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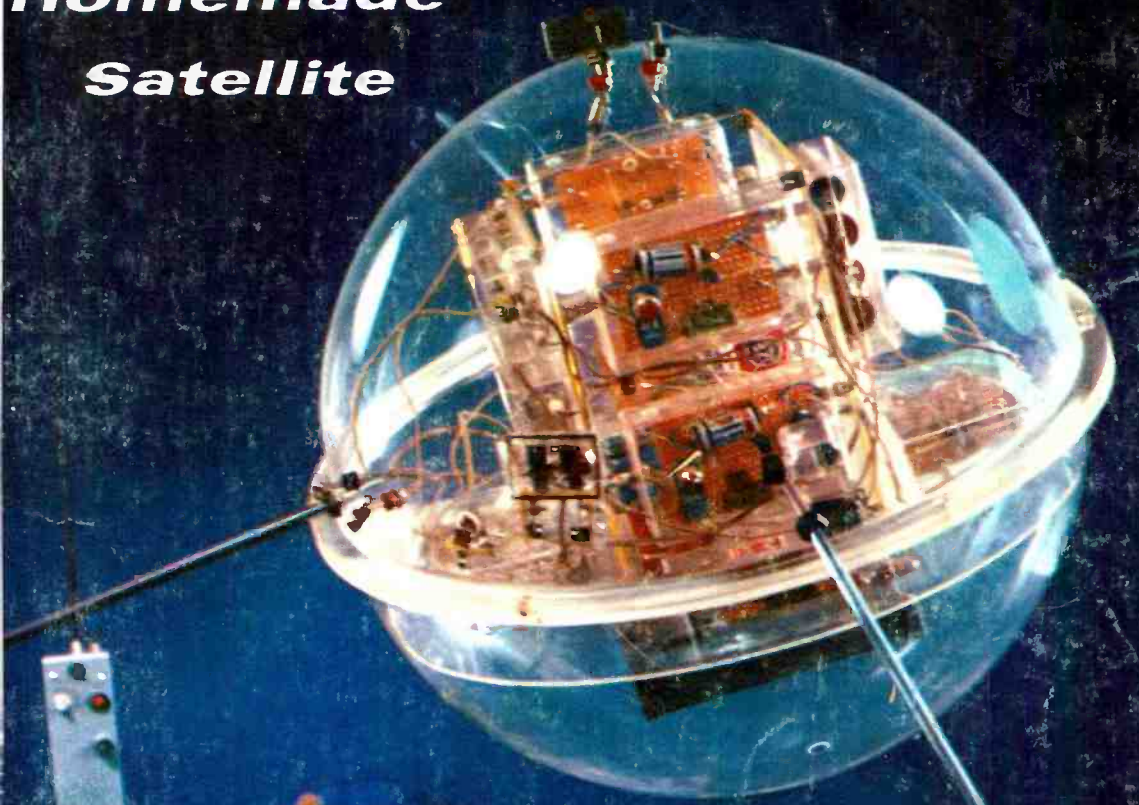
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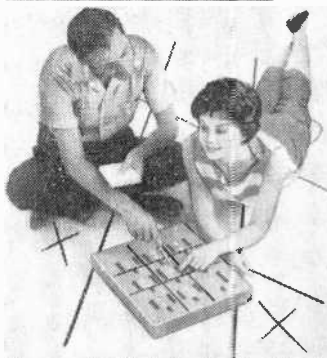
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ELECTRONICS



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How to expand your DX listening to include ships at sea . . . how the language barrier between nations can be broken by electronics . . . how to build a high-gain antenna for receiving signals from the satellites . . . these are only a few of the many other articles scheduled for the November issue.

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"Let's just pray something doesn't come floating down and touch that 132,000-volt line. If it does, this whole city will be without power; and with the river already above flood stage, that's all we need."

Carl, holding the radio-controlled model plane he and Jerry had been flying above his head to keep it from being damaged by the surging crowd, edged closer to the chief. "How come you don't use the telephone or your radio to get the power company?"

"That sizzling thunderstorm and the high wind we had last night knocked out all the lines between here and Garden City. It also wrecked the antenna system of the police radio over there. I sure hope that water-logged old tree stays put," the chief added anxiously, as he stared at the bare limbs of a huge dead sycamore that was snagged on the bottom some hundred yards directly upstream from where the power lines nearly touched the water.

Suddenly Jerry, whose black eyes missed

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Antene Mello, 68 Union Street, Nantucket, Mass.	1st	10
Jeha Ward, 407 E. Cowden Ave., Midland, Texas	1st	10
F. T. Verga, 538-7th Street, Buffalo, N.Y.	1st	12
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Anthony Giacquinta, 404 Dale Dr., Silver Springs, Md.	1st	12
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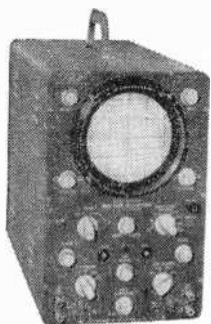
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Carl & Jerry (Continued from page 8)

very little, shouted: "Hey, Chief, look what's coming down the river!"

A mutter of astonishment that was almost a groan swept through the people on the bank as their eyes followed Jerry's pudgy, pointing finger. Two young men—they looked to be in their late teens—were floating down the middle of the river in a rubber raft. Wearing only bathing suits, they were waving gaily at the staring people on the bank and were obviously quite pleased at the daring picture they were certain they were creating.

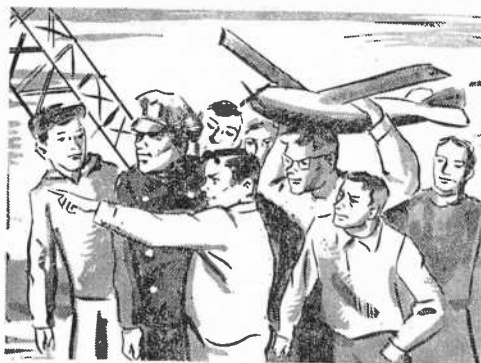
"There's never a disaster without some thoughtless fools to make it worse!" the police chief muttered from bitter experience as he grabbed an electronic megaphone from a nearby emergency truck and started running along the bank toward the approaching raft.

"That wire below you is carrying 132,000 volts! Don't go near it!" he shouted, speaking as distinctly as he could.

Immediately the boys stopped clowning and stared in fascination at the deadly loop of wire toward which the river was carrying them so swiftly. Suddenly they grabbed paddles from the bottom of the raft and began frantically driving their clumsy craft toward the sunken tree. They just made it, and grabbed hold of the naked white branches sticking above the surface.

"Whe-w-w-w, that was close!" the chief said, setting the megaphone on the ground.

A wave of sound from the people behind him snapped his head up just in time to see the great tree roll ponderously over and start moving down-stream. As it rolled, one of the tree's huge branches came squarely down across the raft and shoved



... Jerry, whose eyes missed very little, shouted: "Hey, Chief, look what's coming down the river!" ...

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Carl & Jerry (Continued from page 10)

it and its passengers beneath the surface. The tree moved only a few feet before it caught and held again. At the same time, the red rubber raft bobbed to the surface. One youth was still lying across it, and the head of the other popped to the surface beside the raft. Quickly the boy clambered aboard and began shaking the inert body of his companion. Even from the shore blood could be seen oozing from a cut on the head of the unconscious boy.

THE PEOPLE on the bank began to scream, and Chief Morton snatched up his megaphone and bellowed: "Look out! You're drifting away from the tree!"

The boy kneeling in the raft looked up and made a desperate grab at the very last branch on the down-stream end of the tree. His hand closed around it, and slowly, with great effort, he pulled the raft up alongside the brittle limb. With his other hand, he kept the face of his wounded companion out of the muddy water that nearly filled the hollow space inside the raft.

"You better get them out of there," a man yelled from the crowd. "That tree won't stay put long, and that kid can't hang on very long, either."

"Sure, sure!" the police chief answered bitterly as he glanced wildly about; "but how? There's no chance of throwing a rope a hundred yards or so. It will take us at least a half hour to get a boat here with a motor on it big enough to do any good in that current."

"If the power could just be cut off that line," Jerry murmured.

"It's worth a try," the chief said as he ran to his car. He snatched the radio mike out of its holder, and called an order in to head-



... His hand closed around it, and slowly, with great effort, he pulled the raft up alongside ...

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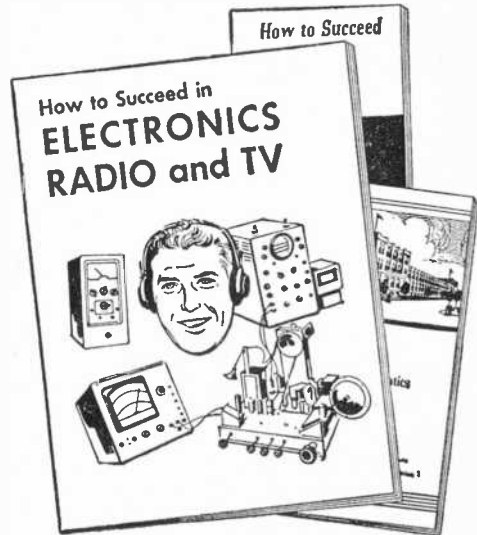
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Carl & Jerry (Continued from page 12)

quarters to have a squad car race to Garden City and have the power cut from the line feeding into the city. At the same time he called for a boat and motor to be sent from the fire department garage.

The chief drove his car back to where Carl and Jerry were standing.

"That fellow is trying to tell us something," Carl said, "but the people are making so much noise I can't figure it out."

"Be quiet! Listen!" the chief shouted.

"I can't hold on much longer. This current is pulling my arm out of its socket," the desperate voice of the youth came faintly across the sucking, gurgling flood. "And every now and then I can feel this tree drag a little."

"Chief, you got any light, strong twine in that emergency truck?" Jerry suddenly asked.

"I think so, kid; what's on your mind?"

"If you will get it and a lot of small rope, I'll show you faster than I can tell you. I don't know if the idea will work or not, but we've got to try something."

The chief was back in a couple of minutes

with a big cone of twine, and two other men carried four large coils of half-inch rope. Carl and Jerry were kneeling on the muddy ground hurriedly gassing the model plane.

"Tie those coils of rope together so the end can pay out freely from coil to coil," Jerry said. "We're going to try and make this radio-controlled plane carry the twine out to where the fellow on the raft can reach it. If we can just do that, he can use the string to pull the end of the rope out to him. Once he has hold of the rope, we can take our end upstream so the current will swing him into the bank."

Some of the people began to snicker at the wildness of the plan, but Chief Morton, who had worked with Carl and Jerry before, silenced them with a fierce glance. "If any of you've got a better idea, let's have it," he growled. "If not, shut up and get back out of the way."

THE TWINE had been fastened to the landing gear of the little plane; some of it had been unwrapped and loosely coiled on the ground. Carl stood ready to start the motor.

"Okay," Jerry said in a tight, shrill voice,

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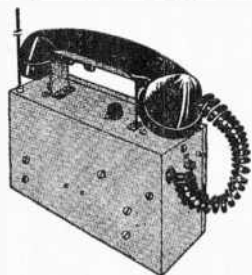
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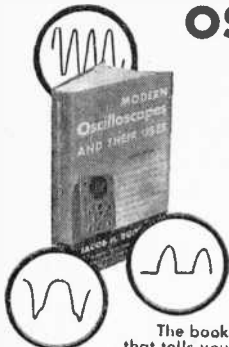
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Carl & Jerry (Continued from page 14)

as his hands nervously clutched the radio-control unit; "start it and let it go. And if you ever did a good job of hand-launching, do it now. One chance is all we'll have."

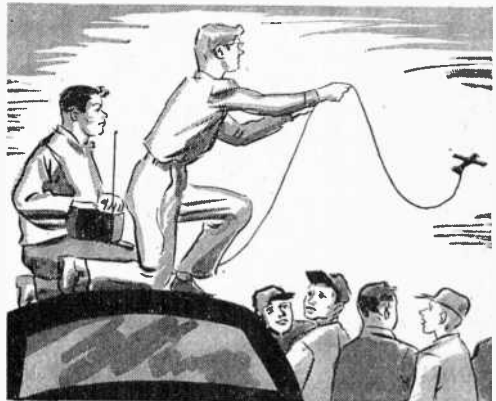
The motor broke into a snarl at the second spin of the propeller. Carl's big hand held the plane steady for a moment, then his long arm snapped it forward and slightly down toward the surface of the water. For a split second, it seemed that the little model was going to dive straight into the muddy froth, but instead it curved upward and to the left in a graceful zoom and started climbing in a fairly tight spiral.

"What's the matter? Can't you control it? Send it out to the boy!" a man shouted in Jerry's ear.

Chief Morton thrust him roughly aside as Jerry answered without taking his eyes off the string that led up into the sky like a miniature version of the Indian rope trick: "We've got to get enough altitude so the string can be carried without touching the water. If that twine gets into the water, the plane will be dragged down. The higher it flies, the less drag we'll have to put on the string to keep it out of the river."

As he finished speaking, the little plane had climbed until it looked pitifully small and frail against the gray overcast. Jerry changed the controls on the box he held in his hand, and the model headed straight out across the river with the white string trailing in a graceful curve beneath it.

Chief Morton was using his megaphone to explain to the boy on the raft what they were trying to do. Carl was paying out the string with all the careful skill of a fisherman trying to land a two-pound trout on a



. . . Carl paid out the string like a fisherman trying to land a two-pound trout on a five-ounce thread . . .

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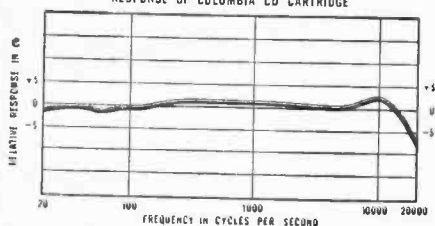
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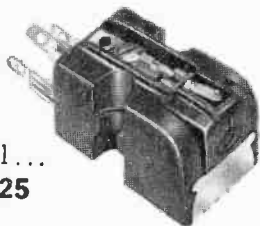


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Carl & Jerry (Continued from page 16)

five-ounce thread. The boy on the raft had managed to throw one leg over the limb and had propped his unconscious friend's head up on the side of the raft so that both hands were free to try and catch the string.

As the little plane sailed farther out across the river, the string bellied closer and closer to the surface in spite of Carl's having climbed on top of the chief's car to keep his end of the twine as high as possible. He was afraid to put too much tension on it lest the plane be slowed down and go into a stall. It was hard to see the string, too, as it neared the raft; but suddenly the boy made a snatching motion with his hand, and a roar went up from the crowd as they saw he had the thin cord.

Jerry put the plane into a circle over the raft, and the men on the river bank quickly broke the string and attached it to the end of the rope. The boy broke the string at his end, too, so as to free the plane, and began hauling out the rope hand over hand. Just as his eager fingers closed over the rope, the tree rolled again and the rubber raft shot away down-stream toward the lethal wire.

Without a moment's hesitation, Chief Morton grabbed up the remaining coil of rope and started running directly away from the river up a side street. Carl jumped from the car top and grabbed hold of the rope right behind him.

The raft described a slow curve down-stream and toward the bank, and when it passed under the high-tension line, there was a good ten feet between the wire and the crouching figure of the boy below with the rope wrapped tightly around his wrist.

IT WAS ALL OVER in a few minutes. A waiting ambulance took the two boys to the hospital. Jerry landed the model plane without damage, and the people congratulated the two boys and the chief of police on the successful rescue. The chief countermanded his order to have the power cut off. He offered to drive Carl and Jerry home.

"Well, boys, you pulled it off again," he said with a tired grin as he drove slowly along; "but next time would you mind not cutting it quite so close? I know I aged ten years in ten minutes back there."

"Know exactly what you mean, Chief," Carl said, nodding soberly. "I'm going right home and look in the mirror for gray hairs myself!"

-30-

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LETTERS FROM OUR READERS

It's the Greatest

■ I just finished the Card-File Transmitter (May, 1958) and it works fine in conjunction with my main rig for local calls, tests, and the like.

The only trouble I had was in tuning the transmitter. The transmitter would tune to resonance only when the plates of the variable capacitor were fully meshed. However, my best DX was to a friend two blocks away.

I then proceeded to retune the transmitter by the following method. First, I turned the transmitter and the station receiver on. I tuned the variable capacitor to maximum indication on the receiver S-meter. This time my friend said that I was overloading his receiver.

I recommend this little transmitter for anyone that needs a small standby rig, or for the beginning ham who would like to experiment on a small and easy-to-build transmitter.

RONALD L. FRIEDMAN
Bayside, 64, N. Y.

High-Gain FM Antenna

■ Could the long-long Yagi antenna described in the July issue of POPULAR ELECTRONICS be recut to cover the FM band of 88-108 megohms? I

live about 200 miles from Boston, Mass., and would like to receive fine music programs.

LOUIS MARDEN
Augusta, Maine

The dimensions given for the long-long Yagi are for 108 mc., but you could change these to fit any frequency between 88 and 108 mc. Results would depend also on how high you mount it and on the terrain between your location and Boston. Perhaps there are experimenters in Augusta that are receiving stations in the Boston area, and could make suggestions.

Tuning Problem with One-Tuber

■ I have just finished building the one tube hi-fi AM tuner in the June issue. I got along fine until I tried to line it up. I used the Miller coils and the 365- μ fd. dual called for in the list of materials, but I can't line up both ends of the dial. If I receive the stations on one end, I don't on the other, and vice versa.

W. MALONE, JR.
Linchburg, Ohio

Be sure the tuning capacitor is a dual 365- μ fd. variable for tuned-radio-frequency circuits and not one with two different sections used with a superhet circuit. If the "TRF" capacitor is used, connect a signal generator to the antenna terminal of the tuner. Rotate the tuning capacitor so that the plates are fully meshed. Close down the compression-type trimmer capacitors on the tuning capacitor, and turn down the iron cores of

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Subject:

Stereo Cartridges and Garrard Players

We are supplying standard Garrard changers and turntables to stereo cartridge manufacturers for test purposes. Knowing of your interest in the newest developments—we reproduce, with permission, some of the comments we have received.

Stereo performance is inherently extra-sensitive to such symptoms as rumble and wow. This makes the selection of record playing equipment even more critical than in the past.

ElectroVoice
INCORPORATED
BUCHANAN, MICHIGAN

The Garrard proved to be entirely compatible for stereophonic reproduction and we would have no hesitancy in recommending our cartridge for use in your changer.

Lawrence LeKashman
Lawrence LeKashman
Vice President, Sales



FAIRCHILD CORPORATION

We have tested our XP-4 rotating coil stereo cartridge with your Garrard changer and find that it is perfectly suitable for playing stereo or other records with this changer.

Ruben E. Carlson
Ruben E. Carlson
Vice President



Pickering and Company, Inc.
ENGINEERS AND MANUFACTURERS

I think it will please you to know that we have used Garrard changers and Garrard Model 301 turntables in these tests and that the results have been eminently superior in every respect.

Walter O. Stanton
Walter O. Stanton,
President



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the two coils. Set the generator to 550 kc. and adjust the iron cores for maximum signal output from the tuner.

Then rotate the tuning capacitor so the plates are entirely unmeshed and set the signal generator to 1600 kc. Adjust the two compression-type trimmer capacitors for maximum signal output. Set the generator to 1200 kc. and readjust the trimmers for maximum output.

There's Another Way

■ I read the article (July, 1958) on three-dimensional color television. However, a sounder method exists. All that need be done is to put a polarized lens over the entire screen surface, and in front of this a thin, transparent nitrobenzene-filled capacitor, also the size of the screen.

The shutter movement in the camera may be synchronized with the capacitor (Kerr cell). Thus, with lens 1 in operation, no voltage would be applied to the Kerr cell, and so the light would be polarized in accordance with the filter backing the cell. Let us assume this to be vertical.

At the time of lens switching, a small voltage is applied to the Kerr cell which rotates the plane of light passing through it by 90°. Now it acts as if it were horizontal.

Thus, the polarity of the light coming from the screen is reversed electronically and instantaneously in accordance with the camera lens in use, thereby doing away with cumbersome motors.

S. D. GOLDBLOOM
Baltimore, Md.

DX Department

■ I would like to see a feature article on the commercial phone outlets such as news and telephone outlets. These have strong signals from countries rarely heard on the regular short-wave stations. I have been SWL'ing since the beginning of this year and have identified over 75 stations in 43 countries on the short-wave bands. My favorites are *Radio Switzerland* and *Radio Australia* for their regularity and their DX programs. My best DX stations are Lebanon, Malta, and Singapore. I receive on a Hallicrafters S-38E with a 40' wire and a modified TV antenna.

CHARLES LOUDA
New York, N. Y.

Suggestions for Charger Cutoff

■ Mr. Hoffman's question about a cutoff of a battery charger, (*Letters*, August '58) suggests the need for a simple device to show when a car battery needs charging . . . that is, a quick warning when the charge is so low that one may be stuck with a car that will not start. Maybe the same device could serve both purposes.

There are two ways to warn when a car battery needs charging. The usual one, with a hydrometer tester, is too much bother unless it can be made by just pushing a button. Another and very old test is a voltage reading between the negative plate and a cadmium electrode. Some old-time battery men in electric substations did not consider the cells fully charged until the cadmium

(Continued on page 26)



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Model 301C, Sloping Counter Case, \$46.50; Kit, \$32.60. Model PTA, Picture Tube Adaptor (to check and rejuvenate picture tubes).....\$4.50

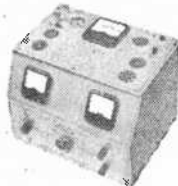


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NEW! Model BEA, Battery Eliminator Adaptor (for Transistor Radio Checking)Wired, \$9.70

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THE SECOND STEP TO STEREO. Connect the E-V Stereo Cartridge leads to the 505 Stereo Control Center (net \$11.50). You can then select from "monaural," "stereo," or "channel reverse" for easy balancing. The 505 also converts your magnetic input to high impedance ceramic input, if required. Run one lead to your present high fidelity system, run the second channel lead to a second amplifier (and speaker). NOTE: The E-V Stereo Cartridge is corrected for RIAA curve, doesn't need the equalization of a second preamplifier.

If you do not plan to purchase a second amplifier and speaker now, you can still get stereo by running the second channel lead through the 505 to your radio or TV set phono input. You can improve your system later by simply adding a second amplifier and speaker. Stereo records are available now. Why wait? Enjoy the vivid reality of stereo sound today. Whether you're purchasing your first system or converting now, use the Electro-Voice Compatible Stereo Cartridge. See your high fidelity dealer, or write Electro-Voice for free booklet on choosing stereo equipment, and a special Stereo Demonstration Record (\$1.50 prepaid).

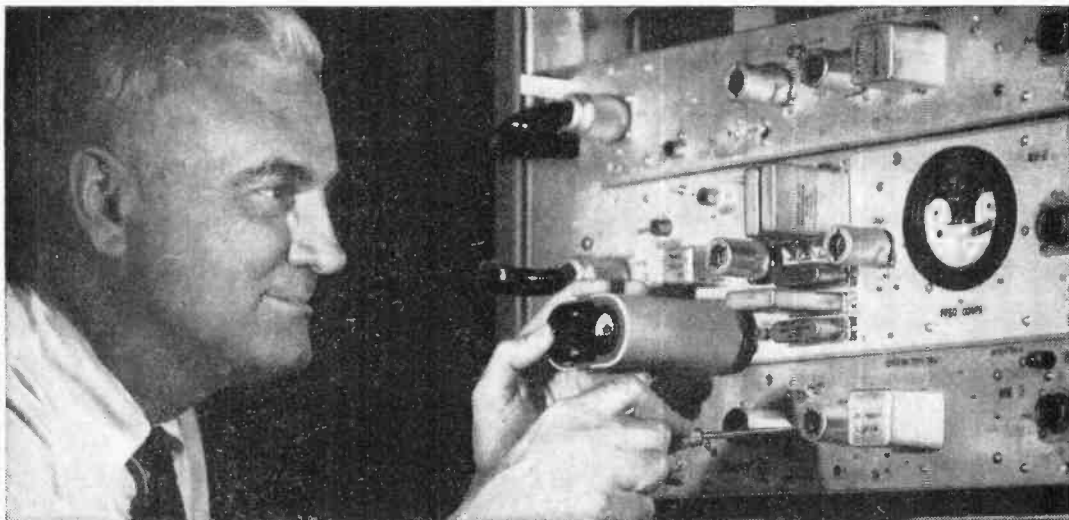


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Bell Laboratories Announces Pocket-Sized Frequency Standard for Microwave Systems



Lawrence Koerner, who developed the portable frequency standard, demonstrates how the device can be plugged in at a radio relay station to supply a checking frequency. Battery-powered, the device maintains precision calibration for several months.

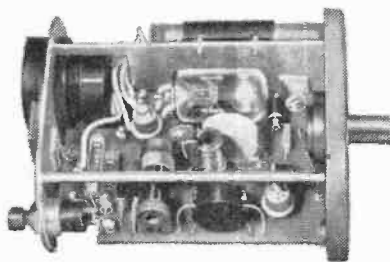
Microwave radio relay systems depend critically on the accuracy of their "carrier" frequencies. At scores of relay stations along a route, carrier frequency oscillators must be checked periodically against a signal from a precise standard.

In the past, the maintenance man has had to obtain his checking frequency by picking up a standard radio signal from a government station. This operation takes time—and requires elaborate equipment.

With a new *portable* frequency standard developed by Bell Laboratories, the job is much simplified. To check an oscillator, the portable standard is plugged in, and a button is pressed. In seconds, it supplies a checking frequency accurate to one part in a million.

Until now, such precision in a frequency standard has been obtainable only in a laboratory. The new portable standard makes it available for routine use in the Bell System. First use of the standard will be to maintain

frequency control in a new microwave system for telephone and TV, now under development at Bell Laboratories.



Inside the portable frequency standard. Four Laboratories-developed devices make it possible: (1) transistor, which converts the power from a battery to radio frequency oscillations; (2) voltage reference diode, which maintains constant voltage; (3) piezoelectric crystal unit of superlative stability; (4) thermistor, which corrects for temperature variations.



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Letters

(Continued from page 22)

was between the positive and negative plates in potential . . . i.e., the cadmium was slightly positive with respect to the negative plate.

Some experimentation with the cadmium electrode along with a hydrometer would probably be necessary to determine the proper voltage between the cadmium and the negative plate.

I suggest that a pure cadmium rod of small diameter protected by a plastic tube with holes in it be permanently fixed in one cell, maybe through a hole in the filler plug. A wire brought out from it, with one from the negative plate of the same cell, could be connected to an indicating device (voltmeter, for example) or an automatic device of some sort that would start the charger when voltage is low or reversed and stop it when the cadmium voltage is right as determined by the hydrometer test.

Cadmium does not dissolve in dilute acid as readily as zinc and, if fairly pure or perhaps amalgamated like the ancient zinc battery plates, may not contaminate the battery solution seriously even though left permanently in it. It has only one valence and therefore probably would not tend to run the cell down as iron in solution would. I think it would be safe even if left in the cell permanently. Pure cadmium in rod form can be obtained from chemical supply houses but cadmium that platers use may do as well. It melts easily.

It should not be difficult to rig up a relay that will open or close the charging circuit at the proper cadmium voltages.

A built-in hydrometer could do the same thing but the cell would probably have to be built for it. Or one might drill two holes through the cell case for attachment of an external hydrometer, but it is doubtful if the circulation would be sufficient to insure the density being the same as in the cell itself.

These are merely suggestions. I leave the details to someone else.

T. G. SEIDELL
Avondale Estates, Ga.

Help Wanted

■ Carl and Jerry's "Fish Sniffing" (May, 1958) fits into something that I have considered doing for some time for protection against shoplifting. Not being well enough schooled to build this system from the column, would someone be able to send me complete plans for making this "sonic tag" and its receiver system?

I will pay for the plans.

RUSSELL REED
P. O. Box 47832 Wagner Stations
Los Angeles, Calif.

■ I would like to know if one of your readers who has built the "Vibrato" (December, 1957) has managed to modify the circuit to permit a foot switch to cut the vibrato in and out without transients.

S. E. RAIKOWKI
11½ Jones St.
Pittsburgh, Pa.

■ I am using a small audio amplifier of about 1-watt output connected to a small coil in front

Always say you saw it in—POPULAR ELECTRONICS

GENIAC

An interesting kit builds circuits that solve problems and play games.

"ELECTRIC BRAINS" THAT WORK in much the same manner as giant computers can now be built quickly and cheaply by the novice using the new Geniac Construction Kit.

One of the most remarkable kits ever introduced to the public, the Geniac kit provides material and instructions for building 125 separate circuits for operating as many "brain machines." Among the devices that may be built are logic machines for comparing and reasoning; cryptographic machines for coding and decoding; games such as tic-tac-toe and nim; arithmetic machines for both decimal and binary computations; puzzles such as "the space ship airlock," "the fox, hen, corn, and hired man;" and miscellaneous devices such as a burglar alarm, an automatic oil furnace circuit, etc.

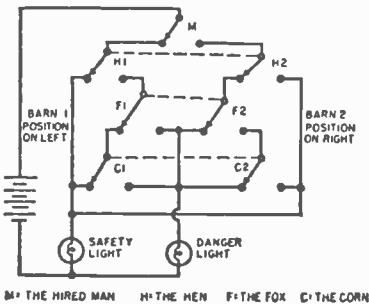
In addition to a complete assortment of all necessary parts is a carefully prepared instruction manual which explains in detail how to wire each circuit. The 63-page manual also furnishes basic information on the application of symbolic logic to circuits, which is the basis of the Geniac kit.

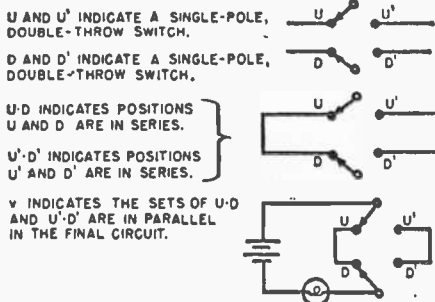
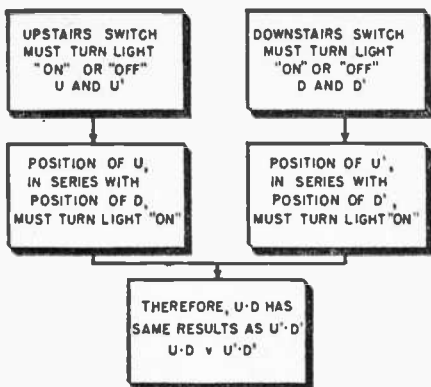
The kit is completely safe for anyone to use. No soldering is required, and every circuit operates on one common flashlight battery.

By the use of ingeniously designed parts, such as a new type multiple switch and special circuit jumpers, the kit provides circuits that "act out" or "prove" the truth of verbal statements about certain situations. One of the most popular of these circuits is the machine for the two jealous wives. In this problem, a "brain machine" must be devised that will inform either or both wives of unfaithfulness on the part of their husbands.

Mathematical basis for the Geniac circuits is the application of "Boolean algebra" to circuit design. George Boole, a nineteenth century British mathematician, evolved a system of logic in which symbols represent specific possibilities of things happening one way or another, such as A and B, or, A or B, etc. Certain types of information, when stated verbally, can be analyzed and reduced to simple statements. These statements, or "elements," are, in turn, expressed in symbols. The symbolic statement or "formula" then represents the verbal statement. From the symbols, it can be determined what circuit components are needed and how, to a large extent, they must be arranged in order to provide a circuit that "acts out" the original statement. The gigantic computers that solve complex problems in the twinkling of an eye are based, in part, on these principles.

The Geniac circuit shown below represents a robot watchman. It warns the farmer when his corn is in danger of being eaten by the hen. It also warns him when the hen is in danger of being devoured by a fox. Circuit takes into account the possibility that the hired man may not be present at all times to prevent trouble. This ingenious circuit also informs the farmer when all is safe.





This diagram shows how Geniac solves "the problem of the hall light." Verbal statements are broken down into algebraic symbols which, in turn, indicate the number and type of circuit components required.

A good illustration of how this system works is the problem of the hall light, one of the circuits included in the kit. The problem, stated in normal language, is this: a man wants to turn off or turn on a hall light either from downstairs or from upstairs. A circuit must be devised so that if either switch is turned the light will go off if it was on, and will go on if it was off.

This is a practical problem and involves a kind of wiring that may be familiar to many readers. It implies a switching arrangement in which either of two switches may be "off" or "on" in any position, depending on the relative position of the other switch.

The circuit solution to this problem evolves logically from stating the problem in Boolean symbols. U represents the upstairs switch in one position, and D represents the downstairs switch in the same relative position. U·D represents the two switches in series and in positions that permit the flow of current to light the bulb. U' and D' represent both switches in their respective opposite positions. Thus, U'·D' also represents a flow of current. U'·D

and U·D' both represent the switches in such relative positions as to break the circuit and permit no current to light the bulb.

Stating this in Boolean symbols: $U \cdot D \vee U' \cdot D'$. The "∨" stands for an expression similar to "and/or" and implies a state of parallelism between the two expressions it connects. Thus, the formula tells us that two series switches are needed in parallel with each other. Since each switch must perform one of two possible functions (the "either-or" element), each switch must be a double-throw switch. The diagram and schematic shown here illustrate this reasoning process.

In every application of Boolean logic to a verbal statement, the circuit must prove the truth of the statement. In this case, the final circuit fulfills the requirements of the man with the upstairs and downstairs halls. In other circuits which can be built with the kit, a similar proof is achieved.

For instance, the kit may be used to construct an electronic version of tic-tac-toe. Now, anyone who has played this game knows that if you make the first move, regardless of what your opponent does, you must either win or draw, provided you make the best possible move following each of your opponent's moves. In other words, the player who goes second cannot win unless the first player commits an error. The Geniac circuit for this situation is a complex one, but once constructed, proves infallible. In a word, you can't beat the machine!

The underlying principles of the Geniac kit have been in development and research for a number of years. One of the best known pioneers in this country in the application of algebraic analysis to the problems of telephone circuitry is Dr. Claude Shannon of *Bell Telephone Laboratories*, whose "magnetic mouse" was described in *POPULAR ELECTRONICS*.

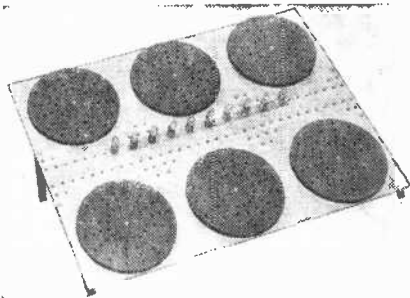
In addition to its value as a source of amusement and education, the kit exhibits certain technological features that may have widespread implications in other areas. The switches themselves are designed for simplicity and economy. Where the equivalent of several banks is needed, which ordinarily requires a multi-deck or multi-wafer switch built up vertically, the Geniac method uses a single wafer. Contacts on this wafer provide the equivalent—laterally—of what conventionally ganged switches do. This single wafer unit is an exclusive Geniac development.

Geniacs are manufactured by Oliver Garfield Co., Inc., 108 East 16th St., N. Y. 3, N. Y. and are available for \$19.95 postpaid.

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TEXT PREPARED BY MIT SPECIALIST

Dr. Claude Shannon, known to the readers of Popular Electronics for his invention of the electronic mouse, that runs a maze, learning as it goes, formerly a research mathematician for Bell Telephone Laboratories is now a research associate at MIT. His books include publications on Communication theory and the recent volume "Automat Studies" on the theory of robot construction. He has prepared a paper entitled "A Symbolic Analysis of Relay and Switching Circuits" which is available to purchasers of the GENIAC. Covering the basic theory necessary for advanced circuit design it vastly extends the range of our kit.

The complete re-designing of the 1958 kit and the manual as well as the special book DESIGN-O-MAT® was created by Oliver Garfield, author of "Minds and Machines," editor of the "Gifted Child Magazine" and the "Review of Technical Publications."

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- 4) DESIGN-O-MAT® introduces the user to over 50 new circuits that he can build with GENIAC and outlines the practical principle of circuit design.
- 5) GENIAC STUDY GUIDE equivalent to a complete course in computer fundamentals, this guides the user to more advanced literature.
- 6) A Machine to Compose Music shows in an actual circuit what other GENIAC owners have been able to do on their own in designing new devices.
- 7) A Machine to Forecast the Weather—again a new adventure in scientific thinking created by one of our users who was trained on his GENIAC Kit.

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We are proud to announce that over 20,000 GENIACS are in use by satisfied customers—schools, colleges, industrial firms and private individuals—a tribute to the skill and design work which makes it America's leading scientific kit. People like yourself with a desire to inform themselves about the computer field know that GENIAC is the only method for learning that includes both materials and texts and is devoted exclusively to the problems faced in computer study.

You are safe in joining this group because you are fully protected by our guarantee, and have a complete question and answer service available at no cost beyond that of the kit itself. You share in the experience of 20,000 kit users which contributes to the success of the 1958 GENIAC—with DESIGN-O-Mat® the exclusive product of Oliver Garfield Co., Inc., a Geniac is truly the most complete and unique kit of its kind in the world.

COMMENTS BY CUSTOMERS

We know the best recommendation for GENIAC is what it has done for the people who bought it. The comments from our customers we like best are the ones that come in daily attached to new circuits that have been created by the owners of GENIACS. Recently one man wrote: "GENIAC has opened a new world of thinking to me." Another who designed the "Machine that Forecasts the Weather" commented: "Several months ago I purchased your GENIAC Kit and found it an excellent piece of equipment. I learned a lot about computers from the enclosed books and pamphlets and I am now designing a small relay computer which will include arithmetical and logical units . . . another of my pet projects in cybernetics is a weather forecaster. I find that your GENIAC Kit may be used in their construction. I enclose the circuits and their explanation." Eugene Darling, Malden.

Oliver Garfield Co., Inc. Dept. PE-108
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Please send me at once the GENIAC Electric Brain Construction Kit, 1958 model. I understand that it is guaranteed by you and may be returned in seven days for a full refund if I am not satisfied.

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Export: Morhan Exporting Corp., New York, N. Y.
Canada: Atlas Radio Corp., Ltd., Toronto, Ontario

Letters

(Continued from page 26)

of which I have placed a reed tuned to frequencies of the musical scale, so that when a musical instrument is connected to the amplifier the corresponding tones can be observed.

It has been fairly successful except for the fact that the reed vibrates over a range that could leave the string to be tuned a little flat or sharp. The resonant peak is rather difficult to make clearly visible but I have overcome part of the problem. Does anyone have any suggestions that would help?

I also have not found out which type of coil would be best suited and how the reed can be mounted for best results.

HENRY RODENBECK
724 N. Maplewood
Tulsa, Okla.

Hub Cap Protector Needed

■ We have been having quite a bit of trouble with the stealing of hub caps here in Albuquerque, and last night they took mine. I was wondering if it would be at all possible, and practical, to wire sufficient voltage from the car's battery to each of the hub caps so that anyone touching them would be shocked? I wouldn't want to use so much current that it would hurt someone seriously if he should be standing in water but enough so that no one could possibly remove them.

It would probably be better to use a.c. current from a converter and perhaps the cigarette lighter outlet for a plug-in that could be used when you were away from the car. When you were in the car, or at a filling station, you could leave it unplugged.

This might be impractical, but hub cap locks are not doing the job, and I sure would like to find something to discourage these thieves.

PHIL HENDREN
802 Parkland Cir. SE
Albuquerque, N. M.

Think of Future Issues!

■ I enjoy your magazine very much. My one regret is that I only started receiving it in February, 1958. Whenever I read the *Letters from Our Readers*, I notice so many interesting ideas referring to issues before February 1958 that I feel like kicking myself for not subscribing sooner.

WAYNE L. STEBBINS
Merrill, Wis.

POP'tronics receives nearly 1000 letters a month from readers. Many request data for construction projects that we have published. Back issues which contain these projects can be purchased from:

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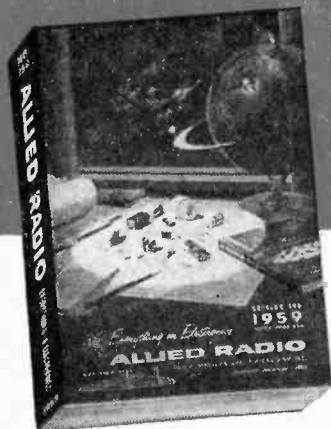
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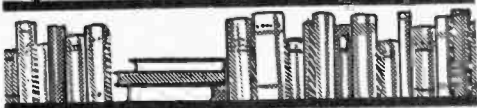
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BOOKSHELF

"TAPE RECORDER MANUAL (VOL. 2)" compiled and published by Howard W. Sams & Co., Inc., Indianapolis, Ind. 160 pages. Soft cover. \$2.95.

