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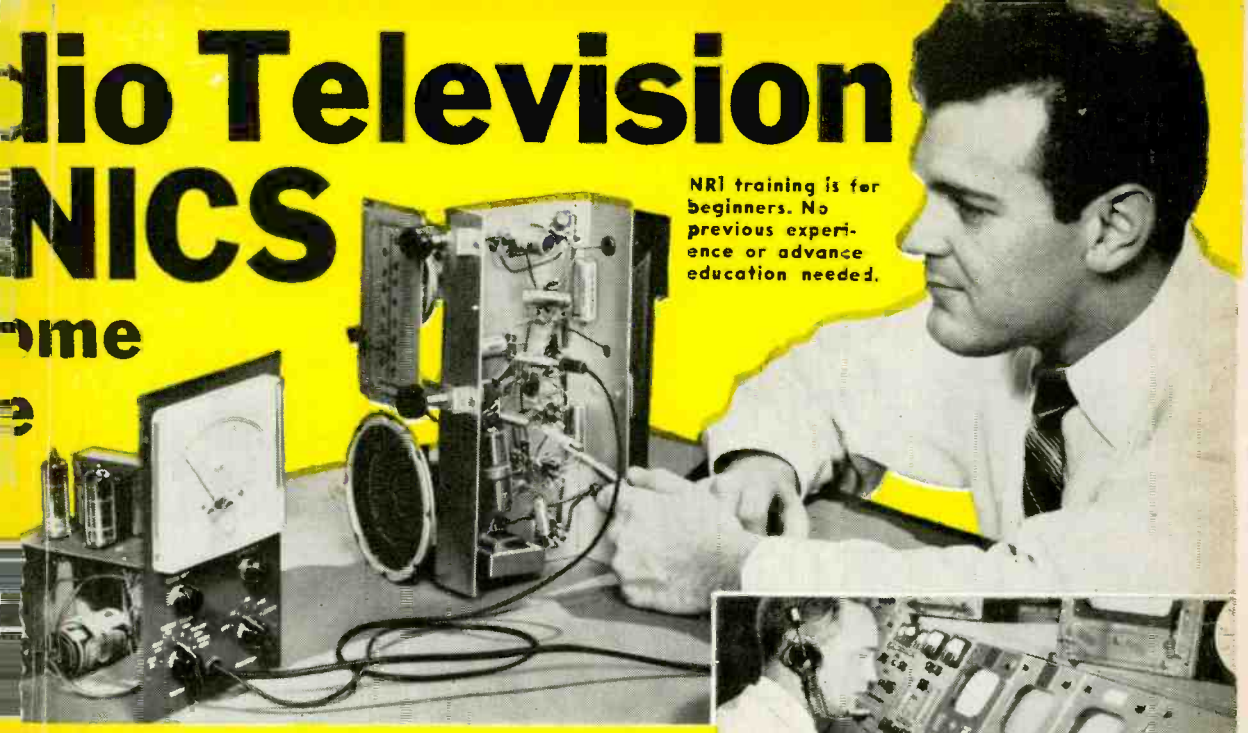

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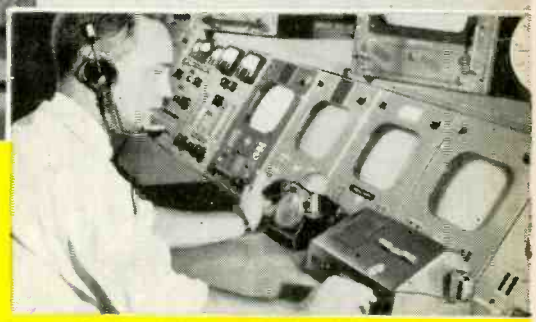

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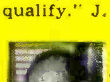

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# ELECTRONICS ILLUSTRATED

July, 1960 Vol. 3, No. 7

A Fawcett Publication




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### BUILD-IT PROJECTS



### FEATURES






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# A Message From the Editor

On page 29 in this issue is a very interesting build-it-yourself project—a hot dog cooker. It is extremely simple to build, inexpensive and should be very useful for the quick and clean cooking of this popular summer morsel. I am bringing this to your attention because it illustrates something about the build-it-yourself projects in *ELECTRONICS ILLUSTRATED*. It proves once again that *EI* is first with the latest. Electrical hot dog cookers have only recently been put on the market and yet here we are with our build-it-yourself version. If you are a regular reader of *EI*, you know that many times we have projects for which there are no commercial counterparts. Our 1-transistor FM pocket radio was one example of this. What I am implying is that you, the regular reader of *EI*, live better electronically than your neighbor.

Sometimes our attempt to bring you something new immerses us in the same type of costly and time-consuming research familiar to industrial and military electronic laboratories. A while back we informed you that we were working on an all-transistor auto ignition system for your car and that we would publish a build-it-yourself article on this subject soon. I have since been kindly encouraged to eat that word "soon." We have had three consultant design engineers and our own staff on this problem and have come up against the same stone wall that the large automobile accessory manufacturers have faced. We have not been able to get the parts that would work properly together. Some unscrupulous operators have advertised plans for transistor ignition systems—I know because we have purchased these plans and tried to make them work. They do not! However, despite the fact that you cannot now buy a commercial transistor auto ignition system anywhere, I will go out on a limb again and promise you that we will have one for you. A breakthrough is in sight.

The fastest growing recreational sport is boating. There are more new small boats put in the water every summer than there were all together before World War II. Electronics is making small boating a safer and more enjoyable sport. Just how it is doing it and what new devices there are in store for the small boatman will be reported in our special 16-page section on

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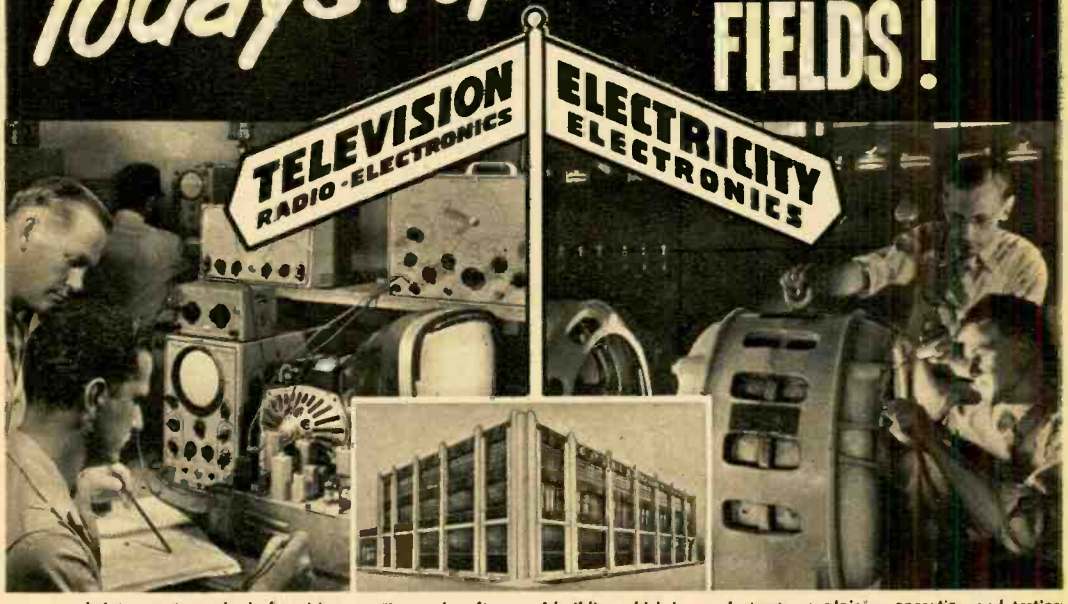


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boating in the August issue of *EI*. Included will be practical down-to-earth installation information and techniques for the proper use of 2-way radio, depth finders, direction finders, etc. In our August issue we will also have one of the most popular build-it-yourself projects for the electronics experimenter—a lie detector. We don't suggest that this one be used by Joe Friday, but the rest of us can have lots of fun at parties with it.

Because of recent abuses of Class D operation in the Citizens Band and because the FCC regulations opening the Citizens Band for Class D non-licensed 2-way radio operation are vague in certain areas, it was a certainty that more stringent regulations would be forthcoming. The first amendments to the regulations covering the Citizens Band use have just been released and surprisingly, they are rather mild. The amendments of interest to our readers concern keeping communications between stations as short as practicable and addressing all communications to specific persons. In the words of the FCC amendments, "Any communication which depends primarily on skywave reflection or any communications or transmissions designed to elicit a response from random or unknown stations (such as by use of the general call CQ or by some similar procedure) is prohibited except in cases of emergency involving the health or safety of individuals, the protection of property, or civil defense operation. . . ." I suggest that all readers interested in class D Citizens Band obtain a copy of the report and order dealing with the amendment of part 19 Citizens Radio Service—docket #12987, available from the Federal Communications Commission, Washington 25, D.C.

Once again, I hope you will be with us next month.

Charles Tuttle

# ...electronics in the news

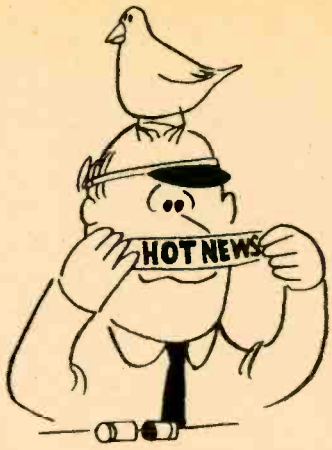
WEEKEND PROJECT? Not on your life! Recent rash of successful U. S. space launches was topped by Tiros I, which has made hundreds of trips around our planet, taking photos of our weather from its 450-mile distant orbit. At left is perhaps the most elaborate electronic space payload yet devised. There are two tiny TV cameras, each no bigger than a water glass. Tubes are half-inch Vidicons. One has wide-angle lens (covering 800 miles), the other a high resolution lens (80 miles). Images are stored on video tape (under plastic domes) and transmitted back to earth on command.

• • • • •

STEREO RESEARCH TAKES ON TWO HEADS! Oscar II is a dummy with two microphones pinch-hitting for ears. It is his job to reproduce the "shadowing" of sound produced by even the smallest movements of the human head, (supplied right by Mary Lou Hartig of Bell Labs). Normally, the ear closer to a sound hears it earlier and louder than the other ear. By altering the natural sounds received in each of Oscar's microphones and sending it into the earphones, it was found that intensity is more important than previously believed. If sound reaches one ear first but reaches the other ear somewhat louder, the listener is completely confused as to direction. The experiments are being conducted in a "dead" room, one without reflecting surfaces. So balance your stereo speakers.

• • • • •

COMMUNICATION BENEATH EARTH'S SURFACE with electromagnetic waves is the goal of Space Electronics Corp., Glendale, Calif. They have set up shop deep inside an abandoned mine shaft somewhere in the Mojave Desert. Why? Because earth crust communications techniques that connect buried sites offer excellent survival potential against atomic bomb attack. So far the company, working with an Air Force contract, claims promising results in short-range communications underground. Such a secure system could be used to link underground ICBM launching sites. Meanwhile, the Navy continues to expand its work in using very low frequencies (VLF) to send messages to submerged submarines.




**Supermarkets again**—They're still thinking about computer automation of supermarket checkout counters that will completely eliminate the "human touch"—as well as the long waits on line. R. R. Segel of Thompson Ramo Wooldridge, Inc., outlined a possible system that would work something like this: A can of beans would be color-coded with a fluorescent paint of a discreet wavelength, invisible and unaffected by the color of the package. The price will be entered into a computer alongside the specific wavelength. As the can passes under a special "electronic eye," the wavelength is sensed and the price is entered instantly upon the customer's receipt. Meanwhile, a "size-sensing" machine sorts the different items for automatic packing into bags or boxes, while another "money-sensing" machine takes your cash and gives you change. What we want to know is: Will they put the tomatoes on the bottom with the eggs and ice cream?

—o—

**Tape Cartridges**—Hot on the heels of CBS's announcement of a 1⅞ ips cartridge, Ampex Corp. announced its own 1⅞ recording system for the home music market based on short wavelength recording principles. Both the CBS system and the new Ampex slow speed recording processes are said to be high on fidelity. Of course, neither have been tested in the home as yet. The CBS cartridge requires a unique playback machine, while the Ampex process can be made compatible with any existing

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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, using 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 Receiver, Transmitter, 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.

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### PROGRESSIVE TEACHING METHOD

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

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

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 & 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.

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J. Statatis, 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 Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

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

### PRINTED CIRCUITRY

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tape system. We believe that there can be some sort of coexistence between the tape cartridge and the more conventional 7½ ips reel-to-reel standard, just as some folks prefer the convenience of record changers while other more sound-conscious individuals prefer the turntable. The tape cartridge, especially one in which the tape is not touched at all (such as in the CBS system), certainly has a strong selling point in convenience. But standard reel-to-reel prerecorded tape at 7½ ips will certainly continue to be issued and will continue to attract many audiophiles.

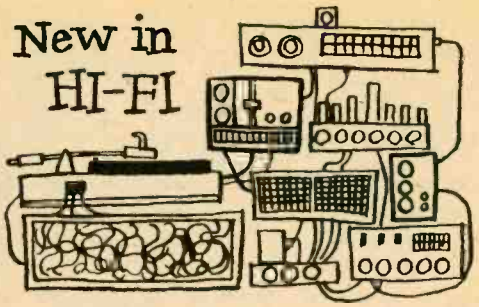
—o—


**AM-FM Portable**—For a mere $189.95 you can get Zenith's new completely transistorized AM-FM portable radio—the Royal 2000. First of its kind, it features AFC, a 5" x 7" oval speaker, and three built-in antennas, two of which form a "pull out" dipole for FM. The whole unit weighs just under 12 pounds and is powered by eight "D" cells.

—o—

**First nuclear-powered aircraft** may very well be a blimp. Pound for pound, nuclear fission offers quite a bit more energy potential than any other chemical propulsion system. The aircraft people now realize that positioning an airborne reactor in a blimp's bulge may cut down shielding problems.

## New in HI-FI

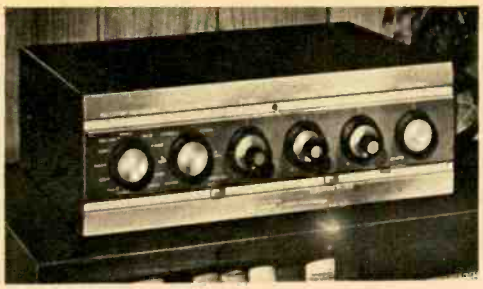


New **stereo amplifier kit** from Heath (Benton Harbor, Mich.) is rated at 35 watts per channel, 70 watts mono. It has a mixed channel output for a center "channel" anti-hole-in-the-middle speaker. Heathkit AA-40 sells for $79.95.

From 70 watts we jump to a **100 watt stereo** hi-fi dual amplifier by EICO, available in either kit ($99.50) or wired form ($139.50). Each channel is rated at 50 watts. For complete details you can write to EICO at 33-00 Northern Blvd., Long Island City 1, N. Y.

Allied Radio (Knight) is offering a stereo AM-FM tuner completely assembled (model KN-135). It boasts flywheel tuning and two extra high impedance outputs for direct stereo or monophonic tape recording. There is also provision for a multiplex adapter. Price: $79.50. 100 N. Western Ave., Chicago 80, Ill.

Allied's new Knight 12" KN-600 HC high compliance two-way speaker has a woofer of half-inch thick polyester foam construction. There is a built-in electrical crossover and brilliance control. The rectangular tweeter horn is mounted in the woofer cone. $59.95.



Moving into **preamplifier kits** we come up with Allied's Knight-Kit deluxe stereo preamp which markets for $64.95. It is designed to handle any stereo or mono operation, including reversed stereo channels.

—o—

A new **speaker system in kit form** from Paco incorporates a 10″ Jensen woofer and a horn-loaded compression tweeter in a pretuned cabinet finished on all four sides so it may be used in a vertical or horizontal position. Unfinished kit: $59.95. Finished in walnut: $69.95.

—o—

Heathkit announces their new AJ-10 AM-FM tuner kit with separate "magic eye" tuning indicators for AM and FM and provisions for AM-FM stereo listening or FM multiplex. Price: $59.95. Complete specifications available from Heath, Benton Harbor, Mich.

—o—

Harman-Kardon has a new all-on-one-chassis unit called the Stereo Recital. It's a combination 24-watt stereo amplifier with dual preamps and separate AM-FM stereo tuner. Price: about $200. 520 Main St., Westbury, N. Y.

Said to be the **first single stereo microphone** for home use, is the Norelco model EL3752/01. It consists of two microphone elements (dynamic "moving coil" types) set at right angles and mounted in a single housing. The pick-up pattern is cardiod. Priced at $39.50, the microphone is standard equipment with the Norelco 4-track stereo tape recorder. For more information write 230 Duffy Ave., Hicksville, N. Y.

Paco Electronics Co. (Glendale, N. Y.) has an AM-FM stereo tuner whose tuner sections are prewired and pre-aligned and are said to require no further adjustment. It can play AM-FM stereo and also contains a multiplex adapter socket. The pre-aligned kit is $99.95; unaligned kit is $84.95; and a factory wired version $134.95.

—o—

University calls its new Sphericon a "super tweeter." According to the manufacturer, it has a flat response up to 40,000 cps with a dispersion pattern of 120° in all directions. There is a built-in network for 3000 cycle crossover and brilliance control: $24.94. 80 S. Kensico Ave., White Plains, N. Y.

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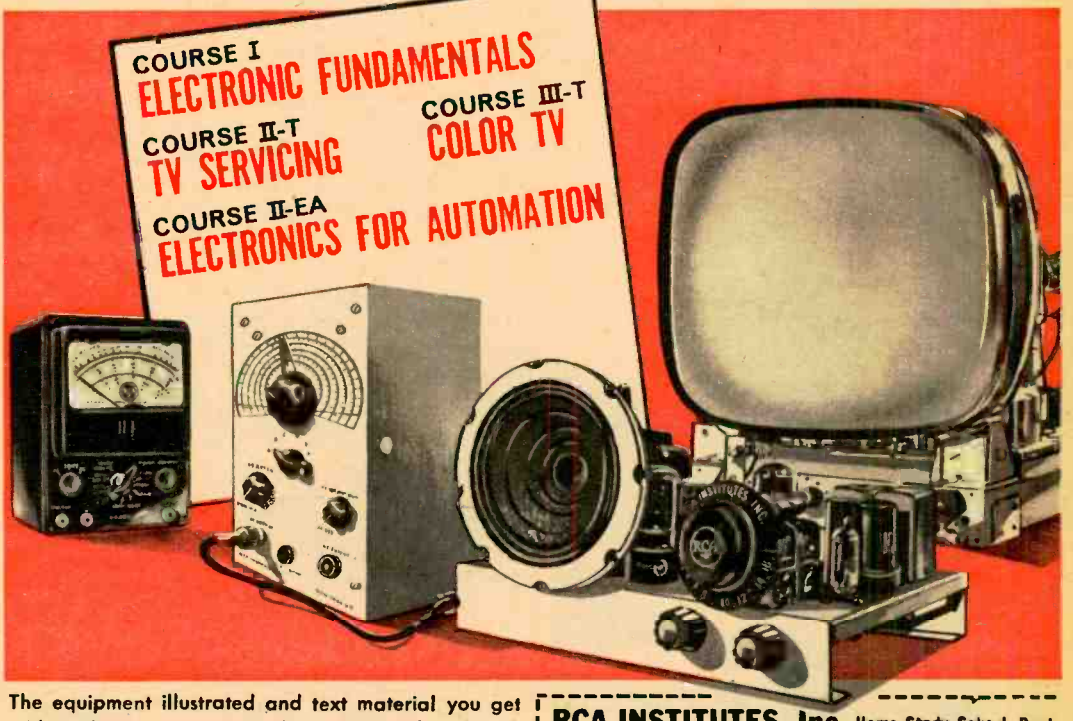


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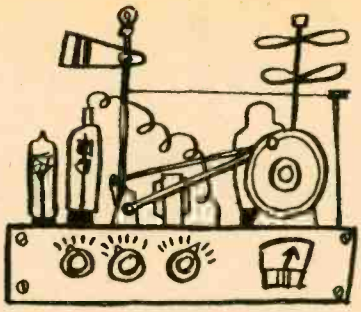
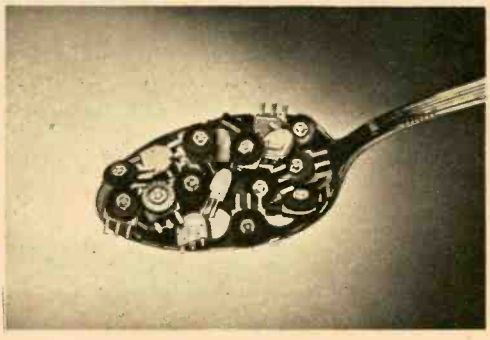


# New Gadgets, Instruments etc.

**Planning to treasure hunt** this summer? Gardiner Electronics Co., 2545 East Indian School Road, Phoenix, Ariz., has come up with a transistorized metal detector that uses only four flashlight batteries. Ten transistors, seven in the receiver and three in the transmitter, do most of the work. The whole unit sells for $175, and the manufacturer says it can detect a gallon can buried 4 feet and a 2′ square aluminum sheet at seven feet. For further information ask Gardiner for a catalog.



**A spoonful** of potentiometers. Called Radiohm, they are being marketed by Centralab. Rated at 1/10 watt, Radiohm boasts low moisture absorption, voltage and temperature stability and noise free performance. You can pour 158 of them into a single cubic inch. Resistance range is 500 ohms to 10 megohms. They are not yet available to the hobbyist, but will be soon. Centralab is located at 900 E. Keefe Ave., Milwaukee 1, Wis.

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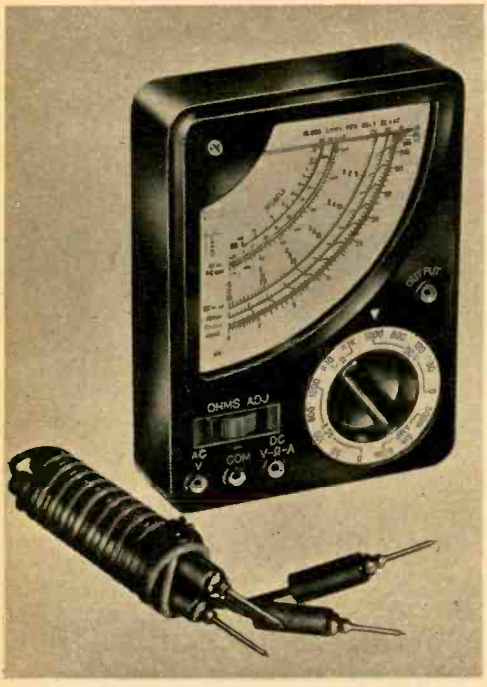
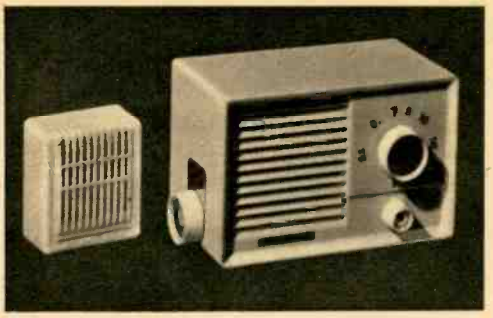
**New transistor**—If you happen to look inside your auto radio and find a transistor with four leads, don't head for a psychiatrist. Chances are it will be a new RCA dual purpose transistor oscillator and mixer. These functions are normally accomplished with two transistors. It is expected that this double emitter transistor will simplify the design of portable and automobile radios. In standard transistor radios only a limited automatic gain control (AGC) can be applied to a conventional converter stage. The use of the double emitter transistor makes it possible to apply AGC directly to the mixer without affecting the oscillator. AGC is a circuit arrangement which keeps a radio's sound at a constant level when the strength of the received signal varies.

—o—




**Pocket multi tester**—Lafayette Radio has come up with an unusually sensitive 10,000 ohms per volt AC-DC meter. Priced at $8.95, it has a 3½" meter face and uses 1% precision resistors throughout. There are two capacity ranges, one at 117-V AC and a second at 6-V AC.



**Radio-intercom**—A five-tube superhet radio that doubles in brass as a sensitive intercom is available from Olson Radio, 260 S. Forge St., Akron, O., for only $15.93. The master comes complete with an extension speaker. You may select operation as a radio, as a radio with remote speaker, and "talk" or "listen" in the intercom position. The radio and intercom functions are completely separate.

## Citizens Band

Within one month no less than five new Citizens Band rigs have come out, three of them in kit form. The **Heathkit** GW-10 sells for $62.95. Its superhet receiver section may be either crystal controlled or variably tuned on all 23 channels. There is a built-in noise limiter and adjustable squelch control. The transmitter of course, is crystal controlled and the entire unit may be mounted under the dash of an auto. It is furnished for 117 volt AC or 6 or 12 volt DC operation.

# Opportunities in Electronics

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In what kind of work are you now engaged?.....

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Desk EI-22

Allied's new **Knight-Kit** model C-11 transceiver has the standard 5 watt transmitter and a super-regenerative receiver section. An accessory mobile power supply for 6 or 12-volt operation is also available. The C-11 sells for $39.95 in kit form, including one crystal and microphone, but not the antenna or mobile power supply.

A 6-channel transceiver by **Transpace, Inc.**, San Fernando, Calif., sells for $169.50 including microphone and

crystal for one channel. It operates on AC, 6 or 12-V batteries and comes with an automatic squelch and an automatic noise limiter. Output power is 3 watts.

**Arkay International** is out with their Sky-Vox SQ-9 transceiver, which has a crystal controlled receiving section. The transmitting section of the kit is prewired. Factory wired the unit sells for $119.95. The kit costs $79.95. Arkay is at 88-06 Van Wyck Expressway, Jamaica, N. Y.

**Browning Laboratories'** R-2700, has 5 crystal controlled receiving channels in addition to vernier tuning of the entire Citizens Band. This unit which departs from the transceiver concept of Citizens Band gear, is designed only for base station operation, with a squelch, noise limiter and volume control all automatic. Price: $149. **Globe Electronics**, of Council Bluffs, Iowa, has put out two new products designed to make Citizens Band operation more pleasurable. One is a noise suppressor (GNS-1) at $4.95, and the Tenna-meter, model TM-1. With its built-in tuning meter and sensitivity control, the Tenna-meter can tell you whether or not the antenna is performing efficiently. It sells for $15, can be used with ham transmitters.

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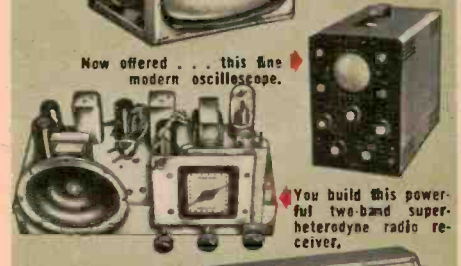

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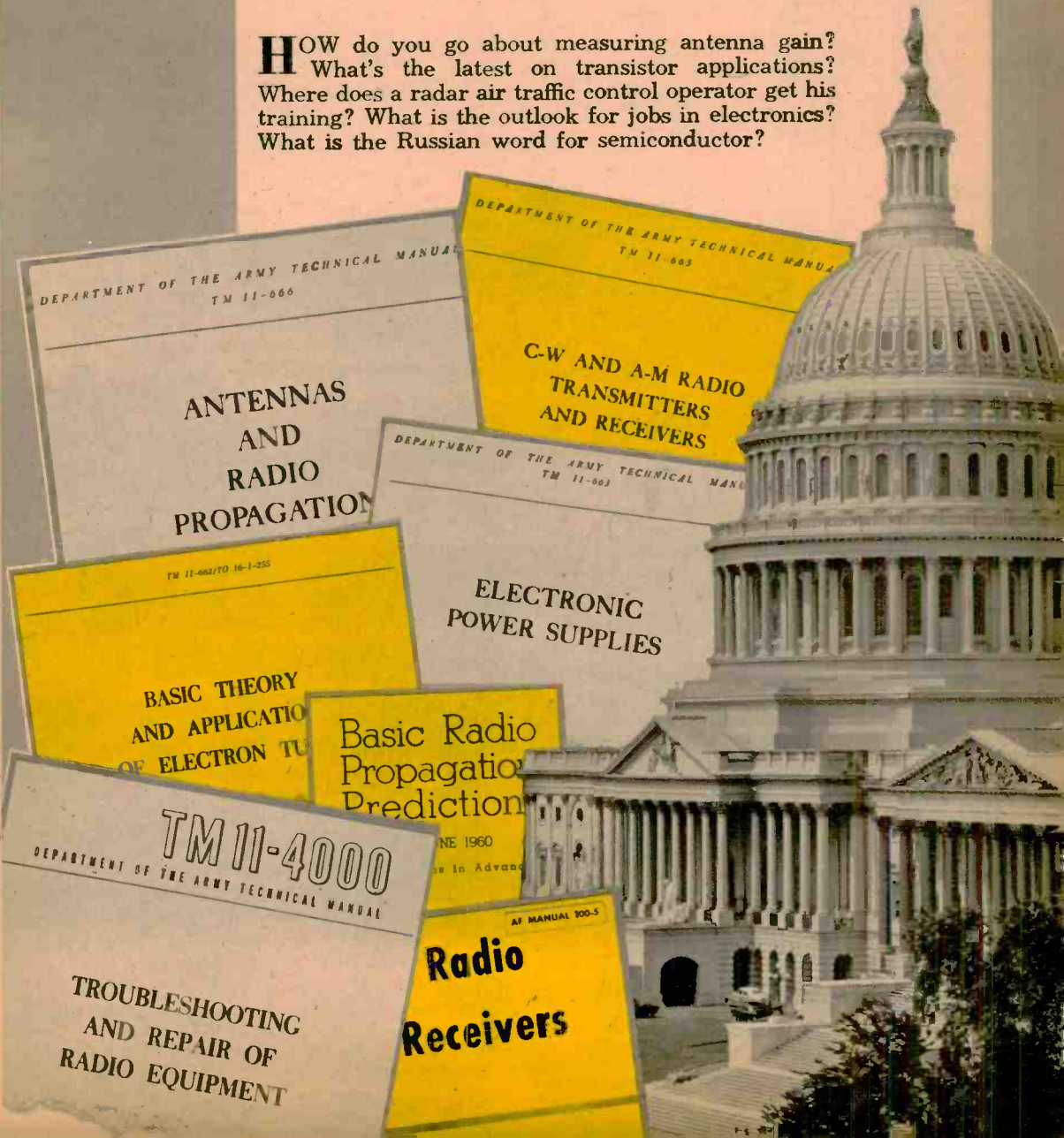
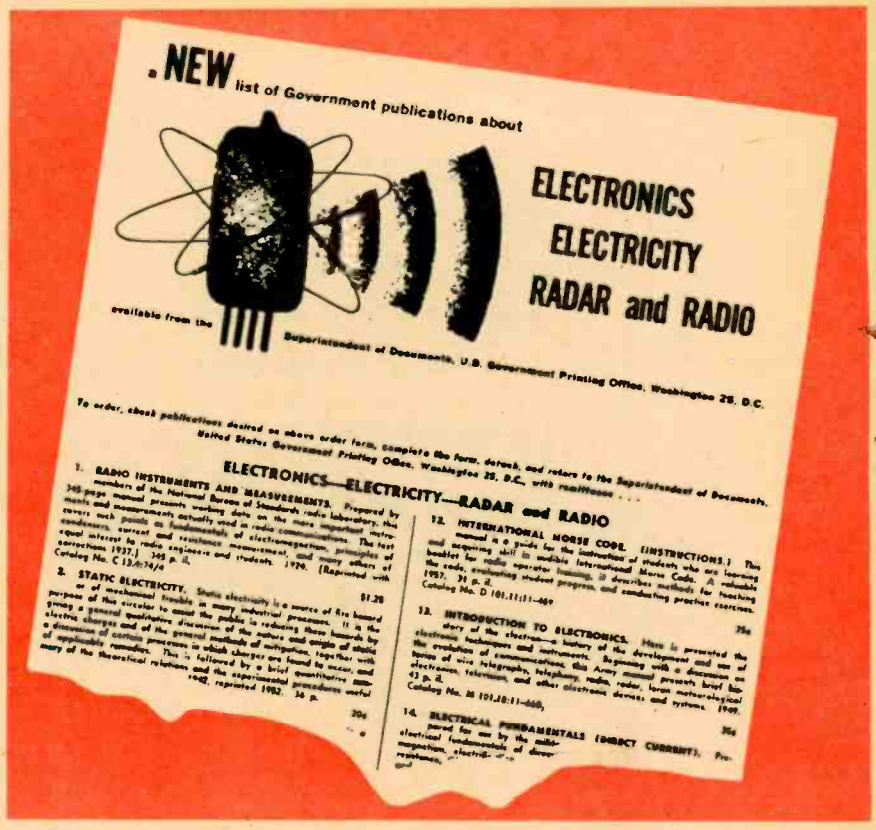
# Electronics Library From Uncle Sam

**By Harry Kursh**

**Books, booklets, magazines and pamphlets covering all areas of electronics are yours for the asking.**

HOW do you go about measuring antenna gain? What's the latest on transistor applications? Where does a radar air traffic control operator get his training? What is the outlook for jobs in electronics? What is the Russian word for semiconductor?






**The Selected List of Government Publications is issued every other week and can be mailed to you free of charge. It includes descriptions of publications, prices and a handy order form. At right is recent biweekly list devoted entirely to electronics, related subjects.**

The answers to all these questions can be obtained from a single source: the United States Government Printing Office. The answers may be found in the ever-growing list of electronics publications produced and sold by Uncle Sam. As a matter of fact, these questions hardly scratch the surface of the amazing amount of authoritative electronics information you can store on your own reference shelf—at bargain prices!

Thousands of electronics reports, research studies, technical bulletins and handbooks are turned out annually by such agencies as the Naval Research Laboratory, the Army Signal Corps, the National Bureau of Standards, the Federal Communications Commission and the army of experts working on space projects. Something new is added to the list every day.

In its first year of existence (1861), the Superintendent of Documents office had only a handful of employees and sold less than $900 worth of publications. Today there are more than 500 on the Superintendent's staff, and they sell an average of some 50-million publications a year. Finding the answers to your electronics questions could be something like looking for the proverbial needle in the haystack, unless you happen to know how to go about it. That's why *Electronics Illustrated* asked me to go to Washington and go through the haystack with the experts.

Carper W. Buckley, Supt. of Documents, outlined the function of his office. "We are strictly a sales and service organization. We do not make policy. We do not dream up a single title, nor do we ask any government official or agency to produce a report or book on any subject. Everything we sell originates first in some government agency. Suppose, for instance, an electronics engineer at the National Bureau of Standards has made a technical report to his superiors on the subject of new transistor applica-

tions. They decide that this report is of widespread interest to their own staff, other government agencies, and the general public—scientists, engineers, inventors, and hobbyists.

"They then place an order for several hundred copies to be printed by the Government Printing Office for official use, and they pay for this from their own budget. At the same time, we will be notified that this publication is being printed, together with a recommendation that a certain number of extra copies be made available for public sale.

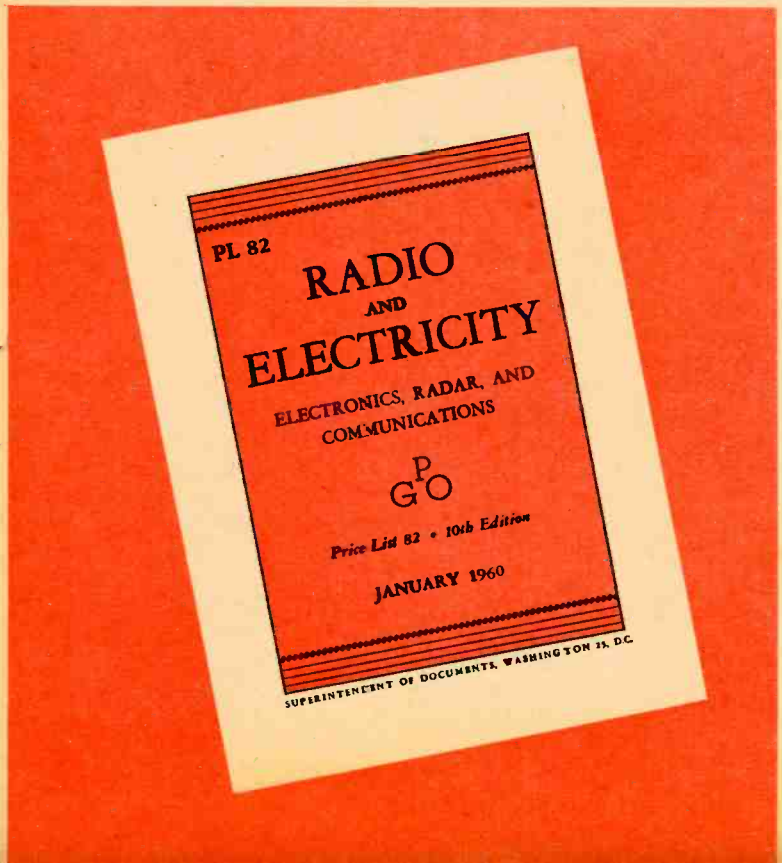
"We consider the recommendations against our own experience and previous sales records of similar publications, and then we place our own supplementary order for additional copies. We add 50 percent to the cost of production and establish the selling price to the public."

Since the cost of production, however, does not take into account such factors as writers' salaries, editorial work, and the enormous amount of research, time and effort that went into gathering the material for the publication, almost everything sold by the Supt. of Documents represents a spectacular bargain. Right now, he has available for sale approximately 30,000 different titles, covering a wide variety of subjects, among them hundreds of volumes covering electronics from every conceivable angle—television, radio, radar, and communications.

Many electronics publications are printed and never made available for public sale. Contrary to popular myth, however, most of these are *not* classified documents and can be obtained, sometimes free, if you know where and how to do it.

There are three basic tools provided by the Supt. of Documents to help you get what you want: (1) *Price Lists* of government publications; (2) lists of *Selected Publications;* and (3) the *Monthly Catalog* of government publications. Since these represent the key to a priceless mint of electronics information, let us consider them separately.

*Price Lists:* These pamphlets cover certain broad categories. There are about 45 price lists and each contains a comprehensive listing and descriptions




**Price List 82 is also free for the asking. It contains twelve pages detailing publications available that fall into the categories headlined on its cover. It is revised and updated annually—an easy to read and valuable bibliography for the hobbyist and engineer.**

**If you live in or near the District of Columbia, or have occasion to visit there, be certain to browse through the modern bookstore at the Government Printing Office. You'll be amazed at the wide variety of subject matter offered by Uncle Sam.**

of the publications, their prices, and how they may be ordered. *Price List No. 82,* for example, is called "Radio and Electricity, Electronics, Radar, and Communications."

Each price list represents all the publications available for sale in its category, and each is free for the asking. The Supt. of Documents revises each price list about once a year, bringing it up to date. If you obtain *PL 82,* the inside of the cover page will provide you with a complete breakdown of the other price lists. If you are interested in electronics information which may be buried in some publication on mathematics, or physics, or weather and astronomy, you can check the complete set of price lists and perhaps ask for *PL 48*—"Weather, Astronomy, and Meteorology"; or *PL 64*—"Scientific Tests, Standards, Mathematics, and Physics." By reading the descriptive matter in each of these price lists, you may find the exact publication you need.

*Lists of Selected Publications.* These are issued bi-weekly to keep you informed on a variety of reports, pamphlets and books of outstanding interest to the public, or which may have come out after the comprehensive price lists were compiled. A recent *Selected Publications* list, for example, featured titles ranging from "Radio Instruments and Measurements" (a 345 page illustrated book for $1.25) to "Introduction to Electronics," (only 35 cents).

You can obtain every issue of *Selected Publications* merely by asking the Supt. of Documents to place your name on the mailing list. It's *free!* One indication of the importance of this subscription service is the fact that more than 500,000 persons are now on the mailing list.

*The Monthly Catalog.* This publication is the key to all publications on sale and those which may never be offered for sale, yet are available to you. The importance of the *Monthly Catalog* lies in that it is a comprehensive, up-to-date listing of all publications issued by all officials and agencies of the United States, and each issue contains a subject matter index which, through a system of cross-references, helps you locate electronics information in the most obscure sources. The December issue of the *Monthly Catalog* contains a cumulative index to the subject matter contained in *all* the government publications for the preceding year. Also, whenever a particular publication may not be available for sale, the *Monthly Catalog* shows which agency published it. Sometimes you can obtain a free copy *directly* from the agency. The *Monthly Catalog* is sold by subscription, $3 per year, through the Supt. of Documents. [*Continued on page* 127]

# Hot Dog Cooker

**By Len Buckwalter**

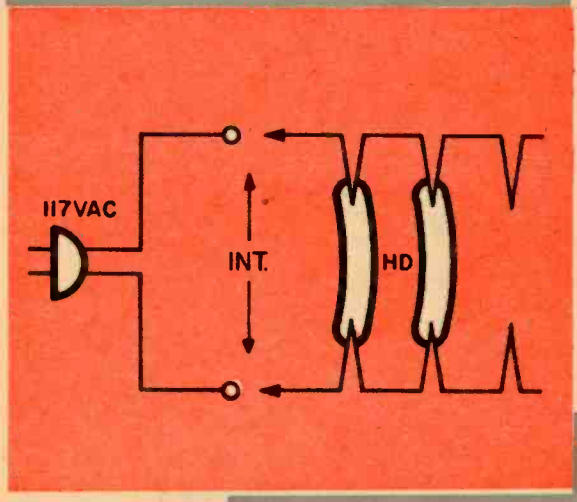
## Electronics goes to the "dogs" with a 90 sec. cooker

HERE'S an item that will tickle the taste buds of the true *thermokynophagist* (From the Greek: *thermo*-heat; *kyno*-dog; *phagist*-eater). From a cold start it will do your dogs to a scrumptious turn in about 90 seconds. Persons biting into one of these $P=I^2R$ franks have been known to exclaim, "Ach, vat a vunderbar viener!"

