectric light guns placed against the radar screens to record and enter target data into the electronic tracking system. Screen shows "picture" of large area, or close-up view, as desired.

Baked Baffle Claimed Better than Wood

Entire "Vibranon" enclosure consists of two marble-like slabs fitted into corner. Front slab with speaker cutout anchors to wall with V-shaped wire shown below. Triangle top rests on rod. Speaker bolts down easily on countersunk screw threads.



MAYBE this girl's pose means that the speaker enclosure supporting her stance sets a new fashion for hi-fi. Actually, the "Vibranon" goes farther than just fashion, being a serious and significantly new approach to an old audio problem. The first commercially available hi-fi loudspeaker baffle made of a totally non-resonant material, it resembles marble and is molded and baked.

The advantage over wood is that the new material simply cannot vibrate along with the speaker cone and thereby add false coloration to the tone of the speaker. Of course, heavily braced, thick wood panels won't vibrate either. But such sturdy wood construction is usually expensive. "Vibranon" claims equal or better results at much lower cost.

Design of the baffle is simplicity itself. It consists of only two slabs that fit in any corner. The two walls and the floor form the remaining sides of the baffle. Felt-lined edges assure airtight fit.

The baffle works on the bass reflex principle. Lows emerge from two openings at the bottom. Response reaches down to 35 cps. The absence of parallel surfaces prevents formation of standing waves, which keeps the baffle from booming.

Absolute rigidity of the marble-like material helps the speaker handle heavy transients, such as drum beats, without random vibration. With such help from the baffle, even inexpensive speakers sound amazingly clean.

The "Vibranon's" inventor, Mr. Mayeri, lived until recently in the isolated highlands of Persia, where modern science is still unknown. He became fascinated with electronics after coming to America a few years ago.

The enclosure, made by Techart Mfg. Co. of Brooklyn, sells for about $60—at Harvey Radio Co., 103 West 43rd St., and Durant Sound Co., 88 West 55th St., New York, N. Y. (plus freight). —30—

Scholarships for Electronics Students

WITH THE GREAT shortage of engineers in the electronics industry, more engineers must be trained to take care of the growing demands. The West Coast Electronics Manufacturers Association is tackling the problem in a practical dollar-and-cents way by sponsoring college scholarships leading to degrees in mechanical or electrical engineering. Degrees in physics are also sponsored.

During the current school term, twenty-five students are attending fifteen West Coast schools with financial aid from this fund. The scholarships are awarded to freshmen and sophomores picked by the deans of the engineering departments.

Economy Vacuum-Tube Voltmeter

By RICHARD GRAHAM

Half-price v.t.v.m. uses new approach in simple design to achieve good accuracy and stability

HOW IT WORKS

Basically, the circuit is a bridge in which each half of the 12AU7 forms one arm of the bridge. Potentiometer *R4* forms the other two arms. Alternating voltage from the transformer is applied to two corners of the bridge formed by the junction of the two 12AU7 plates and *R4*. With no voltage input to the 12AU7 grids, the bridge is balanced by means of *R4*. Any positive voltage input to the grid (pin 2) of the 12AU7 will make that triode draw more current. This increased current causes the cathode voltage of that half of the 12AU7 to rise. Since the meter is across the two cathodes, a current will be read which is proportionate to the voltage placed on the grid.

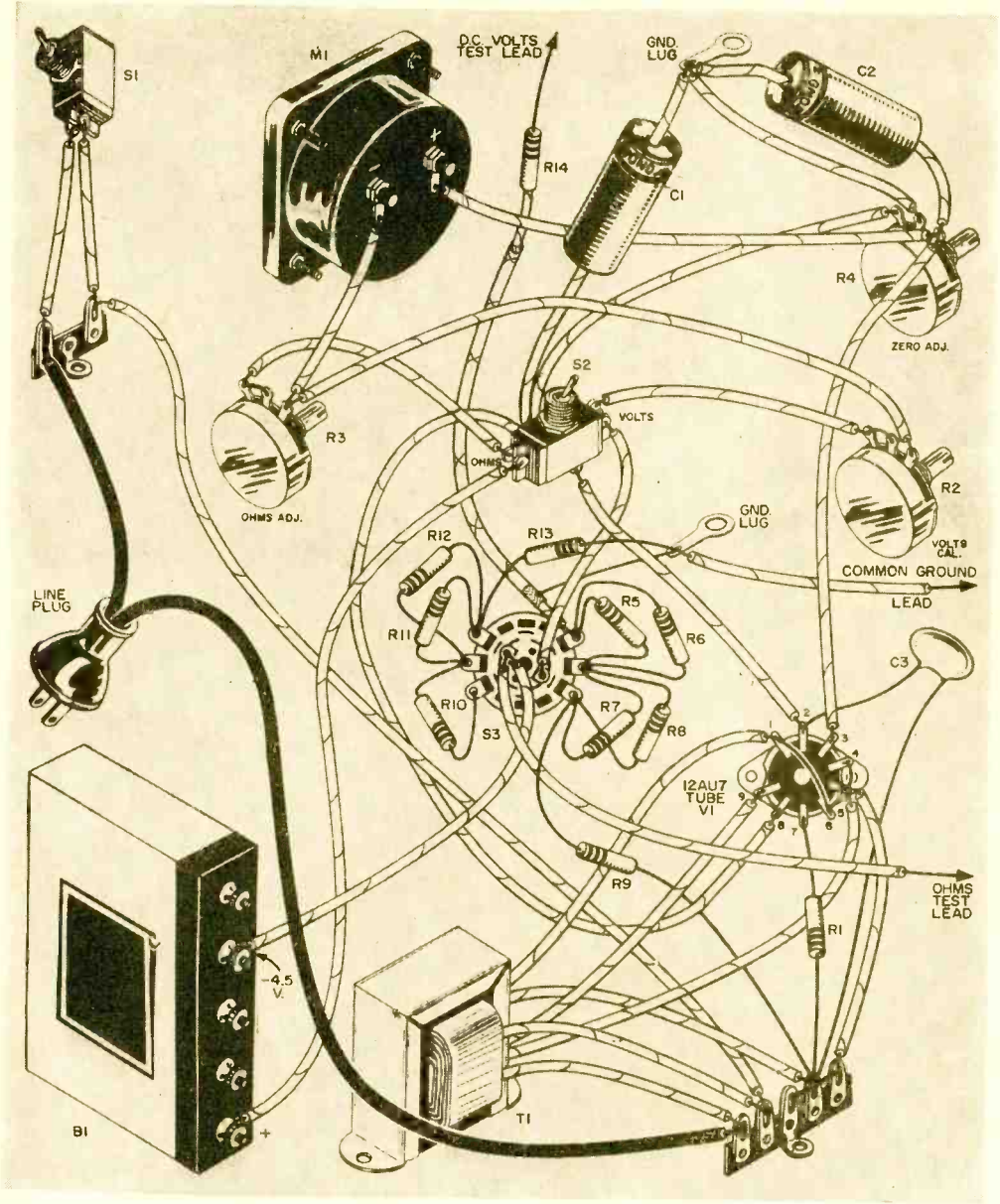
The fundamental range of the meter is approximately 4.5 volts. This is the range over which readings will be linear. The 2.7-megohm resistor (*R1*) in the probe serves to multiply all ranges of the meter from multiples of six on the input to multiples of 4.5 (approx.) on the 12AU7 grid. Exact voltage calibration is accomplished by the voltage-adjust potentiometer, *R2*.

Since the fundamental range of the v.t.v.m. is approximately 4.5 volts, a 4.5-volt battery must be used for the ohmmeter section. The principle of the ohmmeter section of the v.t.v.m. is quite simple. The meter will read full scale regardless of the resistance in series with the 4.5-volt battery placed between grid and ground. However, if the grid is shunted by any resistance, the meter reading will fall by the amount of the voltage division between the resistor in series with the battery and the resistor shunting the grid.

THERE really isn't any need to expound the usefulness and versatility of the vacuum-tube voltmeter—it is one of the basic items of test equipment in setting up any shop, ham station, or laboratory. But the v.t.v.m. described here can be built for less than half the cost of the popular kits available today—assuming all new parts are used in construction.

Such economy is not accomplished at the sacrifice of performance but rather by keeping a sharp eye on all the electrical and constructional details. This v.t.v.m. has an input impedance of 12.7 megohms on all ranges. It has three d.c. voltmeter ranges of 0-6, 60, and 600 volts full scale. There are also three ohmmeter ranges, making measurements of 10 ohms to 10 megohms quite feasible.

The "Economy" v.t.v.m. utilizes a 0-1 milliampere meter which may be purchased for approximately $3.50. (Any 0-1 ma. meter may be used—the determining factor is mainly one of price.) The meter is of the moving-vane type and has an internal resistance of about 1000 ohms. If a moving-coil type of meter is used, a 910-ohm, ½-watt resistor should be placed in series with the meter when it is employed in the v.t.v.m.



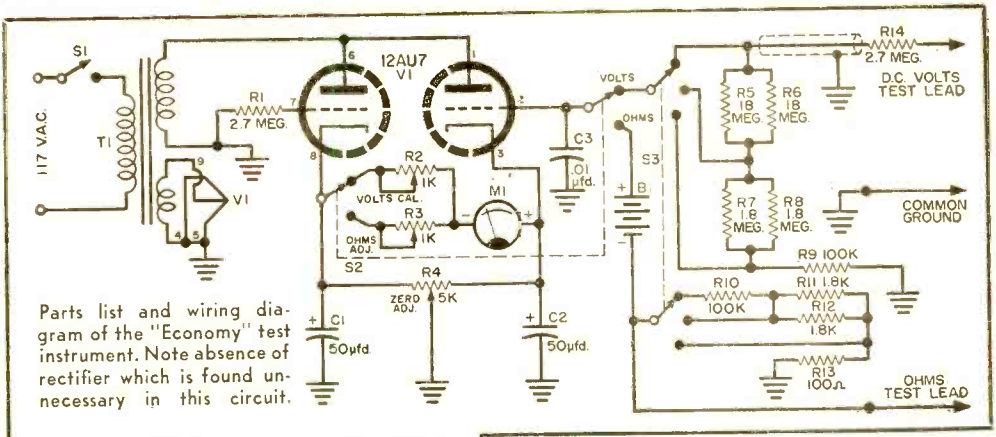
Pictorial wiring diagram shows how various components are connected. Note particularly the wiring around switch S3 and shielded lead attached to R14.

Layout and construction details can be seen in the photographs. The v.t.v.m. is housed in an aluminum case which measures 7" x 5" x 3".

A big item in the economy of construction is the use of 5% resistors for the voltage divider and ohmmeter multipliers. It will be noted that some of the resistors in the voltage divider ohmmeter multiplier are in parallel—to achieve the exact calculated value. For example, one of the values called for was 900,000 ohms. Since this is not an RETMA standard value, two 1.8-megohm resistors—which are standard—were placed in parallel (see *R5* and *R6*, *R7* and *R8*).

The d.c. volt test lead should be a shielded cable. A three-foot length of single-conductor microphone cable is ideal for this purpose. The common test lead and the ohms test lead are made of standard rubber-covered test lead wire.

No jacks were used for the test leads since there is never any need to disconnect



Parts list and wiring diagram of the "Economy" test instrument. Note absence of rectifier which is found unnecessary in this circuit.

B1—4.5-volt "C" battery (or 3 penlite cells in series)
C1, C2—50-μfd., 25-volt electrolytic capacitor
C3—.01-μfd., 600-volt ceramic capacitor
M1—0.1-ma. Shurite meter or equivalent (see text)
R1, R14—2.7-megohm, ½-watt, 10% resistor
R2, R3—1000-ohm potentiometer
R4—5000-ohm potentiometer
R5, R6—18-megohm, ½-watt, 5% resistor
R7, R8—1.8-megohm, ½-watt, 5% resistor
R9—100,000-ohm, ½-watt, 5% resistor
R10—100,000-ohm, ½-watt, 5% resistor
R11, R12—1800-ohm, ½-watt, 5% resistor
R13—100-ohm, ½-watt, 5% resistor
S1—S.p.s.t. toggle switch
S2—D.p.d.t. toggle switch
S3—3-pos., 2-pole rotary switch
T1—Power transformer, 125 volts at 15 ma., and 6.3 volts, at 0.6 amp. (Stancor PS8415)
V1—12AU7 tube

Table I

0–1 MILLIAMMETER READING	NEW VOLTS SCALE CALIBRATION
0	0
.166	1
.33	2
.50	3
.66	4
.83	5
1.0	6

Table II

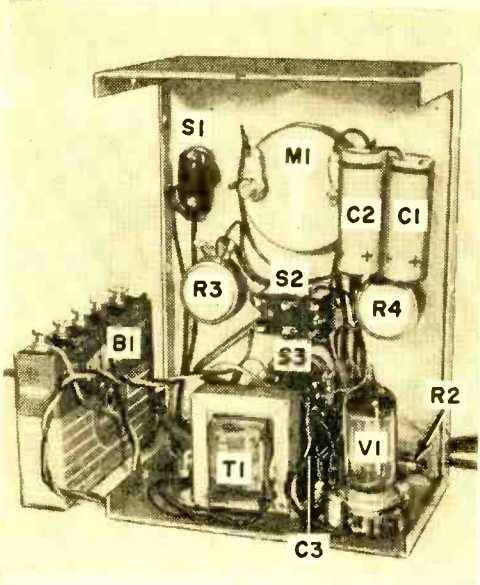
NEW VOLTMETER SCALE READING	NEW OHMMETER SCALE CALIBRATION
VOLTS	OHMS
.546	1
1.0	2
1.385	3
1.715	4
2.00	5
2.25	6
2.47	7
2.66	8
2.84	9
3.00	10
3.60	15
4.00	20
4.50	30
5.00	50
5.46	100
5.72	200
5.89	500
5.94	1000
6.00	INFINITY

them. In fact, the general practice of using jacks at these points only leads to more difficulties such as poor contact, loosening up, etc.

The most painstaking operation in constructing the v.t.v.m. is making the meter scale. First, disassemble the meter by bending the four ears up on the back of the meter. Next, carefully remove the scale. Lay the scale on a piece of paper and fasten it temporarily in place with Scotch tape. Now, divide the scale into six equal parts—since the meter scales are to be multiples of six instead of ten. Use the meter readings listed in Table 1.

Transfer the scale calibration to a new scale which can be drawn on a white file card. Make an arc corresponding to the original meter scale arc. Draw lines to the seven division points; this will divide the scale into six equal parts. Now subdivide each of the six divisions into five equal subdivisions; these correspond to 0.2, 0.4, 0.6, and 0.8.

The next step is to draw in the ohmmeter scale. You can do it by referring to Table 2. Draw another arc for the ohmmeter scale just above the voltmeter scale. From the data in Table 2, a line is drawn



Inside-the-case view of the v.t.v.m. shows actual location of the major components used by the author.

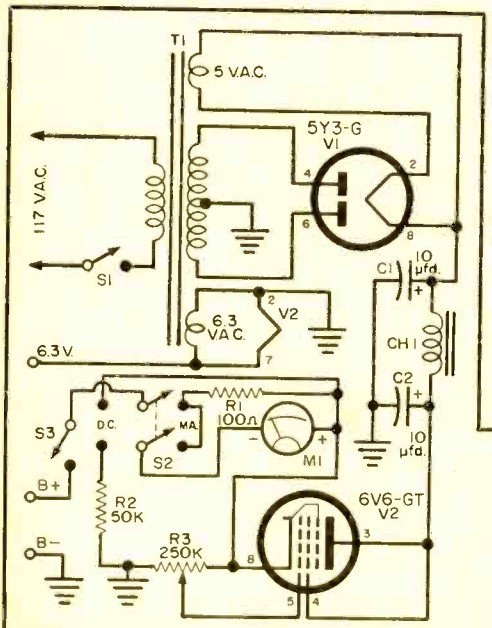
on the new scale through the center point and the voltage scale reading indicated. Both arc and calibration points and lettering for both scales can be inked in with India ink and the pencil guide lines erased. The scale can then be cut to size. Use paper rubber cement over the original meter scale to hold it in place.

After the unit is constructed, the only calibration necessary is for the d.c. voltage. The 4.5-volt battery can be used as a convenient source of known voltage. Temporarily remove the battery from the circuit. Set the meter to the 6-volt position. Set *R4* so that the meter reads zero. Connect the voltage test probe to the positive end of the 4.5-volt battery, and connect the common lead to the negative end of the battery. Adjust *R2* inside the v.t.v.m. so that the meter will read 4.5 volts. This automatically calibrates all the voltmeter ranges. The battery can now be reinstalled in the v.t.v.m.

The ohmmeter is calibrated in use by adjusting *R3* on the front panel for full scale when the function selector switch is in the ohms position. —30—

Variable Power Supply for Experimenters

EVERY now and then a friend drops by with a small gadget he wants tested. In each case I have to use different plate voltages. It was quite a problem until I constructed a unit which will supply a variable d.c. potential from 50 to 350 volts and a filament supply of 6.3 volts a.c.



Wiring diagram of power supply and parts list.

Potentiometer *R3* sets the d.c. output to any selected value. The 6.3-volt winding supplies filaments of the 6V6 and any other tube that requires it. Although the power supply is conventional, the metering circuit is a time saver for those who don't like the idea of installing a meter or dragging out the voltmeter each time the plate voltage is changed.

I used a 0-5 d.c. voltmeter purchased for $1.95 in a surplus store. With a d.p.d.t. toggle switch, d.c. voltages and milliamps can be read with a flick of the switch. Resistors *R1* and *R2* are values needed with this meter, but any d.c. meter will work by changing *R1* to read milliamperes and *R2* to read d.c. voltages.

Any transformer and rectifier tube that is available will do; or local radio shops have old radios for $1.00 and up that contain all parts except the meter. Use your voltmeter and a milliamp meter to check the unit before you rely on meter readings.—*G. W. Pellerin, Jr.* —30—

C1, C2—10-µfd., 450-volt elec. capacitor
CH1—110-ma. filter choke
R1—100-ohm, ½-watt resistor
R2—50,000-ohm, ½-watt resistor
R3—250,000-ohm potentiometer
S1, S3—S.p.s.t. toggle switch
S2—D.p.d.t toggle switch
T1—350-0-350 power transformer
V1—5Y3-G tube
V2—6V6-GT tube
METER—0-5 d.c. volts

England Sets Up TV Training Center

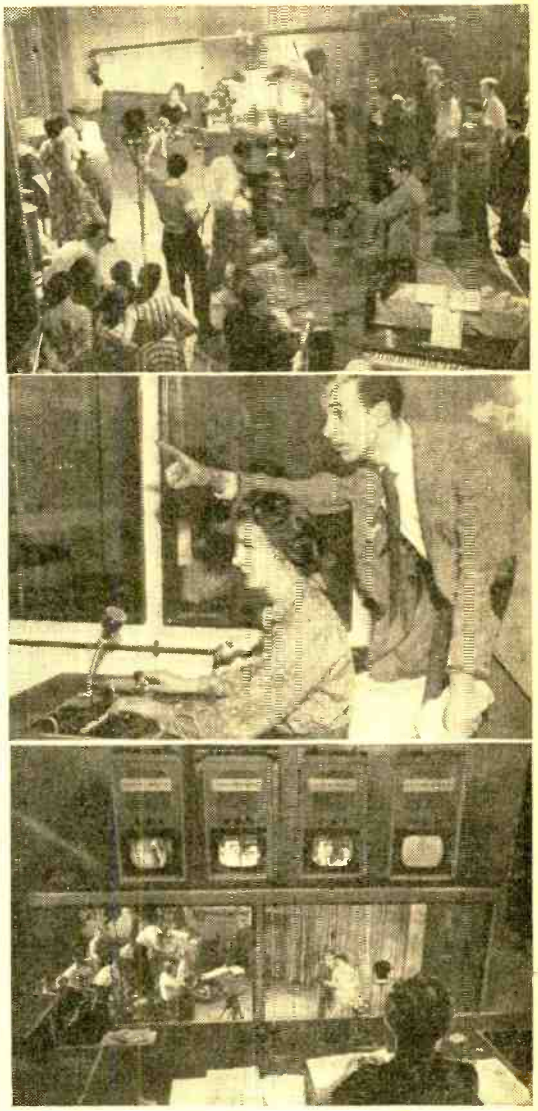
LAST YEAR, commercial TV suddenly threw some spice in Britain's bland television diet. For the first time in the history of broadcasting in England, the government-sponsored programs of the British Broadcasting Corporation (B.B.C.) were rivaled by a newly licensed commercial TV network.

Since England had been among the earliest TV pioneers, sending out regular program schedules almost ten years before TV took over America, all the technical problems had been pretty well ironed out. The snag was in personnel. When the new commercial TV company more than doubled TV activity in England, there just weren't enough people who knew how to put a show on the air.

The answer to this problem has literally taken on concrete shape. The brand-new Marconi Television Centre now rises in downtown London, training a whole new generation of camera men, sound technicians, maintenance crews.

This TV school includes a fully equipped studio with a 2000 square-foot stage, the latest type cameras, video monitors and audio mixing consoles. There are also complete facilities for filmed TV programs, including film editing and sound dubbing machines. Even a remote pickup truck is available in training for on-the-spot coverage. TV producing firms wishing to train their own staffs in studio operation can rent both faculty and facilities of the Marconi Centre.

With the new Centre as its hub, TV studio work is a lively newcomer to the ancient and established trades of Britain. No doubt this first generation of young technicians will start for their new trade the tradition of workmanlike competence characteristic of British craftsmen. —30—



Sound crew (top) learns to trail action on set with mike boom. Director points at low-hanging mike to warn against lowering the boom into the camera's field of vision. Cueing actors on different sets (center), the director coordinates switch-over with girl at control console, who selects one of four cameras from monitor screens over control room window (bottom).

Intricate camera innards (left) are unraveled by teacher for benefit of maintenance students. The show must go on; trained troubleshooters and standby equipment make sure that it does.

what's new in hi-fi

LAFAYETTE RADIO
100 Sixth Ave.
New York 13, N. Y.

Turntable and tone arm of professional quality at reasonable cost are available as complete assembly or as separate components. Turntable (PK-100, net $49.50) uses 4-pole shaded motor, features variable adjustment at three speeds (33⅓-, 45-, and 78-rpm). Wow is less than 0.2%, flutter less than 0.05%. Arm is viscous-damped (PK-90, $19.50 net), accepts all cartridges, will handle discs up to 16" in diameter. If dropped, arm cannot damage records.

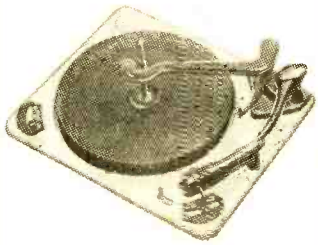
HARMAN-KARDON, INC.
520 Main St.
Westbury, Long Island,
N. Y.

AM-FM tuner features new "FM Rumble Filter," a 10-kc. AM whistle filter, and a cathode-follower output. Full Armstrong circuit (limiter-discriminator) is used. The "Rondo," (Model T-120) is only 3⅜" high. Net price of $95.00 includes metal cage.

QUAM-NICHOLS CO.
Marquette Rd. &
Prairie Ave.
Chicago 37, Ill.

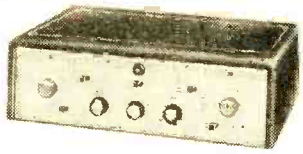
Low-cost 12" woofer handles 10 watts of power, has frequency response of 40 to 5000 cps ± 5 db, with resonant point at 60 cps (Model 12A10L, $16.00 net). Fifteen-inch version handles same power but bass response extends to 30 cps, with resonance at 45 cps (Model 15A10L, net price $21.00). Either woofer may be used with company's Model 3A15T or 5A15T tweeter, or with any other tweeter of similar quality, to make a 2-way speaker system.

GARRARD SALES CORP.
Port Washington, N. Y.



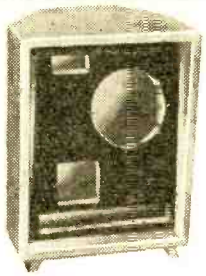
Record changer intermixes 12"-, 10"-, and 7"-diameter records and plays at standard three speeds. The "Renown" (Model RC-121) is Garrard's newest unit; it can be used as a manual player or fully automatic changer. Arm accepts any standard pickup. Four-pole motor is shaded and shock-mounted. Turntable is covered with rubber mat to minimize rumble pickup. Net price, $42.50 (less cartridge, 45-rpm spindle adapter, and mounting base).

HERMAN HOSMER SCOTT, INC.
385 Putnam Ave.
Cambridge 39, Mass.

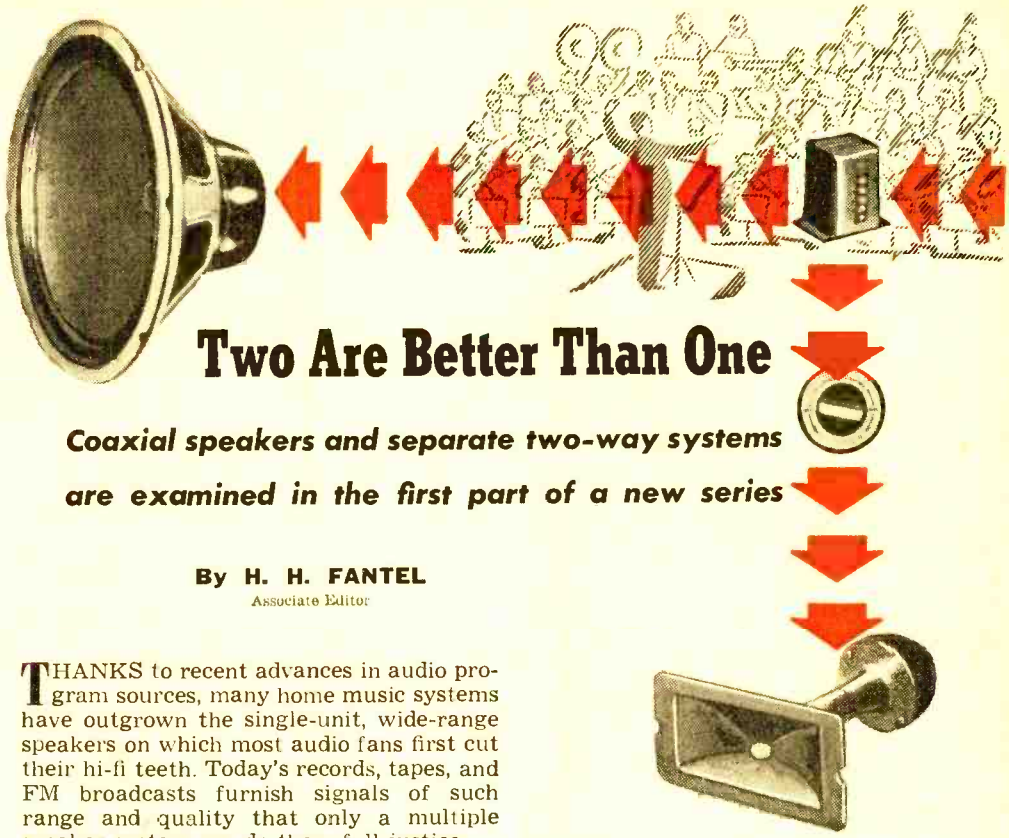


Amplifier (Model 99-B) has power output of 22 watts, plus complete audio "front end." Control facilities include record preamp-equalizer, tape playback control, and all switching needed for hi-fi system. Response is 20 to 30,000 cps. Net, $99.95.

UNIVERSITY LOUDSPEAKERS, INC.
Desk PA-8
80 So. Kensico Ave.
White Plains, N. Y.



Bass reflex speaker enclosure with rear horn-loading can be built from kit containing pre-cut panels. Enclosure may be used in any position in room, can house any type—or combination of—speaker units from single-cone speaker to separate 3-way system. Model KEN-12 (shown in photo) is for 12" reproducers, sells for $39.75. Model KEN-15 houses 15" units, nets for $49.75. Both kits, known as "KwiKits," use ¾" birch plywood.



Two Are Better Than One

Coaxial speakers and separate two-way systems are examined in the first part of a new series

By H. H. FANTEL
Associate Editor

THANKS to recent advances in audio program sources, many home music systems have outgrown the single-unit, wide-range speakers on which most audio fans first cut their hi-fi teeth. Today's records, tapes, and FM broadcasts furnish signals of such range and quality that only a multiple speaker system can do them full justice.

Just to set things straight at the outset, a "multiple speaker system" does *not* mean simply adding extension speakers to an existing speaker setup. It *does* mean using separate reproducers to handle different frequency ranges. A two-way speaker system divides the audio range into lows and highs for a woofer and tweeter, respectively. A further refinement is to divide the sound into lows, mid-range, and highs for a three-way system—woofer, squawker, and tweeter.

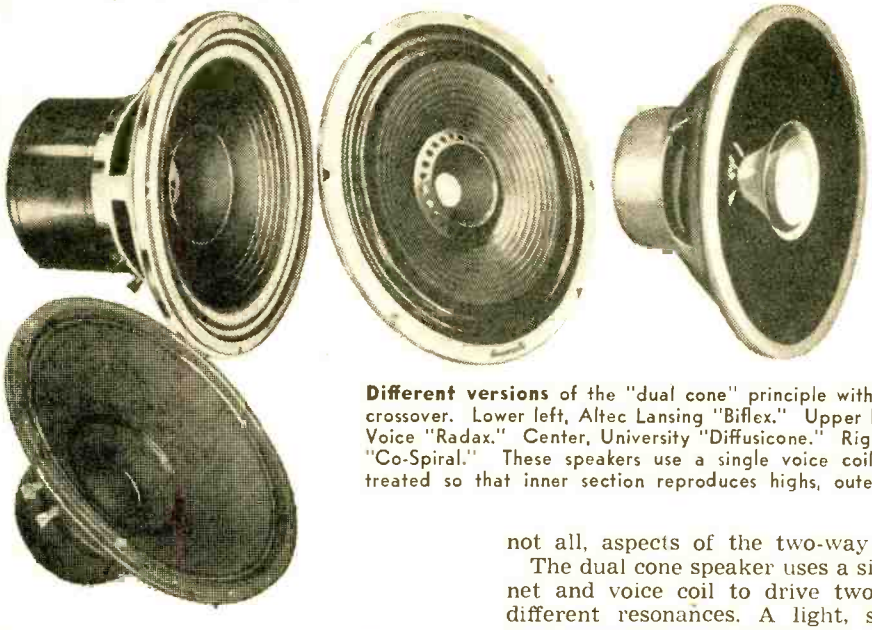
How does this division help? An orchestra uses separate instruments to produce different frequency ranges. To reproduce the orchestra's full tonal range, a multiple speaker system imitates the original division of labor between the musical instruments. For instance, the three-way speaker system corresponds roughly to such instrument groupings as violin, cello, and bass viol—or, flute, clarinet, and bassoon. The idea is the same in each case: each instrument within the group can best handle a specific frequency band. You can't get piping piccolo notes from a bass tuba, and you can't squeeze deep growls from a flute!

Specialized Speakers. The optimum range of any speaker lies in the region near its natural resonance. Response grows weaker at outlying frequencies. Beyond certain limits, the speaker becomes mute. A single-unit speaker necessarily suffers from having to do two jobs at once—from having to stretch its response both ways from a single resonant point. Such a speaker may strike a good musical balance, but only at the sacrifice of extreme highs and lows.

No such compromise limits the performance of multiple speaker systems. Free from the over-all responsibility of the single-unit speaker, tweeters and woofers can be designed to *specialize* in treble and bass. Their widely spaced resonant points enable them to reach the extreme frequencies at both ends of the audio band.

Pushing out the frequency limits is only half the story. Since each speaker in a multiple system operates only within the relatively narrow band best suited to its design, it can cover this band with less effort and more uniform efficiency. The result is flatter and smoother response throughout.

IM Distortion. Contributing to listening pleasure perhaps even more than added range is the reduction of intermodulation (IM) distortion. This type of distortion often occurs in single-unit speakers where treble and bass are sounded simultaneously



Different versions of the "dual cone" principle with mechanical crossover. Lower left, Altec Lansing "Biflex." Upper left, Electro-Voice "Radax." Center, University "Diffusicone." Right, Stephens "Co-Spiral." These speakers use a single voice coil; cones are treated so that inner section reproduces highs, outer part lows.

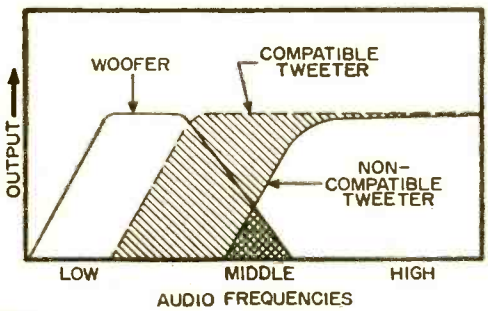
from the same speaker cone. The treble then becomes modulated by the bass in much the same way that an r.f. carrier is modulated by the a.f. signal in a radio transmitter. The resulting sidebands clash against the music in subtle dissonance. Since its level is usually low, IM distortion may be hard to detect at first hearing. Yet, after long listening, it causes nervous strain —one of the chief factors in "listener fatigue." Multiple systems simply sidestep this IM problem by physically separating treble from bass.

Dual Cone Speakers. A two-way system consists of a woofer and a tweeter with a frequency divider or "crossover" to separate treble from bass and feed each to its appropriate speaker. The simplest—and generally cheapest—approach to two-way performance is the "dual cone" type of speaker. This type incorporates some, but not all, aspects of the two-way principle.

The dual cone speaker uses a single magnet and voice coil to drive two cones of different resonances. A light, stiff inner cone acts as tweeter while a larger, heavier outer cone handles bass. In some models, the two cones form concentric rings. A strip of soft material, known as a "mechanical crossover," lies between the two cones. It transmits the heavy bass thrusts but absorbs the rapid treble vibrations, thus providing an elementary sort of frequency separation between the two cones.

Speakers of this kind (e.g., the University "Diffusicone," the Electro-Voice "Radax," Permoflux, Stephens "Co-Spiral," Altec Lansing "Biflex," etc.) offer excellent value in the $40-$50 class. They represent an economical compromise between a single-cone unit and the full two-way system which uses separate treble and bass drivers and an electrical crossover network.

Graph shows response of two-way speaker system using woofer and tweeter. Compatibility of the two reproducers is vital to the mid-range. Overlapping is desirable, prevents audio gap in the response.



Coaxial Speakers. The coaxial speaker is a complete two-way system with independently driven woofer and tweeter. The tweeter, either horn or cone type, nestles inside the woofer. Coaxials therefore take up less space than separate woofer and tweeter components and require only a single cutout for mounting. Hidden within the housing, or enclosed in a separate box, are the coils and capacitors of a full *LC* crossover network. This electrical network separates bass and treble more accurately and effectively than the previously described mechanical crossover, enabling coaxial speakers to rival the performance of separate component systems. Among coaxials, the margin of quality largely remains with models featuring full *LC* crossover.

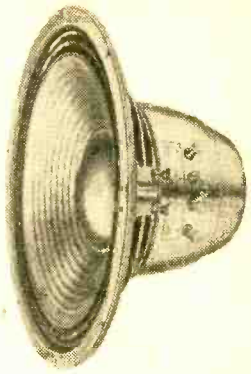
Three-Way Speakers. Some manufacturers, notably Electro-Voice, University, and Jensen, carry the coaxial principle

a step further and produce "triaxial" speakers. These are neatly tucked-together three-way systems. The Jensen Model G-610 is the only speaker in this group that uses completely independent drivers for all three speaker elements. Others use a common driver with mechanical crossover for bass and mid-range, and a separate driver with electrical crossover for the tweeter.

