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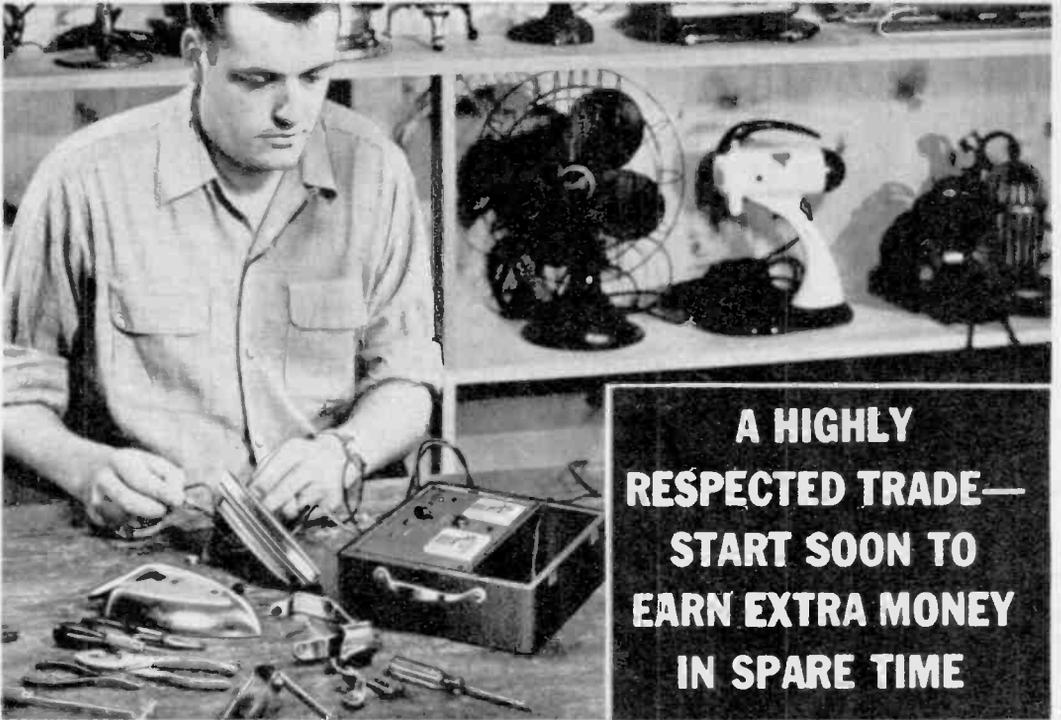
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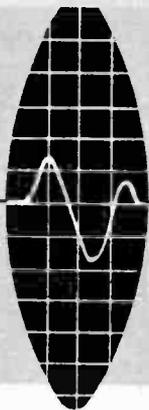
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ELECTRONICS ILLUSTRATED

DECEMBER, 1959

Vol. 2, No. 12

A FAWCETT PUBLICATION



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ELECTRONICS ILLUSTRATED is published monthly by Fawcett Publications, Inc., Fawcett Place, Greenwich, Conn. W. H. Fawcett, Jr., President; Gordon Fawcett, Secretary and Treasurer; Roger Fawcett, General Manager; Roscoe K. Fawcett, Circulation Director.

EDITORIAL AND ADVERTISING OFFICES: 67 West 44th Street, New York 36, N. Y. ADDRESS ALL MAIL: Subscriptions, change of address, Form 3579 to Circulation Dept., Fawcett Bldg., Greenwich, Conn.; and all editorial and advertising to Fawcett Publications, Inc., 67 W. 44th St., New York 36, N. Y.

Second-class postage paid at Greenwich, Conn., and at additional mailing offices. Subscription price \$3.00 per year in the U. S. and possessions and Canada. All other countries \$6.00 per year. Foreign subscriptions and sales should be remitted by International Money Order in U. S. funds payable at Greenwich, Conn.

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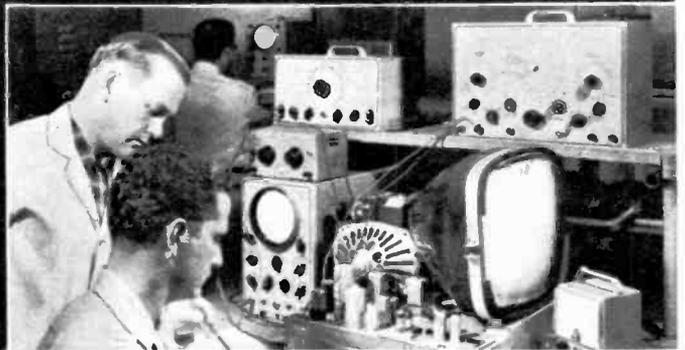
(Shown at left—Instructor explaining operation and testing of a large Motor Generator in our A.C. Department.)