The electronic principle: a hot dog speared across 117 volts AC acts like a variable resistor. At first, just enough current trickles through to cause slight heating within the frankfurter—which liquefies some of the fat. Resistance drops and a condition somewhat similar to thermal runaway in a transistor occurs; more heat, more current. Fortunately, the process begins to taper off in about two minutes and won't turn the hot dog into a charcoal stick if cooking time is accidentally doubled.

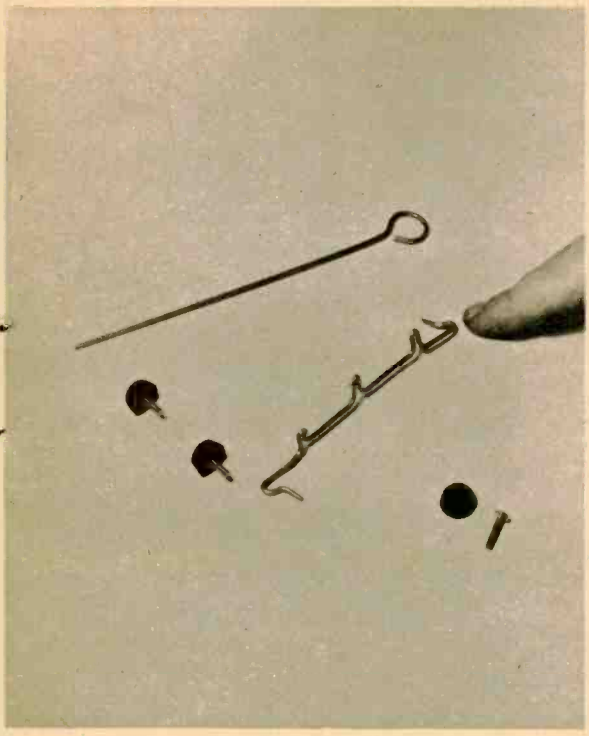
To prevent shock hazard, the unit is built into a Bakelite case


All the major parts used in construction are shown here. Note card with skewers.

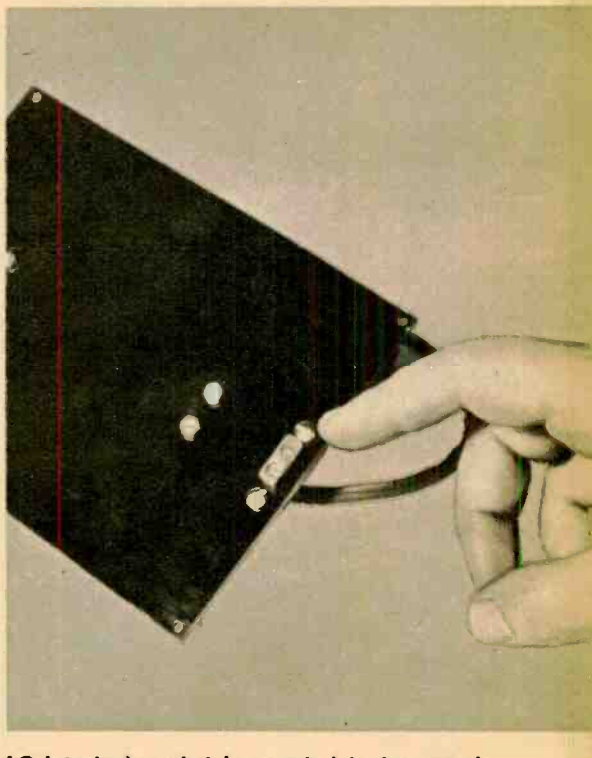



Schematic diagram of circuit has hot dogs (HD) between parallel skewers. Interlock (INT) avoids shock hazard.

Complete hot dog cooker is shown below with the cover removed. Two L-brackets (not visible), hold male plug to case.



**Finger points to curl at end of skewer. Screws secure both skewer and rubber feet to case.**



**AC interlock socket is mounted to top panel with screws and nuts. File screws to fit well.**

and uses an interlocked AC cord. When the top cover is removed, both sides of the AC line disconnect from the exposed skewers within the case. The interlock is the familiar TV-type "cheater" cord and plug; installed as shown.

The skewers, upon which the franks are pierced, are stainless steel pins bent into proper shape. Note how they are held in place by machine screws, washers and nuts inserted through holes in the case. These screws also hold the four rubber insulating feet.

Although the cooker is simple in construction, there is one critical factor. This is the contact area of the skewers that hold the franks. If heating is found to be insufficient, surface area must be increased. This can be done in two ways; increase the length of the skewers so they completely pierce the hot dog, or use double skewers on each side.

Wiring between the AC plug and skewers is done with #18 enamelled wire. In the model shown here, #20 was used; each conductor consisting of a twisted pair for rigidity. Solder lugs under the screws that hold one end of each skewer are convenient connection points for the wires.

After each use, the cooker requires a minimum amount of cleaning to remove flecks of grease that drip to the bottom of the case. It's best done with a soapy sponge—do not submerge in water—then wiped clean (there is no need to run water into the case). Be sure to remove any carbon that forms on the skewers.

PARTS LIST

INT—Interlock consisting of TV "cheater" cord and matching chassis-mount AC plug
Bakelite case—6¾"x5¼"x2¼" with matching panel (Lafayette MS-218 and MS-219). A Lucite cover may be substituted
Skewers—Stainless steel, found in supermarkets or houseware stores (Type used in cooking turkeys)
Rubber feet—Four ½-inch OD (Walsco Cat. No. 7054-F)
Handle—Available in most hardware stores
Misc.—4-40 machine screws and nuts, two solder lugs, #18 enamel wire, two small L-brackets


Infrared detection gear is super-chilled by this 8-oz. cylinder containing helium at 300 psi in a tiny compartment. Plastic piston is cold end of tube which refrigerates -350° F.

## *hot future for*

# Super-Cold Electronics

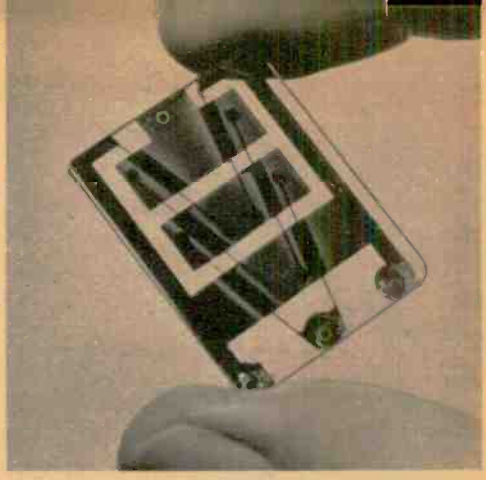
**By E. M. Delman**

**Strange things happen near absolute zero, —460° F. Result: New realities and exciting possibilities.**

AT its bitterest, the South Pole dips to —100°F. But the dozens of cryogenics laboratories throughout the world don't even get into business until they create the incredible chill of —300°F. And with a little added effort, they can push temperatures of gases, metals, and electronic equipment almost down to —460°F —or zero degrees on the Kelvin scale—absolute zero. You just can't get any colder!

At a few degrees above absolute zero some spectacular physical effects of special interest to electronics take place. By utilizing these effects, specialists in super-cold electronics are close to making, or hope to make the following:

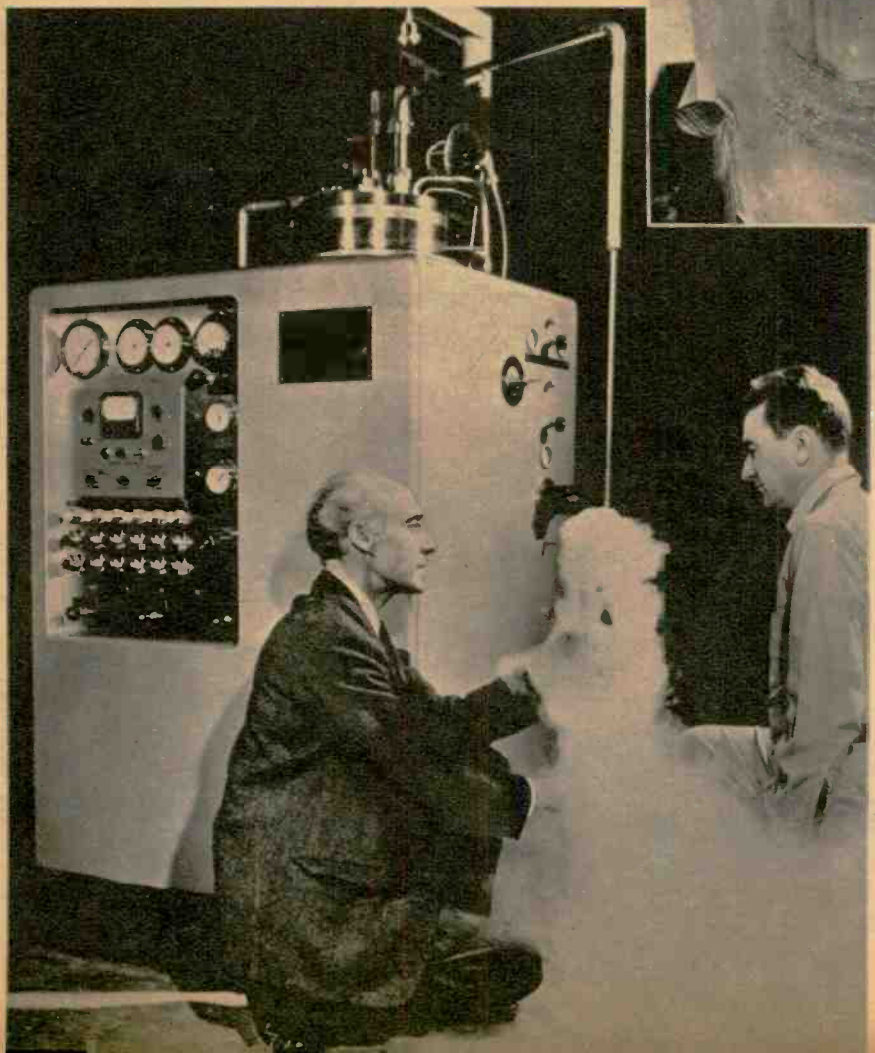
- A giant computer that will fit into a shoe box.
- An electron microscope that will enable man to look into the atom for the first time.
- A DC to AC amplifier with *no* drift and *no* noise.
- Resonant cavities for use in oscillators that would be so stable (drift-free) that they could be used as frequency standards



Cryotron electronic switches operate in helium at -452°F to take advantage of superconductivity. There are six cryotrons on this wafer of thin tin and lead deposits.

Superconductivity, where certain metals lose all electrical resistance, can cause lead to float. Lead sphere in liquid helium is supported by magnetic field in rings.

There are now more than 140 installations of the ADL Collins helium cryostat, the instrument which has become a basic tool for ultra-low temperature research.



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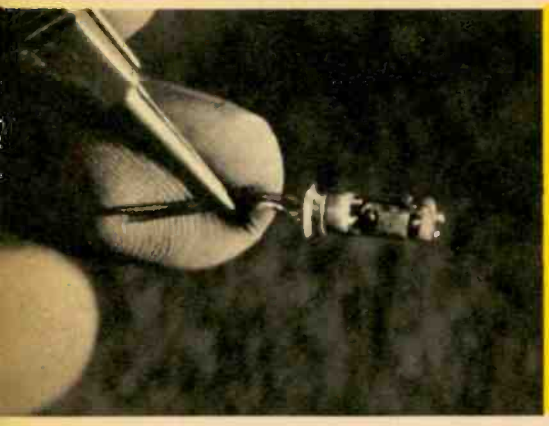
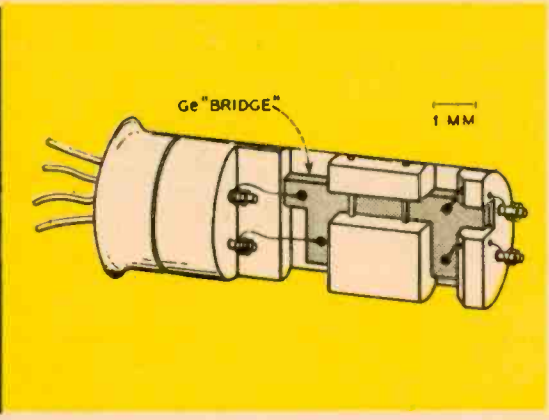
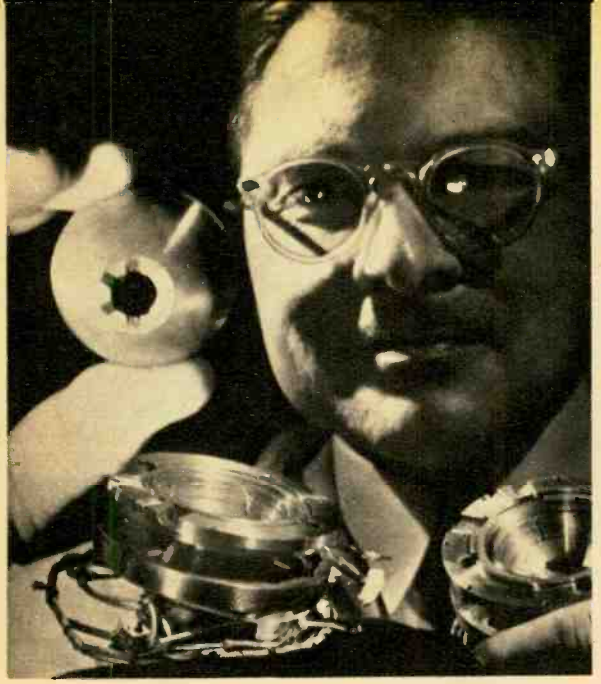


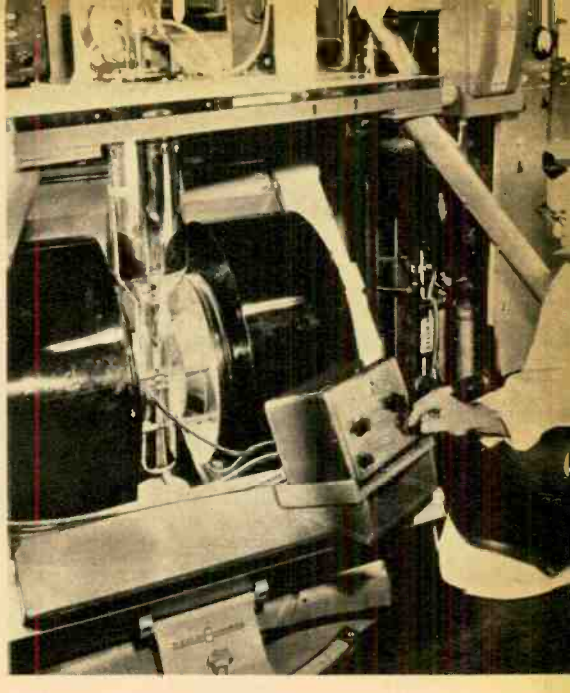



**Germanium resistance thermometer, developed by Bell Labs, measures temperatures near absolute zero with extreme accuracy. As ultra-low temperature varies, the resistance of germanium (Ge) changes; change in resistance can be read as temperature with a specially calibrated ohmmeter.**

**Liquid oxygen (LOX), used largely as a high-energy missile and rocket fuel, is here frozen into a cone. What happens? The solid oxygen has developed magnetic properties it didn't have as a liquid and can be attracted by a permanent magnet.**



Strange behavior of some metals near absolute zero enables this super-accurate gyro sphere to be suspended solely by a magnetic field so that it can rotate rapidly in a vacuum.



Experimental maser "package": two black drums in foreground are coils of an electromagnet, while silver flask holds liquid gases which keep ruby crystal close to absolute zero.

in broadcasting. Their accuracy could approach that of the atomic clock, the most accurate timepiece in the world.

Cryogenic electronics engineers have already constructed navigational gyros of greater stability than any previously known. These gyros are set to go into electronic, self-correcting inertial guidance systems for ships, space vehicles, and guided missiles. Noise-free amplifiers for radio astronomy, long-range missile-detecting radars, and deep-space communications also depend on extreme cold, as do some infrared detectors for military and peacetime uses.

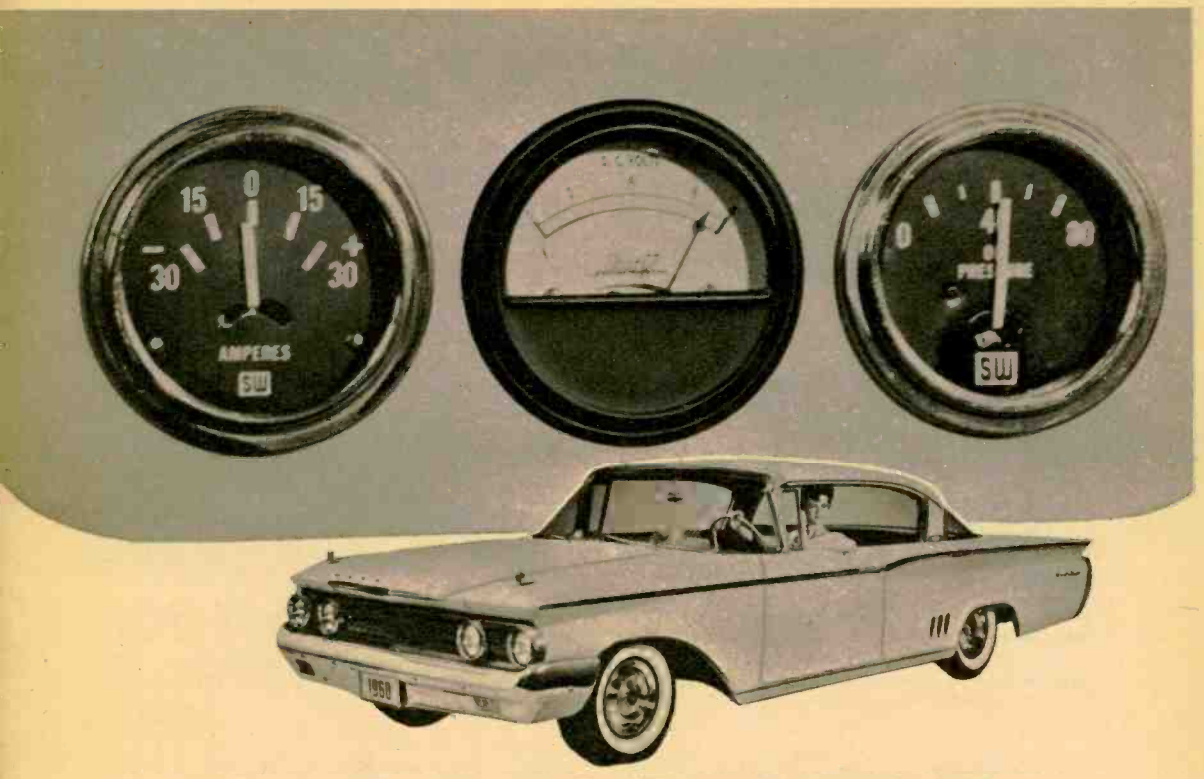
At absolute zero all atomic motion, which we sense as heat, is believed to stop. Fortunately, this theory breaks down a few degrees above absolute zero —and many unexpected and highly useful phenomena occur in this twilight zone. Since scientists can never really create absolute zero (although they get within a few hundredths of a degree), this "discontinuity" works in our favor.

The refrigeration device that makes cryogenics possible is called the "cryostat." It is simply an outer container for liquid helium or liquid hydrogen—the two coldest substances known to man—surrounding an inner container to hold the material under study.

Electronics engineers are most interested in cryogenic temperatures because of what they do to certain metals and compounds. Within a couple of dozen degrees of absolute zero these materials become "superconductive." That is, they offer no resistance to current. Mercury, lead, tin, columbium, and tantalum, plus 15 other metals have been found to "give up the fight" near absolute zero.

When a current is induced in a superconductive ring, it apparently runs on forever without any applied voltage. In one experiment, an induced current ran on without aid in a superconductive ring for *two years*—until the experimenter got tired of watching!

Such a current also creates a magnetic field which remains constant indefinitely, an effect known as "magnetic flux trapping." Super-conductors are also magnetic insulators. Up to a certain strength, a magnetic field cannot penetrate a super- [*Continued on page* 119]




### *triple threat dashboard panel will*

# Monitor As You Motor

**By Paul Hertzberg**

A SIMPLE auxiliary instrument panel that can be constructed and hooked up in a few hours can save you many expensive repair bills on your car. The addition of an ammeter, voltmeter and oil pressure gauge will give you the inside story of how your electrical system is operating and whether the engine is receiving lubrication.

The three meters mounted on the panel have disappeared from auto dashboards during the last few years and have been replaced with a variety of warning or blinking lights. Usually when these so-called "idiot" lights come on and stay on, serious troubles have already developed and the car may not be safe to drive. Our new panel doesn't remove the function of the existing lights, but rather adds the auxiliary gauges. Due to the vast differences in instrument panel shapes it is impossible to describe one panel to fit all cars. Cut from 3/16" Masonite and painted to match the dash color, the one shown will be an attractive addition to your dashboard. An aluminum panel can also be used. Small L-brackets and 6-32 hardware mount the panel to the edge of the dashboard. It may not even be necessary to drill any holes under the dash

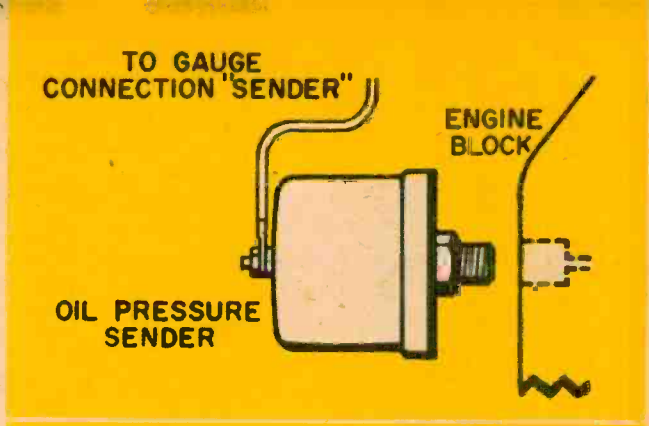
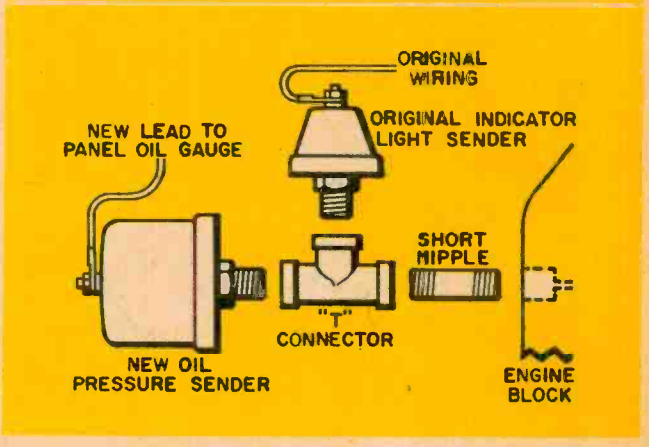
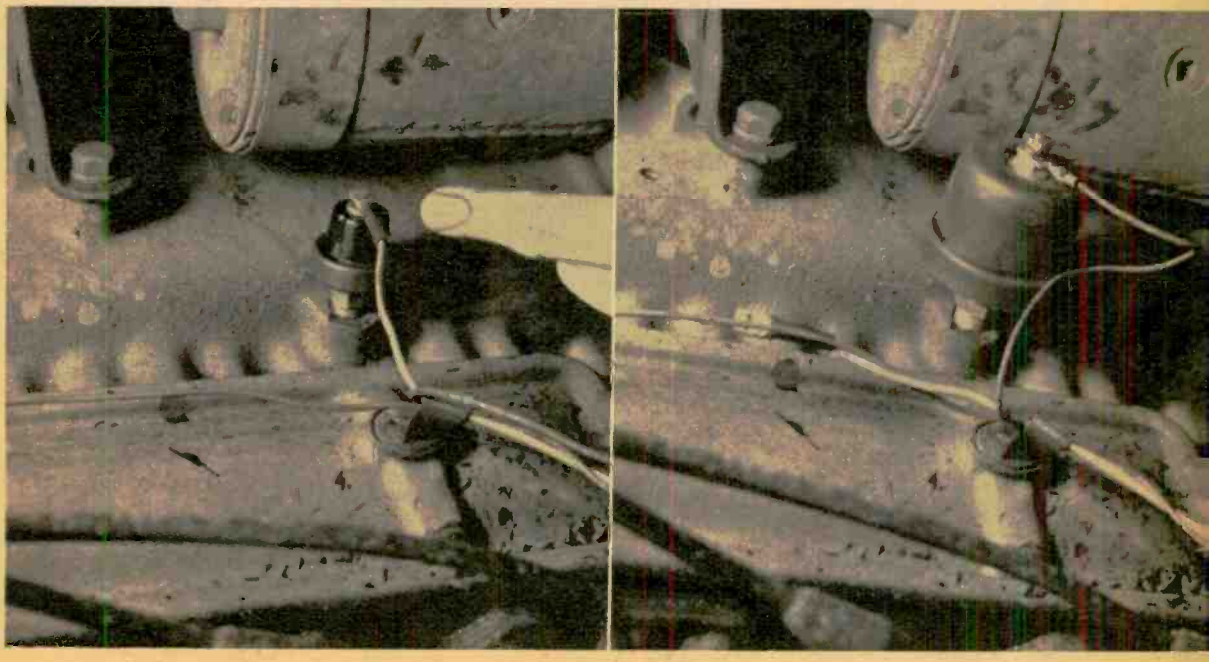



Fig. 1. New oil pressure sender is tightly screwed into engine block. Fig. 2. An alternate hook-up where the old signal light switch and the new sender can be used simultaneously. Be sure to shut off the engine when changing connections.




The original indicator switch left, and new pressure sender on engine block.



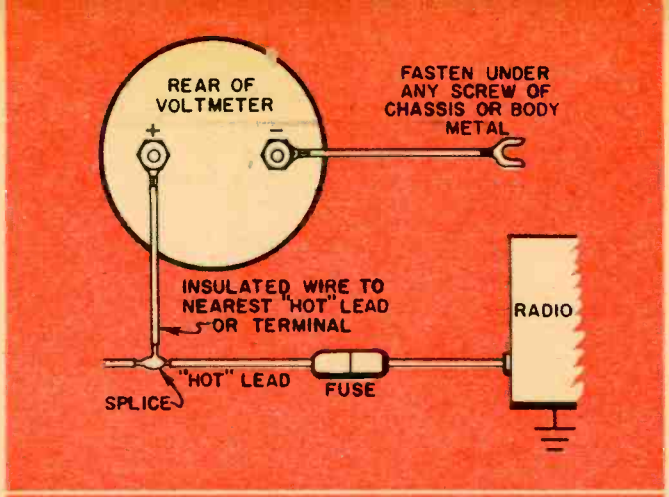
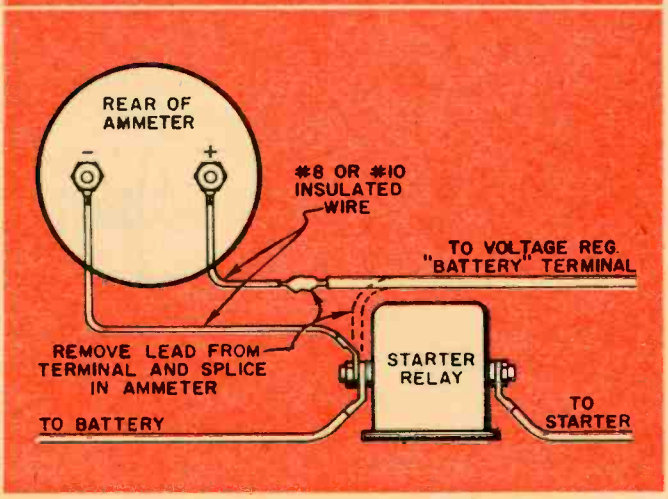
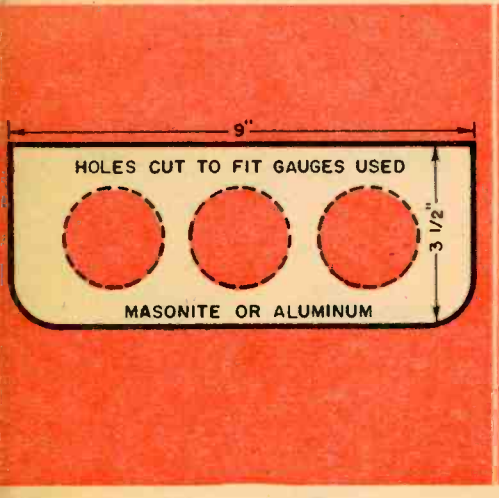



Fig. 3 and Fig. 4 indicate the connections needed for the voltmeter and ammeter. The polarities shown are based on the use of negative ground system in car's wiring. Polarities must be reversed for positive gnd.



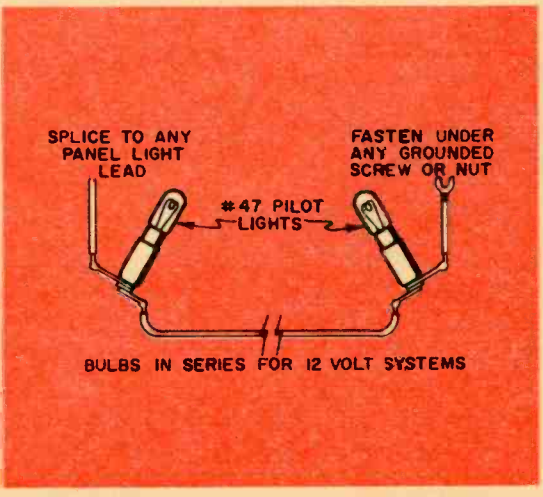




Fig. 5 shows relative size of panel required. Fig. 6 is wiring guide for panel lamps in a 12-volt electrical system. At right, the panel lights are connected in parallel for 6 v use. Two L brackets hold the panel securely to the dash.

because many cars have a dozen holes already drilled during the car's manufacture. The ammeter leads and the oil sender wire can be run through existing holes in the firewall where the other electrical leads now pass. If feasible, the gauges may also be mounted directly into the dashboard or fitted into unused clock openings.

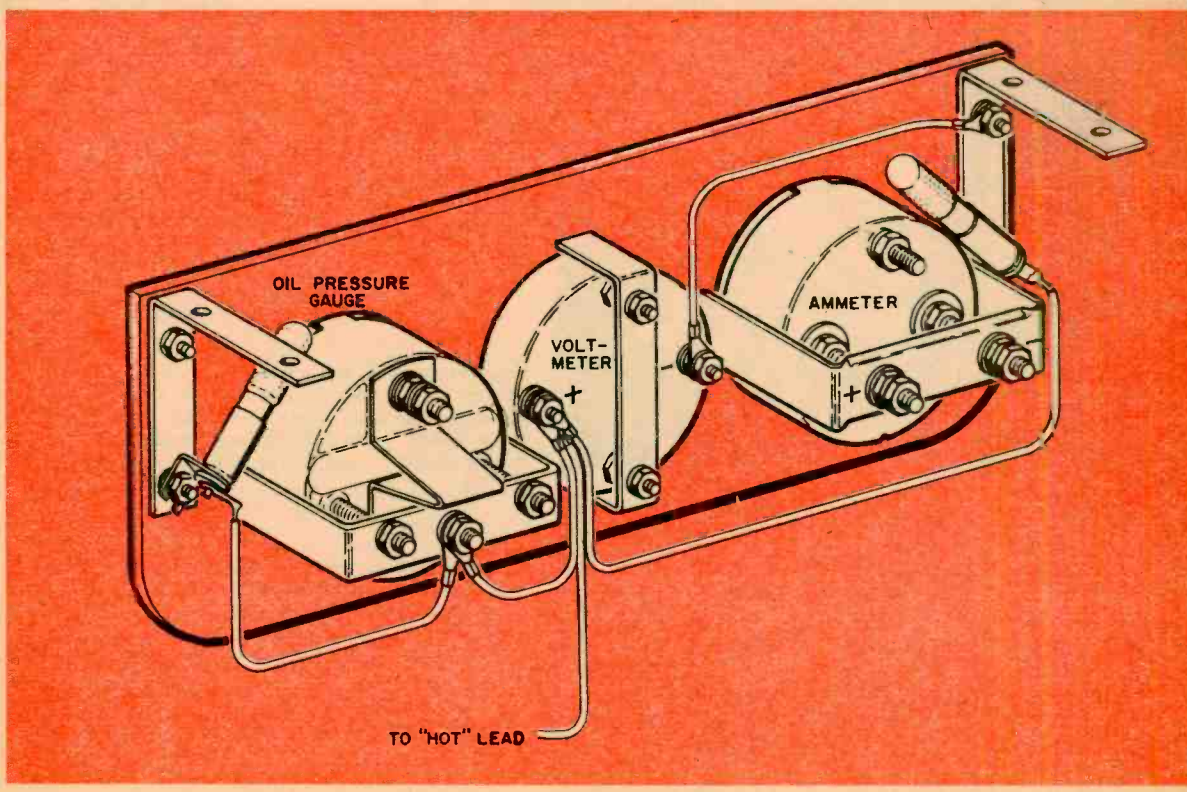
It is important for you to disconnect the battery leads while making any alterations to avoid damage from an accidental short circuit. Especially remember not to remove the oil gauges while the engine is running. The oil is under 40-60 pounds per square inch pressure and you can get a face full if you're not careful.

A variety of oil pressure gauges may be used. The basic difference between them is slight. One gauge can be illuminated from behind the instrument panel while others need light shining directly on the face of the meter. The mechanical type of gauge has more scale divisions than the electric type and it is possible to detect slight rises or drops in pressure. This type is slightly more advantageous to use on modern engines that are very

[*Continued on page* 120]

PARTS LIST

| | |
|---|---|
| Ammeter | Stewart-Warner 30-0-30 (2 1/16") indirectly lit $6<br>Stewart-Warner 30-0-30 (2") $4<br>Sears-Roebuck 30-0-30 (2 1/16") $1.50<br>Shurite 30-0-30 #5215 (2 5/16") $2.50 |
| Voltmeter | Shurite 0-15 volt #5108 2 5/16" $1.85<br>Shurite 0-8 volt #5106 2 5/16" $1.85 |
| Pressure Gauge | Stewart-Warner 12 volt 306 G 353 Z electric sender $16<br>Stewart-Warner 6 volt 305 B 353 E $8<br>Sears-Roebuck non-illum. mechanical gauge $2.19 |
| Misc. | #6-32 hardware<br>Masonite panel<br>L brackets<br>#10 insulated wire<br>#14 or #16 insulated hookup wire<br>#47 pilot light bulbs and sockets<br>Touch-up paint to match panel to dashboard color<br>Optional "T" connector, 1/4" to 1/8" reducer |

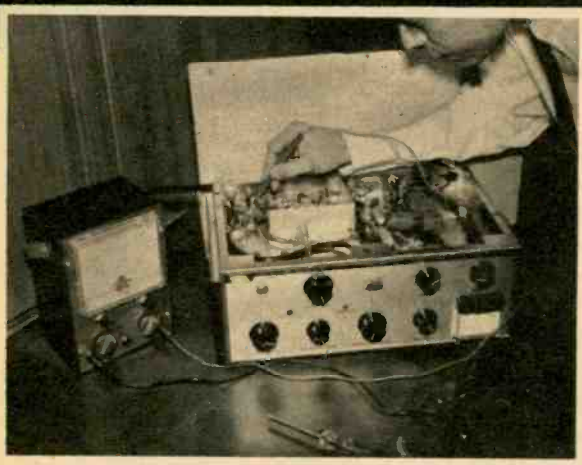


| DATE TIME | STATION CALLED | CALLED BY | MIS FREQ ON DIAL | MIS SIGNALS RST | MY SIGNALS RST | FREQ MC | EMIS-SION TYPE | POWER INPUT WATTS | TIME OF ENDING QSO | OTHER DATA |
|---|---|---|---|---|---|---|---|---|---|---|
| 2-14-60 1838 | W7AIB | X | 3535 | 589 | 569 | 3.5 | A1 | 65 | 1849 | RAG CHEW BEFORE NET |
| 1904 | W7GIP | X | " | 579 | 579 | 3.5 | " | " | 1933 | QNI WSN-Sent 1 Recd 2 |
| 1949 | W7QLH | X | 3575 | 589 | 559 | 3.5 | " | " | 2008 | Checked into RN-7 No tfc |
| 2020 | CQ | | | — | — | 7.0 | " | SB | 2033 | Rag chew - his handle "DON" |
| 2035 | " | | W6XMO | 708B | 569 | 7.0 | " | SB | 2035.2 | Band condx poor - closed sta |
| 2-15-60 1906 | W7JEY | X | 3535 | 449 | 569 | 3.5 | A1 | 60 | 1928 | QNI WSN - no traffic |
| 1940 | CQ | | W9ABC | 7110 | 459 | 7.0 | " | 60 | 1956 | Rag chew - much QRM & QRN |
| 1959 | WØFXD | X | | 7130 | 559 | 7.0 | " | " | 2001 | Unrate him - too much QRM maybe |

Feb 9 OPR Bud

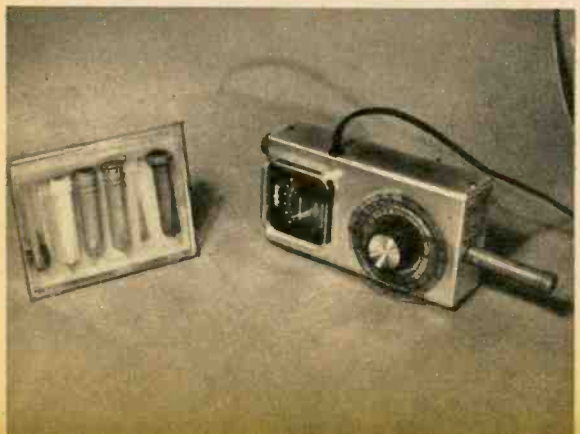
| TIME | CLD | BAND | END | RMKS |
|---|---|---|---|---|
| 1420 | 4ZXM | 40 | 1438 | Short QSO |
| 1441 | 3VKD | " | 1443 | no ans |
| 1509 | 2 zi | 80 | 1511 | " |
| 1515 | 3XXX | " | 1528 | Short chew |
| 1542 | CQ | 20 | 1544 | no ans |

Qrd band condx lousy so knocked it off at 1545



It's easy to keep a legal log if you use a fill-in-the-blanks logbook. If you make your own logbook, be sure to include all required info. Asterisked columns are *must* information. "Bud" is missing some.

Your transmitter has a milliammeter, but how're you going to know your input power to the final stage unless you also know plate voltage? Voltage remains constant, but check fairly occasionally.



Grid dip meter satisfies requirement for independent frequency measuring gear. Other uses: absorption-type wavemeter, parasitic locater, transmitter and antenna tuner, receiver alignment, etc.

# Are You a Legal Ham?

**By Howard S. Pyle, W7OE**

**Without knowing it, you may be asking for an FCC "pink slip." Here's a checklist reminder for hams.**

FORTUNATELY, the FCC has had to deal with a remarkably small percentage of violators in proportion to the total ham population, now over the 200,000 mark. Amateurs have done a fine job of self-policing through a large force of volunteer "official observer" amateur stations. But in view of the sharp rise in the FCC's "violation curve," due primarily to Citizens Banders with little technical knowledge and a vague notion of the rules and regulations, radio stations in general may come in for more careful scrutiny. Perhaps now would be a good time to run a constructively critical eye over our regular ham bands, both from the standpoint of legal equipment compliance and operating procedures.