Crossover Networks. Also called "dividing networks," these circuits divide the total frequency range into treble and bass channels. The network must keep bass out of the tweeter lest the heavy bass amplitudes damage the tweeter assembly and produce harsh sounds as well. Conversely, treble must be kept out of the woofer where it might cause IM distortion or simply burn up as heat because the heavy woofer cone cannot keep pace with rapid treble vibrations.

A complete crossover network, therefore, combines low-pass (inductive) and high-pass (capacitive) filters. A simple capacitor in series with the tweeter, sometimes found in low-cost installations, is somewhat effective but is not a true *LC* network. As a high-pass filter, it will help channel most of the highs to the tweeter and keep bass out of it. But it is—at best—a short cut; there is no inductance provided to intercept treble that might reach the woofer. The door is thus left open to whatever IM distortion may occur within the woofer range.

Separate Speaker Components. In their quest for the best, audio designers find limitless leeway in devising speaker systems consisting entirely of separate components. Freed from the restrictions of the coaxial frame, designers of speaker systems may use oversize parts to achieve greater power capacity and improved performance. Adding a "squawker" for the mid-range, and a "super-tweeter" for extreme highs results in a three-way or four-way system. The advantages of such a system lie in further reduction of IM distortion. The greater the number of speakers, the narrower the band to be covered by any single speaker. Hence, there is less chance for intermodulation within that band. Of course, these refinements are realized fully only when the rest of the hi-fi system (amplifier, tuner, and pickup) equals the quality of the speaker system. Such elaborate systems also involve more elaborate—and carefully designed—crossover networks as well as larger housings.

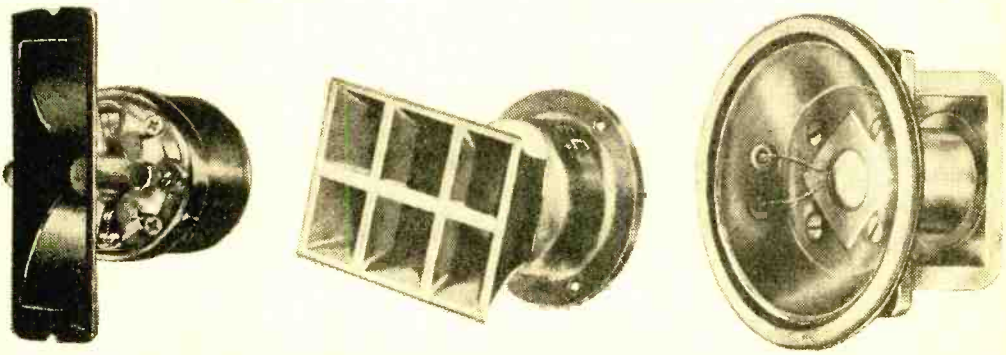


Woofer specializes in bass and forms "bottom" half of two-way speaker system. This 12" University woofer has response from 40 to about 6000 cycles. Provisions are built in for frequency cutoffs at 700, 2000, or 5000 cycles. Other woofers are available in 8" and 15" sizes.

In a two-way system, the physical separation of the woofer and tweeter also precludes the possibility of acoustical interference between treble and bass, which sometimes besets coaxials — where the tweeter may lie directly in the path of low-frequency notes. The separate two-way system is ideally suited for the use of folded horn enclosures. The woofer may be located at the horn's apex, deep within the enclosure, while the tweeter is front-mounted for direct treble radiation.

Ready-made, factory-assembled multiple

Basic tweeter types are illustrated by examples below. Left, the Electro-Voice T-35 horn tweeter which relies on diffraction principle to spread highs. Center, Altec Lansing's 300-A; this horn tweeter uses multicellular construction to fan out highs. Right, Lorenz LP-65; in this cone tweeter, highs are spread from stiff, shallow, plastic diaphragm. Choice of a cone or horn tweeter is largely a matter of personal listening taste.



speaker systems come in a variety of enclosures—from shelf-sized two-way "miniatures" with 8" woofers (suitable for small apartments) to four-way giants capable of filling the largest room with massive sound of astonishing realism. The price range is nearly as wide as the frequency range—from about $55 to several hundreds of dollars. There are good bargains at the bottom—and you still get your money's worth at the top.

Home Assembly. Perhaps the main attraction of separate speaker components is for the audio fan who assembles his own system. Liberty to try out different combinations of woofers and tweeters makes separate speaker components the natural choice for the hi-fi experimenter. One could, for example, compare various horn and cone tweeters to pick the type and model best suited to his own room acoustics. The separate—and independently mounted—tweeter (or tweeters) may be pointed at any desired angle. Remarkable realism often results from turning the tweeter *away* from the listener to let the highs reflect from corners or bounce off the ceiling. The sound then becomes diffuse and non-directional, and the listener feels pleasantly "surrounded" by the music. Separate tweeter level controls (included in most large systems) balance the proportion of highs and lows for any listening situation.

"Growing" a Speaker System. Flexibility in combining different woofer and tweeter components is also a money-saver. Audio fans who start with a single "wide-range" speaker can convert to a multiple speaker system without losing their original investment. After adding a new tweeter and crossover network, the old wide-range speaker may serve as a woofer. Later, if a larger woofer is desired, the original speaker still remains useful as a fine mid-range "squawker." In this way, the speaker system grows up gradually, keeping pace with the listener's own tastes and his limitations of budget.

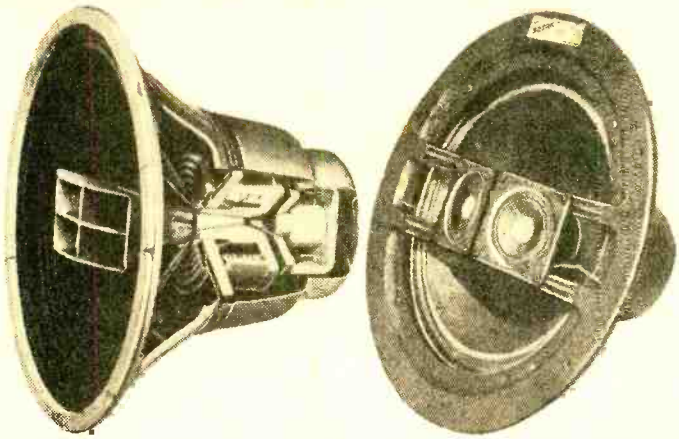
Recognizing this interest on the part of many audio fans, some manufacturers have worked out such gradual "speaker expansion" programs in kit form. Speakers are bought and added one at a time until a complete three- or four-way system is assembled, thus distributing the load not only electronically but financially as well. These factory-planned expansion systems also assure the customer that all speakers and their crossover networks will be correctly matched.

Picking Your Own Components. The most adventurous among radio fans insist on experimenting more freely, combining different makes and types of speaker components for what they hope will be a unique and personal achievement. Therein, for many serious hobbyists, lies much of the excitement and reward of hi-fi.

Once he is on his own, there is no sure way of foolproofing the efforts of an audiophile. Yet, the following hints might avert costly blunders:

1. Woofer, tweeter (and mid-range unit, if any) must be "compatible" in terms of crossover frequency. Between them, the entire audio range must be covered *continuously*. If woofer response falls off below the frequency where the tweeter takes over, the resulting response gap plays havoc with the middle, imparting a strangely disembodied feeling to the sound. For smooth transition, a certain amount of overlap between speakers is desirable, as long as the woofer and tweeter are so positioned that no phase cancellation occurs in the overlap band.

Compatibility and non-compatibility are illustrated in the graph on page 54. If an already-present single-unit speaker is to be expanded into a two-way system by the



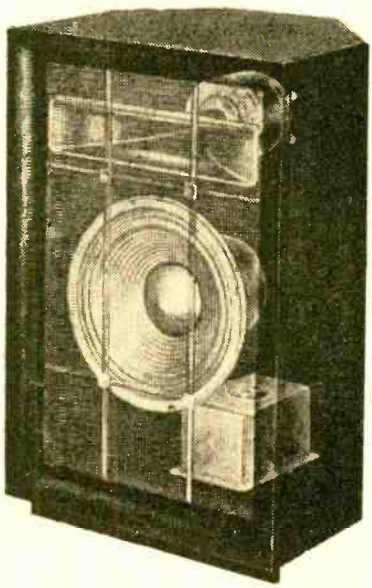
Representative coaxials (reading from left to right, pages 56 and 57). Cutaway view of University 6201, in which the horn tweeter nestles within the frame of the surrounding woofer. The Lorenz LP-312-1, showing how the cone tweeter described in the text is mounted on a frame across the front of the woofer. Altec Lansing 604C speaker combines a 15" woofer with a multicellular horn tweeter; crossover network is in separate box. Cutaway view of Jensen H-222, another example of a low-cost full coaxial. The Bozak B-207A utilizes two coaxially mounted cone tweeters.

addition of a tweeter, the crossover frequency must be at—or above—the low-frequency cutoff of the tweeter. Other factors remaining the same, the lowest feasible crossover point will give the best performance, since it reduces IM in the woofer.

2. The crossover network itself must actually furnish the dividing frequencies and impedance ratings required by the speaker components. A tweeter designed to take over at 4000 cycles should not be connected to a network with a crossover frequency of 2000 cycles. Similarly, a network for an 8-ohm impedance might not do too well connected to a 16-ohm speaker. Commercial crossover networks are clearly labeled for correct connections.

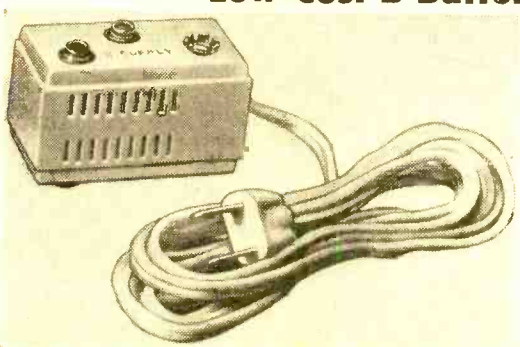
3. Where no level control is provided for adjusting the relative output of woofer and tweeter, these speaker components should be about equally efficient, so that neither "outshouts" the other.

The use of more than one woofer and tweeter in two-way and three-way systems, various crossover values and their applications, matching components of varying impedance ratings, and general descriptions of typical three- and four-way systems will be discussed in later articles. —30—



Complete separation of components distinguishes full 2-way system from the coaxial. Physical independence of tweeter from woofer permits increasing relative sizes, allows higher power ratings, often enables more advantageous placement of units.

Low-Cost B Battery Rejuvenator



A 67½-volt B battery rejuvenator has been announced by Lafayette Radio, 100 Sixth Ave., New York 13, N. Y. This unit may also be used to replace a B battery when the voltage requirements are near a 117-volt a.c. source. The portable eliminator/rejuvenator is fused for additional safety. Known as the Model F-195, it measures 1¼" x 2½" x 1⅝" and is sold complete with a convenient 6' line cord. Experimenters using 67½-volt batteries will find that this unit adds many hours of life to their partially run-down batteries.

Betting Safe on the Weather

By Herbert Reid

FEW GAMBLERS would take bets on the way the wind might turn a week from now. Yet at the Weather Bureau in Washington, a giant gambler with a steel brain will soon lay four-to-one odds on just that kind of deal. Nobody minds, because every time he wins, the public benefits.

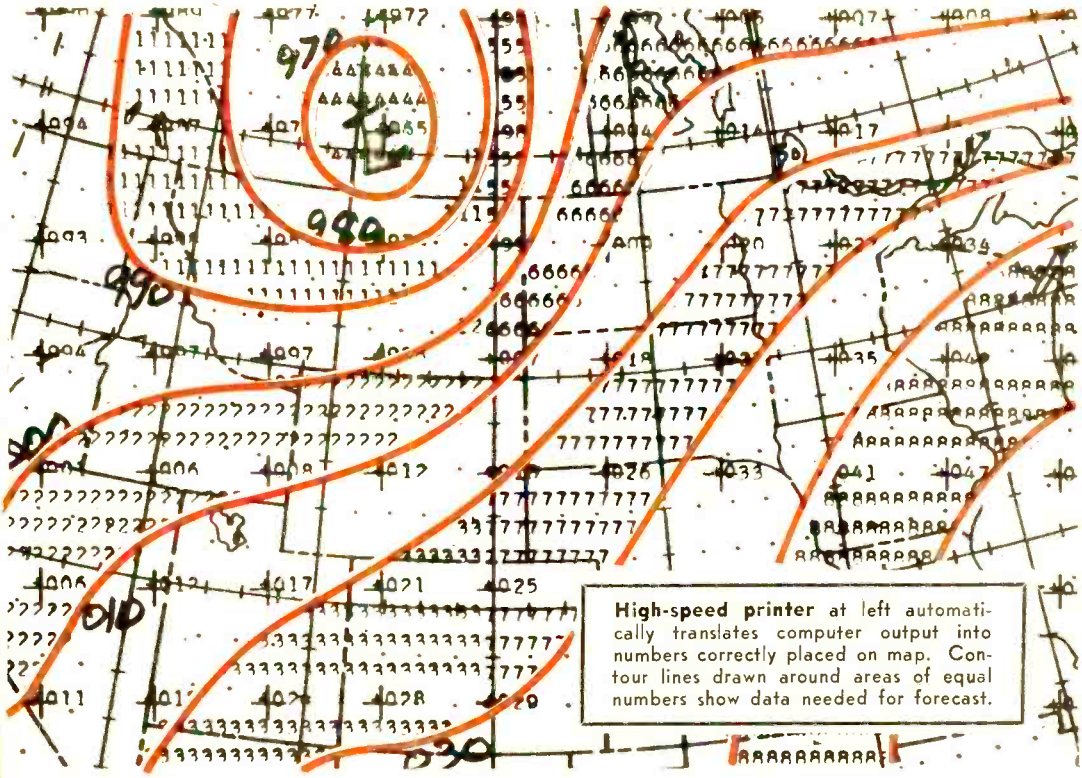
Like any skilled gambler, the Weather Bureau's electronic IBM computer is betting on a "system." Its system for predicting the weather is based on a "mathematical model" of the weather-generating layers in the atmosphere. Such a mathematical model is a sort of mental picture of a situation expressed in equations understood by the computer. The equations describe the situation not only "as is" but also take into account all possible ways in which the situation might change.

In our particular case, the "model" represents the air ocean over the United States. Its drifts and swirls are continuously charted and teletyped to Washington from 171 Upper Air Sounding Stations throughout the country. Since conditions must be graphed on several different altitude levels, the data represent a "three-dimensional chessboard" on which movement takes place up and/or down as well as sideways.

Readings of wind velocity, barometric pressure, temperature, moisture, etc., naturally vary from hour to hour. But the principle by which these factors interact to determine our weather stays always the same. This unchanging principle of atmospheric interaction is retained in the computer's magnetic memory.

With this vast background information always on hand and constantly "consulted" by electric scanning pulses, the computer develops current weather reports into predictions for the future.

Fast Figuring. Each prediction means a mass of math. The greater the number of factors considered, the more reliable is the forecast. The most accurate nationwide 24-hour weather forecast possible today involves about ten million calculations. On such a job, the weather outruns the weatherman. With a houseful of clerks buzzing away on ordinary desk calculators, reports might get out just in time for last year's newspaper.



High-speed printer at left automatically translates computer output into numbers correctly placed on map. Contour lines drawn around areas of equal numbers show data needed for forecast.

Up to now, the main reason for the uncertainty of weather forecasts was the early deadline. There just wasn't enough time to do all the necessary figuring. Hence, hunches had to pinch-hit for mathematics. The new computer, performing 14,000 mathematical operations per second, clicks out the answer in 48 minutes. It is now possible for the first time to make accurate forecasts before the prediction turns into history.

On a trial run before installation, the machine astounded the members of the staff by spotting a brewing storm that they had missed completely. Senior weathermen were delighted to be "shown up" by the robot newcomer.

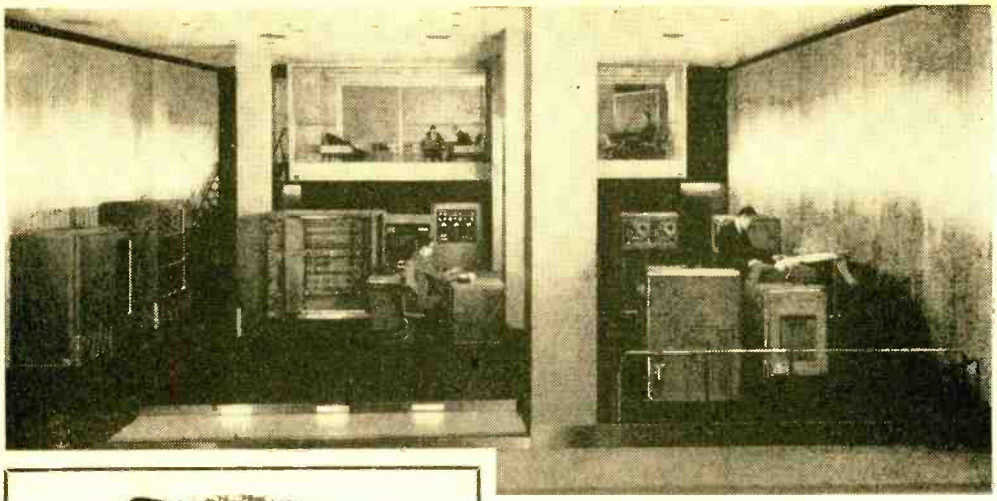
At present, the Weather Bureau computer grinds out weather maps for the next 36 hours. The computation of such a map takes only 105 minutes. Weathermen are now working to stretch the reliable prediction span to 72 hours. Even weekly and monthly forecasts may soon boast up to 80% accuracy. Basic research is busy defining the mathematical basis for such long-range prediction.

While ultimate hopes are high, immediate expectations must still be held in check. All weathermen know that after a major breakthrough scientific progress returns to its gradual pace. Initial operation of the new system must be evaluated, shaken down, and streamlined until reliable results can be taken for granted. Various mathematical models may yet have to be explored in terms of their theoretical limit of accuracy.

More Automation. As if all this weren't enough, weathermen are now teaming up with electronics engineers to make weather forecasts almost fully automatic. At present, information from outlying stations is fed to the computer on punched cards after the data come in on the teletype. To eliminate the time-consuming card punching, scientists are considering the possibility of telemetering weather data directly into the computer.

Weather signals from balloons aloft would be re-transmitted by ground stations over telemeter lines or relays. The computer could then continuously "keep posted" on atmospheric changes as they occur. Of course, the input section of the computer would have to be modified to "read" the telemeter signals instead of the punched cards. Even the most optimistic admit that this may still be far in the future.

Meanwhile, as an intermediate step toward automation, teletype machines have been designed to present their information directly in punched card form rather than in printed alphabet letters. Consequently,



Navy, Air Force and the U.S. Weather Bureau chipped in their cash and know-how to set up jointly this IBM installation for mathematical weather prediction. Racing ahead of speed limits formerly imposed by desk calculators (left), the electronic computer completes complex forecast figuring before the weather catches up with the prediction.

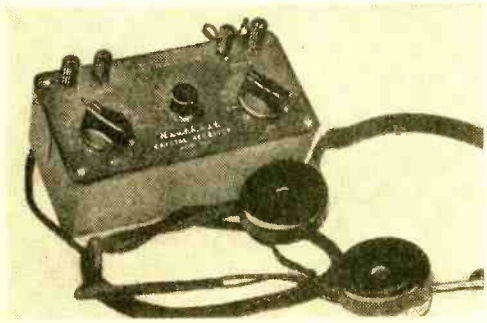
the teletype information no longer has to be "translated" by hand into punched card code. This automatic coding eliminates the chance of human error misguiding the computer. Eliminating routine coding operations also saves time and frees personnel for more vital tasks.

Nature vs. Man. Floods and hurricanes taking their tragic toll remind us dramatically how human life is intertwined with the whim of the weather. From airline flights to scheduling baseball games, the modern community depends on accurate advance weather news. Less obvious, but reaching more deeply into our national life, are such long-range weather factors as crop prediction and water supply.

Like a giant hand, the force of weather grips the whole surface of our planet. Aside from occasional attempts at seeding rain clouds, the atmopshere still eludes human control. But the new electronic aids to meteorology take the surprise element from the elements. We are no longer quite so helplessly at their mercy.

When Mark Twain complained that "everyone is talking about the weather but nobody's doing anything about it," he could hardly have envisioned a huge maze of electronic circuits with feelers flung across a continent, converting climatic quirks into an almost sure pattern of predictability. And the rain and thunder gods of our ancestors would be even more amazed. —30—

CD or Hi-Fi Crystal Set Offered by Heath



A SENSITIVE CRYSTAL set using two tuned circuits has been announced by the Heath Co., Benton Harbor, Mich. Attractively mounted in a black Bakelite case, the receiver is self-contained and has nothing to wear out or fail in service.

Sold as a complete kit with elaborate instructions, the Heath Co. feels that this unit will serve three purposes. A beginner can use the manual to understand the fundamentals of radio reception, the householder can use it for Civil Defense and the hi-fi fan for excellent AM reception.

Tuning the Short-Wave Bands

=with Hank Bennett

WE THOUGHT you might like to hear about the experiences of another steady s.w. reporter from New England, Paul Mathieu. Paul, who is 17, lives at 25 Chestnut St., Southbridge, Mass. He is a senior at Mary E. Wells High School in Southbridge.

Replying to our questionnaire, Paul says that he does his DX'ing on a Hallicrafters SX-28-A receiver, a 15-tube superheterodyne. To bring the signals into his shack, he uses an end-fed rectangular-shaped long-wire antenna, about 40 feet above the ground and the same in perimeter. Supplementing this antenna are two 100-foot long wires oriented NE/SW and NW/SE. Additional equipment includes a home-made two-tube preselector, an antenna tuner, three-speed turntable, auxiliary audio amplifier, Admiral table model superhet, and a Sessions time clock and switch system.

Paul first became interested in radio in late 1954. He is a Novice, with the call WN1YZH, and hopes to obtain his General soon. His first foreign verification was from *Radio Gonaives,* Gonaives, Haiti. At one time he had a report to *Radio Commerce,* Port-au-Prince, Haiti, published in a Haitien newspaper in a radio column. He carries on a steady correspondence with Sr. Luis D. Carbone Mora, Director General of the Iquitos station of *Radio Nacional del Peru.*

Since 1954, Paul has logged a total of 92 countries, with 83 of them verified. He has heard 151 s.w. stations, with 112 veries. Paul's most prized veri is from *Radio Tahiti* in Papeete, Tahiti. When writing to the foreign stations, his letters are in English, French, Spanish, or Greek. Being able to read, write, and translate Greek has made him an invaluable reporter on the activities of the various Greek stations.

Paul writes that his favorite s.w. bands are 41 and 49 meters or, roughly speaking, 5900 to 7400 kc. His favorite s.w. stations are those of the Swiss S.W. Service because of the great variety of interesting programs and a usually reliable signal. His best DX includes Tahiti, Japan, Noumea, New Zealand, Lebanon, VLT6, the Forces Stations in Athens and Larissa, Greece, and *Radio Mediterraneo,* Valencia, Spain.

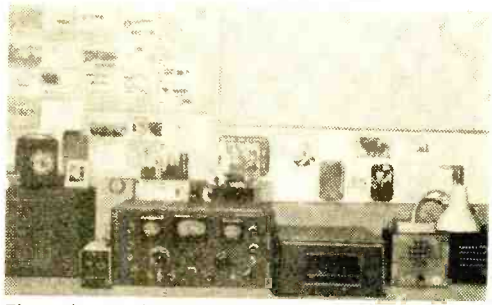
Radio clubs to which Paul belongs include the Newark News Radio Club and the Quinnebaug Valley Radio Club of Southbridge. He is also interested in photography, languages, and any kind of electronic experimentation.

In closing, Paul states that he would like to see more items on choice DX-bits, instead of so many reports on the stations that are generally audible without trouble even to an inexperienced DX'er.

Club Notes

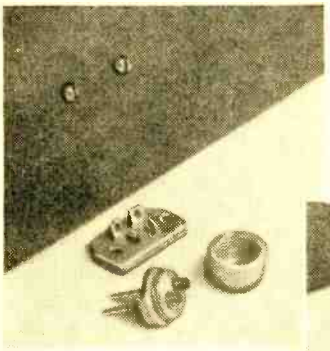
One of the newer clubs at present is the International Shortwave League of Indianapolis, Ind. Editor and Publisher Joel Whitaker II writes that the club is currently undergoing changes in format but that shortly bulletins should be going out every month. The dues are $1.75 in North America; $2.50 elsewhere. Details can be obtained from Mr. Whitaker, 3156 N. New Jersey St., Indianapolis 5, Ind.

(*Continued on page* 116)



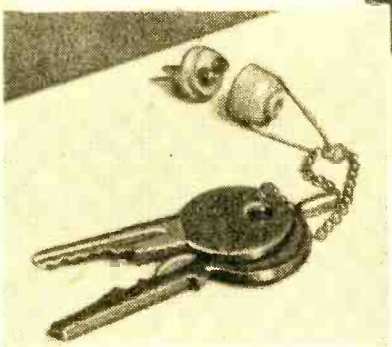
The radio shack of Paul Mathieu, WN1YZH, Southbridge, Mass. See text for equipment line-up.

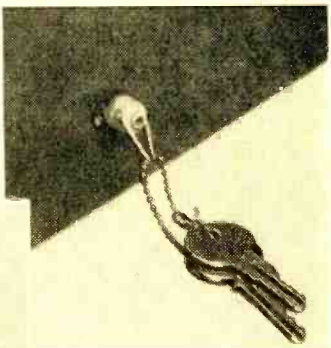
Secret Switch Paralyzes Radio



Phone plug and socket, while small in size, are husky enough to carry 117-volt a.c. house current—or battery current—without heating. The above photograph shows how socket is mounted on the rear panel of a radio cabinet.

Wire jumper is soldered across the two terminals inside the plug. Drill two small holes through the cover of the plug (below) so that the plug can be fastened to a key chain by means of a small loop of dial cord or fish line.





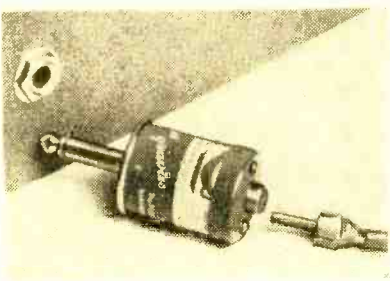
The "key" is plugged into the socket while the radio is in use. There is no danger of shock because the exposed part of the plug is well insulated, and the mounting screws of the socket are insulated from the socket terminals.

IF YOU HAVE a piece of radio or electronic equipment that you don't want anybody to use while you're away from home or shop, install the simple plug and socket shown in the photos above. The socket is connected in series with the power supply (either 117-volt a.c. or batteries) of the equipment to be protected. If you want to use the equipment, simply insert the shorted plug into the socket. When you leave, pull out the plug and take it with you. Mount the socket where it is not easily seen, and keep the "key" a secret!—*Arthur Trauffer.* —30—

Phono-Plug to Phone-Jack Adapter

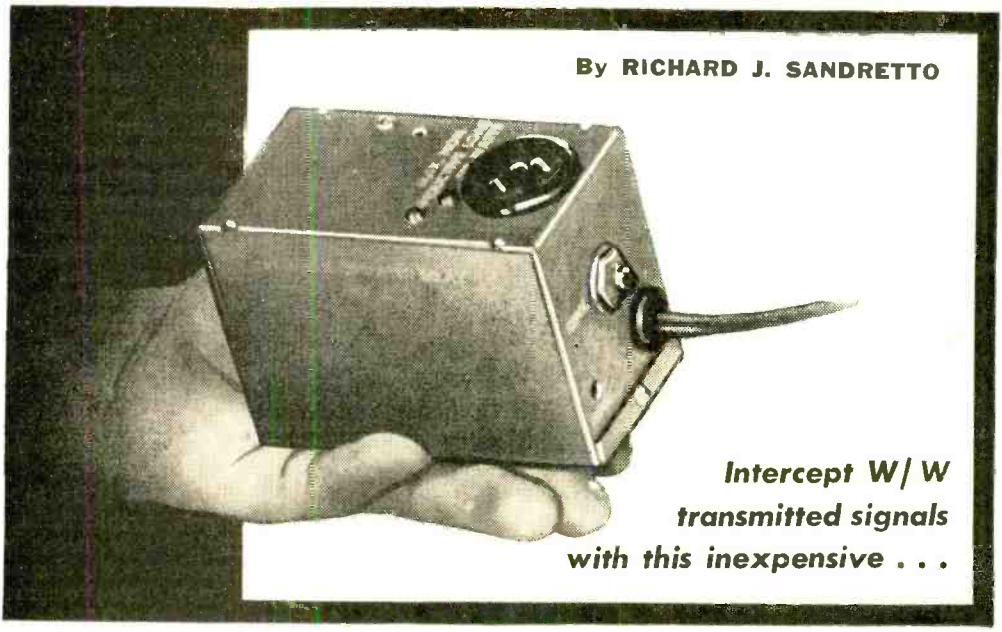
IN EXPERIMENTAL and test work, or for permanent installations, you will sometimes want to connect a phono plug to a phone jack. A shielded adapter can easily be made from junk-box parts—or for about 35 cents if you buy new parts—which will do this job quickly and efficiently.

Cut off a 1"-diameter metal container to a length of 1¼", using a fine-tooth thin-blade hacksaw, and smooth the rough-cut edge with a knife blade or sandpaper. Drill a ¼"-diameter hole in the center of the bottom of the can, and then enlarge it to ⅝" using a rat-tail file. This ⅝" hole is for the threaded part of the phone plug. Solder a short length of insulated flexible wire to the center terminal on the phone plug. Then screw the plug into the ⅝" hole in the bottom of the can, and solder the plug to the can bottom with small dabs of solder at two or three spots. If you do not have an old phone plug, buy an Amphenol 75-MC1P plug (29 cents) and solder the wire to the center terminal on this plug.



A standard phono jack (about six cents) just fits inside the can lid. Drill the three necessary holes in the can lid, and mount the phono jack as usual. Now solder the wire from the center terminal of the phone plug to the center lug on the phono jack. The connection from the outside terminal of the phono jack to the outside shell of the phone plug is automatically made through the metal can, which acts as a shield at the same time. Be sure that the phono jack makes a good connection to the can lid, and that the can lid makes a good connection to the body of the can. For an even better job, you may want to solder the lid to the can. —30—

By RICHARD J. SANDRETTO



Intercept W/W transmitted signals with this inexpensive . . .

A FEW of the many applications of wired-wireless control were mentioned last month in Part 1, and details were given on a suitable one-tube *transmitter* that would transmit on a single frequency or on one of several frequencies, so that several different receivers could be separately controlled.

You can build a *receiver* unit very cheaply because only eight or nine components, including the tube and the relay, are required. This also means that you can house it in a very small metal box, as the photographs show.

The receiver is connected across the power line and remains on standby duty until an r.f. signal is received via the line. A small gaseous triode, which draws current only when activated, is used as the trigger tube. Total standby current is such that the power drawn amounts to only ¼ watt.

Construction. Employ any convenient size box for the housing. The larger unit shown in the photographs uses an OA4-G, and was housed in an ICA #3817 cabinet, which measures 3″ x 4″ x 5″. This cabinet comes with a small chassis attached to the front panel. The smaller unit uses a 1C21 and was built into a 4″ x 2″ x 2½″ LMB interlocking box.

Mount the ferrite antenna as shown in the interior views. Although the proximity of the metal cabinet will reduce its effi-

HOW IT WORKS

Two types of operation may be employed. Figure 1 gives the circuit of a controller whose relay is operated only during signal transmission, and Fig. 2 shows a unit which remains on after the transmitter has been switched off. Either an OA4-G or a 1C21 tube can be used. Each tube contains three electrodes: the cathode, starter-anode, and anode. A sufficiently high voltage between any two of these elements, which are surrounded by an inert gas, creates a glow-discharge.

Voltages applied to the tube electrodes in the controller circuit are such that ordinarily there is no conduction between cathode and anode. If, however, a sufficiently high voltage appears between the cathode and the starter-anode, the resulting glow discharge between these two elements instantly starts a cathode-to-anode discharge, and the relay is activated. Tube conduction occurs only on positive cycles of the line voltage, provided that the starter-anode discharge is still present. *C3* and *R2* smooth out the ripple to prevent relay chatter.

The no-signal voltage on the starter-anode is adjustable by means of *R1* and *R3*. *R3* is a potentiometer, and it acts as a sensitivity control. The preset voltage increases whenever an r.f. signal of the frequency that the loopstick, *L1*, and the capacitor, *C2*, are resonant to is received via the power line.

When you want to operate a device remotely and then leave it on for long periods, it is sometimes desirable not to have to keep feeding r.f. continuously over the power line. The circuit of Fig. 2 responds at the first instant of signal transmission, and thereafter current continues to flow through the tube and relay coil whether a signal is still being transmitted or not. This is accomplished by supplying the tube anode with d.c. instead of a.c., as in the circuit of Fig. 1. This lock-in controller has the disadvantage that it must be manually reset by momentarily opening *S1*. The tube conduction continues for a brief period while *C1* discharges.

ciency somewhat, the effects are not too detrimental.

If you have a plate relay with a higher coil resistance than that specified, use it—exact value is not critical. If this substitution is made in the circuit of Fig. 1, some other experimentally selected values for *C3* and *R2* may be needed to obtain good filtering action.

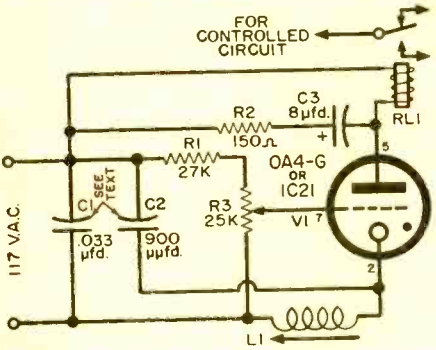


Fig. 1. Circuit of the basic wired-wireless remote control receiver. See parts list below.

C1—.033-μfd., 600-volt capacitor (see text)
C2—900-μμfd. ceramic capacitor (see text)
C3—8-μfd., 250-volt electrolytic capacitor
L1—Ferrite core broadcast antenna coil
R1—27,000-ohm, ½-watt resistor
R2—150-ohm, 5-watt resistor
R3—25,000-ohm potentiometer
RL1—S.p.d.t. plate circuit relay, 2500-ohm coil (see text)
S1—S.p.s.t. toggle switch (see Fig. 2)
SR1—65-ma. selenium rectifier (see Fig. 2)
V1—0A4-G or 1C21 tube
1—Line cord and plug
1—Octal socket
1—Cabinet, 3" x 4" x 5" (ICA #3817) or 4" x 2" x 2⅛" (LMB)—see text
1—2-terminal tie point
1—1-terminal tie point
Misc. machine screws, wire, solder, grommets, etc.