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A Message From the Editor



THE big news is that our January issue will contain a bonus of 16 additional pages. We are using these extra pages for a full feature-length treatment of one subject — how to build an electronic digital computer. This will include plans, step-by-step instructions, and information on how digital computers work and what you can do with this one. This project will be one of the most interesting and instructive you have ever built and incidentally, this complete

computer can be built for under \$40. What a science fair project!

We have more unusual and valuable feature-length sections coming in future issues. Unfortunately, these 16 extra pages cost lots of money. To cover these additional costs and to make certain that we keep publishing the kind of magazine that you, our readers, have indicated to us that you want, it is necessary that we raise the price of each issue to 35¢. I hope you will continue to feel that at 35¢ we are still, as we have always been, a bargain.

Two very interesting articles in this issue deal with our space and missile program. One concerns the much-in-the-news X-15, the other is an historical recollection of our first guided missile. Our first guided missile was not rocket or jet powered — in fact, the warbirds used were World War I vintage. Here's a bit of Americana that many of you probably never heard of. As for the X-15, although you've read a lot about it and its flight in the papers we are, as always, presenting the facts behind the news.

We've an interesting story to tell regarding the article about FM automobile radios in this issue. When we decided to do a story on this subject we contacted the major radio suppliers of the auto industry and asked them whether they were going to release FM radios. You can read their answers in the article but they boiled down to a unanimous *NO*. We were not put off and decided to find out for ourselves whether you could get appreciably better radio reception from FM in a car than is available on AM. Our tests with the FM auto radios available now left no room for doubt — read our report.

Just a word to those many readers who completed and sent in

"HOW A 'CRAZY RUMOR' GOT ME PROMOTED!"



What I overheard one morning shook me right out of a rut!

"Company's getting ready to cut back . . . bound to be layoffs," I heard them say. "Just another crazy rumor," I told myself.

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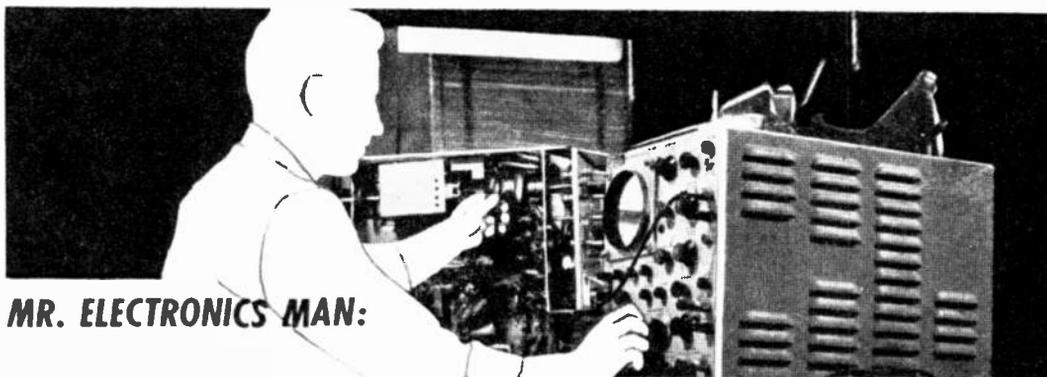
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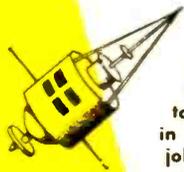
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the stereo questionnaire printed in our October issue. We were slightly overwhelmed by the number we received and although we promised an immediate reply by return mail, this became a physical impossibility. If our answer to you on how to set up a stereo system in your home with your equipment was a bit late please understand our predicament.

A new series starting in our next issue describes the different amateur radio and short-wave bands and tells who uses each and how you can listen in on each one of them. Incidentally there are important conferences now going on relative to the use of radio bands. The international conference in Geneva and the FCC and Congressional hearings in this country are evaluating the utilization of the different bands and may recommend changes of far reaching consequences. To give you an overall understanding as to what various and conflicting pressures are at work and just what may be done, we intend to publish an exclusive report on this subject.