Where can you go wrong? Here's a partial checklist:

Input power to final amplifier
Key clicks
Sideband splatter
Off-frequency operation
Log-keeping
Crystal control (Novice only)
Overmodulation
Harmonic radiation
Conelrad equipment
Independent frequency measurement

[*Continued on page* 121]

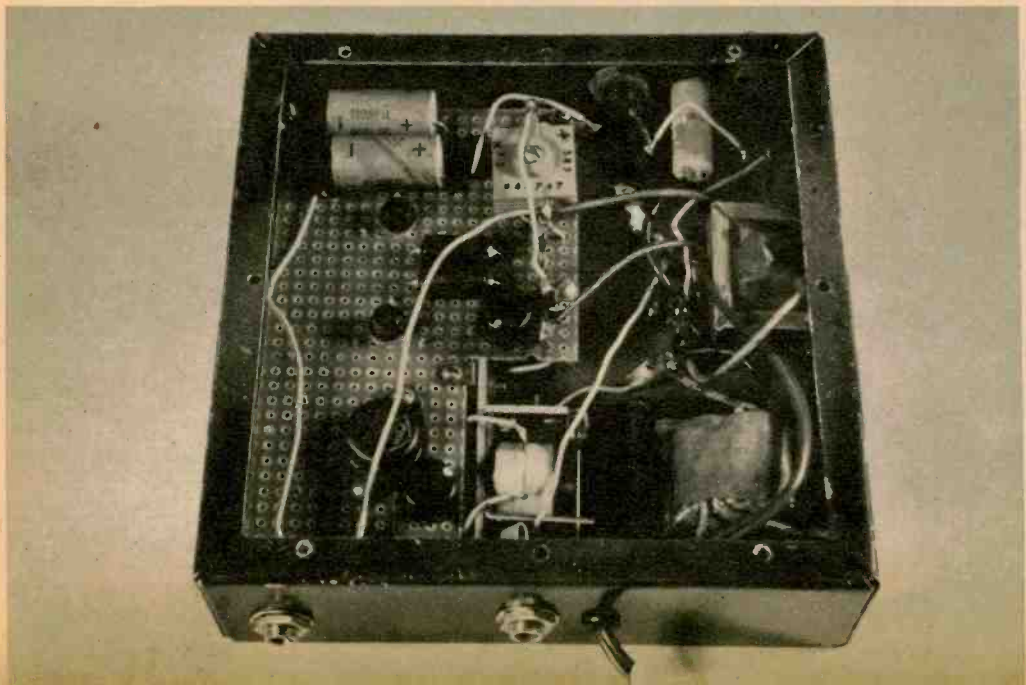

**Most often neglected requirement is that of Conelrad monitoring. This commercial monitor was modified by author, who put an "Alert Alarm" indicator light in parallel with buzzer. When broadcast station carrier fails, buzzer and light operate simultaneously and meter drops to zero providing sure-fire monitor alarm well above requirements.**

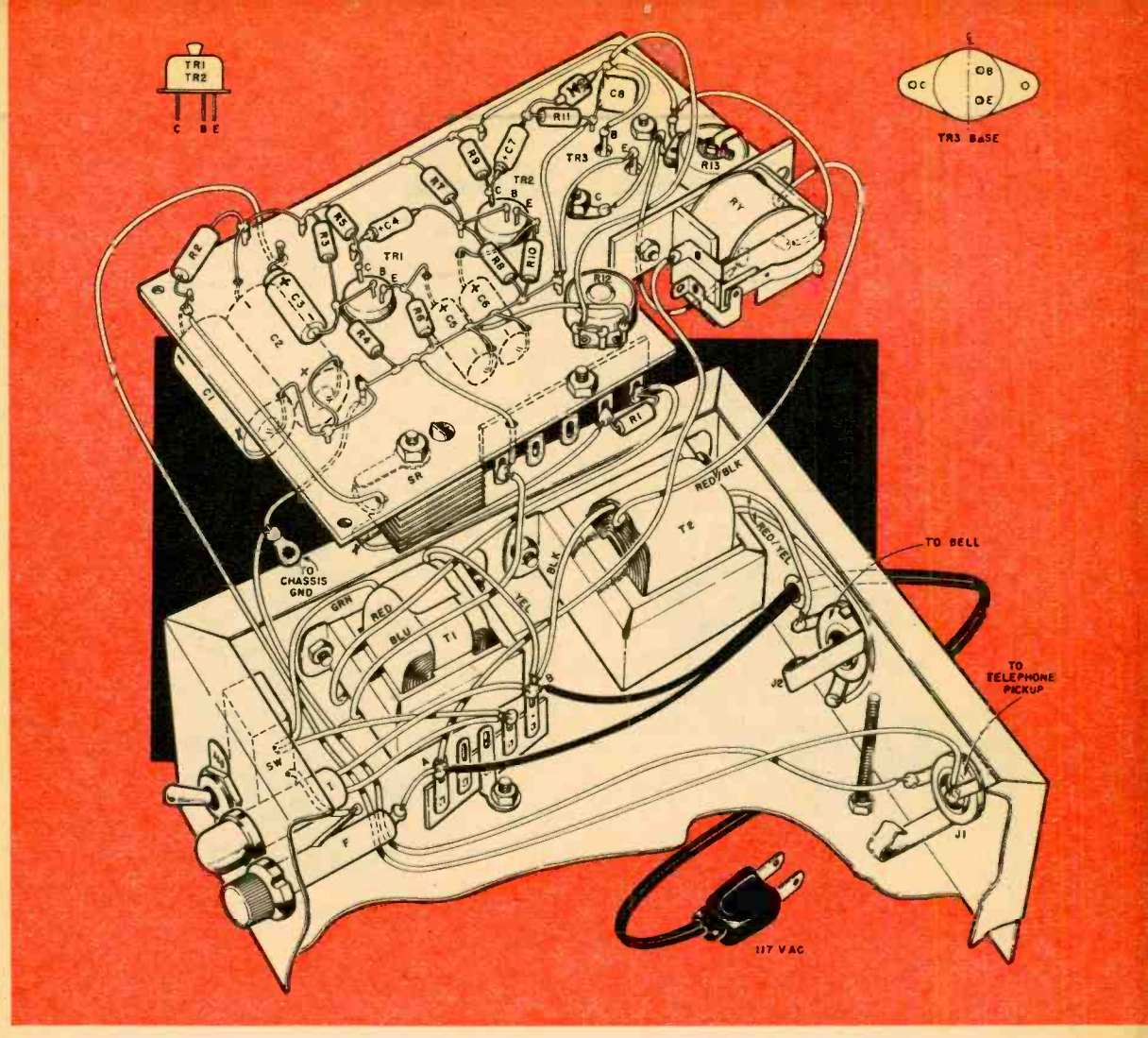
# External Telephone Bell

**By Ronald Benrey**

**Hear the phone ring anywhere in the house or garden. No wiring connections into phone are needed.**

**In the photo above, telephone rests on chassis of amplifier. Fuse, pilot light assembly and on-off switch are right front. An induction pick-up protrudes beneath phone at upper left. Below is underside view of complete unit.**



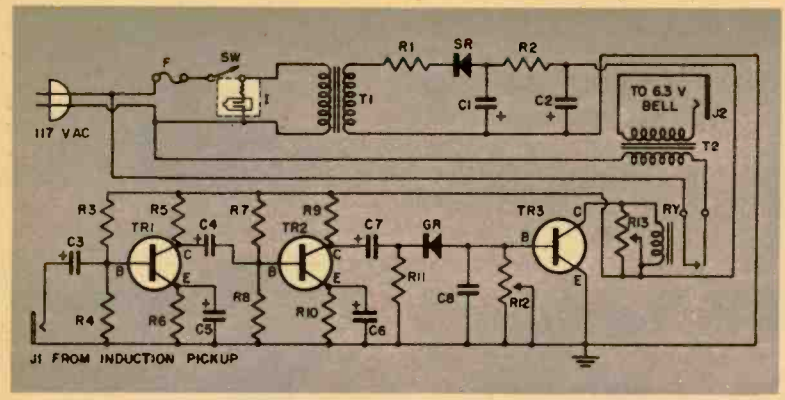



**In the wiring guide, the perforated board is displaced above main chassis to clarify connections. Be careful to mount transistor terminals as shown at top.**

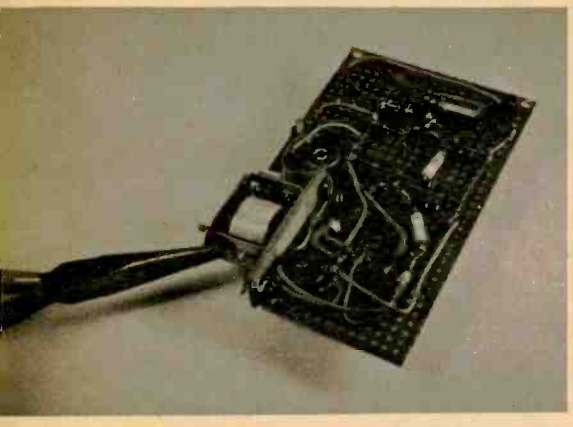
ALTHOUGH the average telephone bell is loud enough to be heard in rooms adjacent to its location, it is easily drowned out by background noises. The device described in this article solves the problem of the "unheard bell."

The magnetic field produced by the ringing bell is detected by an induction pickup placed directly under the telephone, amplified by a two stage transistorized amplifier. The amplifier keys a transistorized relay, actuating one or more indicating devices (bells, buzzers, lights, etc.) which may be located anywhere in your home. The unit makes a useful weekend project, and if all new components are used it should cost slightly more than $15.

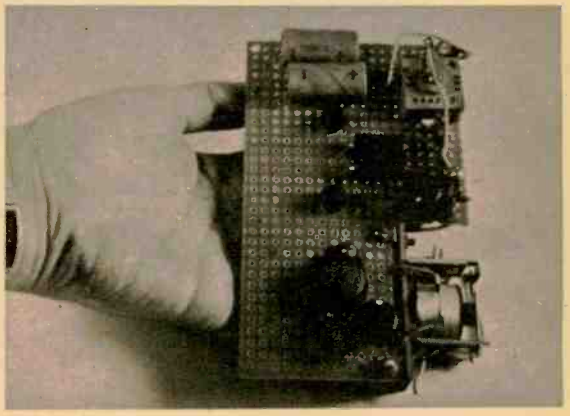
Begin construction by mounting the components on the Bakelite sub-chassis using the accompanying photographs as location guides. A notch must be cut out of the sub-chassis to provide clearance for the relay, which is then secured to the sub-chassis




**Dotted line indicates pilot light (I) with built-in resistor. Polarity of electrolytics and diodes is critical.**



**Adjust spring strip on the LB5 relay until it pulls in when connected to a 15 volt battery.**



**Top view of sub-assembly. Allow space around rectifier and TR3 for adequate ventilation.**

with angle brackets of suitable size.

The two audio transistors are mounted in miniature sockets, and the power transistor is bolted to the sub-chassis with machine screws. When mounting the power transistor be sure to scrape away the paint around the mounting holes. This is a precaution taken to insure a good connection to the metal case of the transistor, which is the collector terminal.

When connecting the electrolytic capacitors, the selenium rectifier, and germanium diode, be sure to observe correct polarities, as you will destroy these components if they are placed "backwards" in the circuit. Since the germanium diode is heat sensitive it is a good idea to use a pair of needle-nose pliers as a heat sink when soldering to it.

The relay used in this device was chosen because of its low cost and small size. However, it will have to be "sensi-

[*Continued on page* 128]

PARTS LIST

R1—22 ohm resistor ½ watt
R2—10 ohm resistor 2 watt
R3,R7—100,000 ohm resistor ½ watt
R4,R8—10,000 ohm resistor ½ watt
R5,R9—4,700 ohm resistor ½ watt
R6,R10—1000 ohm resistor ½ watt
R11—2,700 ohm resistor ½ watt
R12—2,500 ohm potentiometer, (miniature)
R13—1 megohm potentiometer, (miniature)
C1,C2—50 mfd electrolytic capacitor 50 volt
C3,C5,C6—50 mfd miniature electrolytic 25 volt
C4,C7—10 mfd miniature electrolytic 25 volt
C8—.25 mfd capacitor 50 volt
T1—Filament Transformer 6.3 volt (Stancor P6134)
T2—Filament Transformer 25.2 volt (Stancor P6469)
TR1,TR2—Transistor 2N44
TR3—Transistor 2N255
GR—1N34A Germanium diode
SR—Selenium diode 75 ma
RY—Relay 5000 ohm coil (Potter & Brumfield LB5)
F—Fuse 1/10 amp in holder
I—Pilot light assembly with built in resistor
SW—Toggle switch (SPST)
J1,J2—Standard insulated phone jacks
Case—7"x7"x2" aluminum chassis with bottom plate (Bud AC-405)
Misc.—Hardware, Bakelite board, flea clips, knobs, paint, induction pickup (Lafayette MS-16)

## *beethoven, bop and barbecue with*

# Outdoor Hi-Fi

**By Victor Brociner**

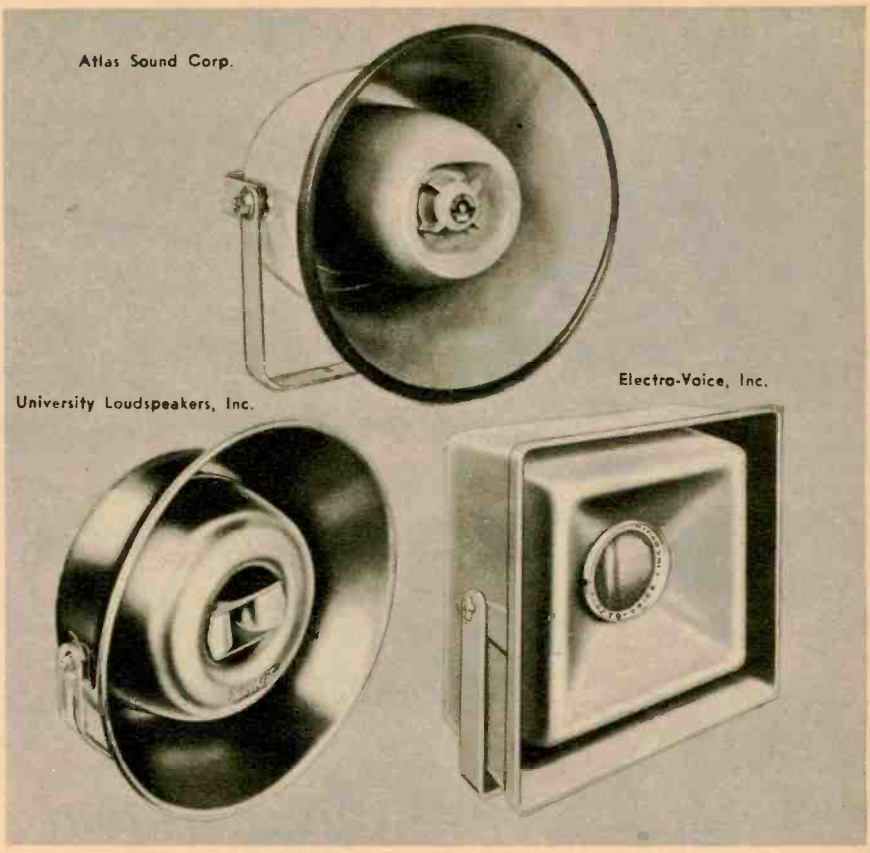
YOU'VE doubtlessly heard railroad station and ball park public address trumpets squawking away on the near edge of unintelligibility. This summer you may be surprised to see similar appearing horns perched atop a tree or sun porch piping honest-to-goodness hi-fi music to some grateful audiophile relaxing in his hammock.

The secret of these outdoor horns—whose frequency response and clarity come close to indoor hi-fi standards—lies in their very special construction. They are usually coaxial jobs with horn loading of both the woofer and tweeter. Clever physical design has not only extended the low range frequency response (the highs are no problem) but, in addition, provided a weather-proof housing.

The internal construction of a couple of typical hi-fi outdoor horns is shown on page 46. Note that there are separate drivers (woofer and tweeter) designed to cover the audio range from around 100 cycles to 15000 cycles with the crossover point at about 1 kc. The relatively high low-frequency rolloff is due to the small physical dimensions of the horn which is only 15″ in diameter and 12″ deep. In general, you could say that the bigger the horn is, the better bass response it will have—and the more expensive it will be.

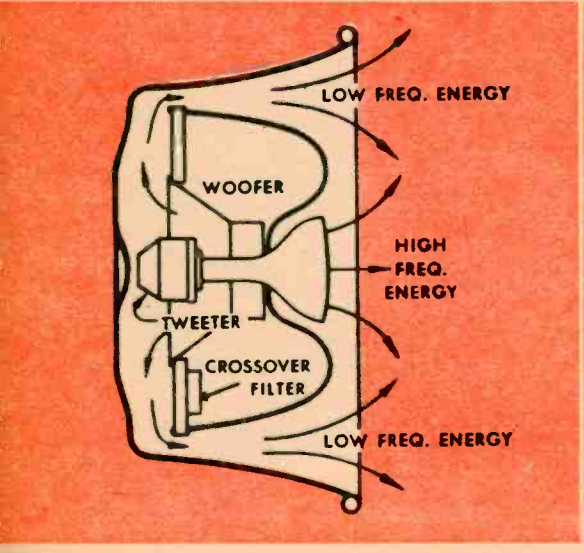
How do you connect them up? It's easy. The speakers have built-in brackets—simple to attach permanently to the side of your house, awning frame, or to trees. Connect the speakers to your regular amplifier (stereo or mono) indoors with ordinary plastic or rubber insulated lamp-cord, and there you are.

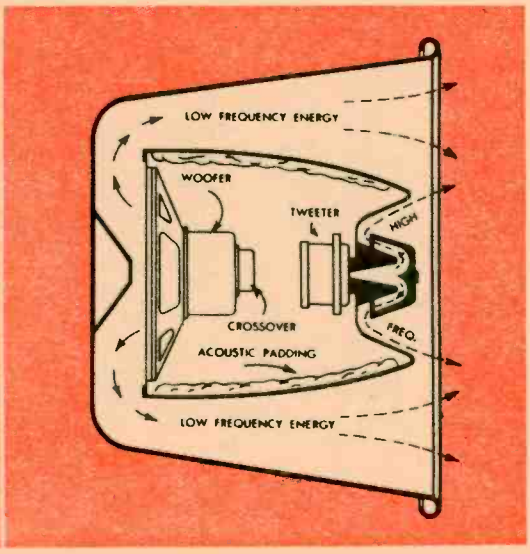
When you hook up one of the outdoor speakers you'll notice that their tremendous efficiency provides ample sound even from a low power amplifier. Such efficiency is needed because outdoor speakers operate unaided by the reflections




**Three typical outdoor hi-fi loudspeakers are pictured at right. All are high-efficiency horn types, weather-proofed and with special mountings.**

**Cross section view showing construction of two outdoor hi-fi horn loudspeakers. In each, a cone-type woofer faces toward the rear of the unit and radiates through a folded horn. The tweeter is also horn loaded.**



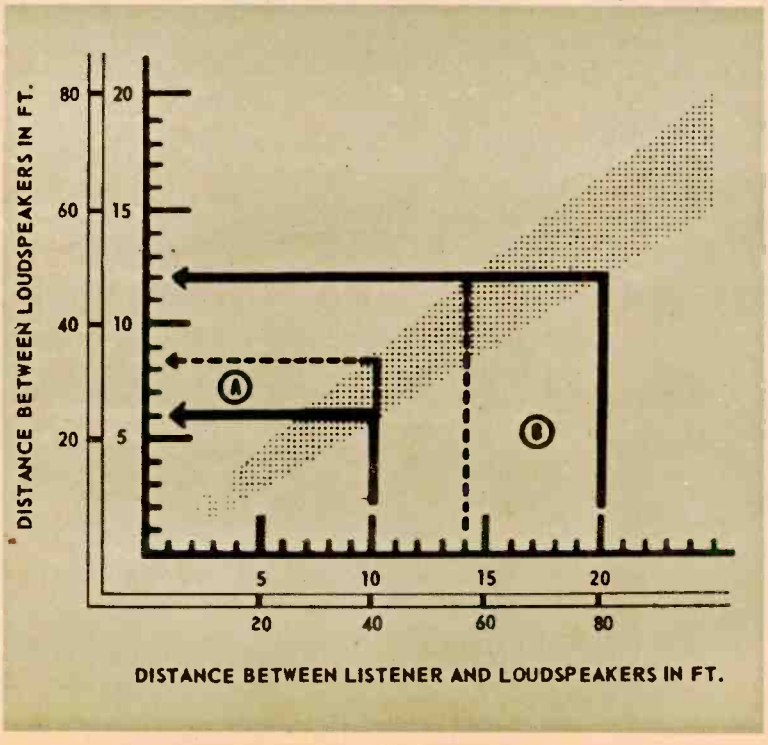
from walls, floor and ceiling that occur inside rooms. For the same reason, outdoor speakers should have good dispersion, for there's no off-the-wall bounce to spread the sound around.

Outdoor stereo requirements are much the same as indoors, modified somewhat by the fact that one will tend to listen outdoors at a somewhat greater distance. The stereo spacing chart is a convenient means for determining correct speaker spacing for a given listening distance.

If you don't want to be bothered to get up and go indoors to adjust volume or balance, a remote volume control is a great convenience. L-pads, which keep the load on the amplifier constant as the volume is varied will serve nicely. It is suggested that the controls be mounted in a small standard black Bakelite box.

Do not use a metal box and be sure to use insulated connectors on the amplifier cable. The reason for these precautions is that most amplifiers and tuners have small noise filter capacitors connected between chassis and the power line. It is possible, if the line plug is in the socket in the wrong position, to experience a slight shock, especially when standing on moist ground. Avoid touching the "live" speaker wires or terminals when the amplifier is plugged in. Do not just turn the amplifier off, *pull the plug!*

Speaker phasing and balancing (when using two speakers for stereo *or* mono) can be accomplished in the same manner as for indoor speakers. If doubt persists regarding correct over-all phasing, a simple test can be made to determine whether your connections are correct; play a mono record, using a stereo pickup and with all controls set for stereo. While listening from the usual position in front of and midway between the speakers, reverse the connections to one speaker. (Unless you have a long set of leads or extraordinarily long arms, it will be more convenient to have someone do this for you!) Do this during a passage that is fairly heavy in the bass. One of the two methods of connection will result in somewhat more bass reproduction than the other; the one with the greater bass represents correct phasing.




**Stereo spacing chart. This chart enables you to determine the spacing between speakers in relation to their distance from the listener. Two scales are provided. Use either both outer figures or both inner ones. Example (A) Center of listening area is 40 ft. from speakers. Distance between the speakers should be 24-32 feet. In (B) the speakers are set 12 feet apart yielding a listening distance of 14-20 feet.**

University Loudspeakers, Inc.

"Wow! Fifteen watts output—and it isn't even plugged in!"

# Monkey Business

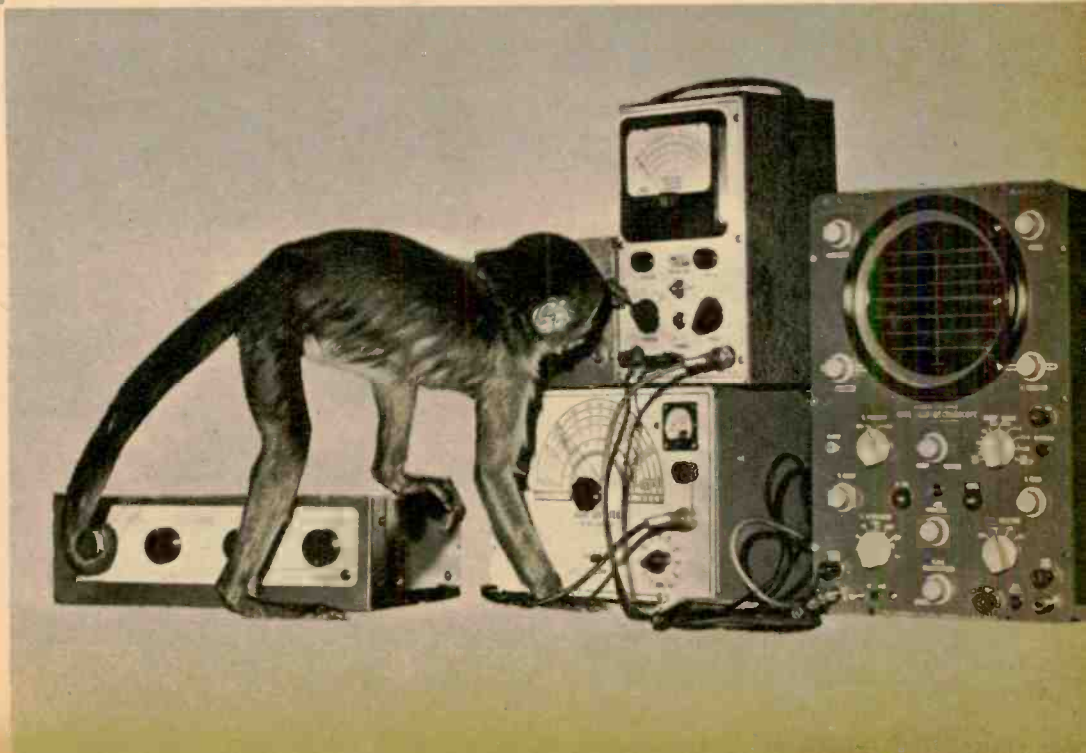
**We knew evolution and do-it-yourself electronics had come a long way . . . Exactly how far surprised even us. Send that monkey a free subscription!**

"If I don't get this thing figured out pretty soon I'll miss that Tarzan movie. . ."

"Now let's see—
If $E=MC^2$ and $W=I^2R$. . .
Yeah, I shoulda used a bigger resistor."

Photos by Larry Klein

"Two db down at 40,000 cycles and they call it hi-fi. . .!"



## *ham hauls 'em in by radio*

# R/C Rod and Reel

**By Mike Lynch**

GEORGE BOLING, W6NOD, was sitting peacefully by the banks of a river near Sacramento, a push-button switch in his hand, when a California fish and game warden "snuck up" behind him.

"What're you doin', mister?" the warden asked.

"Fishin'," George replied.

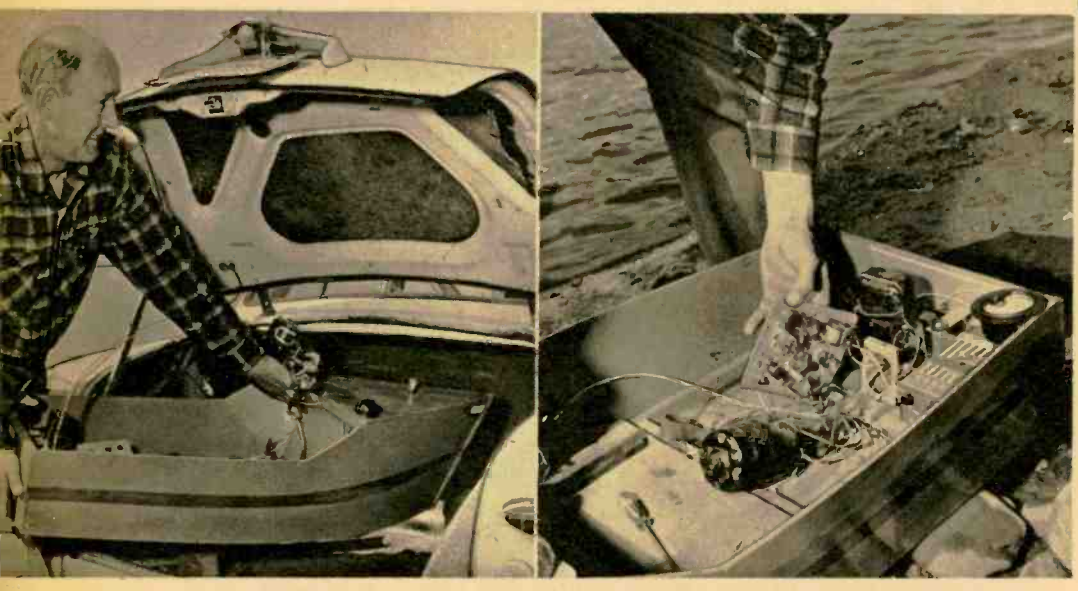
"C'mon now! You can't pull my leg. Where's your pole?"

George pointed toward the middle of the stream where a small wooden hull was moving slowly against the current, sporting an antenna, a rod and reel and a couple of colored balloons which were bouncing in the gentle breeze.

The warden scratched his head and walked away.

That boat in midstream was George's brainchild—a masterful combination of his two favorite hobbies, ham radio and angling for steelhead trout.

How does he do it? Once the boat is launched, the rudder is locked and the motor switch is turned on. As the boat moves into fishing waters, George takes over by radio control (with a three watt crystal-control portable rig which he built himself). When he presses the control button, the boat steers to the right. When he releases the button, the boat veers to port. As long as the boat is



**Four-foot long plywood hull fits in auto trunk. It is powered by a 6-volt car battery fixed with rheostat control. The propulsion system consists of a fan motor from an auto heater shafted to a 2-inch propeller. R/C hybrid receiver has a CK722 transistor and an RK61 relay tube. Abaft the receiver is windshield wiper motor, used for rudder control, and meter for monitoring the battery.**

Boling never gets wet or tired when he goes fishing, yet he catches his share of steelhead trout and striped bass. His R/C rigged automatic fishing boat can be made to play fish like expert angler. Note xmtr.

Here W6NOD fixes a wobbler lure to boat's line, 50' of which is slacked off during R/C trolling. Balloons swing down, float on water when fish bites. They also keep the boat from being pulled under by a big one.

under control, a running light on the stern stays lit.

When a fish bites, the tension on the rod acts as a switch to send the reel a-winding slowly. The tension also acts on the rheostat, causing the propulsion motor to speed up. By radio-controlling the rudder, which sculls, George can keep the boat heading against the fish until the fish gives up the fight.

Then, with a smile on his face, George heads the strange vessel back into shore.

Occasionally, as do radio-controlled model airplanes, the automatic fishing craft takes off for parts unknown. Who gets the blame? Generally it's some unknown ham in New York whose kilowatt signals are bouncing off the ionosphere right into the boat's little antenna. This is when electronic angling really becomes a challenge. George can spot what is happening, *if* he happens to be looking. The boat most often takes a few erratic turns before setting out on its own. Then he simply employs the necessary push button skill to bring her under control again.

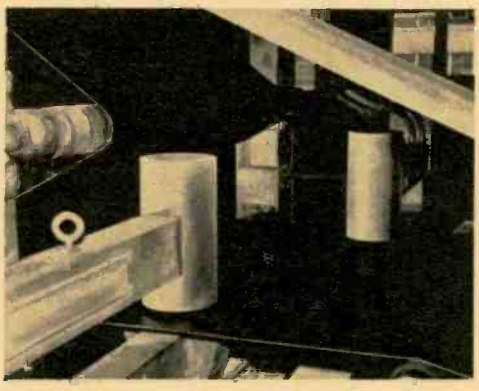

Firestone physicists record noise and vibration in road test of experimental tires. Tapes (4-channels) are analyzed and charted in lab. Polyester (see chart) gave more even ride.

Because of physical danger involved in high speed tire test with dynamometer that spins tires in excess of 500 mph, this Goodyear technician monitors the impending blowout with the aid of closed circuit TV.

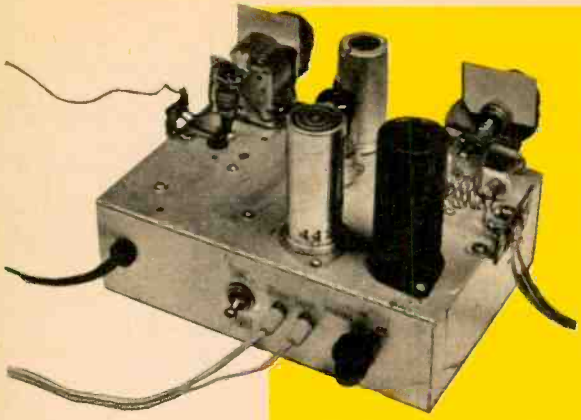
# Electronics and Safer Tires

NEARLY every step in the manufacture and testing of the modern auto tire is handled by electronics. For instance, an infrared analyzer monitors the flow of gas in a petrochemical plant for impurities before the gas is polymerized into rubber. At the Esso Research lab in New Jersey, a small sample of new synthetic rubber (one of many samples) is struck by a hammer while electronic strain gauges feed the reaction into a computer for comparisons. When a test calls for destruction of a tire, engineers can safely follow the blowout "close-up" by means of closed circuit TV. Other electronic tests are pictured here.

Fluoroscope and X-ray devices take the guesswork out of tire inspection at Goodyear. Circled area in "inside-the-tire" photo reveals trapped air, a major production problem.



Accu-Ray system detects slightest variations in thickness of coated tire fabric by passing beta rays from strontium-90 isotope through fabric into ion chamber for measurement.



# 2-Tube Binaural Receiver

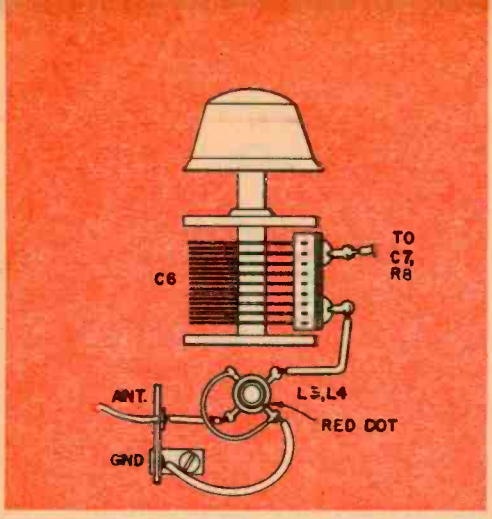
**By George Byron**

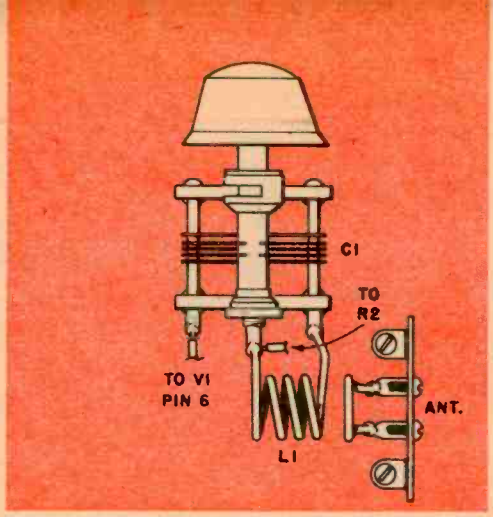
**Simple circuit picks up AM-FM simulcasts for 3-D reception**

IF you want to get a taste of stereo via FM-AM broadcasts and are not inclined to shell out the money just yet for expensive receivers, this little set is your baby. Only two tubes and associated circuits of a super-regenerative (FM) and regenerative (AM) design, deliver to you a choice of *either* FM or AM programs *or* simultaneous broadcasts through a pair of inexpensive stereo headphones.

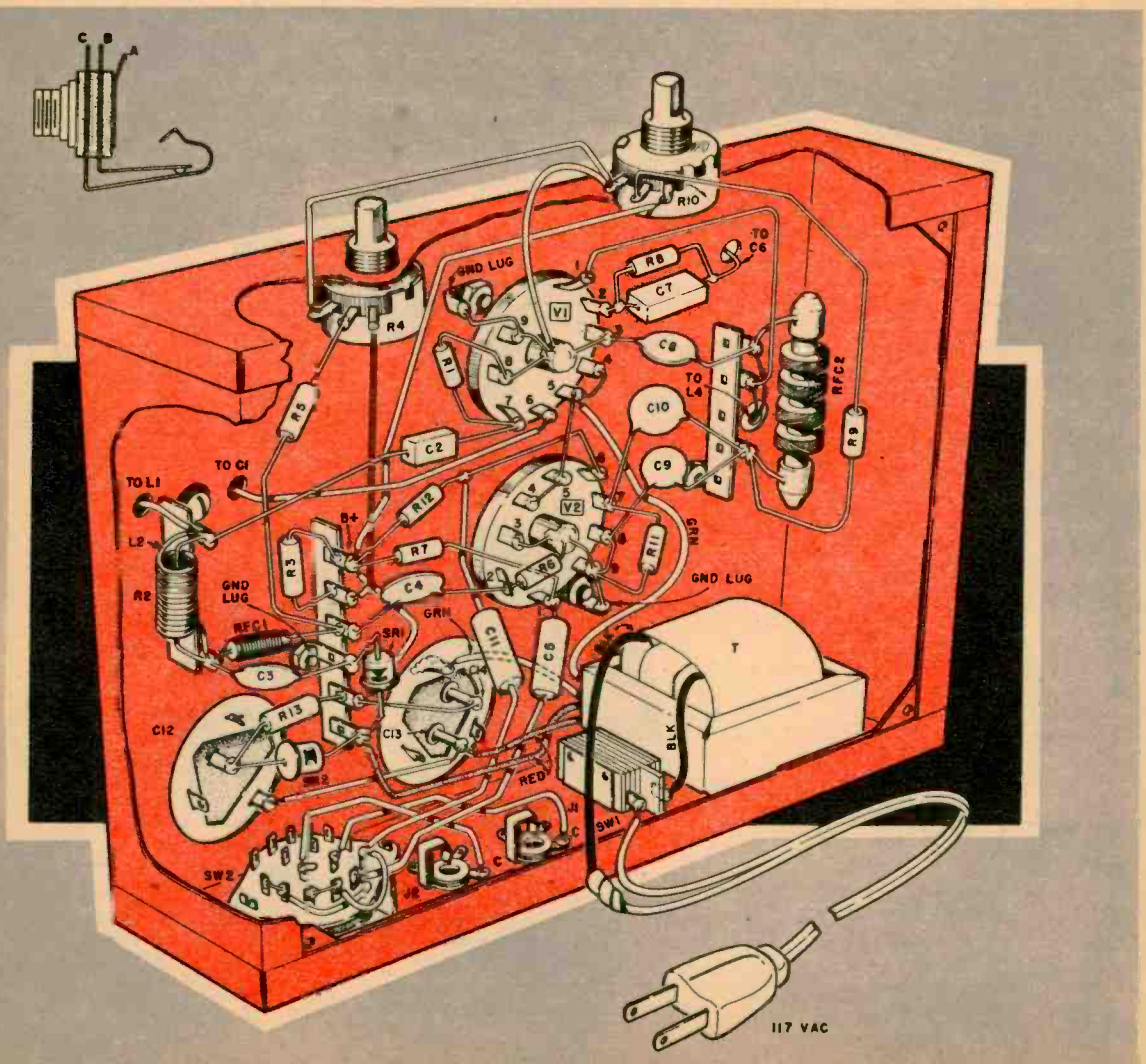
Remember this is basically an experimental device and is intended for use in areas with strong signal strength. Don't expect this little job to be anywhere near the equal of a commercial AM-FM rig. There's lots of latitude for experimentation, so don't be afraid to try, for example, different number of turns for L4 or a different output tube for V2.

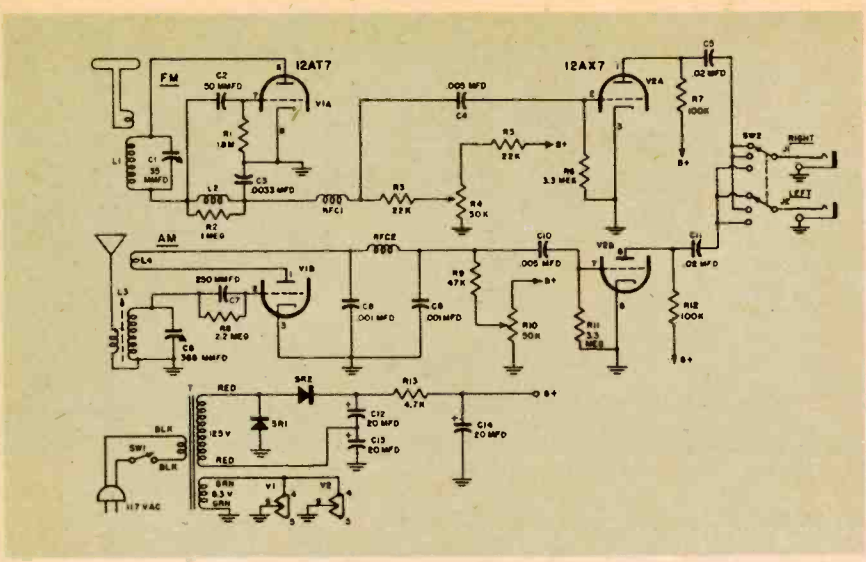
In many areas of the country, AM-




Details above show wiring of the two tuning circuits; AM section at left, FM at right. Note spacing and relationship of L1 and its antenna coupling loop. Jack detail at left, below, shows "hot" contact (C); lug (A) is grounded to chassis. Note that can capacitor C12 is mounted on insulating plastic plate.






**Complete schematic of binaural unit. FM or AM section may be built as individual receivers. Power supply may be tube operated full wave rectifier.**

FM stereo musical broadcasts have been available for some time. The left side of the orchestra is usually transmitted over FM carrier: the right side over AM. Your local newspaper will supply information regarding the simultaneous FM-AM broadcasts. Although this two-tube receiver cannot be considered high fidelity, the headphones will add the remarkable qualities of *direction* and *depth* which are missing in ordinary single-channel broadcasts.

Because stereo broadcasts are less frequent than the monophonic type, a three-way switch (SW2) has been incorporated in the receiver's output circuit, which will permit you to utilize both earphones for either FM or AM broadcasts alone.

You should have little trouble constructing this unit, for parts values are not critical. Aside from keeping RF leads short, a 20% deviation from value of parts listed is okay.