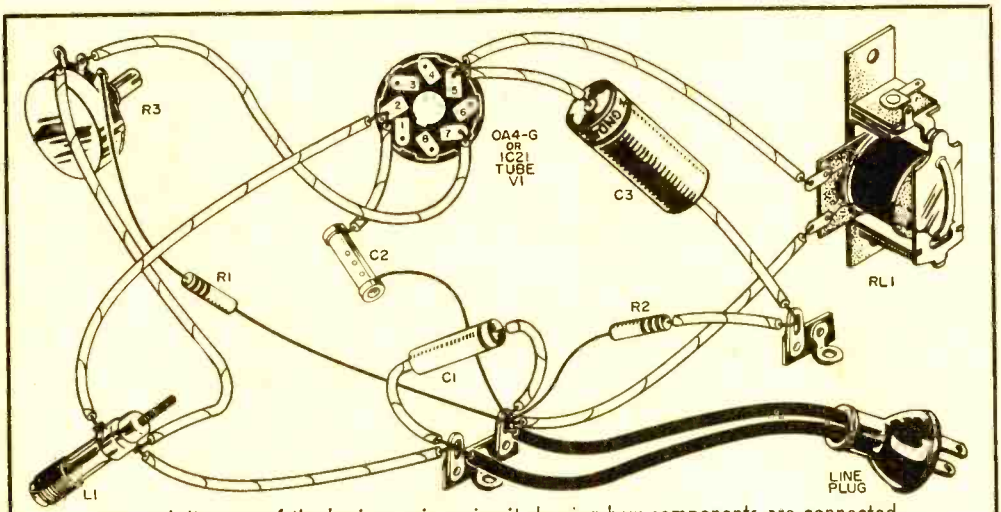
Although the nominal value of 900 μμfd. is specified for *C2* in both diagrams, the needed value will depend on the tolerance and true capacitance, the control frequency, and the inductance of *L1*—whose value varies among various ferrite antenna coils. The needed value of capacitance—which will permit adjustment of *L1* in order to tune the receiver to the control frequency—should be chosen by trial-and-error. This is not difficult because the control frequency (determined in Part 1) dictates approximate values to try: 1000 μμfd. for 340 kc.; 1500 μμfd. for 290 kc.; 1800 μμfd. for 240 kc.; and 2700 μμfd. for 190 kc. This capacitor, mica or ceramic, is connected but left unsoldered until the adjustment which follows shows it to be a workable value.

Adjustment. If you use a 1C21 tube, remove some of the black coating painted on the bulb so that an interior discharge can be seen. A rag moistened with lacquer thinner should do the trick. This procedure will not be necessary with the OA4-G.

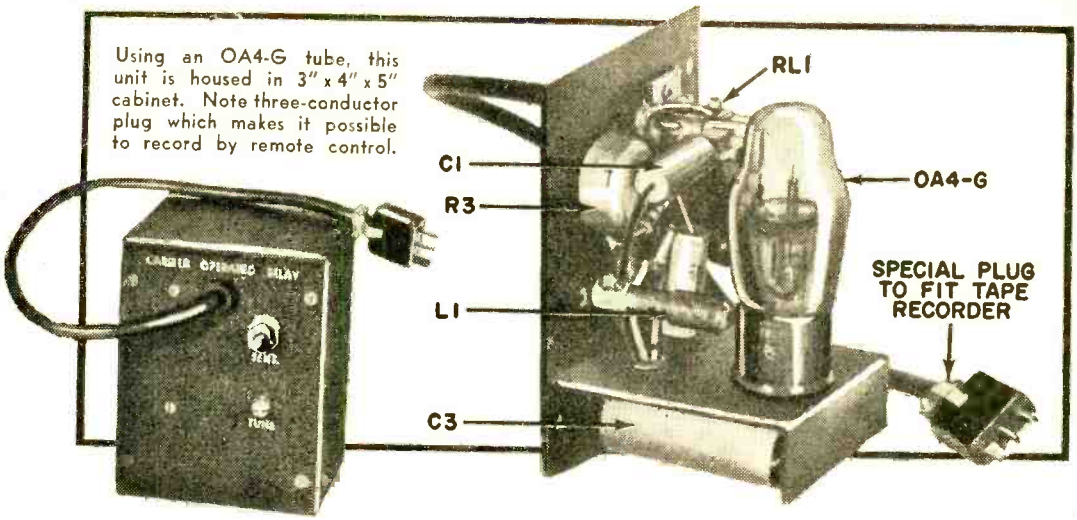
Check the wiring carefully, then plug the unit into the power line. At one extreme setting of the sensitivity control, the tube will not conduct; at the other end of rotation, it will conduct. Adjust the control to a setting just below the point where tube conduction begins.

Next, plug the transmitter into the same outlet that the receiver has been plugged into, and set the transmitter to the proper control frequency. Although the receiver is probably far out of tune, the brute force of the adjacent transmitter should activate it. Tune the receiver by turning the loopstick screw adjustment in or out.

Reduce the sensitivity control setting to



Pictorial diagram of the basic receiver circuit showing how components are connected.



a point where the tube just stops conducting prior to each tuning adjustment, so that any improvement will show itself by the tube's beginning to conduct again. It should be possible to reach a point where further adjustment in the same direction causes a reduction in sensitivity. If this does not occur, it means that *C2* has not brought the coil within range of the control frequency. Try a slightly lower capacitance for *C2* if the coil adjustment screw is all the way out (minimum inductance), or try a slightly higher value if the adjustment screw is all the way in (maximum inductance).

Another technique is to connect an r.f. probe of a v.t.v.m. across the ferrite antenna coil of the receiver unit, and use the meter indication for tuning. Remove the tube so that it will not affect the adjustment. However, a final adjustment should be made by the first method, and with the transmitter and receiver plugged into separate outlets. This is necessary because the v.t.v.m. and the tube have different loading effects on the circuit, and also because the location of the units affects the tuning slightly.

If more sensitivity is needed, the following two things can be tried. First, connect different values of capacitance, *C1*, (.022-.068 μfd., 600 volts) across the power line terminals in the receiver. One value may boost the signal pickup considerably. Second, try varying the number of turns of plastic hookup wire that have been wrapped around the transmitter coil.

Applications. The smaller unit shown in the photographs features a built-in receptacle and was designed to be inserted between an electric outlet and an appliance to be controller. The receiver will control a non-inductive load of 500 watts

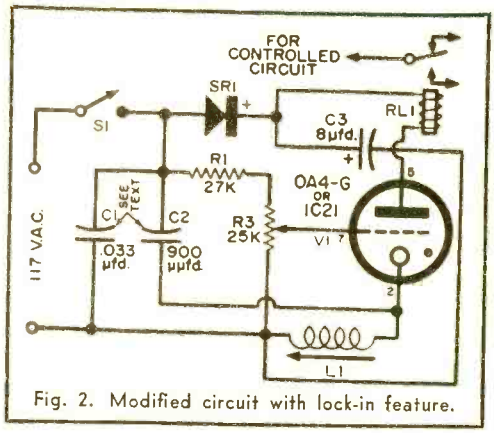
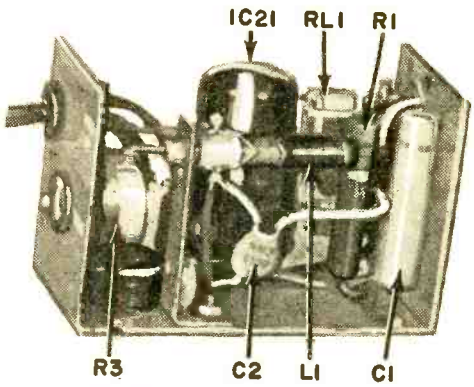


Fig. 2. Modified circuit with lock-in feature.



Smaller receiver, in an interlocking box, uses IC21 tube and features built-in a.c. receptacle.

or an inductive load of about 150 watts. To control a heavier load, add another relay capable of handling larger loads.

The larger unit shown was equipped with a three-conductor Jones plug. Insert-

(*Continued on page* 108)

Radar Equipment Gets Boost from Iron Rust

RUST IS THE BANE of most equipment, but not so for radar. In fact, Sylvania engineers have found that iron rust can actually help the performance of a radar system. The iron-oxide composition of rust is used for making "ferrite isolators." These are "one-way windows" for radar signals—they pass the powerful transmitter pulse to the antenna, then they "look" the other way to receive the echo signal returning from the target.

What's more, tiny rods made of ferrite can themselves be used as radar antennas. A group of these rods causes a radar beam to scan an area like a searchlight—without need for the familiar giant reflector being continuously rotated.

The ferrite isolator (shown in photo at left) may also prove to be useful for extending the number of channels used in television, as well as improving telephone microwave relay systems for long-distance communication.

Amplifier Frees Both Hands During Phone Conversation

ANOTHER ONE of those "why-didn't-someone-think-of-it-before" gadgets is a transistorized amplifier recently announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. This device boosts voice signals going into—and coming out of—a telephone. Placing the telephone handset onto this unit permits you to hear your party, as well as talk back, from clear across the room. Both your hands are free to take notes, or continue eating your lunch, or consult the files—as shown in the photo.

Dubbed the "Telemaster," the device is also ideal for on-the-spot conferences, since all present can listen easily to an incoming call and participate directly in the conversation. An adjustable volume control on the "Tel-O-Master" boosts weak incoming signals to normal hearing level. Completely portable, the device requires no connections to the telephone or the electrical system. It is powered by miniature cells. Price is $69.50.

Catch This Train and You'll See a TV Show!

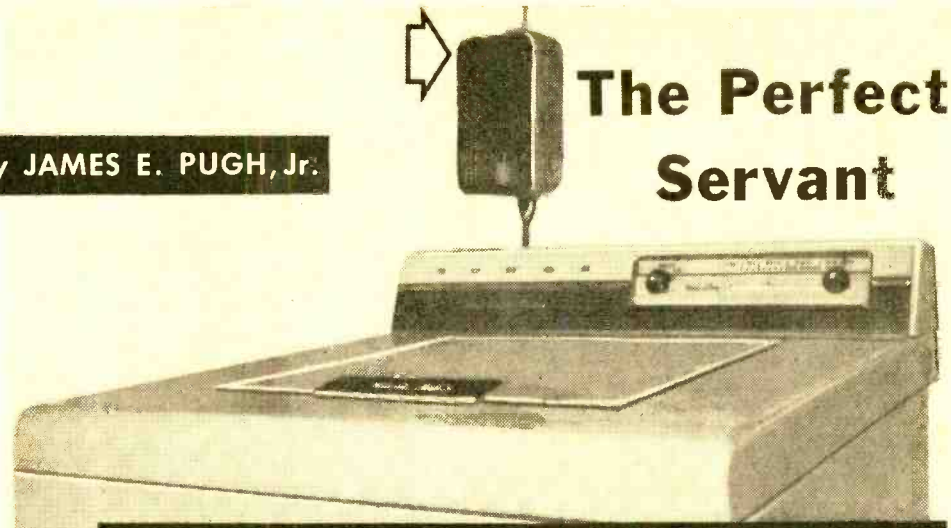
TV VIEWERS fearful of missing their favorite telecasts because of the need to catch a train will be able to travel and watch the screen too—if a system tried out on the Chicago, Indianapolis and Louisville Railway Company goes into general use.

Using a Crown antenna rotator and a TACO antenna, the receiver—installed aboard a car of the railroad—traveled from Chicago to Rome, Georgia, and back to Chicago. Video reception was reported as "good all during the trip."

Installation techniques used in the railroad car are said to be ideally suited for placing TV sets in boats operating on inland waterways. Technical details on the rig may be obtained by writing to either Crown Controls Co., Inc., New Bremen, Ohio, or to the Technical Appliance Corp., Sherburne, N. Y.

The Perfect Servant

By JAMES E. PUGH, Jr.



Heavy Duty Clock Timer Works Wonders

LIKE MOST PEOPLE who can be in only one place at a time, we have often wished for an extra hand to do things around the house while we are asleep or away. We finally found a willing and reliable servant at very small cost in the form of an automatic time switch. Here are some of its many tasks.

It regularly starts the automatic washing machine early in the morning—about 4 a.m. That's when there is plenty of hot water in the heater that would otherwise be idle through the night. Besides, after the family gets through with its morning showers, there usually isn't enough hot water left to do the wash. Best of all, the wife feels more cheerful when she finds the wash all finished and ready to be dried when she gets up in the morning.

In summer, we hook on the attic fan to draw in the cool early morning air. In winter, it can be used as a heater control.

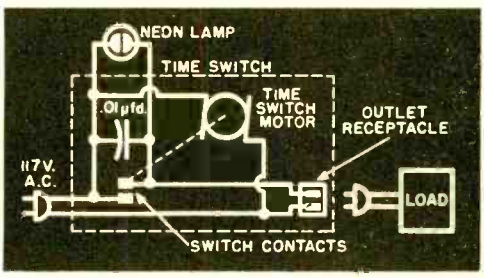
When we're on vacation, the time switch acts as a burglar "discourager." Every night it switches a lamp and a radio on and off. "On" starts at sundown, and "off" at our normal bedtime. This system is cheaper and better at "fooling" would-be burglars than the light-controlled photoelectric switches that go on at sundown and off at sunrise. Most well-informed burglars would know that we don't stay up all night several nights in a row.

The switch is set in advance for a "program" containing up to 12 on-off periods a day. This program is repeated automatically every 24 hours—a cycle which matches the usual household routine. Some of the fancier time switches even permit a different program to be set up for each day of the week, and the entire weekly sequence will repeat indefinitely. An "override" switch allows manual "on" and "off" switching at any time without disturbing the automatic settings.

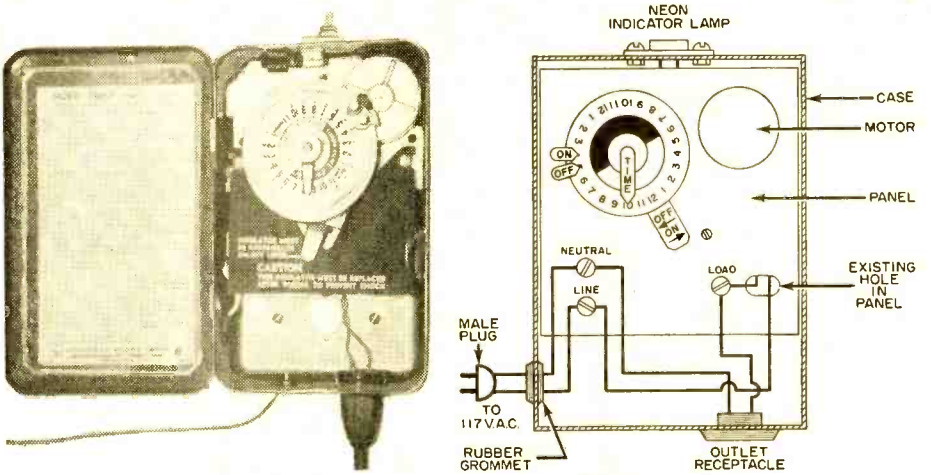
"Ready" Light. We started with a 24-hour Intermatic Time Switch Model TS60SP, obtainable by mail for about $8 either from Lafayette Radio, 100 Sixth Ave., New York, N. Y., or from Allied Radio Corp., Chicago 80, Ill. This switch is ready for operation when you unpack it.

However, we are a fairly absent-minded bunch and looked rather sheepish when we discovered why some of our carefully timed gadgets never started: the appliance switch itself had been "off" all along.

To guard against this possibility, we connected a neon lamp across the time switch contacts. This lights up whenever the appliance switch is closed, even if the time switch is open. In this way, it tells us that



This wiring diagram shows the internal electrical connections in the heavy duty clock timer. The neon lamp, capacitor, and outlet receptacle are added parts.



These additional close-up views of the heavy duty clock timer show wiring details. The single wire hanging from the bottom of the case in photo at left is a "ground" connection to a cold water pipe. The neon indicator lamp is connected to the two wires passing through the "hole in panel."

the appliance is "ready" to go on when the time comes.

To make the neon lamp work properly, we had to make another modification. We discovered that the neon lamp would fire even if the switch on the connected appliance was open—due to the capacitance created by the connecting wires. To nullify this effect, we hung the capacitor *C1* (.01-μfd., 400-volt) across the contacts.

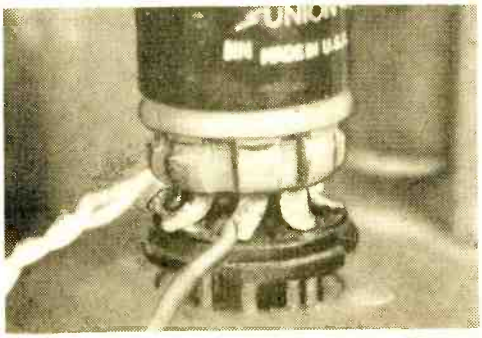
Finally, for convenience, we added a male plug and cord and a female outlet receptacle.

The holes in the switch case for mounting the neon lamp and the output socket can be made either with a chassis punch or a large tapered burring reamer. Our neon lamp is a Drake Type 110 "Flush-lite," which requires an oblong mounting hole. This we made by drilling a series of $\frac{1}{16}$" holes close together in a row, just inside the required outline. Then we knocked out the separations with a chisel.

The switch handles loads up to 35 amperes. The case should be grounded to the nearest water pipe by means of a wire and pipe clamp. *Never ground the switch to a gas pipe.* You should always ground heavy duty a.c. appliances to the nearest cold water pipe. —30—

Homemade Tube Socket Adapter

THERE ARE times when the experimenter needs a source of voltage to test a new circuit. If he doesn't have a separate power supply, the alternative is to tap into the power supply of existing equipment. An easy way to do this is to insert an adapter into one of the tube sockets, replace the tube, then attach leads to appropriate lugs of the adapter.



Dismantle a metal tube by prying out the crimping locks that hold the base to the metal housing. Remove the wires from the pins by heating with a soldering iron. Then run lengths of heavy solid wire through the tube pins and solder into place. Set the tube socket over the tube base to align the key of the base and the key slot of the socket. Make sure that pin No. 1 of the tube base goes to lug No. 1 of the socket. Work the ends of the wires into the respective holes of the socket lugs and solder.

The adapter is now ready to go. It can be used to tap filament and B+ voltages temporarily from a radio or amplifier. Or, by leaving the adapter in place, power can be supplied to a preamplifier or other equipment.—*Wm. B. Rasmussen.* —30—

OPERATION CHAOS

By Carl Kohler

I HAVE a curious wife.

As long as I'm working on an ordinary project, such as dissecting a radio or tinkering with the innards of a TV, I am left alone. But let me begin juggling the components of an off-beat experiment, and here comes Old Big Eyes on the double—usually ill-concealed behind the pretext of delivering hot coffee.

Her timing is so deadly that I'm faced with stretching credulity and admitting there's something *to* feminine intuition—or that I've innocently gotten myself hitched to a lady-telepath.

Meanwhile, I consistently get caught with my plans down.

Not long ago, I dreamed up a humdinger-ish notion which I figured would not only prove a boon to wearied parents across the land (for that matter, across the planet, maybe), but would also move electronics ten years forward on the domestic front. Lastly, I reasoned, I should most probably make enough out of the idea to retire.

This latter angle, alone, seemed reason aplenty to put the idea into a frame of actuality.

Quite simply, I planned to produce an R/C stroller for people who were sick and tired of *pushing* their offspring around the block. First, I invested in a second-hand washing-machine motor. Second, I pilfered Junior's stroller. And, third, I went to work with the intensity of a madman picking the funnyhouse lock.

Unfortunately, the Girl Psychic beamed my vibrations.

And here came the coffee.

"WHATEVER are you doing to the stroller?" She stared hard at the half-installed sequence-reversing, speed-control switch and the rest of the transmitting and receiving equipment . . . all the while pouring scalding java into my lap. "Now what do all *those* crazy gestures mean?"

When my lap cooled sufficiently for my voice to return from the outer regions of agony, I stopped dancing around and began composing a reply. I have bitterly learned that women prefer anything to logic.

"Perhaps you may find it difficult to visualize yourself as being the lucky lootpartner of a genius, much less a soon-to-be wealthy genius," I said carefully, "but you'll just have to acclimate yourself to these wonders and learn to put up with easy street."

She narrowed an eye at me.

"Boy, maybe you needed this coffee more than I thought."

I fought back a psychosomatic hiccup.

"No snow, you lucky kid," I chittered assuringly. "The Kohler Radio-Controlled Stroller is the charming vehicle upon which the Kohlers are destined to ride to fame, fortune and a much higher tax bracket! I'm still undecided whether to let POPULAR ELECTRONICS or LIFE have the scoop of the decade.

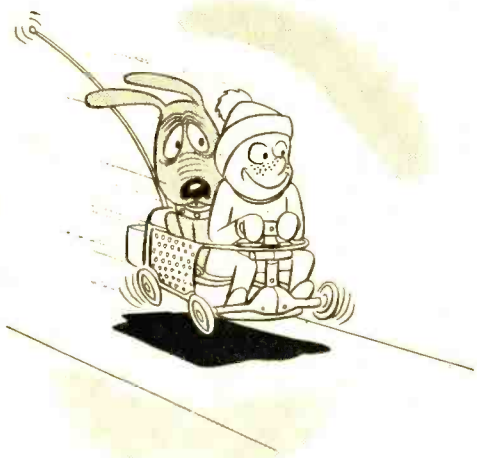
"The original king-size imagination," she muttered to no one in particular. "Come *off* it. I just want to know why you see fit to tear apart a practically brand-new stroller when you're all the time howling about overhead and—"

She broke off—suddenly the picture of a girl whose nerves have had a nasty jolt. Cold green horror crawled across her face. *"Radio-controlled! You mean something like that nightmare you turned loose on the*

"Whatever are you doing to the stroller?" She stared hard at the half-installed sequence-reversing, speed-control switch . . .

whole neighborhood a few months back?"

Sometimes I despair of her *ever* forgetting Frankie—that R/C robot. I had the modesty to blush and avert pain-filled eyes. I snapped a martyred expression on my map that could have earned me an honorary membership in the Barrymore clan, for effort if not professional quality. *"That,"* I whimpered "was *different.* Not the same



. . . Without warning, the stroller shot forward at increased speed and disappeared across a lawn . .

thing at all. Besides, the robot had a faulty escapement and this stroller is the last word in perfection."

She regarded the stroller as though it had just slithered out from under it's rock.

"Look," I pleaded, trying logic as a last resort, "I've built a lot of R/C airplanes since then—"

"Lost a lotta them, too."

"—and, surely, you don't think I'd put our child in any machine that I wasn't absolutely certain was safe—"

"Child! You'll put the dog in that monstrous thing over my inert body, *much less* try luring our beloved Junior into *that* electronic bone-breaker!" Outraged Motherhood regarded me as though *I* had just slithered out from beneath *my* rock. "Honestly, the things you spend perfectly valuable time dreaming up! Honestly!"

"You said the same things about the TV-Babysitting-Scanner when I first brought it into the house," I protested. "Now, you wouldn't know what to do without it."

"That's different. That was—"

"Think of the thousands of steps electronics has saved you," I persisted, grimly determined to sell this bill of goods. "Look at the photoelectric doors on the garage, the pantry, the porch . . . their very existence sparing you needless effort and energy. And this intercom system. Electronics, again, making your life a paradise of saved-time compared to your mother's, your grandmother's, your greatgrandmother's, your—"

"I'm grateful, I'm grateful," she snarled.

"Did you ever stop to think that electricity cooks our food? That it heats our house? That it allows you to run up fabulous telephone bills, have hot and/or cold water in unlimited amounts at a second's notice?" I glared mildly at this spoiled darling of super-civilization. "No, you never thought of poor, old overworked and faithful electricity as your best friend. You never gave electricity a decent chance. Serve you right if it refused to come in the house—the way you rave against it."

"Who?" She was a mite uncertain.

"Electricity," I said reverently, whipping off my cap and holding it over my heart while I leaped to attention. "It slaves for you, keeps your radio singing, your TV picture bright, floods your house with warm, yellow light, runs your automatic washer so you are saved from rough, red hands, keeps the scoff eatable in the refrigerator and the surplus scoff safe in the freezer . . ." I hesitated, flicking a tear from my cheek. "Yessir, good old, everlovin' electricity and you refuse to give it a chance."

Her lower lip began to quiver.

"W-Who refuses t-to give it a c-chance?"

I bussed her soundly. "That-a-girl! I knew you'd see it my way!" I slurped the now-icy java. "You run in and let electricity put some heat in this chilly brew whilst I finish installing the batteries and motor in the Kohler Stroller, hey! There's also a little matter of adjusting my solenoid-controlled-brake-device to be solved before our little fortune wagon is ready to roll us to wealth." I gleamed the choppers at her. "Wouldn't want to start something I couldn't—haw, haw,—stop! Get it?"

"Oy," she moaned and took off.

FOUR DAYS LATER we were ready for the test-run.

"I *still* don't see why Junior should be cheated of the honor of being the very first passenger to enjoy a ride in the stroller that's going to make him a rich man's son," I complained as the Nervous Mother shoved Digger, our terrier-dachshund-collie-what-have-you into the seat of the stroller, fastening him there with the leash.

"Geeple," agreed Junior, enthusiastically.

"OOOOOOOOWWWWWWWWOOOOOOOO!" commented Digger.

"No dice. Our agreement was to let Digger risk his life and if he survives—then, perhaps, Junior can have a ride. It's that or find some other sucker, genius." She took a firmer hold on the heir and

(*Continued on page* 123)

DISC and TAPE REVIEW

By BERT WHYTE

AS REGULAR READERS of this column know, for the past two years we have been delving into the musical treasures of the LP catalog, with a view towards building a sound basic library. For the most part, we have reviewed recordings that fall into the category of "standard repertoire," with an occasional foray into some "offbeat," more "esoteric" type of material to lend a little spice. From your kind letters, it would appear that this program has met with your approval. However, I have received a number of letters recently in which the writers expressed a desire for something a little different.

In essence, what these readers would like is a review of the works which would constitute a basic record library of a given composer. I have done something similar to this from time to time, as witness my surveys of the recorded works of Mendelssohn, Paganini and others. It really boils down to the question: what degree of selectivity does one apply to these surveys? From what I can gather, the readers would have me review only those works which are the most important and the most basic in the repertoire of a particular composer. I think this is a good idea, and we will give it a whirl.

Works of Debussy. This month we'll cover works which might constitute a "basic library" of Claude Debussy. Music of this great French composer has enjoyed increasing popularity with the passage of years . . . and deservedly so, for his is among the most beautifully melodic music ever written, with a quasi-mystical quality which gives much of his music a soft, dream-like, almost "other-worldly" sound. There are several of his works which could be considered his most famous. In order of their popularity, these are: *Clair de Lune, The Afternoon of a Faun,* and *La Mer.* Needless to say, there are many recordings of each work in the LP catalog.

Clair de Lune. This is actually but one fragment from the piano work, *Suite Bergamasque.* It is a hauntingly lovely little work, which I think sounds best in its original piano scoring. Its popularity has given birth to countless transcriptions for many instruments and for orchestra. The orchestra is by far the least objectionable, some of the instrumental transcriptions going far beyond the bounds of good taste.

We will review the piano recordings of the work before the orchestral recordings in order to avoid confusion. Actually if one wants *Clair de Lune* as a distinct musical entity, it is necessary to accept it as part of some piano collection-type record, which means that you will have to take whatever other music is on the disc . . . like it or not. There are numerous examples of this type, some of which are absolute pianistic abortions. Fortunately, among the nine versions, there are four recordings which are reasonably good in

Tape Review

Richard Strauss—***Don Juan***
Till Eulenspiegel

Artur Rodzinski, conducting the Philharmonic Symphony Orchestra of London

Sonotape SW1017, 7" reel
7½-ips double-track, NARTB, $7.95

Here is another sensationally good-quality tape put out by Sonotape, Westminster's prerecorded tape subsidiary. Rodzinski's Don Juan *is a powerful, vigorous reading, with rather rough-hewn lines. His tempi are about right, his phrasing rather deliberate, and his dynamic shading very wide in compass.* Till Eulenspiegel *is well performed, although a little ponderous at times—a faster pace would have helped quite a bit. Soundwise, you have the typical fine string tone of the London Symphony, heard here in edgeless splendor, woodwinds that are breathily alive with presence, brass which is richly sonorous and crackling bright on demand, and altogether awesome percussion—especially the snares and bass drum in* Till Eulenspiegel. *The beautiful passages for French horns, a recurrent motif in* Don Juan, *are superbly reproduced. Everything is ultra-wide range in frequency and the dynamic range is tremendous. No distortion was discernible. Acoustics were very spacious and the recording detailed, resulting in "big hall" liveness with completely articulate orchestration. This is one of the best tapes yet produced and is highly recommended to you as a worthwhile investment.* —B. W.

both performance and quality of sound.

Best of the lot from the sound standpoint is the reading by young Leonard Pennario on Capitol P8312. This is a good, clean piano sound, recorded fairly close-to, but with enough reverb to sustain liveness. Transient response is excellent and "ringing," and hammer-action noise is at a minimum. It is modern, wide-range piano with excellent dynamics. The Pennario performance is fluent and graceful but lacks the warmth and suave polish noted with other mature artists.

Next in line is the reading by George Copeland on MGM 3024. This, too, is what must be described as modern sound, but it is also subject to a few of the ills that can crop up in the difficult task of recording the piano. The tone is rather thin and "wiry" . . . sounds like far too much emphasis on the high end, and there is some noticeable flutter here and there. However, the piano is very articulate and the acoustic perspective is the saving grace. Copeland is almost a carbon copy of Pennario . . . good technical command, an easy smooth manner of playing, but here again, a paucity of any real feeling.

Orazio Frugoni holds forth on Vox PL7700 in our third recording. Vox has done some good work recording piano, and while this is not one of the very top efforts, it has much to recommend it. This is an intimate close-focused recording, almost dry-sounding with the limited reverb. Sound is wide range in frequency and dynamics, subject to some transient distortion. However, the piano tone is very rich-sounding . . . and if you can ignore some of the more obvious faults in the recording, you will find this disc quite pleasing. Frugoni is somewhat fussy in his playing, but none can deny his technical facility, nor his grasp of the score. He manages to imbue his reading with considerable warmth, although falling short of some big-time virtuosi in this respect.

And—last but not least—we have the effort by the great Iturbi on Victor LM1167. This is a rather old recording, with many limitations but—oddly—with few defects that are downright pervasive and annoying. Cramped acoustics and frequency response result in a thin-toned sound which serves as a barely acceptable medium for the talents of Iturbi. As far as Iturbi's performance is concerned, it is by far the best. This is obviously a master playing, as one can perceive from the firm "big" tone, the delicacy of phrasing, the expressive dynamics. There is depth in his playing, and the score is projected with feeling . . . yet it avoids the saccharine statements that are the wont of many other artists. In spite of the limited sound, this is the best of the *"Clair de Lune*-for-itself" recordings.

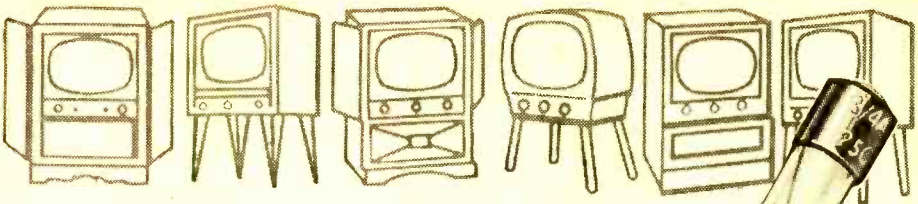
As to the very best of *all* recordings of *Clair de Lune,* this will be found in the *Suite Bergamasque* on Angel 35067, as played by the incomparable Gieseking—Debussy specialist ne plus ultra. The sound of the recording is fairly good but is by no means outstanding. What it lacks soundwise is more than made up for by the incredible artistry of Gieseking. This is a passionately lovely utterance, a thing of unearthly beauty, with every facet of the score meticulously polished by Gieseking into a resplendent jewel of pianistic perfection.

And if sound quality is the paramount thing with you, here too you must get your *Clair de Lune* as part of the *Suite Bergamasque,* this time played by young Friedrich Gulda on London LL754. It is top piano sound . . . wide in frequency and dynamics, no transient distortion, no wow or flutter or "hammer-action noise," and with appropriate acoustic perspective. Gulda's playing is quite acceptable, but like the other young men who have tackled this work, he is long on technical fluency and short on expressiveness, although not quite to the extent of the others previously mentioned.

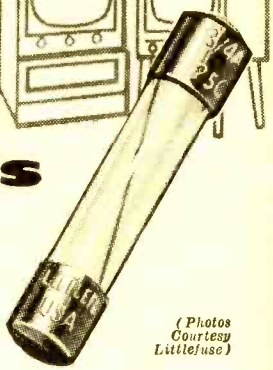
For *Clair de Lune* transcribed for orchestra, you can have your choice of several recordings. If you like overdone sentimentality, Andre Kostelanetz is the past master of this school on Columbia CL798, with sound that is not particularly distinguished. Or if you want a fairly straightforward reading of the work, but with the absolutely gorgeous string tone of the Philadelphia Orchestra in a fine modern recording, then get Ormandy's version on Columbia ML4983. If you want reasonably good sound with the best performance, Stokowski is the man for you on Victor LM1154. No one can get more out of a romantic score than Stokowski. While he has often been criticized for taking certain liberties with the score in matters of tempo and dynamics, his readings always have a magic excitement of their own that justifies his alleged tampering. Well, I hope that settles the matter of *Clair de Lune!*

Afternoon of a Faun. Debussy's famous *Prelude to the Afternoon of a Faun* is taken from his ballet of the same name, which was commissioned by impresario Diaghalev as a vehicle for the great dancer, Nijinsky. This piece best characterizes Debussy's talent as an orchestral colorist, and is also most representative of the "mystic" element of his music. It is a supremely beautiful work, a lyrical rhapsodic piece with softly flowing line. The scoring

(*Continued on page* 108)



Fuses and TV Sets



Typical fuse used in the a.c. line of a television set.

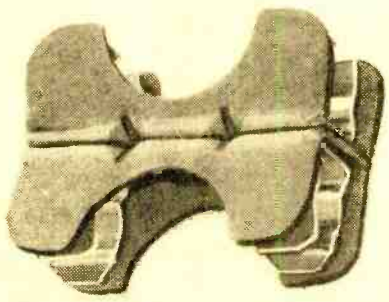
(Photos Courtesy Littlefuse)

THE cheapest protection any electronic device can have is a fuse. As long as the correct fuse is used, you can rest assured that the equipment will be protected against any sudden surge of current which, in the absence of this simple safeguard, could easily destroy the equipment.

In television receivers, fuses, when used, are found in two locations. One position is in the power line which leads directly to the wall outlet. The fuse here has a rating of between 3 and 5 amperes and it is generally mounted in a fuse holder.

The second place in television sets where fuses are found is near the high-voltage section. This section can be identified by the perforated metal cage which is placed around it. In the few instances where the cage is not used, the high-voltage section can be located by tracing back along the high-voltage lead which brings the high voltage to the bulb of the picture tube. This lead connects either to the center of the bell-shaped section of the picture tube or, in the case of metal tubes, to the front rim of the tube.

Fuses which are used in this section of the receiver are either held in open clip-type holders or else possess pigtails which are soldered into the circuit. The clip-held fuses are readily changed; replacing the others is more troublesome. A pigtail fuse can be unsoldered and another soldered in its place. This takes time, however, and means that you must have a soldering gun or iron and some solder. A simpler solution is to let the defective pigtail fuse remain in the circuit. Then a special snap-on fuse holder can be placed over the defective fuse and another, good fuse inserted in the other side of the holder. In effect, this shunts the second fuse across the first and re-establishes the current path. Any radio parts jobber can supply the snap-on fuse holder.



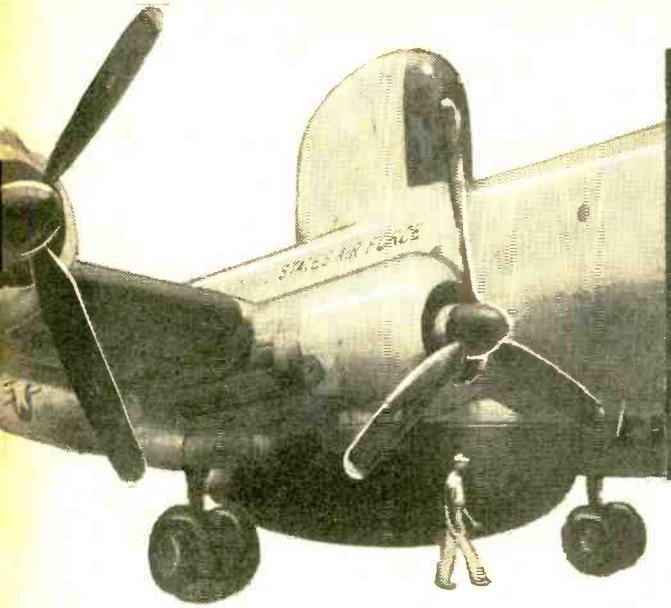
A "snap-on" double-ended fuse clip which requires no special tools for installation.