Now that the various visits of Americans to Russia and Russians to the United States have been consummated and the results are being evaluated, it may be time for us to inquire whether we can obtain from Russian scientists more space data than they have heretofore made available. They did not contribute much during the International Geophysical Year and subsequently, when they supposedly sent a rocket to the moon, we received no data on what they learned. Certainly defense security is not involved—they know how far we've advanced in data gathering and an exchange of such information would be more helpful to them than to us. Is it too much to ask that they respond to pure research as we have? Actually, by supplying such data they will furnish some proof that they actually have accomplished the space exploits they claim and which many scientists have reason to doubt.

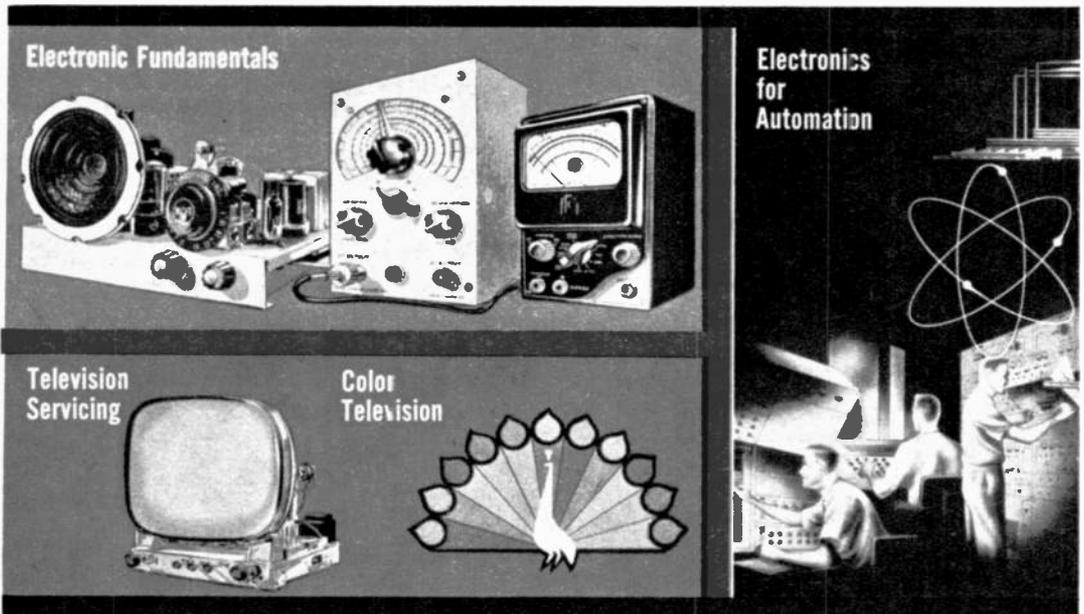
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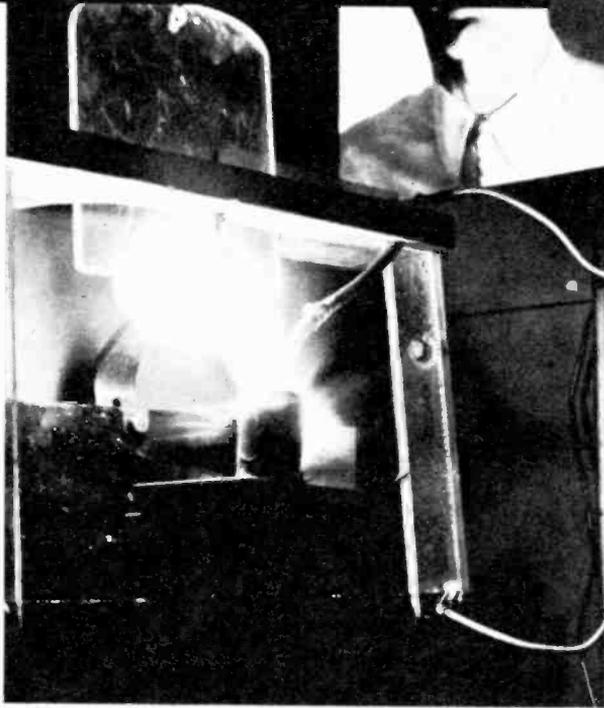
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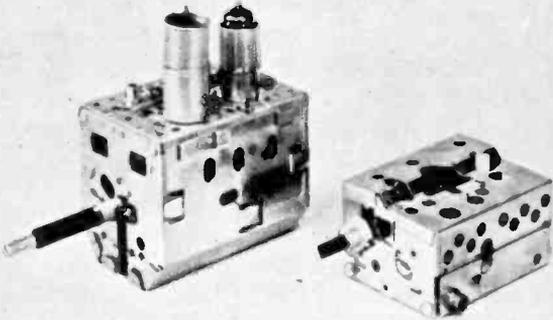
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Electronics in the News