The AM signals are picked up by the AM antenna and induced into the tank circuit comprising L3 and C6. The tuned signal is fed to the grid of V1B where it is detected and amplified. A portion of the amplified signal energy is fed back from the plate via the tickler winding (L4) to the secondary of L3. This causes regeneration and serves to increase the [*Continued on page* 123]

PARTS LIST

*Capacitors*
all fixed capacitors have 350 volt rating or above
C1—35 mmfd variable (Hammarlund MC 35S or equiv.)
C2—50 mmfd mica
C3—.0033 mfd disc
C4,C10—.005 mfd disc
C5,C11—.02 mfd paper or disc
C6—365 mmfd variable
C7—250 mmfd mica
C8,C9—.001 mfd disc
C12—20 mfd @ 350 volt electrolytic can capacitor (with insulating plate and shield)
C13,C14—20-20 mfd @ 350 volt dual electrolytic can capacitor
*Resistors*
R1—1.8 megohm, ½ watt
R2—1 megohm, 2-watt (part of L2)
R3,R5—22,000 ohm, 2-watt
R4,R10—50,000 ohm, 2-watt potentiometer
R6,R11—3.3 megohm, ½ watt
R7,R12—100,000 ohm, ½ watt
R8—2.2 megohm, ½ watt
R9—47,000 ohm, 2-watt
R13—4700 ohm, 2-watt
L1—4 turns #14 copper wire on ½", 1 turn coupling loop
L2—25 turns #30 wire on R2
L3—Broadcast band antenna coil with tickler winding added
L4—tickler winding (25 turns of #30 wire closewound to secondary of L3)
RFC1—Any small RF choke, 25 microhenrys or more
RFC2—2.5 millihenry choke
T—Power transformer Primary: 117-volt; Secondaries: 125 volts @ 15 ma, 6.3 volts @ .6 amp (Stancor PS-8415 or the equiv.)
SR1,SR2—130-volt silicon rectifiers (Sylvania SR 200 or equiv.)
SW1—SPST Switch
SW2—4-pole, three pos, switch; 2 poles unused (Lafayette SW-30)
Headphones—Stereo, crystal—100,000 ohms
J1,J2—Miniature phone jack
V1—12AT7
V2—12AX7

*milt kiver on*

# Transistor Testing-2

**Continuation of our series with an analysis of leakage and gain tests.**

IN checking transistors, two tests are always performed—leakage and gain. Of the two, leakage is always checked first because it is the more sensitive indicator of the condition of a transistor. High leakage will almost always drag down the gain and increase distortion. If a transistor passes the leakage test, it is then checked for gain.

In nearly all of the commercial transistor testers designed for the technician, leakage tests are performed in one of two ways. The most widely employed method is the $I_{CEO}$ test shown in Fig. 1A. In this test, a meter, resistor, and a battery are connected in series. If a PNP transistor is being checked, the positive terminal of the battery connects to the emitter while the negative terminal is attached to the other end of the circuit which terminates at the collector.

Current flow through the circuit is a function of temperature, the resistivity of the germanium or silicon, and the applied voltage. Any contamination on the surface of the transistor, or a short circuit within the device, will produce a high reading on the meter.

This leakage test is referred to as $I_{CEO}$ because the current (I) is flowing between the collector (C) and emitter (E), with the third element (base) open (O). The foregoing test provides enough current to actuate a milliammeter and this is the chief reason for its popularity. Perhaps a more sensitive indicator of the leakage condition of a transistor is the $I_{CBO}$ current. (Fig. 1B.) Here, leakage current is measured between the collector and base, with the emitter open. Since the transistor is reverse biased, ideally no current at all should flow. Practically, if a transistor is in good operating condition, this current will be very low; no more than 10 or 15 *micro*amperes. Since the $I_{CBO}$ test requires a highly sensitive meter movement, most of

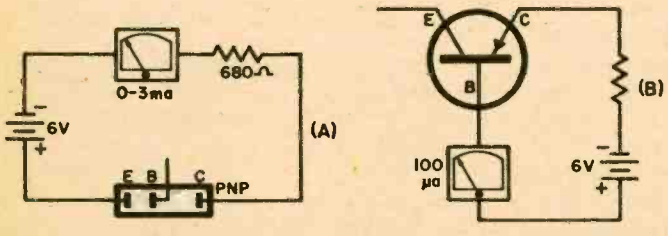



**Fig. 1. Leakage tests. (A) collector-emitter current with open base. (B) collector-base current, open emitter.**

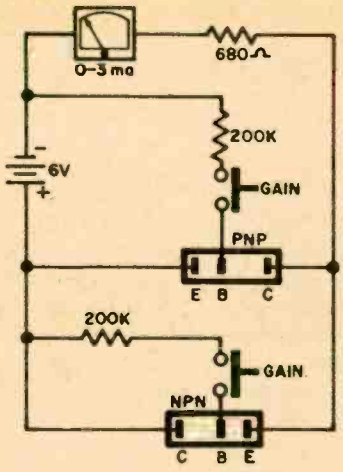



**Fig. 2. Early GE tester uses separate sockets for PNP, NPN transistors; leakage is read first.**

the low-cost transistor testers instead measure the larger $I_{CEO}$ current.

### Gain Measurement

Once it has been established that the transistor leakage falls within acceptable limits, the next test is the measurement of the DC beta gain of the transistor. This test is usually performed by introducing a small current into the base circuit and noting the ratio of increase in collector current. There are several ways to do this as we shall see when examining the various commercial testers.

### Commercial Testers

One of the first transistor testers available was manufactured by General Electric. See Fig. 2. Separate sockets are used for PNP and NPN types and the $I_{CEO}$ leakage test is used. When the transistor is inserted in the appropriate socket, the leakage current flow will be indicated by a 0-3 ma meter. As long as the needle comes to rest at some point other than BAD, it can be assumed that the transistor leakage is within normal limits.

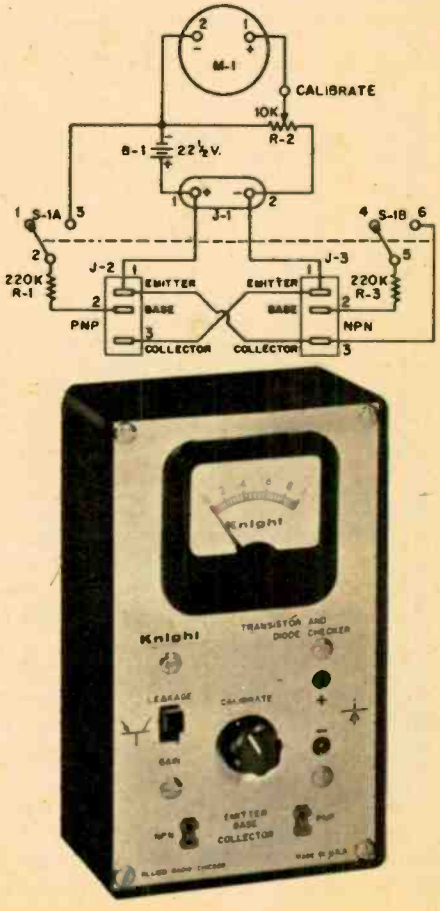
After this has been established, the appropriate gain switch is depressed. This connects a 200,000-ohm resistor to the transistor base into which a current of 30 microamperes flows. A larger current should flow in the collector circuit which is indicated by the meter. GE's instructions indicate that an increase of at least one division on the scale represents an acceptable current gain.

Note that the actual value of the beta of the transistor under test is not directly given by this instrument. Rather, a relative reading is taken and so long as the needle moves a sufficient number of divisions for the gain test and the leakage does not exceed a certain value, the transistor can be presumed to be satisfactory.

### Knight-Kit Transistor Tester

Another inexpensive transistor checker is marketed by the Allied Radio Corporation as their Knight-Kit Tran-

**Fig. 3. Transistor tester available in kit form from Allied Radio. S-1 is in leakage position.**



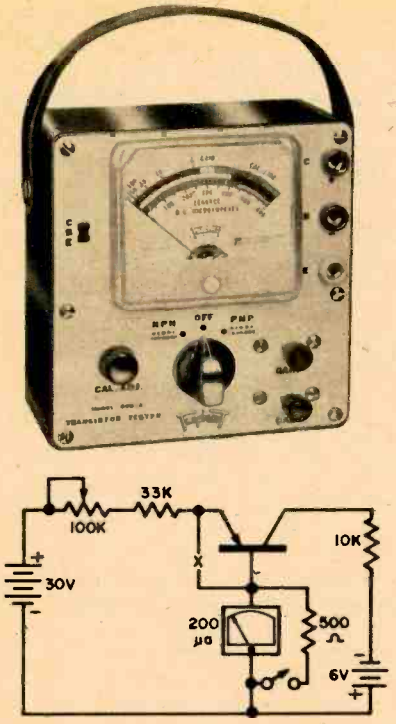



**Fig. 4. Triplett Model 690-A tester measures beta directly after calibration procedure.**

sistor and Diode Checker. The internal circuit arrangement (Fig. 3) is quite similar to Fig. 2.

In use, the transistor is inserted into the tester and the switch labeled LEAKAGE-GAIN is set to the GAIN position and calibration control $R_2$ is rotated until the meter reads "1" or full scale. The switch is then permitted to return to the leakage ($I_{CEO}$) position and the meter reading is noted. If the leakage current is found to be less than the gain current (arbitrarily set at 1 for every transistor), the transistor can then be assumed to be good. The greater the difference between gain and leakage readings, the better the unit. Thus, while this instrument has the same basic circuitry as the GE checker, the actual test method is somewhat different.

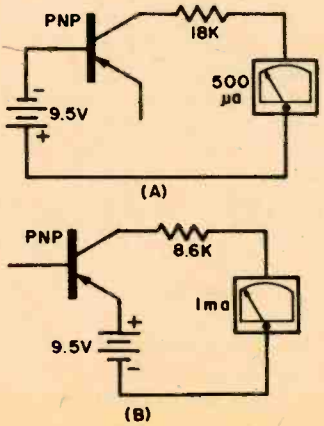
The foregoing arrangement permits a wide range of transistors to be checked because no matter what the beta value is, the calibration control always establishes it at 1. Thus, this checker does not directly measure beta either; rather, it indicates the ratio between beta and leakage for a given transistor. The higher this ratio, the better the transistor.

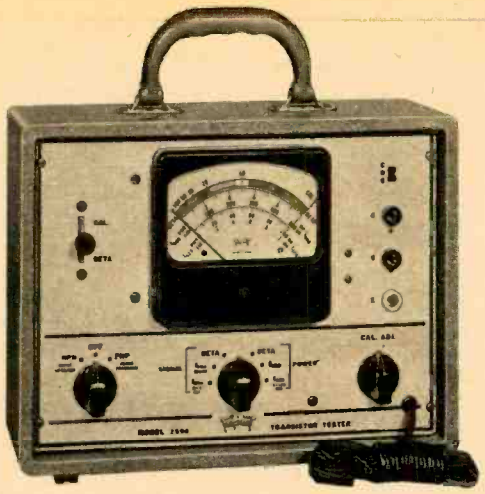
### Triplett Transistor Testers

The Triplett Electrical Instrument Company has two transistor testers, a Model 690-A and a Model 2590. The simpler Model 690-A, (See Fig. 4) will be considered first. The $I_{CBO}$ leakage is made by reverse biasing the base-collector elements with a 6-volt battery. The emitter is left floating. A 200-microampere meter connected into this circuit indicates any current flow. For small transistors; i.e., low-power units, the leakage current should be less than 20 microamperes, otherwise the transistor is defective. Most power transistors will have less than 100 microamperes leakage current. Good silicon transistors should not produce any meter reading at all.

In order to measure beta gain, the 690-A must first be calibrated. A 30-volt battery is connected in series with a 100,000-ohm potentiometer, a 33,000-ohm resistor and a 200-microampere meter with a 500-ohm shunt. Because of a short circuit (X) placed between the emitter and the base, no current passes through the transistor. Instead, all of it flows through the meter (and its

**Fig. 5. More expensive unit enables check of both $I_{CBO}$ (A) and $I_{CEO}$ (B) types of leakage.**





shunt). With this set-up, the 100,000-ohm potentiometer is adjusted until the meter needle lines up with an indicated calibration point at 500 microamperes.

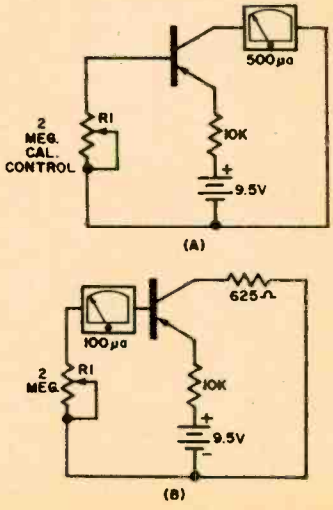
Once this calibration is established, the short circuit is switched out together with the 500-ohm shunting resistor. Now the current passes into the emitter element; 3-5% of the current flows to the base circuit, but the bulk of it flows to the collector circuit. In short, the transistor begins to function. This causes the meter needle to drop from the calibration line, and if the scale on this meter is examined, it will be seen that the smaller the current that flows in the base circuit, the higher the beta gain of the transistor. That is why the gain scale has the largest numbers at the left end. These markings can be read directly and, wherever the meter needle comes to rest, this represents the DC beta value for the transistor under the specific test conditions.

In the second transistor tester developed by Triplett, Model 2590, leakage can be measured for both $I_{CEO}$ *and* $I_{CBO}$. See Fig. 5. This is a departure from any of the previous instruments. For the gain measurement, a somewhat different arrangement is employed here than in the previous Model 690-A. The initial step in gain measurement is to first calibrate the meter scale according to the transistor under test.

The calibration circuit is shown in Fig. 6A. This is a simple circuit in which current is fed into the base and the resulting collector current is then measured by a 100-microampere meter which has sufficient shunts to handle up to a maximum of 500 microamperes. The calibration adjustment, $R_1$, is then rotated until the meter needle comes to rest at the extreme right-hand edge of the dial at the point marked CAL. The central selector switch on the test instrument is switched to the beta position, producing the circuit of Fig. 6B. The meter which was previously in the collector circuit has now been replaced by an equivalent resistor while the meter movement itself has been shifted to the base circuit and its sensitivity of 100 microamps restored. The base current is now measured directly. Because of the previous calibration, the beta value can be read directly from the scale. Note that here again, because the meter movement is shifted from a high current circuit to a low current circuit, that the beta values themselves are shown increasing to the left. Obviously, the less current required by the base circuit to produce a certain collector current, the higher the beta value for that particular transistor.

Next month we will discuss some of the other commercial transistor testers and the special circuits and techniques they employ.

**Fig. 6. Calibration (A) and beta test (B) circuits of transistor tester shown above at left.**



# Electronic Brain

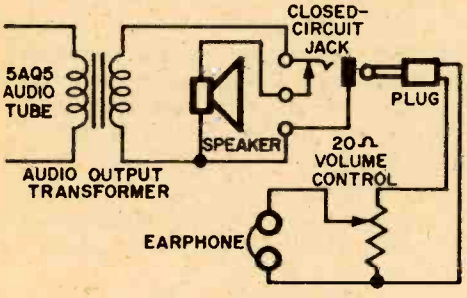
**Have you any question on electronics? Send it in and the Electronic Brain will provide the answer.**

### Earphone for TV

*How can I add a 6-ohm earphone with a plug and jack to my AC-DC television receiver without creating a shock hazard? Will the difference of impedance affect the TV sound?*

*Gerald A. Wooldridge,*
*Harper Woods, Michigan*

According to the diagram you sent with your letter, the metal cabinet is isolated from ground (hence from either leg of the AC) by a 470,000 ohm resistor. The earphone may be connected as shown in the accompanying diagram without producing any more serious




shock hazard than already exists. In other words, if you feel no electrical "tickle" when you touch the metal cabinet and a good ground, such as a pipe or radiator, with the TV set's plug in *either* way in the wall receptacle, then the presence of the earphone will not alter matters.

The difference in impedance will have no noticeable effect upon the performance of the television receiver. Since you did not state whether or not you want the earphone to cut the speaker out automatically when plugged in, we shall assume you do want this arrangement. It is the more usual one, anyway. The jack required is the so-called "closed circuit" type. When the plug is inserted, the speaker will become silent and the earphone will be energized; we have also included a volume control for the earphone since we believe it will be necessary.

### DC Conversion

*What are the standard methods used to convert DC to AC?*

*Terry Holcomb,*
*Colorado Springs, Colorado*

There are three methods in general use for converting DC to AC. The one actually selected depends upon the required load current, the frequency of the AC needed, and the over-all power requirements.

*Vibrator Method:* This method is suitable for medium power applications where, for example, an automobile radio is to be operated from an automobile storage battery. The function of the vibrator is to break the steady current from the battery into pulsating DC of sufficiently high frequency to be useable as the primary current for a step-up transformer. Normal transformer action accepts pulsating DC in the primary and converts it into raw AC in the secondary winding. This AC is then rectified and filtered and used as the plate and screen supply for the radio.

*Oscillator Method:* Suitable for low power applications, the oscillator method is popular for electronic devices. The DC is used as plate supply for a tube or collector supply for a transistor oscillator. The AC output of the oscillator is obviously easily controlled in frequency and may be used in its raw state or it may be rectified for other applications.

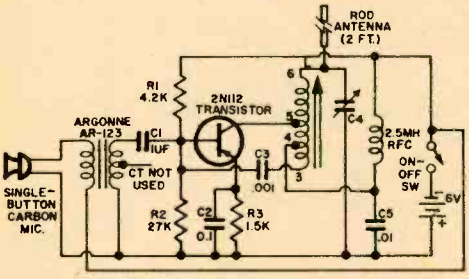
*Motor-Generator Method:* A DC motor may be connected to the source of DC electrically, but mechanically coupled to an AC generator. By proper selection of the generator, various voltages and frequencies may be made available. Commonly called an "M-G Set" (motor-generator), this combination is used for low, medium, and high power applications.

## Walkie-talkie

*What kind of circuit is used in the very inexpensive wireless mikes I see advertised in the magazines?*

*R. O. Graham,*
*East Liverpool, Ohio*

In general, the inexpensive walkie-talkies advertised in the magazines for around $10 to $12 utilize a single RF transistor oscillator modulated by the output of a single button carbon microphone. Naturally, each manufacturer will use his own pet circuit, but most of them are minor variations.




C4 35-350MMFD TRIMMER
L MILLER #2023 (TAPS 182 NOT USED)

The operation of the wireless microphone is relatively simple. The transistor oscillates at a frequency that can be tuned in on a standard broadcast receiver; thus, its output is the "carrier." The base current of the transistor is then varied by the audio voltage induced across the secondary of the microphone transformer. This results in amplitude modulation which can be detected in the radio receiver. A clear spot on the broadcast dial should be selected for reception and the walkie-talkie tuned to this frequency by adjusting the setting of C4 (a compression-mica trimmer) and the slug of the oscillator coil.

## Voltage Conversion for Overseas

*I am going on a trip to Europe and would like to use my clock radio and electric razor there. Both of these are 117 volt, 60 cycle appliances, but the power available where I am going will be 220 volts, 50 cycles. Can I avoid buying a step-down transformer?*

*Rudy Appel,*
*Kew Gardens, N. Y.*

Best electrical practice calls for a step-down transformer for the purposes you mention. Both your radio and razor could be operated from the same transformer, and since these are not expensive, we should certainly recommend that you buy one. A clock radio cannot be used on 50 cps current because the clock would run too slowly—50 minutes would be indicated for each actual hour. Disconnect the clock and use the radio without it.

A dropping resistor is a poor second choice, but can be used provided that you are willing to measure the current that normally flows in each of the appliances. The dropping resistor value and required power dissipation may then be found from these equations:

(1) Resistor value = 120/current in amperes

(2) Power required = $(\text{current})^2 \times$ resistance

## Modulator for Crystal Oscillator

*I have a 40-meter crystal oscillator using a 6L6 that is directly coupled to an antenna. Can you give me a circuit that will enable me to modulate this oscillator with a 7-watt audio amplifier?*

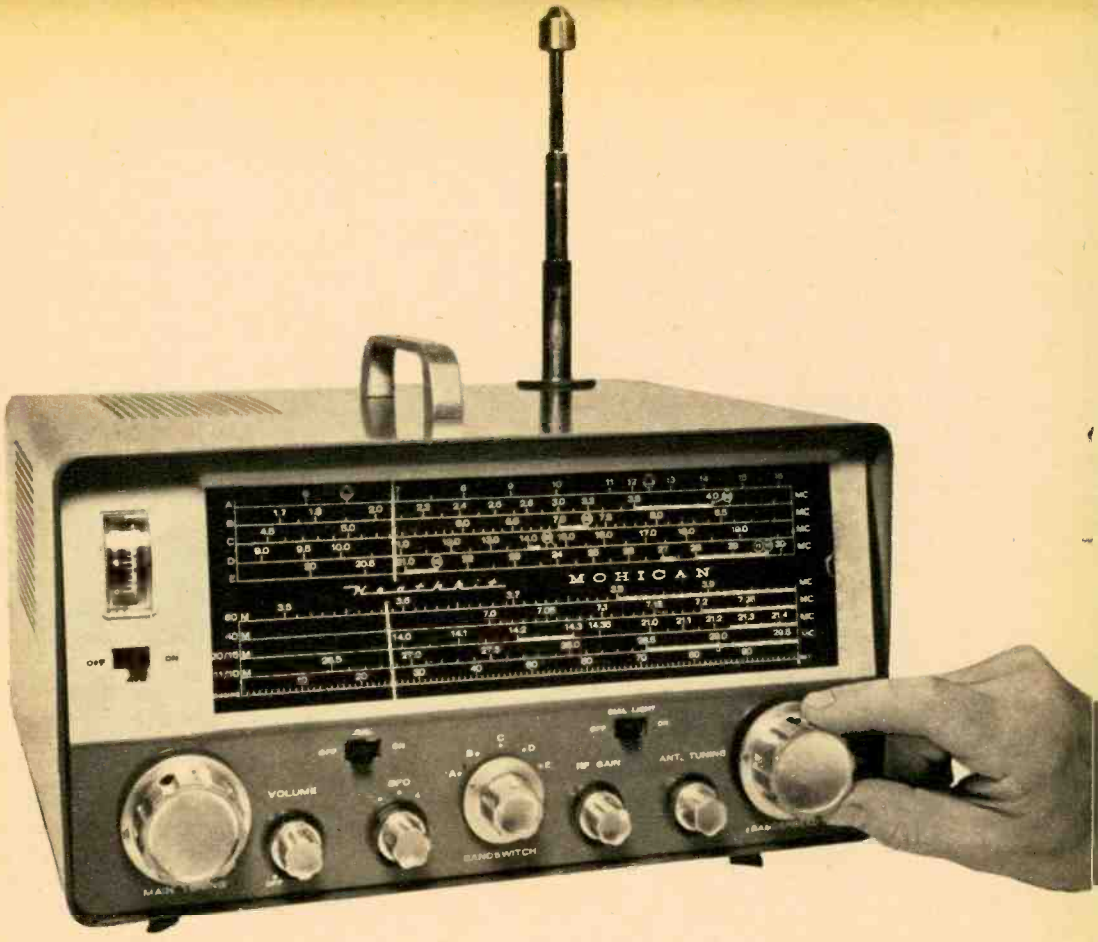
*Joel Fentin,*
*Hawthorne, California*

There are three *serious* things wrong with what you propose to do.

First, a transmitting antenna should not be coupled directly to the tank coil of a transmitter. Not only does this represent a potential danger with respect to DC shock, but the harmonic radiation may be severe and cause interference to others.

Second, an oscillator—even crystal-controlled—should not be modulated to obtain an AM signal. The amount of frequency modulation introduced thereby would violate the rules and regulations of the F.C.C. An oscillator should be followed by an amplifier, if AM is to be used. Better yet, a buffer stage between final amplifier and oscillator is highly recommended.

Third, 40 meter phone modulation (A3) is strictly for General Class hams between 7200-7300 kc. If you are a Novice you are allowed only CW (A1) on 40 meters.




*EI builds an*

# All-Transistor General Coverage Receiver

COMPLETELY self-contained and tuning a wide range of from 560 kilocycles to 30 megacycles, the Heath "Mohican" is the first *all-transistor* general-coverage receiver in kit form. A full band-switching, battery-operated superheterodyne, boasting an RF stage and three IF stages (ten transistors in all), it is astonishingly "hot." With its telescoping 58″ rod antenna, AM broadcast stations are pulled in from near and far and short-wave stations from everywhere.

Weighing about 17 pounds, this set is "transportable" rather than portable. It is ideal for field and pack trips, use on small boats, etc. It is also unexpectedly useful in a house or apartment when a person wants to listen-in privately without disturbing other members of the family. He can close himself in any room, plug in his headphones and take his choice of local news, Radio Moscow or hams on the other side of the globe. A plug-in power pack to convert to AC operation is available from Heath.

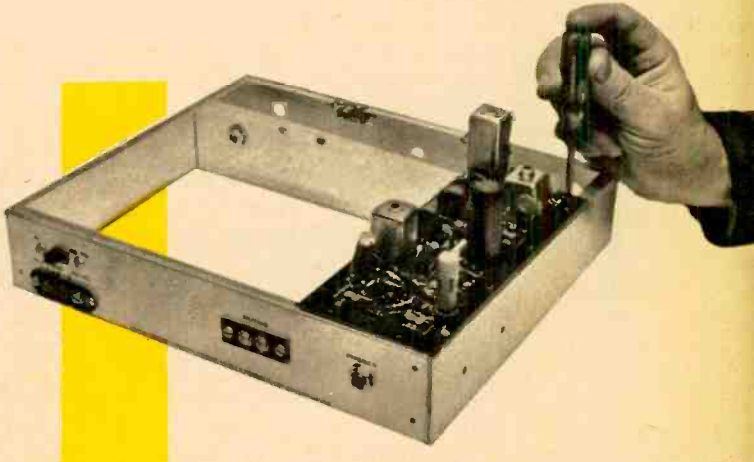
The "Mohican" incorporates both conventional assembly and a printed-circuit board, but it's a good idea for the constructors to have two or three successful kit constructions behind them before they tackle this one.

Fifteen individual coils and their associated trimmer capacitors, along with two IF transformers and a beat-frequency oscillator coil must be mounted, wired *and aligned* by the builder. This isn't as bad as it sounds; in fact, the alignment process is both interesting and instructive.

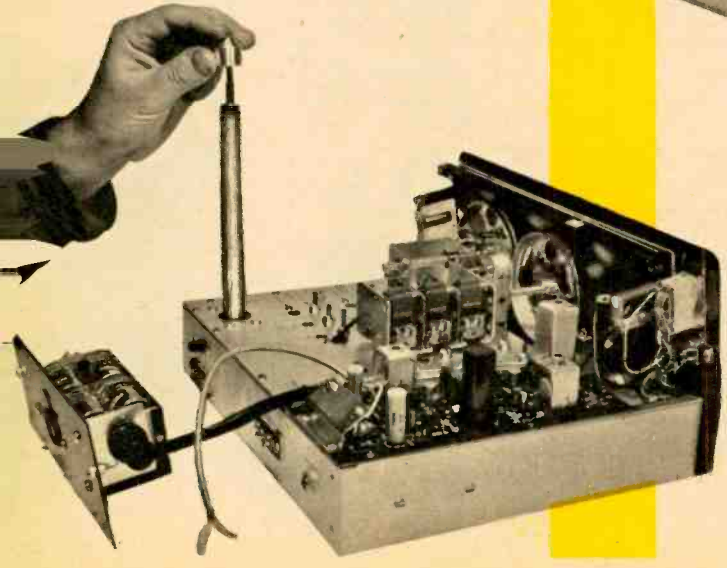
### Construction

The coils, trimmers, bandswitch and three transistors are assembled on a metal sub-chassis. The IF and audio components and their seven transistors go on the printed circuit board, which is well marked and laid out. The two units are then mounted on a main chassis bearing a three-section main tuning capacitor and a single-section bandspread capacitor. An inclined front panel holds ten controls.

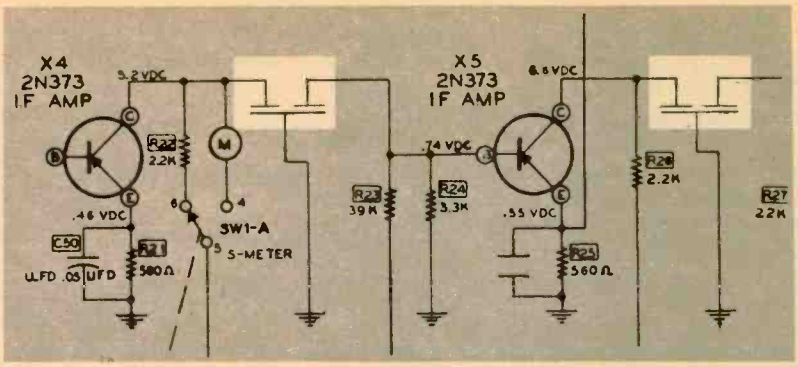
The assembly is straightforward nut-and-bolt, and requires three hands in only a few areas. The toughest part of the entire job is the wiring of the tuning coils to the band switch. The RF, mixer and oscillator sections are separated by two shield plates, which are only 1½" apart over the central mixer section. It is absolutely impossible to use a pair of ordinary long-nose pliers here to snag wires to terminal lugs and do other forming and holding operations. Your *EI* reviewer was quite ready to give up the entire project as hopeless when he



**Printed-circuit board mounts along right rear edge of main chassis. On apron, extreme left, are terminals for the outdoor antenna normally not required. Muting terminals are for hams.**



**Completed chassis showing position of telescoping antenna. Battery box extreme left, has plug-and-socket connection to chassis. Open wire over battery cable is connected to built-in speaker.**




**Portion of "Mohican" schematic indicating the new ceramic IF transfilters previously found only in military equipment.**

spotted a unique little tool called "Seizer" in a local radio store. Its long, slender jaws make the wiring no longer impossible, but merely tricky.

A soldering gun with a wire-loop tip is required. This flexibility is important, since the band-switch wafers have twelve lugs, some of which are actually behind or beneath immovable posts or other supports.

The printed-circuit board, on the other hand, needs careful and delicate soldering with a pencil type iron of not more than 25 watts. Solder must be applied sparingly, to avoid spillover from one printed line to another. It is a smart idea to examine the finished board under a magnifying glass and to fleck off excess rosin and pinpoints of solder with a fine-pointed tool.

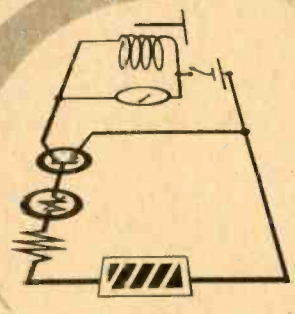
An experienced hand with kits, your *EI* reviewer clocked the Mohican at just 40 hours of work. Was it worth the effort? Yes! At $100 this versatile receiver is a long-term investment in listening pleasure.

# Electronic Rhythm

PLAY an instrument? Want professional rhythm backgrounds? Can't afford a union musician? Well, automation has hit the music industry. Now you can get everything from a tom tom to a bass drum from a versatile electronic device called "Side Man" by its maker, the Wurlitzer Co., DeKalb, Ill. Using oscillating tubes, three hi-fi speakers and an amplifier, the Side Man offers any rhythm at almost any tempo without interruption. Seventy-two pre-set variations of the fox trot are available, to say nothing of tangos, sambas, marches, rhumbas, cha-chas, waltzes, etc. Cymbal effects, maracas—even temple blocks are within the gadget's electronic talents. Tempo is adjustable from 36 to 195 beats per minute, and slowing down or speeding up does not alter the rhythm pattern or change the quality of the sound. At right is close-up photo of Side Man's control panel. Tubes, etc., are housed in a cabinet measuring 22″ x 22″ x 11″. It is priced at $395 in mahogany.

*Special Bonus Feature*

# PHOTOGRAPHY SECTION



# Revolution In Picture Taking

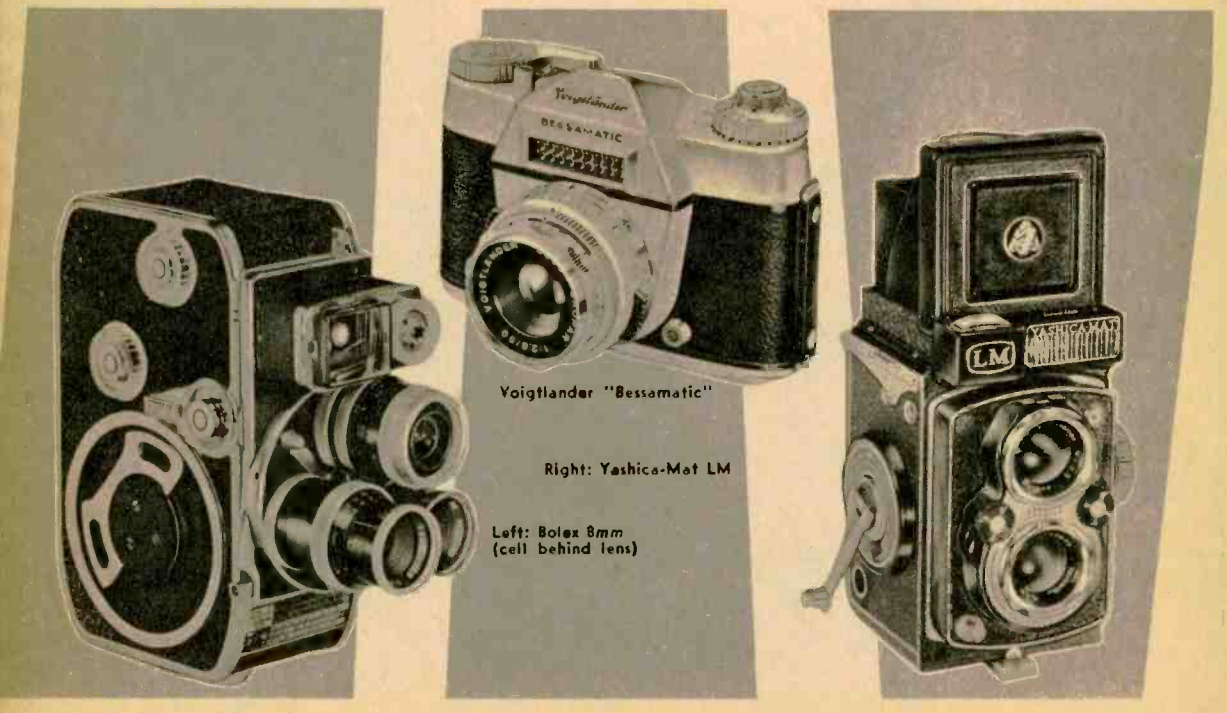
**From camera to darkroom, electronics has entered every area of photography. Here are the results.**

AS in nearly every other field, electronics is throwing its considerable weight around in photography. Camera advertisements try to give you the impression that thinking is old-fashioned. The camera does it all for you. Is it true? Well, maybe. And then again, maybe not.

Let's get down to the basics of the electronic industry's invasion of photography. We will attempt to guide the novice photographer in his search for the proper type of equipment, and set up a few warning signals where the gear may not match the claims made for it.

Once upon a time it took skill, patience and an expert knowledge of the primitive cameras and photo plates to make an acceptable picture. Nowadays, almost anyone who can sight through a viewfinder can turn out acceptable prints and movies. They may not be artistically "great," but they will measure up in nearly every respect to "good quality"—*as long as the limitations of the camera are known and it is used properly within these limits.*

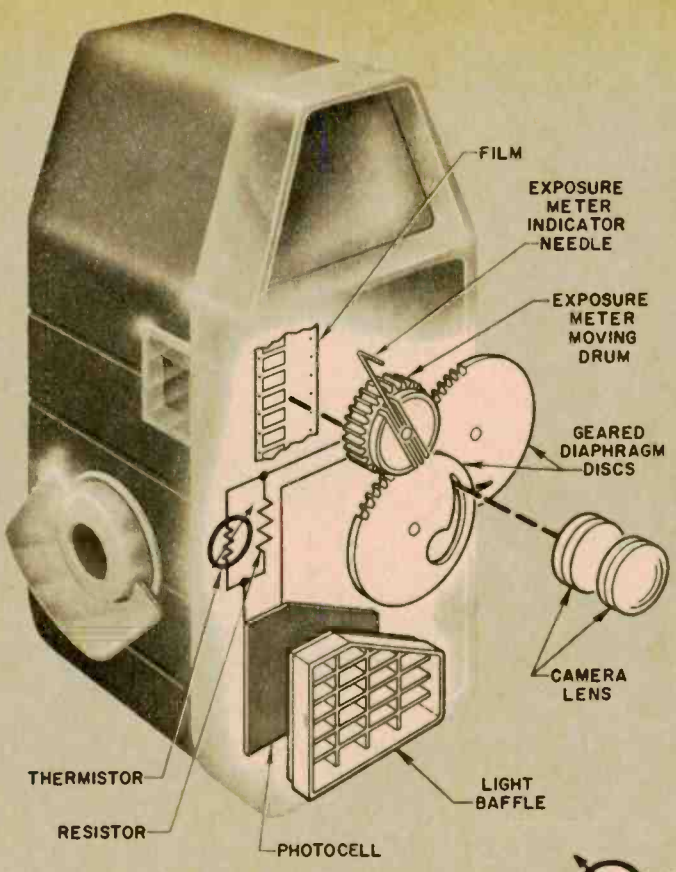
This ease of picture-taking is due mainly to the photocell which, in photographic parlance, is known as the "photoelectric exposure meter." When hooked onto a camera, it becomes an "electric eye."



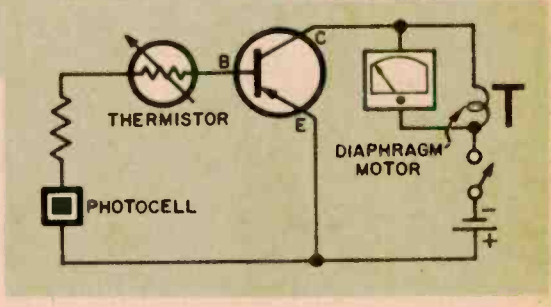

Voigtlander "Bessamatic"

Right: Yashica-Mat LM

Left: Bolex 8mm
(cell behind lens)




**Typical movie camera automatic control: The light from subject hits photocell causing tiny current flow through galvanometer within geared drum, which rotates in proportion to amount of current. Drum turns two geared discs which have teardrop openings directly behind lens. The more the drum turns, the smaller the opening in the discs (which act as the diaphragm). Pointer on drum indicates the f-stop setting. The thermistor compensates for temperature change.**

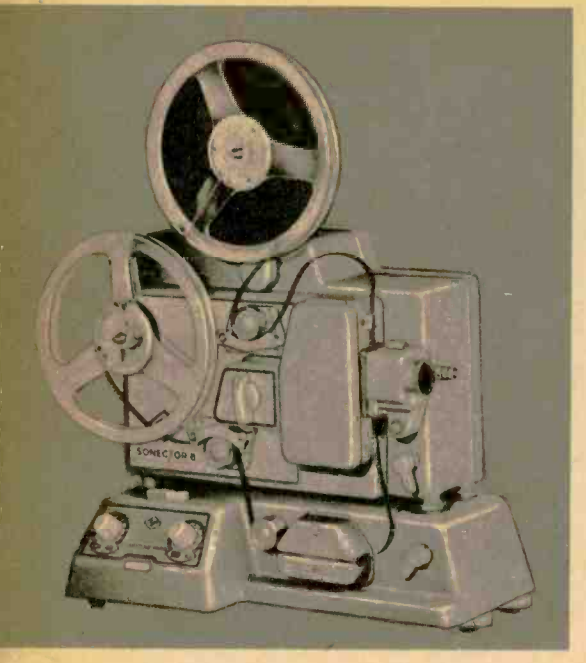



**At right is schematic diagram of the typical transistorized booster circuit found in automatic movie cameras. Note that the indicator needle, which reads out as f-stops, is linked directly with the camera's diaphragm, which may be revolving discs as shown above. The amount of needle swing (hence diaphragm opening) is proportional to the intensity of the light on photocell.**

Anyone familiar with basic electronics knows that light acting on some materials, such as selenium, will cause a flow of electrons —an electric current. The more light, the greater the flow. When this current is harnessed to a galvanometer, it can cause a needle to move over a distance proportional to the strength of the flow. The more light, the more current, the greater the needle swing.

In the ordinary exposure meter, this is just about the whole story. The dial is calibrated to show the proper lens opening for a variety of shutter speeds and film sensitivities. When the meter is pointed toward the subject, the reflected light "seen" by the meter causes the needle to deflect proportionally. It is then a simple matter to pick a lens-shutter combination for the specific needle deflection.

As film sensitivities began to rise, the ordinary meter was not sensitive enough to give a reading under the low light conditions that the film could record. (Some films enable you to take a pic-



New Agfa projector has special synchronous head for adding sound to oxide-striped film.

Transistorized Fairchild 8mm camera makes home movies "talkies" at time of exposure.

ture using a single candle as illumination.) So meter manufacturers simply hooked a booster cell into the meter to amplify the light-generated current under such conditions. In some meters, the booster cell is thrown into the circuit automatically; in others this must be done manually.

Yashica, GE and Weston make meters with "memories." Instead of a fluctuating needle, these meters "remember" the reading by "holding" it when a button is pressed.

The use of the photocell as an accessory is not new. However, the real revolution in photography came about when manufacturers built the cell into the camera itself and allowed the light intensity to automatically control the lens opening and/or the shutter speed.

Here's how the fully automatic camera works: When the camera is turned on the subject, the meter movement deflects relative to the amount of light entering the cell. In some simple models, such as the Kodak Starlite, the meter needle itself acts as the diaphragm and the greater the deflection, the more the lens closes down. In others, such as the Agfa Optima, a more complex mechanical linkage to shutter and diaphragm may keep the lens opening constant while the shutter speed changes, or vice versa. In low light levels, the lens opening remains at its widest position and the shutter speed changes. At a lens/speed combination where there would begin to be overexposure, the shutter speed becomes the constant and the lens closes down.

Theoretically, with the cell doing the "thinking," the photographer should get perfect exposures. Actually, this is not quite true. The light meter can only "average" light. In other words, it

considers the light and dark areas in its field of "view" and gives a reading somewhere down the middle.

For instance, if the photographer were shooting a light object against a dark background (or vice versa), he would find that neither was properly exposed, since the meter would be setting the camera for the average light coming from the combination. Therefore, most automatic cameras have an optional "manual" control to allow the photographer to bypass the meter and make his own settings, usually from an accessory exposure meter which he can take right up to the subject.