When a television receiver becomes inoperative and it has been determined that power is being supplied to the set, the fuse is the first likely suspect. Most fuses can usually be checked visually by taking them out of the set and holding them up to the light. In a good fuse, the thin ribbon of wire running through the center of the unit will be visible and intact. There will be no breaks anywhere along the line and the glass container of the fuse will not be discolored. If there is any doubt, simply substitute another one.

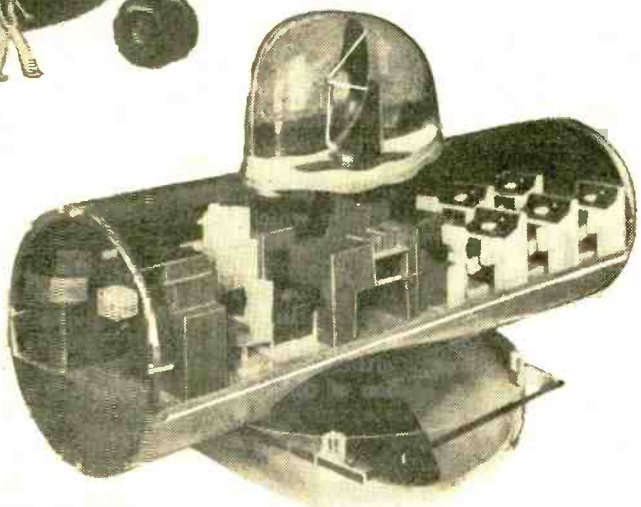
There are two precautions to observe when changing fuses. First, and foremost, is the current rating of the fuse. This should never be exceeded. If the fuse is a 3-amp. fuse, as indicated by the inscription on the metal portion of its case, replace it with another 3-amp. fuse. Do not use a 4-, 5-, or 6-amp. fuse because each successively higher rated fuse affords less protection.

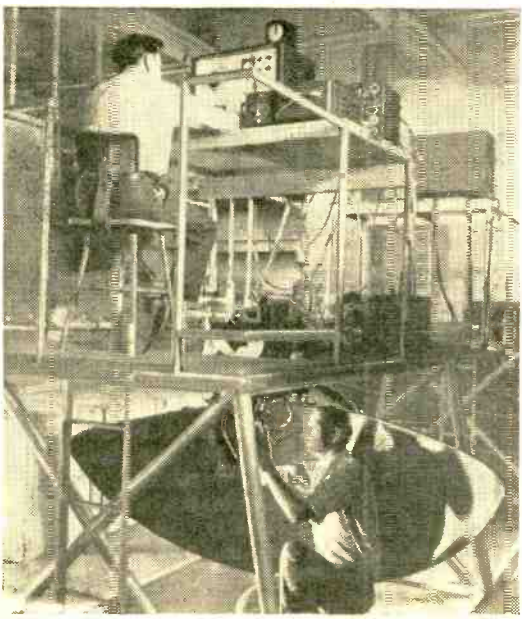
Second, never use a fuse with a voltage rating which is too low. Use one having the same rating as the one replaced. Fuse voltage ratings represent the upper limit of usefulness for a fuse at a particular voltage. For the normal 117-volt power line, a 3-amp. fuse should be used when the power required by the device falls between 150 and 250 watts. For a requirement of 250 to 350 watts, a 5-amp. fuse should be used; finally, for wattages between 350 and 450, the fuse rating should be 6 amps.—*Milton S. Kiver.* —30—

Aboard a RADAR Picket Plane



New and powerful, the airborne radar built by General Electric is carried by this Lockheed long-range high-altitude reconnaissance scout, patterned after the Super-Constellation transport (Navy designation, WV-2; Air Force designation, RC-121). Radar antennas are mounted inside bubble-like structures ("radomes") atop and below aircraft's fuselage. Both Navy and Air Force use giant planes as flying radar stations off East and West coasts where they supplement the "radar fences" that guard against sneak air attack.

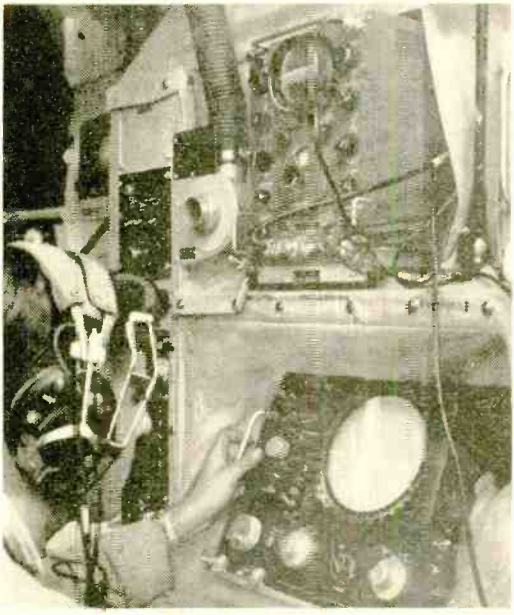




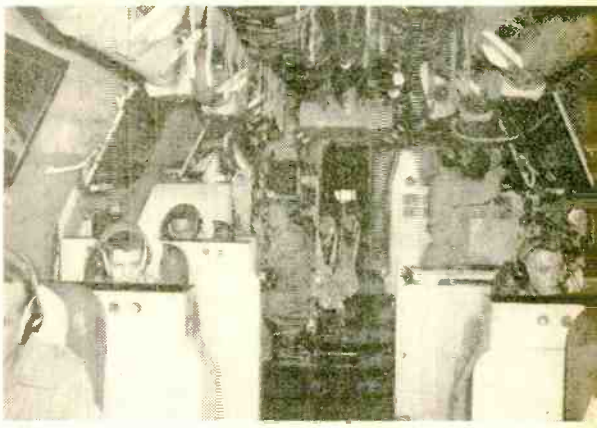
Phantom view of radar plane (above) shows main cabin where radar operators monitor displays on screens. Rotating "dish" antennas are housed in both upper and lower turrets. Information received is coordinated in Combat Information Center aboard aircraft. This flying CIC can plot course of enemy invaders and then direct our own fighter planes to repel any attack. According to G.E., the radar is twice as powerful as any previous airborne search unit.

High-flying radar stations will extend the detection range of existing land-based units whose beams do not bend over the horizon. Provisions built into the equipment permit its use in anti-submarine action, aeronautical weather reconnaissance, and navigational aid, in addition to its chief function of aircraft detection. About six tons of electronic equipment are carried on one plane, in addition to a crew of thirty men. At left is a special test rig built by G.E. at Utica, N. Y.; this mock installation simulates setup on plane, removes system's "bugs" before use in real situation is permitted.

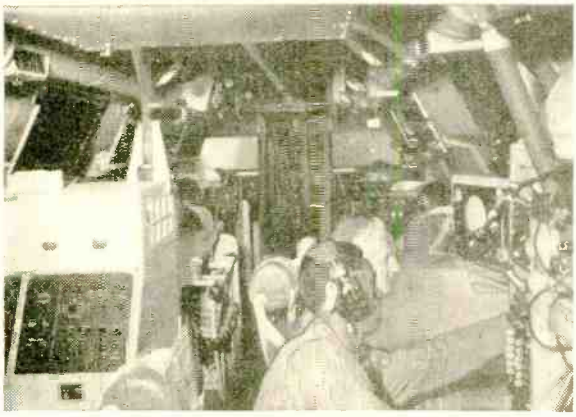
Two dozen men live and work together in giant aircraft whose super radar system guards against sneak air attack



Radar operator, one of a large team of observers, studies screen of indicator 'scope. Displays on screen show "pictures" of distant planes, giving range and bearing. In recent maneuvers, carrier-based fighter planes played role of "enemy attackers" and were repelled by land-based fighters. "Enemy" carrier was "sunk" by defenders using data supplied by radar plane, whose crew never even saw the "attacking" carrier or its aircraft.



Inside the main cabin, looking aft. Each operator is responsible for observing a particular segment of the total area being scanned by the rotating antennas. Weight and size of the equipment has been kept down, despite increased power. Chassis are readily removed for easy inspection and quick maintenance.



Information received on radar screens is coordinated and verified in another part of the cabin. These men maintain radio contact with other aircraft and with surface stations. Special apparatus automatically distinguishes between friendly and enemy aircraft, is virtually foolproof. Often these planes are used as part of a large force which includes blimps and ships.

Time out for coffee and . . . A complete galley, as well as bunks, helps keep the crew well-fed and refreshed. Staying high in the air for 24 hours or longer, each aircraft carries two crews for all stations. The double staff assures that rested men are available at all times for any emergency. Planes work with each other and with ground forces.

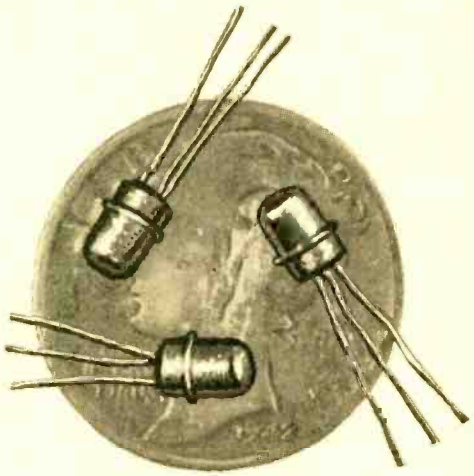
Transistor Topics

By LOU GARNER

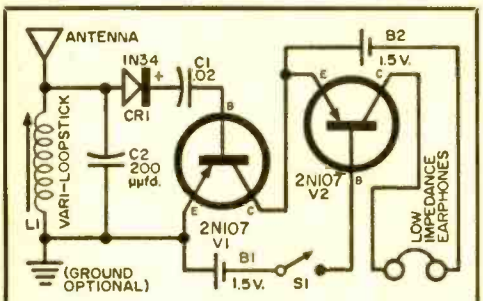
FOR THE PAST few weeks, I've been reviewing the many letters and cards you fellows have addressed to this column. Your ingenuity is amazing, and your interest in experimenting is most gratifying. To all who have written . . . *congratulations* . . . and keep up the good work! And keep sending those letters and cards! After all, this is really *your* column and will be run just the way you want.

Today, the "transistor tinkerer" occupies a unique pioneering position, roughly analogous to those experimenters in the early days of radio who built their own receivers . . . or did without! Back in those days, a "cheap" vacuum tube cost more, *in actual dollars*, than even an expensive transistor does today . . . and each tube was handled with great care, as if it were a valuable jewel.

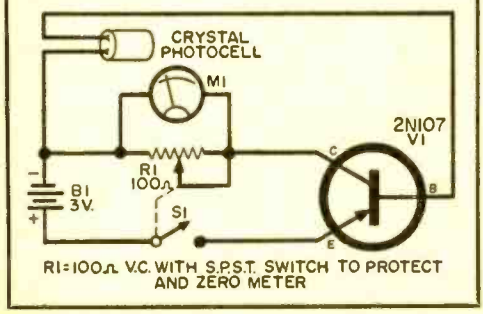
Yet regardless of cost, these early experimenters persevered in their hobby, and from their ranks came many of the engineers and technicians of today. In the same manner, from the ranks of the present-day experimenters will come many of the engineers, scientists and technicians of tomorrow. It may be that the *Chief Electronics Engineer* on the first Space Ship to land on the Moon . . . or on Mars . . . is reading this column today!!



Philco's subminiature M-1 transistor, believed to be the smallest transistor yet developed.



Above, Frank Seidita's two-stage receiver. Below, light meter circuit worked up by Joe Gabus.



Readers' Circuits. From your letters and post cards, it is apparent that most of you are interested in receiver circuits. But there is a growing interest in instruments and gadgets.

We have two interesting circuits this month . . . both of which are relatively simple and inexpensive to duplicate. One is a two-stage receiver, suggested by Frank Seidita of 268 Deysaw St., Brooklyn, N. Y. The other is a simple light meter, suggested by Joe Gabus of 51 Wawayanda Ave., Middletown, N. Y.

Two-Stage Receiver. Frank's receiver circuit uses one diode and two *p-n-p* junction transistors. Basically, it is a diode detector followed by a common-emitter amplifier *direct-coupled* to a modified common-base amplifier which, in turn, drives a pair of headphones. The direct-coupled feature is particularly interesting, for many development engineers are working with this type of circuit. Such an arrangement provides a simple, reliable circuit which requires

relatively few components and, therefore, is less costly to build.

According to Frank, good results are obtained without a ground and with a relatively short antenna. He uses penlite cells for *B1* and *B2* and reports that battery life is quite long.

Light Meter. Joe Gabus has been experimenting with cadium sulphide photocells and transistor amplifiers. His circuit uses a Clairex type CL-1 photocell direct-coupled to a G.E. 2N107 *p-n-p* transistor which serves as a common-emitter d.c. amplifier. A 500-microampere meter (*M1*) is used as an indicating device and Joe reports that an "off scale" reading is obtained in bright sunlight. The meter is shunted by a 100-ohm rheostat (*R1*), both for protection and to provide a *zero adjustment.*

In operation, light falling on the photocell causes a drop in its d.c. resistance. This, in turn, allows the transistor's base current to increase. As the base current increases, a much greater collector current flows—due to the gain of the transistor.

A few tips, Joe. Most cadium sulphide photocells give much better results as higher voltages are used. It even may be practical to use a small hearing-aid battery for the photocell while retaining the 3-volt battery in the transistor circuit. I would suggest trying a *Burgess* Y10 or U10 15-volt battery, connecting the *positive* side of the battery to the positive terminal of *B1* and removing the photocell connection to this battery. The "free" lead of the photocell may be connected to the *negative* terminal of the 15-volt battery.

For a similar circuit, you might refer to Harvey Pollack's article on the "Transistorized Light Meter," appearing on page 43 of the January, 1956, issue of POP'tronics.

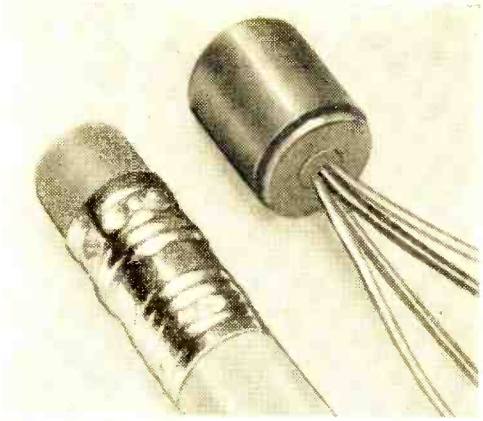
Hi, fellows! If you've missed Trans' Topics recently, there's a good reason. The editing of this department has been shifted to a Contributing Editor of POP'tronics, Louis E. Garner, Jr. During the transfer, it was necessary to suspend the department temporarily.

"Lou," as his friends call him, has been one of POP'tronics' Contributing Editors since the first issue, so you've probably seen many of his articles. He has published in many other semi-technical and technical magazines also, including our sister publication RADIO & TELEVISION NEWS. To date, between 150 and 200 of his articles have seen print, including more transistor application articles than any other technical writer in the nation has published. He authored the *first* elementary book on transistors, *Transistors and Their Applications,* and is currently working on another volume . . . *The Transistor Circuit Handbook.*

An avid experimenter and gadgeteer, Lou has his own laboratory facilities and has been working with transistors since the first units became available commercially. A private technical consultant as well as a writer, Lou has designed circuits, prepared manuals, developed new products, and given technical advice to a number of well-known firms, including one of the largest test equipment manufacturers in the world.

So, don't worry about Trans'Topics in the future. With Lou at the helm, you can expect this department to grow . . . and grow . . . and grow! ! ! !

The Editors



UTC "DOT" is not much bigger than pencil's eraser.

Experimenter's Contest. Here's good news for you fellows who like to work up new circuits . . . now you can turn your ingenuity to profit. Lafayette Radio, of 100 Sixth Ave., New York 13, N. Y., is conducting a contest with a first prize of *fifty dollars* (that's right—50 bucks) worth of merchandise, with five additional merchandise prizes worth *ten dollars* each. These prizes go to experimenters who submit the best new circuits to Lafayette based on the use of their Transistor Lab Kit plus a minimum of additional parts.

Incidentally, Lafayette's Lab Kits are based on a series of articles which appeared in past issues of POP'tronics.

The Experimenter's Contest was originally scheduled to end April 30, 1956, but has been extended to give everyone a chance. Good luck!!!

Getting Smaller!! Even the first transistors were very small compared, say, to vacuum tubes and other electronic components. But manufacturers have continued in their efforts to reduce the size of these "mighty midgets" . . . and they have been mighty successful!

Newest entry in the battle for smallness is Philco's subminiature M-1 transistor. Designed for audio applications, this transistor is so small *that more than 20 can be placed*

(*Continued on page* 108)

Underwater TV System

PERFORMANCE of the swimming team at M.I.T. is judged by means of an underwater electronic camera. Developed from original designs by Professor Harold E. Edgerton of the Electrical Engineering Department at M.I.T., where a series of underwater cameras has been built during the past several years, this camera enables the swimming coach to study the actions of members of the team from all angles. Of special interest is the turn, when the swimmer reaches the end of the pool and reverses his direction. Faulty swimming strokes are easily spotted by the camera.

The actual camera was made to accompany an underwater television system. The flash camera is located so that it will view the same scene as the TV camera. When the observer sees the desired photo in the screen, he pushes a button to make the exposure on the underwater camera. Thus, he uses the TV system as a remote view finder.

The camera chassis slips out of the pressure tube for loading. A standard 100-foot roll of 35-mm. film is used, giving 800 35-mm. Leica size negatives. Two wires supply 115-volt, 60-cycle power to the camera and flash lamp. The exposure is made when the power circuit is broken. Then, when the circuit is re-established, the motor rewinds and the strobe recharges for the next flash. The shutter is electrically operated by means of a capacitor discharge into a magnet which drives the shutter blades.

Who's an IDIOT?

DON'T USE the word "IDIOT" loosely. It might—and does—stand for Instrument Lab DIgital On-line Transcriber. This IDIOT can electronically transcribe more than three million items of information during an eight-minute test run. It's a special-purpose computer which is installed ahead of a general-purpose computer to convert jet flight test data from radio telemetering language to computer language.

Vacuum Tube Lamp

AN UNUSUAL table lamp has been made from an obsolete radio transmitting vacuum tube by James F. Sutherland, of State College, Pa. The tube used as the lamp support in the photo below is a type 849. It was mounted upside down so that the brass base of the lamp socket shell could be soldered to the brass cap of the tube. Two brass bolts were soldered to the two filament pins, and the tube is held to the lathe-turned walnut base by two recessed nuts with washers. A push switch was installed in the walnut base, and the pull chain removed from the lamp socket.

The SWL's Friend- An Antenna "Peaker"

By FRANK H. TOOKER

ARE YOU LISTENING to the short-wave bands and wondering if that hunk of wire out back is doing a good job? Is your receiver losing some of its old pep? Well, take heart, because this little device may be the answer to your problems.

The majority of radio amateurs wouldn't think of putting a transmitter into operation without first tuning the antenna and "matching" it to the power amplifier. Yet few amateurs and even fewer SWL's ever think of taking similar care with their receivers.

Now, the author has no particular quarrel with a random length of receiving antenna. Properly installed and properly used, it works surprisingly well. First of all, though, we must realize that such an antenna nearly always presents a poor match to the receiver. The result is a loss in signal at the very spot in the receiving setup where it hurts the most.

You can prevent this loss by tuning your receiving antenna just as they do in the biggest transmitting stations—in a much smaller fashion, of course. Using the "Peaker," you can probably produce a free signal gain of one to three S-units—which is equal to the transmitting station increasing its power 15 to 20 times!

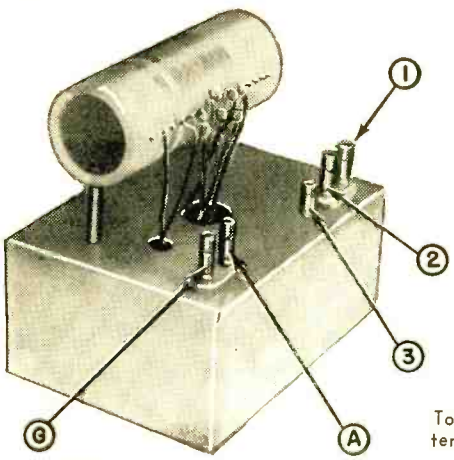
The sketches shown in Fig. 1 are the two antenna terminations possible with the "Peaker." Figure 1(A) shows the antenna connected to terminal 2, no connection to terminal 1, and the ground to terminal 3.

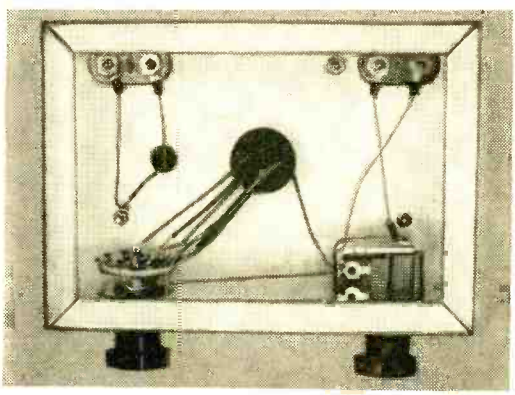
HOW IT WORKS

Under average conditions, the impedance of a random length antenna is either too low or too high to match the receiver input. The extent of the mismatch depends on the length of the antenna and lead-in, the frequency to which the receiver is being tuned, and the actual input impedance of the receiver at that frequency. For instance, if the length of the antenna plus its lead-in is equal to or near a quarter-wavelength or any odd multiple of a quarter-wavelength at the frequency being received, its impedance will be quite low.

The average commercially made receiver has a nominal input impedance of about 400 ohms. In practice, and with different makes of receivers, actual impedance will vary widely from this nominal value. The input impedance of home-built receivers is nearly always unknown. It can vary from a few hundred ohms for receivers using an antenna coupling coil to many thousands of ohms for receivers using a small capacitor from antenna terminal to the grid circuit of the first tube in the receiver. The latter type of input circuit cannot be used with this particular antenna tuner.

This simple device is a resonant circuit with switching facilities to permit its use in a series or in a parallel arrangement. By adjusting the coil tap and varying the capacitor, it can be made to cancel the reactance presented to it by a random length of antenna.





Top and bottom views of the "Peaker" show locations of antenna terminals. See wiring diagram on page 80 for details.

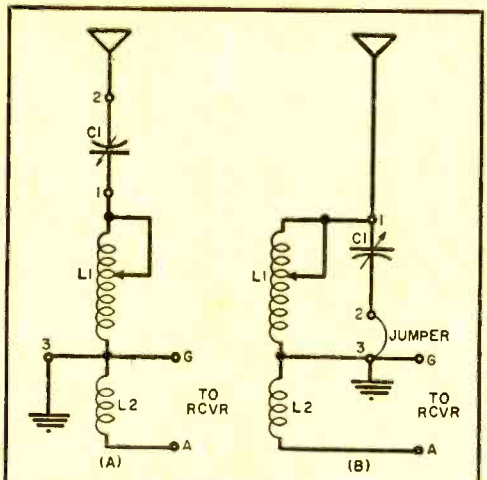


Fig. 1. Two possible antenna terminations: (A) series and (B) the parallel connection.

This is termed a series connection, because the coil, the variable capacitor, and the antenna-to-ground capacity are in series in the circuit. A series circuit is most useful when the antenna impedance is low.

Figure 1(B) shows the parallel connection. The antenna is connected to terminal 1, and a jumper wire is connected from terminal 2 to terminal 3. The coil, variable capacitor, and antenna-to-ground capacity are now in parallel. This connection is most frequently used when antenna impedance is high. Antennas that are very short will probably require such a parallel connection.

Try both the series and the parallel connection, and choose the one which performs best. It is reasonable to expect that a series connection will give the best performance at some frequencies and a parallel connection at others, even when the same antenna and receiver are used. In fact, the series connection and the parallel connection normally tend to follow each other alternately as one tunes continuously from one end of the short-wave spectrum to the other.

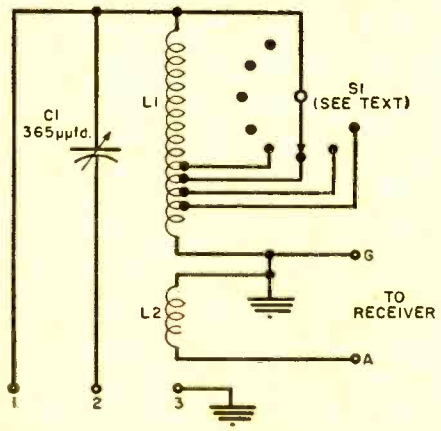
The antenna tuner and matcher has been designed for use with an average length antenna and an average receiver. It covers a frequency range of approximately 1.5 to 20 mc. Construction is simple, and the layout of parts and length of the leads are not especially critical.

The coil is 2" in diameter and consists of 32 turns of No. 20 solid tinned copper wire spaced to occupy two inches, i.e., 16 turns per inch. Spacing need not be exact. The link coil, *L2*, has 4 turns similarly spaced. It is located about ¼" away from the grounded end of the tapped coil. Any coil form of similar dimensions may be used instead of the one pictured. The tap switch should have ceramic insulation. The coil is tapped at 4, 8, 12, 16, 20, 24, 28 and 32 turns from the grounded end. To make the diagram easier to read, only a few of the taps are shown in the wiring schematic.

If your receiver has an r.f. amplifier stage preceding the mixer, connect the "Peaker" output terminals to the antenna and ground terminals of the receiver. Connect your antenna to the "Peaker" in either the series or parallel connection as shown in Figs. 1(A) and 1(B). Vary the tap switch, *S1*, and the variable capacitor, *C1*, until maximum output is obtained from the receiver. The "Peaker" will work best around the 20-mc. end of its range with all but four turns shorted out, and *C1* set with its plates almost full out. At the lower frequencies, say, around 1.5 to 3.0 mc., none or few of the turns will be shorted out.

If your receiver doesn't have an r.f. stage, the "Peaker" should be connected and used as described in the preceding paragraph—with one exception. Coupling is more critical in a receiver having no r.f. stage. When

(*Continued on page* 108)



C1—365-μμfd. broadcast-type variable capacitor

L1—32 turns No. 20 solid tinned copper wire spaced to occupy 2" on 2"-diameter form, tapped at 4, 8, 12, 16, 20, 24, 28 and 32 turns from ground end.

L2—4 turns, average, No. 20 solid tinned copper wire spaced to occupy ¼" and separated ¼" from L1 (see text)

S1—1-pole, 8-pos. rotary switch with ceramic insulation (Centralab Type PA-2001 or equal)

1—Chassis, 5" x 7" x 3"

2—2-terminal binding post terminal strips

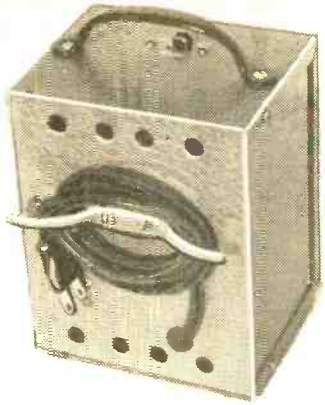
1—Ground binding post

1—Coil form

2—Knobs

Misc. hardware, wire, solder, terminal lugs, etc.

Wiring diagram and the parts list for the "Peaker." Layout of parts and length of leads are not critical.



The "de luxe" booster has a clothesline cleat on the back panel to store line cord.

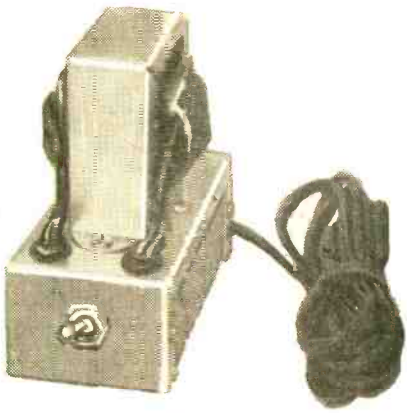
Build Your Own

LINE VOLTAGE BOOSTER

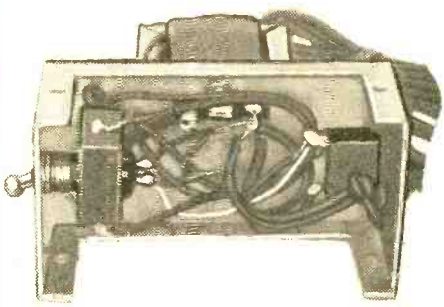
DOES YOUR TV SET suffer from slipping sync? Is your soldering iron lukewarm when you want it red-hot? If so, you may be located in an area where the line voltage drops slightly during early evening hours. Cure these effects with a line voltage booster!

Boosters are available commercially, of course, but an ordinary filament transformer properly connected will do the job equally well. All you need do is hook up the transformer so that its secondary voltage will be added to the line voltage. The "economy" booster consists of little more than a 6.3-volt filament transformer and a switch to cut the booster in or out. The "de luxe" booster features a meter and two different boost voltages.

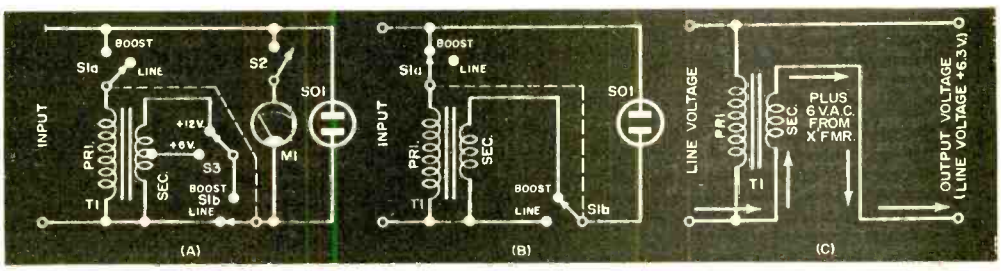
The "de luxe" booster is shown in wiring diagram (A) and the pictorial diagram on page 82. The meter, *M1,* is connected across the receptacle, *SO1,* to measure the voltage at the output of the booster. Switch *S1,* the *line* or *boost* switch, cuts the transformer secondary in or out

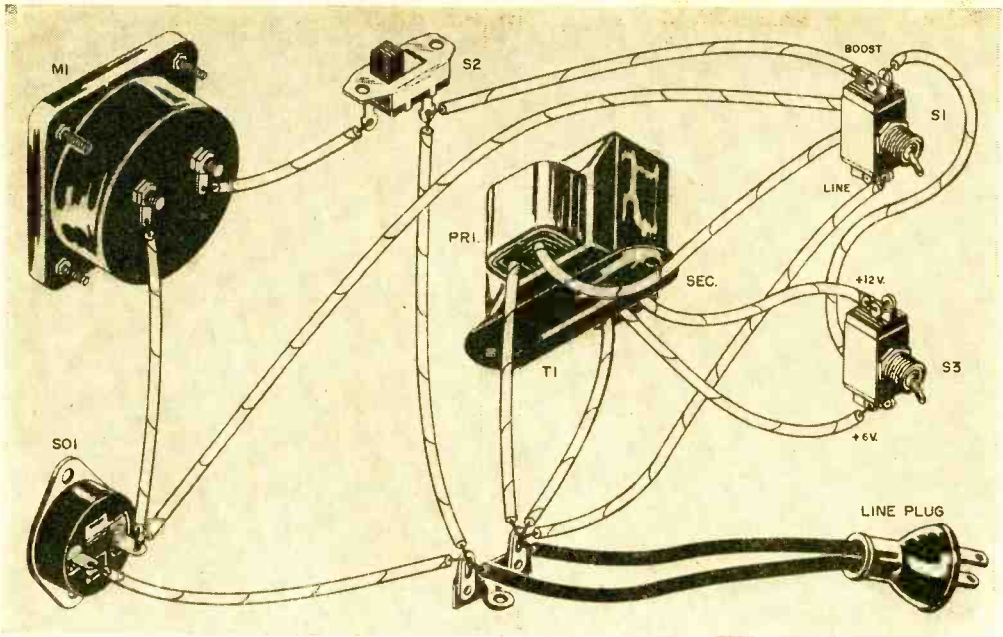


The "economy" booster, assembled on a small aluminum box, can be built for under $5.



Under-chassis view of "economy" booster.





Pictorial diagram of the "de luxe" voltage booster shows how components are interconnected.

of the circuit and simultaneously connects or disconnects the line voltage from the primary. The transformer operates only when *S1* is in the *boost* position.

Switch *S3* selects the amount of the boost. Either 6.3 volts (at the secondary center tap) or 12.6 volts may be added to the line voltage, depending on its setting. A transformer with a 2-amp. secondary will handle any device drawing up to about 200 watts of power. It is a good plan to allow 1 ampere in the transformer secondary for each 100 watts to be drawn from the output of the booster. For example, a 10-ampere secondary will handle a kilowatt (1000 watts) of power. A slide switch, *S2*, mounted on the top of the cabinet, is used to disconnect the meter.

Phasing the transformer in a circuit of this type will either add voltage or subtract voltage—depending on how the transformer's primary connections are made. When the transformer is adding voltage to the line, its secondary is said to be "in phase" with the line; when it is subtracting from the line, its secondary is said to be "in reverse phase" with the line.

What we want in a line voltage booster is the adding or in-phase connection. This

(*Continued on page* 127)

PARTS LIST

"De Luxe" Booster

M1—0-150 volt a.c. voltmeter
S1—D.p.d.t toggle switch
S2—S.p.s.t. slide switch
S3—S.p.d.t. toggle switch
SO1—Chassis-type outlet receptacle
T1—12.6-volt, c.t., 2-amp. filament transformer (Stancor P-8130, or equal)
1—Aluminum box, 4" x 5" x 6"
1—Power cord
1—4½" rope cleat

"Economy" Booster

S1—D.p.d.t. toggle switch
SO1—Chassis-type outlet receptacle
T1—6.3-volt filament transformer, 2 or more amp. secondary rating.
1—2-piece aluminum box, 1⅝" x 2⅛" x 4"
1—Power cord

HOW IT WORKS

The voltage booster is a demonstration of transformer action based on turns-ratio. In each of the cases illustrated—see simplified diagram (C) on page 81—the voltage induced in the secondary is added to the voltage applied to the primary. This is an autotransformer action. The phase of the voltage generated in secondary is quite important. If the phase is not correct, the autotransformer effect will be to subtract the secondary voltage from the primary. This is sometimes referred to as "bucking" the primary voltage. In some locations where the line voltage is too high, "bucking" may prove of value to the constructor in keeping the line voltage under control.

CAUTION: Do not use the booster if the line voltage is actually 117 volts. The additional voltage may harm the equipment to which it is applied. Check the name plate of the device before using the booster. Allow one ampere in the secondary winding rating for each 100 watts of power to be drawn.