As a result of the growing tape recorder market, Sams is now putting out a series of volumes devoted exclusively to tape recorders. This second manual covers 16 tape players and recorders, including two stereo models. It incorporates an index to all the tape, disc and wire recorders that have been discussed and illustrated in previous Sams volumes.

Both home-recording units and the more expensive professional models are covered in the usual comprehensive manner. Photos, schematics and special exploded views contribute toward a complete understanding of a machine's electrical and mechanical operation. In addition, you'll find complete information on possible troubles and their remedies, and a complete mechanical and electrical list of replacement components available from the manufacturers or distributors.

Recommended: to technicians and audio fans who want to make adjustments on either the transport or amplifier systems of their own recorders.



"THE UNIVERSITY TECHNILOG" published by University Loudspeakers, Inc., 80 South Kensico Ave., White Plains, N. Y. 65 pages. Soft cover. \$1.00.

Intended primarily for the technician rather than the hi-fi fan, this handy compilation is packed full of technical loudspeaker information. Each of the 11 sections covers a specific type of public address speaker and the problems encountered in its installation. The last section deals with cone type speakers (as opposed to trumpets, projectors and horns) and their mounting and baffling problems. An interesting nomograph is presented, reprinted from *Audio Engineering*, which will help you select the

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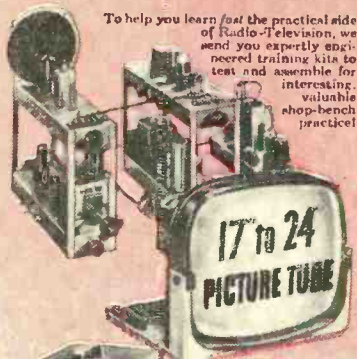
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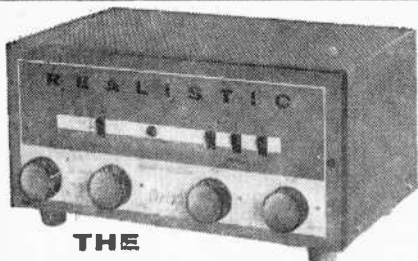
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Bookshelf (Continued from page 32)

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"ELECTRICITY AND ELECTRONICS — BASIC" by William B. Steinberg and Walter B. Ford. Published by American Technical Society, Chicago, Ill. 245 pages. Hard cover. \$4.50.

Without doubt this is one of the clearest and simplest volumes on basic electricity and electronics ever published. The one fault evident is that the former is covered much more thoroughly than the latter. It is to be hoped that this will be rectified in a later edition.

One of the best features in the book is the section at the end of every chapter called "Interesting Things to Do." In it are basic experiments and projects for each classification—an ideal way to learn by doing. Diagrams and photos are clear and to the point.

Recommended: to all readers who are "starting out" in electricity and electronics, and to "old hands" in need of refresher data on basics.



"INDUSTRIAL SOUND SYSTEMS" by Leo G. Sands. Published by Howard W. Sams & Co., Inc., 2201 East 46th St., Indianapolis 5, Ind. 270 pages. Soft cover. \$3.95.

Sound and intercom system requirements for factories, theaters, schools, offices, stadiums, trains, etc., are fully described in this handy volume. Amplifiers, input devices, loudspeakers, control circuits, portable and mobile equipment, and sound distribution methods are discussed and illustrated. An appendix contains charts and tables to aid in proper selection of speakers. Factors considered are speaker power rating, type, frequency dispersion, the background noise level, speaker cable requirements, etc. Installation and maintenance are discussed, and the many diagrams and illustrations should answer just about any question that might arise.

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WEATHERS TECHNICAL MAGIC IS SOUND

Bookshelf (Continued from page 34)

it will help you select the best possible setup for the school auditorium, baseball field or outdoor summer festival.

Free Literature Roundup

Catalog No. 590, available on request from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, New York, N. Y., is this company's latest general catalog of electronic parts and equipment. Its 260 pages are chock full of all types of useful equipment far too numerous to itemize here. A complete line of stereo hi-fi components is presented in the hi-fi section, including the newest stereo equipment and conversion components, and all major-label stereophonic discs and tapes are listed.

A new 16-page, 2-color 1958 catalog describing the complete EICO line of electronic test instruments and high-fidelity equipment in both kit and wired form has just been released. The hi-fi units include an FM tuner, preamplifier, integrated and power amplifiers, and bookshelf and floor speaker systems. Write to Elec-

tronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N. Y.

American Microphone Manufacturing Co., 412 S. Wyman St., Rockford, Ill., has issued a 16-page catalog describing in detail its full line of tape recording, broadcast and public address microphones. Also covered in Catalog 58 are handsets, phono cartridges and arms, and accessories.

An eight-page illustrated catalog and price sheet covering synchronous $\frac{1}{4}$ " magnetic recording equipment and "sync kits" has been announced by Rangertone, Inc., 73 Winthrop St., Newark, N. J. "Sync kits," which can be installed on practically any tape recorder, make it possible to record "lip sync" sound for motion pictures.

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Partial List of Contents:

Basic Semiconductor Theory	Transistor Switching Circuits
Construction Techniques	Transistor Logic
Basic Amplifiers	Tetrode Transistors
Hi-Fi Circuits	Silicon Controlled Rectifier
Radio Circuits	Power Supply Circuits
Unijunction Circuits	Specifications

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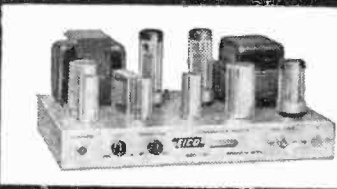
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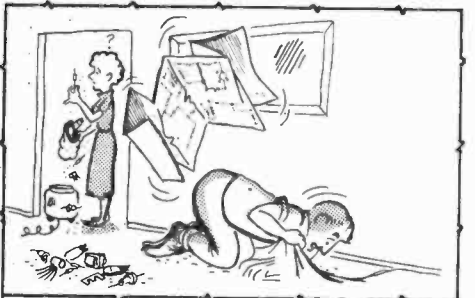
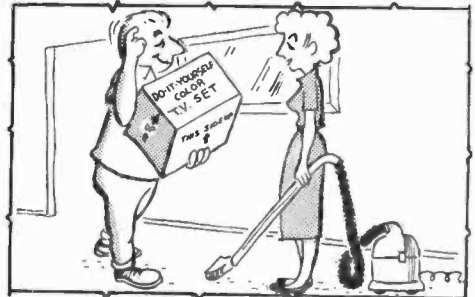
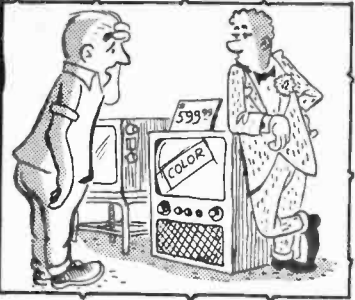
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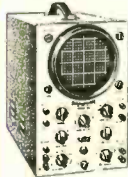
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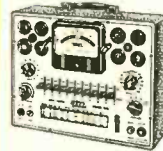
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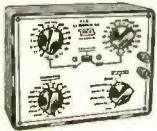
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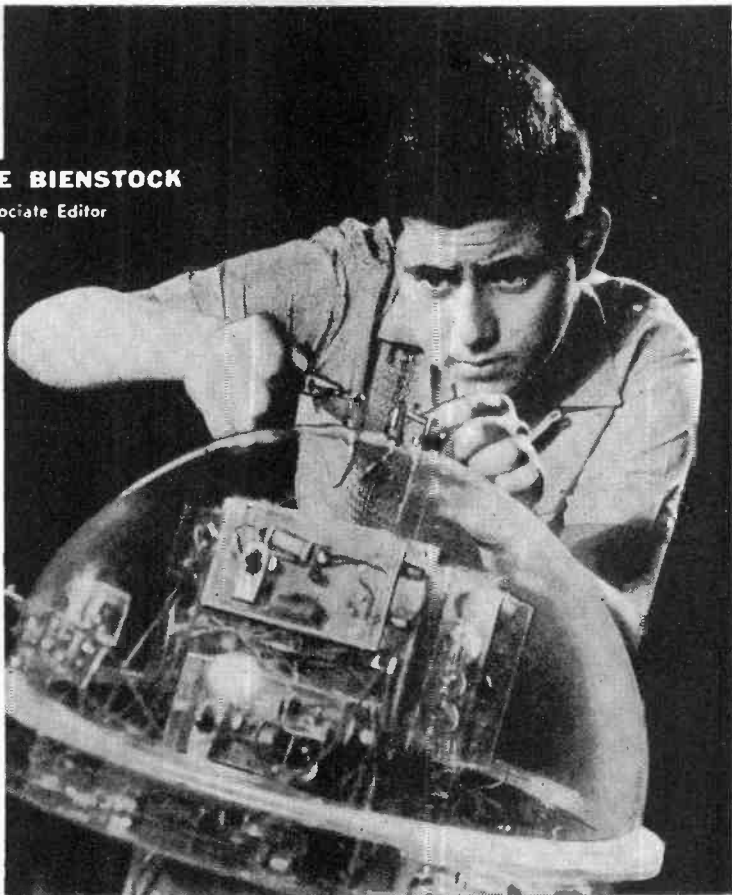
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on Page 38

By **MIKE BIENSTOCK**

Associate Editor



Instrumenting an Earth Satellite

Ar'gus (är'güs), n. |L., fr. Gr. Argos. | 1. Gr. Myth. A hundred-eyed monster set to watch Io. 2. A watchful guardian.

WEBSTER'S DEFINITION of Argus is incomplete. In Greek mythology, Argus has another connotation — it denotes the starry heavens. In all respects, it is a fitting name for a model satellite — “Argus I” — built by Ronald Michael Benrey and entered in the National Science Fair.

The satellite took second prize at the Fair and took first prize in the Air Force's Awards Program, as well as receiving other citations. While it doesn't have the 100 eyes of the mythological Argus, it does have seven “eyes” — sensors designed to “see” such things as temperature, ultraviolet light

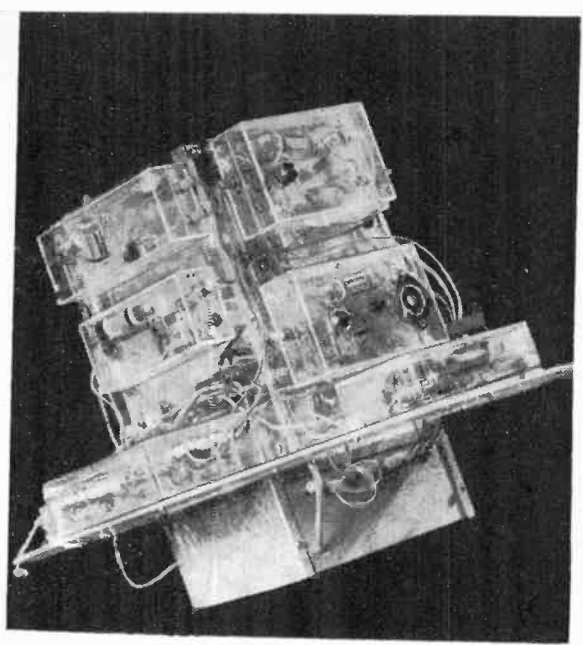
Prize-winning Science Fair model reels off space secrets at the push of a button

and micrometeorites—as well as two “voices”—transmitters to relay the information to receivers.

The satellite shell is made of Plexiglas, 18" in diameter, in two hemispheres. Most of the components are mounted in plastic boxes within, for visibility.

With the antennas in place, “Argus I” measures 54" in diameter and weighs 20 pounds. With batteries, it weighs 30 pounds. It is completely transistorized, using 15 transistors in all. Total cost of the project was about \$200.

Ground Control. When set up, the ground control equipment consists of a modified radio control transmitter operating on 27.255 mc. and three receivers, one tuned to the constant frequency of satellite trans-



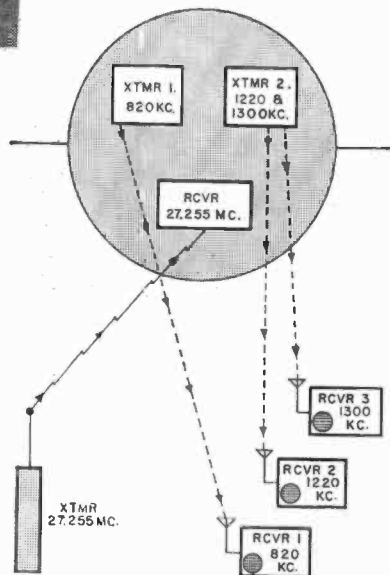
The designer of the satellite is shown at left making an adjustment in an equatorial thermistor sensor which registers skin temperature. Above is a view of the “works” in Argus I. Note that almost all components are cased in plastic to allow full visibility—the metal box at bottom houses the “Brain”. Diagram below shows frequencies used by satellite.

mitter Number I (820 kc.) and the other two to the frequencies of transmitter Number II (1220 and 1300 kc.).

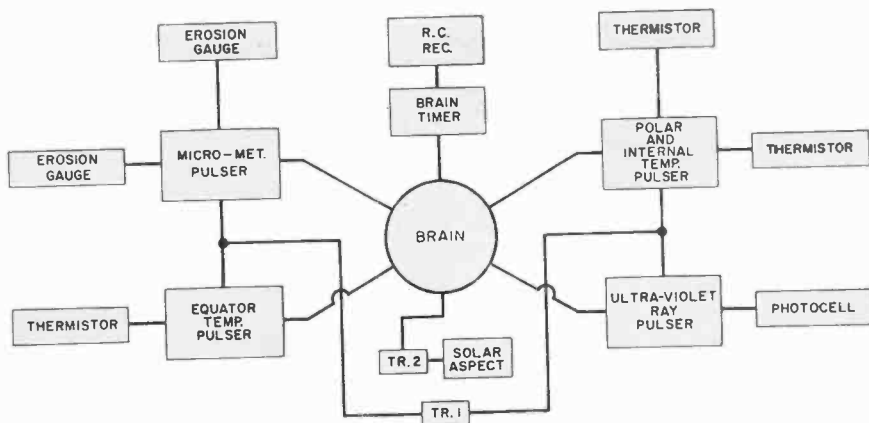
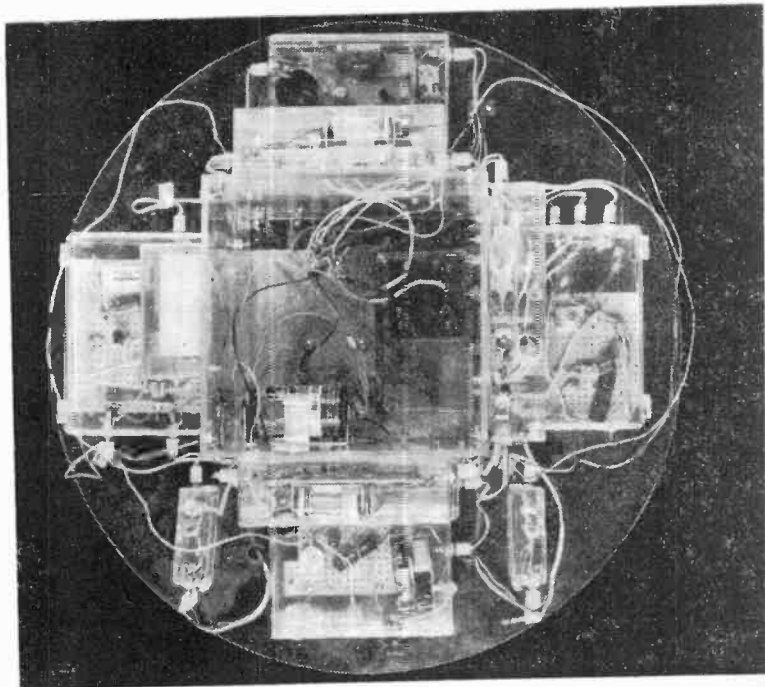
To conserve battery power, one of the satellite’s transmitters is silent until keyed by the ground transmitter. The satellite carries a two-transistor receiver to pick up the R/C ground interrogation signal, automatically keying the “Brain” into its instrumentation cycle.

Telemetry System. If “Argus I” were put into orbit, it would telemeter the following information back to earth:

- Skin temperature at two points (at the satellite’s pole and equator)
- Internal temperature
- Number of strikes by micrometeorites at



Interior of satellite (right) looks like this from the top. Equipment is mounted on circular sheet of Plexiglas which rests against lower hemisphere. Block diagram below outlines functions of the model satellite.



two points on satellite pole and equator)

- Ultraviolet radiation

In addition, it shows the "solar aspect" (whether the sensor faces or turns from the sun, indicating the satellite's attitude toward the sun).

The basic circuit in the telemetering system is shown in the schematic. The pulse rate of the unit (a metronome, in effect) is varied by using a resistance changing sensor in place of a variable resistor. Such sensors include a thermistor for temperature, photocell for ultraviolet rays, and erosion gauge for micrometeorites.

The erosion gauge is a mirror with the paint backing carefully removed with a cotton pad dipped in nail polish remover, or it can be a photocell with an opaque coating. In the case of the former, the "sand-blasting effect" of micrometeorites erodes some of the silver from the back of the mirror, changing the resistance; in the case of the latter, the erosion allows more light to get through to the cell. In this way the sensor-pulser unit's pulse rate is a function of the phenomenon measured.

Instrumentation Cycle. The output of these units is amplified and each pulse keys

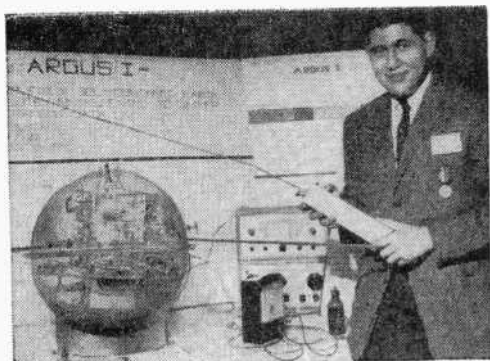
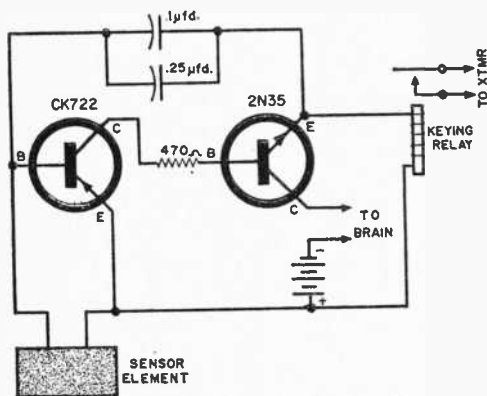


Exhibit of Argus I which netted Ronald second prize at the National Science Fair. He is holding R/C transmitter used to query satellite.



Pulser circuit above feeds sensor information to transmitter, where it is sent in its proper sequence at a signal from the "Brain."

You Can Record the Satellites

You can join in the greatest of all scientific experiments—the scouting of space by the IGY satellites. A new Audio Devices booklet describes how to use a modified FM broadcast receiver in conjunction with a stable communications receiver to tune in the signals from the satellites. With your tape recorder, you can record the latest "news" from the heavens about meteors, ultraviolet radiation, and other space phenomena.

This booklet not only tells you how to make and interpret the satellite recordings but, most important, it explains how you can determine if your recordings have value to the official satellite project. For your copy of "You Can Record the Satellites," see your audio dealer or send 10 cents to Audio Devices, Dept. PE-10, 444 Madison Ave., New York 22, N. Y.

the transmitter via a keying relay. Each pulser is turned on, hooked to the proper sensors and connected to the transmitter by the "Brain." This consists of a "timed" 22-position five-deck stepping relay which advances one position every five seconds, giving "Argus I" a programmed instrumentation cycle. By "turning off" the Brain timer by means of radio control, the cycle can be stopped at any point for prolonged observation of one physical phenomenon.

A second transmitter is included to allow the listener to know when the instrumentation cycle is starting and when the Brain is advancing. Both transmitters are one-transistor c.w. oscillators with a power input of 15 mw., and are fed by a 15-volt hearing aid battery.

A separate ultraviolet photocell changes the capacitance of the tuned circuit of transmitter Number II. As this sensor alternately faces and turns from the sun, the frequency of the transmitter is changed, switching from 1220 to 1300 kc. The frequency difference is relatively large so that the natural Doppler shift doesn't affect the solar aspect indication. Sensitivity is low, so starlight, moonlight or earth glow doesn't affect the sensor.

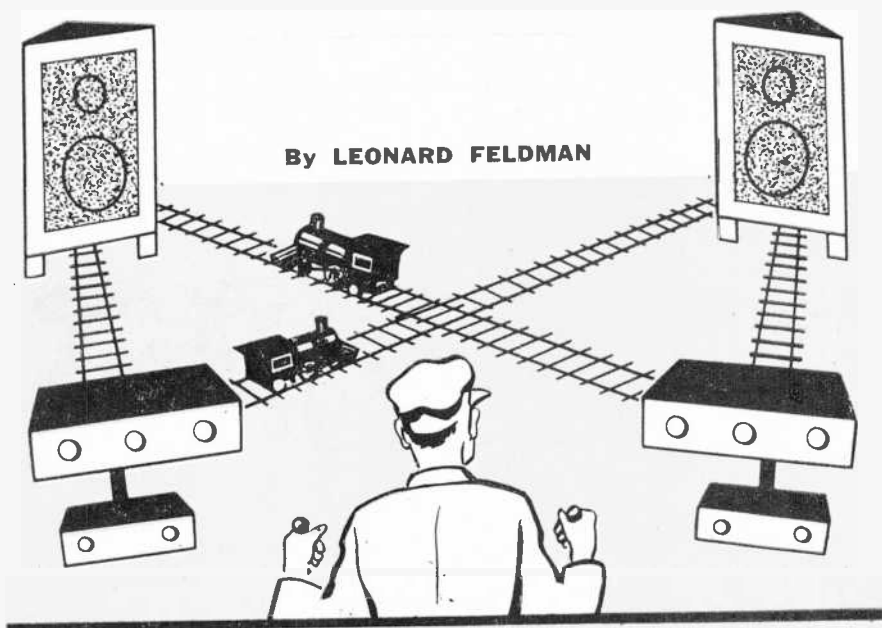
The radio control receiver in the satellite is tuned to a frequency of 27.255 mc., and is powered by two 1.5-volt penlight cells and a 22.5-volt battery. The transmitter, a typical radio control unit, has a 3.2-watt input.

Pulses of the instrumentation cycle, varied by the sensors from five beats to one-half beat per second, sound like short, staccato "beeps" typical of the Sputniks.

The cycle is as follows: recognition signal—10 seconds; equator mic. meteorite—20 seconds; polar mic. meteorite—15 seconds; equator temperature—15 seconds; equator UV radiation—35 seconds; polar temperature—10 seconds; internal temperature—5 seconds; and solar aspect— $\frac{1}{2}$ second every 5 seconds. Total—117 $\frac{1}{2}$ seconds. Duration of the cycle is variable from about 40 seconds to about 235 seconds.

Decoding. Equipment needed to decode the cycle includes three receivers, Doppler-effect correction devices, a graph-type recording counter with device for noting solar aspect, and interferometer (if desired). The beep rate is counted by the graph counter and notations are made by the operator regarding which phenomenon is being re-

(Continued on page 123)



SWITCH to STEREO

*Add flexibility to your hi-fi system so you can listen
to stereo or monophonic programs*

MANY HI-FI FANS are adding an additional channel to their existing equipment to obtain stereo reproduction. This is a matter of economics—it is generally the least expensive method.

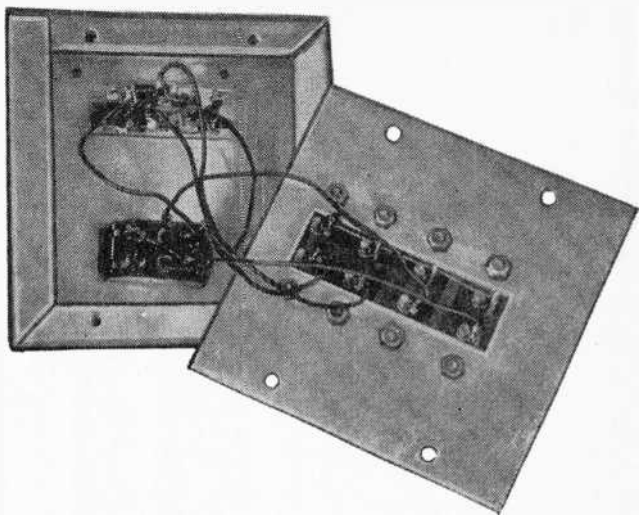
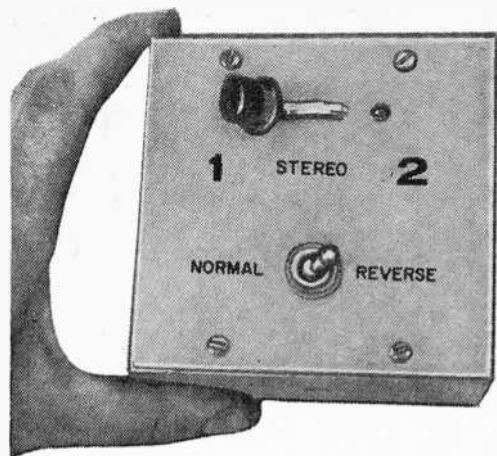
One drawback to such an installation is its lack of flexibility compared to a new dual amplifier-preamplifier combination. While the front panel of such a combination usually resembles the control board of an electronic computer, the knobs perform extremely important functions.

For one thing they offer switching provisions for feeding *either* a monaural signal or the two channels of a stereo signal to *both* speakers. In this way, both speakers are always in use and full amplifier power is available. With two separate amplifiers, you might just as well turn one of them off when you listen to a monaural

source, for the amplifier in use is connected to only *one* speaker of your pair.

Channel Reversing. At the present time, while there is general standardization as to which half of the tape is left channel and which is right (to some extent, this is also true of discs and cartridges), it's convenient to be able to reverse channels by flipping a switch. Most stereo amplifiers and preamplifiers feature such a switch on the front panel. In a two-amplifier setup not so equipped, about the only thing you can do to reverse channels is manually to disconnect and reverse the left and right speakers or input.

Balancing. Each amplifier will have its own volume control of course. If all sources of stereo were perfectly balanced (right with respect to left), you could easily learn the optimum settings of these con-



trols. Unfortunately, the settings for phono will certainly be different from the settings for stereo radio broadcasting (AM-FM, or, eventually, FM-multiplex), which will in turn be different from the settings for your stereo records.

What's more, unless your pair of volume controls is located within arm's reach of your best listening area, you may end up jumping up and down a dozen or more times trying to adjust each volume control for best results. What appears to be balanced sound when you are off to one side is far from balanced when you center yourself between the two speakers.

The Stereo Switch. The first two "aids to flexible stereo" can be accomplished without tearing into any of the electronic circuits of your two amplifiers. Switching from monaural to stereo and speaker reversal are combined in an easy-to-build device.

Because these two functions can be performed *after* the amplifiers (that is, between amplifier and speaker), a double advantage results: the wiring is simple and not subject to hum and noise problems and the control can be conveniently installed at your listening position.

Construction Details. The controls are built into an aluminum chassis-box measuring 4" x 4" x 2". Size is not critical, however. The front panel contains a three-position lever switch and a double-pole, double-throw toggle switch. The rear sports four two-terminal screw type terminal strips, two for amplifier outputs from

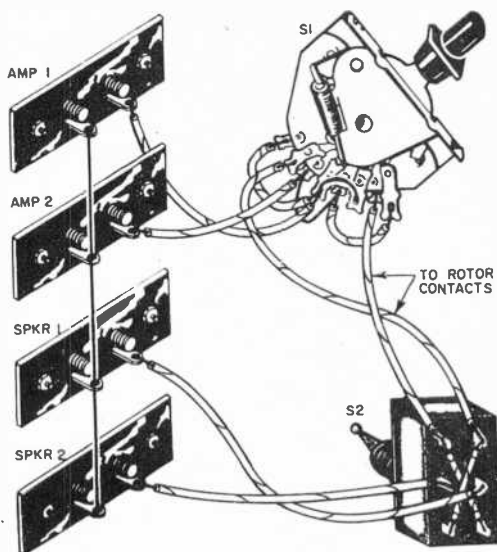
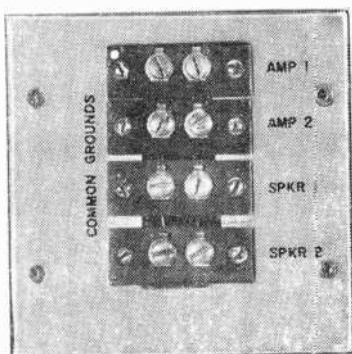
each amplifier and two for connection to the two speaker systems.

The "common" or ground sides of the amplifier inputs and speaker output terminals are tied together. Besides simplification in wiring, this insures proper phasing of both amplifiers with respect to each other and with respect to the speakers being used.

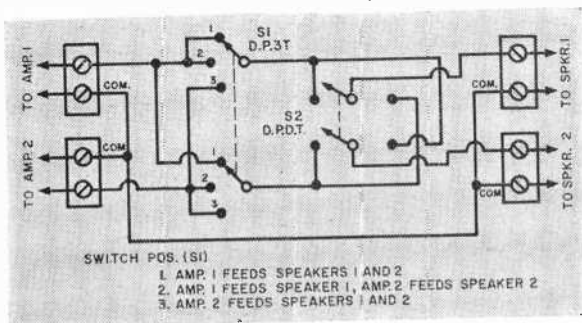
A schematic diagram of the switching system explains the actions of the switches. The lever switch (double-pole, three-position) is shown in the AMP 1 position. In this position, whatever signal is coming from amplifier 1 will be fed to *both* speakers. When the lever switch is moved to stereo position, the signal from AMP 1 will be connected only to SPKR 1 and the signal from AMP 2 will be fed only to SPKR 2. Finally, when the lever is thrown to AMP 2 position, whatever signal is developed in the second amplifier will be applied to *both* speakers.

The toggle switch labeled NORMAL and REVERSE is functional only when the lever switch is in the STEREO position. At that time, if it is thrown to REVERSE, the signal from AMP 1 will be fed to SPKR 2 and the signal from AMP 2 will feed SPKR 1. Obviously, when *either* amplifier is feeding *both* speakers, it doesn't matter what position the NORMAL-REVERSE switch is in.

Hooking It Up. In connecting the two amplifiers to the input terminal strips of the switch box, it is essential that the "common" or "ground" terminal of each amplifier be connected to the "common" side of



In this adapter, no switch position is included to provide for playing monophonic LP's with a stereo cartridge. Check the cartridge manufacturer for special connections required. See schematic at right. Pictorial (above, right) shows how to connect function switch. Photos above and at left show completed stereo switch and its interior.



PARTS LIST

- S1—2-pole, 3-pos. lever switch (Centralab 1454)
- S2—D.p.d.t. toggle switch
- 1—2" x 4" x 4" aluminum cabinet
- 4—Bakelite terminal strips, two-terminal screw type
- Misc. 6-32 machine bolts and nuts, solder, wire

each input terminal strip. If you are using two identical speaker systems, connect the *same* terminal of each speaker to the "common" terminals of the two output strips. To do otherwise would result in an "out-of-phase" condition between the two speakers which would tend to reduce the stereo effect under certain program conditions.

If you plan to use two speakers of different model number or manufacture, you will have to "phase them out" before connecting them to the switch box. By applying the voltage from a small flashlight

battery to the terminals of each speaker, it is a simple matter to determine that connection which results in similar motion of each cone. Label the terminals + and -, and connect the same signs to the common, and the opposite signs to SPKR 1 and 2.

Added Flexibility. From the schematic it is easy to see the various modes of operation available. With the lever in the first position, amplifier 1 will feed both speakers. In the middle position, amplifier 1 feeds speaker 1 and amplifier 2 feeds speaker 2 for stereo listening. If you find the strings and tympani reversed, just flick the normal-reverse switch to the position which corrects this.

Finally, the third position of the lever results in amplifier 2 supplying both speakers. This, of course, doubles the number of available inputs for monophonic listening with two speakers and lets you have compatible stereo at the same time. —30—

Electronic

Garage



ELECTRONICS is taking all the fun out of life. For instance, who would deny that the great joy of the garage attendant is the "kicks" he gets in manhandling an auto's transmission, brakes—and perhaps fenders—in parking the car?

Now, Swiss engineers, those killjoys, have developed an electronic garage that takes all the thrill out of parking an automobile, although the insurance companies may breathe a bit easier.

A car arriving at the Basel "Autosilo" is assigned to a receiving bay by the control

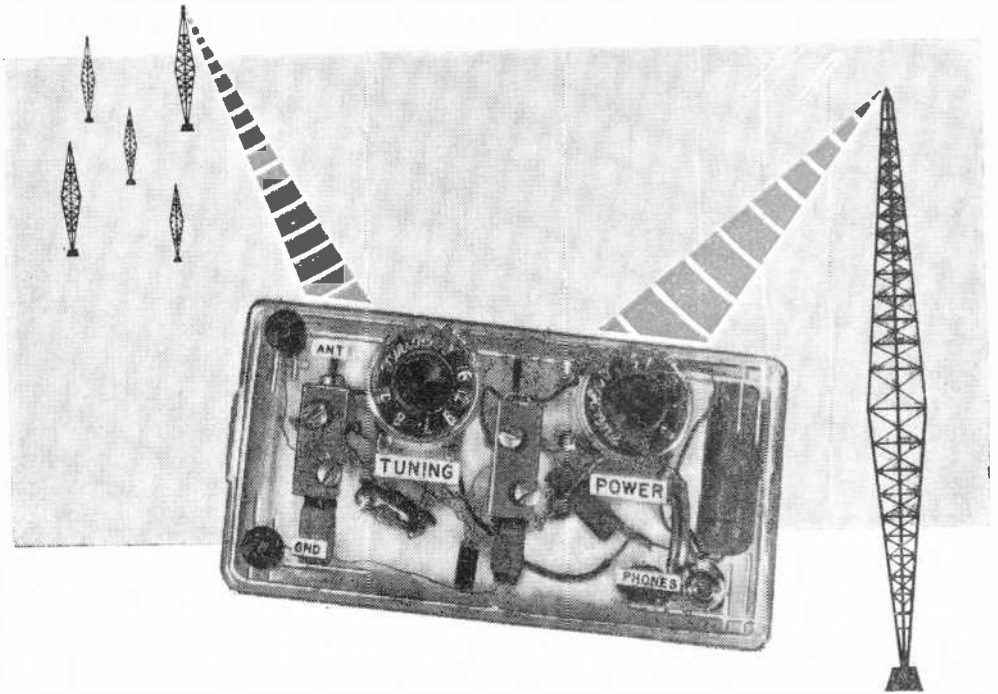
desk. After putting the car in the bay (photo at left), the driver pushes a button and electronics takes over. Electrical impulses open and close doors, cranes and conveyors gently lift and deliver the car to the designated floor and exact spot at which it is to be parked.

When a customer calls for the car, the entire process is reversed. As the auto reaches the delivery bay, an automatic computer (see top photo) tallies the exact time it was parked at the garage. The cost is only one franc (25 cents) for the first hour, and half a franc for each additional hour.

A vast network of automatic safety devices was installed in this system of cables, conveyors, lights, switches and buttons. Each operation is electrically and mechanically checked before it continues into the next phase.

—30—

"Stolen Power" Transistor Radio



**Power from one local station can operate transistor amplifier
to boost signals from the other stations**

By J. R. MACK

TRANSMISSION and reception of electrical power without wires has been one of man's dreams since the days of the first spark-gap transmitter. However, despite laboratory demonstrations, practical application of usable broadcast power had to await the era of the transistor. Because the transistor requires so little power, it can be operated from unusual voltage sources.

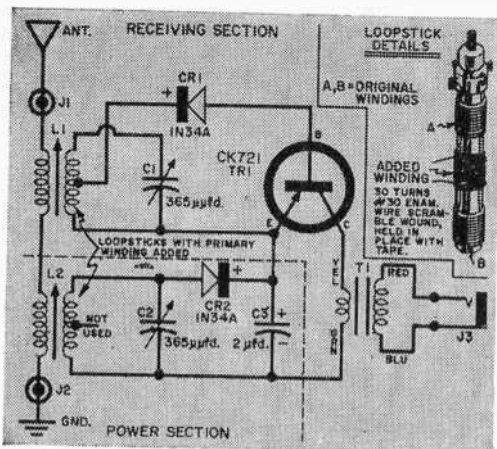
An ordinary receiving antenna can pick up several hundred microwatts of radio-frequency energy from a station in a strong-signal area. If this r.f. power is converted to a d.c. voltage, it will be sufficient to oper-

ate a low-current-drain transistor audio amplifier.

This, in turn, can amplify the audio output of a crystal detector receiver which can be tuned not only to the station being used for power, but also to other stations within its range.

Construction. The stolen-power ear-phone radio can be built, with plenty of room to spare, in a 6" x 3" x 1½" plastic case. All drilling should be done from *inside* the cover, and with very little pressure, to avoid cracking the plastic.

Antenna coupling windings must be added to *L1* and *L2* as shown; leave ends



Note in schematic of "Stolen Power" receiver at left that the primary of T1 is connected to J3; this transformer provides proper match for a crystal earphone. Observe polarity when installing diodes. Rear view of receiver below shows general parts layout to be followed.

about 4" long for wiring into the circuit. One end of the new *L1* winding goes to *J1*, while the other is soldered to one end of the antenna winding on *L2*. The free end of this winding is then soldered to the *Gnd* jack (*J2*).

The coils are fitted into the brackets supplied and the brackets are mounted with small 6-32 screws. Although the coils have tunable slugs, they do not require adjustment.

When the crystal diodes are installed, be sure to observe polarity and avoid overheating. The output transformer is a crystal microphone-to-transistor type, connected backwards.

Operation. A good ground connection to a water or steam pipe is a necessity. The longer the antenna used, the greater will be the d.c. power and the louder all stations will be.

In strong-signal areas, this set has worked well with a good ground and the antenna clip connected to a tall metal lamp or metal kitchen cabinet. For best results, an outdoor antenna from 50 to 100 feet is recommended.

Tuning the receiver is a little tricky since both the *power* and *receiver* tuning capacitors must be individually set. Slowly tune *both* *C1* and *C2* through the broadcast

band. When a station is picked up, leave the *receiver* set and "sweep" the *power* tuning slowly across the band until you hit the point where the received station comes in at maximum volume. Leave the *power* knob set and retune the *receiver* to the desired station.

The receiver is most effective within a few miles from the station used for power, depending on your antenna length and efficiency. Further away, there may not be sufficient d.c. voltage output to power the transistor audio amplifier, but again, this also depends on your antenna.

PARTS LIST

C1, C2—365- μ fd. miniature tuning capacitor
C3—2 μ d., low-voltage metalized paper capacitor (Astron)

CR1, CR2—IN34A crystal diode

L1, L2—Loopstick antenna coil, tapped for transistor, for use with 365- μ fd. tuning capacitor (Lafayette MS-299)

J1, J2—Pin jack

J3—Miniature phone jack

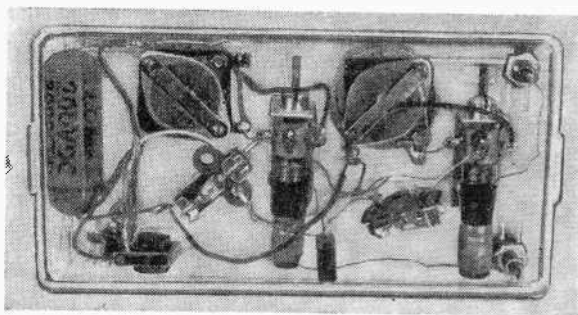
T1—Miniature transformer; primary, 100,000 ohms; secondary, 1000 ohms (Lafayette TR-97 or the equivalent)

TR1—CK721 transistor

1—Plastic case with removable cover

1—Crystal headset (Lafayette MS-369)

1—6' length of #30 enamel-covered wire for added windings on *L1* and *L2*



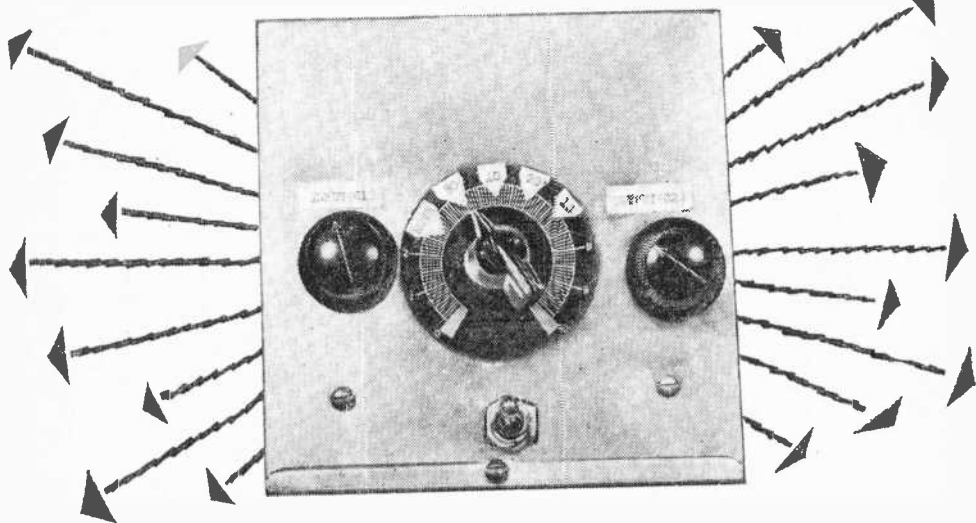
HOW IT WORKS

The receiver has two sections: (1) a *power* section which is tuned to the strongest local station and converts the r.f. energy to a d.c. voltage; and (2) a crystal detector *receiving* section with a transistor audio amplifier (*TR1*) operated by the d.c. supplied by the *power* section.