Another type of "automated" camera is the semi-automatic. With this, the *user* must do what the meter indicates. Generally, the photographer must align a needle connected to the diaphragm and/or shutter with the meter needle. When the two are aligned, the camera is set properly. The Voigtlander Bessamatic is an example of this type.

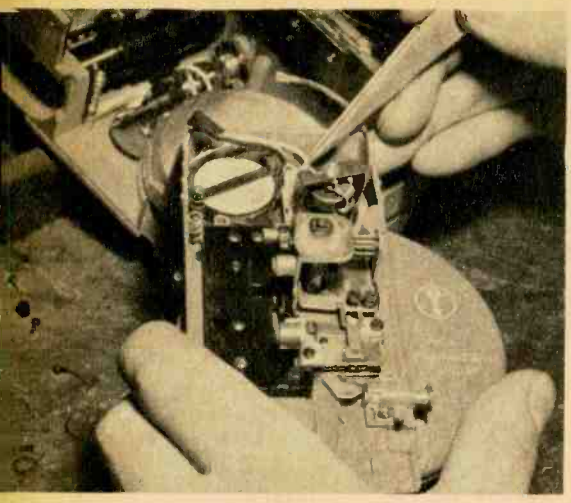
Practically, this semi-automatic arrangement in the new "Light Value System" shutter allows the photographer a great deal more latitude than the fully automatic arrangement since he can, if he wishes, control his shutter speeds and lens openings within the specific range allowed by the meter. (The shutter in the LVS system is geared to the diaphragm. As one changes, the other also changes in proper proportion.)


**Basic, versatile exposure meters have had to keep pace with faster films, lenses and shutters. This meter handles 0-25 foot candles.**

Another type of still camera employs a completely uncoupled meter. This is simply a reference meter and works like the accessory exposure meter, except for the fact that it is built onto the camera. An example of this type of camera is the Yashica-Mat LM.

If you are in the market for a camera, remember that the completely automatic camera may have two major faults: a) it can be fooled under certain light conditions and; b) optical and mechanical quality may have been sacrificed in order to include the automation and still retain a competitive price. However, there are several cameras with semi-automatic and reference meters which conform to the highest standards of optical and mechanical quality. While the professional and serious amateur may prefer to avoid the automation and rely on his accessory exposure meter, which makes his camera more flexible and versatile, the "occasional" photographer (on vacations, at Christmas and periodic photographing of the children) often find the "automatics" just fine.

In the *8mm* movie field, the meter has suddenly blossomed as "the thing"—and a new twist has been added. The first models were operated with a simple cell, such as described above. This was suffi-



**Never try to service an electric eye camera yourself. They're delicate, require an expert.**

ciently sensitive to cope with the slow color films usually used in movie cameras. However, some newer models have appeared using transistor amplification, powered by a tiny, long-lived mercury cell which activates the diaphragm. An example of the simple cell is found in the Bell & Howell line; the transistor is used in the Yashica EE. Bolex has added a new twist to the semi-automatic type, placing the cell behind the lens where it measures only the light "seen" by the lens. When the photographer presses the button, the photocell swings out of the way. This feature tends to give a much more accurate reading. This, of course, has the disadvantage of operating only when the camera is not running. Changes in light intensity during camera operation will not be "seen" by the meter.

Another development in the home movie field has been the addition of synchronous sound. This is being accomplished in three ways: adding sound to tape and synchronizing the tape recorder to the film; adding a magnetic "stripe" to the film after it has been exposed and processed and; recording sound on oxide-striped film simultaneously with the exposure of the film.

Both Bauer and Eumig offer tape synchronous devices, while Bolex makes a sound stripe recorder. But the newest type, developed by Fairchild Camera and Instrument Co., goes a step further. While the earlier units allow the addition of a sound track *after* filming, Fairchild's new system allows simultaneous recording with the filming. In other words, the photographer can make the sound track *while* he's shooting the scene.

This is done by using pre-striped unexposed film which, during exposure, passes over the head of a tiny transistorized recorder built right into the camera. The microphone, of course, plugs right into the camera itself. An accessory amplifier-speaker system allows direct playback of the soundtrack as the film is being projected.

While each system has advantages, each also has drawbacks. The first two will not allow simultaneous recording—the photographer can only add commentary or music to the film afterward. The Fairchild system makes film editing rather difficult since sound would be edited away at the same time as the unwanted film frames. This is a serious consideration since few films —amateur or professional—require no editing.

Another tremendous stride made in the past few years has been in the field of flash. Flashbulbs last for only one exposure, but the electronic flash makes use of a sealed tube of gas which can be illuminated by an electrical charge and its life may be as much as 10,000 flashes. The trouble with early electronic flash units was that they required bulky power packs which the photographer had to tote on his shoulder. Now the transistor has come to the rescue making possible extremely lightweight flash units and

lightweight power packs. Some have done away with the accessory pack itself, sealing the transistors in the flash head, with the batteries in the handle. The Heiland Strobonar is such a unit.

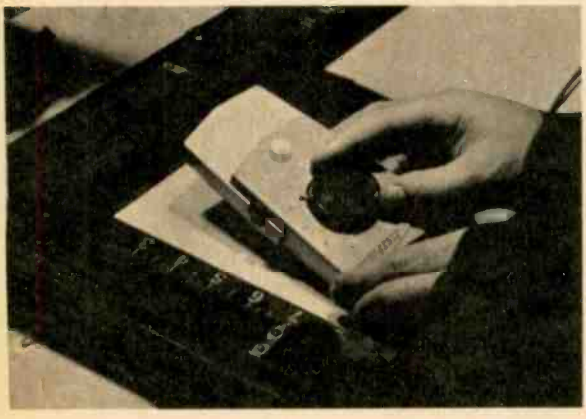
An accessory is the "slave" flash. This is a second (or third, etc.) flash which is set off at the same time as the primary to provide additional lighting from another angle. This used to be accomplished by hooking the slave to the primary, but such an arrangement was cumbersome and power consuming. Now slave flash units employ a photocell to "sense" the light of the primary flash as it goes off, in turn setting off the slaves. This happens at the speed of light—which means, in effect, it's instantaneous.

Electronics has even come to the aid of the darkroom drudge. One of the most difficult tasks faced by the darkroom man is determining the proper length of time to expose the print paper when enlarging, and the correct enlarging paper to use. (The grade is generally determined by the density of the negative.) Normally, the beginner must run a long series of tests with strips of various grades of enlarging paper, at various time intervals. With more experience he develops a fairly accurate idea of exposure time and paper, but still must run several tests to get a perfect enlargement.

However, with the use of the electronic densitometer, this tedious work can be cut down to a bare minimum. The densitometer is actually a photocell which measures the intensity of the light coming through the negative in the enlarger, and relates this light intensity to exposure time and grade of paper by means of a reference dial. Basically, what the meter does is kick on a neon glow lamp when the light intensity reaches a predetermined level. At this point, the dial will indicate the proper exposure time.

The price of a densitometer or a densitometer-type instrument varies from $16 to several hundred dollars. With the lower priced units, the darkroom worker will not get perfect results, but rather a fairly accurate guide to the right "neighborhood." These instruments are a good investment for those who would like to cut down on time and cost of materials.

What can we expect in the future? Certainly the trend will continue toward completely automatic cameras—cameras that will be better in every way, with tiny electric motors that will automatically wind the film after each exposure. As to the film itself, you may expect the chemical process types now in use to give way to thermoplastic recording, where electronic impulses bombard a plastic film to form a pattern of visible images of very high quality. (See "New All-Purpose Recorder," *Electronics Illustrated*, April 1960.) However, don't expect to see this latter development before 1963.



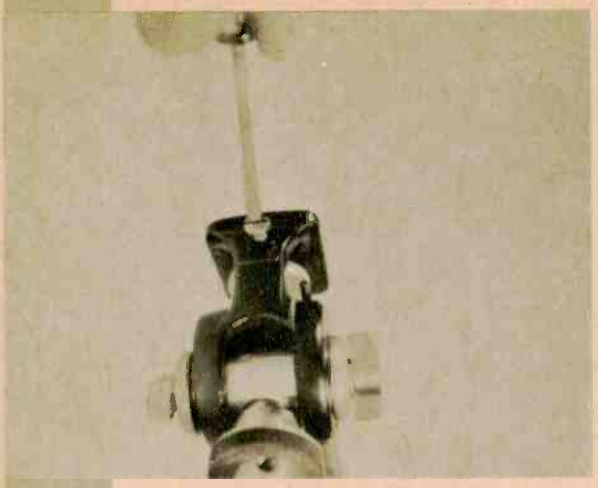
**Densitometer-like units (Photo-Genie shown) save time in arriving at enlarger settings.**

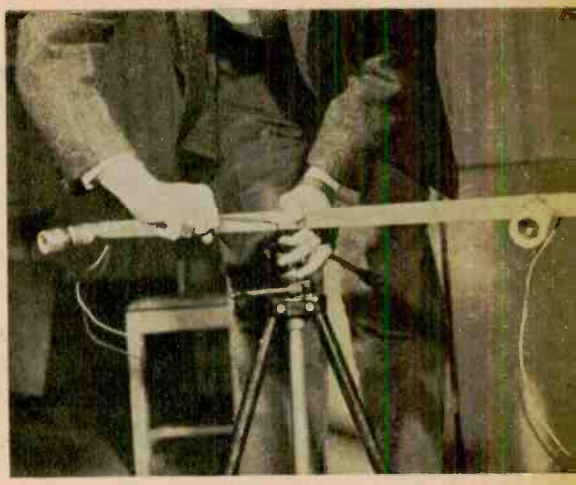
**On the next several pages you will find three useful build-it projects. In addition, we have on tap two projects for the near future—a strobe flash and a darkroom timer. Watch for them!**

# A Photo Light Bar

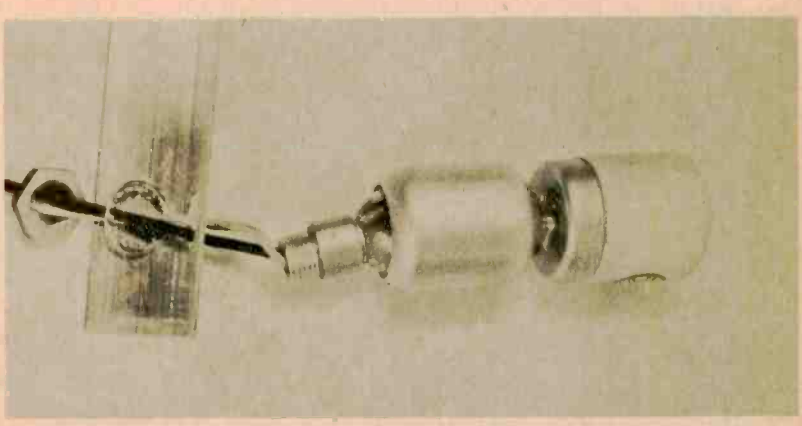
By H. Landsman

A shutter-bug's delight—ideal for close-up work!



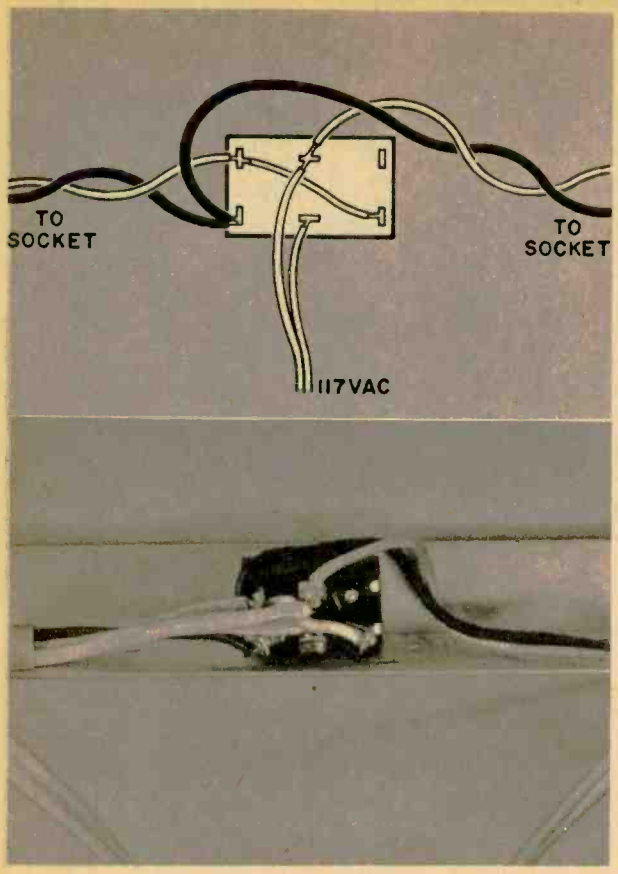


**To make sure you achieve the correct mounting position of the bar, place the desired length of Reynold's do-it-yourself aluminum angle against the tripod head as shown and drill a small pilot hole right through both units. Then drill and tap a hole in the tripod head to take a 10/32 size screw.**



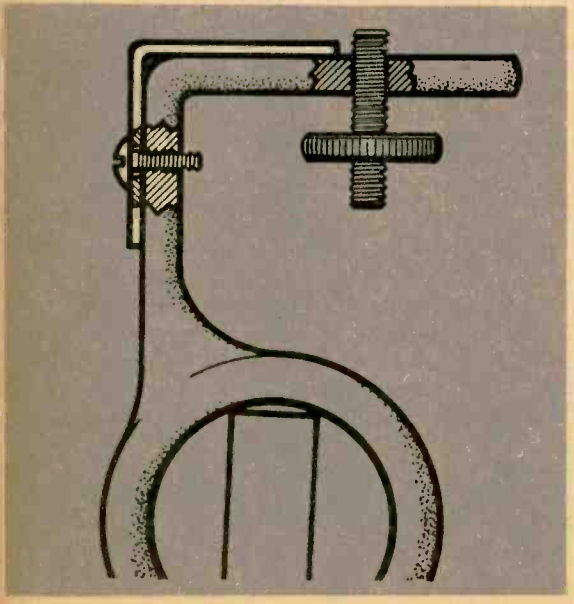
**The mounting hole in the aluminum should be enlarged and additional holes drilled for the two sockets. The swivel sockets are mounted at the ends of the light bar with the hardware provided. Hardware dealers carry these.**

THE convenience of a "light" bar for quick table-top setups is obvious to anyone who has ever done any equipment photography. The simple setup described below will handle about 90% of your lighting setups, including portrait work, and eliminates both the problems of light-stand juggling and working under hot photoflood lamps. A flick of a three-way toggle switch in one direction from its center "off" position, will connect your photofloods in series. In this position, the lamps are no brighter than ordinary household bulbs—thus providing ample illumination for all arranging, focusing, and other pre-shutter-snapping preparations. Then, when everything is in readiness, another flick of the same switch in the opposite direction and presto . . . the lamps are parallel and at full brilliancy.




A Lafayette DPDT toggle switch (AR-191) is mounted about halfway between the center of the bar and the light socket. The switch is wired as shown in the wiring guide. A shield is made from scrap metal to cover the exposed switch contacts and is insulated with black plastic tape. Wires are held in place by small cable clamps using 6/32 screws and nuts.

Detailed cross-section of tripod head shows correct positioning of aluminum angle bracket.



Three-position toggle switch provides control of illumination, either dim or brilliant.

# A Strobe Slave

**By F. A. Garlick**

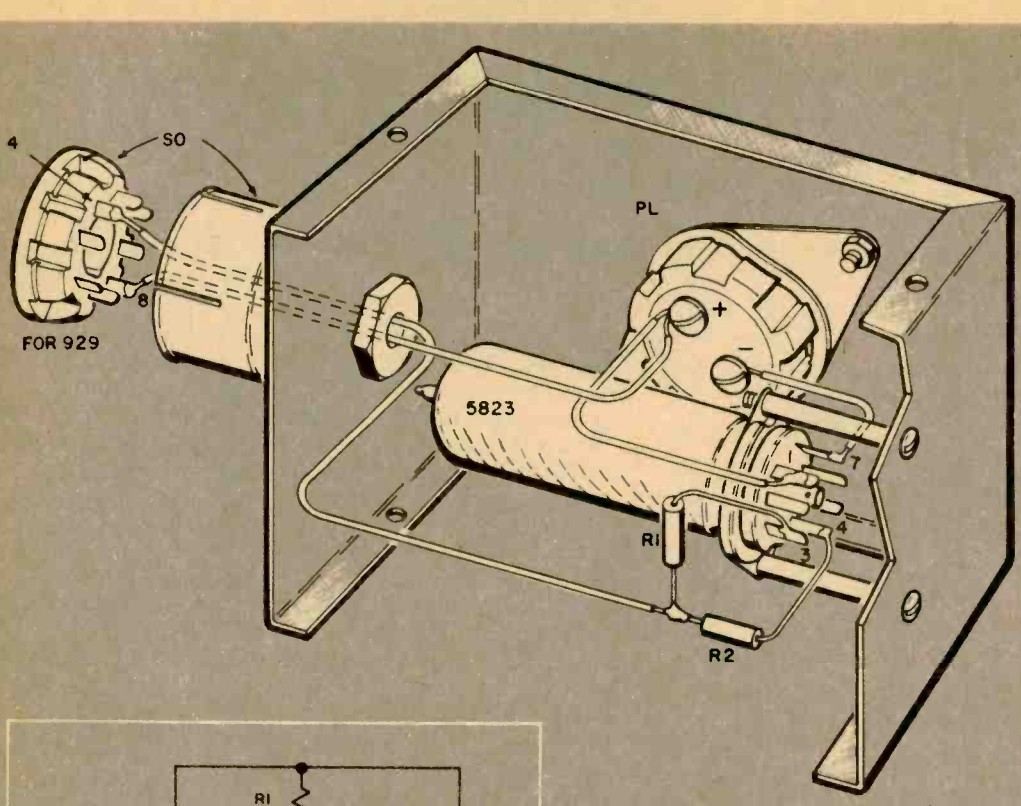
**Adapt that extra speedlight for use as a slave.**

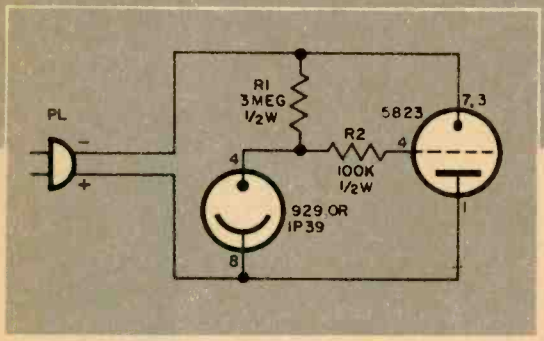
"OH, that shot would have been much better if I just had back lighting." How many times has this happened to you? Even when you had an extra speedlight available from a friend or neighbor—there was no means of "syncing" it without stringing long trip cords and possibly burning out delicate shutter contacts.

Necessity being the mother of invention, we set to work on an idea and came up with a little unit that will plug directly into your strobe light (or speedlight, if you prefer) *shutter receptacle* and convert that extra strobe to an independent light triggered slave.

Plugged into a speedlight with a circuit similar to the one in Fig. 2, the plate and cathode of a 5823 trigger tube are across the shutter contacts. A resistance (R1) from the cathode to starter is set to the point where the trigger tube is just short of firing. When light strikes the photo tube it conducts and overbalances the trigger tube. This, in turn, triggers the strobe light. Note that run-down batteries will cut the triggering voltage enough so that the slave will occasionally misfire. If you have an AC-battery unit and are indoors, use AC to prevent misfires. The slave unit can be mounted on a light stand with the photo tube aimed at the main strobe light.

The components for this unit cost about $5.00 and are available in any of the larger electronic parts supply houses.




**All bare wiring shown above should be insulated from the case with "spaghetti."**

**Fig. 1. Plug PL connects to shutter contacts of slave flash head. Observe PL's polarity.**

The photo tube should be able to rotate so that the slave light can be placed at a convenient angle for picture taking. A short length of threaded electrical tubing and some flat nuts make it easy to rotate the photo tube base.

The male Amphenol plug (PL) should be the one with the retaining ring so that it can be placed in any one of its various positions as determined by the need of your own particular flash unit. If you cannot obtain a polarized plug, you will have to file one prong (usually the lower one) narrower so that it will fit into the flash unit. This, in most cases, is the positive terminal.

Polarity of the shutter contact socket on your strobe light should be checked with a voltmeter set to the 250-500 volt range. Some strobes have the positive terminal at the top. *Check polarity.*

### Construction

The miniature socket is mounted on standoffs to the bottom of the box. A couple of strips of electrical tape or other fiber sheet should be put on the bottom of the box to insulate it from the terminals of the socket. Remember that your strobe carries high voltage so be sure to insulate the slave unit wherever shorts may develop. After the unit is completely wired, plug it into

[*Continued on page* 78]

## How A Speed Light Works

The basic operation of an electronic flash is best described by the use of Fig. 2. A direct current source (from 250 volts to 5000 volts in the big commercial units) is connected directly across the main power capacitor C1. When C1 is fully charged, the voltage then appears across the resistor string (R1, R2, R3) where it serves to: (1) charge the neon lamp capacitor (C2). The neon fires when the charge reaches about 65 volts DC. (2) charge the .25 mfd triggering capacitor (C3) up to about 150 to 200 volts. The flash tube is constructed so that it will not fire at the operating voltage (which may be from 200 to 4000 volts, depending upon the design of the unit) unless ionized. When the camera shutter closes, it shorts out resistance (R2) and the trigger capacitor charge travels through the shutter contacts and on to the primary of the trigger coil (T). This gives a momentary pulse to the primary coil. The step-up transformer action of T produces about 18,000 volts on the secondary. This high voltage is impressed between electrodes 3 and 2 of the flash tube causing it to ionize. The voltage in the main capacitor is then allowed to discharge through the flash tube causing the flash that takes the picture.

There is usually a current limiting resistor in series between the power source and the main capacitor, as C1 is almost a direct short circuit to the power source when discharged.

Power sources include 117 volt AC with half wave rectification, high voltage batteries, or low voltage batteries with a vibrator and voltage step-up facilities. Modern units frequently have a very efficient transistor oscillator power supply.

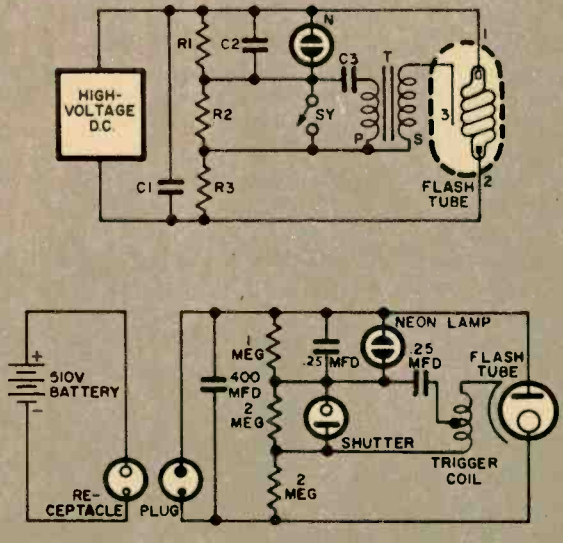



**Fig. 2. Here are theoretical and practical circuit diagrams of a standard DC strobe.**

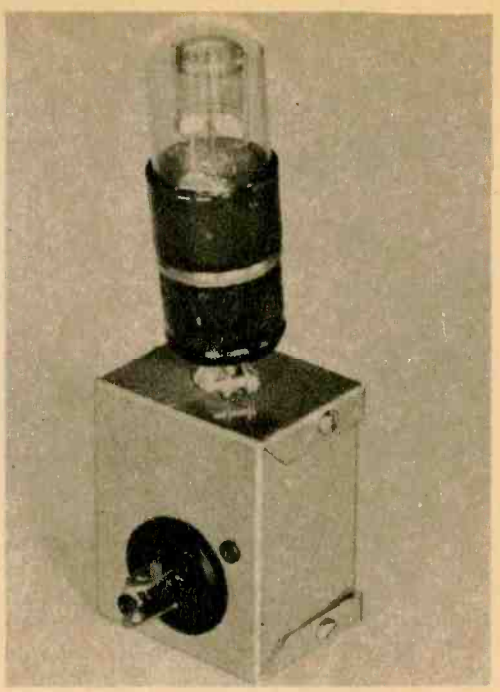
your strobe light. If you have observed proper polarities, you should be in business. However, if you cannot fire your strobe, try reversing the male plug.

In some units there might be a "flashing over" of the slave unit. In this case replace the 3 megohm resistor (R1) with an 8.2 megohm resistor. Other units that are on the borderline of firing, but just don't (indicated by the neon indicator light going out, but no flash) may be helped by changing R2 to 47000 ohms.

This unit works on the Heiland, Dormitzer, Graflex, Ascor, and the Braun Automatic set at full power, but *not* at half power. There are some newer units that use a lower triggering voltage that will not work with this unit.

PARTS LIST

R1—3 megohm resistor, 1/2 watt
R2—100,000 ohm resistor, 1/2 watt
1P39 or 929 RCA phototube or equivalent
5823 RCA trigger tube or equiv.
SO—receptacle to match phototube chassis mounting
PL—male plug, two prong
Misc.—case 1⅝"x2⅛"x2¾", 7-prong miniature tube socket, hardware



**Front view of completed unit. Photo tube, top, placed on swivel can be locked in position.**

# Automatic Light Switch

## For professional slide and home movie presentations

DO your slide or home movie shows start like this?

"All ready, will someone turn off the lights please?"—— "Will someone turn them on again?" CRASH——

"Oooooh, my lovely lamp. . . ."

Or do they start like this?

"Everyone seated and ready?" Click—on goes the projector—off go the room lights—automatically. You sit back and enjoy the show and hear murmurs of—"I wonder how he did it?"

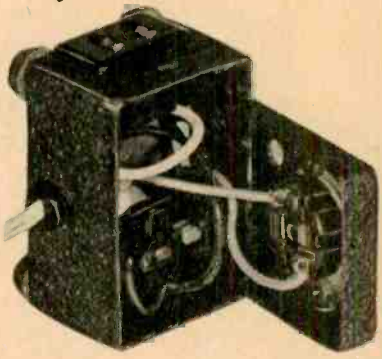
The answer is very simple. It's all done by a little box with two outlets in it; one for the room lamp—one for the projector. The projector is connected in series with a current relay (RY). When the projector is turned on, RY is energized and opens the NC (normally closed) contacts turning off the room light. When the projector is shut off or (as occasionally happens) the projector lamp burns out, the room lights will automatically come on again.

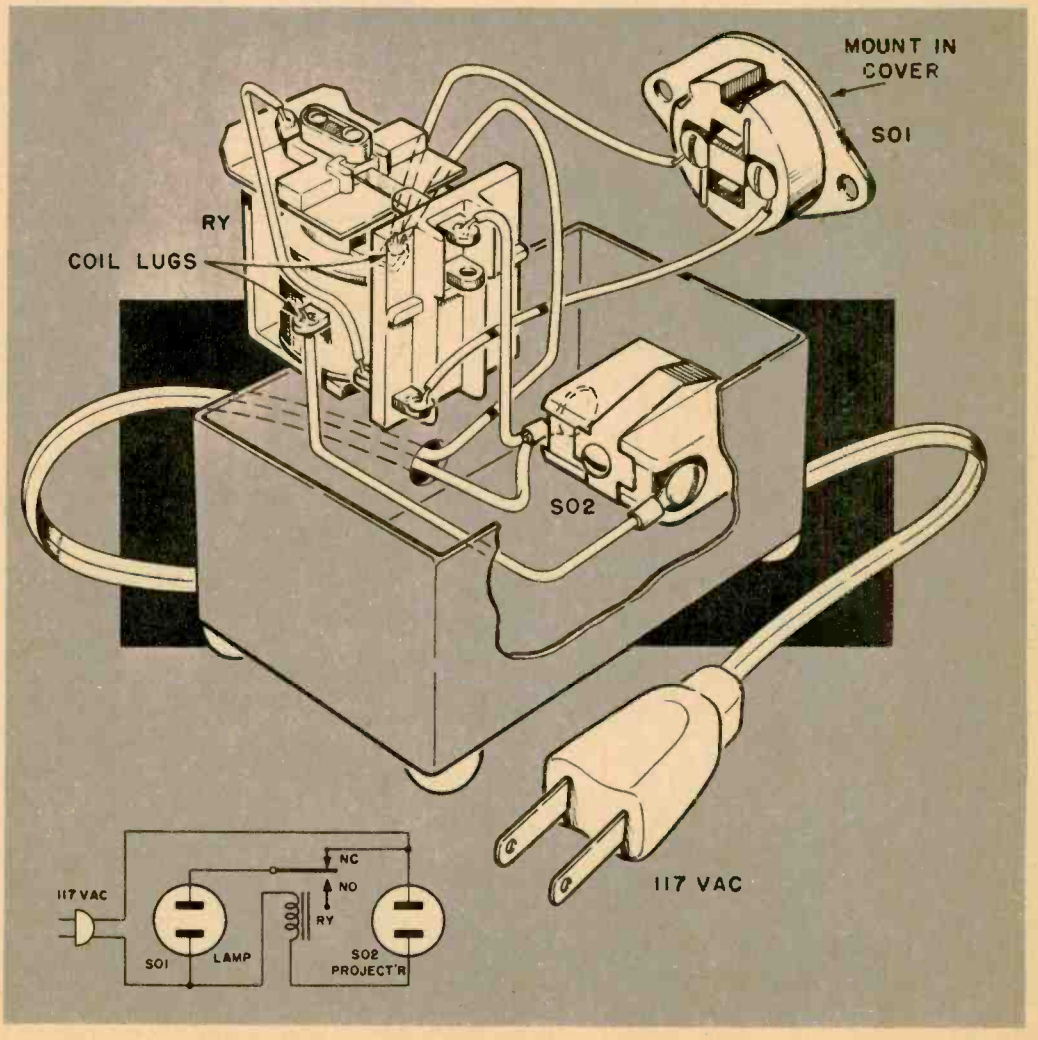
The construction of this unit is very simple. The relay (Potter & Brumfield KA 1061-1) is available direct from Potter & Brumfield, Princeton, Indiana at about $3.65. A Guardian relay type #G-56906 can also be used. The relay specs are as follows: .08 ohm, 115V AC coil with pull-in current of 1.9 amps, and a drop-out current of 1.47 amps. The contacts should carry about 5 amps

@ 115V. Do not use a 100 watt load.

Two outlets are used, a standard Amphenol MIP two-prong round receptacle for the room lights and a Cinch-Jones rectangular two-prong receptacle for the projector. The rest of the unit consists of a Bud Minibox CU 2101A or equivalent, about 8 feet of #16 or #14 lamp cord, an Amphenol or Heyco strain relief, and four rubber feet.

With this unit there is no wiring or operational changes needed in your projector. These units work well with projectors with up to 750 watts of light. With movie projectors the room light will stay lit while the projector motor *only* is running for threading or rewinding. When the projector lamp is turned on, the additional current drawn energizes the relay and out go the room lights.





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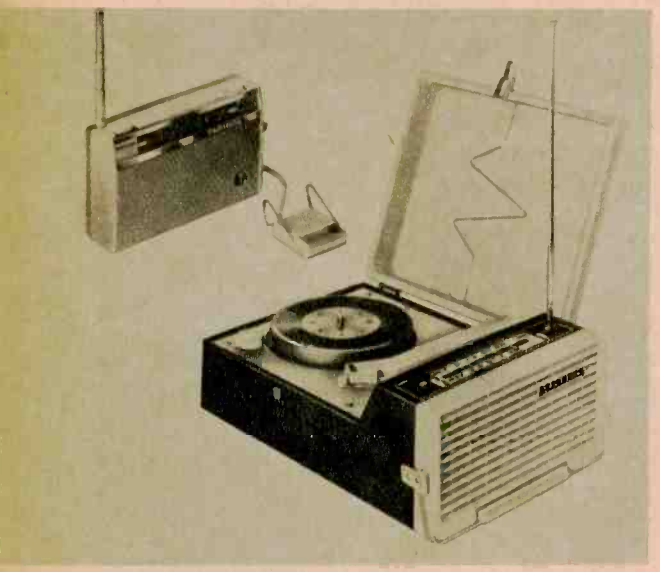
Ask anyone 'in-the-know' about photography, and he'll tell you—"You can't beat Yashica for value—for quality and features at sensible, down-to-earth prices". Now, with Yashica in transistor electronics, the same thing still holds true—'You can't beat Yashica for value'. See for yourself.



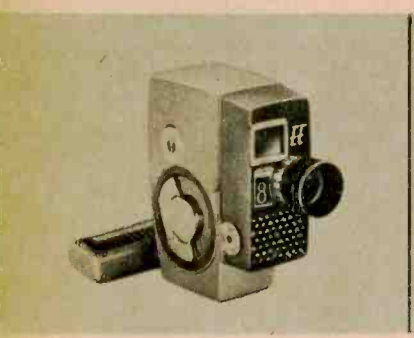
**YASHICA YT-300**
**battery-operated, 10-transistor, 2-band radio with telephone pickup amplifier**

Sensitive 9-transistor superhet circuit covers broadcast and shortwave band from 3.2 to 12mc. Has ferrite-core broadcast antenna and omni-directional, telescoping whip antenna for shortwave. Gives brilliant, clear, room-volume reception, indoors and out. Transistorized telephone pickup amplifier (special YT-300 feature) amplifies incoming voice, and permits anyone in room to hear both sides of conversation. Attaches easily and quickly—no wiring or splicing. With batteries, private earphone, telephone amplifier and leather case. ONLY $69.95

**OTHER FEATURES: • built-in tuning meter • built-in battery tester • jack for earphone • operates on 4 penlite batteries.**

**YASHICA YP-500**
**battery-operated, 9-transistor, portable 2-band radio and stereo-adaptable phonograph**

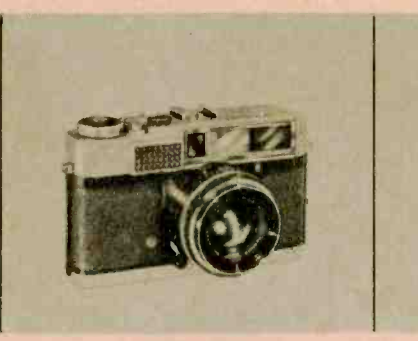
Requires no outside power source. Weighs less than 13 lbs. and measures only 10½ x 14 x 5 inches. Radio covers broadcast and 3.8 to 12mc shortwave bands. Built-in antennas, tuning meter and battery tester as in YT-300. 3-speed phono (33⅓, 45 and 78rpm) has turn-over crystal cartridge with sapphire styli for stereo and mono records. Addition of optional, external speaker-amplifier gives full stereo reproduction. Elliptical 4" x 6" loudspeaker has superb tone quality. Operates on 6 standard D flashlight batteries. In handsome two-tone case with nesting carrying handle. ONLY $99.95



**YASHICA EE1 movie-8**
**fully automatic exposure control with diaphragm-coupled electric eye**

You point the camera and shoot, the electric eye does the rest—automatically sets the super-speed f1.4 lens for correct exposure even in poor light because the eye is transistor-boosted for extra sensitivity. ONLY $69.95 with trigger-grip

**FEATURES INCLUDE: • automatic electric eye for all film from 10 to 40ASA • super-speed f1.4 Yashinon lens • single-frame exposures • auto-reset footage counter • drop-in loading.**



**YASHICA YM35**
**with built-in electric eye LVS exposure indicator**

You simply set the shutter for the indicated LVS number. This automatically sets shutter speed and diaphragm for correct exposure. Most attractive 35mm value in the field! ONLY $64.95 (case $12.50)

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**YASHICA-MAT LM**
**twin-lens reflex with built-in electric eye exposure indicator**

The most famous of all Yashica Cameras, now with built-in exposure meter. It's the greatest focusing reflex value available today! ONLY $79.95 (case $10)

**FEATURES INCLUDE: • built-in exposure meter • single-stroke crank automatically advances film and sets shutter • Yashinon f3.5 lens • M-X synchro shutter: 1 sec. to 1/500th, 'B' and self timer • fresnel-type focusing screen • knurled thumbwheels for setting exposures • auto-reset exposure counter • bayonet lens mount • sportsfinder • magnifier.**

*On sale at Yashica dealers everywhere. For further details, write:*

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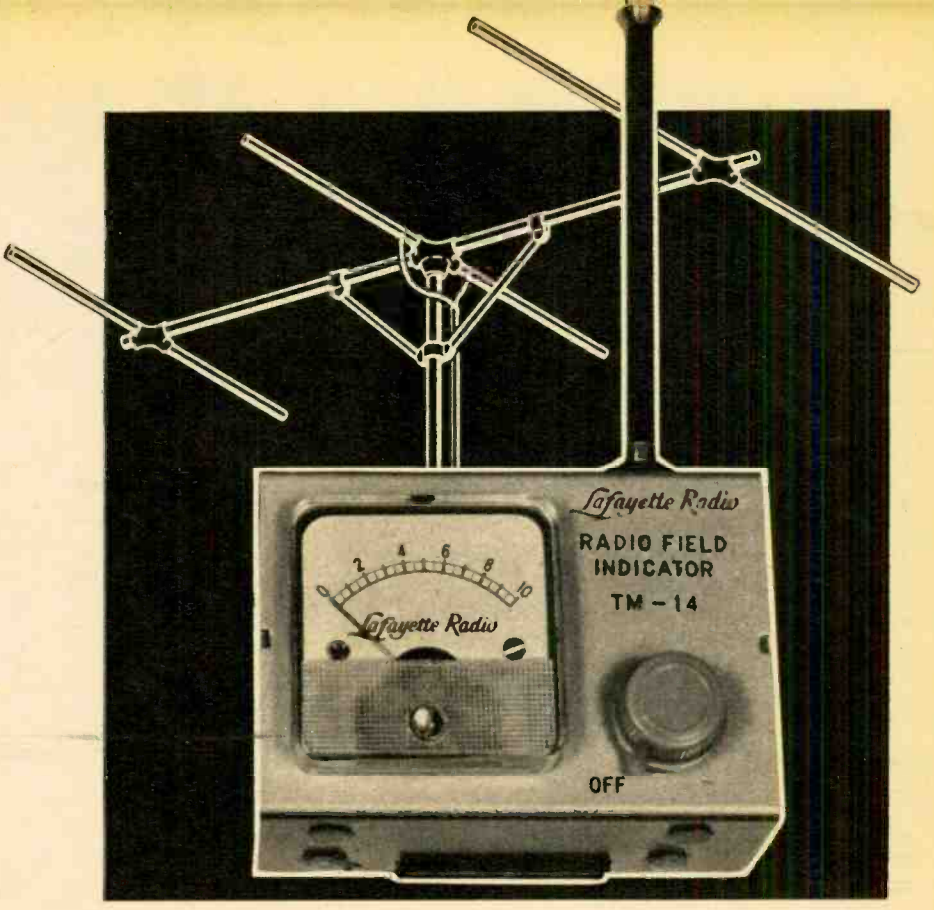


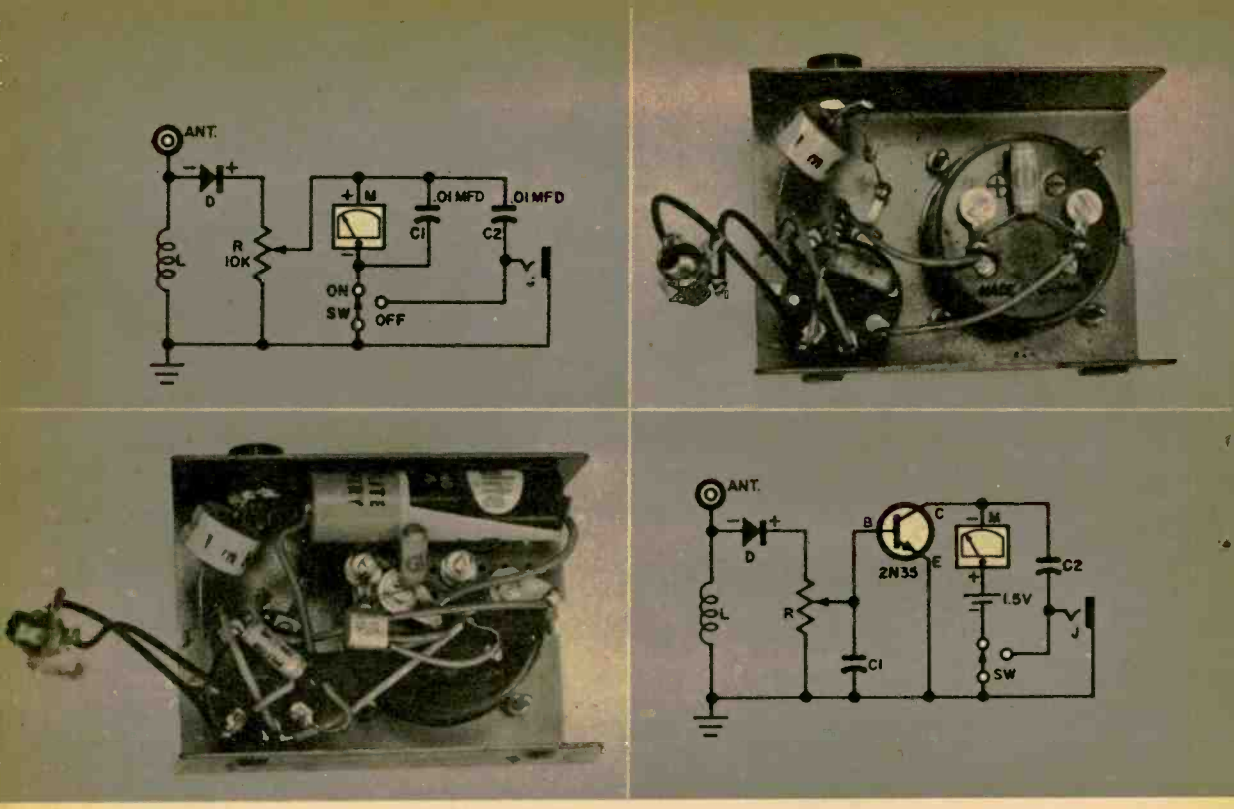

# Transistorized RF Field Indicator

**By Harvey Pollack**

**Add a transistor to "soup-up" this pocket-size RF meter—ideal for transmitter and antenna tuneup.**

ANYTIME you can get an RF field indicator for under $8, you really have something! And the Lafayette TM-14 is no exception; it's practically unique (and uniquely practical). With a little souping up (adding a transistor and penlight cell), you'll have an extremely sensitive and very handy gadget for tuning up ham, CB rigs and antennas. The 200 microammeter will give a constant indication of transmitter output on any frequency from 100 kc right through the VHF range.