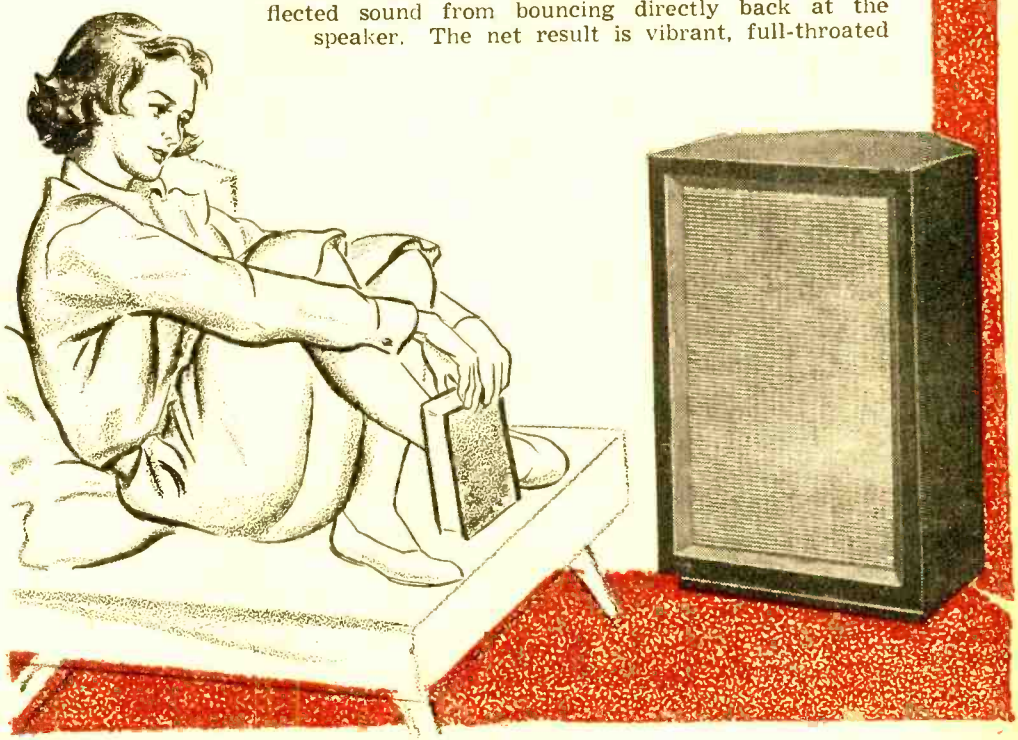
Famed Enclosure Now Comes As Kit

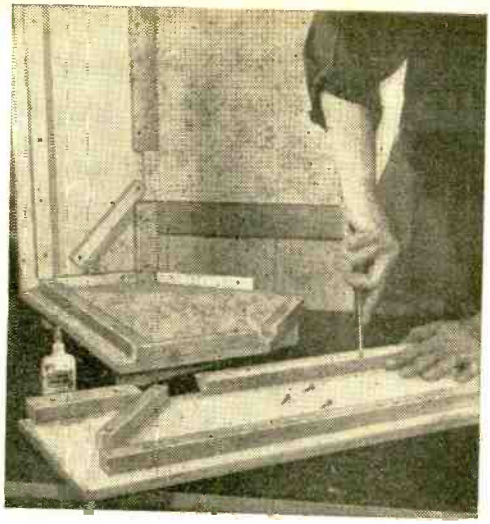
Electro-Voice "Aristocrat," now priced for low budget, is quickly put together in only twelve easy steps

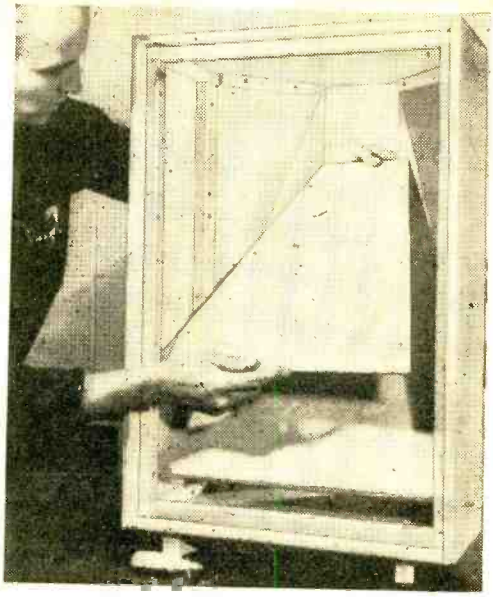
MANY top-notch components formerly sold only ready-made at stiff prices are now obtainable in kit form for home construction. Latest item in this trend toward putting high-class equipment within reach of low-budget builders is the famous Electro-Voice "Aristocrat" corner loudspeaker enclosure.

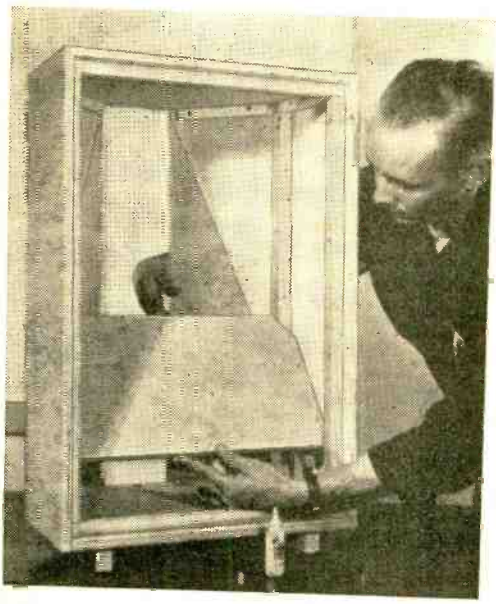
The kit retains all the features that made the factory-finished "Aristocrat" a hi-fi favorite, yet the job of assembly has been remarkably simplified. As carpentry is a far cry from electronics, everything has been done to foolproof the job for the audio fan when he takes up the unaccustomed glue pot. All holes are drilled, the pieces marked, and hardware is supplied. The whole assembly job is broken down into twelve steps just complicated enough to hurl a challenge at your screw-driving talents. Stick to the instructions, and nothing really can go wrong. With two left hands, you'll still be all right.

Superior Sound. Performance-wise, this enclosure is a true "aristocrat" of its breed. Fortified by all the traditional virtues of the horn family, the Aristocrat ranks near the top in efficiency, good damping, and absence of resonance boom. With a bit of cooperation from an able speaker, the bass really hits bottom. Corner placement, obligatory for this enclosure, helps push out more bass. The walls, converging in the corner, act as horn extensions. Hence, the size of the enclosure could be kept down to about 19" x 16" x 29" without skimping on low-frequency response. Moreover, corner placement assures uniform treble spread throughout the room and keeps reflected sound from bouncing directly back at the speaker. The net result is vibrant, full-throated









Screw fastening (top left) only serves auxiliary function. Glued joints provide the strongest possible bond, assure airtight seals and even stress distribution. The screws merely clamp the pieces together while the glue sets.

Odd-angled panel (above) is accurately pre-cut to slip easily into place. Slant position presents no problem since cleats provide support. Taper provides exponential flare for optimum air-coupling and for keeping horn anti-resonant.

Certain plywood pieces, like the one at left, cannot be screwed in place. They are lowered into a thick mortar of glue and then left to set. The resulting bond is so strong that the wood rather than the joint would give in a tensile test.

sonority in nearly any acoustic setting.

Bottom Price. Like the Shorthorn Kit described in our March, 1956 issue, the Aristocrat design is based on Klipsch corner horn patents. Yet unlike the Shorthorn, the Aristocrat's interior panels are angled to approximate an exponential horn flare. This pays off in uniform air loading of the speaker cone over a wider frequency range. Despite the more elaborate inner structure, the price is held down to about $36. With nothing cheap about the materials or workmanship, this clearly marks the kit as a bargain.

Good Looks. Unlike some other home construction kits, the Aristocrat comes out as a neat piece of furniture. With simple outlines and picture-frame molding around the attractive, wrinkle-free grille cloth, not even the fussiest hi-fi wife would evict the Aristocrat from her living room. The smooth plywood panels take any kind of furniture finish so you can be sure of harmony for the eye as well as for the ear.

Speaker Choice. The Aristocrat takes any 12″ speaker, including coaxials. If you prefer, you can mount the separate components of a two-way system right on the speaker panel. All you have to do in that case is to saw an additional cutout for the tweeter. The hole for the 12″ woofer is already pre-cut. This makes the Aristocrat adaptable to plans for gradual expansion of your speaker system. —30—

Under-the-Phone Crystal Set

USE of the telephone as an antenna is not a new idea. Back in the 1920's, some old-timers set a phone on a pie pan, then connected the pan to the antenna post of the radio and used capacity coupling to telephone lines as an antenna.

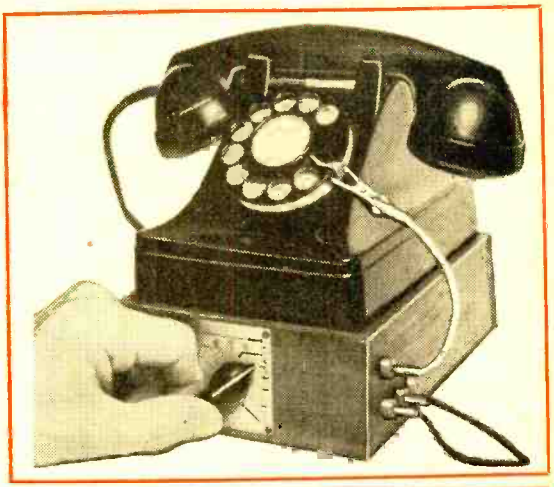
This novel crystal radio makes use of the same trick. It is built into a wooden box slightly larger than the base of the telephone. A thin metal plate is mounted on top of the box and connected to the input of the crystal circuit. When the phone is placed over the metal plate, it is capacitively coupled to the plate, and the telephone circuit is used as an antenna without any direct connections to the phone lines. Where increased sensitivity is required, an antenna jack can be used, allowing a wire jumper to be plugged in and clipped to the finger-stop beside the dial of the phone.

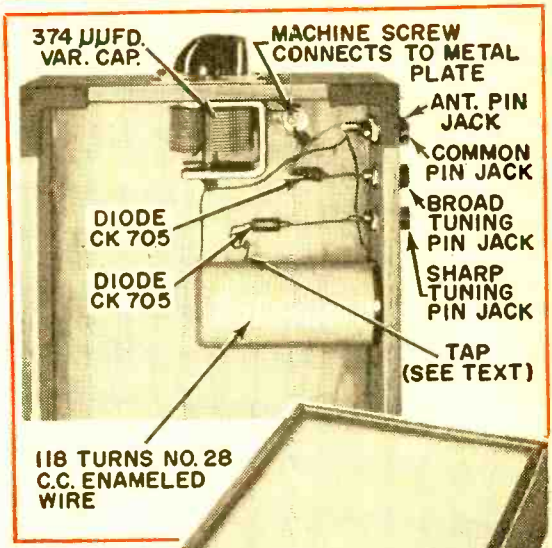
Two germanium diodes are employed, and there are three tip jacks for the earphones. One diode is connected in the conventional manner, and the other is connected to a tap on the coil. You can change from "broad tuning" to "selective tuning" by simply moving one phone tip from one jack to another.

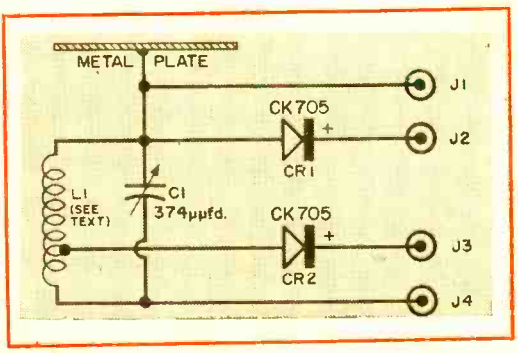
The four sides of the wooden box shown in the photos are made from 2¼" x ¼" walnut, and the top is ¼" plywood. The plywood platform should be ⅛" or 3/16" below the top edge of the box, to keep the phone from sliding off. Size of the platform depends on the phone model; the platform shown measures 7⅝" x 5 3/16".

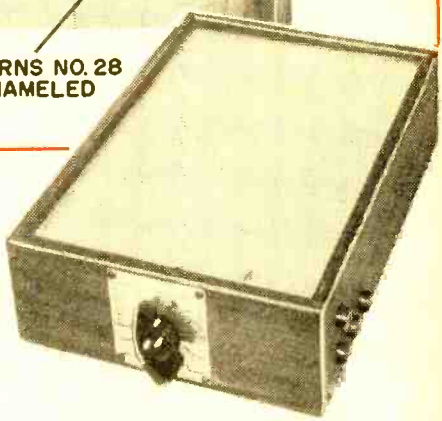
Cut a piece of thin sheet metal, just the right size to fit on the

(*Continued on page* 111)









Note simple construction of wooden box and layout of parts. The metal plate (above), which fits snugly into the top of the box, is capacitively coupled to the telephone.

AFTER CLASS

SOME FACTS ABOUT METAL LOCATORS

IF YOU'RE looking for a metal locator that will detect a U. S. dime under thirty feet of wet sand or a lost gold ring at the bottom of a salt-water bay—you're chasing a wild and elusive dream! The gadget that will do a job like this just hasn't been invented yet. All of which, naturally, brings up such pertinent questions as: Just how well do prospecting metal locators perform? What types are there? How do they compare? How much do they cost to build or buy? Let's take these questions one at a time.

Types of Locators. As a start, we should recognize the fact that metal detectors which are built to spot metal scraps in baked bread, nails and bolts in the stomachs of cows, or files in the pockets of convicts are also designated as metal locators. We are not concerned with these highly specialized units; our interest centers around prospecting and mineral locating equipment.

These generally fall into one of two broad classifications: the *beat-frequency* type which is the simpler of the two, and

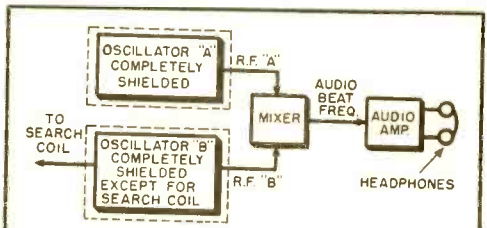


Fig. 1. Block diagram of beat-frequency metal locator which uses varying audio pitch as "warning" signal to operator.

the *field-distortion* or *reflection* variety which can outperform the other but is more complex and costly.

Figure 1 illustrates a representative *beat-frequency* locator in block diagram form. Two oscillators turned to very nearly the same frequency are coupled to a mixer stage. After heterodyning and mixing in this stage, a difference frequency or beat-note is obtained. This audio tone is fed to an amplifier which passes the increased audio power to the headphones. Oscillator "A" is completely shielded to avoid the effects of outside influences; oscillator "B," however, is tuned by a wide-diameter search coil at the end of a long pole. The search coil is surrounded by a radio-frequency magnetic field which penetrates into the earth below to a degree

Fig. 2. This commercially available locator can be used to find objects as deep as seven feet. The instrument is carefully balanced so that it will not tire the operator.

determined by many factors (to be discussed farther on).

As long as there is no electrical conductor in the vicinity of the projected field, the beat-note heard in the phones is constant in pitch. Upon encountering a metallic mass of non-ferrous nature (gold, silver, platinum, copper, aluminum, etc.), the inductance of the search coil is reduced as a result of the eddy currents that are induced in the metal mass. Since the search coil is the tuning element of oscillator "B," the frequency of the latter rises, causing a sharp change in the pitch of the audible signal. Metals or ores containing iron have the opposite effect; the increased permeance in the area around the search coil raises the inductance and lowers the frequency of the associated oscillator, producing a variation of the beat-note in the opposite direction. Figure 2 shows a typical beat-frequency type of metal locator in action.

The *field-distortion* or *reflection* variety operates on a somewhat different principle: a separate transmitter and receiver are equipped with exposed coils, again of large diameter. The plane of the transmitter loop is oriented vertically with respect to the ground plane rather than horizontally as in the case of the beat-frequency version. The receiver pickup coil is placed at right angles to the other to minimize direct coupling between the units. This is illustrated in Fig. 3.

In operation, the controls are adjusted while the equipment is held over non-conducting ground so that the headphone tone is relatively weak and the visual indicator —a meter mounted where it may be read with facility—reads nearly zero. The loudness of the received tone is thus a function of the shape and magnitude of the electric field being radiated from the transmitting loop under conditions in which little external conduction in the form of metal masses is present. Upon approaching metal of any type, the field becomes distorted; such deformation destroys the balance set up in the initial adjustments and causes the headphone tone to become louder and the visual indicator to increase its reading.

Performance Factors. How well will a certain metal locator perform under a given set of prescribed conditions? A precise prediction of this kind is difficult if not impossible to make because so many factors affect its operation. The size of the metal mass or mineral deposit and the depth below ground are the primary considerations; the length of time a piece of metal has been buried, the type of metal it is, and the degree of mineralization of

Fig. 3. This is a field distortion locator as mentioned in the adjacent text.

the soil are other significant factors. Let's dispose of of the last three and then give our attention to the size vs. depth behavior of typical locators.

Although it seems strange at first glance, the longer a metal mass is buried, the more easily it is detected. This is apparently due to the fact that metals attain a degree of association with the surrounding mantle rock due to chemical action; thus they extend their effective conducting areas. Captain Kidd's treasure would be easier to locate than would the buried gold of the hermit who died last year—all other things being equal, of course.

Native gold, silver, and copper are the most suited metals for this kind of geophysical investigation; metallic sulfides and

Expressions of interest in this department have recently been overwhelming. At least 70% of POP'tronics readers turn to "After Class" within the first hour after visiting a newsstand or receiving their copies in the mail. Such a faithful audience can scarcely go unrewarded, and in this issue we have sorted out a single theme. It concerns a subject which interests many, but which at the same time cannot be found in most textbooks. This is the new look in "After Class" . . . more subjects not found in the classroom or textbook, more drawings (and now photos), and tidbits of information on commercially available equipment. We hope you like it.

The Editors.

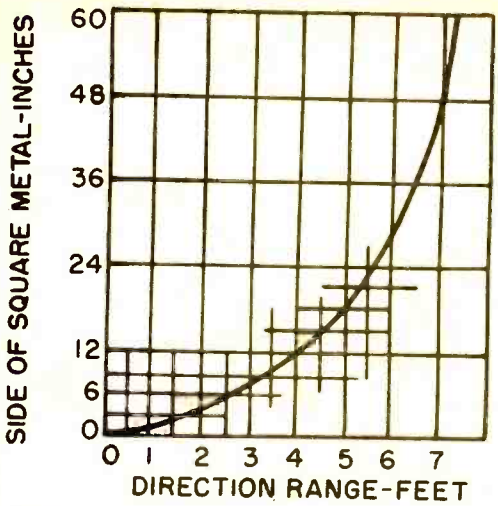


Fig. 4. Claimed performance characteristic of a typical beat-frequency metal locator.

sulfide ores such as galena (lead sulfide), chalcopyrite (copper sulfide), cinnabar (mercury sulfide), and molybdenite (molebdenum sulfide) are also good conductors. Iron ores do not, as a rule, provide the same sharp response as the others.

If the soil is heavily mineralized or very moist, the presence of metals or mineral deposits well under the surface is likely to be masked, making detection difficult. These conditions often make it impossible to use metal locators successfully in certain areas at any time. In others, the time of the year becomes a determining factor.

Manufacturers approach performance details in a straightforward, scientific manner. Among the most satisfactory ways of specifying what one can expect from a given model is the performance curve. This is based upon the reaction of the metal locator to a given metal buried at various depths in normal soil. The minimum area required to provide a satisfactory aural and visual indication on the instrument is plotted against varying depths.

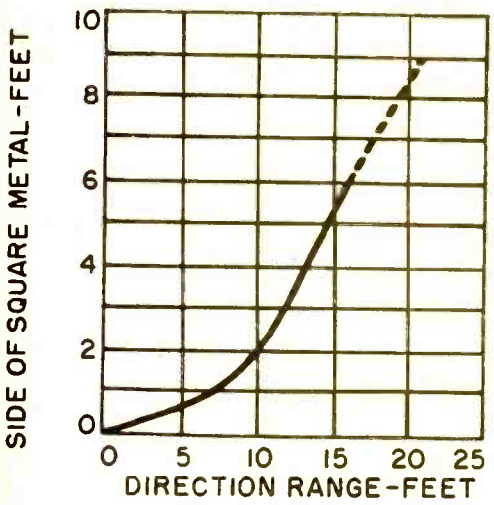


Fig. 5. Compare this curve with the one diagrammed above. This field-distortion type locator costs nearly twice as much money.

A performance curve for a beat-frequency type of locator is given in Fig. 4. The metal used in the preparation of this chart is a square sheet of copper; it ranges from three inches on a side to about 60 inches. For example, a sheet of copper measuring 12″ x 12″ (one square foot) would provide a satisfactory indication if it were buried no deeper than four feet under average soil. To detect a similar sheet at a depth of six feet, an area of well over four square feet would be required.

The superior performance of a heavy duty field-distortion type of locator is shown at a glance in Fig. 5. For one square foot of copper sheeting, the detection range is approximately 7½ feet under normal soil. When conditions are favorable, such a detector is capable of penetrating about 25 feet to large deposits of metallic ore or native metal.

Cost Figures. The figures given below have been compiled from a substantial sampling of manufacturers' literature. They do not represent exact prices:

Type	*Cost*	*Max. Range*	*Weight*
Beat-frequency ...	$ 50	5′	3½ lbs.
Beat-frequency ...	100	7′	8 lbs.
Field-distortion ..	150	18′	11 lbs.
Field-distortion ..	175	27′	24 lbs.
Beat-frequency Kit	40**	6′*	5 lbs.
Factory wired ..	80		

* Depends on search head used.
** Comes equipped in either kit or factory-wired form with a general-purpose search head. Kits for "small object search head" ($3.85) and "large object search head" ($11.50) are available at extra cost as shown. Factory-wired heads are available at approximately twice the prices shown for the kits.

QUIZ

1. What is the difference in the indication given by a beat-frequency type of metal locator as compared with the field-distortion form?
2. How do the indications of the presence of ferrous and non-ferrous metals differ in beat-frequency locators?
3. Which has the greater range of penetration per lb. of carrying weight, the beat-frequency or the field-distortion type of metal locator?
4. Why might an attempt to use any metal locator after an extended rainfall meet with little success in many locations?
5. Why are the coils of a field-distortion type of locator oriented in planes at right angles to each other?

(Answers appear on page 127)

Radio Amateurs to Monitor Satellite

Low-cost v.h.f. tracking system planned for hams

CALLING all hams! You may have an important job to do in the not-too-distant future. How much do you know about Project VANGUARD and the "Minitrack" system?

Project VANGUARD is the code name for the earth satellite phase of the U. S. scientific program for the International Geophysical Year (1957-58). The VANGUARD satellite launching vehicle, being designed and built by the Martin Company of Baltimore under the auspices of the U. S. Navy, will be a finless, three-stage rocket about 72′ long and 45″ in diameter at its widest point. Launching and testing will take place at the Air Force Missile Test Center in Cocoa, Florida.

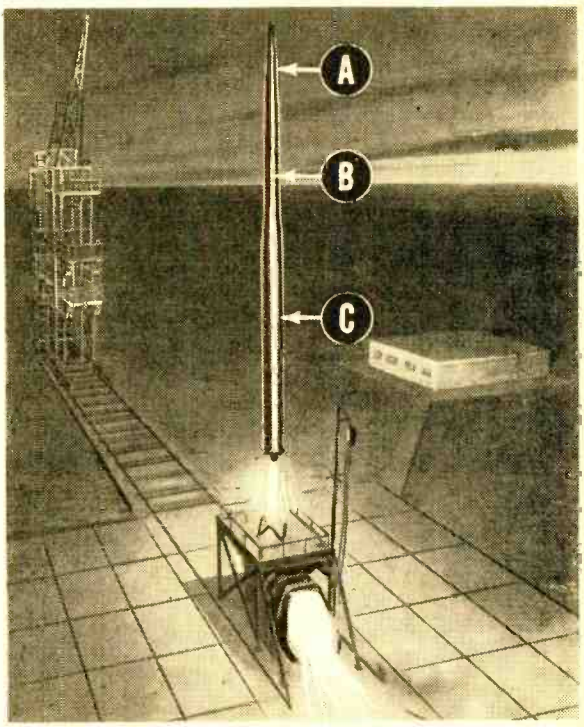
The first stage of the rocket ©, an improved Viking, serves primarily as a booster. The second stage Ⓑ, another liquid-fueled rocket, contains the complete guidance system for all three stages. The third stage Ⓐ, a solid-propellent rocket housing the satellite proper, is ejected from the second stage at the orbital altitude (200 to 300 miles above the earth).

Radio tracking will handle three jobs for the satellite: (1) prove that it is actually orbiting; (2) determine its precise orbit; and (3) measure what is happening within the satellite. The tracking problem is said to be similar to finding and following a golf ball thrown out of a jet airplane traveling at 60,000 feet with the speed of sound.

The "Minitrack" system of radio angle tracking developed by the Naval Research Laboratory is prepared to solve this problem. It utilizes a tiny transmitter within the satellite to send a beam of radio energy to receiving antennas at ground stations. By comparing the path length from the transmitter to one antenna with the length from the transmitter to a second antenna, the satellite can be located in its orbiting position. Similar measurements with another set of antennas help to fix the satellite accurately.

In the actual ground station layouts, there will be seven antennas. Data obtained from these antennas can be sent to a central computing facility within 20 minutes of receipt, and used there to determine the progress of the satellite.

The system, which will supplement optical tracking stations and also obtain scientific data telemetered or radioed back to earth, is expected to work despite weather conditions, clouds, seeing conditions, or the time of day. Details of a simplified version will be made available to radio amateurs at a later date so that they may join amateur astronomers in observing the satellite. And that's where you come in!



Artist's conception of the vehicle which will place the world's first man-made satellite in its orbit around the earth. In the background is the gantry used to set the vehicle on its launching stand and the concrete blockhouse from which scientists will fire the 3-stage rocket and record its course.

It has been predicted that during a satellite event the evening newspapers will publish three boxes on their front pages—one for baseball scores, one for horse race results, and one for the evening times and angles at which you can pick up the earth satellite. —30—

Simple

What are you looking for in a Geiger counter? These two units feature light weight, small size, economy and simplicity —take your choice!

UNIT ONE

By James E. Pugh Jr.

YOU CAN ENJOY prospecting for uranium if your equipment isn't so heavy that it bogs you down, and if you don't have to carry a set of spare batteries around with you because of the high current drawn by the equipment. Also, you'll probably be able to have more fun with your equipment if you haven't spent a fortune to build it. And if it is simple to construct and maintain, so much the better.

The first instrument to be described here was designed for your enjoyment—it takes full advantage of the small size, light weight and low operating cost of a transistor amplifier combined with a relatively cheap Geiger counter tube.

An ideal enclosure for this instrument is a 3" x 4" x 5" utility box. Total weight, including batteries, is less than 2½ lbs. The physical layout, shown in the photos, lends itself to easy assembly and is such that batteries can be easily replaced.

Exact layout is not critical, but the 300-volt battery takes up a large portion of the available space; so it is well to plan carefully in advance to make sure that everything fits.

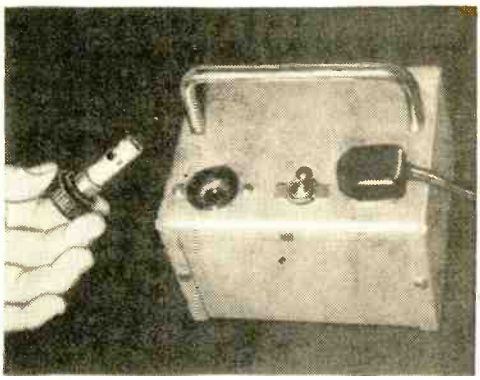
Proper mechanical balance is obtained by locating the handle off center. This technique also allows more room for the controls on top of the case. The battery strap is mounted on one side of the bottom section of the case, and consists of a single strip of metal clamped to the battery by two long screws.

A simple mount for the counter tube can be fashioned from a sheet of ⅛" polystyrene 1½" x 4" and a 3" piece of ½" i.d. polystyrene tubing. Cement the tubing lengthwise on top of the sheet about 3/16" from one end. Drill a hole at the other end of the sheet and mount a 2-terminal tie point at this same location, with a flat-head screw recessed flush on the bottom. Wrap a 3" x ⅛" rubber band around the 1B86 as in Fig. 2 (page 92), slip the assembly inside the plastic tube, and carefully solder the 1B86 leads to the tie point. Center the

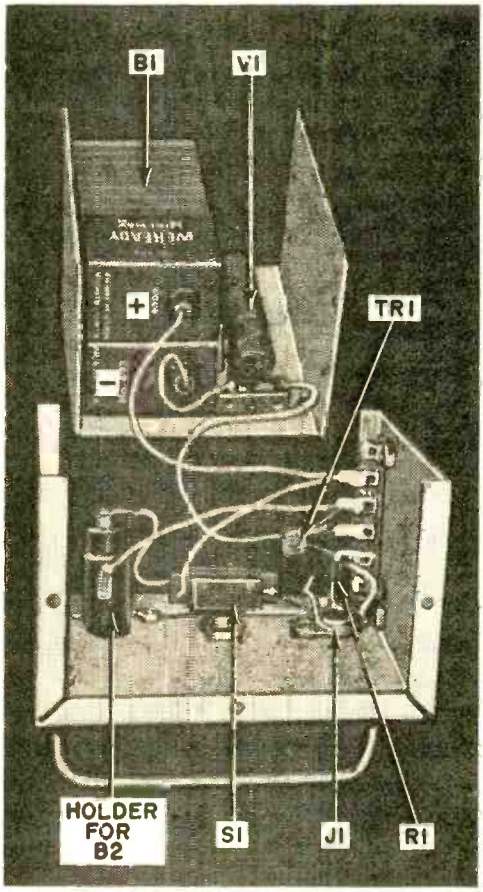
Transistorized Geiger Counters

Geiger tube assembly in the bottom of the case after the 300-volt battery has been installed, and cement in place with Polyweld "912" or a similar cement.

For the 1½-volt battery holder, modify a type HPC fuse holder as shown in Fig. 3. First, clamp the lug in a vise, pull the fuse holder outward to compress the internal spring, and cut off the shaft as close as possible. Disassemble the holder, and drill and tap the shaft as shown. Replace the original spring with a two-turn volute—or spiral—spring clipped from a medium-sized spring in a General Cement assort-



Weighing less than 2½ pounds, the first unit is housed in a 3" x 4" x 5" utility box. Fuse holder is modified to take the 1½-volt penlite cell as shown in Fig. 3 on page 92. Placing the handle off-center makes for proper mechanical balance.



Interior view (at left) shows location of important components and wiring details. As the 300-volt battery fills up much of the available space, care must be taken to make sure that everything fits—although the exact layout is not critical.

HOW IT WORKS

Two basic circuits for the first unit are shown in **Fig. 1, one** for an *n-p-n* transistor and the other for a *p-n-p* transistor. Aside from polarities, the circuits are identical and should provide equal performance, assuming that the transistors are equivalent. At the present time, *p-n-p* transistors are a little cheaper.

When a beta or gamma ray passes through *V1*, the gas in the tube ionizes and a small pulse of current flows through *R1*. This pulse is amplified by the transistor, and appears as a click in the headphones.

A potential of 300 volts is required for operation of the Geiger tube. This is provided by a special 300-volt battery. Although fairly expensive, the current drain is very low, and battery life approximates shelf life. The transistor itself operates on 1½ volts, and gives a gain of about 20 db. Here again, the current drain is very low—about 50 microamperes—which gives very long battery life.

High-impedance headphones will give good performance, but they must be of the magnetic type to provide a d.c. path for the collector circuit of *TR1*. The standard 2000-ohm units are satisfactory, but the Trimm 24,000-ohm style will give somewhat better volume.

ment. Check Fig. 3 carefully for assembly details. When completed, a Burgess No. 7 penlite cell will fit nicely inside.

Mount a 4-lug tie point on one end of the case, as shown in the photograph above. Complete the wiring, including the 300-volt battery plugs, and solder all joints carefully. Excessive heat can permanently damage the transistor—grip the leads with long-nose pliers between the transistor and the point being heated, and don't remove the pliers until the joint has cooled.

Insert the battery in the fuse holder. Polarity will depend on the transistor used: for an *n-p-n* unit, insert the positive end first; reverse for a *p-n-p* unit. Plug in the

Fig. 1. Basic circuit for (A) n-p-n transistor and (B) p-n-p transistor. Parts list applies to both.

B1—300-volt battery (Eveready 493 or equivalent)
B2—1½-volt penlite cell (Burgess No. 7 or equivalent)
J1—Open-circuit phone jack (miniature)
P1—Phone plug to fit jack
R1—2.2-megohm resistor
S1—D.p.s.t. toggle switch
TR1—Type 2N35 or CK722 transistor (see text)
V1—Type 1B86 Geiger tube (Victoreen)
1—Pair of headphones (Trimm 24,000-ohm Featherweight)—see "How It Works"
1—Panel-mounted fuse holder (Buss HPC)
1—3" x 4" x 5" aluminum case (ICA Fleximount)
1—Handle (U. S. Eng. Co. No. 1010 or equiv.)
1—2-terminal tie point
1—5-terminal tie point
1—Set of battery plugs (Amphenol 71-1L and 71-1M)
1—Sheet of ⅛" polystyrene, 4" x 1½"
1—½" i.d. polystyrene tubing, 3" long
1—Coil spring (see text)
1—On-off switch plate
1—3" x ⅛" rubber band
Misc. wire, solder, machine screws, etc.

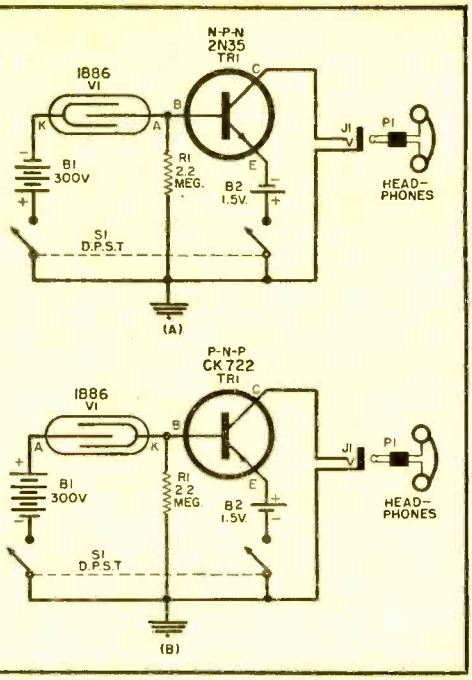


Fig. 2. How rubber band is wound around tube.

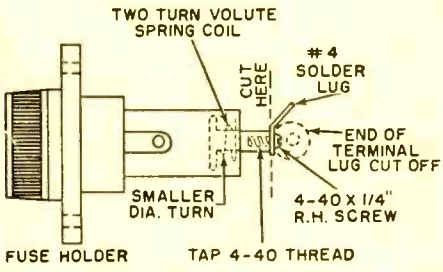


Fig. 3. The modification of the fuse holder.

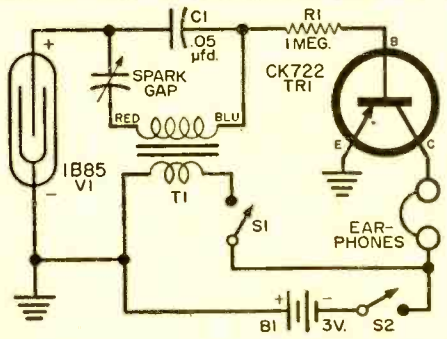
high-voltage battery connectors, turn on the switch, and listen for clicks. With no uranium in the vicinity, you should get a background count of about 30 counts per minute.

UNIT TWO

By Wayne Milburn

For extreme simplicity and economy of initial cost and maintenance, this Geiger counter is hard to beat. The two 1½-volt flashlight cells give excellent life as the current drain is about 100 microamperes and few parts are needed.