Power Section. The powering station is selected by modified loopstick antenna coil *L2* and tuning capacitor *C2*. Crystal diode *CR2* rectifies the r.f. signal and builds up a d.c. voltage across filter capacitor *C3*. The positive d.c. voltage from the power section is fed to the emitter, while the negative d.c. is connected to the collector through output transformer *T1*.

Receiving Section. Coil *L1* (also with a special winding) and tuning capacitor *C1* tune to the desired listening station. The station listened to need not be the same as that tuned by the power section. The received signal from the tap on *L1* is rectified by *CR1*, and is applied to the base of *TR1*.

**Put
PEP
in your
Antenna Tuner**



By **JOSEPH W. DOHERTY, K2S00**

**The coupler you built last November grows up with
just a few extra parts**

IF YOU BUILT the *pi*-section receiver antenna coupler described in November 1957 POP'tronics ("Soup Up Your DX with an Antenna Tuner"), here is a worthwhile addition you can make at slight expense and in little time.

If you have not yet built the coupler, you can put together the complete unit in one evening. It is sure to pay extra dividends in improved reception. As a matter of fact, this unit, which started out as a simple antenna tuner and grew into a preselector and signal booster, can make your old receiver practically jump right off the table.

It combines the impedance-matching properties of the *pi*-network coupler with a signal booster amplifier. The power supply is self-contained but, if desired, an

external supply can be used. No expensive components are required and the layout is extremely simple.

Design Features. This signal booster will provide amazing improvement even in a well-matched antenna system. There is a band selector switch position which allows you to bypass the coupler without having to disconnect the antenna and reconnect it to the receiver.

The power supply is of the a.c./d.c. type. However, neither leg of the line is connected to the chassis, thus eliminating the shock hazard associated with power supplies of this type. The rectifier is a silicon diode #1N1084 which comes complete with mounting hardware and 10-ohm resistor in the Sarkes Tarzian Replacement Kit #M150. Any other type rectifier with a

20-ma. or higher rating may properly be substituted.

To conserve space, a resistance-type line cord was used. Take care not to coil or bunch this cord, since it must be allowed to give off heat. Also, do not attempt to shorten it. The built-in resistor is 390 ohms "long."

Construction Details. The original design was modified to accommodate the r.f. amplifier with minimum expense and fewest circuit changes. Follow this procedure.

First remove the original *Bypass* jumper from *S1a*, *S1b*. Disconnect the lead to the junction of *L1* and *C2*. Then disconnect the antenna input lead from *S1a*.

Connect the antenna input lead to the wiper contact of *S1b*. Connect a lead from the 80-meter position on *S1b* to the *S1a* 80-meter position and *S1a* wiper. Now connect the *Bypass* lead from *S1b* to the ungrounded output terminal and, finally, connect the grid lead from *C3* to the junction of *L1* and *C2*.

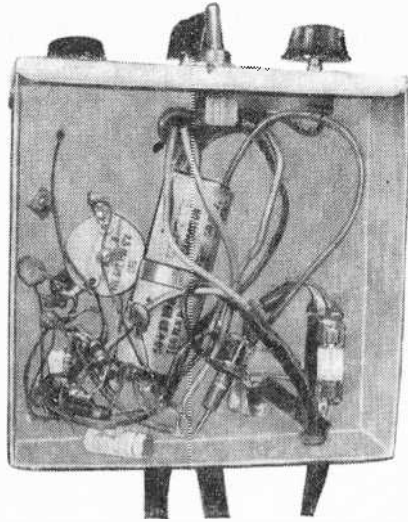
Since there is considerable gain in the amplifier, it is recommended that the input and output leads be kept well separated or oscillation may result. As an example of the gain obtainable, one station heard in the bypass position was read on the receiver S-meter at "S6." The preselector raised this same signal to 40 db over "S9," thus pulling it well out of the noise.

The coupler should be grounded to a cold water pipe or similar good ground. If the receiver used is of the a.c./d.c. variety, connect the coupler output terminals to the receiver antenna terminals *only*.

Tuning the Preselector. Tuning is not difficult if you remember that *C1* is the loading capacitor and *C2* is the frequency-determining capacitor. There is some interaction between the two but, to keep it simple, adjust both alternately for the loudest signal. It is best to start out with *C1* at maximum capacitance, tuning *C2* until the signal is loudest. Keep in mind that the bandswitch must be in the proper position.

Decrease the capacitance of *C1* gradually until the signal starts to fade. Re-adjust *C2* for the loudest signal. If the signal has increased, decrease *C1* still further and repeat the process until the greatest signal strength is achieved.

In most cases, a point will be reached where advancing *C1* will cut the signal



HOW IT WORKS

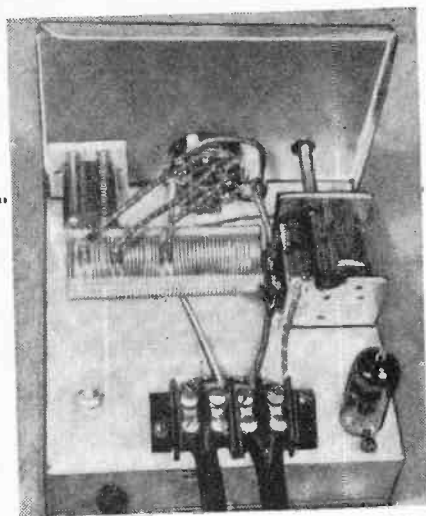
The *pi*-network coupler is the tuned grid circuit of the 6AG5 tube. An untuned plate circuit is used to prevent oscillation. The output is resistance-capacity-coupled and fed directly to the receiver input terminals where it may be peaked by the receiver input circuits, depending on design.

Choke *RFC1* maintains a high impedance to ground in the grid circuit of the amplifier, and provides a grid return circuit. Capacitor *C3* provides an r.f. grounding path from the negative side of the power supply.

PARTS LIST

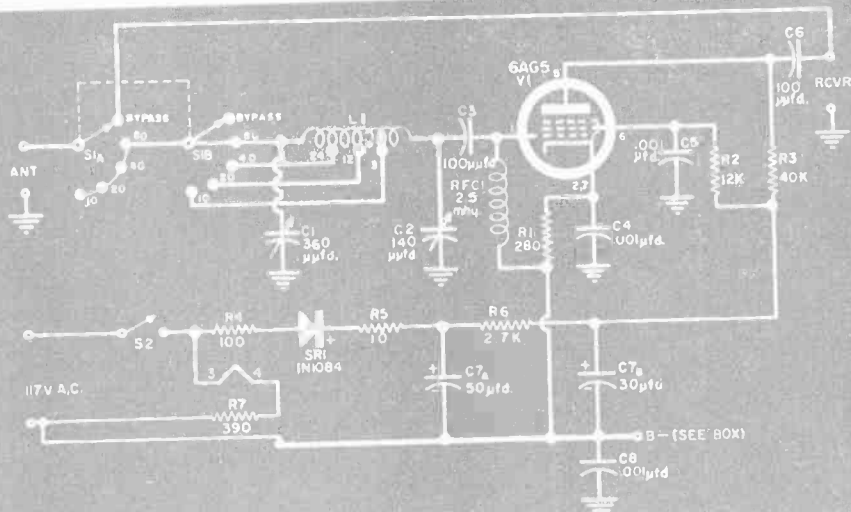
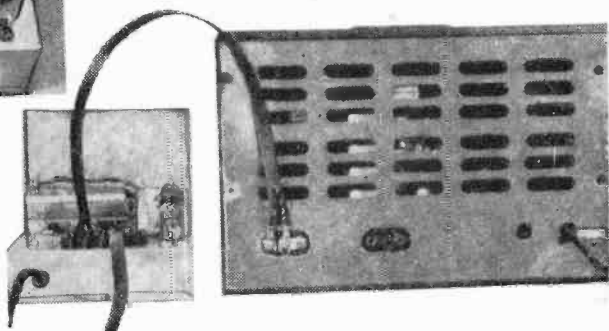
- C1*—360- μ fd. variable capacitor
- C2*—140- μ fd. variable capacitor
- C3*—100- μ fd. disc ceramic capacitor
- C4*, *C5*, *C6*—0.001- μ fd. disc ceramic capacitor
- C6*—100- μ fd. disc ceramic capacitor
- C7a/C7b*—50-30 μ fd., 150-volt electrolytic capacitor
- L1*—3" x 1" coil (B & W Miniductor #3015—48 turns, tapped as shown in schematic)
- R1*—280-ohm, 1/2-watt resistor
- R2*—12,000-ohm, 1/2-watt resistor
- R3*—40,000-ohm, 1/2-watt resistor
- R4*—100-ohm, 1-watt resistor
- R5*—10-ohm, 1-watt resistor
- R6*—2700-ohm, 1-watt resistor
- R7*—390-ohm resistance line cord (JFD #2190)
- RFC1*—2.5-mh. r.f. choke
- S1*—2-p., 5-pos. shorting switch (Centralab #1404)
- S2*—S.p.s.t. toggle switch
- SR1*—Silicon diode Type 1N1084 (Sarkes Tarzian—see text)
- V1*—6AG5 tube

strength in spite of adjusting *C2*. This point is just beyond optimum coupling, which means that the antenna is over-coupled. At this point, rotate *C1* in the other direction slowly while adjusting *C2* through resonance until the optimum adjustment is found.



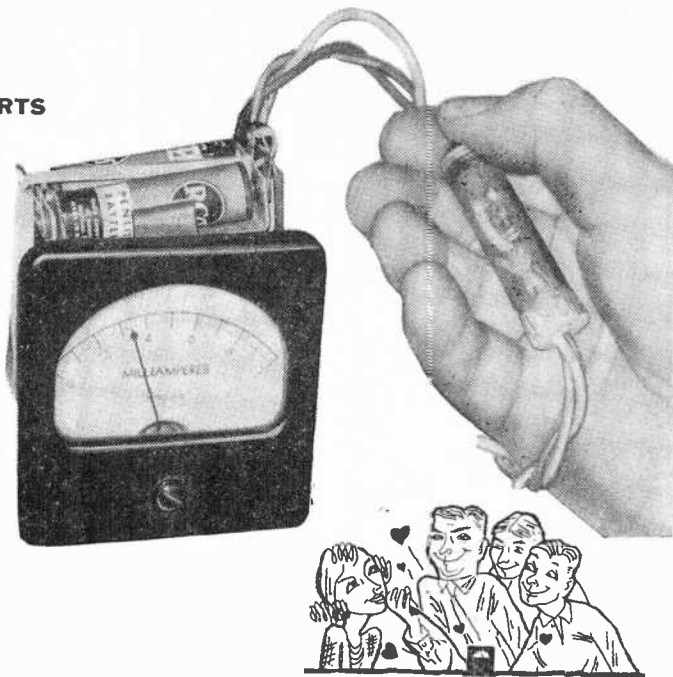
NOTE: While we normally bar a.c./d.c. chassis projects because of the possibility of shock hazard, in this case—since the antenna preamp was built up from an earlier project on the same chassis—using a transformer would have been difficult due to lack of space. While all B— points are raised above chassis ground, there is still some possibility of leakage. Therefore, we advise using an isolation transformer with this project.

THE EDITORS



The B— return shown on the schematic must be kept above chassis ground; this can be done by using a tie strip as return point. Note that R7 is the line cord dropping resistor, SRI and R5 are included in the replacement kit as indicated in the text. Photo on opposite page shows completed under-chassis wiring. Photo at top left shows top of tuner, while photo above indicates proper method of connecting tuner to receiver's antenna input.

By JAMES A. McROBERTS



Liven Up That Party...

With a "Warmth Meter"

WHEN the small talk has dropped, the refreshments have run low, and you're biting your nails to think of some way to pep up your party, drag out the "Warmth Meter." It's guaranteed to put sparkle into that get-together. Handled properly, it is also possible that this inexpensive little device can build up your reputation as a Casanova in modern dress.

Most of the parts, except the transistor and its socket, will probably be available in your junk box. Meter *M1* is a standard 0-1 ma. d.c. type. The two penlight cells (*B1*) snap into their holder in place of a switch, although you can add a switch if you wish. As you can see from the schematic on page 124, the circuit is quite simple.

It Shows Warmth. The transistor changes resistance when it is heated by fingers held against it. More collector current flows, which can be interpreted as the 'warmth' or 'lovability' of an individual. The meter reading will increase slowly since the G.E. 2N107 has a thermal lag of about 10 seconds to applied body heat.

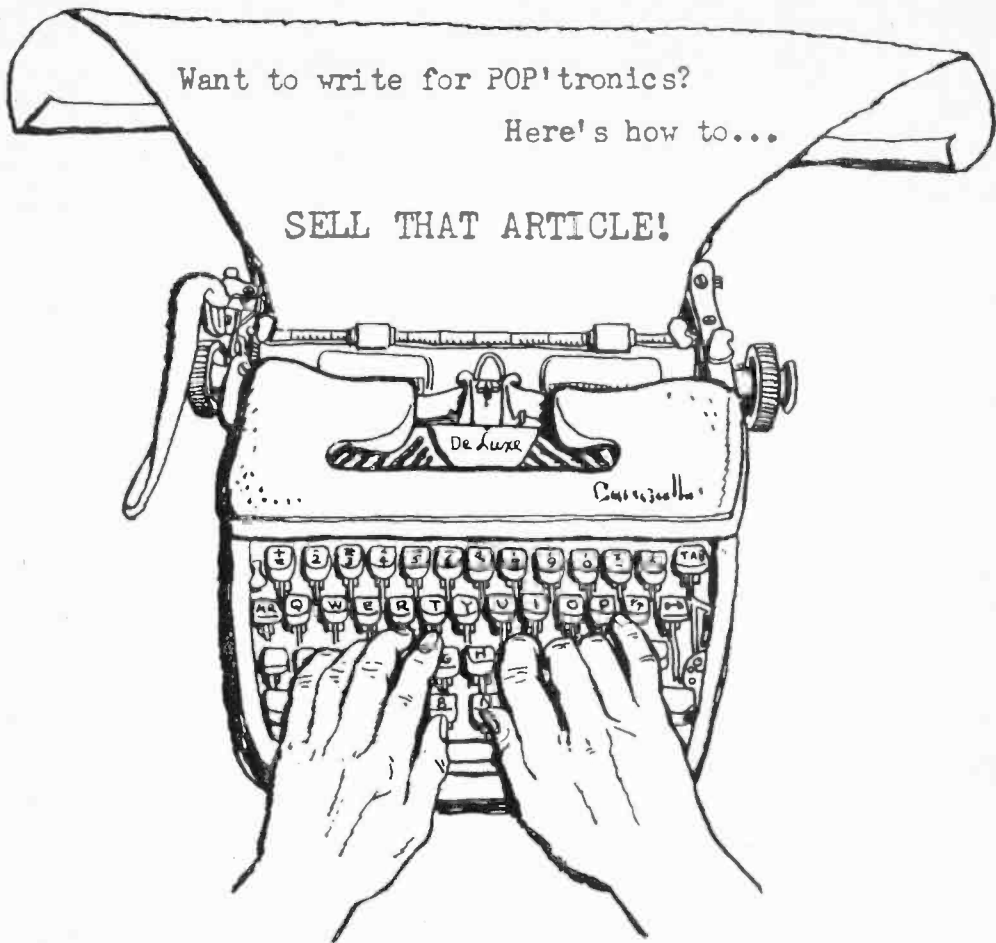
A single transistor measures the temperature of your guests' hands . . . with a gimmick!

Good thermal contact with the transistor shell will raise the reading from 0.25 ma. to about 0.6 ma. at normal room temperature. The rise will vary with the individual. It will drop back slowly when the hand is removed.

Transistor *TR1* is housed on the end of its own shipping case, a plastic tube. The base resistor (*R1*) and transistor socket are in the plastic tube, too, as well as the 100,000-ohm resistor (*R2*). The latter resistor and a lead from the base extend to two contacts on the side of the plastic case.

There's a Gimmick. By shunting these two contacts, the meter reading can be in-

(Continued on page 124)



By RICHARD J. SANDRETTO

PERHAPS you have designed an unusual electronic device, found a new application for old principles, or would like to write about some practical procedure that you have found successful. Yet, you may have hesitated to do so for lack of incentive or knowledge of article writing technique.

Incentives. Three incentives are apparent: money, prestige, and experience. The rate paid for an article upon acceptance depends on its length, the number and quality of drawings and photographs, the publisher, and finally, the amount of editorial work needed to adapt the article to the publishing requirements of the magazine.

Prestige is the second motive for writing. Employers of technical personnel usually

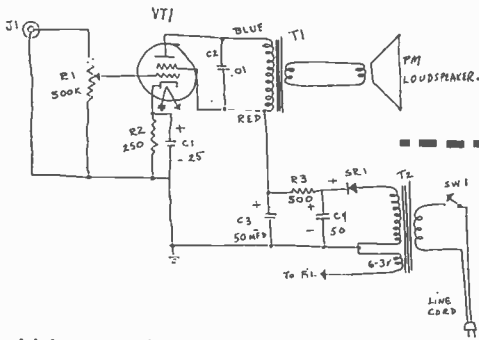
respect this evidence of an employee's aptitude and sincerity of interest in the electronics field. And you, as author, will get a feeling of accomplishment when your original work appears in print.

The final incentive is experience. The ability to express thought efficiently in a manuscript transfers to academic and on-the-job report writing. Experience also makes your later manuscripts more valuable.

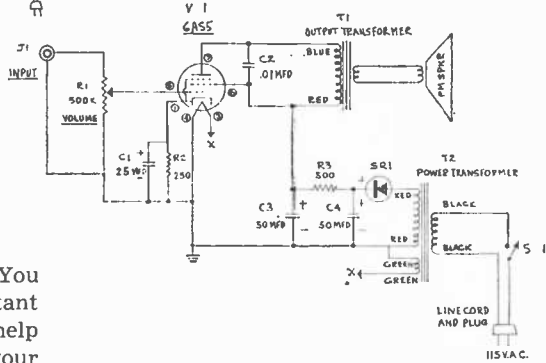
Choosing Material. Your subject must be suitable. It must have mass appeal. It should be either practical or very novel, although sometimes an exceptionally humorous article is published primarily for its value as humor.

Having a valid subject, you must decide





Wrong way (left) and right way (below) to draw a schematic diagram. Use of an inexpensive plastic drawing guide with punched electronic symbols will simplify the job.



which magazine your article would appeal to most. Magazines are written and planned for somewhat different readerships. Your choice will influence the way you construct your article.

An outline which lists in orderly sequence the details to be discussed can be a powerful aid in arranging a mass of material into orderly form. You can check it to make sure that no important omissions have been made. And it will help to anticipate and answer any questions your readers may have.

The Text. Every article should begin with an introduction stating exactly what the article is about. It must also make a strong appeal for the reader's interest. No reader (or editor) will continue to read what promises to be disinteresting material.

The text must be written clearly and concisely, not overwritten. Avoid lengthy sentences. Even when they are grammatically correct, they tend to confuse the reader. Examine each word and phrase; omit those that are superfluous. Editing time that you can save adds to the value of the manuscript. If it is the magazine's policy, use appropriate subtitles.

Your manuscript should be neatly typed, double-spaced, on 8"x10" white paper, with wide margins to allow ample space for editing. Use triple spacing between paragraphs for clarity.

The title page should contain your name and the approximate number of words in the text. You should also include a synopsis for the editor so that he will know at a glance whether or not the subject matter is suitable for his magazine.

All pages of the actual manuscript should be identified: your name and address in the upper left-hand corner and the title and page number in the upper right is good practice.

"SELLING" POINTS TO REMEMBER

1. Your subject should be unusual, new or practical, and have mass appeal.
2. The introduction should state exactly what your article is about, and make a strong appeal for reader interest.
3. The text must be clearly written and concise.
4. Manuscripts should be neatly typed with wide margins to allow space for editing. Number and identify all pages.
5. Include a synopsis for the editor.
6. Follow the magazine's policy with regard to style and presentation.
7. Diagrams and drawings, when necessary, should be accurate, complete and neatly drawn.
8. All illustrations should have adequate captions.
9. Clear, glossy enlargements of photographs will increase the value of your article. Use "human interest" whenever possible.
10. Check the manuscript, schematics and/or drawings carefully before submitting your article.

Keep a carbon copy of your manuscript. The original could get lost, or more likely, the editor may want to inquire into the text further while holding the original.

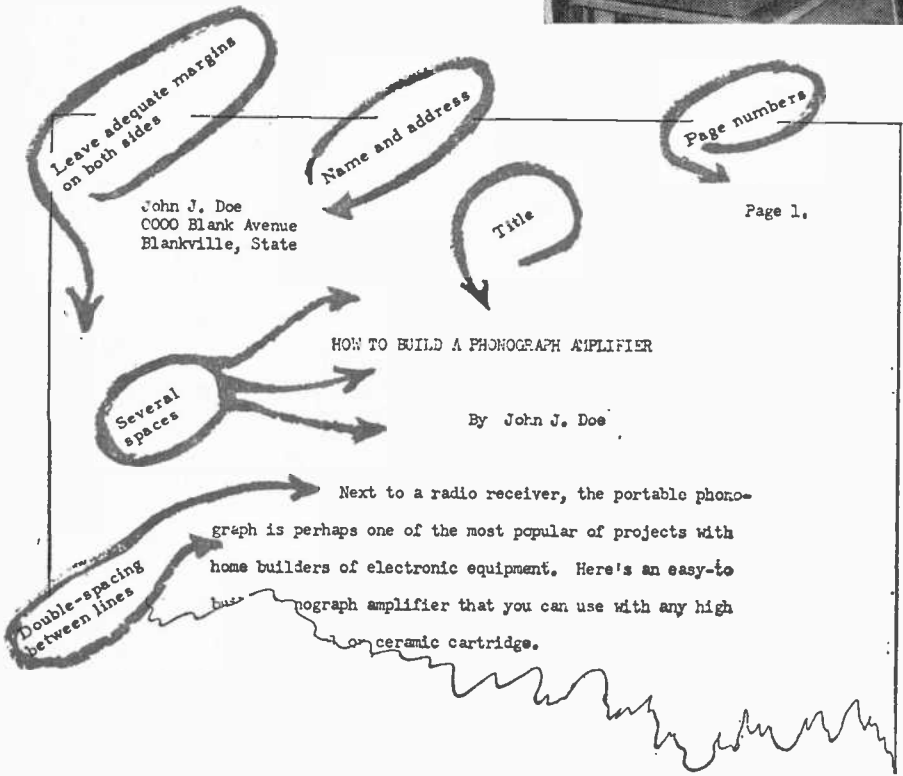
You will notice that many construction articles in POPULAR ELECTRONICS include a separate "How It Works" box which briefly summarizes the technical theory or operating details of the circuit. A separate page

of the manuscript should be used for this purpose. This is an example of writing in keeping with a magazine's policy of presentation.

Diagrams and Drawings. Nearly all electronics articles require schematics and parts location diagrams. These can be



The author at work (right). Sample page below shows a few of the details to be kept in mind when preparing a manuscript.



drawn on ordinary typing paper, but better ones are made on heavy, white 8"x10" drawing paper, available in tablet form.

Neatness is essential, and a two-dollar plastic drawing guide having punched electronic symbols will prove helpful. These can be purchased at drafting supply stores and book stores. Drawing can be done in pencil, and followed by careful inking, although the latter is not essential because drawings are redone by the magazine staff to insure uniformity.

Some magazines use separate parts lists; others include the values on the schematic. If needed, a parts list should be typed

(double-spaced) on a separate sheet of paper.

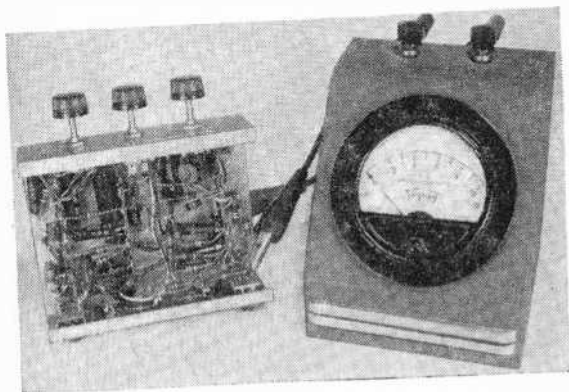
An article describing the construction of a speaker enclosure or other cabinetwork must include dimensioned drawings, plus a separate "Bill of Materials," which is a list of the dimensions, kind of wood, and number of pieces of each size of wood required.

All illustrations should have fairly comprehensive captions which tie in with the text discussion. This is especially true of photographs.

Photographs. These are *very* important. They sell the article first to the editor, then to the reader. Snapshots can be

sent, but enlargements, which are easier to reproduce, will increase the value of your article. You might inquire as to a particular magazine's policy in this regard if it is necessary to have them done commercially. POPULAR ELECTRONICS prefers either negatives and contact prints or 8"x10" glossies.

Photos are most interesting when they contain "human interest," such as an attractive young woman or man shown using a device. This puts an element of action

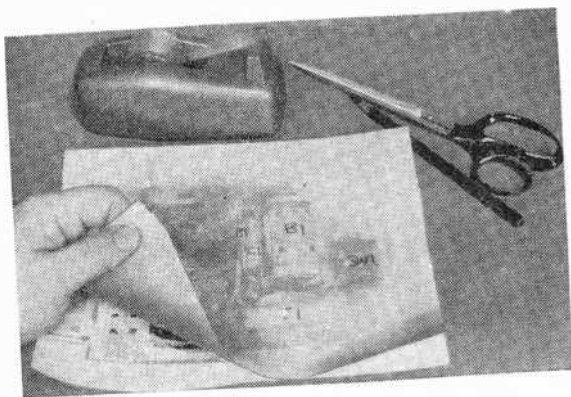


are best taken by positioning the unit against a diffused light-colored background such as a pastel-colored blanket, so that the background is unobtrusive and may be easily masked out in any photo retouching work done by the magazine staff.

One way to identify an enlargement is to type out the caption and attach it securely to the bottom of the photo with a piece of Scotch tape. If you prefer to list your captions on a separate sheet, be sure to indicate on the back of the photo the caption which applies to it.

Any text reference to a part shown should be indicated by a call-out sheet placed over the enlargement. This is a sheet of tracing paper, available in tablet form, which is used to point out part

Good photographs are a must. Note clarity of meter dial at left. Circuit parts should be located on a call-out sheet (tracing paper) which is attached to internal view of chassis with a strip of Scotch tape.



into the picture. A close-up of a small control unit being held in someone's hand to give size comparison would be another example.

If you want to submit a construction article, a minimum of four photographs should be included: one showing the unit in use, two internal views (top and bottom or side), and a close-up of construction details of particular interest. The latter can be omitted if the described unit is fairly small because sharp enlargements of internal views give full construction details.

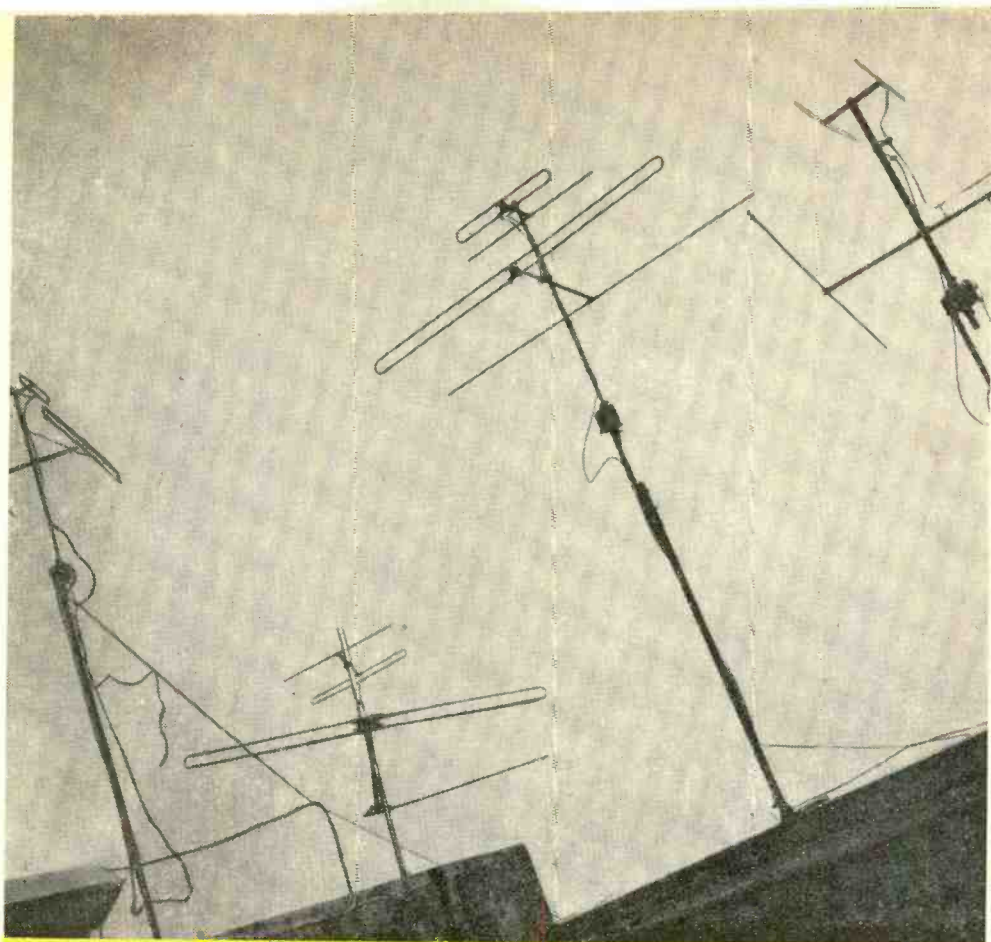
Take all views as close up as possible while maintaining sharpness. Internal views

locations. Prevent indentation of the enlargement by removing the sheet while marking it.

Final Steps. After you have finished your article, proofread the manuscript. Then check the schematics and/or dimensioned drawings for accuracy and completeness.

Type a letter of introduction stating any unusual reasons for having written the article, and place this with return postage on top of the orderly arranged manuscript. Clip everything together with a large paper clip and insert the material along with one or two 8"x10" pieces of corrugated cardboard into an envelope addressed to the attention of the managing editor.

Finally, send your completed manuscript via first class mail and await an acknowledgment of its receipt. It won't do any harm to keep a hopeful eye on your mail box. Electronics publications welcome new authors.



Turn It - for Better Pictures!

***Aim your TV antenna directly at transmitter to eliminate
ghosts and weak signals that mar reception***

A TELEVISION set can give top performance only if adequate signal level is present at its antenna terminals. There seems to be a growing tendency, however, for set manufacturers to minimize the need for antennas and proper installations, and to point up portability and set quality.

Under certain conditions, this is fine, and good pictures are received, but in many locations picture quality is poor on one or more channels. The finest TV set can only handle the signal that is fed into it, and if this is poor, the resultant pictures leave



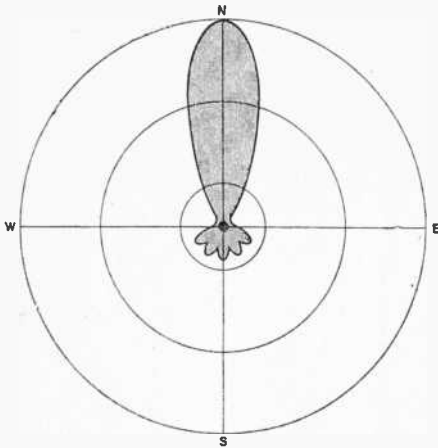


Fig. 1. Typical reception pattern of a directional antenna. Because the antenna is so highly directional, it is very important to get the lobe pointed "on the nose" for top reception.

a great deal to be desired by the viewer.

Good antennas properly designed for present-day channel allocations are available at reasonable prices. So are the hardware and accessories necessary to make a neat, efficient installation with plenty of signal outlets—so that the set can be operated almost anywhere and will give a good picture. In many locations, this means the installation of a rotator under the antenna so optimum signal can be obtained from every available channel.

High-gain antennas today have very sharp, directive pickup patterns. (See Fig. 1.) These provide many advantages: more signal strength; less interference from other stations on the same channel, but in a different direction; much less pickup of noise or interference in the vicinity of the TV set. The more directive the antenna, the more necessary is the use of a rotator to point it in the proper direction to make full use of these advantages.

What Rotators Are. Essentially, an antenna rotator consists of a small control unit located at the set, and a motorized rotating assembly attached to the mast supporting the TV antenna, plus the required multi-conductor cable joining the control unit and rotator assembly.

Good rotators are available in a number of shapes and sizes—the major difference being the ability to handle various sizes and weights of antennas. The smaller units are suitable for single-bay antenna arrays

that weigh up to 20 pounds or so. More powerful units can handle larger arrays or multiple antennas weighing up to 150 pounds. As the latter units hold any antenna better when subject to wind, they are to be preferred in those areas where storms are prevalent.

Although rotators themselves vary little in basic design, their associated control units usually offer a choice of models which can be classified as follows:

- **Automatic type:** this model adjusts itself to preset directions. The TV viewer sets the control knob or pointer at the desired direction, and the rotating assembly automatically points the television antenna in the correct direction, then stops.

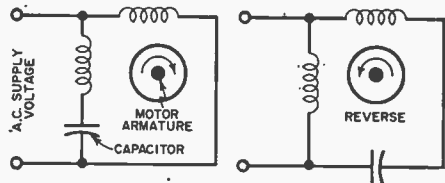
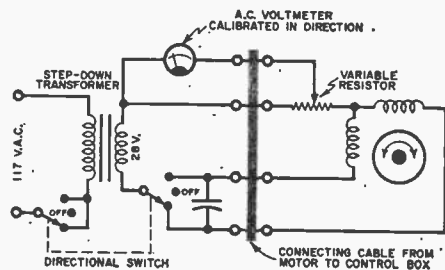


Fig. 2. Note how motor will reverse when capacitor is put in series with line.

Fig. 3. All the features of a modern rotator are indicated in this schematic.

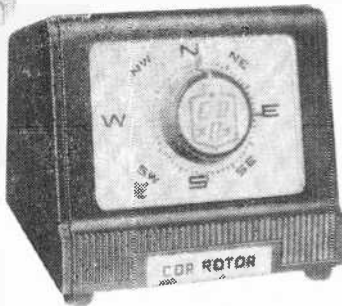
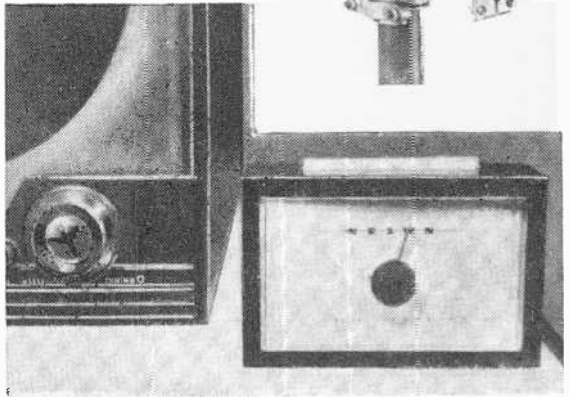
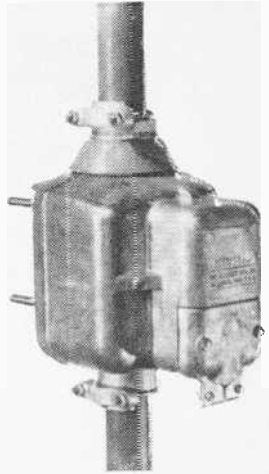


- **Direction indicator type:** this model operates as long as the unit is actuated until the desired direction is achieved, as indicated on the meter of the control unit. Rotation stops when the control is released.

- **Non-indicating type:** this is similar to the direction indicator type except that the viewer visually adjusts the television antenna until the sharpest and clearest picture appears on the screen.

Reversible Motors. Every rotator system uses a low-voltage reversible a.c. motor in the mechanical unit. The voltage sup-

Alliance Tenna-Rotor (right) is sealed against the weather and factory-lubricated for the life of the unit. A typical control unit (below, right) for Alliance rotators automatically indicates compass direction of the antenna, harmonizes with decor of the home.



Cornell-Dubilier CDR rotator, factory-sealed against the elements, is lubricated at the plant and never has to be touched once it's installed. Control box with it also indicates antenna direction.

plied to the motor is kept below 30 volts so that inexpensive, easily installed power cable may be used. Such motors have two windings and three of the leads in the power cable are used so that direction of rotation can be controlled.

The rotator motor is basically a two-phase device. When two windings on an a.c. motor are placed so as to be 90° from each other and the a.c. voltage applied to one of these windings is fed through a capacitor of the proper value, the current

(Continued on page 121)



SO you *had* to do it!" groaned my wife. "You *had* to unearth that miserable flop of a digital-computer-type monster from the basement."

I fanned a fond glance over the dismembered components of "Funiac," spread across the workbench.

"Got a marvelous idea," I admitted.

"I've heard that one before, too." The wife shook her head slowly, negatively. "Talk about your masochistic—"

"Odd that you should use that term," I said, thoughtfully. "Especially since my idea revolves around the theory that a short-cut to a whumping, annual fortune in royalties lies in developing, producing and mass-marketing an electronic counselor! Perhaps that alleged feminine intuition you are continually touting *has* psychic propensities after all!"

"Electronic counselor?"

"Certainly. What with the increasing pressures and problems imposed upon our society, an electronic counselor—installed in public places and, perhaps, even in homes—would prove indispensable to an ever-growing population, most of whom are laden with an excess of doubts, fears and questions regarding their futures, their plans and their present dilemmas." I

smirked roguishly. "Operated by the insertion of a coin—say, four-bits an answer—a horde of Kohler Electronic Counselors would put us in the 90% bracket faster than you could spell out Form 1040 with signal flags, babe!"

"What's old dismembered Funiac got to do with it?" She eyed the makeshift cabinet dourly. "As I remember, Funiac was something of a psychotic machine."

"Cheaper to modify the components in Funiac than to wreak havoc with the so-called budget by buying new ones. Actually, the modification process calls for surprisingly few changes." I tapped my schematics meaningfully. "With a couple of pulse regulators, here, and a new storage gate or two, there—whipsy-tinkle—Funiac has been converted into an entirely different instrument!"

"All your nutty ideas sound like lead-pipe cinches," she observed bitterly. "But I'm still wearing cotton dresses and doing my own housework."

"You'll appreciate being filthily rich all the more for these long years of genteel, middle-class poverty," I declared positively. "Assuming you call a lovely home, a treasury of electric, labor-saving appliances, two closets full of cotton dresses and a small, delightful foreign car definite proof of genteel, middle-class poverty."

"Some wives wear mink and drive Cadillacs."

"Some wives," I returned, "have a little

By CARL KOHLER



faith in their brilliant, persevering husbands."

We left it there.

SIX WEEKS LATER—having reread my books on Boolean Algebra and Advanced Cybernetics to diminish needless errors, and having completed the Counselor—I finished installing the carefully designed components and their cleverly devised mountings and housings in the ball-like cabinet which I had decided upon, that ultra-modern shape being more pleasing to the eye than



the archaic, conventional cabinet previously used. Standing back, I regarded the globular Counselor with some pride.