The unmodified TM-14 is basically an untuned RF probe with a meter indicator and provision for headphone monitoring of modulated signals. The intercepted signal develops a radio-frequency voltage across the RF coil (L) which is rectified by a diode. The meter (M) reads the DC voltage across the sensitivity control (R), while the headphones are coupled to the diode




**Before (upper) and after (lower row) photos with their accompanying schematics indicate the several circuit changes for the conversion.**

through a .01 microfarad capacitor (C2).

Tests run on the TM-14 show it to be more than adequate for reading field strengths of even low-power transmitters down to a few watts when brought into close proximity with the radiating antenna. Due to the absence of tuning or amplification, however, the instrument does not perform well in jobs where the RF field strength is extremely low. For example, an attempt to use it to measure the back-to-front ratio of a low-power 56 mc beam antenna was unsuccessful when it was moved from the immediate vicinity of the beam elements. Tuning a beam antenna demands that the field strength meter be moved to a distance that is at least ten to twenty times the size of beam elements. Even vertical antenna adjustments on fixed and mobile installations should be carried on with the RF field strength meter at a fair distance away. This requires either tuning or amplification or both.

A transistor meter amplifier was designed with two factors in mind: first, the current gain had to be as high as possible, and second, the leakage current ($I_{co}$) had to be as small as possible to keep the no-signal meter reading low. The Sylvania 2N35 was used because it is inexpensive, has high current gain (about 40) and its leakage current was lower than any of the equivalent transistors tested.

### Construction

A small piece of perforated Bakelite is used to support two new terminals (flea clips or screwed down solder lugs) and the battery. The Bakelite sheet is secured to the original meter terminals by the same screws that formerly held the meter solder lugs in place. The meter leads should now be slipped on to the new terminal screws and all nuts tightened. The transition from the basic TM-14 circuit to the new amplified design can be accomplished in a few easy steps. The transistor is held in place by its own leads over which spaghetti tubing is slipped; when soldering to transistor wires, the wire should be gripped by a pair of long nose pliers

near the joint so that the heat can be conducted away.

The battery, too, is supported by its own leads. The little cell is very light in weight so that #20 hookup wire soldered directly to its terminals support it easily. To be sure that the battery terminals will not be short-circuited when the case cover is replaced, install a short length of vinyl tape inside the case opposite the battery terminal.

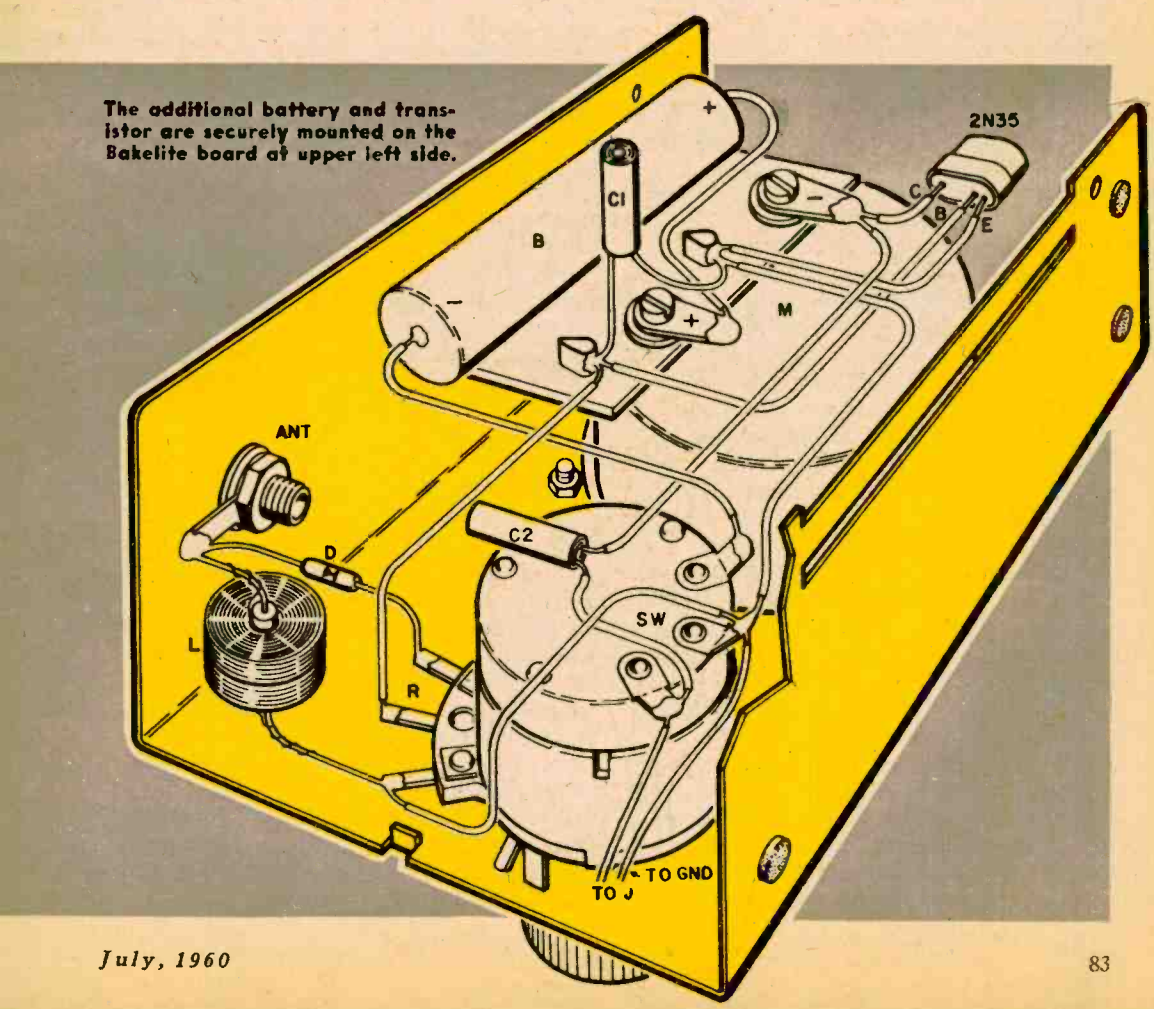
### Testing and Use

If you test the new instrument immediately after completing the wiring, you will probably find the leakage current to be quite high when the gain control is advanced fully clockwise. This is the result of heat carried to the transistor during soldering. Since it takes quite a while (15 minutes or more) for the transistor to return to room temperature, delay your test for at least this period.

When using the instrument in an unknown field, always start with the antenna collapsed and the gain control fully counterclockwise. Remember that the modified instrument is extremely sensitive. In fact, the weak field produced by the local oscillator of a transistor radio can drive the needle offscale if the antenna is extended and the gain is up all the way! Therefore, it is important to take these precautions to avoid damaging the meter.

PARTS LIST

TM—14 RF Field Indicator (Lafayette Radio)
*Additional parts required:*
TR—2N35 transistor npn
B—1.5 volt penlight cell
Perforated Bakelite 7/8x1 1/2




**The additional battery and transistor are securely mounted on the Bakelite board at upper left side.**

# EI's Hi-Fi Doctor. . . .

**Evolution of Audio—Part II**

A lot of you will remember the days when no audio man would dream of building an "integrated" amplifier. Integrated meaning that the power supply and power amplifier are all one chassis. I am not sure what their reasons were; possibly they were trying to avoid power transformer hum being induced to the input tube or output transformer. Or it might just have been that two chassis are a darn sight easier to carry than one chassis of the same weight. Even today you will find some die-hard perfectionists maintaining that for minimum hum, the dual-chassis is the thing. I think they don't know what they are talking about because the *EICO single-chassis* 60-watt basic amplifier, for example, has a measured hum level as low as minus 90db. That's the sort of hum you would have to stick your head *inside* the speaker cabinet to hear.

Then we have the matter of running bus-bars. No old timer would ever have dreamt of producing an amplifier (and particularly not a preamplifier) without having a couple of heavy-duty No. 12 or No. 14 rigid copper bus-bars to prevent ground loops. But again, let me cite amplifiers such as the Acrosound, Dynakit Mark III and Grommes which coast merrily along at 50 or 60 watts with no bus-bars and no hum. Individual ground lugs are all over the chassis.

The bus-bar boys have more of a case when they begin to build preamps. If you get a chance to check into some of the earlier hi-fi preamps, such as the Brociner, you will find neat parallel bus-bars running from one end of the chassis to the other. This made a lot of sense, and actually was simpler to engineer than struggling to find the point on the chassis to which grid and cathode resistors could be soldered without their picking up ground loop hum. However, the ground loop problem in this day and age is more or less a dead issue; for commercial hi-fi, that is. Even the new super gain stereo preamps do very nicely hum-wise without bus-bars, using individual ground lugs at optimum chassis points.

Speaking of hum, there is still a bit of controversy about the need to operate high-gain preamps with DC powering their filaments. My personal opinion is that the whole DC filament question is a holdover from the days when there were no such things as special audio preamplifier tubes.

Several investigators have found that the hum from other causes (bad layout, ground loops, etc.) is likely to swamp out any gain realized from DC operation of preamplifier tubes. A simpler method of cutting down the hum in preamplifier tubes is to connect a potentiometer of about 100 ohms *across* the filament winding and then feed 20-50 volts DC to the center tap of the pot. Adjustment of this pot now simultaneously establishes a balanced AC ground point for the filament supply and saturates the filament with DC.

This DC saturation business is a little complicated, but the idea seems to be that if you raise the voltage level of the entire filament (with respect to the cathode), the AC ripple on the filament will then represent only a negligible portion of the field around the filament. The hum induced into the cathode circuit will then be minor. The 25-50 volts required for DC biasing of the filaments can be tapped off the power supply or taken from across the cathode resistor of the output tubes.

If you have enjoyed these evolution of audio remarks write and tell us so. We have other audio cobwebs we can sweep away if you would like us to.

# and Clinic

**Hi-fi questions are all answered by mail. If of general interest they will appear in this column.**

### Cartridge Shielding

*My cabinet is arranged so that my turntable and arm are directly above my amplifier. My cartridge seems to pick up hum from the power transformer. How do I go about shielding the cartridge? I don't want to rearrange my setup.*

*Charles Sporn, Detroit, Michigan*

You probably can't. Sometimes a sheet of iron (cut from a large tin can) installed beneath the turntable motor, and connected to the ground wire, will remove some hum. But even the best shielding material might not remove it all. Your best bet is to try a different cartridge. A ceramic or a low impedence cartridge probably will solve your problem.

### Speaker Wire

*A fellow I know uses shielded wire on his long loudspeaker lines. He says this is much better than regular wire. Is he right? What is the best wire to use in my system?*

*Ed Coblance, Columbus, Ohio*

Assuming normal hi-fi impedances of 4-16 ohms, your friend is quite wrong. For commercial lines, where the impedance goes up to 500 ohms, shielding is sometimes used on long lines, but even there it is not absolutely necessary. As a matter of fact, shielded wire can cause trouble. The best kind of wire is ordinary plastic-covered lamp-cord wire. This is a common item at hardware stores.

### Hum Control

*There is a hum control on my amplifier. When I adjust it I can't hear any difference. Is this normal?*

*J. Milligan, Pittsburgh, Pa.*

It could be. If you have a very high quality amplifier, a low impedance or well-shielded cartridge, and ideal conditions; it would be almost impossible to hear any difference. At the factory, the adjustment is made with instruments, not by ear. If you can't hear hum, or notice any change at full volume, with the selector switch in the "Phono" position, you've got a very good system, indeed. About the best thing you could do is set the control about mid-position and forget about it.

### Oiling Record Players

*How often should I oil my record player?*

*Paul Smith, Elizabeth, N. J.*

You'd probably be better off if you didn't. Unless the booklet that came with your unit shows exactly where and when to oil the parts, don't! It's possible to ruin the parts of the rubber drive system with oil. The expense of repairing such damage would far outweigh the cost of any wear and tear that might take place without the oil. Most units are made with a bearing material that is oiled at the factory for life.

### Changer Cleaning

*I cleaned my changer mechanism, and after I replaced the turntable, I noticed that there was a change in pitch once per revolution. I've changed the rubber drive wheel, but this does not help.*

*Robert Grayson, Falls Peak, Va.*

It wouldn't. From your description, I'd say you have a once-around-wow. Look on the inner rim of the turntable, and see if there is an irregularity, or something stuck there. Feel around the surface, and see if there's a dent. I hope you didn't drop the turntable platter when you were cleaning it. If you did, you may need a new turntable, for it's practically impossible to fix this.

*spotlight on:*

# 2-Meters and up

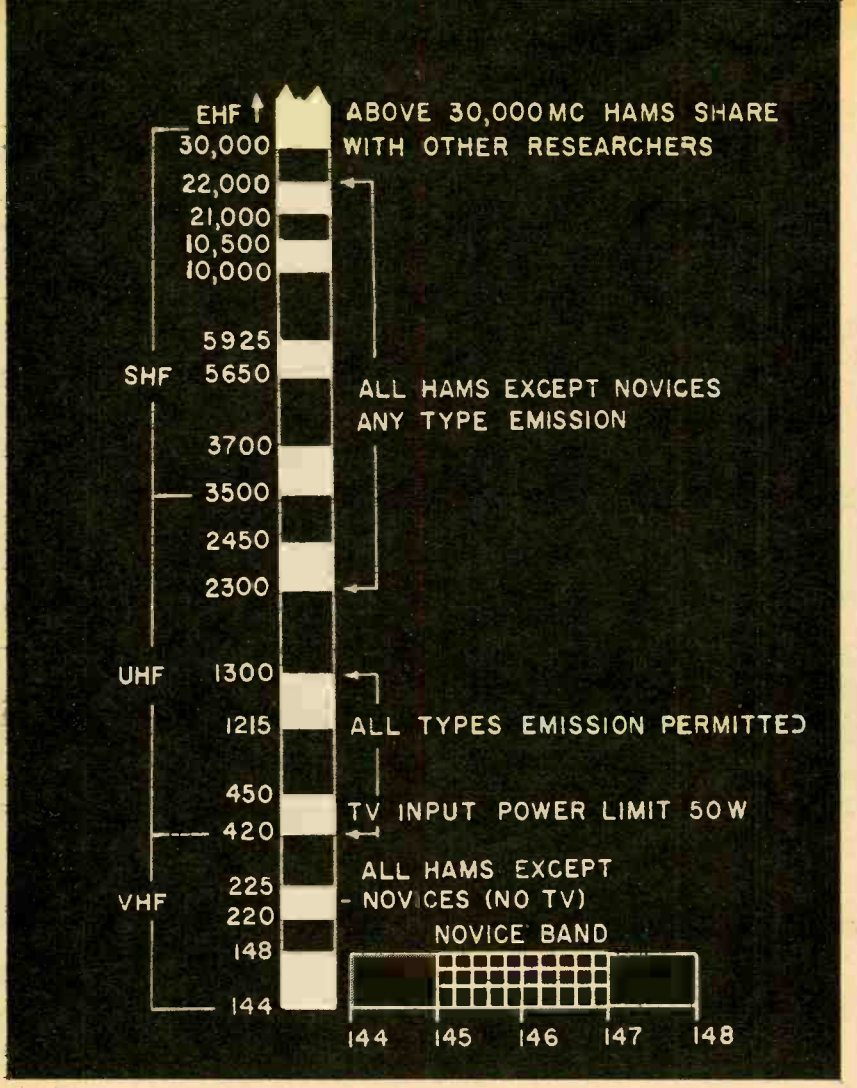
**By C. M. Stanbury II**

**A band where all hams can get together, some TV, experimentation in the upper reaches, and a future in space.**

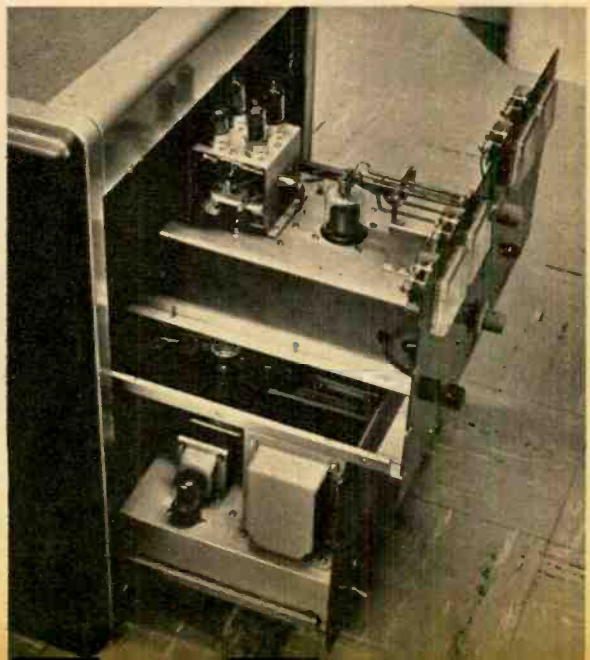
TWO meters is called the "real" VHF band because conditions found here closely approximate those found generally on VHF. The band (144-148 mc) lies almost in the center of the 30-300 mc range and like six meters, it is most useful for short range communication, with one notable exception which we'll cover later. Antennas are even smaller than those for six meters and almost any directional array may be chosen, even by the mobile operator. This is a happy situation familiar to other commercial and public service VHF users.

Reflection of two meter band signals via the F2 layer is extremely rare. Sporadic-E layer propagation is uncommon, but certainly not rare. At least a couple such openings occur every

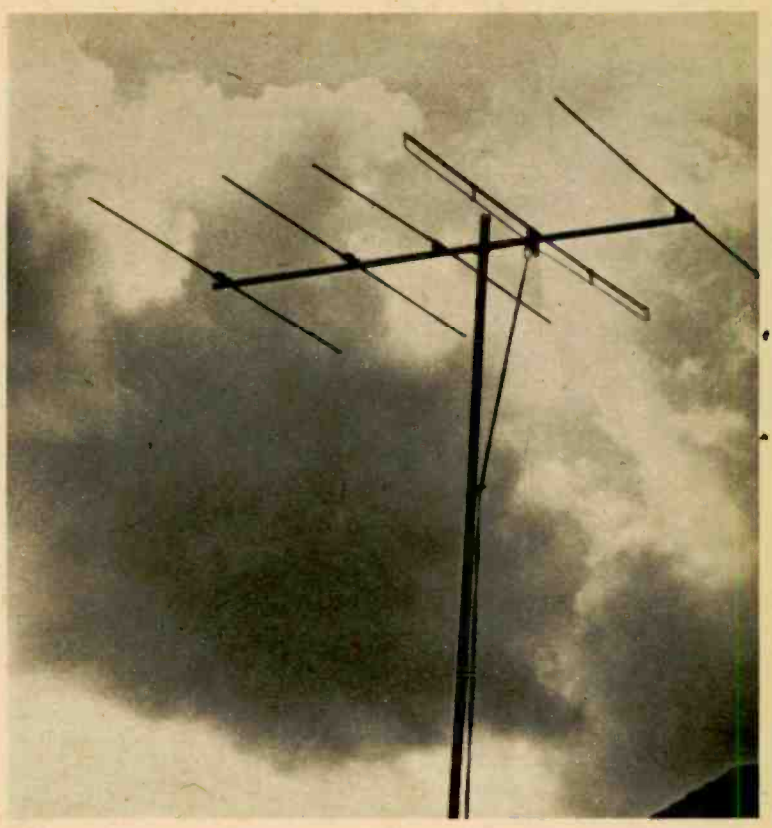
**Arnold Proner, W2OMU, goes video from Lewisboro, N. Y., on 432 mc with home brew gear, including camera. He has had QSO's with W2MMY in N.Y.C.**




**Two meter band between 145-147 mc is the only band where all hams can get together regardless of class of license. Amateur TV is permitted on all bands (white areas on chart) above 300 mc. There is an apparent "gentleman's agreement" on 420-450 mc band that amateurs using teletype and FM stick to those frequencies between 420-430 mc, leaving 430-450 mc to amateurs using television.**



**At right is Electron (Dallas, Tex.) model V-2050 Ling amateur TV transmitter. It delivers 30 watts of video-modulated RF carrier to antenna. The same company markets a complete ham television station for about $2895, including antenna and camera, but not including audio contact equipment. Audio contact can be maintained with hams' existing gear on six or two meter bands. W2OMU at left uses an FM subcarrier for audio which is 4.5 mc from the video. His total bandwidth is nine mc.**



**The elements of a two meter beam antenna are quite small and any number of directors in front of the driven element may be added. Shown here is Taco's model 5A2M antenna.**

summer. Normal atmospheric bending, a relatively important factor on the six meter band, is less effective here, but during the summer this is more than compensated for by "ducting," VHF's number one DX medium.

Ducting differs considerably from ionospheric propagation. In ionospheric propagation, the radio waves are literally reflected. This is also true of the Sporadic-E layer. But ducting occurs so near the earth that it may be considered a "waveguide" effect. As you may know, a waveguide (generally a hollow piece of "plumbing" which roughly resembles a ventilation system duct), can carry wavelengths no greater than twice its width. In ducting, the earth itself usually forms the lower boundary and an abrupt change in atmospheric conditions the upper limit. This upper limit is formed during an "inversion," when the temperature increases with height (the opposite is normal), and/or when there is an unusually sharp drop in the water vapor content of the air. The two meteorological phenomena usually go together. An inversion will often appear on a clear, calm summer night, a night without turbulence to break up the desired duct formation. It can also occur when warm and cold air masses meet to form a front. Ducting is so common in the summer and early autumn as to almost approach the reliable. Communications beyond the horizon is even possible during the daytime at this period of the year.

Again comparing the two meter band with six meters, there is very little long range DX during winter and spring and reliable working distances are somewhat shorter. But for medium-range DX and fairly reliable summertime coverage, 144-148 mc is somewhat superior to 50 mc. Just how much superior depends upon climate and terrain. Diffraction might carry a 50 mc signal around a mountain. It probably wouldn't do the same on this band.

### Everything Goes

Every kind of frequency modulation for CW or phone transmissions, any type of amplitude modulation, including facsimile (A4), but not television (A5) is permitted between 144-148 mc and in the 220-225 mc bands. While the dividing line between facsimile and TV is not very clear-cut, a moving (and therefore live) picture may not be transmitted via A4.

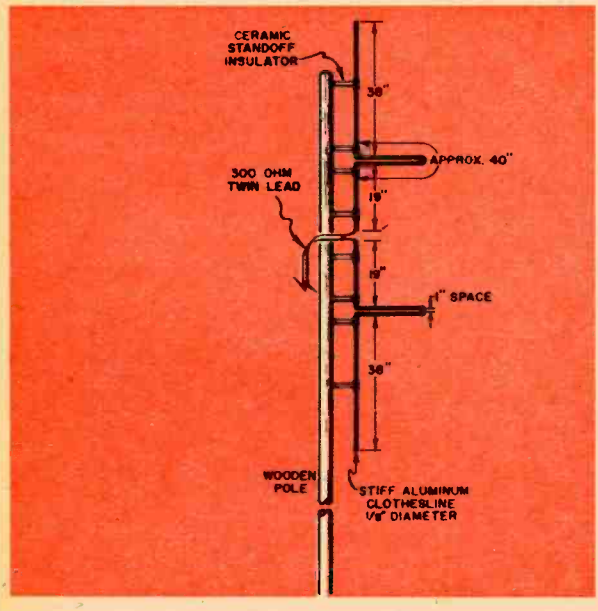
The Novice is permitted to operate on 145-147 mc, smack in the middle of the band. What's more, he may use any of the above emissions except facsimile. This is the only ham band on which the Novice may get away from pounding the key, but along with the many advantages, there is one major disadvantage for him.

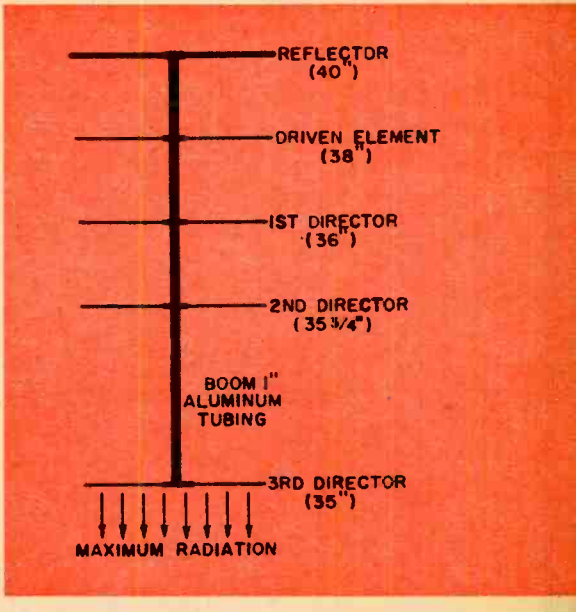
Construction experience is, of course, one of the plus features. The beginner may build for himself anything from a single-sideband exciter to the most complicated F2 radioteletype setup. But there probably won't be many Novice RTTY calls.

Next, FM operations. No extra power for modulation is needed and therefore FM phone almost approaches the economy of a CW transmitter. If he's going to use phone, FM is the most economical method, from a power standpoint.

However, phone operations sidestep the Novice's number one problem—the 13 wpm code test when his Novice call expires. This inescapable challenge can be met in just one way—practice and more practice. Obviously, if too much time is spent on voice work, the General Class exam will be flunked.

Last month we outlined a way out—the Technician license. This requires General Class technical know-how, but only 5 wpm. On two meters, Technician hams are allocated the same frequencies as the Novice, 145-147 mc, but with full power, in other words anything up to a kilowatt. As we mentioned before, the Technician Class was created for no such purpose, but rather for those interested in the technical side of radio, particularly VHF [*Continued on page* 122]




**Next to vertical and horizontal dipoles, simplest antenna for two meters is collinear array (left) of two half-wave elements vertically stacked and both fed in phase. It is bi-directional. At right is simple bay with parasitic elements. Most have at least four elements. A two meter antenna can be made by trimming TV Channel 6 yagi to sizes shown and feeding with 300 ohm twin lead.**

*El's money making careers in electronics*

# Silent Circuits Bag Burglars

By James Joseph

**Electronic sentry systems catch crooks red-handed, perform (for profit) many varied alarm functions.**

Even if would-be burglars have duplicate key, they could not avoid "proximity detector" in door which operates on hand capacitance to trigger silent alarm at the central office.

Jerry Linder designs and builds many of the electronic trapping devices his firm installs. Infrared beam alarm is at extreme right. The other units include popular proximity detector.

BACK in 1953, Jerry Linder (then only 22 years old) and two school chums—Tom LeNay (fresh out of college with an electrical engineering degree) and Ralph E. Fiedler—turned professional man-trappers. They chipped in $300 apiece and launched American Fire Dispatch, Inc., an organization dedicated to catching crooks electronically for profit.

Today, AFD fields nine radio-rigged "prowl" cars, keeps round-the-clock electronic vigil for more than 800 clients, maintains a central office hooked by direct line to police headquarters —and yearly grosses more than $200,000. In seven years, AFD's electronic man-traps have nabbed more than 300 badmen, caught dozens of crooks red-handed.

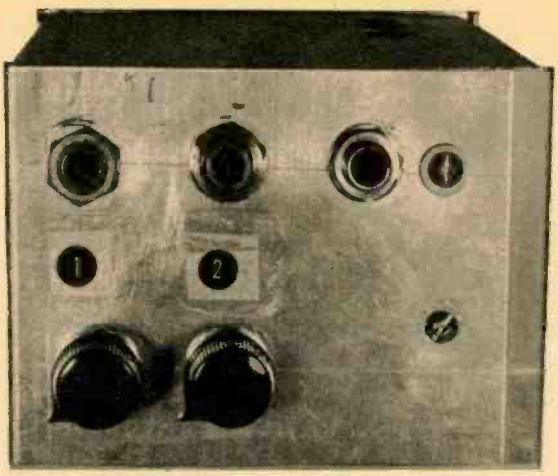
"And proved," adds Jerry, "that silent circuitry is the greatest bagger of burglars."

Hundreds of AFD ultrasonic installations flood clients' stockrooms with inaudible, burglar-detecting high frequency "sound." Scores of clients' safes and strong boxes are rigged with "capacitance detectors"—electronic devices which signal AFD's central office if, after business hours, a clandestine hand comes within inches of safe or cash register. Countless AFD invisible infrared beams—battery-powered and transistorized—booby trap premises that house liquor, edibles, appliances . . . and military secrets.

For such round-the-clock electronic protection—against fire, theft and hold-ups—clients pay anywhere from $18 to $200 a month.

Explains Jerry, "Electronics as a cop isn't new, of course. What's new is our dedication to circuitry, which makes it simple for us to do what older, mechanical devices simply can't do: nab a guy while he's still at his dirty work. And [*Continued on page* 128]

**Ultrasonic transmitter, mounted high on wall of camera store, below, fills the store with "silent sound." Any movement after the store closes for the night is detected and an alarm is sounded. Store was burglarized twice in one month before system was installed. Right, AFD has nine radio-equipped cars to nab thieves. Linder checks in with one of firm's salesmen standing by.**

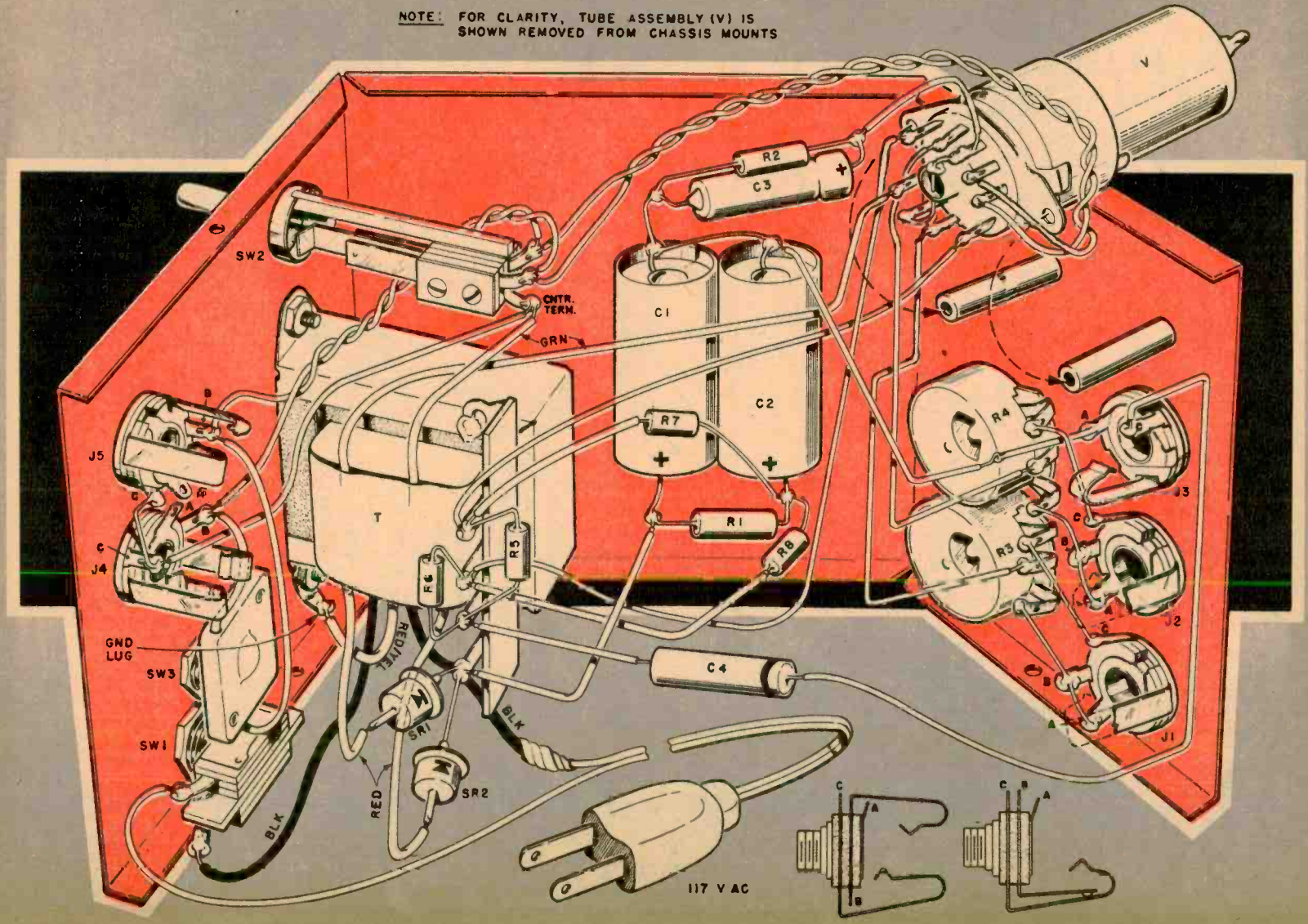



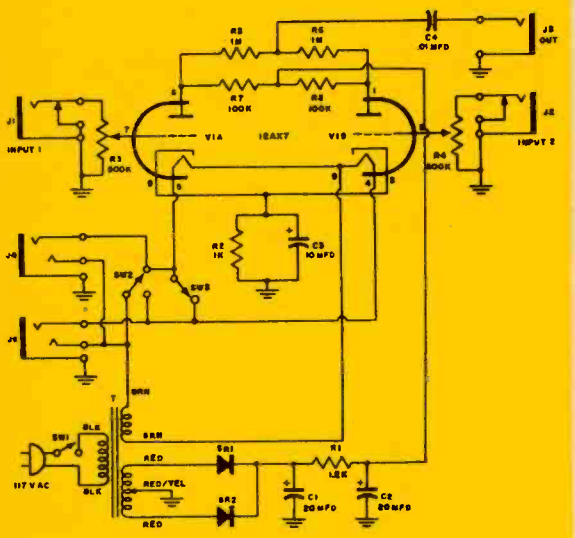
# Automatic Mixer-Cross Fader

**Has an expert audio engineer built right in.**

**By Steve Hahn**

IF you jazz up your home songfests, movies or slide shows with tape recorded narration, you probably would also like to add background music or occasionally cross-fade from talk to music. Well, you don't have to be an expert audio engineer or an octopus handling elaborate mixing controls. For about $10 you can build a control unit that will handle any two signal sources, cross fading and mixing them *automatically* to preset levels.


NOTE: FOR CLARITY, TUBE ASSEMBLY (V) IS SHOWN REMOVED FROM CHASSIS MOUNTS
V
R2
C3
SW2
CNTR. TERM.
GRN
C1
C2
R7
R4
J5
T
R1
R8
R5
R6
J3
J4
C
GND LUG
SW3
RED
WHT
C4
SR1
BLK
J2
SW1
J1
RED
SR2
BLK
117 V AC
C
A
B
C
B
A




**Mixer-cross fader schematic is shown with SW3 in mix position. For fades, SW3 is open.**

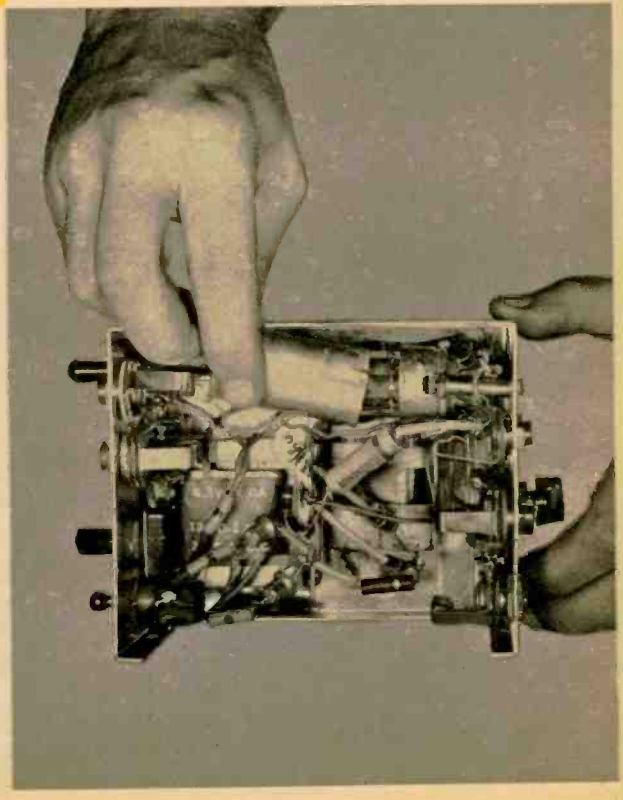
The unique cross fading circuitry is extremely simple and completely click-free and smooth. Cross fading is accomplished by using a dual-triode audio tube with a dual filament. By supplying AC to either of the filaments, each half of the triode can be energized separately. Thus, a switch inserted in the filament circuit which turns one filament on and the other off, can be used as an automatic cross fade control. The time of the cross fade will vary a little from tube to tube, so try a number of tubes in order to obtain a variety of timing. On the average, however, a complete cross fade cycle takes from five to eight seconds.

In addition to straight cross fading, a third very useful feature can be added by means of a small outboard control box. In many recording sessions, you may want the faded channel to "die" to a preset level and continue as background. (A typical example would be music continuing at a low level, under narration.) You can do this by inserting a rheostat (R9) in series with the filaments of the fading tube. The jacks (J4 and J5) are wired in such a manner that when R9 is plugged into either one, it is in series with the particular filament involved.

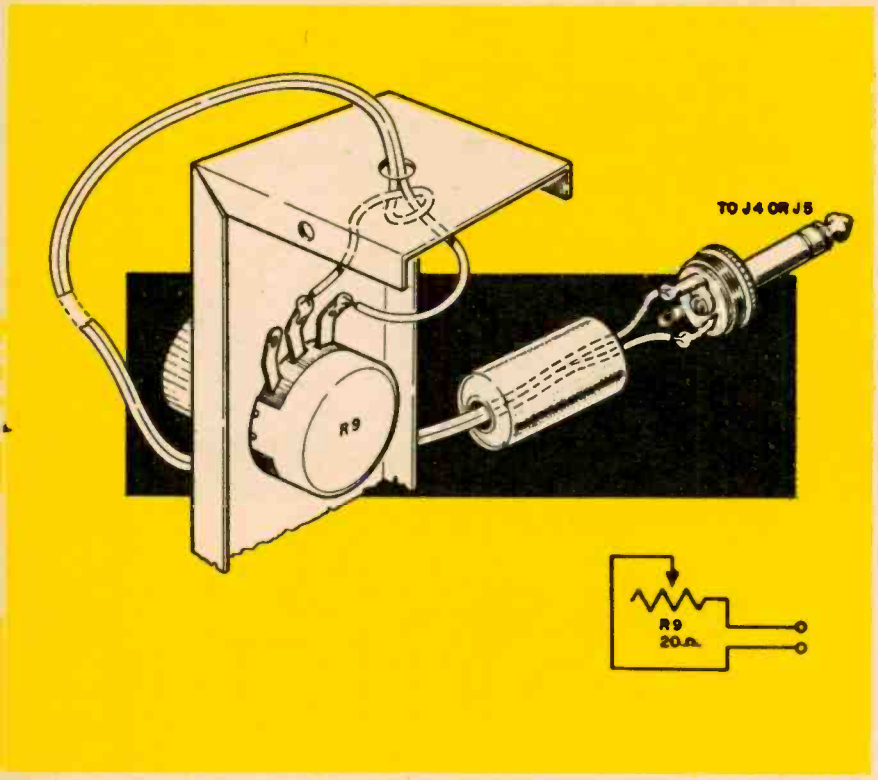
Let's see what actually happens when the rheostat R9 is plugged into jack J4. Under this condition, when the cross fade switch (SW2) is in the Channel 1 position (up) R9 is shorted out and the Channel 1 filament receives its full voltage.

Channel 2 filament is open, hence its signal does *not* appear at output jack J3. When the cross fade switch (SW2) is thrown to the Channel 2 position (down), the short across R9 is removed and R9 now sets the filament voltage (and therefore the audio output to J3) at a new lower level.

In the meantime, the Channel 2 fila-



**Note stand-off mounting of 12AX7 shielded socket. All controls and jacks mount on sides.**




**Optional background fader circuit uses three-contact plug. Note that normally grounded section (body) is not used.**

ment now receives its full voltage and the signal from this channel comes through loud and clear to J3. We can now see how it becomes possible to fade from one channel to another and still retain either channel as a background signal. Using R9, the level of the background signal can be controlled from barely audible to full strength. With R9 out of the circuit the unit operates as a straightforward automatic cross fader.