A novel technique is employed to produce the high voltage (800-900 volts) for the Geiger tube. D.c. from the battery is passed



Schematic diagram and parts for second Geiger counter. A p-n-p junction transistor is used here.

B1—Two 1½-volt flashlight cells
C1—.05-μfd., 1000-volt plastic sealed capacitor (author used 600-volt rating, but higher rating is desirable)
R1—1-megohm, ½-watt resistor
S1—S.p.s.t. Microswitch or any snap-action spring-return switch
S2—S.p.s.t. toggle switch
T1—Small audio output transformer, such as 4000 ohms to 4-ohm voice coil (not critical—almost any output transformer should operate satisfactorily)
Gap—Altered 3-30 μμfd. trimmer capacitor (see text)
TR1—CK722 p-n-p junction transistor
V1—Geiger counter tube (Victoreen 1B85 or Raytheon CK1026)
1—3" x 4" x 5" aluminum cabinet
1—Kitchen cabinet handle
Misc. wire, solder, terminal strips, phone jack, etc.

through the voice-coil winding of an output transformer, and then quickly interrupted by the switch *S1*—inducing a high-voltage surge in the high-impedance winding. This surge will have two polarities—one when the primary current starts flowing, and one when it ceases. The larger of the surges will break down the special spark gap, and will charge up capacitor *C1*. This high voltage is then used to operate the Geiger tube.

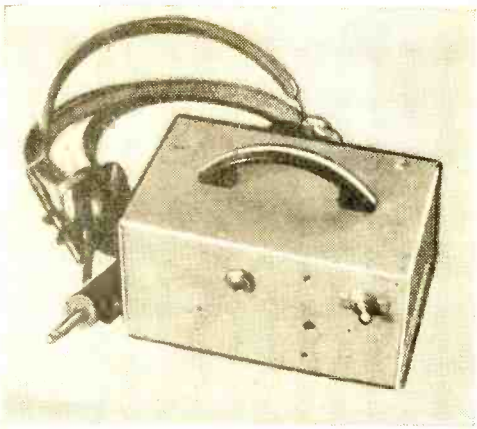
Heart of the device is the special spark gap, made from a small 3-30 $\mu\mu$fd. trimmer capacitor. Unscrew the adjusting screw, remove the mica insulation, and replace the screw. Adjust the screw to the point where it rectifies the transformed voltage but will not arc back.

It is essential that *C1* be charged to the proper polarity, as indicated in the schematic. Use a high-impedance voltmeter to determine polarity. If it is incorrect, reverse the voice coil leads in the transformer.

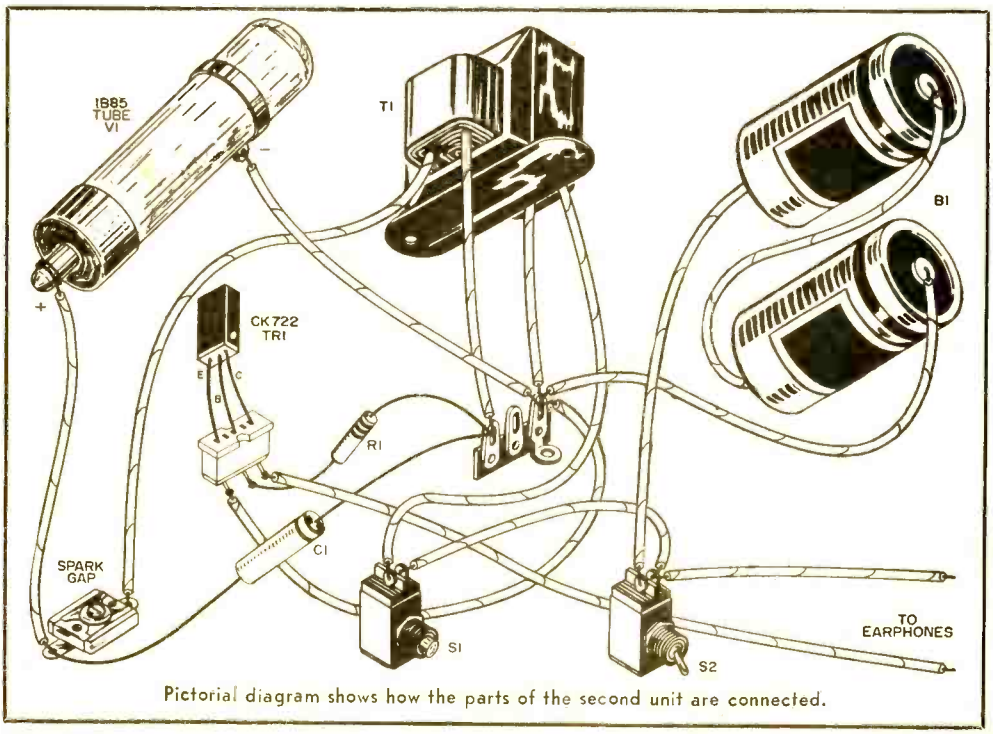
This arrangement should give 800-900 volts after 20 or 30 pulsings of *S1*, depending on the turns ratio of the transformer. Use a high-quality capacitor for *C1*, and make certain that it is well insulated from ground. A single charging should operate the Geiger tube for several minutes. An occasional push on the switch will then keep the counter in operation.

To provide comfortable headphone volume for the clicks, a transistor amplifier is included in the unit. It is direct-coupled to the counter tube, that is, the pulses of current from the counter tube also pass through the base-emitter circuit of *TR1*. *R1* serves to protect the transistor in case of an avalanche discharge through *V1*. Magnetic headphones must be employed to provide a d.c. path for the collector circuit of *TR1*.

Although inexpensive and simple to build, this counter will give reliable indications of the presence of radioactive material. Try it out on your luminous dial watch to check its operation. —30—



This unit, also housed in a 3" x 4" x 5" box, employs spark gap made from a trimmer capacitor.



Pictorial diagram shows how the parts of the second unit are connected.

THE TRANSMITTING TOWER

Herb S. Brier, W9EGQ

ONE OF the big thrills of amateur radio is working other amateurs far away and preferably in foreign countries. This is commonly called DX.

By staying up late, it is possible to work all over the United States on the 3.7- and 7.15-mc. Novice bands. But even when conditions are favorable, it is seldom possible to work foreigners on them—because the top halves of the 3.5- and 7-mc. bands are usually allocated to commercial services outside of North America. On the 145-mc. Novice band, over 50 miles is DX with low power and a simple antenna.

This leaves the 21.1- to 21.25-mc. band as the only possible one on which Novices can work much DX. Fortunately, it has been cooperating wonderfully well. In the past several months, many Novices have worked all continents (WAC) and over 25 countries on 21 mc.

To understand how these different bands behave, we need to know something of how radio waves travel through space—which, in turn, requires some knowledge of the *ionosphere*.

The Ionosphere. As the sun rises in the morning and shines down on the earth, it bombards the upper atmosphere with ultraviolet radiations. This causes some of the atoms in the gas molecules forming the atmosphere to lose electrons, thereby becoming *positive ions*. The electrons freed in this manner float around in the atmosphere or attach themselves to other atoms, converting the latter into *negative ions*. Thus, an electrically charged region is developed which extends from about 90 to 300 kilometers (55 to 190 miles) about the earth.

The intensity of its ionization is determined by several factors. Its daily maximum occurs at noon when the sun is highest, and its yearly maximum occurs in midwinter, when the sun is three million miles closer to the earth than it is in midsummer. In addition, when there are many spots on the sun—an indication of great explosions on the sun—upper-atmosphere ionization is high. We are now well into the upward swing of the latest sunspot cycle, which means that sunspot activity will continue to be high for the next several years.

At night, when the sun is in no position to bombard the atmosphere, ionization gradually decreases until—by dawn—the ionosphere has dwindled to a comparatively thin layer about 300 kilometers high. This decrease in ionization is greater in winter than in summer, because the nights are longer in the winter.

The importance of all this to amateurs is that the ionosphere is what makes long-distance, high-frequency radio communication possible. Radio waves normally travel only in straight lines. If it were not for the ionosphere, the signals radiated from our transmitting antennas would shoot out into infinite space, never to return. However, in traveling through the ionosphere, the difference in its electrical density gradually bends them back towards the earth.

Three things determine how much a radio signal is bent in the ionosphere. They are the frequency of the signal, the angle at which it arrives at the ionosphere, and the density of the ionization in it.

KN4GHH at the controls of KN4CDZ, Winston Salem, N. C. With 30-watts input, this station has worked 44 states, Canada, Puerto Rico, Virgin Islands and Cuba. See "News and Views" (page 115) for details on KN4CDZ and its operator.

During the middle of the day, all signals radiated at any angle on frequencies as high

as 10 mc. will be bent back to the earth in the ionosphere. Those that arrive at an acute angle are returned at an equally acute angle to the earth near the transmitter. On the other hand, low-angle signals return to the earth many miles from the transmitter. It would seem, then, that signals radiated at low angles are best for long-distance work. This is true, but—

D Region. Below the ionosphere, another ionized layer, called the *D region,* forms as the sun rises in the morning and disappears as it sets at night. In a negative sort of a way, this region is almost as important as the ionosphere itself. Instead of bending high-frequency signals passing through it, the D region attenuates them.

In one week of operation, Joe Minyard, KN5DXL, Eupora, Miss., made 30 contacts in 13 states on 80 meters. He uses an AT-1 transmitter, an S-53A receiver, and a 135' "folded-dipole" antenna.

The amount of this attenuation increases enormously as frequency decreases. For example, if a 7-mc. signal is attenuated 12 db (2 "S" units) in passing through the D region, a 3.5-mc. signal making the same trip will be attenuated 48 db (8 "S" units), while a 21-mc. signal will be attenuated only about 1½ db. No wonder 3.5-mc. signals are a bit weak in the daytime!

Low-angle signals, traveling at a "slant" through the D region, are attenuated more than high-angle signals. This attenuation is so great that daytime range is limited to 100 miles or less on the 3.7-mc. band and to about 400 miles on the 7-mc. band. At night, though, when the D region disappears, signal strengths and ranges increase greatly on these bands.

At higher frequencies, low-angle signals get through the D region without excessive attenuation, even at midday; therefore, they cover long distances. At the same time, high-angle signals at these frequencies pierce the ionosphere, resulting in a zone of no signal hundreds of miles wide between the transmitter and the areas where the low-angle signals return to the earth.

It is not unusual for signals to bounce between the earth and the ionosphere a couple of times in traveling long distances. In fact, the curvature of the earth and the height of the ionosphere limits the maximum "one-hop" distance that can be covered to 2400 miles; therefore, multiple hops are always required to cover greater distances. Of course, each bounce attenuates the signal a bit more. For this reason, it is always best to choose the highest frequency and the lowest angle of radiation usable over a given path at a given time, in order to deliver a strong signal to the remote receiver.

When sunspot activity is high, as it will be for the next several years, low-angle signals up to 30 mc. are useful for DX work from dawn to dark between early fall and late spring. During the summer, the maximum usable frequency drops below 25 mc., but it remains high enough to support 21-mc. communications in some direction during most of the daylight hours.

Getting on 21 Mc. A good antenna is the most important requirement for good results on 21 mc. As noted above, only low-angle signals are useful on the higher frequencies. The maximum usable angle of radiation on 21 mc. rarely exceeds 25°, and best results are had with angles below 15°.

In free space, a horizontal antenna would radiate equally well straight up, straight down, and at any angle in between. But when an antenna is mounted close to the ground, the power it radiates downward is reflected upward from the ground, to cancel or reinforce the power radiated at upward angles. Which angles are cancelled and which are reinforced depend upon the antenna height.

An antenna ½-wavelength high has its maximum lobe of radiation centered around 32° above the horizon. One ¾-wavelength high has its lowest lobe of radiation centered around 20°, and one a full wavelength high has its lowest lobe centered around 12°.

At 21 mc., ½-wavelength equals about 23', and a wavelength equals about 46'. Consequently, a minimum height of 35' is recommended for a 21-mc. antenna. A 45' height is better; less than 25' gives comparatively poor results.

Most center-fed 7-mc. antennas, especially if cut for the low-frequency end of that band, work quite well as three half-wave antennas on 21 mc. So do the "all-band" Novice antennas described in the *Transmitting Tower* for December, 1955, and on page 92 of the March, 1956, issue of POPULAR ELECTRONICS, assuming that they meet the height requirements.

A ½-wave antenna for the 21-mc. band is only 22' 1" long, calculated from the formula: L (ft.) $= 468/F$ (mc.). It may con-

HELP US OBTAIN HAM LICENSES

In this section of the Transmitting Tower, the names of persons requesting help and encouragement in obtaining their amateur licenses are listed. To have your name listed, write to Herb S. Brier, W9EGQ, % POPULAR ELECTRONICS, 366 Madison Ave., New York 17, N. Y.

W1 CALL AREA

Joseph P. Obrien, 142 Ocalligham Way, South Boston 27, Mass.

Michael Drew, (15), 20 Maple St., Lisbon Falls, Maine. (What is the best equipment to start out with?)

Leonard Rock, 82 Franklin St., New Britain, Conn.

Arnold Fine (17), 29 Monroe Ave., Worcester 2, Mass.

W2 CALL AREA

Richard Parini (16), 1099 1st St., Rariton, N. J.

Jason Kaatz, 80-11 246 St., Bellerose 26, L. I., N. Y. (Will answer all letters)

Richard Bilon (14), 5 Nugent St., New Hyde Park, N. Y. (Theory, pen pals)

Fred Becker, Jr., 60 Stewart Ave., Riverside, N. J. (Wants help and ideas on building a receiver)

Scott Fitzgerald, 20 Alexander Ave., Montclair, N. J.

David M. Abramowitz, (19), 2977 Avenue W, Brooklyn 29. N. Y.

Steve Vadas, 17 Pleasant Ave., W. Caldwell, N. J. (Theory)

Robert A. Sherwood, 110 Vreeland Ave., Bergenfield, N. J. (Code)

Jay P. Sage, 99 Vreeland Ave., Bergenfield, N. J. (Code)

PFC Bruce B. Burpee, US 51294903, Co. D, 34th Sig. BM., Corps, APO 107. New York, N. Y. (Will soon be out of Army and wants to become a ham; wants suggestions for a modest station to start)

Peter Rohrs, 51 Bayview Ave., New Rochelle, N. Y.

Robert Tournier, Post Brook Farms, R.F.D. 1, Butler, N. J.

Alex Kalbouss, 7 West 92nd St., New York 25, N. Y. (Pen pals)

John Hunter, Jr., 36 Atlantic St., Jersey City 4, N. J. (Code and theory)

Henry Meiseles, 1472 43 St., Brooklyn 19, N. Y. (Will answer all mail)

W3 CALL AREA

Marshall Mackler (15), 400 S. Sterling Rd., Elkins Park 17, Phila., Pa. (Wants to hear from other prospective hams and SWL's)

Gary Kaplan, 6721 Horrocks St., Philadelphia 49, Pa. (Wants pen pals)

Ronald Shelton (14), 2911 W. Lanvale St., Baltimore, Md. (Pen pals)

Larry Ierley, 425 S. Wood, Middletown, Pa. (Novice license)

Ed K. Shilts. 1183 Balmoral Dr., Allison Park, Pa. (Pen pals)

Thomas McCoy, R.D. #1, Brockway, Pa.

W4 CALL AREA

Rex Johnson, 403 E. College St., Griggin, Ga. (Wants suggestions about kind of transmitter to get)

Norman Fink (14), Rt. 10. Box 336. Roanoke, Va. (Radio theory and code, pen pals)

H. S. Booth, Jr., 800 W. 30th St., Richmond 25, Va. (Help in securing a ham license)

Billy Crafts, Route 3, Box 165, Athens, Ala.

Jeff Jacobs (16), 602 E. 5th St., Cullman, Ala. (Code)

Michael Hodges (14). Rt. 7, Box 88, Fayetteville, N. C. Phone: 3-0919. (Help in becoming a ham)

W5 CALL AREA

Jerry Johnson (15), Box 506, Celina, Texas.

Bob Gulley, 2502 W. Mulberry, San Antonio, Texas. (Wants pen pals, will answer all letters)

Mike Gulley, 2502 W. Mulberry, San Antonio, Texas. (Wants pen pals, will answer all letters)

Donald Auderer, 6414 Texas Ave., Houston, Texas. (Wants help with Novice license, overseas pen pals)

Randall Caselman, 17 W. 6th St., Fayetteville, Ark. (Wants diagrams of 2-meter transmitters, letters from amateurs on 2 meters)

A/3C J. O. Akin, 2nd Recon. Tech., Ron., Sac, P.O. Box 50, Barksdale AFB, Shreveport, La.

James McWain, (17), 206 N. Schopmeyer, Gainesville, Texas. (Code and theory)

Bob Patterson. 310 11th St. South, Columbus, Miss.

David Holder (15), 307 Aurora St., Houston 8, Texas. Phone: UN-4-3913. (Amateur radio)

Silas Dunn (12), 712 South Cedar, Little Rock, Ark. (Code)

E. L. Purifoy, 826 Rock Is. Ace., E. Dorado, Ark. (Amateur license)

John Waddell, 9709 Pine Lake Drive, Houston 24, Texas.

Howard Wuks, Rt. 4, Box 449, Marshall, Texas.

W6 CALL AREA

Vernon James (13), 1437 Berkeley Way, Berkeley, Calif. (He and two friends want to become Novices by December)

Joseph S. Kernohan, Box 105, Rio Dell, Calif. (Just home from U.S. Army in Germany)

Richard A. Hart (31), 929 S. Pine St., San Gabriel, Calif. (Theory)

Charles J. Henderson, C/O P.O. Box 1026, Atascadew, Calif. (Wants to correspond with other hams)

Bill Rowes, 1241 McWood St., W. Covina, Calif. (Pen pals)

Walter Pollind, 524 25th St., Hermosa Bch, Calif.

Robert Bonner, 1208, S. School St., Lodi, Calif. (Code)

W7 CALL AREA

Wayne Wright, WN7ZGO, 5703-110 S.W., Tacoma, Wash. Phone: LA-9242. (His Novice license is about to expire; needs help with code and theory)

Steve Ogard, 1600 N. E. 137th St., Portland 20, Oregon.

Ralph Goodwin, 214 So. 12th St., St. Helens, Oregon.

W8 CALL AREA

William V. Jenkins, S.M. San., 1500 Blakeslee St., Kalamazoo, Mich. (Recovering from TB in Sanatorium; has lots of time to study; needs a little help; will answer all cards and letters)

chrane, C/O Mrs. Hanley, 420 S. Constantine, Mich. Phone: 3015 almost totally paralyzed as the re- swimming accident when a child much to become a ham)

icy Brower, (18), 5231 Second, De- ich. (Student at Wayne University ittle help in both code and theory ne test)

Kaser, (16), 304 Pine St., Mt. Vernon, Code and theory)

Gale, 19991 Garfield, Detroit 19, Mich. and would like to hear from American rs, pen pals)

Marchant, 16905 W. 12th Mile Rd., Oak. Mich. (Novice license)

l Hafertepe (15), 290 Mohawk St., Cin- ati 14, Ohio. (Help in radio theory)

Dennis Shesterkin, 19520 Georgia, Roseville, Mich. (Help on Novice exam)

Ralph Omness (14), 115 N. Bond St., Saginaw, Mich. (Would like to receive letter from SWL's)

W9 CALL AREA

Barry Weiss (13), 1633 Monroe St., Evanston, Ill. (Help in getting his license)

Paul Parton (14), 1405 Merdian St., Anderson, Ind.

Steve Lindsey (14), 430 W. 7th, Anderson, Ind. (Code)

Richard Roessler (14), 221 S. Ferkel, Columbia, Ill. (Wants SWL pen pals)

James Bowater, 2751 S. Greeley St., Milwaukee 7, Wis. (Needs suggestions for getting antenna up in small yard; also help with code)

Mrs. Dixie Hinkle, 2218 W. 65th St., Indianapolis, Ind. (Help and information in obtaining Novice amateur license)

Duane Read, 608 E. Main St., Plymouth, Wis.

W0 CALL AREA

John Orcutt, Holyoke, Colo.

John Globokar, (15), Box 333, Biwabik, Minn. (Would like letters from licensed hams, and also from any prospective amateurs)

Lee Van Dyke, 3708 South Hooker, Englewood, Colo.

Dale Drake, 5770 W. 4th Ave., Denver, Colo.

Ronald Muriett, 1600 50 Steele St., Denver, Colo.

Kenneth Noll (16), Box 286, Monticello, Minn. (Help in obtaining Novice license, code, pen pals)

Dennis James, 2655 Quevec St., Denver 7, Colo. (Help in obtaining a ham license)

Glen Meiz (14), 319 E. Fir Ave., Fergus Falls, Minn.

VE CALL AREA

J. M. Fitzgerald, 5417 Bannantyne, Verdun P2, Canada. (Interested in receiver and transmitter and wants help in obtaining radio amateur license)

Don Dorward, 78 Royal York Road, North Toronto 18, Ontario (Code and theory)

Jim Spalding, 11302-103 St., Edmonton, Alberta.

To help prospective amateurs obtain their Novice licenses, the Radio-Electronics-Television Manufacturers Association offers a set of code records (recorded at a speed of 33⅓ rpm) and a Novice Theory Course for $10.00, postpaid. The complete course or more information on it is available from RETMA, Suite 800, Wyatt Bldg., 777 Fourteenth St., N.W., Washington 5, D. C.

sist of a length of No. 14 or No. 12 copper wire, split in the middle by an antenna insulator four to six inches long, and supported on each end with similar insulators. Feed it across the center insulator via 50- to 75-ohm coaxial or "twin-lead" transmission line, and face it broadside to the directions you are most interested in working.

Next to the antenna in importance comes the receiver. To be honest about it, some of the less expensive communications receivers available leave something to be desired on 21 mc. However, either a preselector or a converter ahead of them usually improves their operation greatly on 21 mc.

If the receiver lacks a bit of sensitivity on 21 mc., but is otherwise satisfactory, a preselector (POPULAR ELECTRONICS, February, 1956, page 52) will overcome the deficiency. If it lacks both stability and sensitivity or is hard to tune on 21 mc. but is satisfactory on a lower frequency band, a frequency converter may be employed to convert 21-mc. signals to that band. A converter may also be used to extend the coverage of a low-frequency receiver to higher frequencies. Several suitable converters are described in recent editions of the *ARRL* and *Radio Handbooks*.

Finally comes the transmitter. Any of the standard 2- and 3-tube Novice transmitters are capable of transmitting strong signals thousands of miles on 21 mc. when feeding an efficient antenna.

Most of the transmitters use 7-mc. crystals and triple frequency for 21-mc. output. As the 21-mc. Novice band extends from 21.1- to 21.25 mc., crystal frequencies between 7034 and 7083 kc. should be chosen. Users of the *Heathkit* AT-1 transmitter should note, however, that it requires crystal frequencies between 5275 and 5310 kc. for 21-mc. operation.

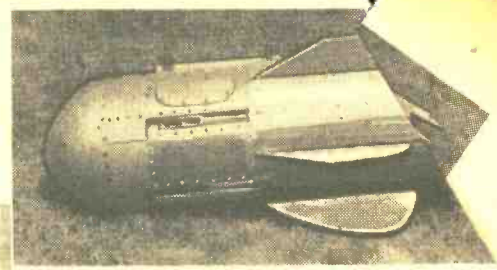
Code-Practice Oscillator

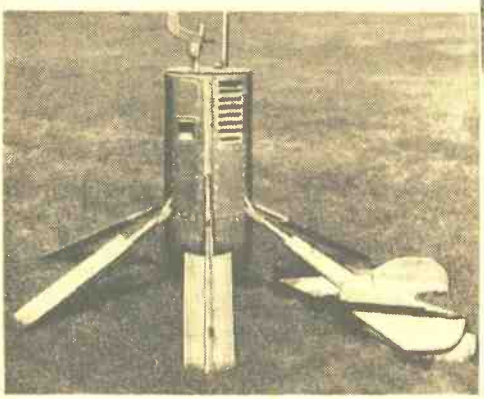
World Radio Laboratories, Council Bluffs, Iowa, is now offering an improved version of the WRL "Economy" code-practice kit for $4.95. It uses a neon bulb in a relaxation-oscillator circuit and obtains its operating power from the 117-volt, 60-cycle power line. Assembling the kit takes about an hour, and the finished oscillator delivers a pleasing, well-keyed tone to a pair of phones.

In my opinion, the "Economy" code oscillator is an excellent buy. A feature I like especially about it is that, in spite of its low cost, it employs an isolation transformer to protect the user from dangerous shocks from the power line. If not already on hand, phones and transmitting key may also be obtained from WRL.

(*Continued on page* 115)

"Grasshopper" Robot Safeguards Polar Flights





Hitting ground starts chain reaction in "Grasshopper" automatic weather transmitter. It sheds parachute (above), then stretches legs to stand up (left), opens louvres, shoots out antenna, and goes to work, operating unattended for two months.

POKING AROUND the pole during an 18-month scientific expedition, Navy Task Force 43 will rely on "Grasshoppers" for weather information amid the ice desert.

The Grasshopper is a 200-pound robot weather station to be dropped from aircraft. Shedding its parachute after landing, the Grasshopper stretches six legs from its plump body to stand itself up on its nose. Then it sprouts a long whip antenna and starts sending out regular weather broadcasts.

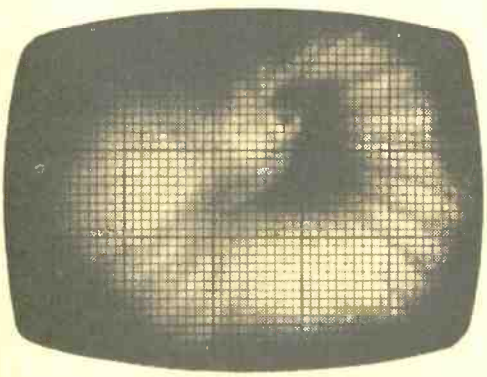
It measures wind speed and direction, temperature, barometric pressure, and humidity, and automatically transmits these data. A preset timer triggers a new broadcast every six hours. Signals can be heard over a radius of 800 miles. The little robot sticks to its job for sixty days without outside help, nursing its batteries through the bitter cold.

The Grasshopper answers a special problem of the planned Operation "Deep-freeze," which will take Navy explorers to the South Pole as one of America's contributions to the International Geophysical Year. Little is known about the weather of the Antarctic, but high winds often make it impossible to parachute supplies from cargo planes. With "Grasshoppers" on weather vigil at their outposts, planes can be certain of being able to unload advance provisions over designated spots. No long flights will be in vain.

Atom Fallout Area Forecast on Tube Face

SAFETY IS the constant concern in nuclear bomb testing. Every precaution is taken before any bomb is exploded on the test range to make sure that no radioactive material falls on inhabited areas in dangerous amounts.

The cathode tube face in the picture shows a fallout pattern predicted for a hypothetical bomb under certain wind conditions. The computer generating this image of the endangered area was described in our May, 1956, issue, page 40.



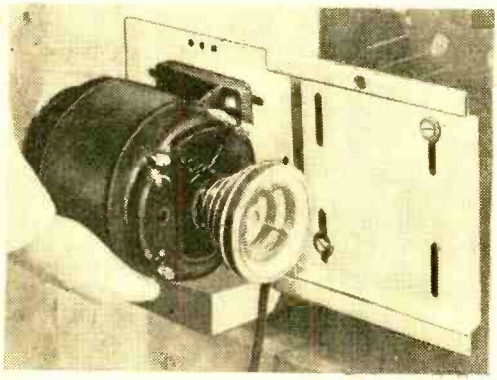
By placing a map over the tube face, the affected towns can be spotted immediately. Controls adjust this display so that it will be presented on the same scale as the map. The effect of an explosion can be predicted for distances up to 500 miles from ground zero. Radioactive strength of the atomic fallout at any point within this area is indicated by the brightness on the screen.

The computer figures the effect of twenty layers of different wind velocity and direction between the top and bottom of the atomic mushroom cloud. Thus, it marks the path of the radioactive particles as they sink down. Their final landing positions on the ground then build up the fallout pattern shown on the screen.

TOOLS and GADGETS

MOTOR MOUNTS FOR POWER TOOLS

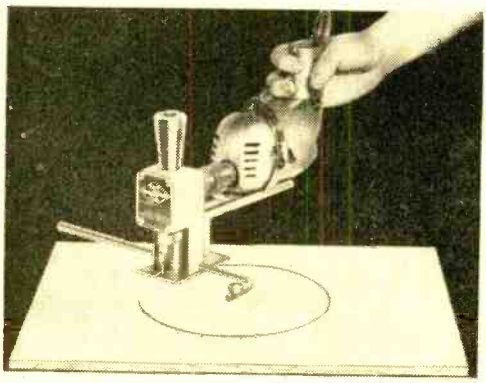
Special motor mounts make it possible for a single electric motor to supply power to more than one power tool. The basic kit, quoted at $5.95 postpaid, consists of one male plate (to be attached to the mounting surface of your electric motor), and two female plates (to be attached in appropriate positions on separate power tools). Additional male and



female mounting plates are available for the extensive use of one motor on many tools, or for adaptation of various motors. (*Warren Williams Productions*, 5247 West Adams Blvd., Los Angeles, 16, Calif.)

PORTABLE JIG-SAW ATTACHMENT

No. 550 "Arco Jig-Saw" is a portable jig-saw attachment with an adjustable circle-cutter and rip gage. The circle cutter assures perfect circles and holes of any size up to 20" in diameter, while the rip gage provides accurate widths of up to 10". For intricate patterns, the jig saw is simply guided over the



cutting line while the automatic air blower blows sawdust away from the blade.

Capable of cutting plywood, plastics, metals —and even lumber up to 2 x 4's—the No. 550 attaches in one minute to any ¼" electric drill. It has the same capacity and cutting speed as more expensive jig saws, yet is priced at $9.95. (*Arrow Metal Products Co.*, 140 West Broadway, New York 13, N. Y.)

MINIATURE PM SPEAKER

Only 1½" in diameter and 15/16" deep, the new Lafayette subminiature PM speaker for transistorized circuitry is claimed to be the smallest PM speaker produced to date. Total weight is 1⅞ oz.

Frequency range and audio output are in excess of requirements for miniature personal portable radios. The magnet is Alnico 5—voice coil impedance, 10 ohms. Selling price, $1.95. A matching transformer, 2000 to 10 ohms, and measuring ⅝"x ⅞" x 11/16", is also available. (*Lafayette Radio*, 100 Sixth Ave., New York 13, N. Y.)

IMPROVED STROBOSCOPE

Rotation speeds of motors, machines, and phonograph turntables can be determined with the Berkshire Labstrobe Model 18-A. A small, light, inexpensive stroboscope unit, it gives 60 brief flashes of light per second when connected to an ordinary 60-cycle power line. In the photo, it is shown being used with a Berkshire Phonostrobe disc to check the speed of a turntable.

This unit supersedes the Model 18, with no increase in cost ($9.95). It is similar in external appearance but the internal construction has been improved—resulting in more accurate centering of the lamp, and easier lamp replacement. (*Berkshire Laboratories*, 898 Bank Village, Greenville, N. H.)

NEW-TYPE ANNUNCIATOR

Unique but simple, the Modern annunciator is designed for a lifetime of service. Its white steel discs are drawn up by coils of No. 28 enamel wire and held with alnico permanent magnets. The numbers are reset by pushing up rod-moving magnets away from the white discs, causing the discs to drop. There is practically no friction and maximum buzzer oscillation on a.c. or d.c. current. (*Modern Annunciator Mfg. Co.*, 59 Sullivan St., New York, N. Y.)

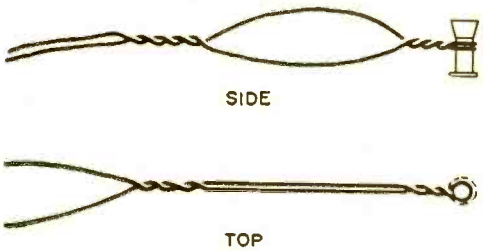
—30—

TIPS and TECHNIQUES

HOME-MADE SOLDERING "POT"

Soldering jobs frequently require joining untinned copper wires. They can usually be handled more easily by first tinning the wire. By using a "micro" soldering pot made from an empty 22-calibre rifle cartridge, you can accomplish such small tinning jobs with little effort.

The open end of the cartridge is flared slightly by inverting it over a suitable conical-



shaped tool (thin-nosed pliers with the jaws closed work nicely) and tapping sharply. A length of iron wire about ten inches long is added, as shown, to provide a handle and base. The "pot" is then heated over a candle, gas, or alcohol flame, solder being fed in as it melts. Wire to be tinned is first cleaned with steel wool or fine sandpaper, then dipped into the molten solder.

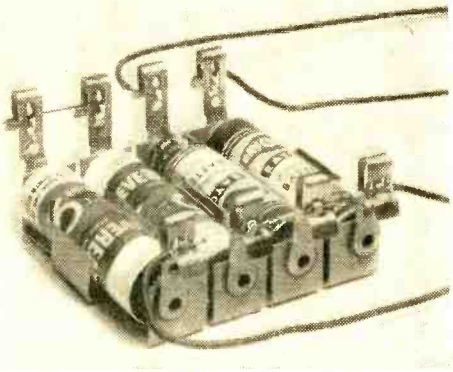
Dip-soldering is also feasible with articles of suitable size and shape. Fresh solder must be added periodically to make up for losses and to maintain the layer of flux on the surface. —*W.B.L.*

QUICK BATTERY-HOLDER CONNECTIONS

Experimenting with transistors? Try this dodge: solder small Fahnestock clips onto the lugs of the battery holders as shown in the photo. Quick connections can then be made to the holders without further soldering, and without using alligator clips or battery clips which tend to pull sideways and short against one another.

An Acme battery holder holding four size "AA" penlite cells is shown in the photo. By means of the Fahnestock clips, the cells can be quickly connected in series or in parallel, or the pack can be easily tapped for any voltage from 1½ to 6. Many combinations of connections can be made. For example, the photo shows a connection giving 4½ volts, with another giving 1½ volts.

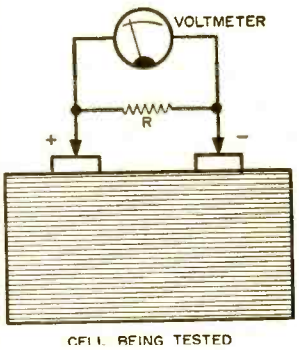
The Fahnestock clips can easily be soldered to the battery-holder lugs if you use a little soldering paste and plenty of solder. After



soldering, clean the entire assembly with Ajax kitchen cleaner and an old, soft toothbrush; then rinse off with hot water. —*A.T.*

SALVAGING WEAK "B" BATTERIES

Most radio "B" batteries come in units consisting of a number of separate 15- to 18-volt cells wired in series to give the necessary voltage. Often, one cell will deteriorate more rapidly than the others and build up a large internal resistance, making the entire battery seem dead. This is especially true if the battery has been allowed to remain on the shelf or in a radio which is not used very much. If you collect a number of old batteries, the defective units from each can be removed and the good cells rewired together in series to give usable units. Care must be taken to observe correct polarity when rewiring.



Cells can be checked by first taking a voltmeter reading to make sure that there is a potential difference of (at least) 15 to 18 volts between the terminals, and then shunting the battery with a resistance on the order of 10,000 ohms. The meter should read a constant 15 to 18 volts for a minimum of about five seconds. —*J.R.*

TIN-FOIL AIDS TV RECEPTION

If the picture on your TV set is marred by interference from an FM station or any other nearby transmitter, here is an easy stunt that may effect an improvement.