Just then, the wife arrived with coffee.

"Let's drink to an electronic achievement, and one, I might add, which will put us on the north end of Easy Street once the world is introduced to my masterpiece!"

"Looks mighty like a hi-fi baffle, doesn't it?"

"Mere esthetics," I chuckled. "The real proof of genius is inside! Would you like

the privilege and honor of giving the Counselor its first problem?"

"What must I do?" She trembled, visibly.

"Take one of these specially designed cards, clearly print your question in a single sentence upon it, and insert it into the Counselor. Pretty simple, eh?"

"This gismo reads?"

Her incredulous expression broke me up. After my spasm of uncontrolled hilarity had evaporated, I managed to give her a reasonably plain explanation of the photo-beam relay system that theoretically would translate a written series of symbols into electronic signals which would, in turn, activate the selector-converter and the information-banks.

"Can I write any kind of a question?"

"Sure," I reassured her. "The Counselor is not limited to a single subject. Write anything."

Painstakingly, she hand-printed on the card: *How are things going to be from now on?* I fed it to the Counselor. There were several muffled sounds similar to a short-wave radio with a head cold—then, the electric, portable typewriter inside the cabinet began clacking furiously. A second later, her card dropped out of the instrument.

"Well?" I demanded in an agony of expectation.

She read the card to herself, giggled and handed it over.

You will meet a tall, dark stranger, said the card.

"That's odd," I mused. "Perhaps the selector-converter unit hasn't settled to its cycle yet. Let me give it a try."

Quickly, I lettered: *When will mankind master outer space and interplanetary*
(Continued on page 129)



Electronics Today

Sound cancels out sound in experimental earphones (above) being used by a U. S. Army tankman. With these electronic earmuffs (see inset), the radioman can hear incoming messages clearly even under noisiest conditions. One circular microphone (lower button) picks up noise that leaks through the cushioning and produces a second noise, opposite in phase, which tends to cancel out the first, resulting in relative quiet. The device was developed by the Signal Corps and RCA.

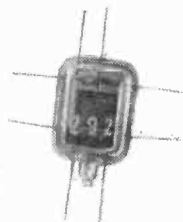


A boon to astronomers is the new RCA intensifier orthicon, which "sees" at extremely low light levels with 100 times the sensitivity of the fastest film. It should aid in discovering details of planets and nebulae heretofore unknown, and should have a wide variety of uses here on earth.

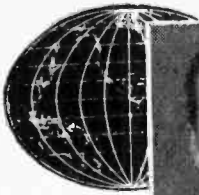
Research to eliminate the problem of metal "whiskers" is being done at Boeing Airplane Company in an effort to increase the reliability of electronic equipment. The crystalline "whiskers" are found on tin, cadmium and zinc surfaces. Invisible to the naked eye, they can actually "grow" through paint and insulation, and often short out circuits. At right, a technician examines such a growth on a potentiometer under a stereo microscope.



The huge steel room above was designed to permit testing of military equipment, including missile components, with a vibration machine weighing 6000 pounds. It is 8' high and wide by 12' deep inside. Installed at the Stromberg-Carlson Electronics Center in Rochester, N. Y., the chamber has a temperature range of -120° to $+350^{\circ}$ F., a humidity range of 20 to 95% and an altitude ceiling of 100,000 feet. These ranges can be extended if necessary.



Electron tubes are getting new containers, as shown at right. These Westinghouse space-saver "match-box" tubes do the same work as conventional types, but are much more reliable and save space in equipment such as computers and TV sets.



Short-Wave Report

By HANK BENNETT

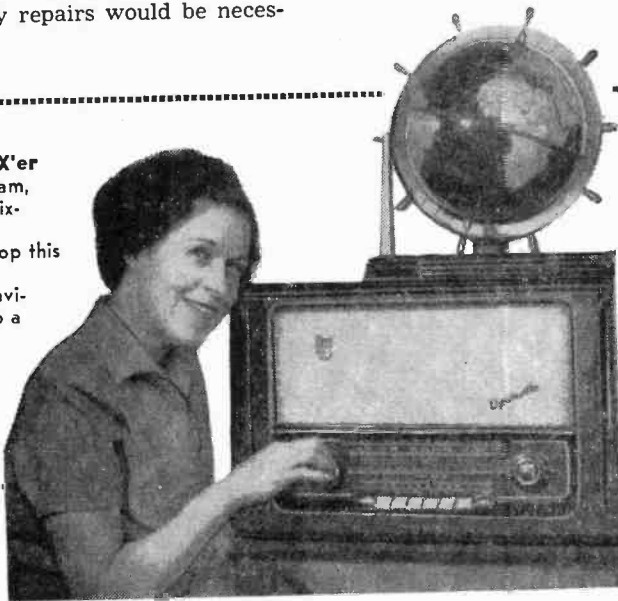
IT ISN'T OFTEN, in short-wave listening ranks, that you find an avid DX'er among the ladies. One of the few that we know is Miss Esther L. Cottingham, of 3508 Altamont Way, Redwood City, Calif., a POP'tronics reporter.

Miss Cottingham, whose chief occupation lies in the journalistic field—she is currently writing for *The Guide to Alaska*—began DX'ing back in 1937 in Oregon. An old Midwest all-wave receiver enabled her to log many short-wave stations. When it appeared that costly repairs would be neces-

sary because of their excellent programming and continually dependable reception throughout the year.

Miss Cottingham puts her best DX under two categories: "distance" and "surprise." In the former she lists ELWA and HLKA. The surprise came about as a result of her hearing a voice news transmission from the "U.S.S. McKinley" on May 17, 1956. This broadcast, basically for the newspapers,

Experienced DX'er
Esther Cottingham, shown with her six-tube Telefunken "Operette." Atop this receiver is a Sonora "Globe Navigator" built into a world globe.



sary, however, she acquired her present six-tube Telefunken receiver, "Operette" model. Coupled to this is a 66' doublet.

Possessing 39 verifications covering 28 countries, Miss Esther has logged 42 countries in all. Her best veries are from Liberia (ELWA) and South Korea (HLKA). Her receiver is usually tuned to the 25- or 31-meter bands (11 or 9 mc.), with *Radio Brazzaville* and *Emissora Nacional*, Lisbon, being her favorite stations

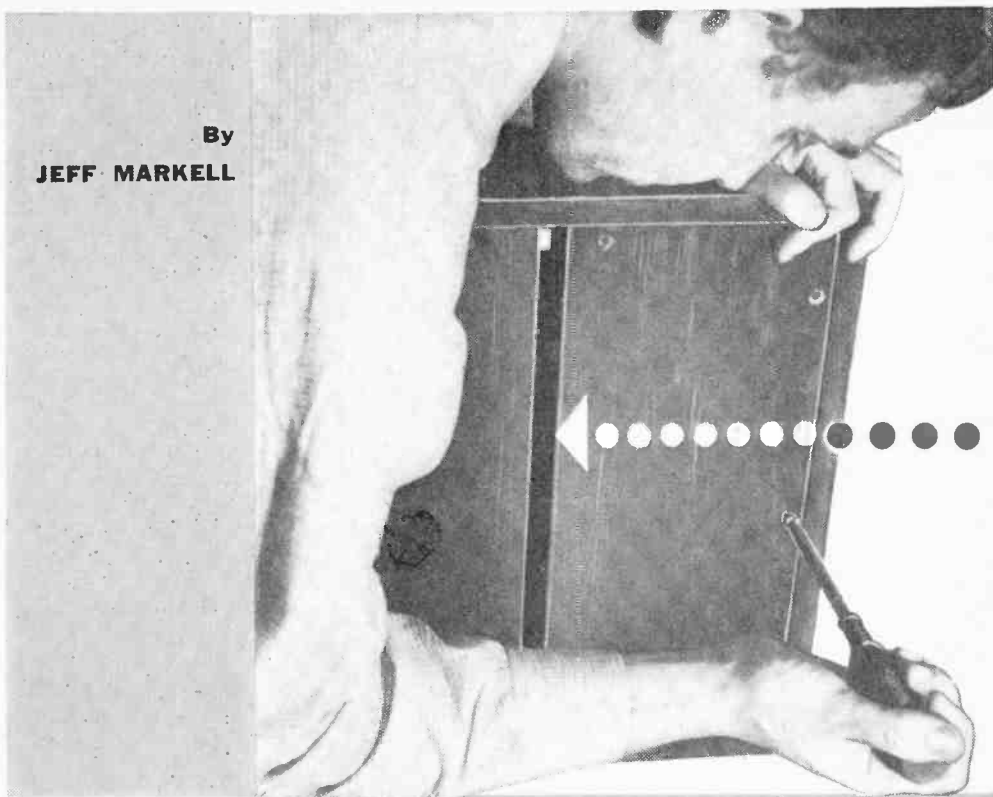
concerned the detonation of an H-bomb in the Pacific Ocean.

In the photograph you will notice a world globe atop the Telefunken receiver. This globe is actually another receiver, although few would recognize it as such. It is a Sonora "Globe Navigator," bought in 1941. Showing shipping lanes, distances, and radio stations, it is a great help in DX'ing, according to Miss Esther.

(Continued on page 137)

POPULAR ELECTRONICS

By
JEFF MARKELL



Slot-Box Your Speaker

***You get BIG sound out of a
small space with this inexpensive and
easy-to-build enclosure***

TO THE HI-FI FAN of modest means and limited room, the problem of acquiring a speaker enclosure that will provide good sound and at the same time occupy a small space is paramount. My solution to the problem is simple, inexpensive, and gives gratifying results.

The entire enclosure measures 16" x 16" x 12" and can be put almost anywhere. You can leave it on the floor, hide it in a corner, or hang it on the wall. It's not very heavy. It could be built in as part of a larger piece of furniture that serves other purposes. Or it could be incorporated as part of a bookcase since it is only 12" deep.

Low Cone Resonance. The unit is designed primarily for use with 8" or 10" loudspeakers of relatively low cone resonance. I have had particularly good results with

the Beam-Stentorian 8" and 10" speakers although there are a good many other suitable ones.

The principle of this friction port enclosure is fairly simple. One of the main reasons a speaker has trouble operating in a completely closed box of small dimensions is that when it tries to make the large excursions necessary to reproduce the bass notes there isn't enough "give" to the small amount of air trapped in the box. As a result, the cone is sharply damped at the low end, and the bass resonance moves up in frequency, thereby causing a rather unpleasant, boomy response.

In this enclosure, before the air pressure inside can build up enough to affect the speaker, air will start moving through the Fiberglas-covered slot in the back. This allows the speaker sufficient freedom of movement at the low end and still maintains a desired degree of air loading.

The slot in the back operates more as a pressure release vent than a reflex port. It will not give your speaker a bass end if it doesn't already have one—which is why you should use a speaker with a low cone resonance. With such a speaker, you will get a smooth over-all response with a clean bass end that is not tubby or boomy.

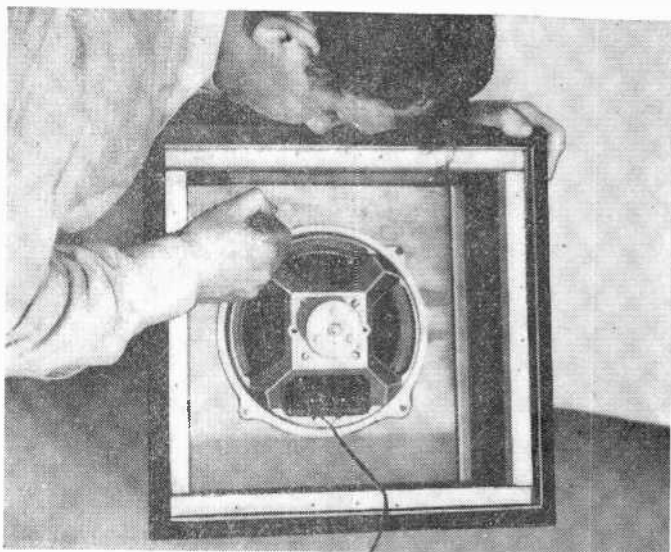
Building the Enclosure. The construction of the cabinet is simple. There are several different ways of jointing it at the corners. If you have equipment available to cut accurate miters, by all means miter the joints. You get a good-looking, professional-type job that way. Otherwise, use a butt joint. It's a matter of appearance, not performance.

Note that the lengths to which you cut your pieces for the top and bottom are the same no matter which way you do the jointing—namely, 16". However, the lengths of the sides will vary depending on the type of joint: miter joint, 16"; plain butt, 14½".

First cut the top, bottom, and two side pieces. Then prepare the ends for joining depending on the type of joints you intend to use. Miter all ends for miter joints, or smooth off the ends for a plain butt.

Assemble these first four pieces to form the basic box, using glue and finishing nails. Then take your molding and make a frame to fit over the front of the box. Attach it with glue and small finishing nails. This time you have no choice—you have to miter the corners. But mitering molding is easy whereas mitering a whole side might not be.

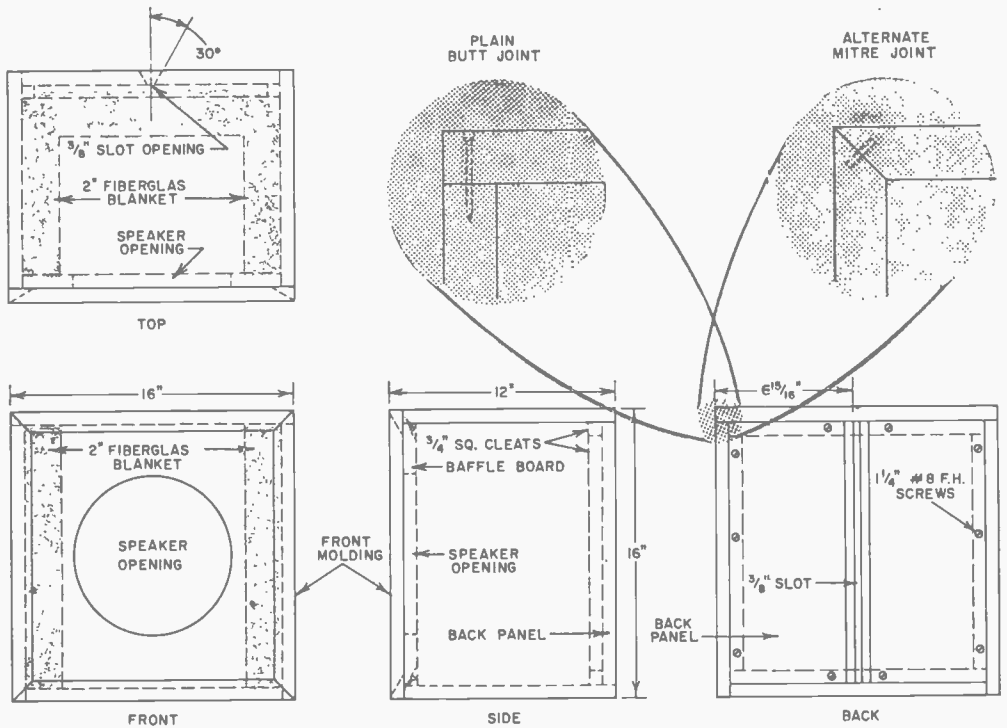
Choose molding to your taste. You will be surprised what a difference it can make in getting this piece to blend well with your furnishings. Be sure the molding overlaps the inside of the box by at least ¼" so that



when you install the speaker mounting board it will have something good and solid to push up against.

Mount the Speaker. Now cut the speaker mounting board. Make it just a shade smaller than 14½" x 14½" on the sides so you won't have to fight to get it in. Cut the speaker opening in the center of the board to the appropriate size for the speaker you plan to use. Most 10" speakers require a hole 9" in diameter; most 8" speakers need a 7" hole.

The next step is to blacken the front of the mounting board and the inside of the speaker hole. Paint or stain will do. This will prevent the speaker from showing up as a dark circle through the grille cloth. After the board is dry, tack or staple the grille cloth to the front of it and trim off the cloth flush with the edges.



Construction diagram above shows how to fit pieces together, and gives two alternate methods for joining. Photo at left shows speaker being mounted in completed enclosure. At right is the final step: installing Fiberglas and "buttoning up" the back.

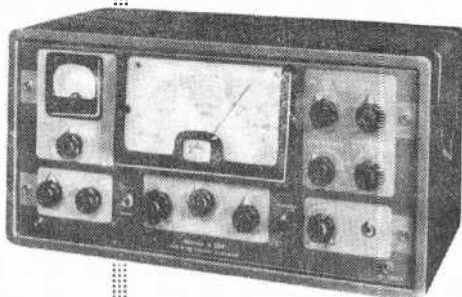
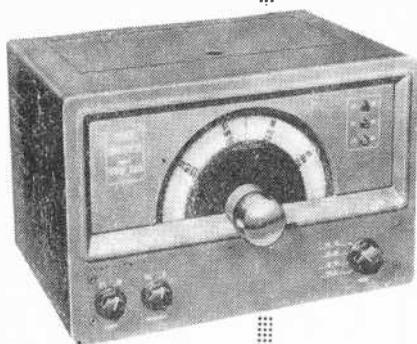
Finish the cabinet before you install the mounting board. Otherwise you may slop stain over the cloth. Then mount the board by screwing diagonally through it into the sides. Be sure it is tight against inside of molding. The material for the $\frac{3}{4}$ " square cleats for the back can probably be obtained as a stock item in a local lumber yard. Install them with glue and nails. When the glue is set, cut out the two back pieces and try them in place to make sure that you have an exact $\frac{3}{8}$ " slot open between them. You will see that the panel edges facing the slot are angled at 30° ; don't fret over a degree or two, but keep them close.

Mount your speaker, insert the Fiberglas



as shown, screw on the back pieces, and you are finished. Note that the Fiberglas is not stapled, glued or otherwise fastened. Just cut it to the right size, shove it in place, and it will stay by itself.

What's New for the Ham and SWL



market is the Geloso G-209 receiver (above). For the 10- to 80-meter bands, this receiver uses 12 standard tubes plus voltage regulator, ballast and dry disc rectifiers. The circuit is a full double-conversion superhet with two crystal-controlled second-conversion oscillators for stable reception of double- or single-sideband signals. A separate crystal oscillator acts as a calibrator for all bands, and there is a noise clipper, a large S-meter, an earphone jack and remote relay terminals. A companion transmitter is also available.

HAMS and short-wave listeners who have been itching to work the v.h.f. bands can lift their sights to these frequencies with the Electro-Voice RME VHF126 converter (top). It works with any receiver that tunes to 7 mc., and will give complete coverage of 1 1/4, 2 and 6 meters. The three bands tune from 48.4 to 54.2, 143.4 to 149.2 and 219.4 to 225.2 mc. It is said that image response is practically eliminated on all ranges. This converter has its own power supply and provides fast or micrometer tuning.

One of the first units of ham equipment manufactured in Europe for the American

The WRL Sidebander DSB100 (left) is available in kit or wired form. It is a band-switching, suppressed-carrier, double-sideband rig covering the 80- to 10-meter bands, with continuous band coverage from 3 to 9 mc. and 12 to 30 mc. Designed for 100 watts PEP double sideband, 40 watts AM phone or 50 watts c.w., it can be used with standard crystals or regular VFO. A minimum of 35-db carrier suppression is claimed on all bands. If one sideband gets QRM, the receiving operator can switch to the other. An internal tone generator facilitates tuning.

-50-

AFTER CLASS

Special Information on Radio, TV,

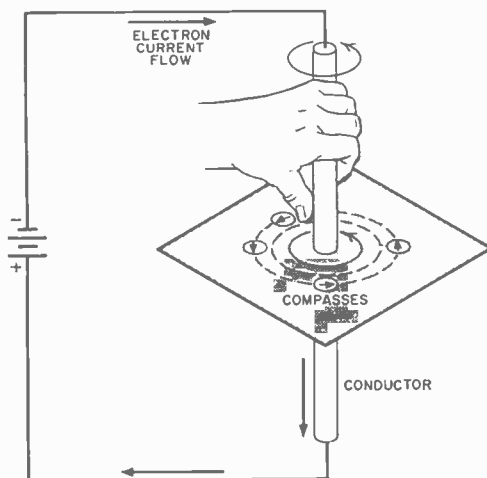


Radar and Nucleonics

SPEAKING OF MAGNETISM—Part 2

WHAT KIND OF FORCE exists between two closely spaced, parallel, current-carrying wires? Are the wires attracted to one another or do they repulse each other? Before we attempt to answer these questions, let's refresh our memories on two simple "hand" rules concerning the direction of a magnetic field due to a current.

Rules of Thumb. The first is Oersted's famous rule: if the thumb of the *left hand* points in the direction of the electron current in a wire, the fingers then encircle the wire in the direction of the lines of force (Fig. 1). Small compasses distributed around the wire show—by the direction in



which their little N-poles point—which way the field is going, and verify Oersted's rule. (If you have encountered this rule given for the *right hand*, it must have been in a book that still employs the old plus-to-minus current flow convention rather than the more modern electron current idea. See *After Class*, June, 1958.)

The second rule of thumb describes the direction of the magnetic field of a solenoid as related to the current flowing in the coil. If the fingers of the left hand encircle the

coil in the direction of the electron current, then the extended thumb will point in the direction of the lines of force produced by the solenoid, as in Fig. 2. To distinguish this from Oersted's rule, it is commonly referred to as the "rule for coils."

Obviously, an electron current traveling *upward* in the conductor of Fig. 1 would produce a clockwise rather than a counterclockwise field in the horizontal plane. If the electron current in the coil turns is reversed, the field direction will also reverse. Both these turnabouts are, of course, predicted by the applicable rule.

Using Field Theory. We now have everything we need to solve magnetic force problems of any type using field theory rather than magnetic poles. Suppose we have two parallel conductors in which current is flowing in the same direction. Looking at these conductors sidewise, they appear as shown in Fig. 3(A).

From this perspective, it is difficult to visualize and draw the lines of force associated with the current. To make the job substantially easier, we will adopt a convention that is now universally accepted:

Fig. 1. Oersted's left-hand rule specifies the direction of a magnetic field which surrounds a current-carrying conductor.

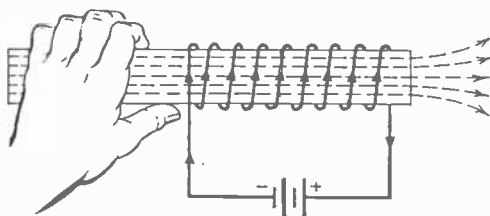


Fig. 2. The left-hand rule for coils is used in determining the direction of the magnetic field due to coil current.

all wires pictured as little circles representing the cross section of the conductor passing through the plane of the paper at right angles.

If the current direction is out of the paper toward the reader, we imagine that he sees an arrow point; thus we designate an outward-flowing electron current by a dot in the center of the circle. For the opposite case, an electron current flowing into the paper away from the reader, we picture a receding arrow whose tail-feathers are visible. We show such a current as a cross (for the tail-feathers) in the center of the circle.

Force Directions. Let us now visualize the two parallel wires of Fig. 3(A) swung through 90° so that they present a cross-

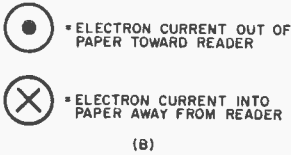
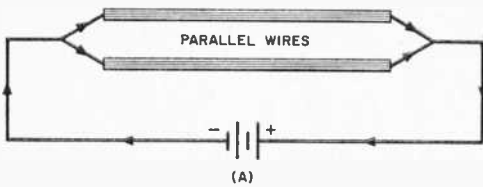


Fig. 3. Two parallel conductors carrying currents in the same direction (A), and cross-section convention (B) for showing electron currents flowing in or out of the plane of the paper.

between the wires, adjacent lines of force have opposed directions, giving rise to an *attractive force* as required by the fourth characteristic of lines of force (see Part 1, August issue).

If you had pictured the two wires of Fig. 3(A) swung around the other way, the electron currents would have had to be shown receding—crosses in the circles as in Fig. 4(B)—and the circular fields would then have been counter-clockwise. Note, however, that this makes no difference in field theory application: the line directions are still opposite between the wires and the force is again attraction.

Fig. 4(C) illustrates the state of affairs when the current flows in opposite directions through two parallel wires. Adjacent lines between the two conductors have the *same direction*; so a force of *repulsion* appears between them as predicted by the second characteristic given for lines of force in Part 1. You can demonstrate these effects by stretching 8" lengths of #32 or #34 wire about 1 millimeter apart and connecting their ends to a 6-volt storage battery; the contact should be momentary to avoid overheating the wires.

These examples lend strength to our contention that polar reasoning must give way to the field approach merely because you cannot work with magnetic poles if you

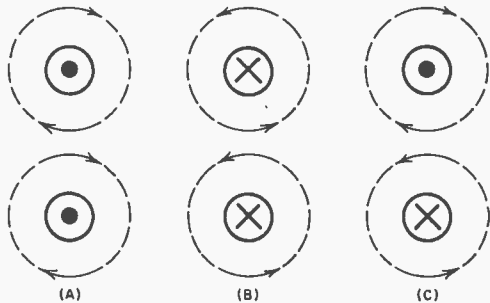


Fig. 4. Both currents flowing out of the paper produce two sets of clockwise fields (A); both currents flowing into the paper produce two sets of counter-clockwise fields (B); and one current flowing into the paper and the other out of the paper produce oppositely circling fields (C).

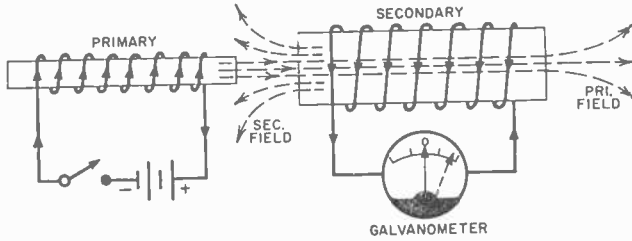
sectional view of two little circles. If the rotation occurs in one direction, the current will appear to be coming out of the paper toward the reader, as in Fig. 4(A). In this case, Oersted's rule tells us that the magnetic field around each wire is clockwise;

can't even find them! Our next example is really the clincher. We will show that with induced currents, the polar attack leads to *two contradictory results*.

Induced Currents. Two coils are positioned end-to-end as in Fig. 5. In series with one of them is a battery and a momentary push button or switch. A sensitive galvanometer with a center-zero scale is connected in the second coil circuit. When the key is momentarily pressed, the galvanometer needle swings one way, say to the

right, and when the key is released, the needle swings to the left.

From the principles of electromagnetic induction, we know that while the magnetic field is building up and out of the first



coil (the primary winding), it cuts through the secondary winding and induces a current. When the key is released, the primary field collapses, cutting back through the secondary coil and inducing a current whose direction is opposite from the first. The direction of the induced current is given by Lenz's law (which, by the way, is merely a re-statement of the Law of Conservation of Energy in electrical terms): *an induced current has such a direction that its magnetic action tends to oppose the motion by which it is produced.*

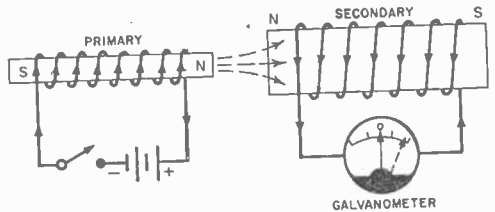
Imagine that the key in Fig. 5 has just been closed so that a surge of electron current occurs in the direction shown. Using the rule for coils given previously, we can say that a magnetic field expands outward from the primary as a result of this current, cutting through the turns of the secondary. The current induced in the secondary coil, according to Lenz's law, must have such a direction that the field it produces *opposes* the initial, expanding field. This current direction—arrived at by again employing the rule for coils—is indicated by the arrows on the secondary turns.

When the primary circuit is then opened, the initial field collapses back into the first coil. This permits us to say that the actual *motion of the field* is now the reverse of what it was when the key was closed. To oppose this motion, the current in the secondary promptly and obligingly turns about and creates a magnetic field toward the right—in other words, it creates a field that opposes the collapse of the primary field.

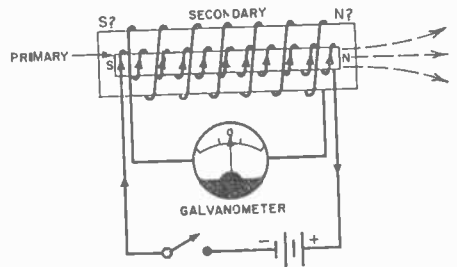
This approach gives the right answer no matter what the relative positions of the coils may be. It works just as well if the

Fig. 5. A primary magnetic field in the process of growing toward the right induces an electron current which causes a secondary field to grow to the left. The galvanometer needle indicates current flow in the secondary coil winding and the direction of the flow.

Fig. 6. With the primary and secondary coils end-to-end (A), polar approach predicts same induced current as field approach, but when primary is inside secondary coil (B), the polar approach gives incorrect induced current direction.



(A)



(B)

primary coil is inside the secondary, outside the secondary, or end-to-end with it.

The Wrong Answer. Now let's see what happens if we try to use polar reasoning. Closing the key causes a growth of the primary field out of the right side of the coil when the windings are end-to-end; this necessitates labeling this side of the coil "N" and the left side "S." (Remember? The N-pole is the side from which the lines emerge.)

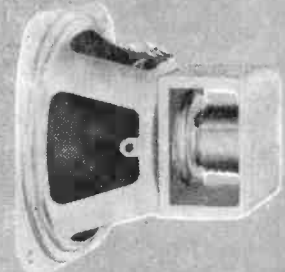
To oppose the growth of an N-pole on the right side of the primary, an induced N-pole must form on the left side of the secondary; since like poles repel, opposition is being produced by repulsion in this instance. See Fig. 6(A). So the answer we

(Continued on page 132)

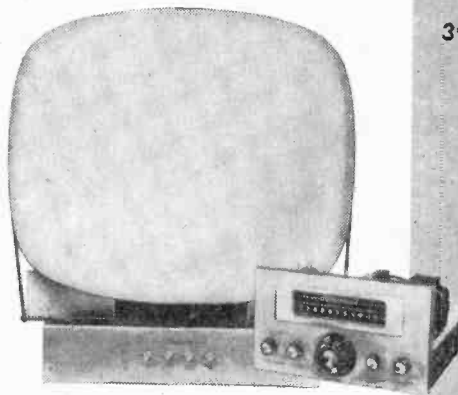
Hi-Fi Highlights

MANY READERS have been writing in to inquire about new and novel developments in high-fidelity equipment that they have heard about. To help supply such information quickly, POPULAR ELECTRONICS presents a roundup of the most interesting high-fidelity accessories crossing our desks in recent weeks. Each brief description is numbered and a box appears on page 125 along with additional items. Just circle the numbers in the box pertaining to the items that interest you and send the box in to the address given. You'll receive complete information on those items.

-30-

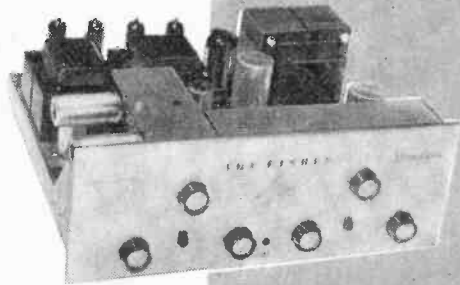


39



40

39 Cone type tweeter with either $\frac{3}{4}$ " or 1" voice-coil diameter for large power applications. This 4" unit has unusually deep housing, and is available in various EIA magnet sizes. Magnavox.



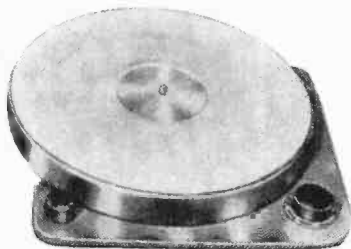
41

40 Remote-control TV system has 4-mc. video bandpass for full definition and cathode follower output to feed audio into hi-fi amplifier. Fleetwood 800.

41 Stereo amplifier-preamplifier with 20-watt output each channel features six pairs of inputs. Eight controls include mechanically ganged but electrically separate audio controls, dual-channel bass-treble controls. Fisher X-101.



42



43

42 Matched arm and magnetic cartridge for stereo said to minimize tone arm resonance effects, cut down crosstalk. Low stylus tip mass, high vertical compliance reduce record wear. Claimed frequency response, 20-20,000 cps. London-Scott.

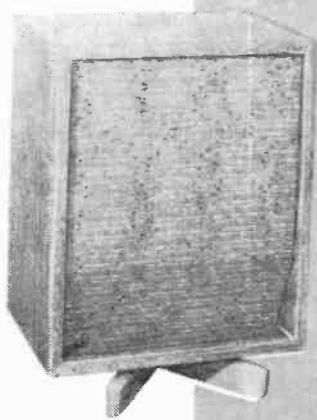
43 Four-speed turntable with 4-pole induction motor rests spindle on single ball bearing. Eddy current brake and free-floating motor mounting, automatic idler disengagement are among features included. Lafayette PK-240.

44 Convertible bass reflex enclosure provided with tapered legs and bar runners at no additional cost, to allow horizontal or vertical positioning. Cabinet finished on all four sides for extra flexibility. Three-speaker system with crossover included. Oxford Components.

45 Leatherette-covered bass reflex enclosure features swivel base to permit it to be turned in any direction for proper sound dispersal. It accommodates 8" or 12" speaker. Wellcor CBC-8-12.



44



45

More hi-fi items on page 125



TIN-CAN CHASSIS

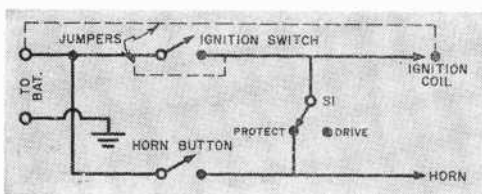
Are you hard pressed to find the particular size chassis you want for that jack box or those test setups? Have you been searching desperately for Miniboxes with exactly the dimensions you need? You don't have to look any further than your kitchen pantry shelf. Assorted empty soup cans, tuna fish cans, and fruit juice cans all will provide you with chassis to order.

Just cut the tin can down to the desired depth with a pair of tin snips. Then file down the cut edge to remove any burrs or sharp edges. The jacks or other components can be easily installed (see photos) either by punching or drilling through the thin sheet metal. —Walter White, Jr., W4UEK

PROTECTION AGAINST CAR THEFT

Most automobile thefts are accomplished by "jumping" the ignition switch with a length of cable, and car owners have devised various methods to protect their vehicles. The most common technique is wiring

the car horn so that it will sound when the ignition switch is turned on. In the circuit shown, a hidden cutoff switch (S1) enables the car owner to disable the protective circuit by throwing the switch to the "drive" position.



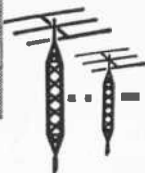
The usual practice in "jumping" the ignition lock is to run a wire directly from the battery to the coil, since this is often easier than working under the dashboard. Such a connection would not sound the car horn with most systems used. This circuit will blow the horn if either the ignition switch is jumped or the wire is run directly to the battery.

The roof of the car's glove compartment is usually a good place to hide the "protect" switch. —Douglas B. Leathem



Among the Novice Hams

By HERB S. BRIER, W9EGQ



SEE NEXT PAGE FOR
list of those who request help
in obtaining their ham licenses

JUST AS IMPORTANT as the equipment in your station is the way it is *set up and operated*. To obtain an efficient operating position with a minimum of effort, you need a sturdy table and desk of some kind. This should be about 28" high and large enough to accommodate at least your receiver and your key, and provide an adequate writing surface for keeping your log, copying messages, and making notes.

Setting Up Equipment. If the table is deep enough, place the receiver about 16" back from the front edge, directly in front of your chair or slightly to its left (assuming that you are right-handed). Place your key in line with your right shoulder far enough back from the table edge so that your entire forearm is supported while you are using the key. Screw the key to the table, or fasten it to the center of a flat board about 1' long and 6" wide, so that the key will not skitter around when it is in use.

The transmitter may be set to the right of the key, and less frequently adjusted pieces of equipment, such as a frequency standard and a keying monitor, may be arranged on either side of the transmitter.

If the table is shallow, leave its center section free of all equipment for a writing surface, and place the receiver and transmitter on either side of the center space. Face them so that—when you turn your head towards them—you will be looking squarely at them, for ease in reading the

meters and dials. Keep the key in line with your right shoulder.

If you have only a small table or lots of equipment, a shelf six inches or so above the receiver will accommodate several units. This is probably the best position for the loudspeaker. It is also an excellent position for a small transmitter that has all its controls on the front panel.

Platform Is Useful. Placing some receivers directly on the operating table makes their controls somewhat awkward to adjust. This can be remedied by setting a receiver on a small platform. The front of

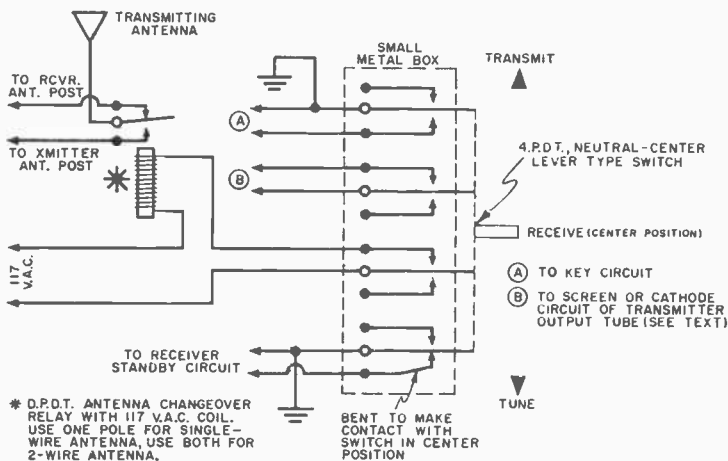


Fig. 1. All circuits in an amateur setup can be controlled by a single four-pole switch. This is one method of wiring the switch in a typical installation.

the platform can be made an inch or two higher than the back, to tilt the receiver panel backwards, making it unnecessary to "scootch down" to read its dials and S-meter.

The space under the platform becomes
(Continued on page 132)

HELP US OBTAIN OUR HAM LICENSES

Prospective amateurs requesting help and encouragement in obtaining their licenses are listed here. To have your name listed, write to Herb S. Brier, W9EGG, c/o POPULAR ELECTRONICS, One Park Avenue, New York 16, N. Y. Please print your name and address clearly. Names are grouped geographically by amateur call areas.