## Construction

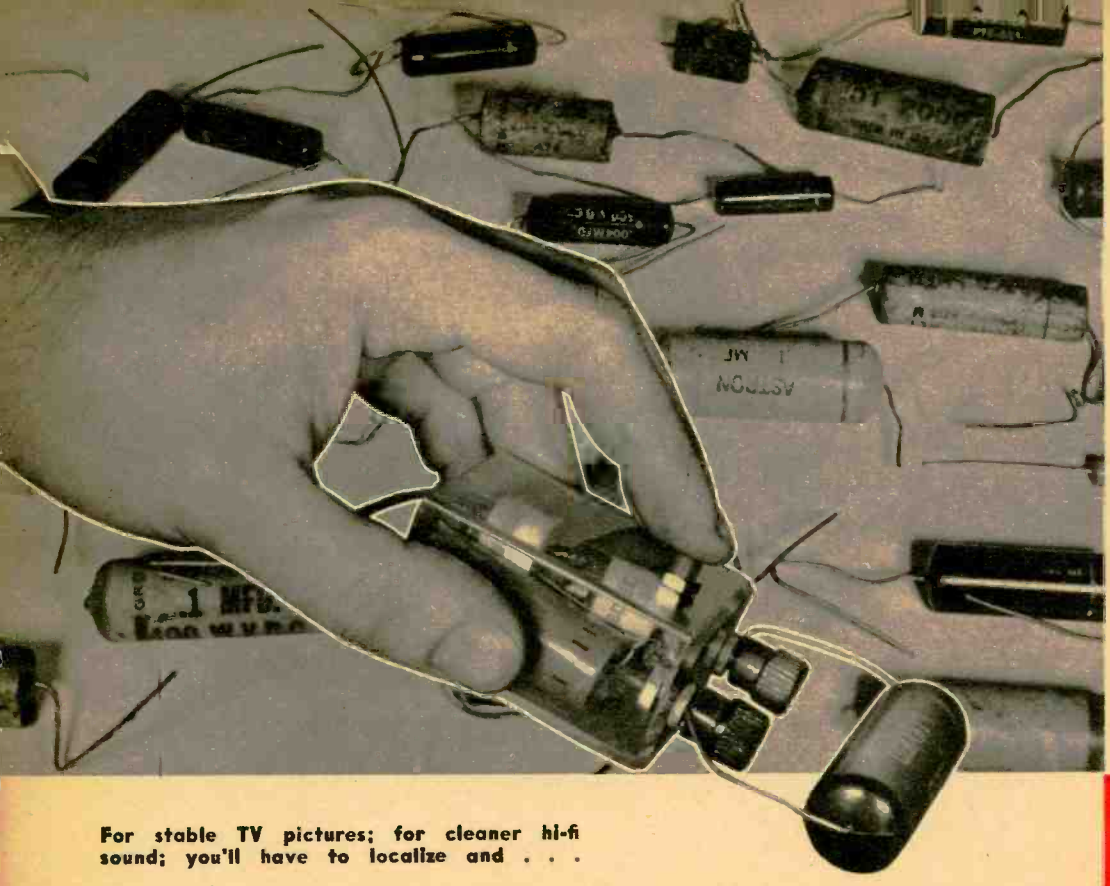
The entire unit, power supply and all, can be built into a 5" x 4" x 3" chassis box. The socket for the tube is mounted on 1" metal stand-offs. The background level jacks (J4 and J5) and control R9 are optional and if the background fade feature is not desired, they may be omitted. If used, J4 and J5 should be the 3-wire type since the tube filaments are not grounded and both leads are "hot."

The automatic cross fade switch (SW2) is a standard single-pole double-throw lever type which makes for easy handling. Switch SW3 determines whether the unit serves as a mixer or a cross fader.

Three ⅛" holes were drilled in the cover plate, above the tube, V1, to allow heat to escape.

PARTS LIST

*Resistors*—all resistors ½ watt, 10%
R1—1200 ohm
R2—1000 ohm
R3,R4—500,000-ohm volume control. (audio taper)
R5,R6—1 Megohm
R7,R8—100,000 ohm
R9—20-ohm, 4 watt wirewound potentiometer (see text)
*Capacitors*
C1,C2—20 Mfd @ 350V electrolytic
C3—10 Mfd @ 25V electrolytic
C4—.01 Mfd @ 400V paper
*Switches*
SW1—SPST toggle (on-off)
SW2—SPDT lever (Switchcraft 1000 or equiv.) (Cross fader)
SW3—SPST rotary or toggle (selector: Cross fade/mix)
V1—12AX7, 7025 or ECC83 tube
T—Transformer: Primary: 117 Volts, Secondary: 125-0-125 @ 25 ma, 6.3 V @ 1A (Stancor PS 8416 or equiv.)
SR1,SR2—117-volt selenium or silicon diodes, 10 ma or higher rating
J1,J2—closed circuit phone jack (input)
J3—open circuit phone jack (output)
J4,J5—3 wire phone jacks (Switchcraft C12B)
Misc.—Chassis box 3"x4"x5", Chassis box 2"x2"x4", 9-pin shielded tube socket, knobs, plugs to match the above jacks, etc.



**For stable TV pictures; for cleaner hi-fi sound; you'll have to localize and . . .**

# Stop That Leak!

**By Ernest Wayland**

**Handy leakage checker locates bad capacitors.**

THE "leak" referred to is not the annoying drip-drip of the kitchen faucet, but the cause of the maddening rip-rip of your television picture. The culprit usually responsible for a tearing TV picture is leakage in one of the dozen or more capacitors in the horizontal oscillator, AFC, or sync. circuits.

If your hi-fi or public address amplifier suddenly starts to "gargle" at you and everything from it sounds as though it were filtered through a barrel of mush, you can bet that's the fault of a leaky coupling capacitor also.

The leakage checker described below is not meant to replace an *in*-circuit checker or a larger qualitative-quantitative analyzer. But, it *is* handy for the tool box or service kit. Furthermore, it's inexpensive to construct, non-critical in assembly, and is just about the fastest tester around. As an added bonus, the capacitor under test is checked, not only for leakage, but for an open and shorted condition also.

Based upon a standard voltage-doubler circuit with a neon

lamp in series with its output.

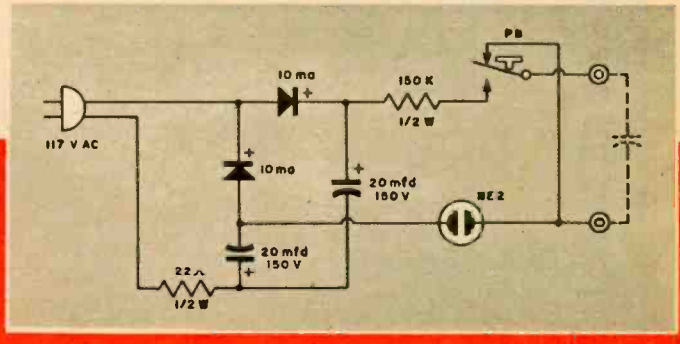
Follow the diagram carefully. Note the polarities of the electrolytic capacitors and the two cartridge rectifiers and double check that you've wired them in their proper electrical relationship with each other.

You *can* get a shock by simultaneously contacting both output jacks or by touching the leads of a charged capacitor; but in both cases the current is limited to a safe value by the 150,000 ohm resistor.

Capacitor testing is a 30-second operation. It's only necessary to touch the questionable paper, mica or ceramic capacitor (.00025 mfd or larger) to the terminals. The neon lamp will blink once at the moment of contact as an indication of the capacitor's charging current. If no blink is seen, the capacitor is probably open.

If the neon bulb stays lit, the capacitor is shorted. Pulses at a 5-per-second or faster rate indicate leakage.

Certain capacitor circuit applications, cathode by-pass for example, are not as critical as regards leakage. Other circuit components, such as coupling capacitors are usually very critical and even a slight amount of leakage will cause a positive bias of the following stage and result in distortion. Most capacitors will show slight leakage at a 1-per-second pulse rate or less, and are useable.



# Let's Dress Up The Ham Shack


This all-band CW and phone "shack" belongs to Hap Helgesen, W7AIB. Non-matching gear is neatly and conveniently placed, with test gear at left. Certificates are properly framed.

Truly deluxe shack with matching Collins "S" line gear is shown below. While equipment is expensive, nice touches like large, colorful wall map of world over operating position are not.

**By Howard S. Pyle, W7OE**

## Don't make excuses about how your shack looks. Do something about it. Here are some sensible tips.

WHAT did you do with your new high fidelity rig? Put it in some dark, cob-webby corner of your basement where you could sit on a nail keg and listen by the hour? You did *not!* You probably gave it the spot of honor in your living room where you could listen in comfort and proudly display it to your guests.

But with as much—and often more—invested in amateur radio gear, too many hams relegate their attractive equipment to a wobbly, discarded kitchen table, an old packing box, or even a couple of planks laid on saw-horses behind the furnace!

Perhaps the hypothetical cases cited above are a bit exaggerated, but let's take a critical look at *your* shack. Consider first the environment. If in a basement, garage or other unfinished space, are you caged in with raw, unpainted studding with exposed and unpainted ceiling joists overhead? A little plywood, wallboard or any number of inexpensive wall coverings, plus a few hours with a saw and hammer and a quart of paint and you've made the "wood-shed" come a lot closer to being fit for human habitation. If pennies count, even a coat of good old-fashioned whitewash on and between the studs and joists will make a remarkable improvement.

That's a start. Your own eyes will suggest many more ways in which to make the shack more attractive, such as molding in the corners and some linoleum, tile, or rug on the floor to contrast pleasingly with the walls and ceiling. [*Continued on page* 125]

**Old Timer Ed Raser, W2ZI, with a little planning has managed to set up much surplus and commercial gear in a small corner. Everything he needs to handle traffic is at his fingertips.**

**A pleasant ham shack is a pleasure to work in, a pleasure to visit. This is Chester Thompson's, W8RE. Central Electronics xmtr, far left, and National NC-300 are mainstays of the shack.**


## *El report on an*

# Integrated Stereo Amplifier

TODAY'S big boom in stereophonic reproduction has naturally created demand for new and different hi-fi equipment. To meet this demand, Lafayette—a well known name in high fidelity—introduced a 36-watt stereo amplifier kit—model KT-236.

The KT-236 is an "integrated" unit that saves space and money by including two complete 18-watt power amplifiers and pre-amplifiers on one chassis. All for a cost of $69.50.

At first glance, construction of the KT-236 seems like a mammoth project. The manual lists nearly 300 separate steps to be "checked off." However, the manual has been so well worked out that every step is clear and easy to follow. Result? This is one of the easiest to put together kits we've built.

In fact, the KT-236 manual is as near to foolproof as we've seen. Construction time for this unit was about twenty hours which is quite good considering that there are two complete amps and two preamps to build. As this reviewer is not particularly speedy as kit builders go, you can consider this time as average for most people.

Another thing we like about this kit is the spacious layout of the chassis. There's plenty of room to work in—none of those tight corners that only a midget's fingers can manipulate in. The control panel and its switches and pots is also readily accessible as it's located on top of the chassis with open air surrounding connecting


points. A pair of printed circuit plates simplify the wiring.

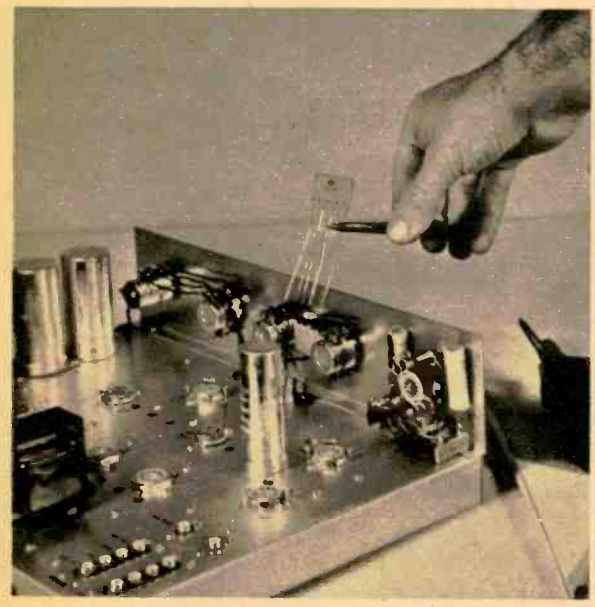
A moment of disappointment came when we finished building the unit and hooked it up for testing. There was an excessive amount of hum. I rechecked my wiring and located what could be called a "flux joint." Let this be a warning to kit builders; any terminal post or tie lug that has two or more wires soldered to it should be checked carefully to make sure that the solder has flowed down and covered *all* the wire ends. Frequently the lowest wire will be held in place by flux alone.

Once the hum problem was licked, the unit behaved properly in every respect. All controls responded as they should and on the basis of pure listening tests the sound was judged to be quite clean and transparent. There's adequate power, too, to handle moderately inefficient speakers and low magnetic cartridges.

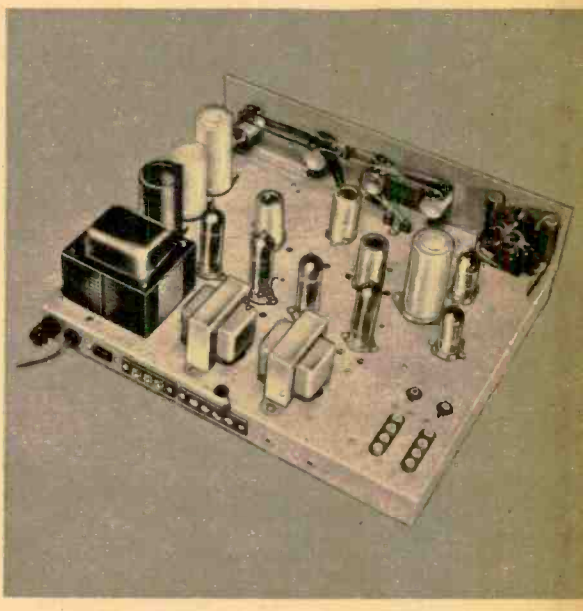
A flexible unit, the KT-236 offers just about every control needed to cope with today's stereophonic reproduction, i.e., volume-balance controls and handy slide switches for phase *and* channel reversal.

A unique feature found in only a few other units is the "blend control." This control provides continuously variable channel separation from full monophonic to full stereo, thereby permitting you to select just the right amount of separation to fit your particular room acoustics and any peculiarities of the recording.

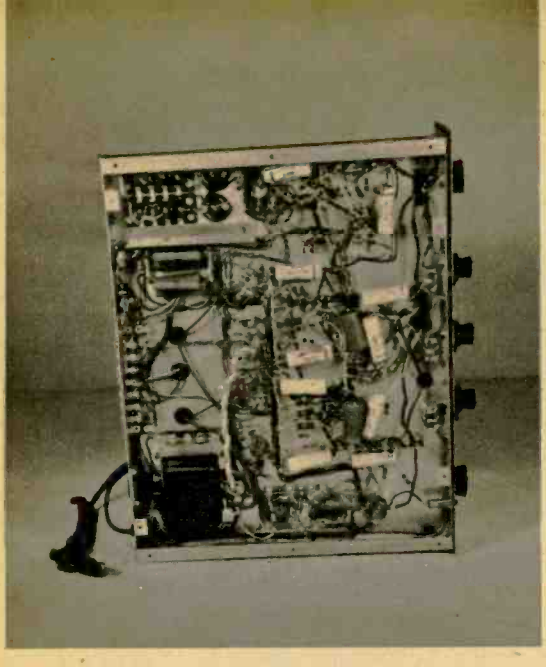
In summing up, the Lafayette KT-236 is a compact unit that is housed in an attractive cabinet. And if you have twenty hours to spare for building, it will afford good stereo reproduction when



**A pair of printed-circuit plates are used in the dual channel tone control circuits. Feedback circuitry is used for both bass and treble.**

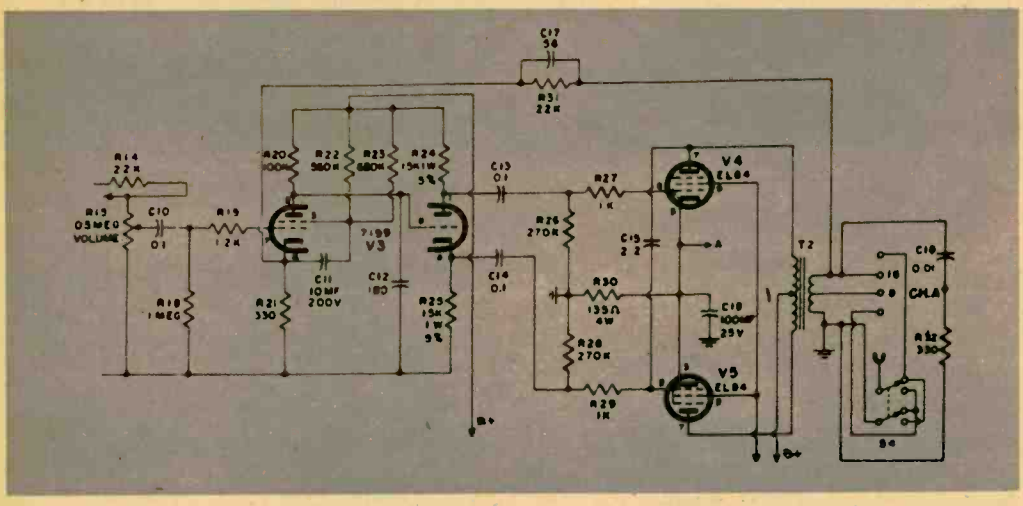


**Open layout of chassis contributes to ease of wiring. Note the four EL84 output tubes in front of power and output transformers.**



**Point to point wiring to parallel mounted terminal strips is used in the construction when the circuit layout and design permits.**

**Schematic below shows one channel's power output stage. New audio pentode-triode tube (7199) is used in a direct-coupled voltage-amplifier split-load phase inverter circuit feeding the output tubes.**



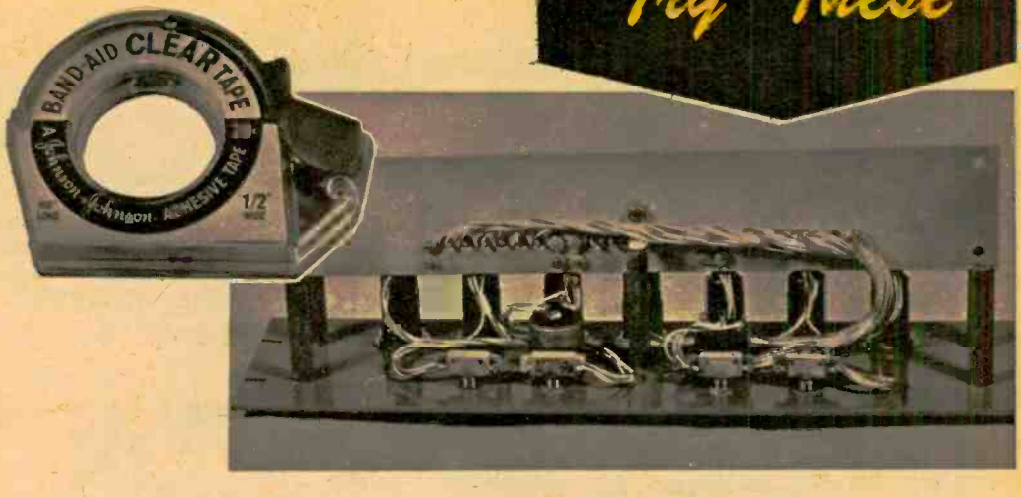

used with associated equipment of comparable quality. As the Technical specifications reveal (see below), this unit performs well within its price range, *EI* rates the Lafayette KT-236 kit a Good Buy.

## TECH SPECS

Our technical checks revealed rigid adherence to the Lafayette instruction manual specifications. At 1 kc, the wattage output of each channel tested alone was within 2 db of 18 watts. A 10 kc square wave was reproduced cleanly with a minimum of ringing and rolloff. As was suspected from the relatively small output transformers, the full 18-watt output could not be sustained down at the low frequency end, but the 12 watts at 30 cycles that were obtained reflected credit upon the Lafayette design and the quality of the components used. Each channel of the KT-236 will provide adequate drive for moderately low efficiency speakers. Monophonically connected, it will easily handle a low efficiency AR-1 or the equivalent.

The gain of the preamp is more than adequate for any of the low output stereo phono pickup cartridges.

# Try These




## Cabling Tape

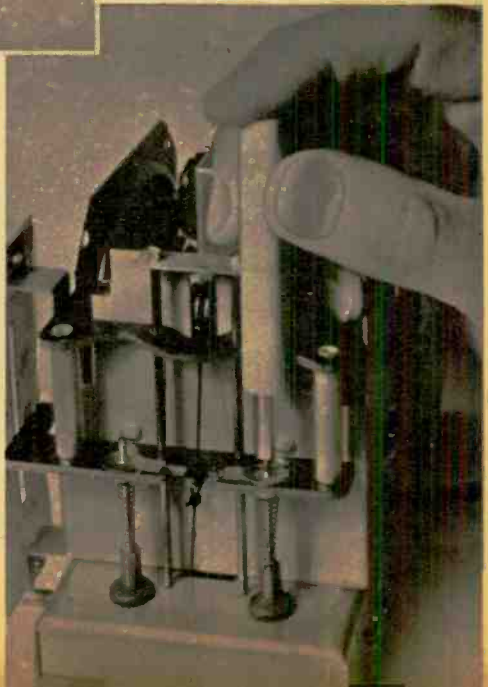
**The transparent tape shown in the handy dispenser is ideal for cabling wires. Stronger and more adhesive than ordinary plastic electrical tapes, it can be used to make neat wiring harnesses. Cut tape in short lengths.**


## Painted Gun Tips

**Printed circuit paint daubed on your soldering gun tip at the point where electrical contact is made with the gun will result in maximum soldering tip temperatures and top soldering efficiency at all times. Helps keep tips tighter too!**

## Tuner Alignment Tool

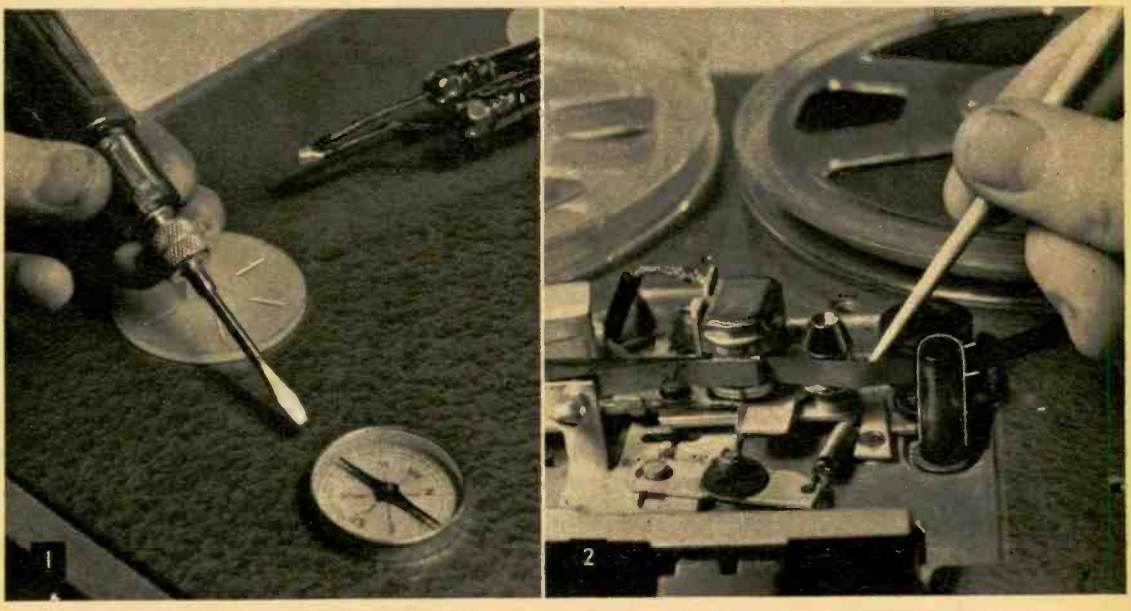
**The tool pictured at right is made to fit slug screws having flat ends, but can be modified for slotted-end screws as well. To make one: handle requires a three or four inch length of ⅜" diameter plastic rod or wood dowel. The tool bit is a 1½" length of metal tubing cut from an empty ballpoint pen refill. Drill a hole in one end of the handle about ¾" deep using a #31 drill, and after adding a bit of glue, force the tube into the opening. A pair of pliers used to flatten the end of the tube for proper fit will complete the job.**



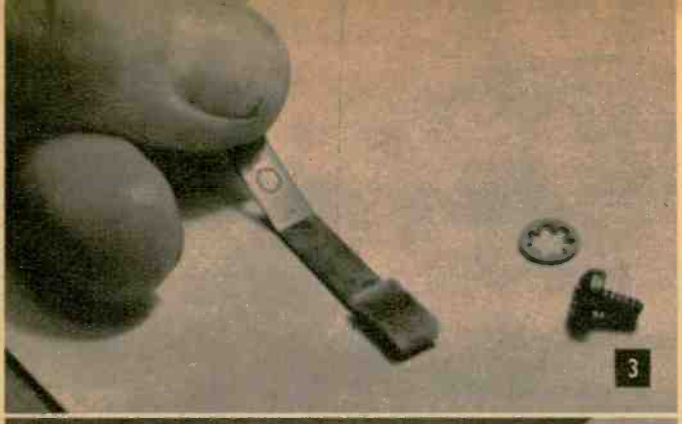
# Tune Up Your Tape Recorder

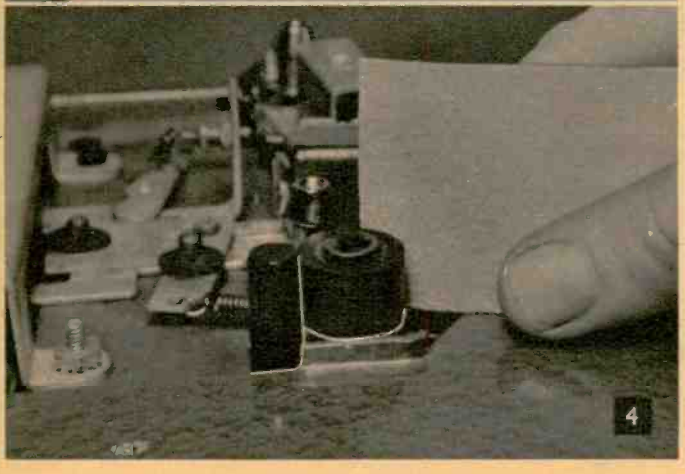
HAS your tape recorder been working erratically lately? Perhaps it is just trying to tell you that it needs a tune-up or spring tonic. If you neglect to give your recorder the occasional care and attention necessary for every machine, you can expect squawks, squeals, and squeaks in return. Follow these simple step-by-step procedures for cleaning and tuning-up.

By John A. Comstock



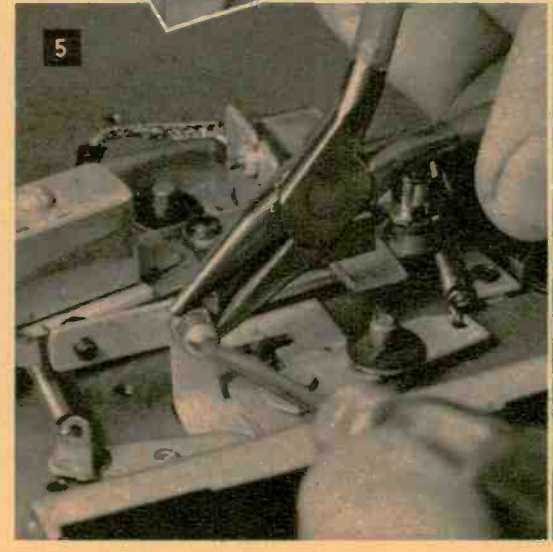

**1—Before using tools near recorder's head, test for magnetism with a compass. Demagnetize tools that deflect compass needle. 2—Check head alignment by pressing lightly on tape between head and capstan while controls are on playback. If treble output improves by downward or upward pressure, align head. Place shims under head if needed. Check maker's head alignment data.**

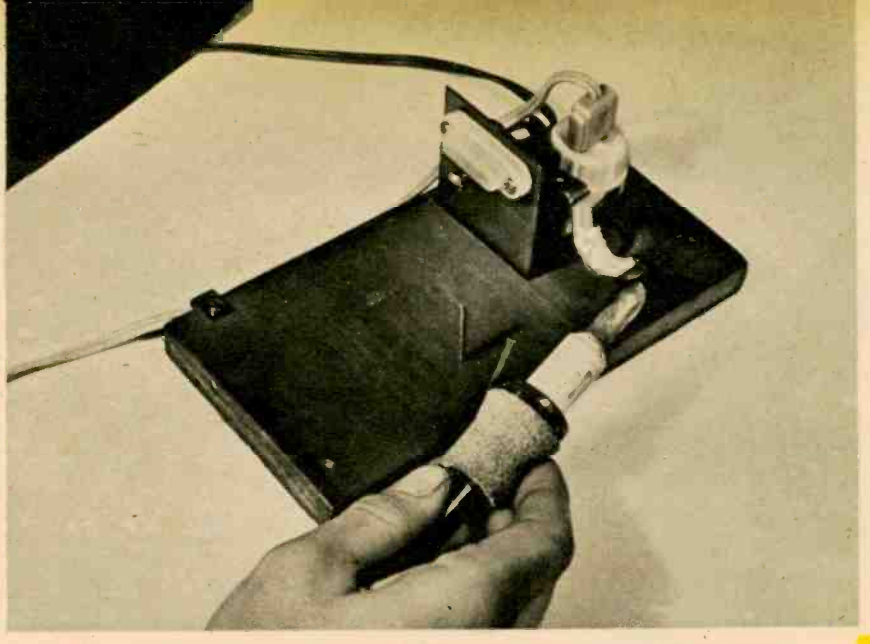



3—Remove pressure pad spring and replace felt pads if they are excessively worn. Substitutes may be cut from an old felt hat. 4—If drive wheels are glazed and pitted, a light application of medium-grit sandpaper while they are turning will uncover fresh rubber. Caution: Do not grind away too much or you will need new wheels, negating all your efforts.

5—Failure of pressure pads to hold recording tape in intimate contact with head will result in background hiss and erratic output. Adjust pressure pad spring for solid but light pressure. 6—Apply a drop or two of oil to bearings at the base of the capstan. A strip of plastic tape around the drive wheel will protect it. All moving parts should be lubricated sparingly.



**Completed stand is shown above with the soldering iron removed. White patch on lever (asbestos pad) helps to protect Micro-Switch from heat.**

# Heat Control Soldering Iron Stand

**By Ernest Kaye**

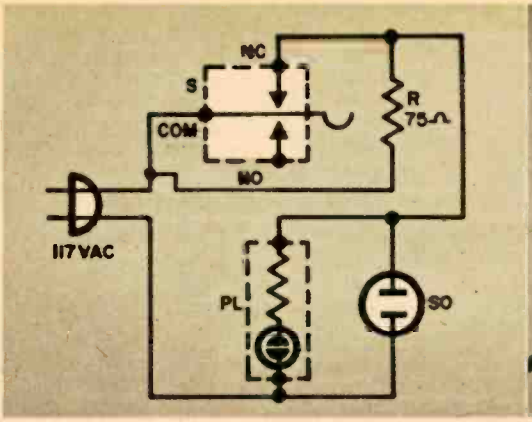
## Simple $3 device avoids overheated soldering irons.

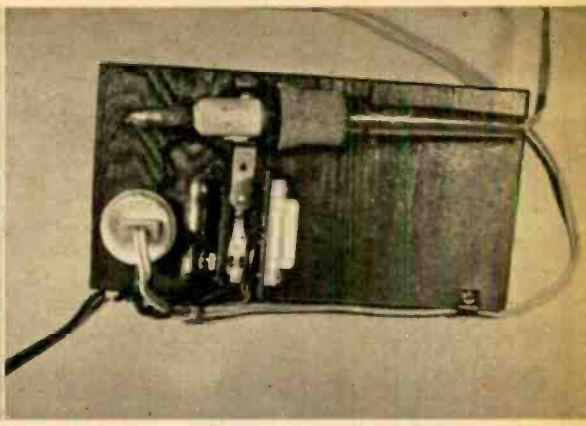
SOLDERING guns first appeared on the electronic scene about 1948. They caught on rapidly and for a while it looked as though the standard soldering iron was going to join the 01A tube in electronic oblivion.

In the past several years, however, a resurgence in favor of the soldering iron has occurred. This is due in part to the increasing use of miniature electronic circuits requiring an iron of high heat, light weight and low cost.

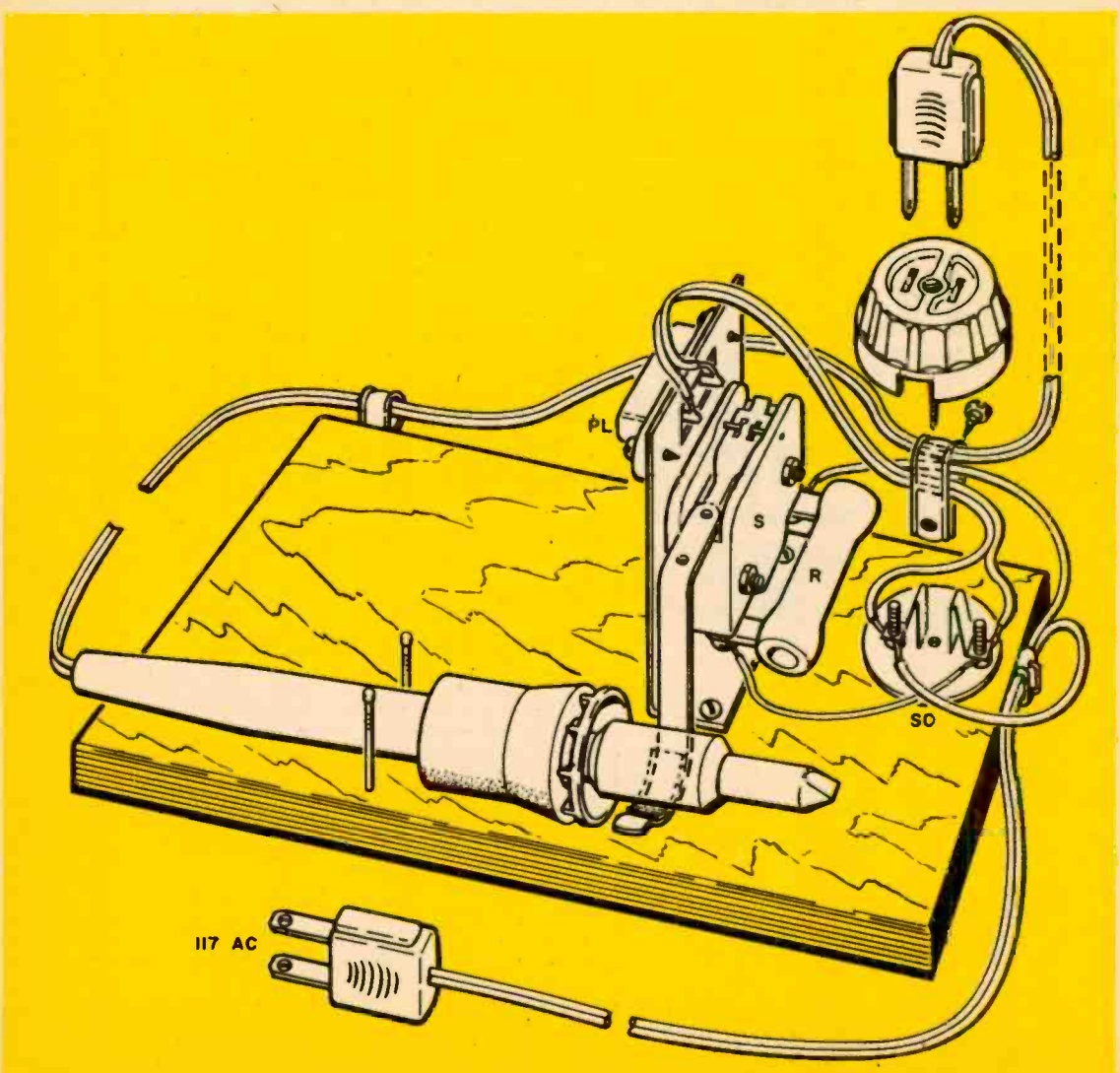
The author does not wish to take a stand favoring one type or the other; both have their uses. For intermittent use in jobs like radio and TV repair, nothing beats the soldering gun. When off, it doesn't eat up current and its two to four second delay before it reaches operating heat won't bother anybody. On the other hand, in kit building when you want the iron hot each time you make a joint (and you make them one right after another) there is nothing like a lightweight soldering iron.

The early miniature irons didn't throw out enough heat to make them as generally useful as they might be. You had a hard time if you had to solder a connection directly to a steel chassis. The guns didn't win any honors at this job either. However, with the introduction of the new high-heat tips, chassis connections are a cinch, but other problems pop up. The high-heat irons run just as hot at rest and their tips tend to oxidize.



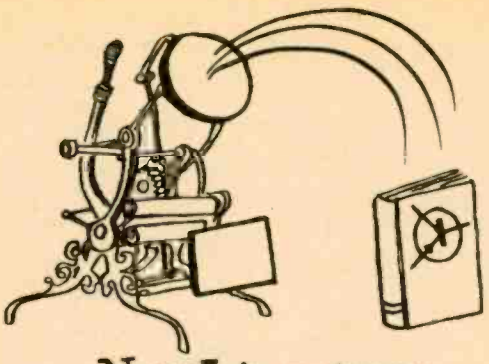



A 75 ohm, 20 watt, wirewound resistor placed in series with the soldering iron provides the necessary 20 volt drop and prevents iron tip oxidation.



The solution to overheated high-heat irons was found in the design of a soldering stand with a switch that cuts down on the applied voltage when the iron is at rest. Almost any Micro-Switch which will take a lever will do in this application. Although a type "W" was used in the author's model, the surplus markets have dozens of different types at less than a dollar which would be suitable. The switch must be a single-pole, double throw type. A 75-ohm, 20 watt resistor is wired across the switch from the common lug to the normally closed (N.C.) lug. When the soldering iron is resting in its stand and depressing the switch lever to its open position, the resistor is inserted in series with the iron and provides a drop of about 20 volts. The iron will then stay at a temperature somewhat lower than normal but spring back to full heat almost instantly when it is lifted off its stand. The neon pilot light assembly wired across the outlet is a valuable accessory in that it prevents you from leaving the iron on overnight.





# New Literature

***EI* author Howard S. Pyle,** W7OE, has just written "ABC's of Ham Radio," sub-titled: "How to Get Your Novice License." It is chock-full of well-organized, well-explained ham information designed to start the would-be ham off on the right foot. Author Pyle has over 50 years of hamming, writes with a welcome sense of humor. The soft-cover book sells for $1.50 from Howard W. Sams, 2201 E. 46th St., Indianapolis, Ind. . . . . The second edition of Lafayette Radio's **Semiconductor Directory** is now out. It has a new section on tunnel diodes and a price list. Free from Lafayette at 165-08 Liberty Avenue, Jamaica 33, N. Y. . . . . **"Tape Recording Head Reference Guide"** is a small bulletin selling for 50c from Robins Industries Corp., 36-27 Price Street, Flushing 54, N. Y. Contains cross-referenced data, specs and illustrations of recording and playback heads and erase heads. . . . . **"99 Tape Recording Terms"** is a free glossary of high fidelity and tape recording language issued by Minnesota Mining and Manufacturing Co., Dept E9-520, 900 Bush Avenue, St. Paul, Minn. . . . . More than 150 stereo-audio accessories are listed in the 1960 **Audiotex Manufacturing Co. catalog.** It includes many maintenance items for records, tape recorders, record changers, etc. The catalog is free from 400 S. Wyman St., Rockford, Ill. . . . . A 33-page **"Audio Designers Handbook"** is available from Amperex Electronics Corp., Hicksville, N. Y., at $1.50 each.

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**Mechanism Only:** Less cartridge, base and cables. Model AD-30, 8 lbs., . . . . . **$22.95**

AA-50 **$79.95**

### HI-FI RATED 25/25 WATT STEREO AMPLIFIER-PREAMPLIFIER KIT (AA-50)

A complete 25/25 watt stereo power and control center (50 watts mono) . . . 5 switch-selected inputs for each channel . . . new mixed center speaker output . . . stereo reverse and balance controls . . . special channel separation control . . . separate tone controls for each channel with ganged volume controls . . . all of these deluxe features in a single, compact and handsomely styled unit! Five inputs for each 25 watt channel are provided: stereo channel for magnetic phono cartridge (RIAA equalized); tape head input; three high level auxiliary inputs for tuners, TV, etc. There is also an input for monophonic magnetic phono cartridge, so switched that monophonic records can be played through either or both amplifiers. The automatically mixed center speaker output lets you fill in the "hole-in-the-middle" found in some stereo recordings, or add extra monophonic speakers in other locations. Nearly all of the components are mounted on two circuit boards, simplifying assembly and minimizing possibility of wiring errors. Handsome cabinet features new "visor" effect, with vinyl-clad steel cover in black leather-like texture with gold design. 30 lbs.