Wrap a 2"x2" length of household aluminum foil snugly around the twin-line antenna lead where it is connected to the set. Slide the foil slowly along the twin line in the direction of the antenna while watching the TV

(*Continued on page* 106)

build your own **HEATHKIT**

... and have fun doing it!

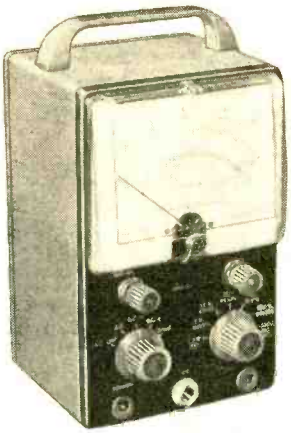
Every Heathkit comes complete with detailed step-by-step instructions and large pictorial diagrams that insure successful construction—even for the beginner. Enjoy both the satisfaction and the economy of "building it yourself."

Circuit boards cut assembly time in half

1% resistors insure instrument accuracy.

High impedance and high sensitivity.

Attractive styling—functional design.



etched circuit vacuum tube

voltmeter kit

MODEL V-7A

$24.50

SHIPPING WT. 7 LBS.

In addition to measuring AC (rms), DC, and resistance, the modern-design V-7A incorporates facilities for peak-to-peak measurements. These are essential in FM and television servicing.

AC (rms) and DC voltage ranges are 1.5, 5, 15, 50, 150, 500, and 1500. Peak-to-peak AC voltage ranges are 4, 14, 40, 140, 400, 1400, at 4,000. Ohmmeter ranges are X1, X10, X100, X1000, X10K, X100K, and X 1 megohm. A db scale is also provided. Polarity reversing switch provided for DC measurements, and zero center operation is within range of the front panel controls. Employs a 200 microampere meter for indication. Input impedance is 11 megohms.

Etched metal, pre-wired circuit boards insure fast, easy assembly and result in reliable operation. Circuit board is 50% thicker for more rugged physical construction. 1% precision resistors used for utmost accuracy.

Heathkit

HANDITESTER KIT

MODEL M-1

$14.50

Shpg. Wt. 3 lbs.

The Model M-1 measures AC or DC voltage at 0-10, 30, 300, 1000, and 5000 volts. Measures direct current at 0-10 ma and 0-100 ma. Provides ohmmeter ranges of 0-3000 (30 ohm center scale) and 0-300,000 ohms (3000 ohms center scale). Features a 400 microampere meter for sensitivity of 1000 ohms per volt. Handy and portable. Will fit in your coat pocket, tool box, glove compartment, or desk drawer.

Heathkit **VOM KIT**

20,000 ohms/v. DC and 5,000 ohms/v. AC sensitivity. Ranges (AC and DC) are 0-1.5, 5, 50, 150, 500, 1500, and 5000 v. Direct current ranges are 0-150 ua, 15 ma, 150 ma, 500 ma, and 15 a. Resistance ranges provide center-scale readings of 15, 1500 and 150,000 ohms. DB ranges cover −10 db to +65 db.

Features 4½" 50 ua meter and 1% precision resistors.

MODEL MM-1

$29.50 Shpg. Wt. 6 Lbs.

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* BENTON HARBOR 5, MICHIGAN

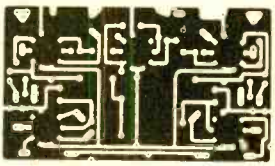
Heathkit 3" oscilloscope kit

ETCHED CIRCUIT

- Push-pull vertical and horizontal amplifiers.
- Light weight and small size for portability.
- Good sensitivity and broad frequency response.
- Etched metal circuit boards for simplified assembly.
- Attractive panel and case styling.

MODEL OL-1

$29.50 Shpg. Wt. 14 Lbs.



This compact little oscilloscope is just the ticket for use in the ham shack or home workshop. Measures only 9½" H. x 6½" W. x 11¾" D. Weighs only 11 pounds.

Employing etched metal circuit boards, the Model OL-1 features vertical response with in ±3 db from 2 cps to 200 kc. Vertical sensitivity is 0.25 volts rms per inch, peak-to-peak, and sweep generator operates from 20 cps to 100,000 cps. Provision for direct RF connection to deflection plates. Incorporates many features not expected at this price level. The 8-tube circuit features a type 3GP1 cathode ray tube.

- Cathode-follower output for isolation.
- No oscillator calibration required.
- Covers 160 kc to 220 mc (including harmonics).

Heathkit signal generator kit

This signal generator covers 160 kc to 110 mc on fundamentals in 5 bands. Calibrated harmonics extend its usefulness up to 220 mc. The output signal is modulated at 400 cps, and the RF output is in excess of 100,000 microvolts. Output controlled by both a continuously variable and a fixed step attenuator. Audio output may be obtained for amplifier testing.

MODEL SG-8

$19.50 Shpg. Wt. 8 Lbs.

This is one of the biggest signal generator bargains available today. The tried and proven Model SG-8 offers all of the outstanding features required for a basic service instrument or for use in experimenting in the home workshop. High quality components and outstanding performance. Easy to build, and no calibration required for ordinary use.

Heathkit grid dip meter kit

This extremely valuable instrument is a convenient signal source for determining the frequency of other signals by the comparison method. Range is from 2 mc to 250 mc. Uses 500 ua meter for indication, and is provided with a sensitivity control and headphone jack. Includes prewound coils and rack. For hams, experimenters, and servicemen.

MODEL GD-1B

$19.50

Shpg. Wt. 4 Lbs.

Heathkit ANTENNA impedance meter kit

Used in conjunction with a signal source, the Model AM-1 will enable you to measure RF impedance. Valuable in line matching, adjustment of beam and mobile antennas, etc. Will double as a phone monitor or relative field strength indicator. A 100 microampere meter is employed. Covers the impedance range from 0 to 600 ohms. An instrument of many uses for the amateur. Easily pays for itself through the jobs it will perform.

MODEL AM-1

$14.50 Shpg. Wt. 2 Lbs.

HEATH COMPANY *A SUBSIDIARY OF DAYSTROM, INC.*

BENTON HARBOR 5, MICHIGAN

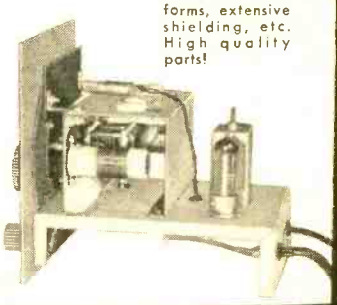
Heathkit

vfo

KIT

- ☆ 6AU6 electron-coupled oscillator.
- ☆ 0A2 voltage regulator tube for stability.
- ☆ Smooth-acting illuminated dial.
- ☆ Easy to build and attractively styled.

Extra features include copper-plated chassis, ceramic coil forms, extensive shielding, etc. High quality parts!



MODEL VF-1 **$19.50**

Shpg. Wt. 7 Lbs.

This variable frequency oscillator covers 160-80-40-15-11 and 10 meters with three basic oscillator frequencies. RF output is better than 10 volts average on fundamentals. Enjoy the convenience and flexibility of VFO operation at no more than the price of crystals. May be powered from a socket on the Heathkit Model AT-1 transmitter, or supplied with power from most transmitters.

Features illuminated and pre-calibrated dial scale. Cable and plug provided to fit crystal socket of any modern transmitter.

Heathkit CW amateur transmitter kit

SPECIFICATIONS:

RF Amplifier Power Input	25-30 watts
Output Connection	52 ohms
Band Coverage	80, 40, 20, 15, 11, 10 Meters
Tube Complement:	
5U4G	Rectifier
6AG7	Oscillator-Multiplier
6L6	Amplifier-Doubler

This CW transmitter is complete with its own power supply and covers 80, 40, 20, 15, 11, and 10 meters. Incorporates such outstanding features as key-click filter, line filter, copper plated chassis, pre-wound coils, and high quality components. Employs a 6AG7 oscillator, 6L6 final amplifier. Operates up to 30 watts plate power input.

MODEL AT-1

$29.50

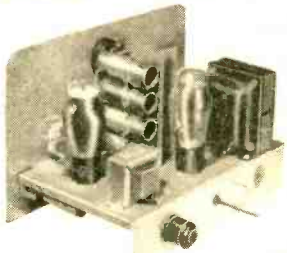
Shpg. Wt. 15 Lbs.

Single-knob band-switching for 80, 40, 20, 15, 11 and 10 meters.

Plate power input 25-30 watts.

Panel meter monitors final grid or plate current.

Best dollar-per-watt buy on the market.

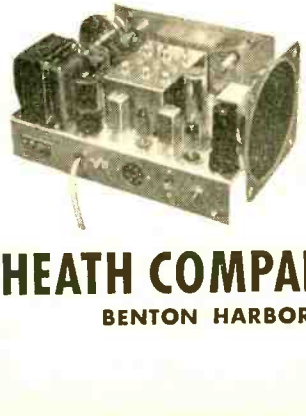


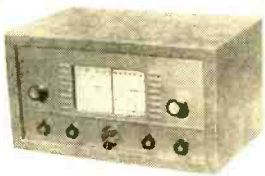
Slide-rule dial-electrical band-spread-ham bands marked.

Slug-tuned coils and efficient IF transformers for good sensitivity and selectivity.

Transformer-operated power supply for safety and high efficiency.

Heathkit COMMUNICATIONS TYPE all band receiver kit





The Model AR-3 covers from 550 kc to 30 mc on 4 bands. Covers foreign broadcast, radio hams, and other interesting short wave signals.

Features good sensitivity and selectivity. Separate RF and AF gain controls—noise limiter—AGC—VFO, headphone jack—5½" PM speaker and illuminated tuning dial.

SPECIFICATIONS:

Frequency Range	550 kc to 30 mc on four bands
Tube Complement	1—12BE6 oscillator and mixer
	1—12BA6 IF amplifier
	1—12AV6 second detector, AVC, first audio amplifier and reflex BFO
	1—12A6 beam power output
	1—5Y3 full wave rectifier

$27.95 MODEL AR-3

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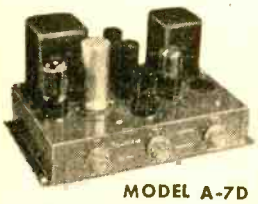

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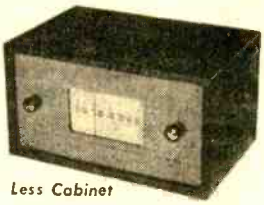

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picture for an improvement. What you are actually doing is using the inductance and capacitance of the twin line and the foil to tune out the interference.

When the point of best reception is found, squeeze the foil tightly around the twin line and tape it in place. Wrap a second piece of foil around the twin line on the antenna side of this point and move it along the line toward the antenna, as before, until a second point of improvement is found. Squeeze and tape this one in place. Additional foil may be added in the same manner. —*F.H.T.*

WATCH THOSE SPEAKER GASKETS!

On most receivers, a rubber or fiber gasket fits into a groove on the chassis. The speaker is then forced slightly against this gasket. If the gasket is missing, or if it is damaged or twisted, any slight speaker noise will be amplified and vibrations may be set up. Therefore make sure the gasket is installed properly before replacing the speaker. —*H.L.*

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Typewriter with a Memory

(*Continued from page* 39)

tory, located on the campus of Columbia University.

Mr. Seeber's initial concept called for a rotating magnetic-drum memory, the most common type of memory in use in computers today. The drums are coated with magnetic recording tape. Magnetic recording heads insert information on the drums, which rotate at about 3000 rpm. Due to the limited availability and high cost of magnetic-drum memories five years ago, Mr. Seeber turned to a simple and comparatively inexpensive plugboard memory. The plugboard is a half-inch-thick sheet of plastic about 18" high x 24" wide.

Not permanently mounted in the memory apparatus, the plugboards can be removed from their sliding frames much as a slide is inserted and removed from a projector. Therefore, a number of boards can be used with each Wordwriter in an office. A completely wired board is not too heavy for a woman to lift and press into the frame. When the plugboard is locked in the frame, male contacts in the back of the board are pressed into mating contacts in the frame.

If a larger capacity memory were employed, Mr. Seeber has reason to believe that a secretary could remember the keys coded to many times 42 phrases—perhaps up to 800 phrases. If the memory has a greater phrase capacity than the number of keys on the typewriter, then two keys could be depressed at the same time to trigger the additional phrases over 42.—*Mel Mandell.* -30-

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1LB4	.55	6AU7	.85	7A5	.53	14N7	.69
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1R4P	.88	6B8	.75	7B6	.44	25CU6	1.10
1R5	.58	6BA6	.45	7B7	.44	25L6GT	.45
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1U4	.55	6BF5	.42	7C6	.44	26	.48
1U5	.41	6BG6G	1.10	7E5	.59	27	.29
1V2	.63	6BH6	.52	7F7	.59	32L7GT	.53
1X2	.65	6BJ6	.49	7F8	.69	35	.32
2A7	.50	6BK5	.75	7H7	.69	35/51	.33
2X2A	.55	6BL7GT	.69	7J7	.69	35A4	.44
3A4	.55	6BN6	.60	7K7	.69	35B5	.48
3A5	.55	6BQ6GT	.75	7N7	.54	35C5	.48
3AL5	.48	6BQ7	.80	7X7	.69	35L6GT	.45
3AU6	.48	6BY5G	.60	7Y4	.39	35W4	.35
3BC5	.56	6BZ7	.80	7Z4	.39	35Z4	.35
3BN6	.65	6C4	.35	12AB6	.45	35Z5GT	.35
3C86	.56	6C86	.50	12AT6	.38	37	.30
3Q4	.45	6CD6G	1.10	12AT7	.65	39/44	.35
3Q5GT	.55	6CU6	.90	12AU6	.42	50A5	.44
3S4	.52	6C6	.45	12AU7	.52	50B5	.48
3V4	.52	6F6	.40	12AV6	.38	50C5	.48
4BQ7	.92	6H5	.42	12AV7	.73	50L6GT	.45
4BZ7	.97	6J4	1.50	12AX4GT	.67	75	.40
5AQ5	.52	6J5	.38	12AX7	.69	76	.40
5J6	.60	6J6	.50	12AZ7	.65	77	.40
5U4G	.45	6K6GT	.36	12B4	.65	78	.40
5U8	.68	6L6	.65	12BA7	.59	80	.35
5V4G	.56	6S8GT	.74	12BE6	.45	84/6Z4	.41
5X8	.78	6SA7	.44	12BH7	.59	117L7GT	1.39
5Y3	.29	6SC7	.50	12BY7	.64	117N7GT	1.29
5Y4G	.35	6SF5	.60	12CU6	1.09	117P7GT	1.29
5Z3	.40	6SH7	.43	12K7	.49	117Z3	.35
6A7	.55	6SJ7	.43	12Q7	.44	117Z6GT	.60
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Transistor Topics

(*Continued from page 77*)

on a dime. The M-1 is hermetically sealed in a metal can. It is a germanium *p-n-p* junction transistor.

On the components front, United Transformer Corporation (150 Varick Street, New York 13, N. Y.) has introduced a new series of subminiature audio transformers. Called the Deci-Ouncer Transformer series (DOT's for short), these units are hardly bigger than a pencil's eraser, having a volume of only 0.03 cubic inches. With an efficiency 30% greater than conventional transformers, they can be used at levels of 100 milliwatts.

Things-To-Come. There should be some transistorized auto receivers available this fall, more "hybrid" (part tube, part transistor) portable *and* home receivers, high-frequency (100-mc. and higher) transistors before the end of the year. . . . Other types of semiconductor devices are being developed and will be available—*tetrode* transistors, *double-based* diodes, more types of power transistors, and transistors using semiconductors other than germanium and silicon.

New Book. Interested in light-powered circuits? You'll want to get a copy of the new paper-bound booklet, *The Use of Selenium Photocells and Sun Batteries*, by John Sasuga. If not available locally, write to the International Rectifier Corporation, 1521 East Grand Avenue, El Segundo, Calif. . . . price is one dollar and fifty cents ($1.50).

This book is chock-full of information and features many practical circuits . . . with part values! Included are sensitive relays, photometers, unusual relays, light beam transmitters and receivers, charts, tables, etc.

New Transistor. As we go to press, Raytheon announces a new low-cost r.f. transistor, to be called the CK768, and which will retail at $1.50. Look for more dope in my next column on this item.

That's it for now . . . see you next month . . .

Lou

Wired-Wireless Receiver

(*Continued from page 65*)

ing this plug into a socket on a tape recorder that has been equipped with an electrically controlled clutch permits remote control of the playback or recording. In this way, you can record desired selections from radio or TV even though you may be busy elsewhere in your home.

A unit can be mounted inside a television set and the relay contacts wired across the loudspeaker terminals so that the speaker is short-circuited whenever the receiver is energized. Thus, you can sit across the room and silence a television commercial simply by flicking the nearby transmitter switch. When the picture clears up, switch the transmitter back to standby and the sound will instantly return. -30-

The SWL's Friend

(*Continued from page 80*)

the tuner has an undesirable effect on the receiver's oscillator, this effect is called "pulling." Pulling is indicated when you can receive no stations with the "Peaker" connected. Sometimes the receiver may break into instability and howl. If you use fewer turns on the link coil, *L2*, or move *L2* further away from *L1*, you can reduce the coupling and the pulling effect. -30-

Disc and Tape Review

(*Continued from page 72*)

is mainly for strings and woodwinds, with flute and oboe solos quite prominent. Out of the 15 recordings in the LP catalog, only four can be considered as worth your attention.

The best-sounding version and, coincidentally, one of the best performances, is that of D. E. Inghelbrecht on Angel 35103. Inghelbrecht is generally considered *the* Debussy interpreter, and a "listen" to his reading is pretty convincing evidence in support of this reputation. In his meticulous attention to tempi, his expressive dynamics and carefully modeled phrasing, it is easy to perceive the study he has devoted to the work. He also manages to evoke some particularly splendid playing from his orchestra, and the result is a wholly beautiful performance. Soundwise, this is typical of Angel's best efforts . . . the string tone is that luminous, almost transparent texture that is so nicely suited to this type of repertoire, and quite clean and edgeless as an added virtue. Woodwind sound is gorgeous . . . and why shouldn't it be? After all, the woodwinds are a French specialty and here we have a French orchestra, playing French music, under a French conductor, and the recording was made in Paris! That certainly should have been enough inspiration! All this fine playing is cloaked in very live, spacious acoustics, wide frequency and dynamic range.

Next in line is Dr. Stokowski once again,

and on the same record as *Clair de Lune*—making this an exceptionally good buy. Stokowski's reading is typical of him . . . he brings out subtleties and nuances in the score wholly missing in the readings of many others, and above all, imbues his reading with a great deal of color and expression. Stokowski has always been an expert at getting good playing from an orchestra, and this disc is no exception . . . here we have typically lush string tone and good woodwind sound, too. Stokowski has a habit of using the top talent he can find for certain key instruments. I can well remember that if he planned to record a work which called for a lot of woodwind scoring, especially for flute, he would fly in people like Julius Baker—one of the world's great flute men—from Chicago or even further. The sound on the Stokowski disc is better than it should be . . . meaning that for the period in which it was made the general level from Victor was not as good. That's another facet of Stokowski which has contributed mightily to his success . . . he has a devoted interest in high-quality sound reproduction and has done much in the way of orchestral seating experiments and in microphone placements to add realism to his recordings. Frequency and dynamic range is fairly wide. Groove distortion, a fault of some early LP's, was not noticeable. Add nice live acoustics, and you have a disc of more than passable quality.

The third disc in question has still another conductor whose name has long been associated with the music of Debussy. I refer to Ernest Ansermet, whose reading of *"The Faun"* is on London LD9031. One would be splitting hairs to prefer the Inghelbrecht or Stokowski performances over that of Ansermet, or vice versa. Ansermet's tempi are perhaps a shade faster, his dynamic shadings not as extreme, and in terms of orchestral balance he doesn't manage quite as well as the other two conductors. But these are very minor factors, and generally Ansermet's is a splendidly conceived and expertly executed performance. He has also been favored with some of London's fine sound—the strings being especially smooth and clean, and the important woodwinds having a very "live" breathy sound. Some inner groove distortion was the only thing that marred a generally good sonic picture.

The other disc for our consideration is part of a three-record album on Angel 3518C. Conducted by Igor Markevitch, a rising star in Europe, the album is entitled "Homage to Diaghalev," and consists mainly of the ballet music that was associated with his name. The sound is very

good, with the same remarks applied to the Inghelbrecht disc being appropriate here. Markevitch has not quite the grasp of the score that the other conductors have . . . he has a tendency to drag his feet. But, in spite of this, he gives an acceptable performance. There are a lot of other good things in that album if you have the money to indulge yourself.

La Mer. Debussy's great tone poem, *La Mer* (The Sea), has had a good break on records, no less than six of the ten versions being reasonably hi-fi in quality. Any consideration of *La Mer* must begin with the Toscanini recording. This is one of the Maestro's truly inspired readings, and is about as thoroughly evocative a picture of the sea as anything that has ever been done. Toscanini has been the victim of some pretty miserable sound, and when *La Mer* first was released a few years ago, it left much to be desired in sonic values. About eight or nine months ago, the record was released with a better coupling (*Iberia* instead of *Midsummer Night's Dream*), and with sound which the Victor blurb claimed had been "enhanced" over the original quality. There is a considerable difference between them all right, but even so the end result is not what one would call tops in sound. Nevertheless, the sound *is* better, and the truly miraculous performance makes this a most desirable disc.

Coming after a top Toscanini performance is a tough spot to be in, but the second recording in question does not suffer too much by comparison, for it is our friend Inghelbrecht again and he defers to few people in matters of Debussy. This time he is on a Westminster disc, 5327, and the sound is near the top in the *La Mer* sweepstakes. Inghelbrecht's tempi are slower than the Maestro's, but otherwise he is not much at variance with the old man . . . at least as far as adherence to the formal score is concerned. The big difference is really in the sheer vitality of the Toscanini reading and in the fact that Toscanini had a much finer orchestra. Sound on the Westminster disc is quite good but not as spectacular as some of this company's other efforts. This one was evidently made while Westminster was still having troubles, as some overload distortion is noted in a few of the big climaxes. Outside of that, it is nice wide-range stuff with superb acoustic perspective. Strings are just a mite edgy for my taste, brass is good and bright, and there is fine intonation on the woodwinds and some heavy accurate percussion.

Number 3 man on the *La Mer* totem-pole is Von Karajan on Angel 35081. This is supposed to be repertoire far outside the

ken of Von Karajan, but you wouldn't think so on hearing his reading, which is eminently satisfying. Sure, he has certain little mannerisms which annoy at times, and some of his ideas on phrasing give one pause, but by and large he gets a sound reading and some fabulous playing from his wonderful Philharmonia orchestra. The sound is a sturdier, more vigorous type than that which is usual for Angel, and is in all aspects outstandingly good.

The remaining recordings of *La Mer* vary considerably in sound quality as well as interpretation. Ansermet on London LL388 gives a good reading with fair quality sound, Monteaux on Victor LM1939 does a splendid job with the Boston Symphony, and Mitropoulos gives an indifferent performance with rather lackluster sound. In nearly all these recordings, even a good performance has a tough time—because of the blazing intensity of the Maestro's reading. He has left a memorial in this work that will be hard to topple. If sound is number one with you, then you won't go wrong on either the Westminster or the Angel recording.

Other Works. Those are the three major—or perhaps I should say most popular—of the basic Debussy works. Here are others which I think should be in a good Debussy library . . . I'll just mention what I think is the best recording of each: *Iberia,* a very exciting Spanish-flavored work of Inghelbrecht on Westminster 5327 (reviewed last month); *Nocturnes,* conducted by Antal Dorati on Mercury 50005; *Le Martyre de Saint Sebastian,* conducted by Ansermet on London LL1061; *Children's Corner Suite,* conducted by Andre Cluytens on Angel 35172; *Jeux-Poeme Danse* and *Epigraphes Antiques,* conducted by Ansermet on London LL992; *Dances Sacred and Profane,* performed by the Hollwood String Quartet on Capitol P8304; *La Damoiselle Elue,* on Victor LM1907; *Pour le Piano,* with Gieseking on Angel 35065; and the *Quartet in G,* with the Budapest Quartet on Columbia 4668. —30—

Under-the-Phone Crystal Set

(*Continued from page* 85)

top of the box, and cement the metal plate in position. Any thin sheet metal such as aluminum, copper, brass, or tin can be used.

The coil form is simply a plastic pill box 1¼" in diameter and 2⅞" long. To make the coil, drill two small holes in the plastic box about ⅛" from the bottom, and anchor No. 28 cotton-covered enameled copper wire in the holes with a little cement. Leave about a 5" long pigtail in the end

of the wire for hooking up the coil later on. Wind about 88 turns and twist a small loop for the tap, then wind 30 more turns and anchor the end of the wire, leaving a pigtail about 6" long.

Drill a ⅛"-diameter hole in the center of the bottom of the pill box, and mount the pill box to the side of the wooden box, using a round-head wood screw ¼" long and a washer. The coil should be mounted as close to the bottom of the box as possible to keep it away from the metal plate. —*Arthur Trauffer.* -30-

Maximum Fi . . . Minimum $$$

(*Continued from page* 38)

for the record player; if you cannot devise this yourself from templates supplied, or re-use an old one which you may have, you can buy one for very little.

The Components. The Granco FM Tuner, Model T-160, uses "coaxial tuning." This is a substitute for the conventional ganged capacitor used in the front-ends of most receivers. In the Granco, a variable capacitance is achieved by sliding two glass-like members one within the other. The temperature resistance of these members, plus a frequency-compensating capacitor in the oscillator circuit, helps stabilize the tuner and obviate the need for a.f.c. Once "warmed up," the set stays tuned to the station selected. There is some drift within the over-all range of the ratio-detected slope, but its effect is negligible (maximum drift of about 30 kc. within the over-all FM bandwidth of 150 kc.). A high-*Q* circuit assures adequate selectivity. The tuner performs noticeably better with an antenna—and hooking some 300-ohm twin-lead to it (the length is not critical) is no task at all.

The record player is the manual kind, with no changing mechanism. This saves you space and money. If the majority of your records are LP's, you really have no need for a changer anyway. The extra money spent for a changer does not necessarily get you a better record player; it goes into the automatic mechanism that makes the "player" a "changer." The Garrard "Model T" uses a shock-mounted 4-pole motor. Its tone arm, with removable cartridge head and adjustable stylus pressure, is about as good as can be designed for a low-cost unit.

Either the G.E. or the Recoton magnetic cartridge will do very nicely as the phono pickup. The G.E. unit is the "swing-around" type for changing from micro-groove to 78-rpm stylus; the Recoton is the "turnover" kind. Each is fitted with two

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Includes: 8 element antenna with crossbar, 5 ft. seamless aluminum mast chimney mount or 7" wall bracket (state your need), 8 stand offs, 50 ft. of 300 ohm wire. List $15. . . . . **$8.29**

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135 watt gun . . . dual spotlight illuminates work when iron is on. Kit includes wire soldering brush. Weller soldering aid to make tight wire twists and reopen old solder joints, pkg. of Kester Solder **$5.49**

UNIVERSAL 4-Prong Auto Radio Vibrator. Takes care of 90% of 6 volt auto sets. Lists $4.90 . . . . . **$1.19**

Send for Free complete tube listing and monthly specials. Get on our mailing list.

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
0Z4	.45	6AX4GT	.60	6SK7	.45	12SK7	.45
1A7GT	.53	6AX5GT	.60	6SJ7	.45	12SL7	.60
1B3GT	.62	6BA6	.56	6SN7GT	.60	12SN7GT	.56
1H5GT	.51	6BA7	.58	6SQ7	.40	12SQ7	.38
1L4	.51	6BC5	.48	6T8	.71	14A7	.43
1L6	.51	6BC7	.75	6U8	.76	14B6	.36
1LC6	.49	6BE6	.46	6V3	.80	14Q7	.52
1N5GT	.51	6BF5	.48	6V6GT	.48	19BG6G	1.48
1R5	.51	6BF6	.48	6W4GT	.43	19T8	.71
1S5	.43	6BG6G	1.18	6W6GT	.53	25L6GT	.41
1T4	.51	6BH6	.51	6X4	.37	25BQ6GT	.82
1U4	.51	6BJ6	.51	6X5GT	.38	25W4GT	.43
1U5	.43	6BK5	.75	6X8	.80	25Z5	.55
1X2	.65	6BK7	.78	6Y6G	.61	25Z6GT	.36
3A5	.65	6BL7GT	.78	7A8	.46	35A5	.48
3Q4	.53	6BN6	.90	7C5	.44	35B5	.48
3Q5GT	.61	6BQ6GT4	.83	7F7	.59	35C5	.48
3S4	.48	6BQ7	.85	7F8	.77	35L6GT	.41
3V4	.48	6BY5G	.60	7N7	.52	35W4	.33
5R4	.95	6BZ7	.95	12AT6	.37	35Y4	.42
5U4G	.43	6C4	.41	12AT7	.71	35Z3	.41
5V4	.49	6C5	.46	12AU7	.58	35Z5GT	.33
5Y3	.30	6CB6	.51	12AV6	.42	37	.59
5Y4G	.37	6CD6G	1.63	12AV7	.73	43	.55
6A8	.40	6CU6	.95	12AX4GT	.60	45	.55
6AB4	.43	6D6	.59	12AX7	.61	50A5	.49
6AC7	.65	6E5	.60	12AZ7	.61	50B5	.48
6AG5	.52	6F5	.44	12B4	.72	50L6GT	.50
6AH4GT	.65	6F6	.42	12BA6	.46	50X6	.53
6AF4	1.02	6H6	.50	12BA7	.58	75	.44
6AK5	.96	6J5	.49	12BE6	.46	77	.55
6AL5	.43	6J6	.61	12BH7	.61	80	.40
6AQ5	.48	6K5	.60	12BY7	.65	84	.46
6AR5	.48	6K6GT	.39	12H6	.50	117GT	1.20
6AS5	.52	6K7	.40	12J5	.40	117L7GT	1.20
6AT6	.37	6L6	.78	12K7	.40	117N7GT	1.20
6AU5GT	.60	6Q7	.40	12Q7	.48	117P7GT	1.20
6AU6	.43	6S4	.41	12SA7	.45	117Z3	.33
6AV5GT	.60	6S8GT	.65	12SJ7	.45	117Z6GT	.65
6AV6	.37	6SA7	.45	12SJ7	.45	1629	.39

We have thousands of tube types too numerous to list here. On ordering types not listed take 75% off current list price for cost of tube.

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10" Table
Model $22.50
Console $25.00

12" Table
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Console $31.00

14" Table
Model $32.50
Console $35.00

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Model $39.50
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10BP4	11.19
12LP4	13.79
12UP4	14.25
14BP4	15.77
14CP4	15.77
15BP (for Dumont)	18.53
16AP4	18.79
16CP4	18.79
16DP4	18.69
16EP4	19.29
16GP4	19.29
16HP4	18.79
16JP4	18.79
16LP4	18.79

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16KP4, 16RP4, 16TP4 . . . 15.99 ea.

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17BP4	17.99
17CP4	20.79
17GP4	21.79
19AP4	23.49
19DP4	23.19
20CP4	24.19
20DP4	24.19
21AP4	27.49
21EP4	27.47
21FP4	27.99
21YP4	27.99
24AP4	43.99
24CP4	43.99
27EP4	64.99

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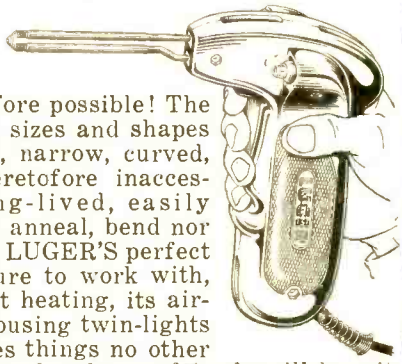

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sapphire styli; the one used for LP's will serve adequately for perhaps 30 hours of play—at that time it might be best to replace it, preferably with a diamond point.

Both the amplifiers listed in the table compared favorably with each other against the standards set up. Both use similar output circuits: 6V6 tubes in push-pull, with negative feedback to an earlier stage. Equalization settings to handle most records are included. A little more could be desired in the treble and bass controls; these provide a usable range, but not the very wide kind you get in a more expensive amplifier. There is plenty of gain built into both of these units; a room 15′ by 20′ was filled with above-average listening level, with either volume control turned about one-third clockwise.

The BL-10 speaker system is the lowest priced complete speaker-and-enclosure package on the market. Slightly larger than a table-model radio, it is completely finished, polished, and covered on three sides with grille cloth. It may be used in any position and in any part of the room, with best results obtained by standing it on end on a shelf in—or near—the room corner. Connected to the rest of the system, its response is remarkably clean and level from about 55 cycles to 11,500 cycles. High-frequency lovers may want to add a tweeter for those elusive overtones, and it is quite easy to do so.

Another point: one BL-10 provides good, clean listening. Two, placed about ten feet apart, provide a sound quality that is rivaled only by much larger and costlier systems.

A Final Word. There it is: the budget-minded man's hi-fi system. We offer it as an example of economy shopping and careful component selection. While it may be "a good word" for many confused music lovers standing at the threshold of the world of electronics, it is by no means "the last word." Those who wish to compromise less can assemble better systems by spending proportionately more. Such systems, using representative components in various price brackets, will be described in future articles. We will also show how the present system can be improved by substituting better units discreetly.

The important thing in hi-fi is not necessarily to spend a lot of money, but to spend it wisely. "True-life adventures" with hi-fi components, now being researched by the POP'tronics staff, will provide systems to suit any taste and fit any budget—from this "lowest cost" system through the better systems, and up to a few installations that cost more than a new car. Watch for them! —30—

The Transmitting Tower

(*Continued from page 97*)

News And Views

John Hugentober, WN8CSK (16), 1535 Northridge Dr., Cincinnati 31, Ohio, reports: "I have been on the air since last September and have worked 32 states and three countries, all on 40 meters. My transmitter is a converted ARC-5 "surplus" unit running 70 watts, my antenna is a doublet, and my receiver is an NC-100. My pet gripe is hams who do not QSL. I'd like a few pen pals, and I'll answer all letters received."

"Marty" Brody, KN2MDL (14), 42 Hemlock Lane, Roslyn Hts., N. Y., writes: "I have been on the air about nine months. In that time, I have worked 45 states and 17 countries in all continents. My best DX is Singapore (VS1) and Northern Rhodesia (VQ2). My transmitter is a Viking Adventurer running 50 watts and feeding a folded dipole antenna. My receiver is an NC-98. I'd like to recommend the 21-mc. band to more Novices. It is great for DX and interference is much less on it than on 3.7- and 7.15 mc. Also, I'd like skeds with Nevada, Utah and Montana."

From 33 Valley View, Tiffin, Ohio, **Roger Shultz, KN8AJF,** writes: "In two weeks on the air, I have worked 10 states, with five confirmed. My transmitter is a WRL Globe Scout running 25 watts to a 100' long-wire antenna. The receiver is an S-53A, and I have crystals for the 3.7-, 7.15- and 21.1-mc. Novice bands."

Terry Meyers, 314 Roosevelt St., Gary, Ind., is one of the several readers of the *Transmitting Tower* who report that their new AR-3 receivers work just as I said they would in the review in the February, 1956 *Tower*. Terry adds that reducing the i.f. tube cathode resistor (part 1-8) from 820 ohms to 150 ohms increases the usable sensitivity of his receiver tremendously, especially on the highest frequency range. It is a change easy to make and well worth trying.

Irving Boime, KN6QDK (15), 447½ N. Curson, Los Angeles 36, Calif., didn't waste any time getting on the air. "I've had my license for two weeks, and I've made 42 contacts in four states. I use an AT-1 transmitter and an S-76 receiver, and I have two antennas, an 80-meter doublet, and a 40-meter long wire. I'd like a few pen pals and some ideas for a 15-meter antenna."