K1/W1 CALL AREA

Richard Bonin, 1 Star St., Pawtucket, R. I. Phone: PA 3-9834. (Code)
Peter M. Stonberg (14), 142 Grant Ave., Newton Centre 59, Mass. (Code and theory)
Proctor L. Dutton, R. F. D. #2, Springfield, Vt. (Theory and selection of equipment)

K2/W2 CALL AREA

Owen Steinweg (15), 157-01 65th Ave., Flushing 65, N. Y. Phone: FI 9-3675. (Code and theory)
Richy McCusker, Jr. (14), 88-23 173rd St., Jamaica 32, N. Y. (Code, theory and regulations)
Charles G. Buono, 556 Ave. Z, Brooklyn 23, N. Y. (Code and theory)
W. Schmeis, 129-14 135 Ave., So. Ozone Pk., N. Y. (Theory and selection of equipment)
Stuart Harradine, 364 W. State St., Albion, N. Y. Phone: AL 1443. (Code, theory and regulations)
Stanley Sacharoff, 3155 Grand Concourse, Bronx, N. Y. Phone: FO 5-9727. (Code, theory and selection of equipment)
Robert Smicinski, 89 Academy St., Amsterdam, N. Y. Phone: VI 2-2796. (Code, theory, regulations and selection of equipment)
Art Zazzi, 6 Maple Ave., Sussex, N. J. Phone: 2-1262. (Code)
Santos Blanco, 5360 Broadway, New York 63, N. Y. (Code, theory and selection of equipment)
Walter Jaros, 101 Cedar Dr., Great Neck, L. I., N. Y. (Code, theory and regulations)
Louis Rios, 545 Maple Ave., Patchogue, L. I., N. Y. (Code and theory)

K3/W3 CALL AREA

Stephen Momot (16), 1126 Highland Ave., Chester, Pa. Phone: CH 4-0781. (Code and theory)

K4/W4 CALL AREA

Leroy Word, 16 Decatur St., Nashville 10, Tenn. (Code, theory, regulations and selection of equipment)
David A. Sackett, 4 Greenville St., Abbeville, S. C. (Code)
James O. Burch, 1909 Kansas Ave., Savannah, Ga. (Code, theory and selection of equipment)
Allen S. Radin, 19620 N.W. 11th Ave., No. Miami 69, Fla. (Code, theory and regulations)
Tommy Holcomb, 1100 Anderson Dr., Williamston, S. C. Phone: 7004 (Code and theory)
Ben Calloway, Box 98, Banner Elk, N. C. (Theory)
Jerry Moore, P. O. Box 423, De Funiak Springs, Fla. Phone: TW 4-2051. (Theory and selection of equipment)
Gary Jacobs, Box 35, Collagedale, Tenn. (Code and theory)
C. C. Van Dyke, Route 1, Box 91, Blowing Rock, N. C. (Code and theory)
John E. Frazier, 841 Wooden Blvd., Orlando, Fla. (Code and theory)

K5/W5 CALL AREA

Bruce Stock, 1801 N. Adams Ave., Odessa, Tex. (Code)
O. G. Sellers (17), 1705 2nd Ave. N., Texas City, Texas. Phone: 5-2681. (Code, theory and selection of equipment)
Don Fronterhouse (12), 4147 N. Prospect, Oklahoma City, Okla. (Code, theory, regulations and selection of equipment)

K6/W6 CALL AREA

Bert L. Coffman, 1816 U St., Sacramento 18, Calif. Phone: HI 6-7436. (Code, theory and regulations)
Elmer D. Richardson, 5970 18th Ave., Sacramento 20, Calif. Phone: GL 6-9205. (Code and regulations)
Larry Bently (15), 18820 Arlington Ave., Torrance, Calif. Phone: DA 9-9080. (Code, theory and selection of equipment)
L. W. Strimpel, 6817 Matilija Ave., Van Nuys, Calif. (Code, theory and regulations)
John Sutherland, 2171 Belmont Ave., Long Beach 15, Calif. (Code)

K7/W7 CALL AREA

Verlin Allen, 4 N. Main St., Malad City, Idaho. (Code and theory)
Charles H. Mondragon, Jr., 3245 E. Jefferson St., Phoenix, Ariz. Phone: BR 5-5304. (Code and theory)
Robert A. Davis, Box 5, Navy 127, c/o P. M., Seattle, Wash. (Code, theory and selection of equipment)
Richard Lionel Clark (14), Rt. Box 141, Kennewick, Wash. (Code, theory and regulations)
Steve McLeod, 2221 Rucker Ave., Everett, Wash. (Code, regulations and selection of equipment)
Richard Imes, 315 Lark, Casper, Wyo. Phone: 3-5285. (Code, theory and selection of equipment)

K8/W8 CALL AREA

James Stirzaker (17), 5313 Rolling Ave., Elyria 7, Ohio. Phone: CE 3-5520. (Code and theory)
Bill Bouwkamp, 1613 Alexander Rd., S. E., Grand Rapids, Mich. (Theory, regulations and selection of equipment)
Keith Molden, 1114 S. Wilson, Royal Oak, Mich. Phone: LI 3-3753. (Code, theory and regulations)
Larry Weaver, Rt. #5, Box 311, Fairmont, W. Va. (Code, theory and regulations)

K9/W9 CALL AREA

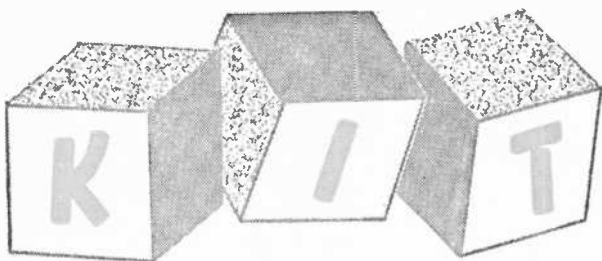
John Webber, 6306 W. Fitch Ave., Chicago 46, Ill. Phone: SP 4-3016. (Code and theory)
Leonard Miczynski, 7625 S. Lathrobe, Oaklawn, Ill. Phone: GA 5-3439. (Code, and theory)
Larry Cloud (15), R.R. #1, Box #153, Westfield, Ind. Phone: 3-2924. (Code, theory, regulations and selection of equipment)
Dick Auman (15), 3830 Sandpoint Rd., Ft. Wayne, Ind. (Code and theory)
Ray Merneigh, 2057 W. 21st St., Chicago, Ill. Phone: CL 4-7862. (Theory and selection of equipment)

K0/W0 CALL AREA

Ronald Shriver (16), Green City, Mo. (Code, theory, regulations and selection of equipment)
George E. Sears, 610 N. Cascade Ave., Colorado Springs, Colo. (Code)
Robert John, Box 1027, George, Iowa. Phone: 141-W. (Code and theory)
Fred Dorsey, 250 Jasmine, Denver 20, Colo. Phone: DE 3-8868. (Code, theory and selection of equipment)

VE AND OTHERS

Dave Beaumont, 2471 Bellevue Ave., West Vancouver, B. C., Canada. (Code and theory)
Douglas Brown, 131 Essex St., Toronto 4, Ontario, Canada. Phone: LE 5-4897. (Code, theory and regulations)
H. E. Horton, Box 25, Mount Hope, Ontario, Canada. Phone: OS 9-4237. (Code)
Gary Galt (17), 37 Belhaven Rd., Toronto 8, Ontario, Canada. Phone: OX 1-8534. (Code, theory and selection of equipment)



BUILDER'S KORNER

STEREO REPRODUCTION is becoming more and more the "rage" among hi-fi enthusiasts. In recognition of this, kit manufacturers are jumping on the bandwagon and producing kits to fill the need. Of the three available methods of playing stereo—discs, tape and radio—the latter can be the least expensive and one of the most satisfying, providing certain conditions are met.

First, you need a good stereo tuner; next, you must have good quality reception on the AM side of the dial (the FM is as-

unit and the FM i.f. strip are assembled on printed circuit boards, necessitating only a minimum amount of external wiring after they are completed and mounted.

While the use of printed circuit boards is a tremendous labor saver, it must be admitted that the wiring job is still long and tedious. The writer clocked at least 25 hours on the job. It could have been done faster, but it was decided to do an extra careful wiring job.

Two errors did creep in and prevented re-



Lafayette
Stereo Tuner

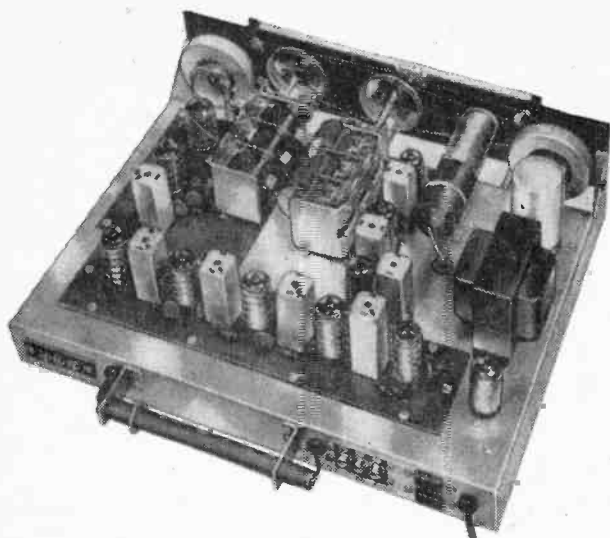
sumed to be much better than the AM because of its inherent qualities); and then, you need to be within listening distance of a station which transmits AM-FM stereo.

The tuner must be capable of receiving both the AM and the FM signal at the same time. Therefore, two completely separate circuits are required, both of which need to operate at the same time. The Lafayette KT-500 is such a tuner.

Printed Circuits. Of necessity, such a tuner is complicated, but Lafayette has wisely incorporated two printed circuits to ease construction problems. The FM r.f.

reception on both AM and FM. When these were traced and corrected, the set played well, since coils and i.f. transformers are prealigned at the factory. To determine just how good the set is, it was sent back to Lafayette for an alignment job. The results proved to be excellent.

Wiring. The author was agreeably surprised at the clean wiring job he was able to do, following the very comprehensive assembly instructions. All parts fitted precisely (not always the case in kits), the layout showed thoughtfulness as to placement of components and dress of leads, and



all of the parts were included.

As with most kits, the wire lengths called for in the instructions were a bit excessive. This is probably a necessary evil, to make certain the lengths are not cut too short. It is suggested that the leads be cut to the length recommended, then measured on the chassis and trimmed to the proper length before hookup. This will eliminate a tendency to messiness underneath.

Two Dial Cords. The real problem encountered was in stringing the dial cords. Unless you have long and agile fingers, it might be a good idea to get a female member of the house-



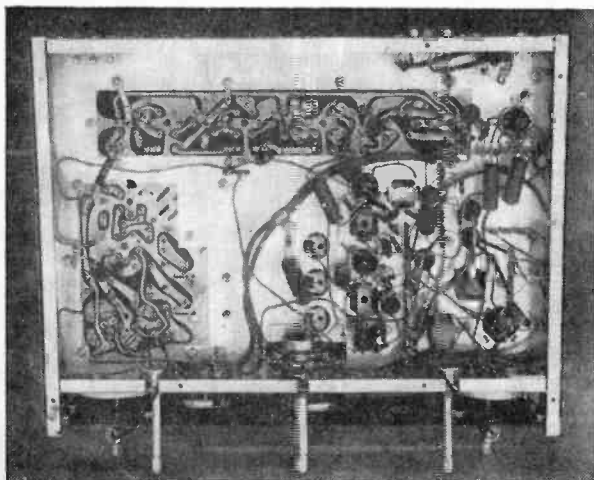
The r.f. and i.f. printed circuits (shown on the foil side, left) fit into the chassis (below) to make up the completed Lafayette stereo tuner (above, without case).



hold to do this job. Make sure you read the instructions carefully and also check the drawings, particularly on the number of turns of cord around the flywheel shafts. We had to do it several times before it came out right.

One last piece of advice: read each step twice, and make a dry run on the procedure before you follow through. It will take a little more time, but it will save headaches later. At least half a dozen times your reviewer assumed something that was incorrect and only caught the mistake after reading the instructions.

All of the usual precautions regarding soldering hold good. It is worth mentioning that for printed circuit soldering, it might be wise to invest in a light, high-heat pencil iron.



ROCKBOUND is the way radio amateurs describe another ham whose transmitter is crystal controlled. They mean that unless he has another crystal to plug into the driving oscillator he is bound to remain on just one frequency. Without a big handful of different crystals he is limited, at best, to a few predetermined spots in the amateur band of his choice.

Most amateurs like the freedom and flexibility of variable frequency operation. This is generally accomplished with a variable-frequency oscillator (VFO).

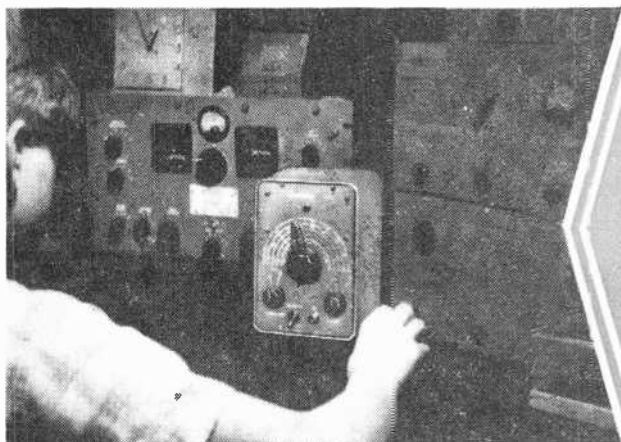
It is easy enough to build a variable-

ly placed and permit fast operation.

Building the Kit. When the kit is unpacked, all components should be checked against the parts list. There are several changes to be made in the construction manual before assembly is begun. These are explained in a letter in the package.

The first step is mounting the power transformer, choke, tube sockets and other components on the power supply chassis. The green-yellow lead from the power transformer will have no connection and is taped to prevent shorting against chassis.

To simplify the job somewhat, a few of



Allied
Knight VFO

frequency oscillator, but many an unwary amateur has failed to consider that as a tuned circuit warms up it can shift frequency, sometimes to a surprising degree. The result can be a pink ticket from an FCC monitoring station with the possibility of legal prosecution and loss of operating privileges because the transmitter wandered innocently outside the assigned frequency band.

Another oscillator problem is short-term stability that is caused either by electrical or mechanical instability. Such an unstable oscillator produces a wobbly, unsteady or rasping note that unnecessarily broadens the frequency space occupied by the transmitter signal. It is unpleasant to hear, hard to copy and is illegal.

The Knight VFO kit has been designed to avoid or eliminate all these troubles and others, too, like TVI. It is easy to assemble and calibrate. The controls are conven-

the connections are made at this point before the rest of the parts are mounted. It may be found that some of the recommended lengths of wire are too long to fit well. When mounting *C13*, the 40- μ fd. electrolytic capacitor, the metal holder may need to be bent to make it fit properly.

Power Supply. It may be easier to mount the power supply chassis on the front panel before connecting the wires to the oscillator. Do not forget to fasten the pilot light assembly to the front panel before the power supply chassis is mounted. After these wires from the power supply are connected, the lever switch, *S3*, and jack *J1* are mounted and wired.

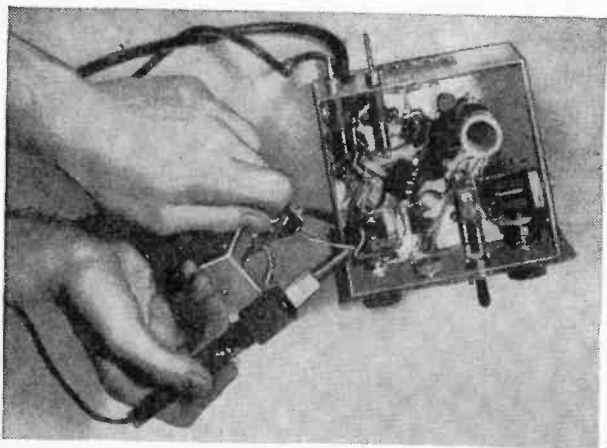
In mounting the oscillator tank coil, it was found that the bolts connected to it did not fit through the holes in the chassis and needed to be bent outwards slightly. After the coil is mounted and wired, the output cable is prepared. It ends in a plug

that fits into the crystal socket of the transmitter.

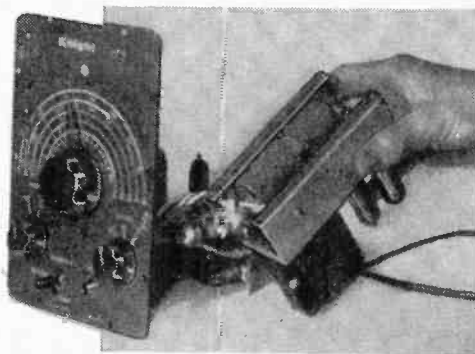
Calibration. The VFO operated perfectly with a signal so strong the output plug was moved a couple of feet away from the antenna lead to the receiver. It was the matter of a minute to set the frequency ap-

other padder, C2. Because there are usually a number of harmonics that develop a strong signal in a superheterodyne receiver, the VFO harmonics were likewise used to check one band against another.

For example, with the VFO set to 3550 kc., the receiver is switched to 40 meters



Soldering underside of Knight VFO (left); instruction book is a primer on good soldering and should be followed in building kit. Power supply subassembly (below) is wired first, then fastened mechanically to front panel of VFO.



proximately by tuning the padder C1. Fortunately, a number of frequency check points were already known for the receiver.

The VFO was warmed up for half an hour and it was thought desirable to calibrate it against a number of 80-meter crystals available in the shack. For this operation, all but the oscillator and buffer stages of the transmitter were disconnected.

A crystal was put into the transmitter and the circuit properly adjusted. The receiver, with beat-frequency oscillator operating, picked up the crystal frequency. Then the beat oscillator on the receiver was turned off and the VFO turned on. With the dial set at the crystal frequency, the padder was tuned carefully for zero beat.

Other crystals used in the transmitter served as check points for the VFO, which performed nicely over the 80-meter band.

Some of the crystals had harmonics within the 40-meter band. These signals were found on the receiver and used to calibrate the 40-meter dial by adjustment of the

and a strong second harmonic signal sought in the vicinity of 7100 kc. (twice the frequency). Then the VFO is set to 40 and the dial turned to 7100. Another signal should be heard in the receiver, which is now the fundamental output from the VFO. When all signals were checked against each other, it was pretty certain that the proper signals were being generated.

We went on the air and called a local Novice who lives less than ten miles away—near enough to tell if the signal has a rough edge. His report was RST 599, which means an easily copied signal (5), best possible tone (9), and loudest measurable signal strength (9).



Transistor Topics

By LOU GARNER

A VARIETY of imported transistor products is now being offered by a number of suppliers, including department stores, mail order houses, and local retail outlets. Many of these items are quite competitive quality-wise as well as price-wise with U. S. products.

Japanese products include transistor radio receivers, hearing aids, telephones, and components, including electrolytic and variable capacitors, coils, transformers, subminiature loudspeakers, earphones, miniature jacks and plugs, solar batteries, and volume controls.

From West Germany, the U. S. is importing transistorized receivers, clocks, and specialized components. Transistors of Dutch manufacture are available through

veloped a two-transistor long-wave radio receiver intended for use by delegates to international conferences. Suspended on a neck strap, it employs a reflex circuit which provides a performance equivalent to a three-stage circuit. It is powered by a nickel-cadmium cell. A six-channel unit, this receiver is designed to pick up signals "broadcast" from an antenna loop surrounding an auditorium or conference room.

Reader's Circuit. Although high-power r.f. transistors are not yet available commercially, many amateurs report surprisingly good results with comparatively low-powered transmitters when they are properly tuned and coupled to an efficient antenna system.

Reader Pete Hanson, KN2MPG, of 75

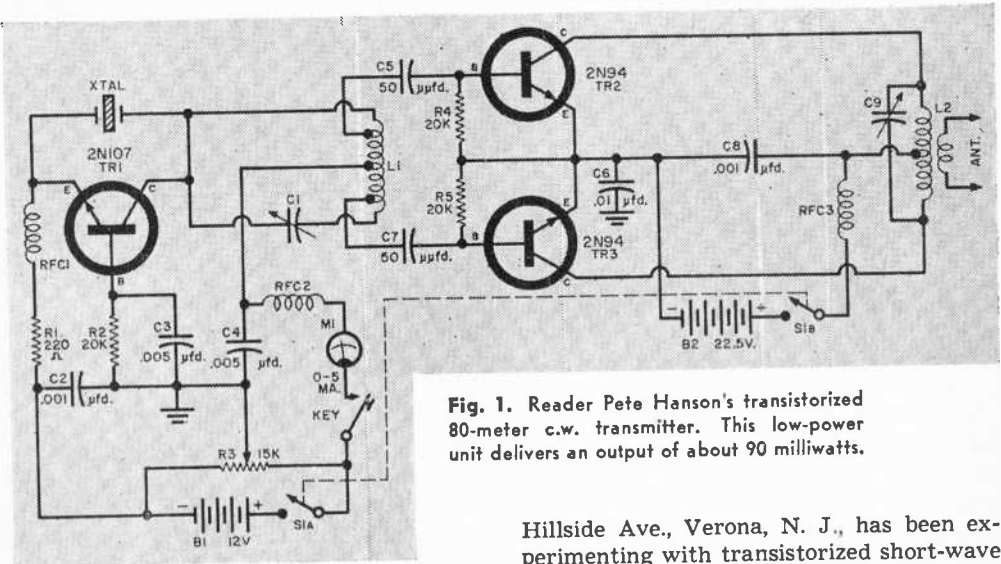


Fig. 1. Reader Pete Hanson's transistorized 80-meter c.w. transmitter. This low-power unit delivers an output of about 90 milliwatts.

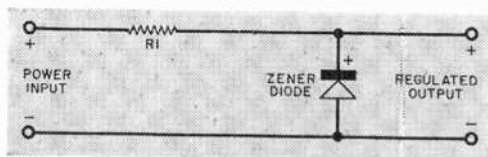
a limited number of outlets. England is sending a number of transistor items to the U. S., too, including a fully transistorized portable p.a. system, instruments, and sub-miniature components.

Siemens & Halske, of Vienna, has de-

Hillside Ave., Verona, N. J., has been experimenting with transistorized short-wave receivers and transmitters for some time. His rig employs three transistors and delivers an output of about 90 milliwatts. He reports that he has worked many states and several foreign nations with this low-power outfit. Basically a crystal-controlled oscillator driving a push-pull power amplifier, the



Fig. 2. How a Zener diode is used as a voltage regulator. See text. International Rectifier's new Zeniac substitution box, shown above, offers a selection of 11 basic one-watt silicon Zener diodes from 3.6 to 30 volts.



available coils were used. $L1$ is a B & W Type MC80, tapped 15 turns from each end. $L2$ is a B & W Type MEL80.

Conventional "chassis-type" construction is recommended with all leads short and direct. Make no attempt to subminiaturize the unit.

When you've finished construction and checked the wiring, you can install the crystal, transistors, and batteries. While a standard 80-meter crystal is used, Pete indicates that a fairly active unit must be employed to insure trouble-free operation.

To adjust the completed transmitter, turn the unit "on," close the key, and set $R3$ for an oscillator collector current of no more than 2.5 ma. Next, adjust $C1$ for a "dip" in $M1$'s reading . . . this will not be as pronounced a "dip" as is obtained when tuning vacuum-tube oscillators. Finally, adjust $C9$ for *maximum power output*, as

transmitter is intended for 80-meter c.w. operation.

Figure 1 shows a slightly modified version of KN2MPG's transmitter. $TR1$ is connected as a common-base oscillator, with the feedback between collector and emitter circuits needed to start and sustain oscillation furnished through the frequency-controlling quartz crystal ($Xtal$). The oscillator output is coupled through capacitors $C5$ and $C7$ to a common-emitter push-pull amplifier. The $n-p-n$ type of transistor is used throughout.

Pete has passed on a few hints for readers who would like to duplicate his circuit. The three r.f. chokes ($RFC1, 2, 3$) are standard 2.5-mhy. units. All fixed resistors are 1-watt units and $R3$ is a 10-watt wire-wound potentiometer.

Tuning capacitors $C1$ and $C9$ are 50- μ fd. variables. All other capacitors are mica or ceramic units. The capacitors should be rated at 50 volts or more. $M1$ is an 0-5 ma. meter.

To simplify construction, commercially

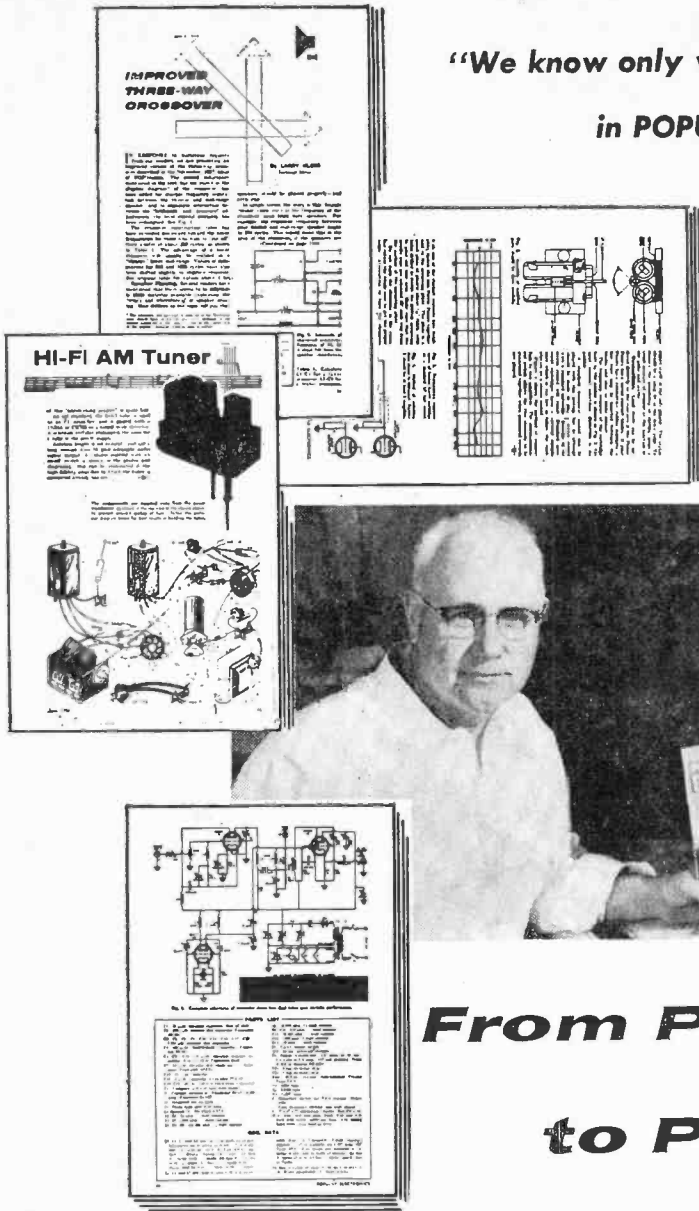
indicated by, say, an r.f. field strength meter.

The Zener Diode. When a *reverse* voltage is applied to a semiconductor diode, the unit continues to offer a high resistance until the applied voltage exceeds a given critical value, called the *Zener* voltage. When this point is reached, the diode's resistance drops to a low value almost instantly, with a corresponding increase in current flow. As long as the diode is not destroyed by the current through it, it will tend to maintain a constant voltage drop. In this respect, the diode's action is roughly analogous to that of a gas-filled voltage regulator tube.

While many diodes will be ruined permanently if operated with high reverse voltages, some units are designed specifically for this type of service. Called *Zener diodes*, these devices may be used as voltage regulators, switches, and relaxation oscillators, or in other circuits similar to those in which gas-filled diodes are used. Zener diodes are used extensively in military equipment, in computers, and in some types of industrial control equipment.

(Continued on page 127)

**"We know only what we read
in POPULAR ELECTRONICS"**



From Pages to Projects

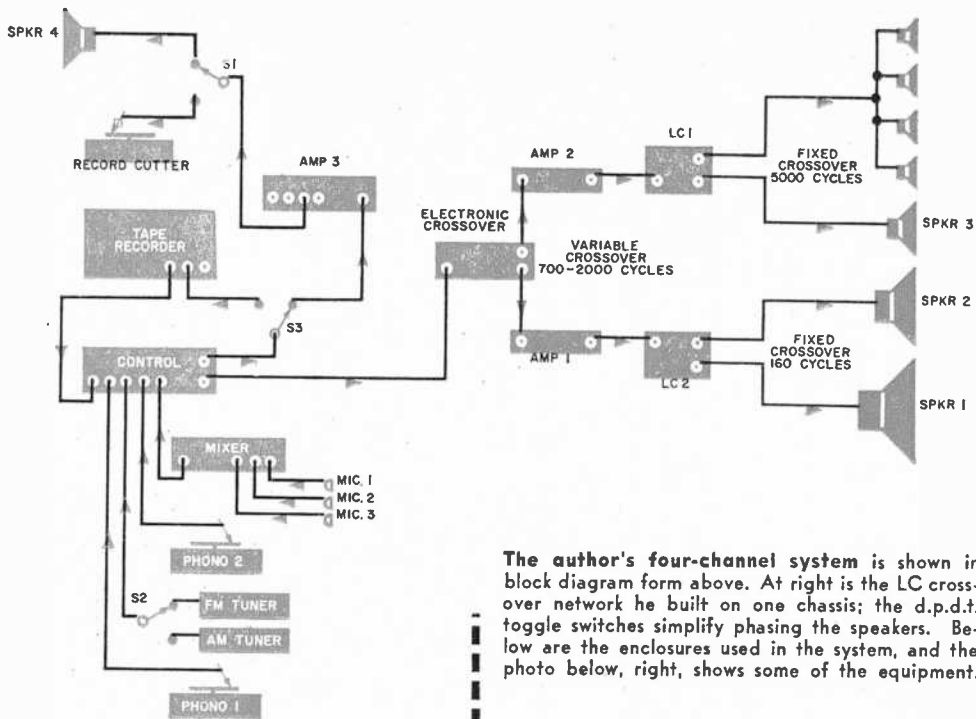
By **LELAND R. REEDER**

THE CHANGES POP'tronics has brought about in our living habits in the past few years are quite amazing. "The High Fidelity Hobby" in January 1955 was, as I remember, the article which started us off. Now hardly an issue comes along from which we don't learn something new or make some new item to add to our extensive music system.

Neither my son nor I had any special

knowledge of or experience in electronics. "We know only what we read" was literally true. Our first high-fidelity system, the direct result of the aforementioned article, brought us together with a mutual interest.

Step by Step. My son assembled the amplifier from a kit, a seven-watt affair with a preamp stage for a magnetic cartridge. I purchased an inexpensive 8" coaxial speaker from a mail-order parts jobber and built a simple bass reflex enclosure from information in POP'tronics. The record player was an inexpensive turntable and



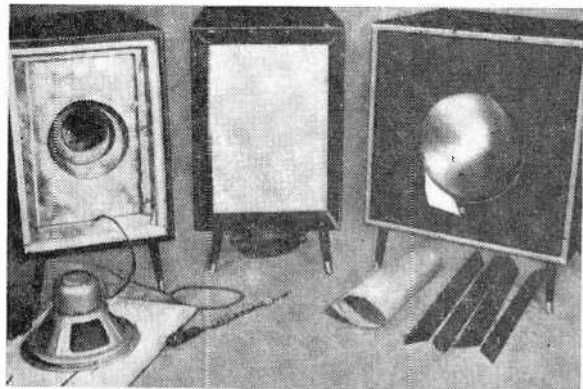
The author's four-channel system is shown in block diagram form above. At right is the LC crossover network he built on one chassis; the d.p.d.t. toggle switches simplify phasing the speakers. Below are the enclosures used in the system, and the photo below, right, shows some of the equipment.

LIST OF EQUIPMENT USED

- Amp. 1—Heathkit Model W4-AM (20 watts)
- Amp. 2—Heathkit Model A7 (7 watts)
- Amp. 3—McGee Model HF-20 (20 watts)
- AM Tuner—Heathkit Model BC-1A
- Control and Preamp—Heathkit Model WA-P2
- Electronic Crossover—Heathkit Model XO-1
- FM Tuner—Granco Model T-160
- Mic. 1—Shure No. 777S crystal (desk stand)
- Mic. 2—Electro-Voice E. V. 611 dynamic (with floor stand and boom)
- Mic. 3—Electro-Voice E. V. 951 crystal (with floor stand and boom)
- Mixer—Knight Model 93-S-283
- Phono. 1—Lafayette No. PK-180 turntable, Argonne AR-600 arm, Ronette TY-88 cartridge
- Phono. 2—Columbia 3-speed turntable, Lafayette GA-4 arm, G. E. Cartridge
- Record Cutter—General Industries R85L crystal cutter
- LC1, LC2—Inductance-capacitance crossover (see schematic diagram on next page)
- Spkr. 1—15" Magnavox speaker
- Spkr. 2—12" Utah speaker
- Spkr. 3—8" Utah speaker
- Spkr. 4—8" Utah coaxial speaker
- Tweeters—Four cone-type units
- S1, S2, S3—Double-throw toggle switch
- Tape Recorder—Revere Model T-100

PARTS LIST FOR CROSSOVER

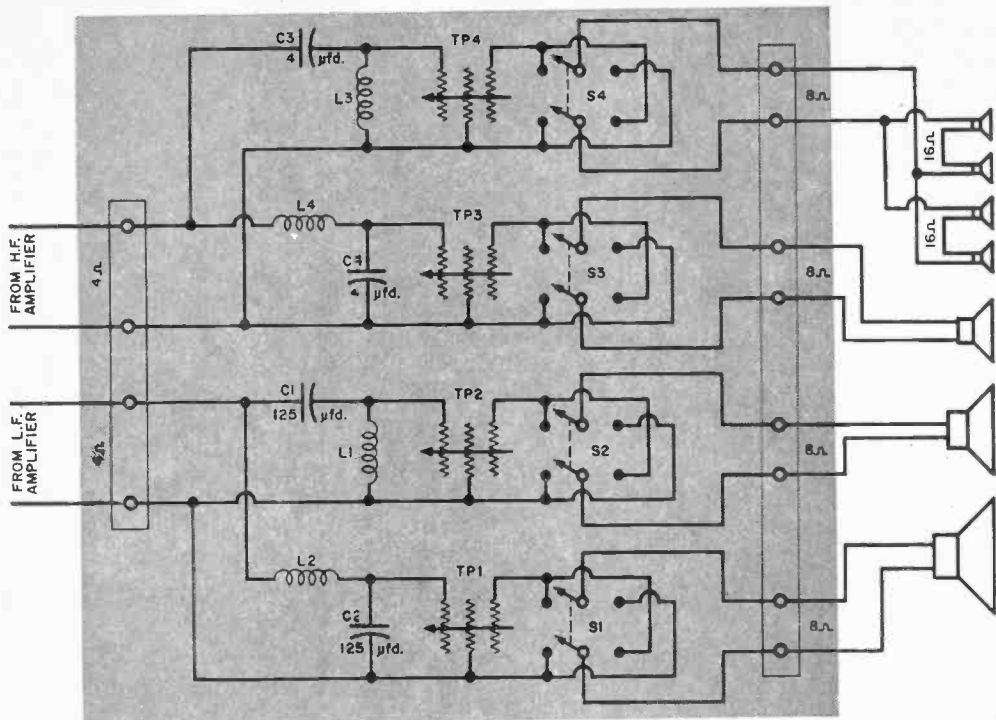
- C1, C2—125- μ d., 150-w.v.d.c. capacitor
- C3, C4—4- μ d., 150-w.v.d.c. capacitor
- L1, L2—7.9-mh. coil, 525 turns of #18 wire, 1" core, 1" wide
- L3, L4—0.25-mh. coil, 90 turns of #18 wire, 1" core, 1" wide
- TP1, TP2, TP3, TP4—T-pads for loudness control @ 4 watts nominal 8-ohm impedance
- S1, S2, S3, S4—D.p.d.t. switch, for phasing



arm with a magnetic cartridge. The results were good, a new hobby was born, and we were off to bigger and better listening.

A subsequent article on push-pull speakers had us building a new enclosure using four 6" x 9" speakers plus two cone-type tweeters. This was a decided improvement on the first speaker setup. It sold us on the practicability of POPtronics articles and we were now firmly entrenched in the high-fidelity hobby.

Our next move was for more power and more flexible control. This time we purchased separate preamp and power ampli-



fier kits. The speaker system was expanded to include a 12" woofer, an 8" mid-range speaker and a tweeter. Enclosure construction was becoming more technical, the more I read, and we ended up installing the three speakers in a modified bass cabinet using a Goodmans Acoustical Resistance unit.

In addition, a tape recorder, a disc record cutter and AM and FM tuners came along at this point.

Our present four-channel setup is shown in the block diagram on page 86. From an article by Norman Crowhurst, "Choosing Your Hi-Fi Crossovers," published in *RADIO & TV NEWS*, another Ziff-Davis publication, we picked 160-630-2500 cycles as the points to work toward. Because we wanted a certain amount of flexibility in the middle ranges to spotlight solo instruments and voices, we included an electronic crossover in our layout. This would give us a variable control between 700 and 3500 cycles and, with LC crossovers, we could fix the separation of the lows at 160 cycles and the highs at 5000 cycles.

Low frequencies are handled by a 15" speaker having a cone resonance of 45 cycles and a frequency response of 20-5000 cycles. This is installed in a modified

(Continued on page 126)

Simple R.F. Meter

Measure r.f. output of the transmitter in your ham shack

. . . or use this meter in a dozen other ways

THIS inexpensive r.f. indicator has a wide variety of uses around the ham shack or mobile radio installation. It can act as an absorption frequency meter (if calibrated), a field strength meter, neutralization indicator, or modulation monitor with phones. However, the main job of the model shown is to indicate proper antenna loading for my "minified" mobile transmitter.

It is relatively simple to put together, and nearly any low-priced transistor will work well. However, for maximum sensitivity, a transistor with a *beta* (current amplification) of between 25 and 45 should be used.

Construction. A 3¼" x 3" x 2½" aluminum chassis houses all parts. The coil (*L1*) is tapped and connected to switch *S1* before installation in the box to facilitate soldering. Then the coil is cemented to the box by its plastic support.

Care should be taken in soldering the crystal diode (*CR1*) into the circuit by "heat sinking" the connections with a pair of long-nose pliers. A socket should be used for the transistor.

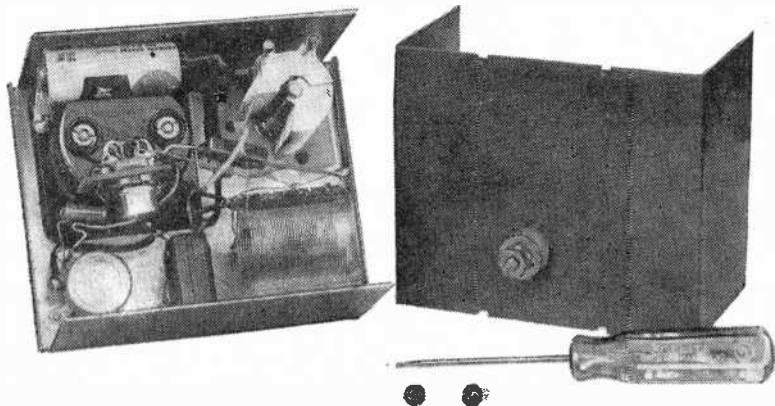
Fasten the 1½-volt cell to the chassis with household cement. With normal use, it should last almost its shelf-life.

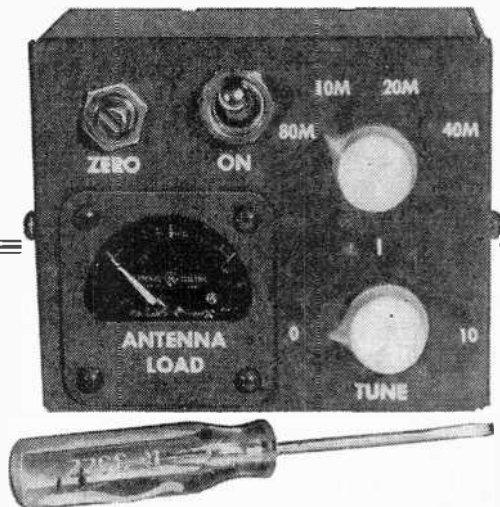
After the unit is turned on, zero the meter with potentiometer *R3* in the collector circuit. Attach a small wire to the input binding post on the rear of the box which feeds r.f. to the tuned circuit, and you are in business.

Applications. If the device is to be used as an absorption frequency meter, it can be calibrated with a heterodyne frequency meter coupled to the input post through a small (about 500- μ fd.) capacitor.

A 2½" length of wire is sufficient for r.f. pickup when checking oscillator, doubler or

The simplicity of the r.f. meter circuit (see schematic on next page) makes for ease of layout on the chassis (below). Number of turns tapped on *L1* for each band is indicated on the schematic. Finished meter is shown at top of page 89.





By CHARLES J. SCHAUERS

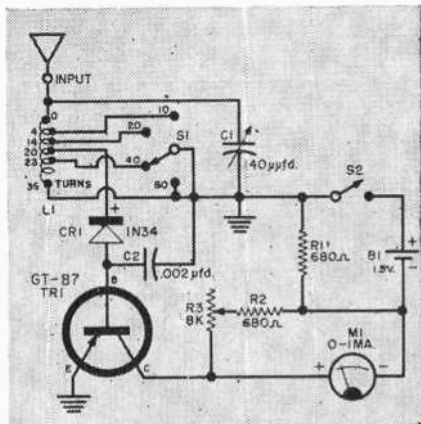
buffer and final amplifier stages of a transmitter.

When using the indicator as a field strength meter to adjust a beam antenna, the pickup wire length will depend upon the distance from the antenna and how much power is being applied from the transmitter's final amplifier. Usually, a 2" piece of wire will afford sufficient pickup at 100 feet with the average low-power transmitter when the device is hand-held.

To provide some attenuation of very strong signals, the indicator can be used harmonically. Set the bandswitch to 40 meters when you want to measure carrier strength on 80 meters.

As a means for tuning mobile or fixed transmitters (especially those employing π -output-networks), this unit enables one to determine very quickly if the antenna and not the π -network is taking the load. For mobile operation, the regular auto broadcast antenna can be used for signal pickup. However, the device should be harmonically operated as described above because of the strong signal present. If the auto antenna is not used, try a small piece of insulated wire taped to the inside of the front bumper, connected with shielded wire to the indicator.