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AA-20 **$34.95**

AA-30 **$45.95**

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Although these two new Heathkit models are designed as companion pieces, either one can be used with your present stereo system. The preamplifier (AA-20) features 4 inputs in each stereo channel (RIAA "mag" phono, "xtal" phono, and two auxiliary inputs). A six-position function selector switch gives you instant selection of "Amplifier A" or "Amplifier B" for single channel monophonic; "Monophonic A" or "Monophonic B" for dual channel monophonic using both amplifiers and either preamplifier: "Stereo" and "Stereo Reverse". Self-powered. (AA-20) 8 lbs.

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Procedures for checking home appliances and automobile circuits are included with the kit. The EK-1 will serve as a prerequisite to following Heathkit Educational Kits. Get started NOW in this new and exciting series. 4 lbs.

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Dependable portable entertainment wherever you are —wherever you go! Choose the gleaming, two-tone molded plastic model or the handsome simulated leather-and-plastic combination—both feature a gracefully curved grille in smart beige plastic. The XR-2P complements the handsome grille with a mocha colored case of high-impact plastic, while the XR-2L encases the grille in sun tan color Sur-o-Lon simulated leather. Vernier tuning control gives you smooth, precise station selection. Six Texas Instrument transistors are used for quality performance and long life; a large 4" x 6" PM speaker provides "big set" richness of tone. Ready to play after simple assembly—transformers prealigned. Six flashlight batteries used for power (500-1000 hrs.) (batteries not included).

**HW-19** (10 meter)
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**Vibrator Power Supplies:** VP-1-6 (6v.), VP-1-12 (12v.). 4 lbs. kit; **$8.95** ea., Wired; **$12.95** ea.

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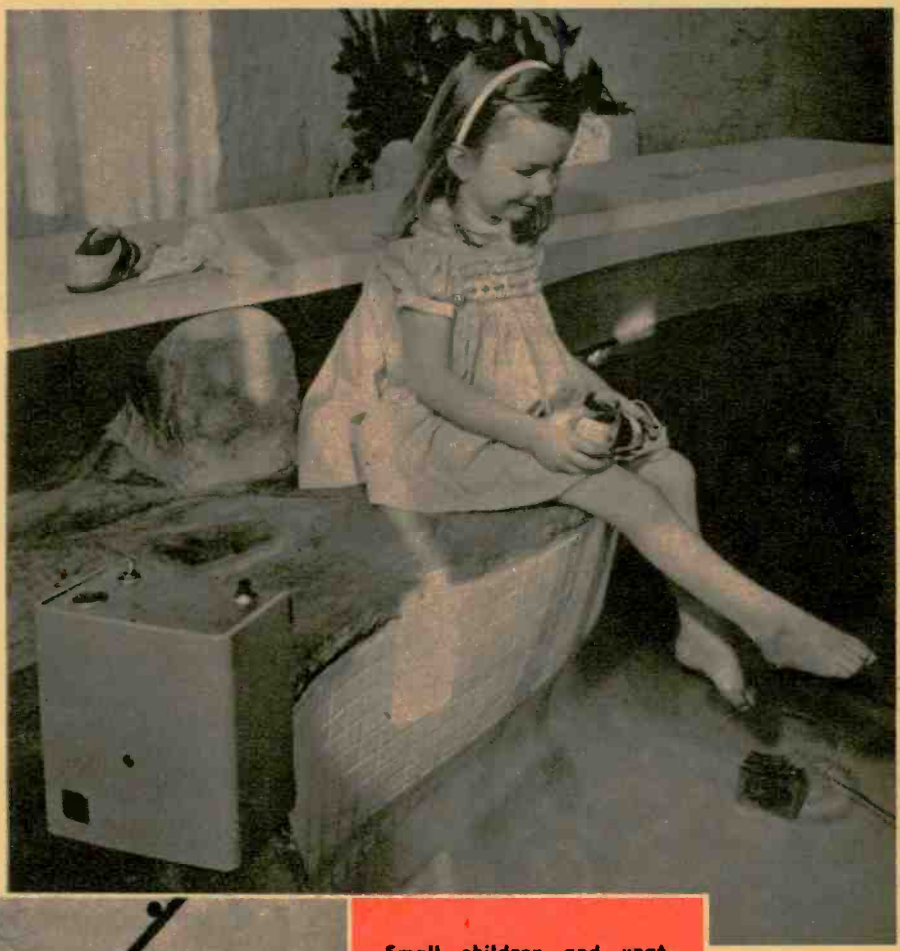
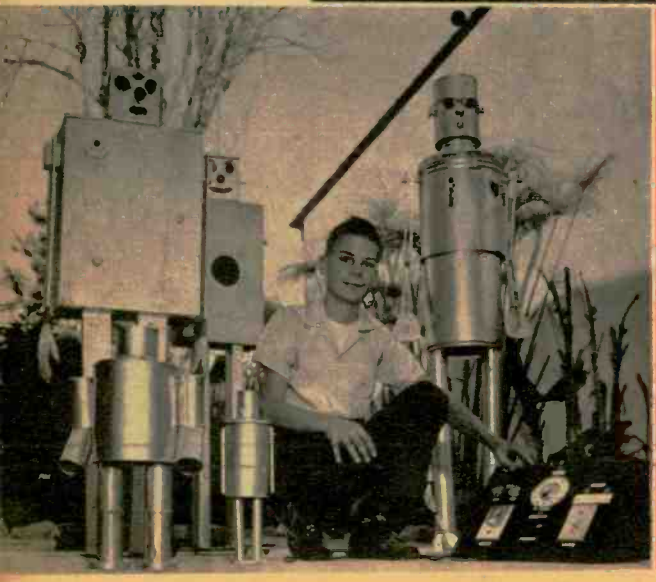
# E I Picturescope



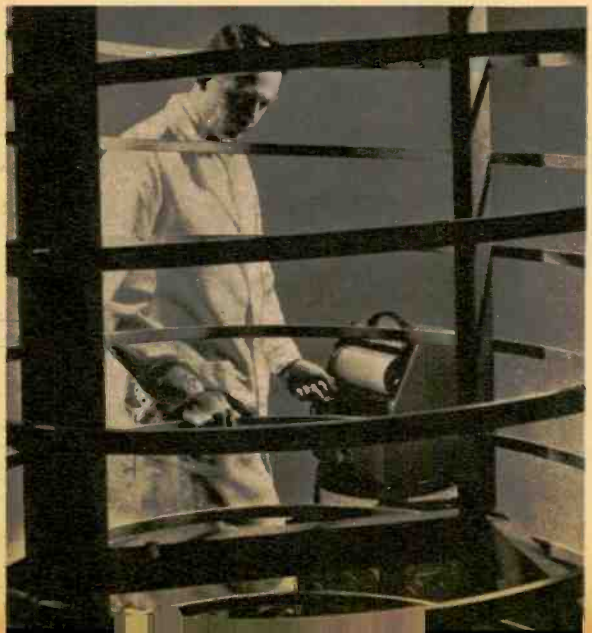


Small children and unattended swimming pools can result in needless tragedy. Minneapolis-Honeywell now sells a pool alarm for under $200. Any splash in water is detected by a submerged sensing unit which transmits a signal to a loud, strategically-placed alarm.

Are they friendly? Companions of Al Haskell, 13, of Mar Vista, Calif., are 7 homemade robots. Latest is 6'10" "Gismo" who says "yes" or "no," lifts his arms, has a heartbeat and parts which can be manipulated from control panel. Haskell's next creation is expected to walk and talk.

This classy mobile TV station belongs to Radiodiffusion-Television Francaise. Built into the roll-back roofed Citroen wagon are 650 mc transmitter (5 watts), two radiotelephones, beam antenna, monitor screen and an oscilloscope.

Electronic "roller coaster" features a rolling steel ball which acts as a moving short circuit to simulate a missile's "riding down" on an enemy target. With this rig, ITT engineers can test sensitivity of fuzes used in the detonation of missiles. Results are recorded on a graph.



Here's a speed trap for "hot rudders"—Venetians who race motorboats through those historic canals setting up dangerous wakes. The device, similar to a radar speed trap, clocks each boat as it glides by and points an accusing needle at craft exceeding the speed limit.

Electronic organ kit gets a going over by Pat Stevenson, who looks pretty well put together herself. The organ was introduced at the 1960 San Francisco stereo hi-fi show by the National Sonics Corp. of Sunnyvale, Cal. Modular in construction, the kit features many preassembled components that double in brass as a high fidelity system. Assembly time is said to be 40 hrs. Cost: $800.

New dental system, developed by Avco for the Navy, permits dentist to view magnified image of any part of patient's mouth on TV screen. An optical probe contains ten thousand hair-like light transmitting fibres. On one end is a tiny lens while a TV camera is attached to the other end. This system may be used also for internal medical probing.

**Unusual collar on this dog's neck carries mild shocking mechanism. Training with this unit, dog will perform very well in field trials.**

Photos by M. Lockman, BLACK STAR

# Remote Control Dog Trainer

WANT to cure your dog of biting the mailman? Push a button. Does he go when you say come? Does he flush the birds when he should be pointing? Push a button . . . well, it's not quite that simple. But a special dog collar is on the market that carries a relay, tiny batteries and two short, dull prongs which are capable of giving the dog a weak but remindful shock accompanied by a buzzing noise. Designed for use by qualified dog trainers and handlers only, the collar mechanism is actuated by a flea-power transmitter that is effective over short distances. Remote Control Co., Box 178, Morenci, Ariz., sells the units.

**Here is close-up of collar and hand-held transmitter with telescoping antenna. This apparatus is recommended for use only by professional or very experienced animal trainers.**

**Stanley Aeck of Sunset Kennels, Issaquah, Wash., trains a champion in the field. Wearing of collar sharpens dog's performance even when shocking mechanism is not actuated.**

*a special EI staff report*

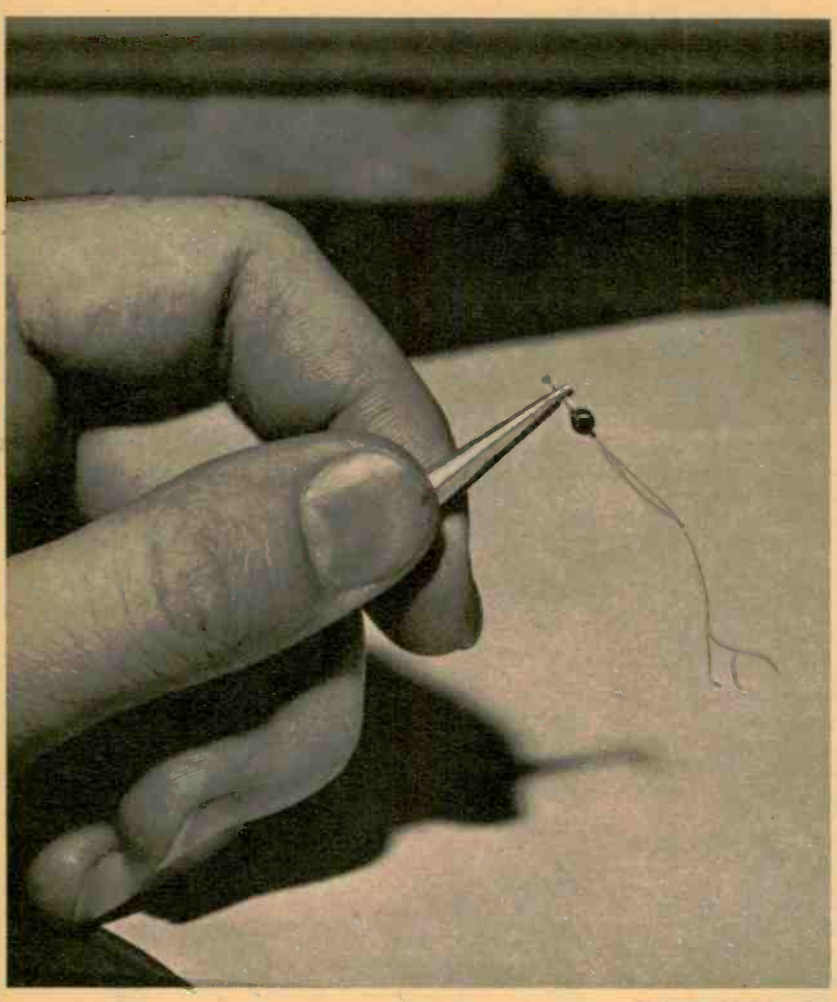
# Making A Stereo Cartridge

**It's miniaturization that must please the human ear.**

PRODUCING a quality stereo cartridge is a bit like trying to give a first-rate ballet performance on a tightrope. One small slip is the difference between success and failure, especially when you're juggling fantastically tiny parts that must be in perfect relation to each other. It takes a sound knowledge of electronics, mechanics and miniaturization, and a solid philosophy of what hi-fi should be—uncompromisingly true sound. Joseph Grado, head of Grado Labs, has taken on the toughest type of cartridge to produce—the moving coil—and has come up with a highly regarded phono pickup which he claims has equal compliance in all directions, flat frequency response from 10-30,000 cps and a channel separation in excess of 25 db. Here's the picture story of how it's made.

**Need for watchmaker tolerances in cartridge manufacture is pointed out by Joseph Grado to *EI* feature editor. Unit must be rugged, reliable with both channels in equal balance.**

**With special machine, girl winds all-important coils. She works in darkened room under special light, color codes each of four ultra-fine wire leads coming from the completed coils.**

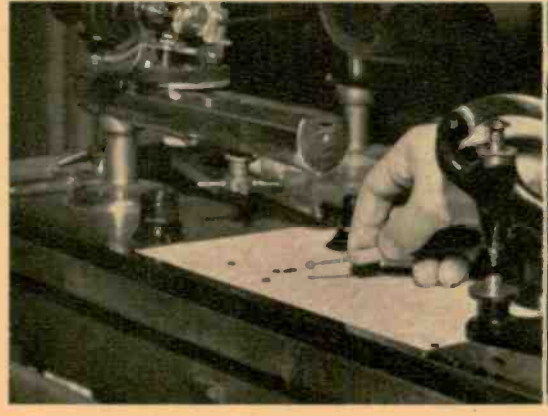


Generating system of Grado cartridge is hollow plastic cube with molded plastic stylus arm. Two coils are wound on cube at 90° to each other and move in a magnetic field to generate voltages on vertical or lateral movements (or combinations thereof) as dictated by record groove. Each coil has 1000 turns of insulated silver-copper alloy wire, gold-plated against corrosion. It would take more than 16 strands of this wire to equal the thickness of single hair.

Photos by Mike Bonvino

Baked and potted coil is mounted in tiny grommet of non-hardening rubber. Unit is then put in a metal bracket and positioned in damped plastic base so that coil is inside magnet gap.

The four previously color-coded coil leads must be spot welded to four matching connection pins. It's impossible to solder such thin wire. Welder must use tweezers, eyepiece.

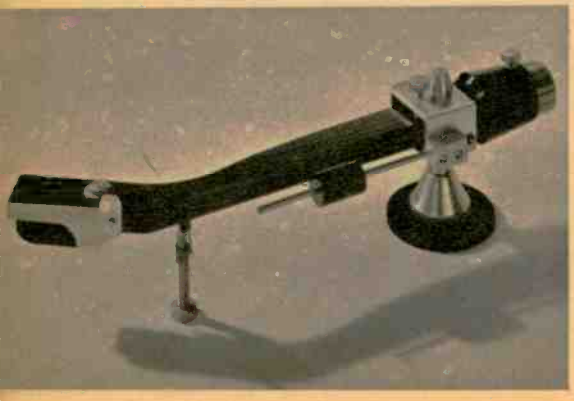


Grado-designed apparatus permanently and safely magnetizes the polished magnet metal in just 1/10,000th second with 21,000 amps, 450 volts. Magnet held without fear.

Orienting the diamond in plastic stylus arm is accomplished by sighting through cross-haired lens of horizontal microscope and applying hot tweezer to reform the plastic.

Part of final test set-up: Specially designed preamp (± 4 db at 4-100,000 cps), oscilloscope, distortion meter, channel switching unit record performance of each unit.

Serial numbers are stamped on cartridge housings. A careful record of initial performance and ultimate owner is kept on file. Grado gives five year stylus guarantee.



At left is model of new Grado 12-inch tone arm featuring, among other things, unusual magnetic balancing. Technical data, price are unavailable at this writing.

## Super Cold Electronics

*Continued from page 35*

conductor. The field induces permanent counter currents on the surface of the superconductor which repel the original field.

However, if the magnetic field is greatly increased, it causes the superconductor to become resistive to current—in other words, it temporarily destroys the superconductive quality. The value of magnetic flux at which this phenomenon occurs is different for each superconductive material and is called the "critical field strength" of that material.

Although superconductors offer no resistance to direct current, they are resistive to high frequency (above 10 mc) currents. This resistance is still much less than that of the best silver and copper conductors, even when they too are brought down to within a few degrees of absolute zero.

How can these interrelated effects be put to work in electronic equipment? The first man to build a practical cryogenic device was the late Dudley Buck of M.I.T. Buck wrapped a columbium wire 3/1000″ in diameter around a straight tantalum wire 9/1000″ in diameter. He dumped this simple arrangement into liquid helium at 4°K.

The superconductive tantalum wire (the "gate") permitted indefinite current flow. The instant a current was run through the columbium coil strong enough to create a magnetic field of the critical value, resistance developed in the gate, and the current stopped instantaneously.

Buck had created a new form of switch. But this was not meant to be an on-off switch for a light or a TV receiver. Because of its remarkable speed of response, measured in millionths of a second, it was a natural for computation. After all, the mathematical section of a giant computer is nothing but a collection of on-off switches.

This unusual switch has been dubbed "cryotron"—the first of many strictly electronic devices that will be developed to operate in the cryogenic region.

Another of the cryogenic phenomena is the conversion of non-magnetic materials to magnetic. For instance, B. T. Matthias, of the Bell Telephone Labs, has noted ferromagnetism in a zirconium zinc compound. The effect has not yet been exploited in any circuitry, but scientists hope to learn more about magnetism, which is fundamental to electronics. Undoubtedly other superconductive phenomena, as yet unimagined, wait to be discovered.

One of the most fruitful of all cryogenic areas was generated by a suggestion that an amplifier could take advantage of the radiation emitted by very cold ammonia gas molecules when they change energy states. The resultant device was the MASER, from "Microwave Amplification by Stimulated Emission of Radiation." After considerable development of the gas maser, a way was found to substitute a solid semiconductor for the ammonia gas.

The basic construction of the maser is quite simple. (See "Those Amazing Masers," Feb. 1959, *Electronics Illustrated.*) The semiconductor, which can be made of the jewel ruby, is mounted in a cavity inside a cryogenic refrigerator (cryostat). The end of the refrigerator containing the crystal is placed in a powerful magnetic field. High-frequency energy pumped into the cavity forces the desired energy change in the semiconductor crystal, and it generates microwave energy with great frequency stability.

Electronic engineers are interested in masers because they have very little "thermal noise" as a result of their operation at extremely low temperatures. Since a maser amplifier has so little self-generated noise, it can be used to pick up extremely weak signals—thus their use in long-range missile-detecting radar, radio telescopes, tropospheric scatter communications systems, and wherever it is necessary to get a high signal to noise ratio.

Another important area of application of low temperatures to electronics is in infrared detection (see "Infrared: New Wonder Tool," July 1959 *Electronics Illustrated*). All of the semiconductive materials which are used as IR detectors become much more sensitive to IR radiation (heat) when cooled to low temperatures. However, the best effects are produced at comparatively "warm" temperatures, hundreds of degrees above absolute zero. For example, gold-doped germanium does not gain in sensitivity below —218°C. That's still pretty cold!

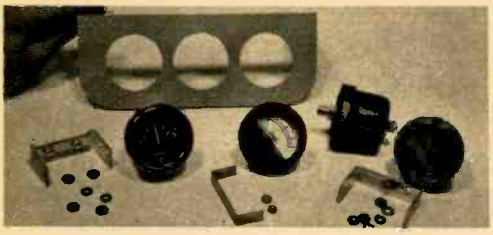
Since the most important application of IR detectors is in anti-aircraft and anti-missile missiles, it is important that the cooling equipment be as compact and light as possible.

Interestingly enough, one of the earliest of IR detectors was based on superconductivity. During World War II, American engineers demonstrated a fast, sensitive detector made of columbium nitride cooled to about 7½ degrees above absolute zero, well into its superconductive range. When hit by infrared radiation, the

[*Continued on page* 124]

## Monitor As You Motor

*Continued from page 39*



critical as to the oil pressure required.

The two Shurite voltmeters in the parts list are accurate enough for all normally equipped cars. Some cars today have many extra electrically operated devices such as power tops, windows, seats, auto antenna and headlight dimmer. All these subject the battery to a heavy drain and it is wise to keep an accurate check on regulator and battery voltages. The use of a more sensitive and accurate voltmeter is then essential. Triplett meters type 221-T or 227-T with a 0-15 volt or 0-10 volt range can be used. Price about $10 each.

**Voltmeter readings**

| Reading | Conditions | Trouble |
|---|---|---|
| 6.6 volts | Ign. on, engine off or ign. on and idling | Normal full charged battery 6V system |
| 6.0 volts | " | Half charged battery |
| 13.2 volts | " | Normal full charged battery 12V system |
| 12.0 volts | " | About half charged |
| 7.2-7.6 volts | Engine turning gen. faster than idle | Approx. correct setting of normal voltage regulator on 6 volt system |
| 14.2-14.8 | " | Normal as above but in 12 volt system |

Local mechanics may set voltage regulators slightly higher than the above reading under severe driving conditions such as stop and go salesman, delivery trucks or taxis. Average passenger car regulators should not be set more than a few tenths of a volt higher than those listed because overcharging and damage to the battery may occur.

**Ammeter readings**

| Reading | Conditions | Trouble |
|---|---|---|
| 0 | Engine off, accessories off | Normal |
| 0 | When should show charge | Bad generator, open ckt. |
| 0 | Engine running, acc. on over idle speed | OK-Generator output equal to drain |
| Discharging | Under 10 mph or acc. on | Normal |
| Discharging | Engine speeded up, acc. on | Low gen. output, poorly seated brushes, loose fan belt, partial short |
| Excessive discharging | Low speed or idle | Regulator contacts closed or stuck |
| Limit of discharge scale on ammeter | " | Overload or short ckt. |
| Needle jerks towards discharge | Engine speeded up | Short, bad gen. |
| Unsteady reading or low charging rate | Engine above idle speed | Loose leads, carbon between commutator segments weak brush springs |
| Charging | Engine above idle speed | Normal |

**Oil pressure gauge readings**

| Reading | Conditions | Trouble |
|---|---|---|
| No reading | Engine running Warm | Bad oil pump, broken oil line |
| Low reading | " | Oil level low Clogged filter |
| Lower than usual | " | Loose bearings Thin or diluted oil. Worn oil pump |
| High reading | Engine cold, just started | Normal |
| High reading Full scale | Engine warm-running | Blocked lines, tight new bearings, dirt in filter |

## Are You A Legal Ham?

*Continued from page 41*

*Frequency measuring:* FCC requires frequency measuring gear to be independent of the transmitter crystal or VFO dial. A stable, accurately calibrated receiver may fulfill this requirement, but is your VFO dial and receiver dial calibration accurate, particularly near the edge of a ham band? Receivers *do* drift, and some combinations of control settings can throw the calibration off slightly, as can parallax in reading a recessed dial. Most hams would not be without a well-built, accurately calibrated grid dip meter, which may also be used as an absorption wavemeter. Proper use of this meter is insurance against receiving a "pink slip."

*Off-frequency operation* should be no problem for the Novice and other crystal-controlled stations, providing the crystals are of good quality and not crowding the band edges too closely. Even the best of them *will* drift slightly at times. Check your crystal frequency with your grid dip meter or wavemeter. Check your receiver with WWV or WWVH, then transfer the calibration to your grid dip meter. Your handbooks will tell you how, as will instruction sheets that come with the meters. You can calibrate your VFO dial from the grid dip meter in the same manner.

*Input power:* You have a milliammeter in your final tube plate supply circuit, but how are you going to figure your input in watts without an accurate voltmeter? A voltmeter is rarely an integral part of a ham transmitter. A good portable volt-ohm-milliammeter should most certainly be part of your shop equipment as you will use it many times for all sorts of measurements. There is little likelihood you will have to measure the plate voltage more than once because it remains relatively constant while you vary the plate current.

*Key clicks:* Perhaps you've been told that they are "very slight." That's not good enough. They don't belong there at all. Good quality factory-built transmitters generally have adequate built-in key click filters, but many "home brews" are without them. A key click filter can be built in a few minutes by wiring a resistor and capacitor across the key leads. If there are still clicks, a choke or two may be added.

*Overmodulation:* The limit is 100 per

cent. For voice frequencies you can go down to 80 percent and still retain excellent voice quality; at 95 percent you'll still be legal. But *101%* won't be! Overmodulation will cause harmonic distortion and increase the channel width. This latter may cause interference with neighboring channels. The best method of seeking out and checking overmodulation is with an oscilloscope, although less expensive indicators may be built from circuits shown in the handbooks. *Sideband "splatter,"* goes hand-in-hand with overmodulation. If you cure one, you'll probably lick the other.

*Harmonic and parasitic radiation:* Both are equally bad. Get after them with your grid dip meter.

Those are the most frequent violations which can and *do* draw FCC citations for equipment malfunctions. Probably the most neglected requirement, however, is Conelrad monitoring. This is understandable, perhaps, since Conelrad contributes nothing to your transmission or reception. But it *is* a legal requirement and that means you *must* have some indication in your ham shack which will inform you when a broadcast station goes off the air for a Conelrad alert. There are a number of very satisfactory Conelrad alarm receivers on the market at nominal cost. An old broadcast receiver will legally serve if you don't mind the music and voice background. You can, if you prefer, keep the volume w-a-y down if you'll remember to turn it up at least every ten minutes to make sure that the station is still on the air. Also, there are commercially available electric clock-timers which sound an alarm every ten minutes to remind you to identify your station. These can serve a dual purpose as both an identifier reminder as well as Conelrad check. Perhaps you'd rather have a silent visual indicator? It's a simple matter to install an S-meter in an old broadcast receiver for a visual indication. This satisfies the requirement—if you watch it! Add a relay and alarm buzzer if you like and you have that much more protection.

That just about catches the major equipment angles. Recently we visited 30 ham shacks in several states. Seven or eight were Novice stations, the others General. We discussed violations and made a number of informal checks. We did not find a single station that was not violating one or more of the rules outlined above! And about 95 percent of these were doing so unknowingly!

Now, how about your *operating* violations. Do you keep an accurate, up-to-date log with all of the required entries? Is it legible? You need only follow the simple instructions printed in almost every published log book. If you make your own log forms, the handbooks will specify what must be entered. Since the log book comprises a station 'record,' you are required by law to preserve it intact for one year from the date of the last entry. The same goes for any messages you may handle. In reviewing station logs we found that two hams had scrawled entries that they themselves could not read!

Every ham should take close, critical and frequent looks at his own shack. This form of self-criticism should become a habit. Inspections definitely should be made whenever we change transmitters, increase power, add a modulator, or do anything which might affect the legality of our emissions.

## 2 Meters And Up

***Continued from page 89***

and UHF propagation. The two meter allocation had an additional motivation. This is the only band on which *all* amateurs may operate, have contact, exchange ideas and understand each other's varying viewpoints.

Chances are pretty good the average Novice has not yet made up his mind which phase of ham radio most interests him. Through two meter QSO's, he will get to know a little more about message handling, discuss sunspots, tropospheric inversions, etc. Perhaps a bit of the propagation-conscious pioneer will rub off.

### And Up

This represents the last article in this current series, but before signing off we want to outline those bands above two meters. The first of these is also within the VHF spectrum, just 4 mc above TV Channel 13 between 220 and 225 mc. Although not as active as two and six meters, it is nevertheless used extensively for communications purposes. Sporadic-E layer reflection this high in the radio spectrum is rare, but not impossible and ducting conditions are approximately the same as found on two meters. There are three UHF ham bands, four in the SHF range and anything above 30,000 mc is open to amateurs (except the Novice). Primarily these are experimental frequencies for the ham and is where the Technician really comes into his own.

In the propagation of UHF and SHF wavelengths, the "scatter" principle, which

is somewhat similar to diffraction along the irregular surface of the earth, becomes a factor in addition to ducting. Unfortunately, scatter communication equipment is costly. The signal strengths are very low and can be utilized only because noise levels are negligible on these frequencies. Incidentally, the same atmospheric conditions which make scatterwave reception possible also create absorption problems, and absorption is a serious obstacle to communications, especially above 30,000 mc.

Today VHF and UHF DX is a very limited proposition, but for some it is just as fascinating as high frequency work—even though in actual miles it is still limited. That's today. Tomorrow these bands, free from the ionospheric curtain, will be *the* DX bands. We are, of course, referring to the time when amateurs extend their activities into space. Sounds like science fiction? Well, what you might call a Buck Rogers day dream has already become reality. A few hams have succeeded in bouncing two meter signals off the moon and their work has been *verified* by the U. S. Government. As reported in the June issue, two hams communicated via the ionized trails of Sputnik III and Explorer VII. Who can say what's next?

## 2-Tube Binaural Receiver

***Continued from page 55***

sensitivity and selectivity at the tuned frequency. The RF carrier portion of the reinforced signal is filtered out by the network (RFC2, C8, C9) and the remaining audio signal is sent to the audio amplifier (V2B) then coupled through capacitor C11 and SW2 to one side of the stereo headphones. Regeneration is controlled by potentiometer R10 which regulates the amount of plate voltage at V1B.

The FM circuit utilizes super-regenerative action, and slope detection of the FM signal: that is, the signal is detected on one side of the resonance curve. Here too, the amount of regeneration is controlled by a potentiometer (R4) supplying plate voltage to V1A. When tuning the FM and AM signals, adjust each potentiometer to a point just before the circuits break into oscillation (with the resulting "howling" effect). The position of each pot will vary for each station frequency depending upon signal strength.

The power supply is a standard voltage doubler type, using two silicon rectifiers (SR1, SR2) and the 125-volt winding of power transformer (T).

Note that the metal shell of C12 is above ground and there is a DC potential on it. Insulate the can with a cardboard sleeve or electrical tape; and also insulate it from the chassis by using a plastic mounting plate. The tank circuit coil (L1) of the FM section should be wound with a ½" inside diameter with separation between each turn. The FM stations (98 to 108 megacycles) are between TV channels 6 and 7. You may pick up sound from adjacent TV stations. This type of unwanted frequency may be minimized by squeezing or expanding L1 until it tunes the desired frequencies. Notice that DC is present on L1 and tuning capacitor C1. Be sure to insulate both from the chassis. The distance of the signal antenna loop from the coil should be adjusted during initial tuning to determine the best coupling point.

The tickler winding on the antenna coil should be wound close to the secondary. You may have to reverse the leads later if you find that you don't obtain the feedback squeal.

## Super Cold Electronics

*Continued from page 119*

detector got slightly warmer, and the corresponding resistance change was followed electronically. This early detector has been rendered obsolete by the semiconductor detectors because its refrigeration equipment was too bulky to be taken aloft.

General Electric engineers have taken advantage of two cryogenic phenomena to invent a new type of frictionless gyro for electronic inertial guidance equipment. The "cryo-gyro" is a combination of a frictionless bearing and a superconductive motor. The bearing operates on the principle that magnetic flux will not penetrate a superconductive material. Therefore, a ball made of superconductor materials can be suspended freely on a strong magnetic "cushion." If the ball contains coils of superconductors, it becomes a motor rotor. Based on this simple idea, GE engineers constructed their experimental frictionless gyro, which has been rotated at 20,000 rpm without pulling itself apart.

All of the cryogenic equipment discussed so far has actually been built. Some of the possibilities in cryogenic electronics are also very exciting.

In present electron microscopes, which can probe into the molecule, the next level of matter up from the atom, magnetic fields focus the image produced by an electron beam passing through the target. The doughnut-shaped magnets that produce these fields act as "lenses" by concentrating the fields in the hole in their middle. Because superconducting materials are magnetic insulators, they could be placed around the hole to eliminate stray lines of magnetic force and further concentrate the field. The effect would be the same as though the resolving power of an optical lens were increased.

Cryogenic electronics is still a very young technology, essentially less than ten years old. Considering the startling devices that have emerged in such a short time, it is obviously of enormous future importance in electronics and in industry in general.

Because of the cost of refrigeration equipment and the material involved, cryogenic electronics is not for the home experimenter. However, in ten years, new advances may make the special refrigerators and superconductors so cheap and widely available that ham radio operators will be using maser receivers, tuning in on space stations on the moon.

## Let's Dress Up The Ham Shack

*Continued from page 99*

Now let's have a look at the operating bench or table. Do you consider it an acceptable piece of furniture? If so, leave it alone. But almost any old table could be improved with paint, trimmed around the edges with one of the many available types of metal edge molding. Cover the top with linoleum or a pressed hard-board which will provide a smooth writing surface.

How about your accessory items? If your key flops around on the table and you have to chase it during transmissions, screw it down, but make certain it is fixed in the most comfortable position for you. Perhaps your phones and mike hang from convenient nails driven in the wall. Pull them out and spend another dime at the ten cent store to replace them with appropriate hooks screwed in place.

Now, your wiring. Many stations give the impression that a mammoth spider decided to weave a web of different sizes and types of wire. If your operating table is your *permanent* one, why are you so squeamish about drilling holes for screws, key leads and other pieces of gear? Do you shudder to make wiring holes and drive screws into a table top if it is highly finished oak or mahogany? After all, if the table is *permanently* delegated for your operating table, make a *permanent* installation!

Don't run straggling AC cords from each individual item of equipment to wall plugs stuffed with cube taps to accommodate them all. If your convenience outlets are not so placed to permit concealing your AC cords, move the outlets or install more.

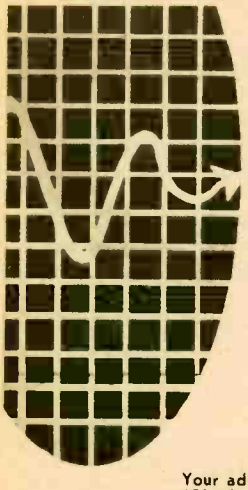
Antenna feeders are a frequent eyesore, draped around the room and from the ceiling on nails driven in and bent over. Ground leads are often a wiggly hunk of wire running any old way to reach the nearest water pipe. Straighten the feeders and the ground wire and route them in such a manner that they parallel wall and ceiling lines and do not cut corners. Then secure them tightly and neatly in place with suitable *insulators* and clamps.

Now that you've created order out of chaos and have made your shack a "thing of beauty and a joy forever," or at least presentable, *don't* spoil the whole effect by plastering all of the available wall space with QSL cards, a practice all too common. Few, if any visitors ever take time to read this type of wall-paper—unless they do it to be polite. To experienced hams they have the same status as shipping room "girly" calendars. Make a tasteful arrangement of ten or a dozen of your most-prized cards if you like, but keep the rest in a card file drawer. You can always haul them out when you feel a need to do so.

Study the illustrations reproduced here. They represent ham stations of many types and using various combinations of equipment. Each of them will serve to give you one or more ideas which you can use in your own layout. An inter-com between the shack and living quarters will save much shouting between you and the XYL.

A station "control unit" such as the one featured in the June 1960 *Electronics Illustrated* ("Ham Station Control Center"), will allow you to have electric clock, phone/CW monitor, individual fuses for each piece of equipment, switches for AC supply, etc., all tied neatly together.

Plan ahead. Get ready for the winter months when atmospherics are at their peak by devoting some spare time to produce a brand new shack to which you'll proudly escort your visitors without the usual apology: "I want to do some fixing up in here when I get around to it, but you'll have to excuse some of this stuff now; it's only temporary!"



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## Electronics Library

*Continued from page 28*

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Whether you are an electronics scientist or hobbyist, you can accumulate an electronics library from Uncle Sam.

## Silent Circuit

*Continued from page 91*

he doesn't even suspect that he's trapped himself, set-off an electronic alarm."

AFD now designs and builds many of its own silent circuits and has devised some hold-up alarms so top-secret that underworld operators have absolutely no inkling that such devices even exist.

"But," says Jerry, "electronics can do more than just put the bee on burglars."

How much more? Well, one electronic device alerts AFD's central office if a supermarket's refrigerator goes on the blink; another tells the moment a sprinkler system is actuated.

Your future in silent alarms? It's as close as the nearest liquor store, bank, supermarket, camera store and factory. All are prospects for electronic alarms.

AFD started with a minimum of cash and its own repeater transmitter (467.1 mc). "Best bet," says Jerry, "is to work for a local alarm company where you can learn the fundamentals."

After that? Chances are you'll find yourself dreaming up new detection devices because crooks, the best of them, get smarter everyday.

No, you don't have to operate a round-the-clock central office. Most neophyte electronic sleuths watchdog their clients' premises with an assist from a 24-hour phone answering service. For perhaps $25-$50 a month, the switchboard girl keeps an eye on the coded-tape machines which, fed via telephone lines, report dirty work afoot.

What you charge a client depends on the gadgets you install. A big department store may be rigged with traditional window-wired alarms. Its safe may be ringed with "proximity" devices—the capacitance detectors which sound silently if a hand moves too close (cost per detector: about $100). Ultrasonics may flood its corporate offices (the transmitters cost $300-$600). Infrared beams may surround the store's jewelry department, each costing $50-$100.

Such big-time clients may pay $200 monthly for protection (which includes the roving watchfulness of your radio-equipped patrol car). The average small client may be billed monthly for about $25-$30 (after the initial cost of installation).

"Usually," says Jerry, "your clients pay a fixed fee for each electronic gadget installed." They may, for example, pay $20 monthly for a single ultrasonic device, another $10 for a special cash-drawer protector, $40 for a sprinkler monitor.

## External Telephone Bell

*Continued from page 44*

tized" to give proper operation. As shown in the photographs, manipulate the spring strip just above the small machine screw on the relay frame until the relay will pull in when the coil is connected to a 15 volt battery.

Mount the components in the aluminum chassis, and complete as much wiring as possible before mounting the assembled sub-chassis in place. The sub-chassis is supported within the case by machine screws and brass spacers, and is grounded to the case through a solder lug connected to one of the spacers.

After completing construction turn R12 (bias) and R13 (sensitivity) to maximum value, plug an indicating device (bell, buzzer, etc.) into the unit, and connect to 117 volts AC. With the induction pickup *not* connected, turn R12 until the relay pulls in and the indicator operates. If it will not pull in, repeat the sensitizing operation. Now, connect the induction pickup and manipulate both R12 and R13 until the relay pulls in when the induction pickup is exposed to a strong electromagnetic field. (Soldering gun, bell, electric drill, large power transformer, etc.) Place the induction pickup under your telephone, put the indicator where you want it, "button up" the case, and *forget it!* The device will function automatically, signaling you through the indicator whenever the telephone rings.

You can let the external telephone bell operate continuously since it draws a very small amount of current in "standby" operation, costing only a few cents a week.

The number and type of indicating devices used is a matter of choice, the selection being made on the basis of your requirements. However, be sure that each is rated for 6 volt AC operation and that the total current drain does not exceed the rating of the transformer.

Since there are no ventilation problems the completed device can be placed anywhere: under the telephone, in a closet, almost any place that you can think of.

Although this device was primarily designed to be used with a telephone, it will respond to any reasonably strong electromagnetic field, and can be used as the basis of other signal devices.

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Right now job opportunities are tight all along the line. Economists now predict a period of mild ups and downs. Look for the "big break" to come in the next three years, they say. That's when good jobs will open up as never before. And men who are preparing themselves *now* will ride the crest of the boom.

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- ☐ Elec. Light and Power
- ☐ Practical Electrician
- ☐ Practical Lineman
- ☐ Professional Engineer (Elec)

**HIGH SCHOOL**
- ☐ High School Diploma
- ☐ Good English
- ☐ High School Mathematics
- ☐ High School Science
- ☐ Short Story Writing

**LEADERSHIP**
- ☐ Industrial Foremanship
- ☐ Industrial Supervision
- ☐ Personnel-Labor Relations
- ☐ Supervision

**MECHANICAL and SHOP**
- ☐ Diesel Engines
- ☐ Gas-Elec. Welding
- ☐ Industrial Engineering
- ☐ Industrial Instrumentation
- ☐ Industrial Metallurgy
- ☐ Industrial Safety
- ☐ Machine Shop Practice
- ☐ Mechanical Engineering
- ☐ Professional Engineer (Mech)
- ☐ Quality Control
- ☐ Reading Shop Blueprints
- ☐ Refrigeration and Air Conditioning
- ☐ Tool Design ☐ Tool Making

**RADIO, TELEVISION**
- ☐ General Electronics Tech.
- ☐ Industrial Electronics
- ☐ Practical Radio-TV Eng'r'g
- ☐ Practical Telephony
- ☐ Radio-TV Servicing

**RAILROAD**
- ☐ Car Inspector and Air Brake
- ☐ Diesel Electrician
- ☐ Diesel Engr. and Fireman
- ☐ Diesel Locomotive

**STEAM and DIESEL POWER**
- ☐ Combustion Engineering
- ☐ Power Plant Engineer
- ☐ Stationary Diesel Engr.
- ☐ Stationary Fireman

**TEXTILE**
- ☐ Carding and Spinning
- ☐ Cotton Manufacture
- ☐ Cotton Warping and Weaving
- ☐ Loom Fixing Technician
- ☐ Textile Designing
- ☐ Textile Finishing & Dyeing
- ☐ Throwing
- ☐ Warping and Weaving
- ☐ Worsted Manufacturing

Name_____ Age_____ Home Address_____

City_____ Zone_____ State_____ Working Hours_____ A.M. to P.M._____

Occupation_____

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