Wayne Ashworth, KN4CDZ, 1920 Lyons St., Winston Salem 6, N. C., says: "DX is good down here, but not from Ark., N. Dak., Ore., and Me. These are the states between me and working all states on 40 meters. This is the only band I operate, but I am planning to try 15 meters soon. I run 30 watts to an 807 (small power supply) and use an S-38D receiver. My DX is Canada, Puerto Rico, Virgin Islands, and Cuba."

"Buzz" Sadler, WN3ERJ, 815 Holland Ave., Pittsburgh, 21, Pa., announces the Pittsburgh Novice Net (PNN), which meets on 7146 kc.

on Thursdays at 1545 EST. An attractive certificate is awarded to any amateur working any six of the PNN members after March 4, 1956.

Also: ". . . The members of PNN will freely and whole-heartedly give help to any person in this district trying for a Novice ticket or to any Novice needing operating help." For more information, write to the address above or call FRemont 1-9954.

"Chuck" Fox, KNØBCH, 921 N. Elm, Minneapolis, Kansas, says: "I got my Novice license a year ago, after wanting to become a ham since I was 11 (six years ago). I took my Technician examination last week, but haven't heard from the FCC yet on how I did. Is 6 meters as neglected as it is said to be? By the way, I'd like a few pen pals."

W5SLJ wants a schedule with Utah on any band from 10 to 80 meters, phone or c.w. Object: WAS. Dale has had cards from 47 states for over a year; so here is a chance for a Utah ham to make Oklahoma happy. Pick the band and the time, and W5SLJ will be there. Allow four days for your letter to arrive. Address: **Dale R. Sterling, W5SLJ,** P.O. Box 162, Berger, Oklahoma.

Jerry Carrier, W9PQZ, 811 18th St., Bedford, Ind., writes: "Brother! I have been bit by the ham bug! It all started with my joining my 16-year-old son in his attempt to get an amateur license. He picked up the code much faster than I did, but being an older hand with more experience, I outshined him on the theory; so we had quite a tussle. We got our Novice licenses the same day, 2-28-55, both flunked the code part of our General examinations 11-4-55, took the Technician examinations Christmas Day and received our Technician tickets on 2-16-56. In the meantime, we took the General Class test on 2-10-56. There, unfortunately, we parted company. Knowing how poor my code was, I kept practicing it faithfully every night; so I passed the code test. Young Jerry, however, depended too much on his superior start and neglected to practice his code enough. You know what happened! But, he'll make it the next time. His call is **W9PQU,** by the way.

"Tonight, I had my first contact as a 'General.' As a Novice, I worked 32 states (30 confirmed) and Canada twice. Best DX was Utah. That's my life story since I got bit."

Until next month . . . keep writing to me C/O POPULAR ELECTRONICS, 366 Madison Ave., New York 17, N. Y. 73,

Herb, W9EGQ

Tuning the Short-Wave Bands

(*Continued from page* 61)

All times shown for the following reports are Eastern Standard, 24-hour system. When sending your reports in to us, kindly show the time zone you are using.

Aden—ZNR, Aden, 6045 kc. (listed as 6049 kc.), can be heard at 1045-1130, with news in Arabic at 1100-1110. It identifies as *Huna Aden* in Arabic, *Here is Aden* in English. (*CS*)

Australia—*Radio Australia* can be heard on 15,320 kc. (dual with 15,160 kc.) at 1815

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14BP4	16.85	21AP4	28.79
16RP4	19.38	21EP4	28.79
16LP4	19.38	24AP4	42.50

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- 1 6BZ6GT tube
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12" SET
Table Model $22.95
Console $24.95
14" SET
Table Model $27.95
Console $31.00
16" SET
Table Model $32.00
Console $34.95
17" SET
Table Model $37.00
Console $39.00

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0Z4	.43	3CB6	.52	6B4G	.52	6L7	.42	7E5	.45	19BG6G	1.15
1A4P	.33	3Q4	.46	6B8	.69	6N7	.60	7E6	.55	19T8	.65
1A7GT	.43	3Q5GT	.57	6BA6	.47	6Q7	.40	7E7	.70	24A	.39
1B3GT	.65	3S4	.47	6BA7	.58	6S4	.40	7F7	.59	25AV5GT	.78
1C5GT	.41	3V4	.47	6BC5	.47	6SA7	.45	7F8	.70	25BQ6GT	.78
1D5GP	.43	5BQ7	.89	6BC7	.80	6SC7	.48	7G7	.75	25L6GT	.47
1E7GT	.41	4BZ7	.95	6BE6	.45	6SG7	.41	7H7	.50	25W4GT	.43
1G6GT	.41	5AW4	.75	6BF5	.40	6SH7	.43	7J7	.75	25Z5	.37
1H4G	.43	5J6	.63	6BF6	.50	6SJ7	.43	7K7	.75	25Z6	.37
1H5GT	.47	5T4	.69	6BG6G	1.15	6SK7	.45	7L7	.75	27	.25
1J6GT	.47	5U4G	.43	6BH6	.50	6SL7GT	.55	7N7	.50	35A5	.46
1L4	.45	5U8	.74	6BJ6	.47	6SN7GT	.55	12AT6	.37	35B5	.50
1L6	.55	5V4G	.59	6BK5	.68	6SQ7	.39	12AT7	.66	35C5	.50
1LA4	.57	5Y3	.31	6BK7	.76	6SR7	.42	12AZ7	.63	35L6GT	.47
1LA6	.47	5Y4G	.36	6BL7GT	.75	6SS7	.41	12AU6	.41	35W4	.34
1LB4	.57	5Z3	.41	6BN6	.58	6T4	.95	12AU7	.53	35Y4	.34
1LC5	.49	6A7	.57	6BQ6GT	.78	6T8	.68	12AV6	.35	35Z3	.39
1LC6	.47	6A8	.45	6BQ7	.78	6U8	.75	12AV7	.67	35Z5GT	.34
1LD5	.57	6AB4	.43	6BY5G	.58	6V3	.80	12AX4GT	.65	37	.29
1LE3	.57	6AC7	.67	6BZ7	.88	6V6GT	.46	12AX7	.58	50A5	.46
1LG5	.57	6AF4	.79	6C4	.37	6W4GT	.39	12B4	.68	50B5	.50
1LH4	.64	6AG5	.50	6C5	.35	6W6GT	.53	12BA6	.46	50C5	.50
1LN5	.47	6AG7	.69	6C8G	.49	6X4	.34	12BD6	.48	50L6GT	.43
1N5GT	.50	6AH6	.69	6CD6G	1.15	6X5	.34	12BE6	.46	75	.42
1R5	.50	6AJ5	.70	6D6	.48	6X8	.73	12BH7	.60	76	.42
1S5	.42	6AK5	.54	6E5	.44	6Y6G	.55	12BY7	.65	77	.38
1T4	.50	6AL5	.39	6F5	.37	7A4	.45	12BZ7	.61	78	.38
1U4	.47	6AQ5	.46	6F6	.38	7A5	.53	12CU6	.95	80	.44
1U5	.42	6AR5	.46	6G6	.40	7A8	.45	12SA7	.45	84/6Z4	.44
1V2	.65	6AS5	.48	6H6	.38	7A7	.43	12SJ7	.45	117L7GT	1.09
1X2	.61	6AS6	1.19	6J4	1.79	7A8	.45	12SK7	.45	117N7GT	.56
2A3	.55	6AS7G	2.19	6J5	.39	7B5	.39	12SN7GT	.55	117P7GT	1.09
2A5	.57	6AT6	.39	6J6	.47	7B6	.42	12SQ7	.37		
2A7	.55	6AU4GT	.65	6J7	.43	7B7	.41	12SR7	.45		
3A4	.51	6AU5GT	.59	6J8G	.85	7B8	.45	12V6GT	.45		
3A5	.50	6AU6	.42	6K6GT	.37	7C4	.39	12X4	.37		
3AL5	.45	6AV5GT	.65	6K7	.39	7C5	.42	14A7	.42		
3AU6	.46	6AV6	.39	6K8	.65	7C6	.43	14B6	.38		
3BC5	.54	6AX4GT	.60	6L6	.68	7C7	.45	14Q7	.50		
3BN6	.70	6AX5GT	.57								

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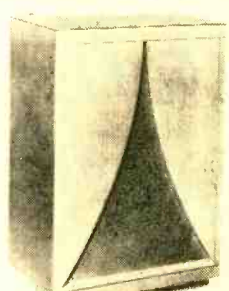

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with news. At 1830, these two channels close; they re-open on 17,790 kc. and 17,840 kc. *(FW)*

VLR6, 6150 kc., Melbourne, and VLT6, 6130 kc., Port Moresby, can be noted around 0420 with news and programs of local interest. *(JB)*

The 9615-kc. outlet opens at 0700 with "Waltzing Matilda" played on a xylophone and the Post Office Clock Tower Bells. This xmsn runs to 0845 with news and music. *(WC)*

News to North America is broadcast at 2245, 0715, 0815, and 1030; to British Isles and Europe at 0330. *(DB)*

Austria—*Radio Osterreich* is still beaming a xmsn to North America at 0600-0700 over OEI38 on 25,615 kc. Power is said to be 20 kw.; QRM is rough at times. Reports are requested. Address is The Austrian DX Club, Landgutgasse 41/19, Vienna 10, Austria. *(RH)*

This station also transmits at 0200-0400 to South America on 25,615 kc., and to North America at 0520-0620 on 25,945 kc. *(LM)*

Azores—CSA93, Ponta Delgada, 4865 kc., can be heard at 1615 s/on. This xmsn is in Portuguese. *(FB)*

Bulgaria—A new schedule in English from *Radio Sofia* lists 7670 kc. and 6070 kc. daily at 1600-1630 and 1645-1715. The 9700-kc. outlet is also used at 2000-2030 and 2300-2330. On Tuesdays, Thursdays and Saturdays, 9700 kc. opens at 1930 with a concert of Bulgarian music. *(RH)*

Brazil—*Radio Rural* is still under construction, and the stations on 6065 and 15,105 kc. are inactive according to a letter from "Ministerio da Agricultura." *(WRH)*

Burma—XYZ, *Voice of Burma,* Rangoon, 9543 kc., is heard at 0930-1015 as follows: 0930-0945, religious program; 0945-1000, news; 1000-1005, weather report; 1005-1008, balance of program. There is music to 1015 s/off. Interval signal is drums and gongs. This is an all-English program. *(CS)*

Dahomey—*Radio Cotonou* is now scheduled as follows: on 1475 and 4870 kc. Wednesdays at 0640-0700 (Saturdays at 0740-0800), and at 1230-1500; on Sundays at 0330-0600 and 1230-1500, according to a recent verification. *(WRH)*

Denmark—OZF, Copenhagen, 9520 kc., reports that the "Saturday Night Club" is now operating at 2100-2200 with English for the last 50 minutes. There is some QRM on the East Coast from *VOA. (LM, BH)*

Dominican Republic—A weak station heard on 3375 kc. until 0000 s/off may be H14V, Bani. It has Latin-American music and many commercials. *(WF)*

England—The North American Service is as follows: at 1000-1215 and 1300-1600 on 15,310 kc. *(GSP)*

All programs are in English except Monday thru Friday when there is French at 1315-1325. *(LM)*

Egypt—Cairo is heard daily on 11,670 kc. in Arabic at 2300-0200 and again at 1200-1700 s/off. On Fridays, it stays open until 1715. This station has Portuguese for South America at 1830-1900 and Spanish at 2000-2030. At 1900-2000, an Arabic program is scheduled on 11,670 kc. to South America and on 6215 kc. to North America. *(AB)*

Formosa—English to North America from

Taipeh can be heard at 0000-0030 and 0130-0200 on 11,920 and 15,300 kc. (*LM*)

France—Paris on 9490A kc. has been noted with "Paris Star Time" at 1830-1900 Sundays in English. (*SW, RK*)

Paris has a listed channel on 9500 kc.

French Cameroons—*Radio Yaounde,* 9270 kc., is operating at 1200-1600 with French news and music. They verify promptly. (*JH, CS, RR, FB*)

French West Africa—*Radio Dakar,* 4893 kc., is often noted opening in French at 0130; Latin-American and popular music is heard on this xmsn. (*BV, GD*)

Radio Conakry, French Guinea, operates on 6154 kc., and can be tuned around 0800-0815 in French. (*RR*)

Germany—*Radio Liberation,* Munich, can be heard at excellent levels some days on 3990, 7130, and 9585 kc. with programs in various

ABBREVIATIONS

A—About this frequency
BBC—British Broadcasting Corp., London, England
BC—Broadcasting service or station
kc.—Kilocycle
kw.—Kilowatt of power
mc.—Megacycle
QTH—Exact location
s/off—Sign-off of station
s/on—Sign-on of station
V—Verified frequency
xmsn—Transmission from a radio station
xmtr—Transmitter used by station

Russian dialects. Other listed frequencies are 6055, 6175, 7225, 9565, 9765, 11,780, 11,965, 15,255, and 15,395 kc., with varied Russian dialect programs put on by escapees from behind the Iron Curtain as the *Free Voice of the Russian People.* This station is operated by the American Committee for Liberation from Bolshevism, Inc., New York. The station wants reports on any frequency as well as reports on interference. (*PM*)

Deutsche Welle, Cologne, may—by this time—be operating as follows: to Far East on 15,275 kc.; Near East on 17,845 kc.; Africa on 11,795 kc.; South America on 11,795 kc.; and to North America on 9640 kc. The schedule reads: 0500-0800 on 15,275 kc.; 0930-1230 on 17,845 kc.; 1300-1600 on 11,795 kc.; 1700-2000 on 11,795 kc.; and 2030-2330 on 9640 kc. (*TL*)

Gold Coast—ZOY, Accra, 4915 kc., has an English program consisting of an Educational Forum at 1130-1155; news from the BBC at 1200-1215; s/off at 1216. (*CS*)

Greece—Athens is noted on a *new* outlet of 17,775 kc. at 1300-1330 with French and English to Western Europe. (*RL*)

Athens on 15,345 kc. is noted from 1400 s/on to 1500 s/off with news and commentaries. It identifies as *Radiofonikos Stathmos Athinon Vrakeon Kimaton.* The Forces Station at Athens, 7422 kc., is still being heard from 0000-open to 0230-close with programs of Greek news, Greek and popular records, and others. It identifies as *Edeo Athinae, Ken-*

drikos Radiofonikos Stathmos Enoplon Dynameon Ellados, signotitos; 1300 kilocicliou, 230 metra, kai 7422 kilocicliou, 40.43 metra. (PM, URDXC)

Guadeloupe—FG8AH, Basse Terre, 7430 kc., has a French news and music program at 1800-1835. It identifies as *Ici Radio Guadeloupe* with a guitar interval signal. This 100-watter is seldom heard due to c.w. QRM. (*CS*)

Guatemala—TGWA, Guatemala City, 9760 kc., is noted at 1845-1900 and 2345-0000, with an English session at 0030-0100. (*MO*)

Haiti—4VEH, Cap Haitien, can be heard Saturdays and Mondays with "Listener's Mailbag" on either 9656 kc. or 9666 kc. (both used). Times are 0930 on Saturday and 2030 on Monday. For a while, 4VEH had to operate on one-third power because of a burned-out tube. (*BB*)

India—*All-India Radio*, Delhi, 11,640 kc., is being heard at 0840-0930 in an English session, with news at 0840. Remainder of program comprises Oriental music and talks on India and her people. Identity is: *This is the External Service of All-India Radio.* (*BV, TL*)

Indo-China—In a letter, Mr. Jean Varnoux, Director of *Radio France Asie*, writes: "I have the honour to inform you that the Vietnamese Government has decided to establish a state monopoly of broadcasting. This decision involves the cessation of broadcasts by *Radio France Asie* . . ." As a result, "RFA" has completely closed down. (*WRH, BE*)

Israel—*The Voice of Zion* presents an English news program on Fridays at 1645 on 9008 kc. (*GI*)

Italy—Rome, 9570 kc., has a Tuesday night feature enjoyed mostly by the YL SWL's called "A Talk on Italian Fashions" which is on the air at 1910 following the announcements. (*LM*)

Jordan—Amman, 6060V kc., can be heard at 0000-0045 with an Arabic program including music. It has been noticed on a Monday in English at 0630-0700. It anounces as *Huna Hashemite Jordan.* (*CS*)

Madagascar—FIQA, Tananariva, 9515 kc., has English at 2230-0030, 0400-0600, and 1000-1230 in parallel with 6172 kc. *Radio Australia* reports that the 3242-kc. outlet is also active. (*JH, MC*)

Mauritius—Forest Side, 15,092V kc., is being heard at 2200-opening to close around 2315-2330. The first hour is French and music, with English world news program from 2300 to s/off. (*GF, ER*)

Mozambique—CR7BF, Lourenco Marques, 11,740V kc., is noted at 2315-2330 with an English musical session. Reports go to P. O. Box 594, Lourenco Marques. CR7BG, 15,285 kc., is noted at 2315 on Sunday with exercises in Afrikaans and possibly Swahili. (*BT, KA, ER*)

Netherlands—*Radio Nederland* has been experimenting on 11,950 kc. and 9745 kc. on Sundays at 1100-1230, with 5-kw. power. (*CM*)

The station also operates to North America daily at 1645-1725 and at 2130-2210 on 9590 and 11,730 kc. The earlier xmsn follows the 1730 Dutch language program to Canada. (*GA, DK, VS*)

Pakistan—The Lahore station of *Radio Pakistan* is operating on s.w. (according to a QSL from 39 Empress Road, Lahore) at 2100-

2230 on 3915 kc., 0130-0330 on 6075 kc., 0630-0830 on 6030 kc., and 0845-1200 on 3335 kc. The station is eager to receive reports. No IRC required. Power is 1 kw. (*WRH*)

This has been heard in Ohio at 1030-1130 with English announcements. (*CS*)

Radio Pakistan is noted at 1415 with English to Turkey; to United Kingdom at 1500 on 11,800, 7010, 9645 kc. It is also heard at 1930-2000 on 15,255 and 11,885 kc. with English news at 2000. (*LM, BE, BB*)

Peru—*Radio El Sol*, Lima, is scheduled with all-Spanish programs over OBX4Q, 5970 kc., and OBX4C, 15,180 kc. (reported 15,197 kc.) at 0600-0200. QTH is P. O. Box 1711. (*CM*)

Radio Nacional del Peru is an easy station to hear around 2230 with Spanish news and music on 9562 kc. This is OAX4T. (*JS*)

Portugal—Lisbon is noted on a *new* channel of 21,495 kc. at 0600-0800, dual to 17,880 and 21,700 kc. (*RL*)

Ryukyu Islands—The *VOA* Relay Station on Okinawa is scheduled on 7160 kc. at 0530-1200 and 1700-1730 to East Asia. Reports go to *Voice of America*, Okinawa Relay Base, Box R, APO 239, San Francisco, Calif. (*DD*)

Solomon Islands—VQO2, Honiara, is reported operating at 0200-0300 daily on 5960 kc. with 100 watts. West Coasters might be able to log this one. (*WF*)

Spain—*Radio Leon*, which formerly operated on 6993 kc., is now on 6950 kc. accord-

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Steve Wilhelm (*SW*), Brooklyn, N. Y.
World Radio Handbook (*WRH*)
Universal Radio DX Club (*URDXC*)

ing to *Radio Denmark*. This station belongs to the *Red De Emissoras Del Movimiento* (R.E.M.). Nearly every reporter sent notes on *Radio Nacional de Espana*, Madrid, 9360 kc. The 12,000-kc. channel is no longer in use; 6122V kc. runs dual to 9360 kc. North American programs are at 2215-2300, 2315-0000, and 0015-0100, all different.

Sweden—SBP, Stockholm, 11,705 kc., is noted at 2055-2110 with news and weather at 2100; press review and music at 2105; all English. (*JC*)

SBT, 15,155 kc., has news and music in English to S.E. Asia until 2200; after that time they broadcast in an Eastern language. (*TL*)

Syria—The schedule for Syria is as follows to the Near East: at 0030-0100 and 0330-0530 on 7145 kc. in English; to Europe in English at 1530-1630 on 9555 kc. (*LM, SF, FG*)

Tahiti—Papeete, 6135 kc., is being heard at 2300-0100; in Tahitian with island music and some gongs until French begins at 0000 with music and commercials. Main announcement is at 0015 when they play part of the "La Marseillaise" and announce in French as *Radio Diffusion-Television Francaise;* Tahitian drums are followed by *Ici Radio Tahiti, La Voix de la Francaise*. (*GN*)

Tangier—*DUX Radio* is heard from 1330 to 1445-close with popular records and Swedish announcements. Interval signal is *The Swedish Rhapsody*. QTH is Proveprogrammet, P. O. Box 6622, Stockholm 6, Sweden. (*BR, FB*)

WTAN, the *Voice of Tangier,* is using a 10-kw. Phillips xmtr in addition to the 2½-kw. xmtr. All evening broadcasts are on 9490 kc. Schedule reads: various languages at 1500-1530 daily (1500-2015 Sundays and Fridays). In English: Sunday, 1630-1730; Monday, 1600-1800; Tuesday, 1600-1745; Wednesday, 1530-1800; Thursday, 1530-1800; Friday, 1530-1815; Saturday, 1630-1730. All English xmsns are beamed to the British Isles. The smaller xmtr is used mornings at 0430-0530. (*PR*)

IBRA Radio operates weekdays at 1145-1400 (Wednesday and Thursday, 1145-1300) and at 1415-1700 (Wednesday and Thursday, 1345-1700) on 9782 and 11,947 kc.; on Sundays at 0745-1045 on 15,245 and 11,718 kc., at 1430-1700 on 7168 and 9782 kc. Xmsns are beamed to Central and Northern Europe. QTH is *IBRA Radio,* Luton, Beds., England. (*WR*)

USSR—*Radio Moscow* has news at 2000, 2100, 2200, 2300, 0000; sports programs at 2015, 2145, and 2345. "Farms and Farming" is on at 2115 and 2230. (*LS*)

Radio Mukden, Mukden, Manchuria, is noted often at 0800-0900 with Chinese programs, on 6525 kc. *Radio Tashkent,* Tashkent, Uzbek, on 6824 kc., is noted around 0949-1000 with identity signal. English news and other programs are heard until 1030. (*PF*)

Venezuela—YVMZ, Maracaibo, 9530 kc., is the outlet for *Radio Popular, Ecos del Zulia* and *Radio Mara*. Current schedule is 0830-1530. YVLK, *Radio Rumbos,* 4970 kc., features the "Supper Club" on Monday thru Friday at 1730-1830, the "Breakfast Hour" at 0630-0730. Another English program is "The Early Bird" from YVKB, 4890 kc. *Radiodifusora Venezuela* can be heard at 0530-0730 with music and news. (*JR*)

Windward Islands—The Windward Islands

B/C Service, Grenada, B.W.I., is now on a *new* outlet on 17,745 kc., replacing 11,830 kc. It operates at 1700-2115 except Saturday in parallel with 3395 kc. (*RL*)

Yemen—Sanaa, 11,904V kc., is heard at 0915-1000 in Arabic with Arabic music, partially readable on parallel 9705 kc. This is best noted Mondays when HCJB is silent. It announces as *Huna Sana*. (*CS*)

Zanzibar—*Radio Zanzibar*, 4795 kc., signs on at 0900 with the anthem "March of Sultan"; announcements are in Arabic and English. Musical religious program is heard at 0900-0915; a mailbag in English and native language at 0915-0930; request records, mostly London records, are tuned until 1000 s/off after repeat of opening announcement. This one takes very sharp tuning to log. (*CS*)

Aero—Some of the boys have been having good luck on the Aero Channels. Phil Finkle, for instance, has logged Rangoon, Chungking, Singapore, Hong Kong, Bangkok, and Bombay on 8845 kc. between 0855-0910. —30—

Operation Chaos

(*Continued from page 70*)

cast a pity-loaded glance at Digger, huddling miserably in the stroller.

"OOOOOOOOOWWWWWOOOOOO," stated the big coward.

"Gopple," observed Junior enviously.

"Well, the weight-factor's about the same—so, here *goes!* Good luck, Digger, old boy, old boy, old boy!" I jabbed the *start* button on the portable transmitting unit and the stroller cruised smoothly up the sidewalk.

"See!" I gloated. "It works like a charm!

"Well, I hate to admit it," said Loser Girl, "but I guess you've stumbled onto something all right."

"Dun & Bradstreet!" I rejoiced, jabbing the reverse button and bringing the stroller back, "we are here! Now shall we let Junior crowd in beside the noble Digger and show off our Stroller Of Tomorrow in the park?"

"That might be fun!" agreed Fair-Weather Girl.

HALF-WAY through the park, a fortune slipped through my fingers. Just like that. Without warning, the stroller shot forward at increased speed, described a figure-eight on two-wheels and disappeared across a lawn—Junior gleefully waving his fat little arms and Digger howling like an anguished banshee.

"Gruss Gott!" I gasped, desperately working every button on the transmitter. "It just can't be!"

"Y-You fiend!" screamed the Stricken Mother, *"You've done it again! Only this time my baby is in the monster!"*

I snapped the transmitter's *off* button.

"Relax," I tittered, hysterically. "They can't have gone far. The center of gravity

is too low, on that thing with the heavy electric motor in it, to tip over—and I've cut the signal—so it should be stalled nearby." Together, we raced across the lawn, neatly hurdling all the *Keep Off The Grass* signs. "I still don't understand it, though."

". . . probably . . . smashed . . . against . . . a . . . tree . . ." panted the Pessimistic Mother, her face pale with visions of tragedy whirling through her mind. ". . . should . . . have . . . had . . . my . . . head . . . examined . . . letting . . . you . . ."

Ahead, a group of citizens burst out of a crosswalk, running for their lives. Behind them came the stroller—Junior grinning evilly at the frightened escapees and Digger baying a stream of canine mental-agony.

"Turn it off!" shrieked the Wild Woman at my side. "TURN THAT THING OFF, WILL YA?"

"IT *IS* OFF!" I bellowed despairingly.

The sprinters and the pursuing stroller vanished down another crosswalk. We galloped forward again, peering vainly in all directions for our son and his runaway steed.

"Look out, Fred, here it comes again!" shrilled a matron from the safety of a tree to which she had scrambled. Fred joined her without comment or waste motion just as the stroller thundered out of the bushes.

I tackled it—madly jerking wires loose at random, and we bumped to a stop.

"Beeble!" protested Junior irritably.

"NO BROKEN BONES," I observed, handing Junior to the Distraught and Weepy Mother. "But let's evaporate before all concerned pull themselves together and pin the rap on us."

We took to the scenery . . . pronto.

Hitting the street, I heard the crackle of static and the metallic-voice of a communications-radio.

"Good lord!" I whispered hoarsely. "They must be throwing a police net around the park! You two run for it! Digger and I will hold them off until—"

"It's only a taxicab, silly."

"Oh." My blood unfroze and resumed coursing.

"Why do you suppose the stroller went so crazy if you turned off the transmitter?" asked Missus Curious, now that sonny-boy was safe in her arms and my project a miserable failure. "You sure can't sell anything that gets out of control and stays that way. Not to *this* mother, anyway!"

"All right, all right!" I rasped peevishly. "I'm resigned to facing a life of labor. You've made your point. I don't *know* why it stayed out of control. There's no explainable reason for it. There was absolutely nothing wrong with my transmitter or my receiver—and this is a brand-new, guaran-

teed sequence-switch, so it couldn't be anything remotely connected with the equipment."

We plodded on in silence. My arms began to ache from pushing the extra-heavy stroller.

"Well, I don't want to sound like an interfering wife—"

Then—it hit me . . . hard.

"Interference," I muttered. "Sure. *Interference!*"

I raced back to the parked taxi.

"Do you happen to know what band your company operates those sets on, Mac?" I pointed to the crackling radio.

"Sure," said the startled hackie. "465, Citizens."

"Know the watt-output, by any chance?"

"Yeh. About two-hunnert fifty."

"Thanks, Mac," I said glumly. "You just solved a slight mystery and limited my R/C plans, in the future, to small model airplanes in the countryside."

AFTER I explained the situation—my puny five wattage against all the city

communication systems—Missus Wife was pleased and had the temerity to suggest I give the electronics field a rest and turn to other things. Chess was her advice. Chess, because she plays a mean bishop. Not to mention that I seem to have a penchant for always trading my queen for one of her pawns.

And, then, I got a terrific idea. Why not R/C Chess? Complex, perhaps, but certainly not beyond the determined abilities of a real electronics enthusiast.

I'm laying out the preliminary schematics now.

And here comes that coffee again. —30—

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Jan.-June, 1956

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—30—

Line Voltage Booster

(*Continued from page 82*)

connection isn't easy to determine while you're doing the wiring, so the best way to proceed is to do all the wiring but make the transformer primary connections temporary. Then set switch *S3* to the 12.6-volt position, *S1* to *line,* and plug the booster into an a.c. outlet. Note the meter reading.

Now switch *S1* to *boost*. The meter reading should increase, indicating that the transformer secondary voltage is being added to the line. If the meter reading decreases when *S1* is set to *boost,* unplug the booster and reverse the two transformer primary (black) leads.

An "economy" booster will be sufficient in a large number of applications, since 6.3 volts of boost is all that is required. The circuit is shown in wiring diagram (B). In this particular model, the transformer has a 3-amp., 6.3-volt secondary and can be used to boost the line voltage to any device requiring up to 300 watts of power.

The transformer may be phased in exactly the same manner described for the de luxe model using a TV set plugged into the receptacle and phasing the transformer for maximum picture size when the booster switch is set in the *boost* position.

Other uses for line boosters are almost as great as the number of appliances designed to be plugged into an a.c. outlet. A booster is especially effective when used with voltage-sensitive appliances, such as electric food mixers, sewing machine motors, electric fans, hand power drills, etc. Photographic darkroom enthusiasts will find a booster just what the doctor ordered for keeping the enlarger or contact printer lamp up to full brilliance.—*B. W. Blackford.*

—30—

METAL LOCATOR QUIZ

(Questions on page 88)

1. Beat-frequency locators indicate the presence of metal by a change in pitch: the field-distortion type reacts by changing the loudness of the tone and also, as a rule, by a visual meter indication. 2. If a non-ferrous metal causes a rise in pitch, a ferrous metal will produce a falling pitch, and vice-versa. 3. The field-distortion type. See cost chart. 4. Although rain water alone is a poor electrical conductor, it dissolves minerals in the soil to form electrolytes, or current-carrying liquids. These react on both forms of metal locators by producing spurious indications. 5. This orientation minimizes the direct pickup from transmitter to receiver so that the initial balancing adjustment may be made sensitive to small distortions of the field by metals or ores.

Classified

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15 **TESTED**—One-tube circuits, catalog and "Radiobuilder" magazine—25c. Laboratories, 328-L Fuller, Redwood City, California.

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SCINTILLATION Counter, transistorized, no tubes or vibrators, 1"x1½" crystal, 2 flashlight cells, weighs only 2 lbs. complete. $389.00, guaranteed. Revolutionary. Write Ute Company Inc, 200 So. 4th, Montrose, Colorado.

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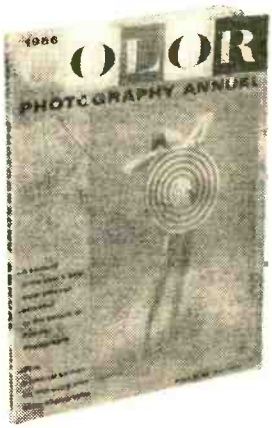

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Superior's New Model 770-A

The FIRST Pocket-Sized VOLT-OHM MILLIAMMETER

USING THE NEW "FULL-VIEW" METER

71% MORE SCALE AREA!!

Yes, although our new FULL-VIEW D'Arsonval type meter occupies exactly the same space used by the older standard 2½ Meters, it provides 71% more scale area. As a result, all calibrations are printed in large easy-to-read type and for the first time it is now possible to obtain measurements instead of approximations on a popular priced pocket-sized V.O.M.

FEATURES

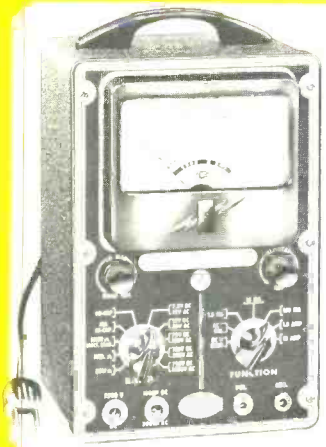
- ★ Compact—measures 3⅛" x 5⅞" x 2¼"
- ★ Uses "Full View" 2% accurate, 850 Microampere D'Arsonval type meter
- ★ Housed in round-cornered, molded case
- ★ Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use.

Specifications

6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 volts.
6 D.C. VOLTAGE RANGES: 0-7.5/15/75/150/750/1500 volts.
2 RESISTANCE RANGES: 0-10,000 Ohms, 0-1 Megohm.
3 D.C. CURRENT RANGES: 0-15/150 Ma., 0-1.5 Amps.
3 DECIBEL RANGES: —6 db to + 18 bd, — 14 db to + 38 db, + 34 db to + 58 db.

The Model 770-A comes complete with self-contained batteries, test leads and all operating instructions.

$15.85



Superior's New Model 670-A

SUPER-METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1Mfd. 1 to 50 Mfd. (Quality test for electrolytics)
REACTANCE: 50 to 2,500 Ohms 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: —6 to + 18 / + 14 to + 38 / + 34 to + 58

ADDED FEATURE:
Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

$28.40

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Superior's New Model TC-55

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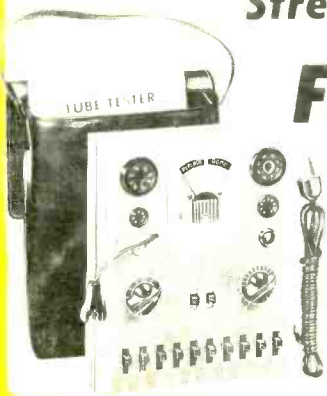

FOR { **The Experimenter or Part-time Serviceman,** who has delayed purchasing a higher priced Tube Tester.
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• **You can't insert a tube in wrong socket.** Separate sockets are used, one for each type of tube base. • **"Free-point" element switching system** Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or even the "top-cap". • **Checks for shorts and leakages between all elements.** Provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals. Continuity between various sections is individually indicated. • **Elemental switches are numbered in strict accordance with R.M.A. specification.** The 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system.

Speedy, yet efficient operation is accomplished by: Elimination of old style sockets used for testing obsolete tubes (26, 27, 57, 59, etc.) and providing sockets and circuits for efficiently testing the new Noval and Sub-Minar types.

Model TC-55 comes complete with operating instructions and charts and streamlined carrying case.

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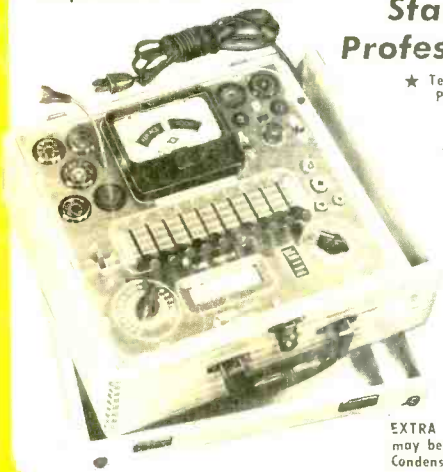
Superior's new Model TV-11

Standard Professional TUBE TESTER



★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.

★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.

★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

★ Free-moving built-in roll chart provides complete data for all tubes.

★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.

★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

The model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

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EXTRA SERVICE — The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

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