If you are interested in monitoring your modulation, a pair of magnetic phones can be connected in the collector circuit of the transistor. The meter is disconnected (as well as the top of the balancing potentiometer) and the phones are connected between battery minus and collector. —30—

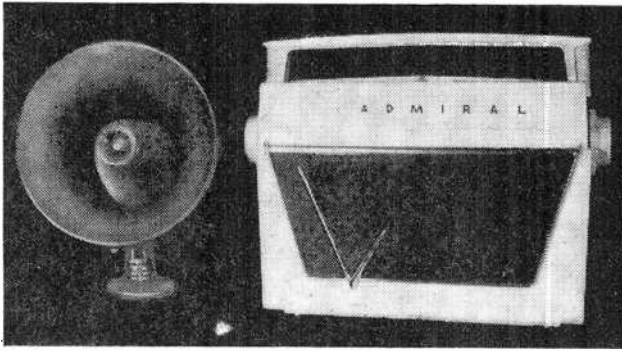


PARTS LIST

- B1—1.5-volt D cell
- C1—140- μ fd. miniature variable capacitor
- C2—0.002- μ fd. mica capacitor
- CR1—Crystal diode (Sylvania 1N34 or equivalent)
- L1—#24-wire, 1" diameter coil (Airdux 832T or B & W 3016—32 turns per inch, tapped as shown in schematic)
- M1—0.1 ma. d.c. meter
- R1, R2—680-ohm, 1/2-watt resistor
- R3—6500-10,000 ohm slotted shaft potentiometer
- S1—1-p., 4-pos. rotary switch
- S2—S.p.s.t. toggle switch
- TRI—Transistor (General Transistor GT-87 or GT-88 or Raytheon CK-721)
- 1—Aluminum chassis box (LMB-135)

HOW IT WORKS

Radio frequency energy tuned by L1-C1 is applied to diode CR1. The rectified current then takes a path through the base-emitter circuit of transistor TRI. Current amplification occurs and is read by the 0-1 milliammeter. Capacitor C2, connected between the transistor base and ground, bypasses the radio frequency. The greater the strength of the r.f. signal picked up, the higher the reading on the meter.



Convert Transistor Radio for Boat

By HOMER L. DAVIDSON

TRANSISTORIZED portable radios do a remarkable job under adverse conditions. But when it comes to putting one to use on a high-speed motorboat, three problems arise. These involve the wind, weather, and direction.

The speaker must be heard over the wind and waves, and it must be weatherproof. The direction of the boat affects the ability of the built-in antenna to pull in stations. Conversion of a transistor portable for boat use is quite feasible, the author has found, provided that the receiver has at least six transistors to insure good selectivity.

To soup up the audio output, a high-efficiency horn-type speaker (University Model MIL-8) was hooked up with a lead and phone plug so as to be able to plug into the transistor portable. A closed-circuit phone jack is mounted in a hole drilled in the portable's cabinet close to the internal speaker. Connected as per Fig. 1, the receiver's speaker will operate unless the external speaker horn's phone plug is inserted.

To use an external antenna, and to minimize the high directionality of the receiver's built-in antenna, a female auto antenna socket is mounted as close as possible to the r.f. section of the tuning capacitor, preferably on the side of the cabinet. Solder a length of wire from the center terminal of the antenna socket to the insulated lug on the tuning capacitor to which the internal antenna connects. The lead from a standard auto radio whip antenna can be plugged directly into this socket.

Plug in your speaker lead, tune to the station you want to hear, and you will be ready to cruise to the tunes of your portable set.

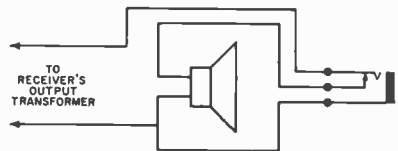
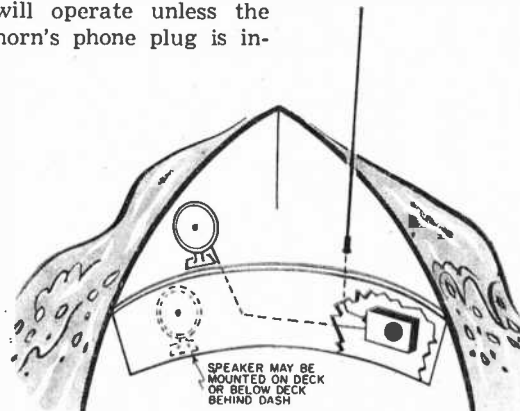
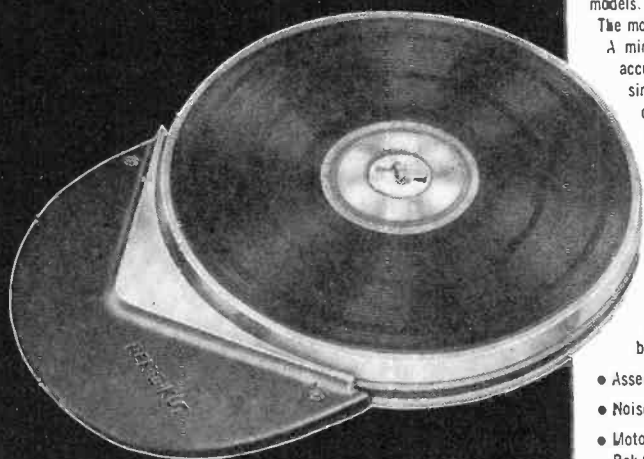


Fig. 1. Add this jack circuit to accommodate extra speaker. Location of units is optional.



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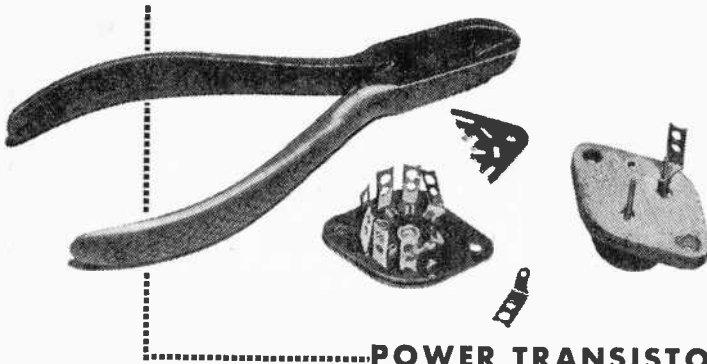
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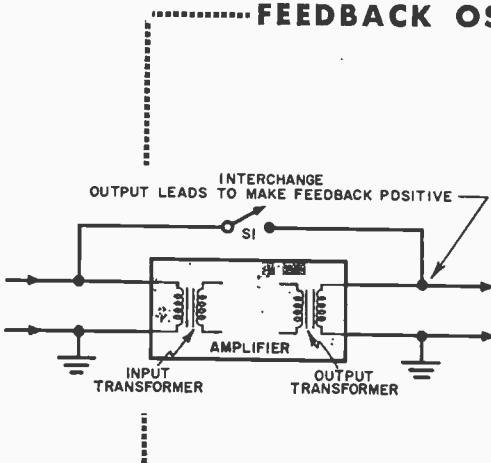
POWER TRANSISTOR CONNECTORS

In most multiwatt power transistors, the collector electrode connects directly to the transistor's outer metal shell. An electrical connection may be made to this electrode by soldering a lead to the metal chassis or "heat sink" on which the transistor is mounted. If the transistor is insulated from its heat sink, make the connection by soldering the wire to a tie lug which is bolted to the transistor shell. Be sure that the lug contacts bare metal and *not* the painted part of the shell. Don't try to solder a lead to the transistor case—you might ruin the component.

Base and emitter electrode connections are made either to a pair of metal pins or

to wire leads. In many popular types, such as the RCA 2N301 and 2N301A, CBS-Hytron 2N255 and 2N256, and Sylvania 2N307, the base and emitter pins are of proper size and spacing to fit a pair of terminals on a standard 9-pin miniature tube socket. When installing these power transistors in electronic equipment, you can either use a 9-pin socket as a connector or, if you prefer, break up the socket with a pair of diagonal cutters, salvaging the terminals for use as individual connectors. Such pin connectors are preferred over direct soldering to the base and emitter pins, as excessive heat from soldering can damage the transistor.—Louis E. Garner, Jr.

FEEDBACK OSCILLATOR FOR INTERCOMS



Positive feedback in an audio amplifier produces a loud howl which is familiar to most audio experimenters. This usually annoying effect can be put to good use in intercom systems working in high-noise-

level areas, such as schools or shops, or in p.a. systems where alarm or code signaling is desired. When the howl is cleaned up to a loud, pleasant tone, the intercom will substitute for whistles or bells at very low cost.

The method shown in the diagram employs a feedback path that includes one or both input and output transformers, and requires only one additional component—call switch *S1*.

In multistage intercom systems, each master station may be modified for feedback signaling. Switch to the desired station before operating the call switch. Some intercoms require a separate "talk" switch to be operated concurrently with the call switch.

—H. J. Carter

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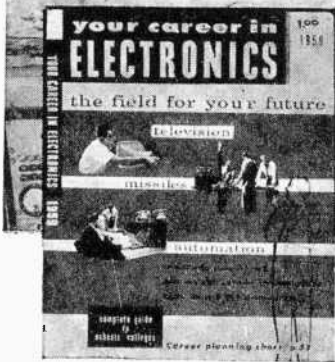
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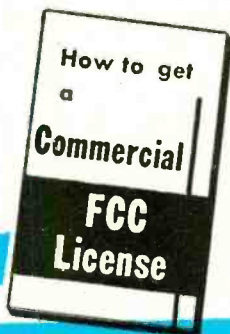
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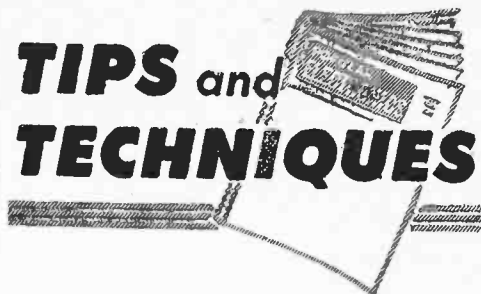
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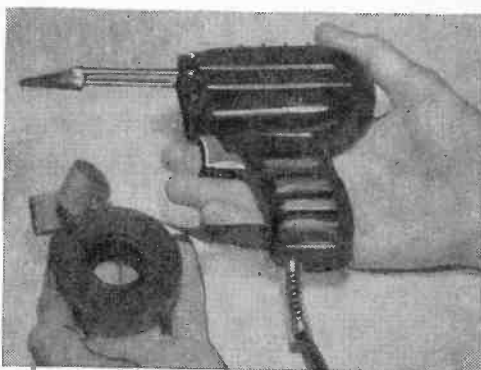


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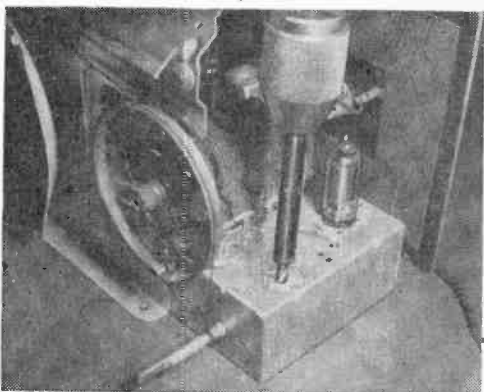


wrap electrician's rubber tape around the gun's grip as shown. The tape will provide a non-slip grip that's easy to hang onto regardless of whether your hands are greasy or perspiring.

—J. A. C.

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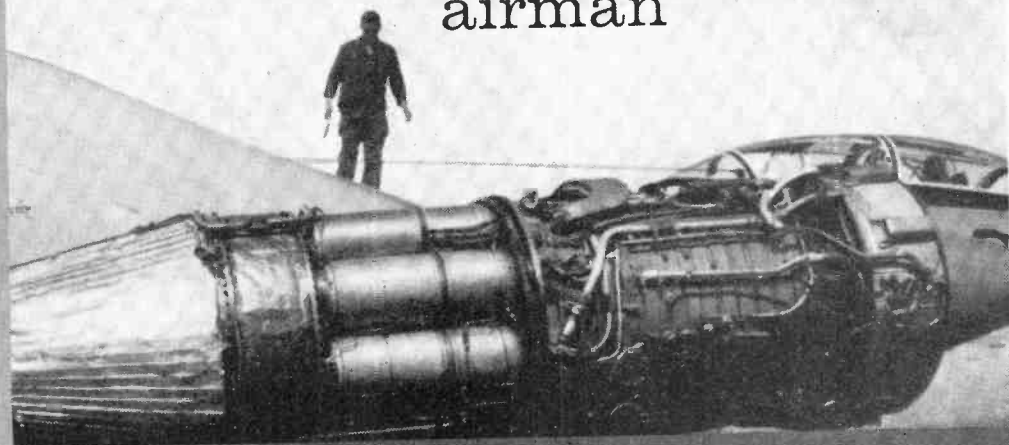


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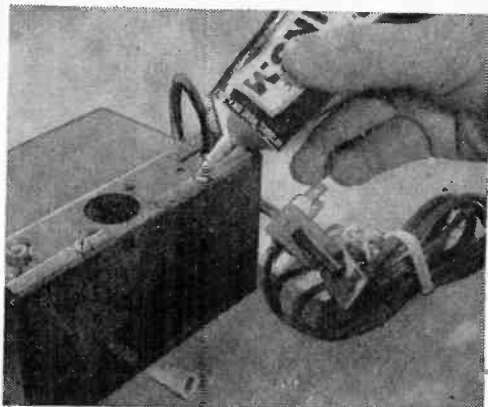
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underneath. To keep this from happening, limit the travel of the drill bit by "stopping" it with a piece of wire insulating spaghetti slipped over the bit. Since spaghetti is readily available in several different sizes, it is possible to select a piece and cut it to fit almost any size of twist drill. —J. A. C.

"SEAL" YOUR RADIO CABINET

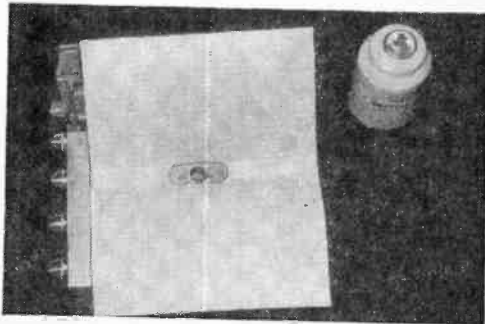
Manufacturers of electronic devices often hermetically seal cases containing delicate gear to protect them from damaging exam-



ination by curious people. Small cases containing transistor radios, meters, etc., may be protected in the same manner by covering all exposed bolt and screw heads with plastic aluminum or a similar material. After the plastic is dry, smooth and polish it with steel wool. When it is necessary to open the case, saw cuts made into these pseudo rivet heads will allow them to be turned with a screwdriver. —K. M.

DECAL SPRAY SHIELD

When coating decals with a protective plastic spray, it is often desirable to avoid spraying nearby parts such as tubes, tran-



sistors, knobs, dials, etc. In such cases, a simple but effective spray shield can be made from a sheet of typing paper. Simply
(Continued on page 108)

LIVING SOUND STEREO

SOUND REALISM at REALISTIC PRICES!



ST-11 AM-FM STEREO TUNER

Here, for the first time, is an AM-FM STEREO Tuner within the reach of every audiophile. Unmatched by units costing twice the price, the

ST-11 is two distinct receivers in one, featuring "Miracle Ear" sensitivity and design for which Arkay is noted. Variable AFC. Single front panel switch controls AM, FM or STEREO Selection. Tuning Range: 88 to 108 mc; Sens.: 4 μ V, for 20 db. quieting (5/N); Bandwidth: 200 kc, 6 db. down; Image Rejection: 30 db. minimum; Frequency Response: -5 db. 20 to 20,000 cps.

Wired and tested.....\$74.50
SAVE! Easy-to-build-kit.....\$49.95

SP-6 DUAL CHANNEL CONTROL CENTER

The SP-6 is a completely self powered sensitive dual pre-amp with dual inputs and outputs. Engineered to fit your requirements today, as well as tomorrow, the SP-6 provides unparalleled flexibility. Output of both amps is individually adjusted by one control, reverse position, hi lo filters, etc. Frequency Response 20 to 30,000 CPS $\pm 1/2$ DB. 1 M Distortion-less than 1/4%. Input level adjustments (4).



Wired and tested.....\$62.95
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16 page illustrated catalogue giving complete details and specifications of Radio, Hi-Fi, & Stereo equipment. See your dealer for your free copy.

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NEW! LAFAYETTE 'STEREO' HI-FI PHONO MUSIC SYSTEM

An Ideal Quality System For Listening To The New High Realism Stereo Sound!
FOR STEREO & MONAURAL REPRODUCTION



LAFAYETTE LA-90



GARRARD RC 121/11



NEW GE GC-7 STEREO COMPATIBLE CARTRIDGE WITH DIAMOND STYLUS



SK-58 SK-58

A superb complete phono music system brought to you by Lafayette's top stereo engineers. Heart of the system is the new Lafayette LA-90 28-watt stereo amplifier with 14 watts per channel or 28 watts monaurally and with all the inputs necessary for a complete stereo control center. Other fine components include the famous new Garrard RC121/11 4-speed automatic record changer, ready to accept stereo cartridges; the Lafayette PK-111 wood base for changer, of fine selected woods; the new GE GC-7 stereo/monaural variable reluctance magnetic cartridge with 0.7 mil genuine GE diamond stylus for microgroove stereo and monaural LP and 45 rpm records; and 2 of the unbeatable, for performance-value, Lafayette SK-58 12" coaxial speakers. Supplied complete with cables, connectors, and easy installation instructions. Shpg. wt., 66 lbs.

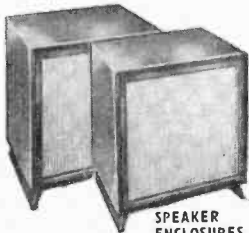
HF-374 Stereo Phono System, with mahogany or blonde wood changer base (please specify) Net **167.50**

HF-375 Same, but with 2-Lafayette CAB-16 mahogany or walnut or CAB-17 blonde speaker enclosures (specify which).
Net **222.50**

STEREO FM/AM-PHONO SYSTEM

HF-376 Same as HF-374 but with new Lafayette Model LT-99 Stereo FM/AM Tuner Net **237.00**

HF-377 Same as HF-376 but with 2-Lafayette CAB-16 mahogany or walnut or CAB-17 blonde speaker enclosures Net **292.00**



SPEAKER ENCLOSURES

Reg. Catalog Price

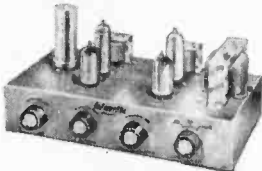
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NEW! LAFAYETTE STEREO AMPLIFIER KIT



- 4 WATTS STEREO OUTPUT
- COMPLETE STEREO CONTROLS
- TRANSFORMER OPERATED

ONLY 17.95

Brand new stereo amplifier kit for that extra small stereo hi-fi set, featuring separate volume controls; ganged tone control; stereo, reverse and monaural switch. 40 millivolt sensitivity! Complete kit with tubes, rectifier, all parts and instructions. Only 9 1/2" x 5" x 4 1/2". For 110-120 60 cycle AC. Shpg. wt., 7 lbs.
KT-126 — Complete Kit, with tubes.....Net **18.95**

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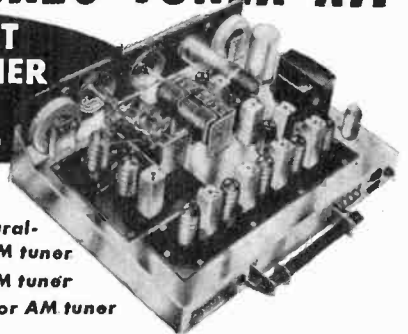
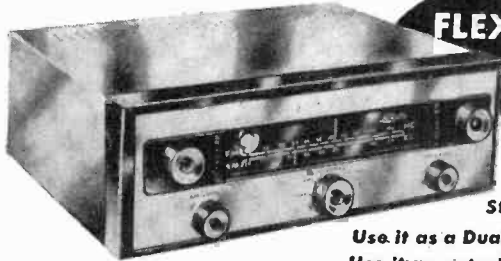
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CUT OUT AND PASTE ON POSTCARD

New!
YEARS AHEAD!

Lafayette STEREO TUNER KIT

**THE MOST
FLEXIBLE TUNER
EVER
DESIGNED**



Use it as a Binaural-
Stereophonic FM-AM tuner

Use it as a Dual-Monaural FM-AM tuner

Use it as a straight Monaural FM or AM tuner

- Multiflex Output for New Stereo FM
- 11 Tubes (including 4 dual-purpose) + Tuning Eye + Selenium rectifier Provide 17 Tube Performance
- 10KC Whistle Filter ● Pre-aligned IF's
- Tuned Cascode FM ● 12 Tuned Circuits
- Dual Cathode Follower Output
- Separately Tuned FM and AM Sections
- Armstrong Circuit with FM/AFC and AFC Defeat
- Dual Double-Tuned Transformer Coupled Limiters.

More than a year of research, planning and engineering went into the making of the Lafayette Stereo Tuner. Its unique flexibility permits the reception of binaural broadcasting (simultaneous transmission on both FM and AM), the independent operation of both the FM and AM sections at the same time, and the ordinary reception of either FM or AM. The AM and FM sections are separately tuned, each with a separate 3-gang tuning condenser, separate flywheel tuning and separate volume control for proper balancing when used for binaural programs. Simplified accurate knife-edge tuning is provided by magic eye which operates independently on FM and AM. Automatic frequency control "locks in" FM signal permanently. Aside from its unique flexibility, this is, above all else, a quality high-fidelity tuner incorporating features found exclusively in the highest priced tuners.

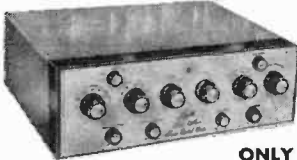
The 5 controls of the KT-500 are FM Volume, AM Volume, FM Tuning, AM Tuning and 5-position Function Selector Switch. Tastefully styled with gold-brass escutcheon having dark maroon background plus matching maroon knobs with gold inserts. The Lafayette Stereo Tuner was designed with the builder in mind. Two separate printed circuit boards make construction and wiring simple, even for such a complex unit. Complete kit includes all parts and metal cover, a step-by-step instruction manual, schematic and pictorial diagrams. Size is 13 3/4" W x 10 3/8" D x 4 1/2" H. Shpg. wt., 22 lbs.

The new Lafayette Model KT-500 Stereo FM-AM Tuner is a companion piece to the Models KT-300 Audio Control Center Kit and KT-400 70-watt Basic Amplifier Kit.

KT-500.....Net **74.50**
LT-50 Same as above, completely factory wired and tested.....Net **124.50**

KT-500 IN KIT FORM
74.50
ONLY 7.45 DOWN
7.00 MONTHLY

NEW! LAFAYETTE PROFESSIONAL STEREO MASTER AUDIO CONTROL CENTER



KT-600
79.50
IN KIT FORM

ONLY 7.95 DOWN

Solves Every Stereo/Monaural Control Problem!

- UNIQUE STEREO & MONAURAL CONTROL FEATURES
- AMAZING NEW BRIDGE CIRCUITRY FOR VARIABLE 3d CHANNEL OUTPUT & CROSS-CHANNEL FEED
- PRECISE "NULL" BALANCING SYSTEM

A REVOLUTIONARY DEVELOPMENT IN STEREO HIGH FIDELITY. Provides such unusual features as a Bridge Control, for variable cross-channel signal feed for elimination of "ping-pong" (exaggerated separation) effects and for 3d channel output volume control for 3-speaker stereo systems; 3d channel output also serves for mixing stereo to produce excellent monaural recordings. Also has full input mixing of monaural program sources, special "null" stereo balancing and calibrating system (better than meters), 24 equalization positions, all-concentric controls, rumble and scratch filters, loudness switch. Clutch type volume controls for balancing or as 1 Master Volume Control. Has channel reverse, electronic phasing, input level controls. Sensitivity 1.78 millivolts for 1 volt out. Dual low-impedance outputs (plate followers), 1300 ohms. Response 10-25,000 cps \pm 0.5 db. Less than .03% 1M distortion. Uses 7 new 7025 low-noise dual triodes. Size 14" x 4 1/2" x 10 1/4". Shpg. wt., 16 lbs. Complete with printed circuit board, cage, profusely illustrated instructions, all necessary parts.

LAFAYETTE KT-600 — Stereo Preamp kit.....Net **79.50**

NEW! LAFAYETTE STEREO/MONAURAL 36-WATT BASIC AMPLIFIER



KT-310
47.50
IN KIT FORM

ONLY 4.75 DOWN

- 36-WATT STEREO AMPLIFIER
- 4 PREMIUM-TYPE 7189 OUTPUT TUBES
- RESPONSE 35-30,000 CPS \pm 1/2 DB
- 18 WATTS PER STEREO CHANNEL OR 36 WATTS MONAURALLY
- 2 PRINTED CIRCUIT BOARDS FOR NEAT, EASY WIRING

A superbly-performing basic stereo amplifier, in easy-to-build kit form to save you lots of money and let you get into stereo now at minimum expense! Dual inputs, each provided with individual volume control. The unit may be used with a stereo preamplifier for 2 18-watt stereo channels, or at the flick of a switch, as a top-quality 36-watt monaural amplifier; or, if desired, it may be used as 2 separate monaural 18-watt amplifiers! **CONTROLS** include 2 input volume controls, channel reverse switch (AB-BA), monaural-stereo switch. **DUAL OUTPUT IMPEDANCES** are: 4, 8, 16 and 32 ohms (permitting paralleled monaural operation of 2 speaker systems of up to 16 ohms). **INPUT SENSITIVITY** is 0.45 volts per channel for full output. **TUBES** are 2-6AN8, 4-7189; GZ34 rectifier. **SIZE** is 9-3/16" d (10-9/16" with controls) x 5 1/4" h x 13 1/4" w. Supplied complete with perforated metal cage, all necessary parts and detailed instructions. Shpg. wt., 22 lbs.

KT-310 Stereo Power Amplifier Kit.....Net **47.50**

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NEW! 6 TRANSISTOR SUPERHET RECEIVER with LATEST NPN-PNP TRANSISTORS

- GE 2N188A AUDIO OUTPUT TRANSISTORS • 100% SUBMINIATURE PARTS - NO COMPROMISES!
- CLASS B PUSH-PULL AMPLIFICATION-PLENTY OF POWER. • FOR GROUP AND PRIVATE LISTENING
- LABORATORY DESIGNED — SENSITIVE, SELECTIVE, STABLE!

Superb Performance! Incomparable Value!

Transistor-wise Lafayette proudly presents its newly revised 6 Transistor Superhet Receiver Kit KT-119A. This improved model uses the latest GE NPN-PNP Transistors in an ingeniously engineered, laboratory tested circuit providing superb performance and an amazing superior commercial quality. The circuit features a specially matched set of 3 IF transformers, Oscillator Coil, High-Q Loop, Class B Push-Pull Audio Amplification and optimum Transformer Coupling in audio and output stages. Has efficient 2 3/4" speaker for exemplary reproduction and earphone jack for private listening. Complete with all parts, transistors, pre-punched chassis, but less battery and leather case. New 28 page easy-to-follow step-by-step instruction book. Size 6 x 3 1/2 x 1 1/2. Shpg. wt., 3 lbs.

- KT-119A — Complete Kit-Less Case and Battery.....Net 27.50
 BATTERY 9V BURGESS 2N6.....Net 1.30
 MS-339A — Sturdy attractive brown leather case with carrying strap for KT-119A. 6 x 3 1/2 x 1 1/2". Shpg. wt., 1 lb.....Net 2.95
 MS-366 — Sensitive matching earphone.....Net 1.29



27.50
Less Case
and Battery

3 TRANSISTOR SUPERHET POCKET RADIO KIT

- A TRUE POCKET SUPERHET RECEIVER NO EXTERNAL ANTENNA
- NO EXTERNAL GROUND



A remarkable sensitive, super-selective pocket superhet receiver with astonishing performance over the complete broadcast band. Uses 2 high-frequency and one audio transistor plus efficient diode detector and features 2 specially matched IF transformers for maximum power transfer. The components are housed in a professional looking beige plastic case.

The receiver's appearance enhanced by attractive maroon and silver station dial. Sensitive built-in ferrite antenna eliminates need for external antenna. A designer's dream in a true pocket superhet receiver! Complete with all parts, transistors battery, case, dial and easy to follow step-by-step instructions. 4 1/2" x 2 3/4" x 1-1/16". Shpg. wt., 1 lb. KT-116 — Complete Kit, less earphone.....Net 14.95

- MS-240 — Super Power Dynamic Earphone.....Net 3.95

NEW!

CODE PRACTICE SET

Economical and practical code practice key and buzzer unit for learning code.

Telegraph key chrome and nickel plated with both adjustable spring tension and contact clearance. The high frequency buzzer has frequency adjustment with locknut to keep tone constant. Screw type pin jack terminals for headphone connection. Works with inexpensive 1 1/2 volt battery. Heavy black molded phenolic base and buzzer housing. Base 6 1/4" x 2 3/4" x 1 3/8", overall length 8 1/2". Shpg. wt., 2 lbs. MS-438 Code Practice Set (less battery). 1.95



- BATTERY Burgess 2......13
 MS-369 Stethoscope Headset.....1.69

NEW MINIATURE HIGH SENSITIVITY MULTITESTER

20,000 OHMS PER VOLT DC — 10,000 OHMS PER VOLT AC
 CLEAR PLASTIC FACE COVER



A terrific buy in a hand-held, compact, light, accurate, completely wired instrument. Has a 36 μ A movement, 1% precision resistors and simple selector switch with calibration markings protected against wear. Scales: Volts DC and AC; 0-5-25, 100, 500, 1000; Ohms: 0-6K-600K-6 Meg; DC Current; 0-50 μ A- 5-50-500 MA; Decibels — 20 to +64 in 5 ranges. Size 4 1/2" x 2 7/8" x 1 1/4". Shpg. wt., 1 lb. Complete with batteries and test leads. Imported to save you money.

- AR-660 Miniature Meter.....Net 22.50

AUDIO LEVEL VU INDICATOR



NEW!

Precision loudness meter. Calibrated in Volume Units and percent, with 20 db variable attenuator. Ideal for setting output level in paging and music systems; removes guesswork when used as record-level indicator with tape recorders. Highly damped meter; responds to average level of voice and music. Impedance 10,000 ohms; sensitivity 1.4 volts for 0 VU. With capacitor for blocking DC to prevent burnout, 4" w x 2-3/16" h x 1-3/8" d. Shpg. wt., 1 lb.

- LAFAYETTE TM-20 Audio Level Meter.....Net 5.95

NEW! STEREO BALANCE VU METER



Removes guesswork in providing perfect balance of the 2 amplifier or preamplifier channels in any stereo system. Can be used as record-level indicator with stereo tape recorders, and for balancing stereo tuners. Impedance 10,000 ohms; calibrated 20 db attenuators, capacitors for blocking DC. Calibrated in Volume Units and percent; highly damped, reads average voltage of voice or music signals. Sensitivity 1.4 volts for 0 VU. Shpg. wt., 1 lb.

- LAFAYETTE TM-40 Stereo Balance Meter.....Net 8.95

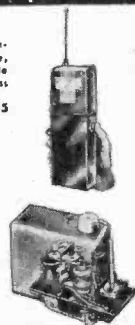
Lafayette's Radio-Control Specialties

LAFAYETTE SPECIAL R/C TRANSMITTER
 New crystal controlled 27.255 MC R/C transmitter, completely assembled, tested and guaranteed. Includes tube, crystal and 6 section telescoping antenna. Approx. 1 mile range. Size 8 1/2" x 2 1/4" x 1 1/4". Shpg. wt., 2 1/2 lbs. Less batteries.....Net 14.95

LAFAYETTE SPECIAL R/C RECEIVER
 New factory wired and tested RC receiver. Completely enclosed — for use around-water — case may be removed. Ready to operate on exam-free 27.255 MC band. Has fine tuning control, antenna lead, and connector plug. Requires one 1.5V and one 45V battery. Complete with 354 tube, less batteries. Size 1 x 2 1/4" x 1 1/2". Ideal companion for F-249 Transmitter. Shpg. wt., 8 oz. F-208 R/C RECEIVER (Less Batteries) Net 8.95

SPECIAL COMBINATION OFFER

Consists of R/C Transmitter (F-249) and R/C Receiver (F-208)
 F-259 Combination Net 22.90



20,000 OHM PER VOLT MULTITESTER SEMI-KIT

- 20,000 OHMS PER VOLT DC — 10,000 OHMS PER VOLT AC
- 40 MICROAMPERE 3"
- D'ARSONVAL METER MOVEMENT
- HIGH INPUT RESISTANCE ON ALL DC AND AC RANGES
- JUST CONNECT A FEW WIRES TO COMPLETE THE KIT



ONLY 11.95

The semi-kit is a new concept in test equipment kits. All the important or difficult parts are already mounted. All that remains to be done is to mount and wire in a few small parts — a job so simple you'll finish before you realize it, and best of all, you'll have one of the finest high sensitivity multimeters on the market. When used in a circuit, the high input resistance on all DC and AC ranges does away with the highly inaccurate readings common to low resistance testers which load the circuit. Ranges: DC Volts, 0-10-50-250-500-1000; AC Volts, 0-10-50-250-500-1000; DC CURRENT, 0-500 μ A, 0-10-250 ma; OHMS, 0-10K-100K-1 meg; DECIBELS, -20 to +36; PLUS 0-5000 henries and 250 mhf. to .02 mfd. Black case 5 1/4" x 3 3/4" x 1 1/4". Complete with test leads, all parts, and instructions. Shpg. wt. 3 lbs.

- TK-10 KIT.....Net 11.95

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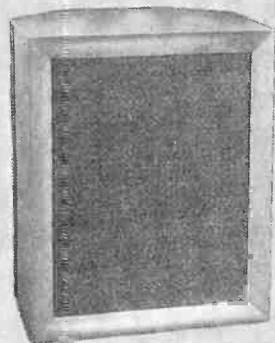


Don't let a lack of experience keep you from enjoying the fun and savings of "Do-it-yourself" kit construction. The easy-to-follow diagrams that come with every Heathkit insure your success. Let our experience be your teacher—and you'll save one-half or more over the price of "built-up" equipment of equal quality.

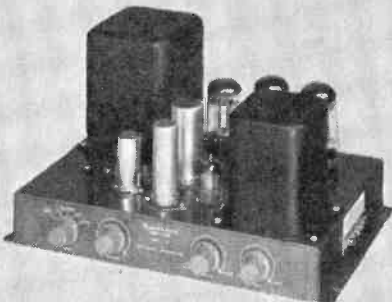
HEATH COMPANY A subsidiary of Daystrom, Inc. BENTON HARBOR '10, MICH.



"BASIC" SPEAKER SYSTEM



RANGE EXTENDER



A-9C 20-WATT AMPLIFIER

**HEATHKIT "BASIC RANGE"
HIGH FIDELITY SPEAKER SYSTEM KIT**

This amazing speaker system can fulfill your present needs and still provide for future expansion. Fine hi-fi performance the result of using high quality speakers in an enclosure especially designed for them. Features two Jensen speakers to cover 50 to 12,000 CPS within ± 5 db. Power rating is 25 watts, and impedance is 16 ohms. Enclosure constructed of veneer-surfaced plywood, $\frac{1}{2}$ " thick, and measures $11\frac{1}{2}$ " H x 23" W x $11\frac{1}{4}$ " D. Precut and predrilled for quick assembly.

Model SS-2
Shpg. Wt. 26 lbs. **\$39⁹⁵**

**HEATHKIT RANGE EXTENDING
HIGH FIDELITY SPEAKER SYSTEM KIT**

Designed especially for use with SS-2 "Basic" system. Contains 15" woofer and compression-type super tweeter. Extends basic unit to 35—16,000 CPS, ± 5 db. Impedance 16 ohms. Measures 29" H x 23" W x $17\frac{1}{2}$ " D, and is constructed of $\frac{3}{4}$ " veneer-surfaced plywood.

Model SS-1B
Shpg. Wt. 80 lbs. **\$99⁹⁵**

**HEATHKIT A-9C HIGH FIDELITY
AMPLIFIER KIT**

This model incorporates its own power supply and preamplifier. Plenty of power with full 20 watt rating. Four separate inputs, selected by panel-mounted switch, and separate bass and treble controls. Ideal for home or PA applications. Output transformer tapped at 4, 8, 16 or 500 ohms. Response within ± 1 db from 20 to 20,000 CPS.

Model A-9C
Shpg. Wt. 23 lbs. **\$35⁵⁰**

HEATHKIT HIGH FIDELITY FM TUNER KIT

Now you can have full-fidelity FM performance from 88 to 108 mc at reasonable cost. Features temperature-compensated oscillator—built in power supply, and beautiful cabinet. Components prealigned at factory!

Model FM-3A
Shpg. Wt. 8 lbs. **\$25⁹⁵**
(with cabinet)

HEATHKIT BROADBAND AM TUNER KIT

Tunes standard AM band from 550 to 1600 kc with fine sensitivity and broadband characteristics. Features include built-in power supply and low-distortion detector. All RF circuits prealigned for simplified construction.

Model BC-1A
Shpg. Wt. 9 lbs. **\$25⁹⁵**
(with cabinet)

**HEATHKIT "MASTER CONTROL"
HI-FI PREAMPLIFIER KIT**

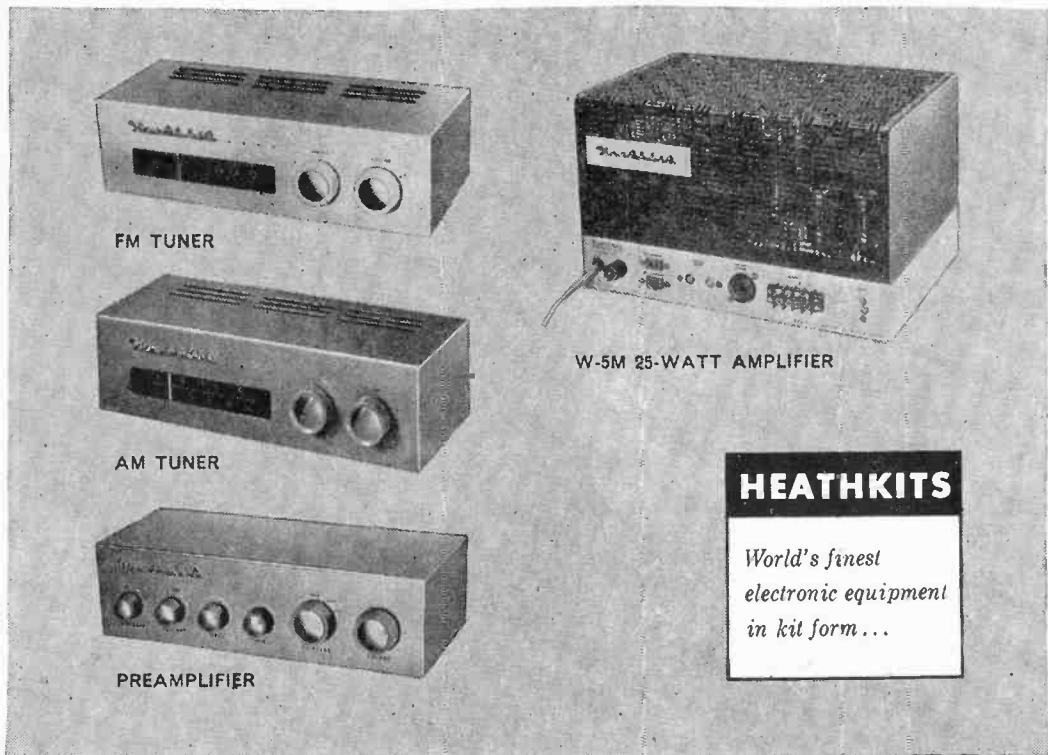
Provides extra amplification, selection of inputs, volume and tone controls, and turnover and rolloff controls, for Williamson-type amplifiers. Beautiful satin-gold enamel cabinet. Derives operating power from amplifier.

Model WA-P2
Shpg. Wt. 7 lbs. **\$19⁷⁵**
(with cabinet)

**HEATHKIT 25-WATT HIGH FIDELITY
AMPLIFIER KIT**

Outstanding 25-watt Williamson-type amplifier employs KT66 tubes and Peerless output transformer, tapped at 4, 8, and 16 ohms. A fine amplifier for the "deluxe" system. WA-P2 preamplifier required for operation. Express only.

Model W-5M
Shpg. Wt. 31 lbs. **\$59⁷⁵**





Choose your own "Do-it-yourself" project
from the world's largest kit manufacturer

HEATH COMPANY

A subsidiary of Daystrom, Inc.

BENTON HARBOR 10, MICHIGAN

Now you can have radio
wherever you go —
with the portable
that plays anywhere!

NEW LOW PRICE!

Model XR-1L
\$34⁹⁵

Model XR-1P
\$29⁹⁵

Note: Prices are with cabinet less batteries.

HEATHKIT MODEL XR-1P TRANSISTOR PORTABLE RADIO KIT

This easy to build transistor radio is designed for lifetime operation. Features 6 name-brand (Texas Instrument) transistors for extra good sensitivity and selectivity. A 4" x 6" speaker for "big set" tone, built-in rod-type antenna, and uses 6 standard size "D" flashlight cells for extremely long battery life (between 500 and 1,000 hours). Cabinet is two-tone blue molded plastic with pull-out carrying handle. Measures 9" L. x 7" H. x 3 $\frac{1}{4}$ " D. Transformers are prealigned eliminating special alignment equipment. Shpg. Wt. 6 lbs.

MODEL XR-1L: Identical to XR-1P except in leather case. Carrying strap included. Shpg. Wt. 7 lbs.

HEATHKIT BROADCAST BAND RADIO KIT

Covers 550 to 1600 kc with good sensitivity and selectivity. Has 5 $\frac{1}{2}$ " PM speaker for good tone quality. Features transformer power supply and built-in antenna. Signal generator recommended for alignment. Cabinet, as shown, available separately. Shpg. Wt. 10 lbs.

Model BR-2
\$18⁹⁵

(less cabinet)

HEATHKIT CRYSTAL RADIO KIT

Features a sealed germanium diode to eliminate critical "cats whisker" adjustment. Employs two tuning condensers for good selectivity, and covers the broadcast band from 540 to 1600 kc. Requires no external power. Kit price includes headphones. Shpg. Wt. 3 lbs.

Model CR-1
\$7⁹⁵

HEATHKIT ENLARGER TIMER KIT

The dial of this handy timer covers 0 to one minute calibrated in five-second gradations, so that the timing cycle of a photographic enlarger can be electronically controlled. Built-in relay handles up to 350 watts, and enlarger merely plugs into receptacle of front panel. Also provision for plugging in safe-light. An easy-to-build device that makes a fine addition to any dark room. Shpg. Wt 3 lbs.

Model ET-1
\$11⁵⁰

TABLE-MODEL RADIO

CRYSTAL RADIO

ENLARGER TIMER

HEATHKIT FUEL VAPOR DETECTOR KIT

The FD-1 is a safety device to detect fuel vapor in the engine compartment or other sections of your boat. The detector unit mounts in the area to be checked, and the indicating meter and controls mount on the control panel. Will operate intermittently or continuously, and indicates dangers of fire or explosion to protect your boat and its passengers. Models FD-1-6 (6 volts DC) and FD-1-12 (12 volts DC) operate from boat batteries. Kit even includes spare detector unit. Shpg. Wt. 4 lbs.

6-volt FD-1-6,
12-vt. FD-1-12
\$35⁹⁵
each

HEATHKIT RF POWER METER KIT

This handy device measures the RF field in the vicinity of a transmitter, whether it be marine, mobile, fixed, etc. Requires no electricity, nor direct connection to the transmitter. Provides a continuing indication of transmitter operation. Merely place it in proximity to the transmitter antenna and it will produce a reading on its 200 ua panel meter when the transmitter is in use. Operates with any transmitter between 100 kc and 250 mc. Includes a sensitivity control for meter. Shpg. Wt. 2 lbs.

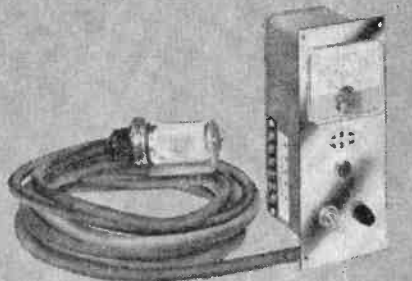
Model PM-1
\$14⁹⁵

HEATHKIT TRANSISTOR RADIO DIRECTION-FINDER KIT

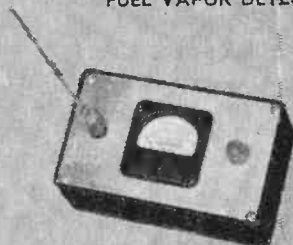
The Heathkit Transistor Radio Direction-Finder model DF-1 is a self-contained, self-powered, 6-transistor super heterodyne broadcast radio receiver incorporating a directional loop antenna, indicating meter, and integral speaker. It is designed to serve primarily as an aid to navigation when out of sight of familiar landmarks. It can be used not only aboard yachts, fishing craft, tugs, and other vessels which navigate either out of sight of land or at night, but also for the hunter, hiker, camper, fisherman, aviator, etc. It is powered by a 9-volt battery. (A spare battery is also included with the kit.) The frequency range covers the broadcast band from 540 to 1600 kc and will double as a portable radio. A directional high-Q ferrite antenna is incorporated which is rotated from the front panel to obtain a fix on a station and a 1 ma meter serves as the null and tuning indicator. The controls consist of: tuning, volume and power (on-off), sensitivity, heading indicator (compass rose) and bearing indicator (antenna index). Overall dimensions are 7 $\frac{1}{2}$ " W x 5 $\frac{1}{4}$ " H x 5 $\frac{1}{4}$ " D. Supplied with slip-in-place mounting brackets, which allow easy removal from ship bulkheads or other similar places. Shpg. Wt. 4 lbs.

Model DF-1
\$54⁹⁵

NEW! Heathkits for the boating enthusiast



FUEL VAPOR DETECTOR



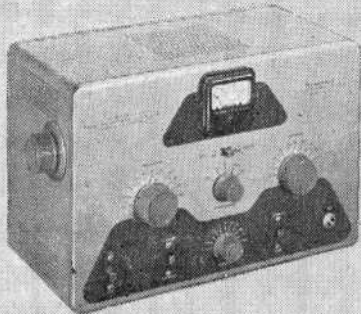
POWER METER



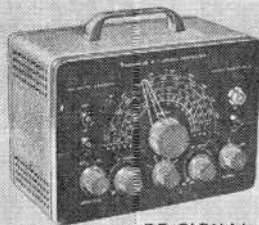
RADIO DIRECTION-FINDER



HEATHKIT



DX-20 TRANSMITTER



RF SIGNAL GENERATOR



GRID DIP METER



HANDITESTER

HEATHKIT DX-20 CW TRANSMITTER KIT

This Heathkit straight-CW transmitter is one of the most efficient rigs available today. It is ideal for the novice, and even for the advanced-class CW operator. It employs a 6DQ6A tube in the 50-watt final amplifier circuit, a 6CL6 oscillator and a 5U4GB rectifier. Single-knob band switching covers 80, 40, 20, 15, 11, and 10 meters. The DX-20 is designed for crystal excitation, but may be excited by an external VFO. Pi network output circuit is employed to match antenna impedances between 50 and 1000 ohms.

Shpg. Wt. 19 lbs.

Model DX-20
\$35⁹⁵

HEATHKIT GRID DIP METER KIT

An instrument of many uses for the ham, experimenter, or service technician. Useful in locating parasitics, neutralizing, determining resonant frequencies, etc. Covers 2 mc to 250 mc with prewound coils. Use to beat against unknown frequencies, or as absorption-type wave meter.

Shpg. Wt. 4 lbs.

Model GD-1B
\$21⁹⁵

HEATHKIT RF SIGNAL GENERATOR KIT

Produces rf signals from 160 kc to 110 mc on fundamentals on five bands, and covers 110 mc to 220 mc on calibrated harmonics. Output may be pure rf, rf modulated at 400 CPS, or audio at 400 CPS. Prealigned coils eliminate the need for calibration after completion.

Shpg. Wt. 8 lbs.

Model SG-8
\$19⁵⁰

HEATHKIT HANDITESTER KIT

Measures AC or DC voltage at 0-10, 30, 300, 1000 and 5000 volts. Direct current ranges are 0-10 ma and 0-100 ma. Ohmmeter ranges are 0-3000 and 0-300,000 ohms. Sensitivity is 1000 ohms/volt. Features small size and rugged construction in sleek black-bake-ite case.

Shpg. Wt. 3 lbs.

Model M-1
\$17⁹⁵

HEATHKIT ETCHED-CIRCUIT VTVM KIT

Sensitivity and reliability are combined in the V-7A. It features 1% precision resistors, large 4½" panel meter, and etched circuit board. AC (RMS) and DC voltage ranges are 0-1.5, 5, 15, 50, 150, 500, and 1500. Peak-to-peak AC ranges are 0-4, 14, 40, 140, 400, 1400 and 4000 volts. X1, X10, X100, X10k, X100k, and X1 megohm.

Shpg. Wt. 7 lbs.

\$24⁵⁰

HEATHKIT ALL-BAND RADIO KIT

This receiver covers 550 kc to 30 mc in four bands, and is ideal for the short wave listener or beginning amateur. It provides good sensitivity and selectivity, combined with good image projection. Amateur bands clearly marked on the illuminated dial scale. Employs transformer-type power supply—electrical band spread—antenna trimmer—separate rf and af gain controls—noise limiter and headphone jack. Built-in BFO for CW reception. Cabinet, as shown, available separately.

Shpg. Wt. 12 lbs.

Model AR-3
\$29⁹⁵

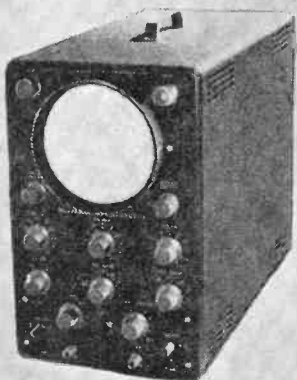
(less cabinet)

HEATHKIT "GENERAL PURPOSE" 5" OSCILLOSCOPE KIT

This oscilloscope sells for less than the previous model, yet incorporates features for improved performance. The OM-2 provides wider vertical frequency response, extended sweep generator coverage, and increased stability. Vertical channel is essentially flat to over 1 mc. Sweep generator functions from 20 CPS to over 150 kc. Amplifiers are push-pull, and modern etched circuits are employed in critical parts of the design. A 5BP1 cathode ray tube is used. The scope features external or internal sweep and sync, 1-volt peak-to-peak reference voltage, three-position step attenuated input, and many other "extras."

Shpg. Wt. 22 lbs.

Model OM-2
\$39⁹⁵



"GENERAL-PURPOSE" SCOPE



VACUUM TUBE VOLTMETER



ALL-BAND RADIO



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Quantity	Item	Model No.	Price
<input type="checkbox"/> SEND FREE Heathkit Catalog			

Enclosed find check money order for \$_____. Please ship C.O.D. postage enclosed for _____ lbs. On express orders do not include transportation charges—they will be collected by the ex-

press agency at time of delivery. On parcel post orders include postage for weight shown. Orders from APO's must include full remittance. NOTE: All prices are subject to change without notice and are F.O.B. Benton Harbor, Mich.

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Model # 3239 84.50

*FM Converter usable only on cars with 12 volt systems.

GONSET
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DIVISION OF
YOUNG-SPRING & WIRE
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Tips and Techniques

(Continued from page 98)

cut a hole of the correct size and shape as shown in the photograph. Hold the shield close to the chassis when you spray and you'll get a neat job. —J.E.P.

TAPE RECORDER CORD STORAGE

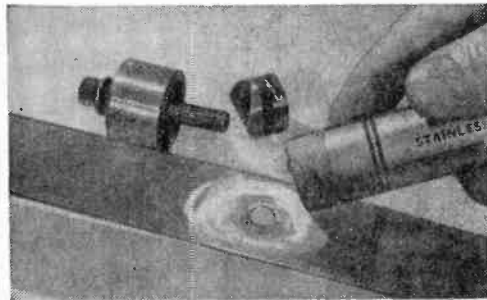
If your tape recorder has a detachable power cord (most of them do), you'll find it easier to store the cord compactly in a



plastic bowl cover rather than to wrap it around the recorder's case. Simply roll up the cord into a coil about 5" in diameter and slip the plastic cover over it. This way the cord can't unroll or tangle up and it makes for neater storage. —J.A.C.

REDUCE CHASSIS-PUNCH WEAR

In addition to keeping a chassis punch oiled, a good way of reducing wear on it is to lubricate the surface to be punched. A



good way to do this is to rub the surface with stainless stick lubricant, which is sold at automobile garages and parts dealers. It stays put during the cutting job, is not messy, and can readily be wiped off afterward. —K.M.

INSULATE WITH RUBBER TUBING

A screwdriver with its shank covered with a section of soft rubber tubing is

Always say you saw it in—POPULAR ELECTRONICS

BUILD 16 RADIO

Reg. U. S.
Pat. Off.



CIRCUITS AT HOME ONLY
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The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL. You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis. You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting in the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester and the accompanying instructional material. You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 16 Receivers, Transmitters, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for Television, Hi-Fi and Electronics.

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 \$22.95. 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 worthwhile investment. 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.

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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 "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, layout 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.

Included in the "Edu-Kit" course are sixteen Receiver, Transmitter, Code Oscillator, Signal Tracer, and Signal Injector circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

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, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, 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 and 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 Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

FREE EXTRAS

SET OF TOOLS

- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
- ALIGNMENT TOOL
- WRENCH SET
- VALUABLE DISCOUNT CARD
- CERTIFICATE OF MERIT
- TESTER INSTRUCTION MANUAL
- HIGH FIDELITY GUIDE & QUIZZES
- TELEVISION BOOK & RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE, FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

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 trouble 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. Statkalis, 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 the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Test Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

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

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- Send "Edu-Kit" C.O.D. I will pay \$22.95 plus postage.
- Send me FREE additional information describing "Edu-Kit."

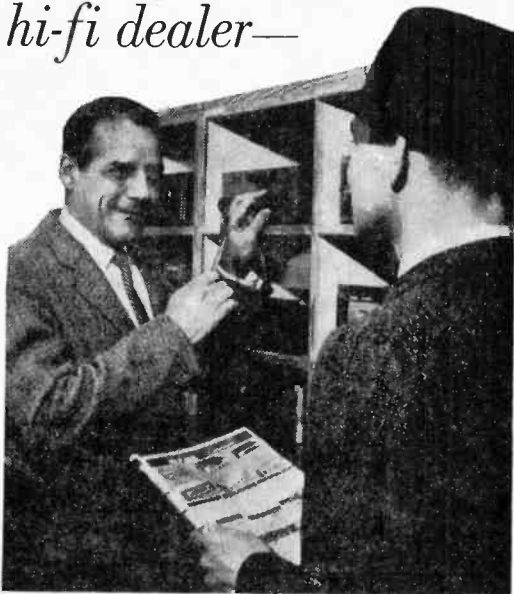
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The **HI-FI DIRECTORY & BUYERS' GUIDE** is on sale in October—watch for it!

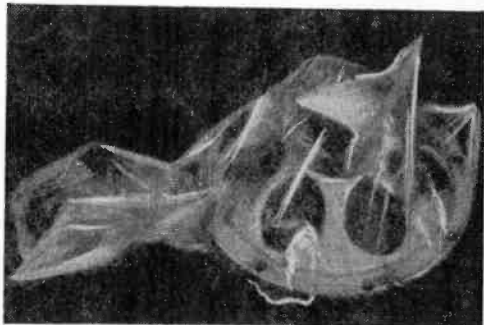


ZIFF-DAVIS PUBLISHING CO.
434 S. Wabash Ave., Chicago 5, Illinois

handy to have around. The tubing will prevent shock and tube breakage and the screwdriver can safely be used to tap tubes when testing for shorts and noise. —K.M.

BAG SAFE-STORES SMALL SPEAKER

Save those plastic bags that records or vegetables are sold in—they're handy dust-proof containers for small speakers. With the speaker stored in a bag until you are



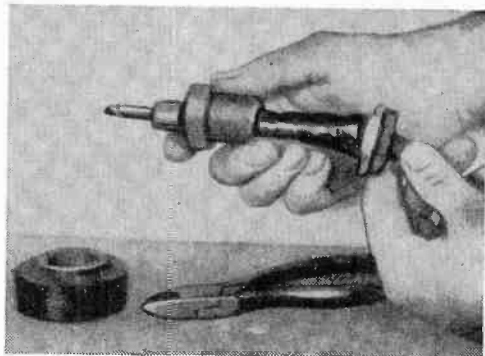
ready to use it, there's less chance of dust or metal particles entering the voice-coil gap to cause distortion. Also, there's less likelihood of the cone getting accidentally punctured. —J. A. C.

DEMAGNETIZING SCREWDRIVERS

Those annoying magnetized screwdrivers that are always picking up metal chips or that small screw at the wrong moment can be easily demagnetized using your soldering gun. With the gun operating, pass the screwdriver blade between the tip holders. The a.c. field set up between the holders is sufficient to do the job. —R. L. K.

UNTANGLED SOLDERING IRON CORD

Are you tired of having a tangled soldering iron cord in your tool box? Cut the



existing cord an inch from the handle and solder a male receptacle of the type used on TV sets to the short leads. Tape the con-

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Signal Oscillator, Key and Flasher . . . the complete outfit to learn to receive and transmit the Morse Code . . . the first step to a Ham License.

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All the parts to build your own Radio Signal Tracer and a Probe Light Continuity Tester. Both pieces invaluable in radio servicing.

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Laboratory demonstration of sound waves, resonance and pitch. Equipment includes Loud Speaker, Resonance tube and Sonometer.

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Gives you a blown up ringside view of the brilliant explosions of disintegrating radium atoms ejecting alpha particles at 11,000 miles per second.

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A sensitive three tube regenerative radio—transformer powered. Can be plugged into regular 110 a/c home circuit. Complete with head set.

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A sensitive carbon microphone that greatly amplifies unsuspected noises. Also adaptable for use with your radio transmitter.

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A variable pulse neon light. "Freezes" motion of rapidly vibrating or rotating objects for close study and checking frequencies, RPM.

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Laboratory studies of heat and its effect on solids, liquids and gases. Provides two Thermometers, Therma-couple, and Alcohol Burner.

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A group of interesting experiments with Optical Lenses, Prism, Photo-meter, Polarized Light, Ultra Violet "Back" Light and Invisible Infra Red.

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Check radioactivity of ores and do radiation experiments with sensitive Electro-scope. Sample of Uranium and other radioactive ore.

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Fascinating optical instrument used to identify and analyze substances by observing the spectrum of their flame. Spectrum charts included.

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Explore functions of vacuum tubes and other electronic components. Build an Electronic Switch—Amplifier, and other experimental circuits.

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Sends clear transmissions of both code and voice to nearby radios. Can be used with your microphone, record player, or code oscillator.

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A mounted astronomical Telescope. High quality ground lens enables you to examine details of the Moon's surface and distant objects.

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High and low power, precision-ground optical lens, self-illuminated. Adaptable for photomicrography in connection with photo lab.

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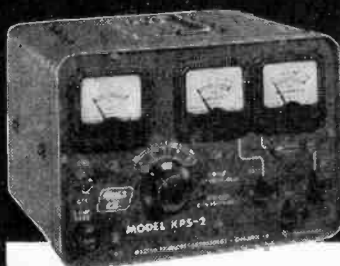
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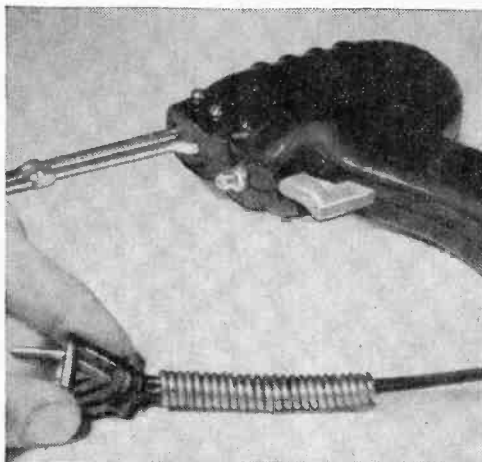
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1A7GT	3BA6	5X8	6BH6	65B7Y	7H7	12S17	35B5
1B3GT	3BC5	5Y3GT	6BR8	65C7	7J7	12SK7	35C5
1C5GT	3BE6	5Y4G	6BJ6	65F5	7K7	12SN7GT	35L6GT
1C6	3BN6	5Z3	6BK5	65F765GT	7L7	12S07	35W4
1C7	3BU8	5Z4	6BK7	65H7	7N7	12SR7	35Y4
1H4G	3BY6	6A8	6BL7GT	65J7	7O7	12V4GT	35Z4GT
1H5GT	3BZ6	6A8A	6BN6	65K7	7R7	12W4GT	35Z5GT
1I6	3C2	6AC7	6BQ6GT	65L7GT	7S7	12X4	# 37
1I4A	3C6	6AF4	6B07	65N7GT	7V7	12Z3	# 39/44
1I6A	3C6	6AG5	6BR8	65O7	7W7	16A7	# 41
1I84	3C6	6AG7	6B58	65R7	7X6	14A17	# 42
1I85	3D76	6AH4GT	6B75G	674	7X7	14B6	# 43
1I6A	3D4	6A8A	6B7A	678	7Y4	14E7	# 45
1I4A	3D5GT	6A85	6B7Z	6U4GT	7Z4	14F8	# 47
1I1N5	354	6A8A	6C4	6U5	8AW8	14H7	50A5
1N5GT	3V4	6A15	6C5	6U8	12A8	14N7	50B5
1P5GT	4B8C	6A17GT	6CB5	6V3	12A85	14Q7	50C5
1Q5GT	4BQ7A	6A8B	6CB6	6V6GT	12AQ5	14S7	50C6G
1R5	4B58	6A8B	6CD6G	6W4GT	12A16	17AX4GT	20L6GT
155	4B8B	6AQ5	6CF6	6W6GT	12A17	17DQ6	5D1A
174	4B27	6AQ6	6CG7	6K4	12A16	19A1A	5D17
175GT	4C86	6AQ7GT	6C86	6X5GT	12A17	19B6G	# 57
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1V	5AQ5	6A58	6CM6	7A4	12AX4GT	19T8	# 81
1V2	5A58	6A76	6CM7	7A5	12AX7	19X8	117L7GT
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2B7	5BR8	6AV6	6E5	7B6	12RH7	25C0AG	807
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2X2A	5I6	6AZ8	6J8	7C5	12CA5	25Z5	
3A2	5T8	6B46	6K6GT	7C6	12C16	25Z6	
3A3	5U8	6B56	6K7	7C7	12D06	# 37	
3A4	5U4G	6B8C	6L6	7C6	12J5	# 30	
3A5	5V4G	6B86	6L7	7E7	12L6GT	# 31	

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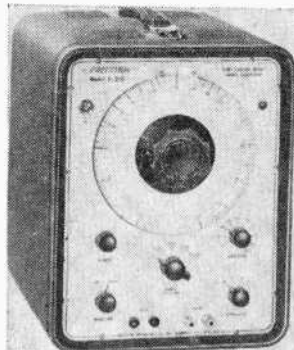
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155	\$.59	5AN8	\$.85	6AL7	1.49	6BC6	1.13	6C7	\$.65	6SQ7	\$.59	12B6	\$.69	25K5	\$.91
1T4	\$.59	5AN8	1.02	6AM8	\$.83	6BD6	\$.65	6CL6	\$.91	6T4	\$.99	12BD6	\$.63	25BQ6	1.29
1U4	\$.59	5AQ5	\$.59	6AN4	1.20	6BE6	\$.59	6CN7	\$.69	6T8	\$.85	12BE6	\$.55	25D6	1.54
1U5	\$.95	5AT8	\$.49	6AU6	1.19	6BF5	\$.79	6DT7	\$.65	6U7	\$.59	12C6	1.29	35L6	\$.61
1V2	\$.59	5AV8	1.11	6AQ5	\$.59	6BF6	\$.49	6C57	\$.78	6V3	1.21	12EH7	\$.79	25W4	\$.78
1X2A	\$.79	5BK7A	\$.98	6AQ6	\$.62	6BG6G	1.59	6C6B	1.19	6V6	\$.59	12EK5	\$.96	25Z6	\$.66
3BC5	\$.59	5WB8	\$.89	6AT6	\$.49	6BL7	\$.95	6D7E	\$.59	6X5	\$.59	12EQ6	1.29	35A5	\$.89
3AL5	\$.54	5T8	\$.98	6AS5	\$.69	6BK5	\$.81	6DE6	\$.59	6W6	\$.71	12EY7	\$.79	35B5	\$.75
3AU6	\$.75	5U4	\$.59	6AS6	1.29	6BK7A	\$.89	6D06	1.14	6X4	\$.48	12B27	\$.77	35C5	\$.55
3BE5	\$.65	5V8	\$.89	6AT6	\$.49	6BL7	\$.95	6E6	\$.59	6X5	\$.59	12C6	1.20	35L6	\$.61
3BE6	\$.63	5V4	\$.59	6AT8	\$.91	6BN6	\$.79	6H6	\$.79	6X8	\$.79	12L6	\$.61	35W4	\$.45
3B86	\$.86	5X8	\$.93	6AU4	\$.96	6BO6	1.15	6J5	\$.49	12AT6	\$.49	12SA7	\$.69	35Z5	\$.49
3B76	\$.86	5Y8	\$.49	6AU5	1.19	6BF5	\$.79	6J6	\$.59	12AT7	\$.79	12E7	\$.69	50A5	\$.79
3C86	\$.65	6AR4	\$.59	6AU6	\$.59	6BX7	\$.99	6K6	\$.59	12A6	\$.62	12SN7	\$.69	50B5	\$.69
3C86	\$.59	6AC7	\$.79	6AU8	\$.92	6BY5	1.11	6S4	\$.59	12A7	\$.66	12S7	\$.69	50C5	\$.59
3C56	\$.59	6AF7	\$.99	6AV7	\$.99	6BZ6	\$.59	6C7	\$.69	12AV6	\$.47	12V6	\$.59	50L6	\$.61
3D76	\$.59	6A55	\$.69	6AV8	\$.45	6BZ7	\$.99	6C87	\$.78	12AV7	\$.79				

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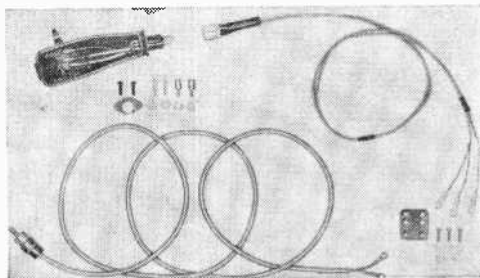


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in one operation. (*Ungar Electric Tools, Inc.*, 4101 Redwood Ave., Los Angeles 66, Calif.)

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Most Garrard record players can be converted in minutes to stereo wiring with a new stereo conversion kit. It consists of a female connector wired with two leads for the tone arm, a complete audio cable with plug for the second amplifier, a stereo shell in which to mount the cartridge, hardware,



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Model 173 is a 1½" meter with a 3.4" scale length, comparable to that of 4½" meters of conventional type. Accuracy is held to ± 3% of full-scale deflection. A D'Arsonval movement meter, it is self-contained and individually calibrated for use on magnetic or non-magnetic panels. (*International Instruments Incorporated*, P. O. Box 2954, New Haven 15, Conn.)



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| 1N5GT | 6AG7 | 6BY5G | 6ST4 | 12AV7 | 25W4GT |
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| 1V2 | 6AN8 | 6CDG6 | 6X4 | 12B7 | 35C5 |
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| 2A3 | 6AQ5 | 6CG7 | 7A4/XXL | 12B7 | 35W4 |
| 2AF4 | 6AQ6 | 6CL6 | 7A5 | 12B7 | 35Z5GT |
| 3BC5 | 6AQ7GT | 6CM6 | 7A6 | 12J5 | 37 |
| 3BN6 | 6AR5 | 6CN7 | 7A7 | 12K7 | 39/44 |
| 3BZ6 | 6AS5 | 6CS6 | 7A8 | 12L6 | 42 |
| 3CB6 | 6AT6 | 6CU6 | 7B4 | 12M7 | 43 |
| 3CF6 | 6AT8 | 6DE6 | 7B5 | 12N7 | 45 |
| 3CS6 | 6AU4GT | 6DO6 | 7B6 | 12Q7 | 50A5 |
| 3LF4 | 6AUSGT | 6F6 | 7B7 | 12SA7 | 50B5 |
| 3Q4 | 6AU6 | 6H6 | 7B8 | 12SG7 | 50C5 |
| 3S4 | 6AU8 | 6J4 | 7C4 | 12SJ7 | 50L6GT |
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| 5BK7 | 6BC5 | 6O7 | 7H7 | 12V6GT | 77 |
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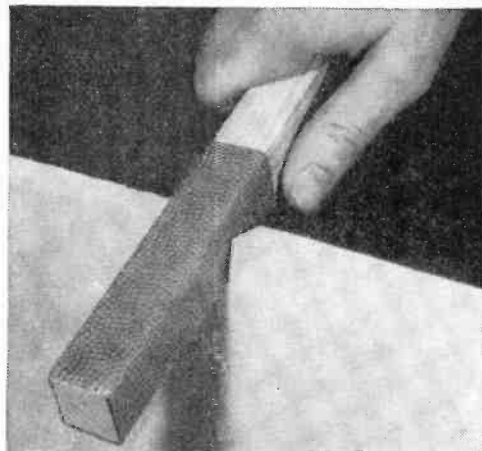
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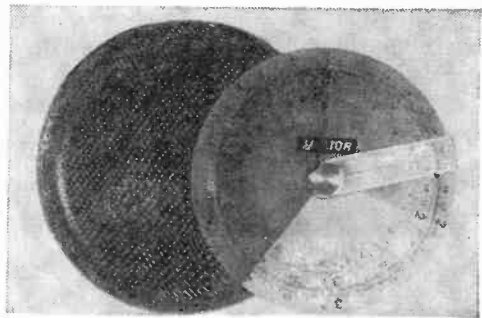
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which multiply, subtract, hold numbers, figure, add and subtract percentages, and perform many other calculations instantly. It can be used easily and unobtrusively. Retail price, \$5.95. (R/B Crafters, 1642 Fairmont Ave., Philadelphia 30, Pa.)

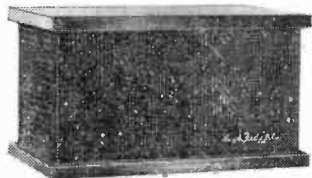
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(Continued on page 131)

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Turn It—for Better Pictures

(Continued from page 61)

in the two windings will be out-of-phase, a rotational force will be applied to the armature of the motor, and it will turn in one direction.

If the capacitor is inserted in series with the other winding only, then the motor will turn in the other direction. (See Fig. 2.) This leads to a simple control system that is used in almost all modern antenna rotator systems—the directional switch.

Directional Switch. This switch applies voltage to one of the motor windings; the phase-shifting capacitor is then in series with the other winding, and the motor turns in one direction. If the switch is thrown to the other side, the voltage is applied directly to the other winding, the capacitor is in series with the first winding, and the motor turns in the opposite direction. (See Fig. 3.)

The phase-shifting capacitor is important in many ways. It must be suitable for a.c. operation and have the proper capacitance for the particular motor it is used with. If it changes value, the phasing and cur-

rent will be wrong, and the motor will not have enough power to turn the antenna. This capacitor is located in the control box along with the direction switch.

To reduce the number of operating controls to a minimum, the main power switch in the control box is usually a part of the directional switch. Thus, when the directional switch is operated in either direction, line voltage is applied to the power transformer. The motor armature turns at approximately 1800 rpm so that a train of gears, worm or planetary, is necessary to reduce the speed of antenna rotation to about one rpm.

If a resistor of a few ohms resistance is inserted in series with the common lead to the motor, and this resistor has a sliding contact of special construction so arranged that the arm is mechanically moved by the same shaft that turns the antenna, then an a.c. voltage is available that is proportional to antenna direction. This voltage can be read on an a.c. meter with special calibration. (See Fig. 3.)

Some means, either mechanical or electrical, is provided to bring the direction indicated on the meter into agreement with

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The Cleveland Amateuradio Convention will be held on Saturday, October 18, from 0800 to 2400 at the Masonic Auditorium at 36th and Euclid. Products of leading manufacturers and distributors of amateur radio equipment will be displayed. Pre-registration is \$2.00 per person, \$3.50 per couple, by October 15. For more information, write Cleveland Amateuradio Convention, P. O. Box 5167, Cleveland I, Ohio.

the direction of the antenna. The manufacturer's instruction sheet or service bulletin has specific alignment information.

Rotator types with a full 360° compass-type indicator usually have a set of contacts in the mechanical unit that open and close in synchronism with rotation. These contacts actuate a solenoid in the control box that turns the direction indicator.

A Good Investment. When contemplating the purchase of a rotator, inquire as to the availability of instruction and service bulletins, parts, and factory repair service. The rotator is a good investment, not only in dollars, but in years of enjoyment of the finest picture quality available on each channel in your area.

Leading manufacturers of antenna rotators include: Alliance Manufacturing Co., Inc., Alliance, Ohio; Cornell-Dubilier Electric Corp., S. Plainfield, N. J.; Crown Controls Co., Inc., New Bremen, Ohio; and Radiart Corp., Indianapolis, Ind. -50-



Instrumenting a Satellite

(Continued from page 44)

corded. The number of beeps per time unit is then plotted against a prepared graph.

The satellite's power supply consists of an NT6 (Willard) 6-volt storage cell for the Brain, and eight 15-volt hearing aid batteries in addition to the 22.5-volt battery and two 1.5-volt penlight cells.

There is provision in the Brain for the use of cosmic ray detectors, and the versatility of the satellite is further enhanced by universal connections which allow change of instrumentation simply by changing sensors.

If "Argus I" were to be set in orbit, a vertical axis spin would be imparted by the last stage of the rocket. Chances are it will never see the undiluted light of space. However, in its earth trials, the satellite

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performs its mission perfectly. Perhaps it will serve as a prototype of things to come.

The satellite's designer lives in the Bronx, New York, and has just entered Massachusetts Institute of Technology. Ronald plans to major in physics and expects to go on and make his career in the field of electronics.

-30-

"Warmth Meter"

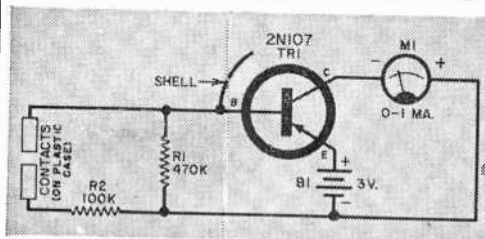
(Continued from page 54)

creased considerably over that otherwise obtained. The shunt may be the fingers (which would be kept secret from the uninitiated, of course). Slyly moistening the fingers can make the meter needle practically jump off scale. Thus, someone in the know can prove visibly that he is a very "hot" individual.

Possible overload damage to transistor, meter, or both, is prevented by series resistor R2. Maximum current through the meter will be less than 3 ma., which will not damage it unless unduly prolonged. For positive protection of the meter, you can put about 1500 ohms in series with it, although this has not been found necessary.

If you wish, the two shunting contacts on the plastic case may be made far less conspicuous, or less easily touched. One might be at the wire entrance hole, for example. The other contact going to the base of the transistor can be omitted. You can simply scrape a little paint off the shell of the transistor since its shell is internally grounded to the base. Touching the contact connected to minus (through the resistor) and the bare spot on the transistor shell will have the same effect as shunting the two contacts.

-30-



PARTS LIST

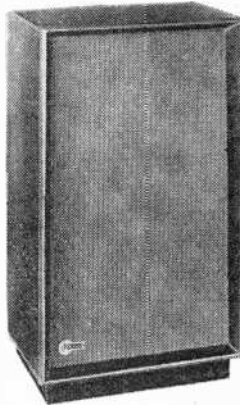
- B1—2 penlight cells
- R1—470,000-ohm resistor
- R2—100,000-ohm resistor
- TRI—Transistor (G.E. 2N107 or equivalent)
- 1—Transistor socket
- 1—Plastic transistor case (or equivalent pill holder)

Hi-Fi Highlights
(Continued from page 75)



46 Console and portable stereo system features four-speed changer, dual amplifiers, jacks for extension speakers, balance and tone controls. Available in seven models. Sonic Industries.

47 Bass reflex speaker system for monophonic or stereo incorporates an "acoustic filter," designed for smooth bass response. Two models offered, one with 12" speaker and tweeter, the other with 10" speaker and tweeter. Enclosures available separately. Wharfedale W/AF/1 and W/AF/2.



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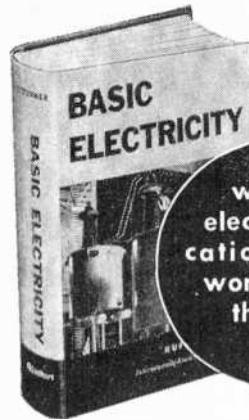
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From Pages to Projects

(Continued from page 87)

"Baffle" on principles advanced by H. A. Hartley in a series of articles in RADIO & TV NEWS. The enclosure has a volume of approximately 10,800 cubic inches. The upper end of the low frequencies, above 160 cycles, is handled by a 12" speaker installed in a smaller "Baffle."

The high-frequency channel crosses over at 5000 cycles. The lower end is handled by an 8" speaker and the higher frequencies are carried by a bank of four small cone-type tweeters designed to handle frequencies up through 17,000 cycles. These five speakers are installed in an enclosure which matches that used for the 12" speaker but without the acoustical damping of the "Baffle" design.

The lower channels are fed by a 20-watt basic Williamson amplifier and the upper frequencies are supplied by our original 7-watt job.

Special Features. Level controls and phasing switches are essential to good operation of this system. The level of the two main branches is controlled at the electronic crossover and a further balance of sound between the speakers in both the high and low frequencies is obtained by using T-pads on the output sides of the LC crossovers. Proper phasing of the speakers is secured by installing d.p.d.t. switches in the speaker leads, as shown in the schematic diagram.

This system provides a broad selection of program material sources. We are using a viscous damped tone arm and a manual turntable for our better records. For the older 78's we switch to another manual player which is fed into a preamp with record equalization.

An important feature of the system is the provision for recording. Two microphones on booms and a smaller microphone located in the control room feed a transistorized mixer and a tape recorder and/or disc cutter. The disc cutter is driven by a 20-watt amplifier which also powers an 8" monitoring speaker in the control room.

The speaker system is installed in a studio room having a floor area of approximately 600 square feet with a nine-foot ceiling. One end wall behind two large grand pianos has been acoustically treated. We try varying the locations of the speakers from time to time but the pre-

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Photo by Hy Peskin, courtesy Sports Illustrated, © Time, Inc.

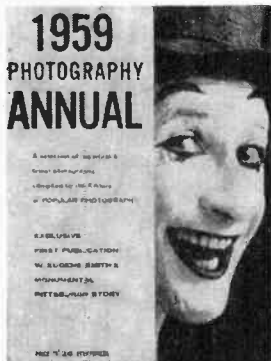
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N. Ravenswood Ave., Chicago 40, Ill.) has introduced a dual-purpose d.c. power supply in kit form, Model KPS-2. Designed to supply operating power to transistor receivers as well as "hybrid" auto sets, this unit has two output ranges. Each range is equipped with its own output current meter and output terminals for maximum flexibility in application.

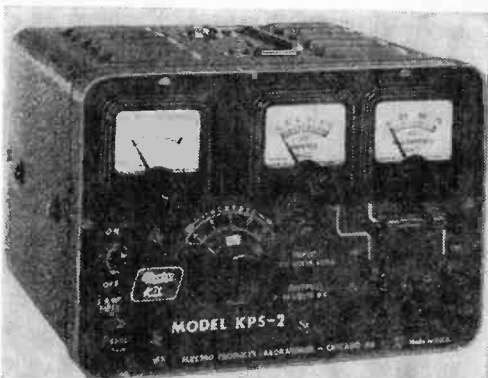
One output range supplies from 0 to 20 volts at a rating of 75 ma. Ripple is only 3 mv. (0.15%) at full output. An exposed, panel-mounted fuse is provided to protect transistors in the equipment or circuits being tested.

The auto radio output range is 0 to 16 volts, with a rating of 5 amperes. Meter range is from 0 to 10 amperes. Ripple is only 60 mv. (0.5%) at full output.

Lafayette Radio (165-08 Liberty Ave., Jamaica 33, N. Y.) has introduced a factory-built d.c. power supply delivering from 0 to 26 volts at a rating of 100 ma. This is a low-cost unit which is intended for the experimenter, technician, and serviceman. Hum ripple is quite low.

Product News. General Electric's Semiconductor Products Division (Syracuse, N. Y.) has announced price reductions of up to 50% on its controlled rectifiers (see September *Transistor Topics*). Also from G.E. comes news that its transistors are used exclusively in electronic organs produced by the Gulbransen Company, manufacturers of a fully transistorized electronic organ.

Lafayette Radio has introduced a series of miniature audio transformers measuring only one-half inch on a side. These units are available in three basic types: the TR97, an *input* transformer with input and



Model KPS-2 general-purpose transistorized power supply available as kit from Electro Products Labs.

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output impedances of 100,000 and 1000 ohms, respectively; the TR98, a *driver* transformer with center-tapped primary and secondary windings having impedances of 10,000 and 2000 ohms, respectively; and the TR99, an *output* transformer with a center-tapped 500-ohm primary and a 3.2-ohm secondary winding. They cost 97 cents each, plus postage.

Lafayette has also announced a power transformer for a low-voltage d.c. power supply. It has a 115-volt primary and a tapped secondary delivering 6, 9 or 15 volts at a maximum current of 100 ma.

Delco Radio (Kokomo, Ind.) has introduced a high-frequency power transistor, the 2N553. This unit has a collector cutoff frequency of 25 kc., and maximum collector current and voltage ratings of 4 amperes and 80 volts, respectively.

That's all for now, fellows. See you next month. . . .

Lou



Misfortune Teller

(Continued from page 63)

travel? Inserting it, I waited for the sounds to define the electronic processes. A moment later, the cycle was completed and a card fluttered from the Electronic Counselor.

Eagerly, I snatched it and read: *You will take a long trip soon.*

"Hurrah!" I yelled joyously, tossing the card to my wife. "We're in! We're made! The Counselor works like a charm!" Overcome, momentarily, by an exhilarating sense of relief, I danced around the machine—planting fond kisses of merriment upon its rotund exterior.

"Wait a minute!"

"Eh?" I stopped my triumphant exhibition.

"For my money, this gismo is handing out answers you can get in any fortune teller's tent."

I stared at her, confused.

"How so?" I asked.

"Well, just look at these replies!" She held up the two cards. "You will meet a tall, dark stranger . . . You will take a long trip soon. Boy, what an *old* routine! How corny can you get?"

"Possibly you haven't yet realized the full *import* of those statements," I said tolerantly, kindly. "The president of the

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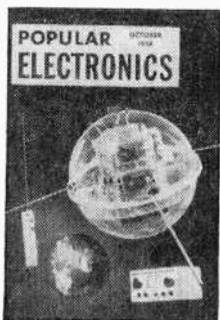
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local bank is tall and dark. And the second answer undoubtedly indicates that I will be the first man to reach the moon! How can you possibly misunderstand those meanings?"

"Oh, yeah? Watch *this!*" She rapidly lettered another question on another card and fed it into the machine. There was a long moment of utter silence. Then, a shrill blast of static bleated forth, followed by the odor of overheated wires and tubes. Suddenly, the Counselor began hurling handfuls of cards into the room. It rained cards. It snowed cards. I dashed to the wall plug and yanked it free. It stopped snowing.

"Good Lord!" I breathed. "Wonder what brought *that* about?"

"Oh, boy!" the wife emitted a howl of glee. "Have a gander at these cards! Oh, *brother!*"

I picked one up. It read: *Cross my palm with silver.*

The wife continued giggling wickedly, as she watched my puzzled face.

I grabbed another card. *Cross my palm with silver.*

By now, the wife had collapsed into a chair and was roaring hilariously.

Desperately, I began grubbing about in the small mountain of cards on the floor. It was futile. They *all* read alike: *Cross my palm with silver.*

"I just don't understand," I said helplessly.

"It's easy to understand!" gasped the wife between spasms of vulgar laughter. "You went and built an electronic fortune teller!" She succumbed to maniacal howls of joy, again.

"But the Counselor was intended to—"

"Counselor, my crooked toe!" wheezed the wife. "Put a pair of golden earrings on that electronic gypsy and send it on the road with any good carnival!"

SOME NINE HOURS LATER—in the middle of the night, to be exact—I suddenly sat up in bed and shook the wife's shoulder until she opened one eye, reluctantly.

"Hey, precisely *what* kind of a question did you put on that third card?" I wanted to know.

She leered slyly through sleep-heavy eyes. "I just lettered: *Wanna make an easy buck?*" she said.

Well, if nothing else—it figured. —30—

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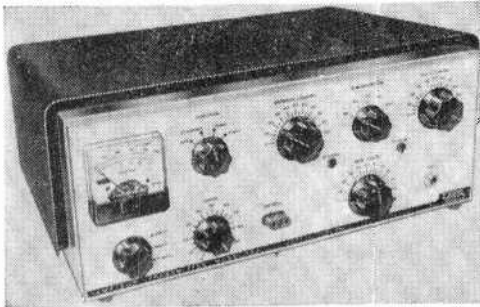
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(Continued from page 120)

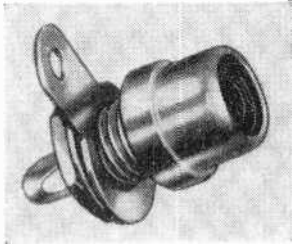
antennas from 50 to 1000 ohms. External plate modulation terminals permits its use as an AM phone transmitter. In kit form,



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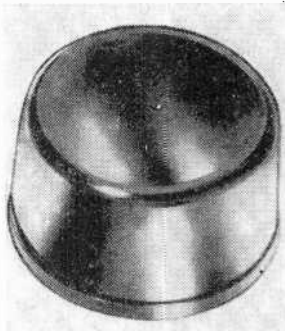
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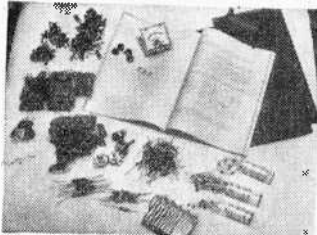
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After Class

(Continued from page 73)

arrive at for the end-to-end arrangement coincides exactly with the solution obtained using field theory.

Here's the rub, however. If the primary coil is now inserted coaxially inside the secondary coil, the polar approach gives the wrong answer. With the expanding primary field producing an N-pole on its right end, the polar hypothesis demands that the secondary coil also form a budding N-pole on its right side to oppose the growth of an adjacent similar pole on the primary coil. Thus, this situation requires that the induced current in the secondary flow one way when the coils are end-to-end, and in the opposite direction when one is inside the other as in Fig. 6(B). This does not happen in practice!

As we showed earlier, field theory makes no distinction between relative positions of primary and secondary and therefore predicts the correct answer. The polar method, on the other hand, falls flat in this instance. Conclusion: abandon magnetic poles and think in terms of magnetic fields! —50—

Among the Novice Hams

(Continued from page 77)

a handy place for keeping pencils, QSL cards, note pads, and other items that inevitably accumulate.

This platform can be easily constructed of two pine 2" x 4" end pieces and a plywood top. Put a partition under the top about eight inches from the front to prevent pencils and the like from working their way too far back to be easily retrieved. A second platform can be made for the transmitter for uniformity.

Safety Measures. A simple precaution that will go far towards increasing the safety of your equipment is to bond all metal cabinets together and to a nearby cold water pipe with heavy stranded wire. The dual purpose of this bonding is to drain off small static charges that may accumulate on the cabinets and to blow the line fuses if the hot side of the line should accidentally short to the chassis or cabinets. The length of the lead to the water pipe is unimportant, but use a clamp to make a firm connection to the pipe.

This ground is an addition to any other

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operating grounds you may use. Be sure that the frame of your key is connected to the grounded side of the key circuit.

Unless you use a permanently grounded antenna or one fed with coaxial cable whose outer conductor is permanently connected to a good earth ground, mount a husky knife switch on the window sill. This will disconnect the antenna from your equipment and connect it to a good earth ground for lightning protection when the antenna is not being used. A suitable ground for the purpose is a 1" pipe driven at least six feet into the earth.

Certainly the best power source for a permanent setup is a separately fused line directly from the power meter. However, the total power drain of a typical Novice station seldom exceeds three amperes, and a nearby wall outlet will usually furnish the power without difficulty, if the outlet is not already fully loaded.

Instead of running separate lines for each piece of equipment to the outlet, it is neater and safer to run a single, well-insulated cord from the outlet to a multiple-outlet tap mounted on the side or back of the operating table. These multiple taps

will accommodate up to eight a.c. plugs per foot of length.

Use a fused plug on the main cord. Such plugs employ the 3AG type cartridge fuses and can be easily substituted for a standard plug. Fusing in this manner protects your equipment without your having to depend on the main house fuses, and it saves you from having to traipse down to the basement—usually in the dark—to change a blown fuse.

The size of fuse to use depends upon the load expected. However, 3-ampere "slow-blow" or 5-ampere standard fuses should be satisfactory for most Novice installations.

Control Circuits. Modern c.w. transmitters are controlled entirely by their keys, once the power switch is closed. Therefore, by using separate receiving and transmitting antennas and monitoring your sending by the clicks in the receiver, it is only necessary to press the key to go on the air. Crude as this system seems, it often works surprisingly well on 80 and 40 meters with transmitters in the Novice power class.

When using a separate receiving antenna, keep it just long enough to bring in signals

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with reasonable signal strength and as far from the transmitting antenna as possible to prevent the transmitter from pumping too much r.f. energy into the receiver.

The better your transmitting antenna is, the more you will sacrifice by not using it on your receiver, too. You can use a double-throw knife switch to change it from your receiver to your transmitter, at the cost

Army MARS Technical Broadcasts

Beginning October 1, the First Army MARS SSB Technical Net "for the dissemination of technical knowledge by radio communication" will broadcast every Wednesday at 9 p.m. (New York Time) on 4030 kc. (upper sideband). During the month of October, the following five subjects will be discussed: "Engineering the White Alice Network," "Characteristics of SSB Power Amplifier Circuits," "Technical Facilities of Radio Free Europe," "Application of Transistors to Power Supply Equipment," and "Maser Amplifiers and Oscillators."

of having another control to manipulate at the start and finish of each transmission. A more desirable method, however, is an antenna-changeover relay controlled with your *Transmit-Receive* switch.*

An operating convenience that should be incorporated in all amateur stations is a simple method of turning on the low-power stages of the transmitter, without turning on the power amplifier, for tuning and for spotting your frequency on the receiver dial without putting a signal on the air. Another one is a c.w. monitor, so that you do not have to use your receiver to monitor your sending.

The average amateur adds these conveniences to his station as his pocketbook affords them, until one day he discovers that he has a couple of switches and other controls to manipulate at the beginning and end of each transmission. Actually, with the proper switch setup, it is easy to control all the circuits with only one switch, saving much time and effort.

One Four-Pole Switch. The switch to use is a 4-pole, double-throw, neutral-center Federal "anti-capacity" switch (or equivalent), available from any of the radio supply houses that advertise each month in **POPULAR ELECTRONICS**. Such switches come with up to six poles, but four poles are usually sufficient. See Fig. 1 (p. 77).

* An electronic "T-R" switch will do the job automatically, but it works properly only in conjunction with an antenna fed through well-matched, low-impedance feed line.

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To control operations with this switch, first apply 117-volt primary power to the receiver, transmitter, and other equipment in the normal manner and turn the receiver *Receive-Standby* switch to *Standby*. With the switch in the center position, the receiver works normally. With the switch in the *Tune* position, the receiver remains on, and the low-power stages of the transmitter are turned on.

With the switch in the *Transmit* position, the receiver is placed in its *Standby* position, the antenna relay transfers the antenna from the receiver to the transmitter, and the opened cathode or screen circuit of the transmitter output tube is completed, so that a signal will be put on the air when the key is pressed. Note that the fixed contact on the *Tune* side of the receiver *Standby* circuit of the switch is bent to complete that circuit even with the switch in its center position.

If you want to leave the receiver on while the transmitter is on, you just set the receiver *Standby* switch to the *Receive* position. With other equipment, the wiring of the switch would be changed somewhat, but its basic operation would be the same.

Mount the switch beside the receiver, where you can operate it easily without stretching. I prefer mine mounted where I can operate it with my left hand, as I copy or use my key with the right hand.

News and Views

Larry, KN6TJG, worked six states in his first six weeks as a Novice on 40 meters. Then he put up a 15-meter, 3-element beam and got a new Hallicrafters SX-99 receiver to help his Heathkit DX-40 transmitter. In the next 2½ weeks, he worked 21 more states, all U.S. call areas, Hawaii, and Canada. Larry recently passed the Conditional examination and is waiting for his license to arrive. . . . When Zeak, KN4UPI, first got on the air, his home-constructed 6L6G transmitter—powered from an old public-address amplifier—had just enough "oomph" to work KN4RKP across town on a daily sked. Now, he runs 15 watts to an 807 in another home-built rig feeding a perfectly *un*matched, 80-meter dipole, and he receives with a National SW-54. KN4UPI is proud of his four states worked and two confirmed. He uses an old TV receiver as his Conelrad monitor, and offers to help anyone obtain his ham ticket to "wonderland."

Len, KN7DKA, transmits on a WRL Globe Chief running 75 watts and feeding a "Windom" antenna about 20 feet high, and receives on a National NC-200 receiver. One-hundred contacts in 12 states in five weeks on the air is the result. Probably by the time you read this, Len will have his new WRL vertical antenna installed. His pet peeve is the fellow

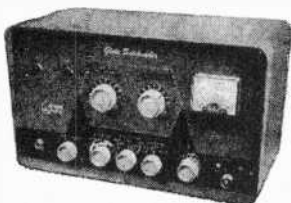


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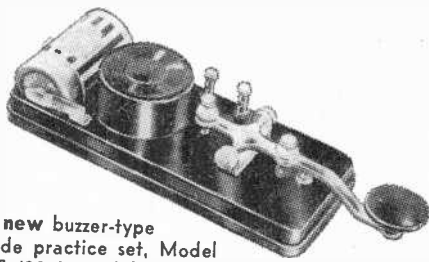
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who gives you a 599X report and loses you on your first transmission. He offers to schedule anyone needing a Utah QSL card. . . . Jim, KN6BHN, uses two home-brew transmitters, a five-wattter for 21 mc. and a 60-wattter for 3.7 mc. He receives with a "surplus" National HRO receiver to which he has added a BC-453 "Q5-er" for increased selectivity. Fifteen states confirmed, plus Alaska, Australia, and New Zealand worked, prove that Jim's equipment—including his "Twin-triplex, DX-special" 15-meter antenna and his 80-meter long wire—is working. Jim confirms all contacts, if he can get an address during the contact or from the Call Book.

Bill, K2PEQ/KN2PEQ, who received his Technician license the other day, operates a Heathkit DX-35 transmitter at 70 watts feeding a 40-meter dipole, which works fine on 15 meters. He receives via an SX-99 with an added Q-multiplier. In seven weeks, his record is 33 states, Canada (VE3, VE7), Czechoslovakia, England, and the Virgin Islands. . . . Bill Hine of Cleveland is "just an SWL" at present who hopes to get his ham ticket soon. In the meantime, he requests that hams be a bit more generous about answering cards from short-wave listeners. From 20 sent, he has received only five replies. Remember, an SWL feels about an unanswered card the same way you do towards the hams you work in new states who ignore your requests for QSL cards.

Jeff, KN9MOA, has a 68' end-fed antenna which is only 15' high. His transmitter is "home-brew," 35 watts on a 807 on 7160 kc., and he receives on a "surplus" BC-348M. After a slow start, due to his inexperience, Jeff made 11 contacts in four states his first month on the air. . . . Harold, KN3CEP, started his ham career with a DX-40 transmitter, a long-wire antenna, and a National NC-88 receiver on 80 meters. Then he put up a 40-meter dipole and spent most of his time on 15 meters, where his DX record is Brazil, Argentina, Panama, Canal Zone, Puerto Rico, and Canada. Now, Harold has a new SX-99 receiver and spends much of his time on 40 meters. KN3CEP's state-total is 35. His father is W3OMF, a ham for 23 years.

Bob, K2YFE, wants to work Utah and North Dakota to obtain his Worked-All-States certificate. He will be glad to listen for Novices in the 40- or 15-meter Novice bands and work them from the adjacent phone bands. Oh, yes, he can copy c.w. K2YFE has a 20-wpm code-proficiency certificate and transmits code practice on 29.2 mc. on Wednesdays at 2030 local time. Besides the 46 states, Bob has

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worked 25 countries with his Johnson Valiant transmitter and a Hammarlund HQ-100 receiver. He also operates 2 meters with a Gonset Communicator receiver/transmitter combination. . . . In a month on the air, **Mac, KN4VNY**, has made 125 contacts in 19 states, Canada, Puerto Rico, Virgin Islands, England, and Austria. He divides his attention between 40 and 15 meters, with a WRL Globe Chief 90-A transmitter, a 40-meter dipole antenna, and a Hallicrafters S-38E receiver. However, his new SX-99 has undoubtedly arrived by now. Mac will sked anyone needing North Carolina for WAS, and he likes to rag-chew.

Jack, W5AJZ, sent your columnist one of his "Hornet" folded-dipole, 40-meter antenna kits for examination. It costs \$7.95, without the required 300-ohm feed line. Write to Hornet Antenna Products, P. O. Box 808, Duncan, Okla., for more information on these antennas.

Contributors to News and Views: **Larry Nelson, KN6TJG**, 870 San Lorenzo, Palm Springs, Calif.; **Eugene Zeak, Jr., KN4UPI** (15), P.O. Box 132, Winter Gardens, Fla.; **Lennard Stillman, KN7DKA** (12), Route 1, Box 974-C, Sandy, Utah; **Jim Whitfield, KN6BHN**, 271 E. Hawthorne, Coalinga, Calif.; **Bill Marx, KN2/K2PEQ** (14), 36 Edi. Ct., Plainview, L. I., N. Y.; **Jeffery I. Lackey, KN9MOA**, 2837 S. Foltz St., Indianapolis 41, Ind.; **Harold D. Hamilton, KN3CEP**, 64 N. Euclid Ave., Pittsburgh 2, Pa.; **Robert R. Migliorino, K2YFE**, 221 19th Ave., Paterson 3, N. J.; **Mac Murray, KN4VNY**, 309 Waverly Rd., Greensboro, N. C.

How about a report on you and your station for next month? Clear photos are welcome. 73,
Herb, W9EGQ

Short-Wave Report

(Continued from page 66)

The following is a resume of the latest reports received. Times are EST, and the 24-hour system is used. At time of compilation, all reports were correct. Stations often change frequency or schedule without notice.

Angola—**Radio Angola** is noted on 9765 and 11,862 kc. from around 1800 on Saturdays with an apparently extended schedule. S/off is at 1845 with "A Portuguesa." (420)

Belgian Congo—**OTM2, R. Congo Belge**, Leopoldville, 9380 kc., signs on at 0000. There is recorded music from 0000 to 0100, French news at 0100, Flemish news at 0108. The signal is good for the most part with some QRM at times. (TH)

Belgium—**World Fair Radio**, Brussels, operates to N.A. as follows: Sundays, Tuesdays, Thursdays, and Fridays at 0530-0600 on 15,335 kc.; Mondays at 1930-2000, Saturdays at 1815-2000 on 15,335 and 9655 kc. The 9655-kc. outlet is the Leopoldville (Belgian Congo) relay. All reports go to Station ORU, P. O. Box 26, Brussels 1, Belgium. (DM, CQ)

Brazil—**New R. Cultura da Bahia**, logged on 15,225 kc. at weak level, was noted at 2125 with American pop music. Another new station, **Radio Drago Mar**, Fortaleza, was found at 2000 on 4775 kc. with native music and Portuguese anmts. The latter channel has

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another Brazilian station assigned to it but it apparently is inactive. (420)

An unidentified station has been noted on 6130 kc. at 2315-2330 in Eng. (LL) (Editor's note: this is most likely *R. Excelsior*, Sao Paulo, listed for 6125 kc.)

British Honduras—The British Honduras B/C Service, Belize, was found on 4900 kc. at 2235 as they were making closing anmts. They gave this frequency, asked for reports. (59)

Cambodia—*R. Phnomphen*, 7190 kc., has Eng. at 0700, French at 0800-0900 s/off. (400)

Ceylon—The correct mailing address for reports to the Commercial Service from Colombo is: G.P.O. Box 1510, Torrington Square, Colombo. An attractive QSL card, letter, and program schedule arrived promptly. (7)

The 4870-kc. outlet has been heard in western states at 0800 with news relayed from the BBC, and at 0810 with home news. Increased power has made the signal from this one much better. (400)

Chile—*R. Nuevo Mundo*, CE1174, Santiago, has moved up to 11,755 kc. (listed for 11,740 kc.) and is noted around 1830. (420)

Cook Island—*R. Raratonga*, 4965 kc., can be heard at times on Wednesdays only at 2300-0030 with a fair signal. (400)

Costa Rica—*R. Casino*, TIQ, 5952A kc. (previously on 5965 kc.), is tuned from 0009 to 0100 closing with jazz music, many commercials. S/off is with a march. (7)

Cuba—A Spanish-speaking station that has suddenly become active around 2100 and that gives TIDCR, Costa Rica, a bad heterodyne, has been identified as COJK, *Voz del Camagueyana*, 9620A kc. (420)

Czechoslovakia—*R. Prague* broadcasts daily to N.A., Australia, and New Zealand at 1930-2000, 2200-2300, and 0000-0030 on 9550, 11,725, 11,835, 15,185, and 15,285 kc. In use for the 0330-0430 xmsn are the 11,875-, 15,185-, and 21,450-kc. outlets. A program for amateur operators is heard on the first and third Thursdays and Fridays of each month at 1930 and again at 0000. This is repeated the following day at 2200 and 0330. (277, 282)

Denmark—Copenhagen broadcasts to N.A. at 2030-2130 and 2200-2300 on 9520 kc. with two half-hour periods (each) in Danish and Eng. There is no Eng. on Sundays. They present a mailbag program on Saturdays and a DX program on Tuesdays. (PB, 338, 412, 438)

Ecuador—An unidentified station bearing an HC3— call is being noted on 8900 kc. from 1900 to 2200 s/off. *R. Cotacachi*, Santa Ana de Cotacachi, Imbabura Province, is a new station which has been noted on 5760 kc. from 1900 to 2205 s/off. (100)

Many listeners, too many to list here, report reception of HCJB, Quito, on 9745, 11,915, and 15,115 kc.

Falkland Islands—A rarely heard station is the Falkland Islands B/C Service in Stanley on 3958 kc. Ham radio 'phone operation in the 75-meter band will make this an excellent catch in anyone's logbook. Try for it at 1815 with weather, 1830 with local news. This is beamed to listeners in Southern Chile, Argentina, South Orkney and South Georgia Islands. American pop music may also be noted after 1830. It was logged using an 8' vertical

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whip antenna which may or may not help in decreasing the QRM. A lot of patience is needed! (61,353)

French Equatorial Africa—Brazzaville operates to N.A. at 1800-2100 on 11,970 kc.; Eng. news at 2015 and 2045. French lessons for Eng. listeners are given at 1730 on Sundays, Tuesdays, and Wednesdays, and at 2045 on Mondays, Thursdays, and Fridays. (NK, 438)

Greenland—An xmsn in Danish and Greenlandic was noted from Anngmagssalik, 7570 kc., at 0900-0950. (349)

Guatemala—TGNA, 9668 kc., and TGNC, 11,850 kc., Guatemala City, have an English program at 2200-2345 daily. Reports are wanted and should go to P. O. Box 601. The same xmsn, as well as another at 2100-2200, may also be noted on 5952.5 kc. (NK, CQ)

Haiti—4VEH, Cap Haitien, 9625 kc., has a mailbag program on Saturdays at 0500-0530. "Morning Dedication" follows at 0530-0550, with "The Bulletin Board" to 0600. (MH)

Honduras—HRQ, R. Supaya, San Pedro Sula, is heard well evenings on 6125 kc. with Latin-American music and all anmts in Spanish. (344)

Hungary—R. Budapest has a DX program entitled "Calling All Radio Amateurs" every Tuesday at 1930 and 2300 on 11,910, 9833, and 7220 kc. (May-October) and 9833, 7220, and 6195 kc. (October-May). (PJ)

India—Try for *All India Radio*, Delhi, at 1445-1545 in Eng., to Europe and Great Britain on 15,250 and 11,710 kc., and to Africa on 17,725 and 15,170 kc. (378)

Israel—Voice of Zion, Jerusalem, 9008 kc.,

SHORT-WAVE ABBREVIATIONS

A—Approximate frequency
anmt—Announcement
BBC—British Broadcasting Corporation
Eng.—English
ID—Identification
IS—Interval signal
kc.—Kilocycles
N.A.—North America
QRM—Station interference
R.—Radio
s/on—Sign-on
s/off—Sign-off
VOA—Voice of America
xmsn—Transmission from station
xmtr—Transmitter used by station

has Eng. to Europe at 1630-1715. This station sends an attractive QSL card. (313, 348)

Italy—Radio Roma operates to Western N.A. on 9570 kc. at 2205-2225 with Eng. news and a musical session. Reports go to *Italian Radio*, Foreign Broadcasting Dep't., P. O. Box 320, Rome. (WG, NK)

Japan—JOB24, Tokyo, now operates on 21,620 kc. with Eng. news, talks, native folk music and feature talks at 0250-0320 beamed to Europe and the USSR. This channel replaces 15,225 kc. From 0320 to 0330/close there is a xmsn in Japanese. (61, 94)

Mexico—Medium-wave station XEQ, Mexico City, definitely has a new outlet on 6078A kc. with ID at 2200. All-Spanish; considerable QRM. (420)

Netherlands—The last schedule received from Hilversum reads: 1615-1655 in Eng. to North America on 21,480, 17,775, and 15,445

kc.; 1630-1800 (Sundays) with "Happy Station" program to South America on 17,775, 15,220, and 11,730 kc.; 1700-1750 in Dutch to North America on 21,480, 17,775, and 15,445 kc.; 1800-2025 (Sundays, 1805-2100) in Dutch to South America on 17,775, 15,220, and 11,730 kc.; 2030-2110 in Spanish to South America on 17,775, 15,220, and 11,730 kc.; 2130-2210 in Eng. to N.A., 2130-2300 (Sundays) with "Happy Station" program, 2215-2250 in Spanish to Central and South America, all on 11,730, 9590, and 6025 kc. (378)

New Zealand—A musical session was noted over ZL7, Wellington, 6080 kc., at 0430-0530; frequent ID. The 9540-kc. outlet is in parallel until 0545. A special xmsn, "Family Corner," is

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aired Sundays only at 0315-0345 on 11,780 kc. and is beamed to the Antarctic Expedition. (GS, MV, 348)

Panama—HOH7, *Circuito RPC*, Panama City, is heard well on 9685 kc. from 2300 with time signals and various anmts in Spanish. S/off is at 0004. All anmts are followed by two notes on a gong. (344)

Peru—OBX4M, *R. Panamericana*, Lima, 5980 kc., has been found from 0015 to 0100/close with frequent ID and varied types of music as well as many commercials. The ID is given with one bell. (7)

Poland—Warsaw operates to N.A. at 0600-0630 and 0715-0745 on 17,800 and 15,275 kc. and at 1930-2030 and 2130-2230 on 17,800, 15,275, and 11,705 kc. The mailbag is featured Mondays at 1930. At times, 11,820 kc. is used instead of 11,705 kc. (JC, CQ, 277, 287, 420)

Sarawak—Kuching operates as follows: 2300-0030 on 9565 kc. (Monday through Saturday); 2300-0130 on 9565 kc. (Sunday); and 0300-0930 on 7160 and 4950 kc. (daily). The 5052-kc. channel has been discontinued. (338, 349, 378)

South Korea—The Korean B/C Service is scheduled as follows: to Japan at 0800-0830 on 7180 and 9640 kc. (Japanese); to N.A. at 0030-0130 on 11,925 kc. and to Hawaii at 0300-0400 on 11,925 kc. (English and Korean); to S.E. Asia at 0900-1000 on 9640 kc. (English and French). All xmtrs used are 100-kilowatt units. (314)

Southern Rhodesia—News in Eng. can be heard from Salisbury on 9505 kc. at 0600-0610. This is a BBC relay. (313)

Surinam—PZC, Paramaribo, 15,406 kc., can be tuned Mondays at 2000-2005 in Eng. and daily at 2000-2030 (Mondays from 2005) in Dutch. (349)

Sweden—R. Sweden, Stockholm, transmits to Eastern N.A. from 0900 on 17,840 kc. and from 2045 on 11,810 kc., to Western areas from

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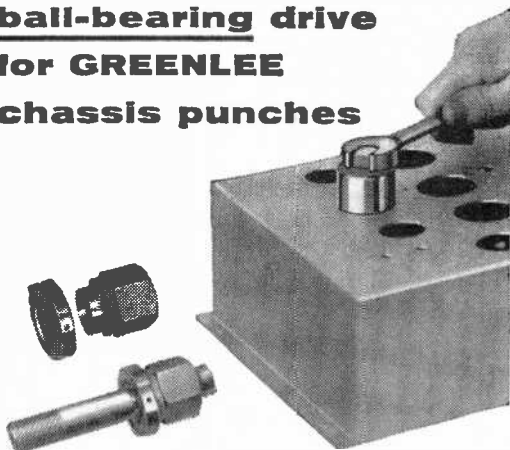
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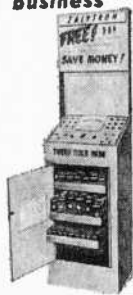
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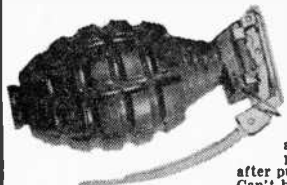
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2215 on 11,810 kc. Swedish lessons are noted Fridays and a DX program on Mondays at 2045. (RB, RP, 277)

Switzerland—Berne has two xmsns daily to N.A.: 2030-2215 on 6165, 9535, and 11,865 kc.; and 2315-0000 on 9535, 11,865, and 15,305 kc. The "Youth Magazine" is on Sundays and a popular jazz show on Wednesdays. (MH, VV, 277, 421)

Tahiti—R. Tahiti, Papeete, 6135 kc., is being well heard in Western areas at 0000-0230 in French, at 0230-0245 in Eng. Other xmsns in-

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 A. R. Niblack (420), Vincennes, Ind.
 Rodney Burns (421), Wayne, Pa.
 Stan Head, Jr. (438), Huntington, W. Va.

clude Tahitian at 2245-0000, 1700-1715, and French at 1715-1800. (VV, 409)

Tangler—On "Report from the USA" over the VOA in the 16-, 19-, and 31-meter bands, the Ham Show is heard at 1600-1630. (165)

Vatican City—The Vatican can be heard as follows: 1755 with IS; 1830-1845 in Spanish to South America; 1930-1945 in Spanish to Central and Northern South America on 9646 kc.; 1000-1015 and 1515-1530 in Eng. on 9646, 11,625, and 15,120 kc. They s/off with the bells of St. Peters. (23, 76, 313, 418, 420)

Venezuela—YVXJ, R. Barquisimeto, Barquisimeto, has moved from 9510 kc. to 9505 kc. and is announcing the use of a new 15-kilo-watt xmtr. (100)

Unidentified stations—A check of 9540 kc. showed a Spanish speaker at 2215 with ID as Radio Central. It may be long-lost TGDx. Guatemala, that formerly was listed for 9700 kc. (420)

A station with an ID of R. Universidad has been noted on 9608 kc. from 0100 to 0200/close in Spanish. The program of light mood music is uninterrupted except for the ID. (61) —50—

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6S5	.65	6AH6	.95	6SH7	.69	12T7	.69
174	.69	6AK5	.69	6S17	.69	14A7	.69
1U9	.59	6AL5	.59	6SK7	.69	19B6G	1.69
1X2	.66	6AQ5	.66	6SL7	.89	25Q6	1.29
2D21	.68	6A55	.75	6SN7	2/31	25Z6	.79
388A	2/31	6AT6	.49	6ST7	.59	35C5	.59
2V3	2/31	6AU4	.89	6T4	1.19	35L7	1.29
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955	4/31	6AX4	.79	6U8	.89	35Z5	.55
957	4/30	6BA8	.59	6V6	.59	50A5	.69
9B19	4/31	6BA8	.59	6W6	.59	50B5	.79
1625	4/31	6BE6	.59	6X4	.39	50C5	.69
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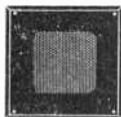
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sulting in less heat and thus reducing possibility of damage or value changes of delicate components. • Meter is virtually burn-out proof. The sensitive 400 micro-ampere meter is isolated from the measuring circuit by a balanced push-pull amplifier. • Uses selected 1%, zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

SPECIFICATIONS

- DC VOLTS—0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance.
- AC VOLTS (RMS)—0 to 3/15/75/150/300/750/1,500 volts. • AC VOLTS (Peak to Peak)—0 to 8/40/200/400/800/2,000 volts.
- ELECTRONIC OHMMETER—0 to 1,000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms.
- DECIBELS:—10 db to + 18 db + 10 db to + 38 db. + 30 db to + 58 db. All based on 0 db = .006 watts (6 mw) into a 500 ohm line (1.73v).
- ZERO CENTER METER—For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

AS A DC VOLTMETER: The Model 77 is indispensable in HI-FI Amplifier servicing and a must for Black and White and color TV Receiver servicing where circuit loading cannot be tolerated.

AS AN ELECTRONIC OHMMETER: Because of its wide range of measurement leaky capacitors show up glaringly. Because of its sensitivity and low loading, intermittents are easily found, isolated and repaired.

AS AN AC VOLTMETER: Measures RMS values if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers are easily read.

Comes complete with operating instructions, probe leads, and streamlined carrying case. Operates on 110-120 volt 60 cycle. Only.....

\$42.50
Net



Model 77—Vacuum Tube Voltmeter—
Total Price\$42.50
Terms: \$12.50 after 10 day trial, then \$6.00 per month for 5 months

The Most Versatile All-Purpose Multi-Range Tester Ever Designed!

Superior's New

Model 79

SUPER-METER

WITH NEW 6" FULL-VIEW METER

- A Combination VOLT-OHM MILLIAMMETER.
- Plus CAPACITY, REACTANCE, INDUCTANCE, AND DECIBEL MEASUREMENTS.

- Also Tests SELENIUM AND SILICON RECTIFIERS, SILICON AND GERMANIUM DIODES.

The model 79 represents 20 years of continuous experience in the design and production of SUPERMETERS, an exclusive SICO development. It includes not only every circuit improvement perfected in 20 years of specialization but, in addition includes those services which are "musts" for properly servicing the ever-increasing number of new components used in all phases of today's electronic production.

Specifications

- D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500.
- A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000.
- D.C. CURRENT: 0 to 1.5/15/150 Ma.
- 0 to 1.5/15 Amperes.
- RESISTANCE: 0 to 1,000/100,000 Ohms.
- 0 to 10 Megohms.
- CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd.
- REACTANCE: 50 to 2,500 Ohms.
- 2,500 Ohms to 2.5 Megohms.
- INDUCTANCE: 15 to 7 Henries.
- 7 to 7,000 Henries.
- DECIBELS: —6 to + 18. + 14 to + 38. + 34 to + 58.

- The following components are all tested for QUALITY at appropriate test potentials. Two separate BAD-GOOD scales on the meter are used for direct readings.
- All Electrolytic Condensers from 1 Mfd. to 1000 Mfd.
- All Selenium Rectifiers.
- All Germanium Diodes.
- All Silicon Rectifiers.
- All Silicon Diodes.

Comes complete with operating instructions and test leads. Use it on the bench and on calls. Streamlined carrying case included, accommodates tester, instruction book and test leads. Only

\$38.50
Net



Model 79—Super-Meter
Total Price\$38.50
Terms: \$8.50 after 10 day trial, then \$6.00 per month for 5 months.

USE APPROVAL FORM ON NEXT PAGE

We invite you to try before you buy any of the models described on this and the following pages. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

TRY FOR 10 DAYS

before you buy! **then** if satisfactory pay in easy, interest free, monthly payments. See coupon below.

Superior's New
Model 82

A truly do-it-yourself type

TUBE TESTER

TEST ANY TUBE IN 10 SECONDS FLAT!

- 1 Turn the filament selector switch to position specified.
- 2 Insert it into a numbered socket as designated on our chart (over 600 types included).
- 3 Press down the quality button—

THAT'S ALL! Read emission quality direct on bad-good meter scale.

FEATURES:

• Tests over 600 tube types. • Tests OZ4 and other gas-filled tubes. • Employs new 4" meter with sealed air-damping chamber resulting in accurate vibrationless readings. • Use of 22 sockets permits testing all popular tube types and prevents possible obsolescence. • Dual Scale meter permits testing of low current tubes. • 7 and 9 pin straighteners mounted on panel. • All sections of multi-element tubes tested simultaneously. • Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.

Production of this Model was delayed a full year pending careful study by Superior's engineering staff of this new method of testing tubes. **Don't let the low price mislead you!** We claim Model 82 will outperform similar looking units which sell for much more—and as proof, we offer to ship it on our examine before you buy policy.

Model 82 comes complete, housed in portable, hand-rubbed oak cabinet with removable cover. Only

\$36⁵⁰
Net



Model 82—Tube Tester

Total Price \$36.50

Terms: \$6.50 after 10 day trial, then \$6.00 per month for 5 months.

Superior's

New Model

TW-11

STANDARD PROFESSIONAL

TUBE TESTER

• Tests all tubes, including 4, 5, 6, 7, Octal, Lockin, Hearing Aid, Thyatron, Miniatures, Sub-miniatures, Novals, Subminars, Proximity Fuse Types, etc.

• Uses the new self-cleaning Lever Action Switches for individual element testing. All elements are numbered according to pin-number in the RMA base numbering system. Model TW-11 does not use 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. Printed in large easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE SEPARATE SCALE FOR LOW-CURRENT TUBES Previously, on emission-type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types.

Housed in hand-rubbed oak cabinet

\$47⁵⁰
Net



Model TW-11—Tube Tester

Total Price \$47.50

Terms: \$11.50 after 10 day trial, then \$6.00 per month for 6 months.

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**SEE OTHER
SIDE**

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MOSS ELECTRONIC DISTRIBUTING CO., INC.

Dept. D-507 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after a 10 day trial positively cancelling all further obligation.

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Superior's New Model 76

ALL PURPOSE BRIDGE

IT'S A CONDENSER BRIDGE

IT'S A RESISTANCE BRIDGE

✓ CAPACITY BRIDGE SECTION

4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. Will also measure the power factor of all condensers from .1 to 1000 Microfarads.

✓ RESISTANCE BRIDGE SECTION

2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms.

✓ SIGNAL TRACER SECTION

With the use of the R.F. and A.F. Probes included with the Model 76, you can

IT'S A SIGNAL TRACER

IT'S A TV ANTENNA TESTER

make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc.

✓ TV ANTENNA TESTER SECTION

Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? Locates a break in any TV antenna and measures the location of the break in feet from the set terminals.

Complete with R.F. and A.F. probes and test leads

\$26.95
Net



Model 76—All Purpose Bridge
Total Price \$26.95
Terms: \$6.95 after 10 day trial,
then \$5.00 per month for 4
months.

Superior's New Model TV-50A

GENOMETER 7 Signal Generators in One!

- ✓ R.F. Signal Generator for A.M.
- ✓ R.F. Signal Generator for F.M.
- ✓ Audio Frequency Generator
- ✓ Marker Generator

- ✓ Bar Generator
- ✓ Color Dot Pattern Generator
- ✓ Cross Hatch Generator

This Versatile All-Inclusive GENERATOR Provides ALL the Outputs for Servicing:

• A.M. RADIO • F.M. RADIO • AMPLIFIERS • BLACK AND WHITE TV • COLOR TV

R. F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

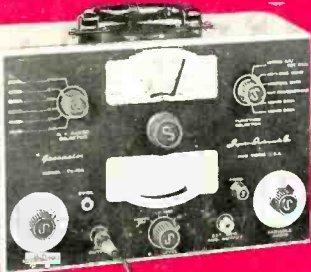
MARKER GENERATOR: The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.

DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50A will enable you to adjust for proper color convergence.

CROSS HATCH GENERATOR: The pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect. Complete with shielded leads

\$47.50
Net



Model TV50-A—Genometer
Total Price \$47.50
Terms: \$11.50 after 10 day trial,
then \$6.00 per month for 6
months.

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pay in easy, interest free, monthly payments. See coupon inside

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