Electric power is fed into a battery of capacitors. Wires from the plus and minus terminals of the capacitors are attached to two electrodes immersed in water. A discharge switch is released and an "explosion" occurs, complete with lightning flash and thunderclap. The resulting spark travels through the water at extremely high velocity creating a shock wave that is equal to 6,000 hp. This is a "spark bomb" as it is called by Republic Aviation Corp. (pictured here). The significance of the "spark bomb" is that it offers a potential solution to the problem of working with high-strength metals used in the production of new air and space craft.



Transistors have conquered still another component — TV tuners. The tuner (right) is designed for battery-powered TV portables. It uses about 1/25th the power needed by conventional tuners (left). 287 parts are packed into 15 cubic inches, with no tubes used. Manufactured by General Instrument.

This burglar-proof brief case has been designed to ward off prospective thieves. If an attempt is made to take the bag, a wailing siren goes into operation frightening criminal into leaving bag behind. Owner keeps bag silent by pressing a small knob in handle.



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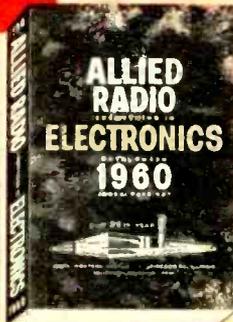
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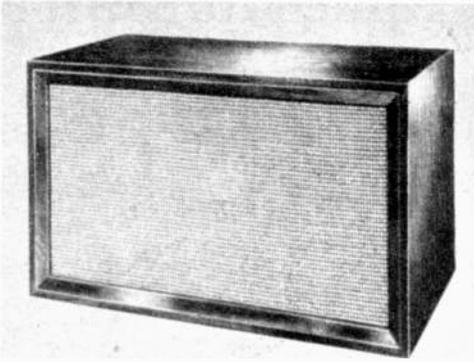
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Lafayette Radio has introduced a new bookshelf enclosure called the "Eliptoflex." Although basically it is a reflex or port type enclosure, two features are added—an elliptical port and a triangular shaped defracting ring mounted on the front of the baffle board—to broaden frequency response. The "Eliptoflex" is designed for optimum performance from any 12" wide-range speaker or 12"

woofer, separate tweeter and dividing network. \$32.50 from Lafayette, 165-08 Liberty Ave., Jamaica, N. Y.



Robins Industries has announced a tape cleaning kit to keep magnetic tapes in good condition. The Gibson Girl Tape Kare Kit contains a splicer and splicing tape, tape clips, and a cloth to clean the tape. The handbook included explains the techniques of tape care and editing. \$3.50 from Robins Industries, 36-27 Prince St., Flushing 54, New York.

Abraham Marcus, co-author of famous best-seller "Elements of Radio" makes amazing offer!



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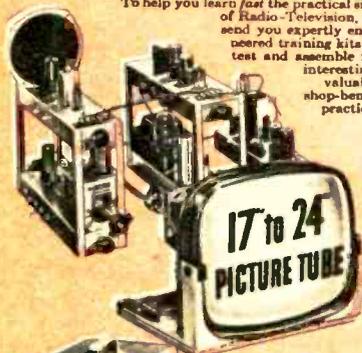
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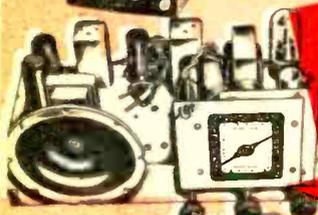
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From 1400 KC to 4000 KC .005% Tolerance.....\$4.95 ea.
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Pin diameter .093	Pin diameter .125	Pin diameter .156	Banana pins

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Specify holder wanted

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.01% Tolerance . . . \$1.50 ea.—80 meters (3701-3749 KC), 40 meters (7152-7198 KC), 15 meters (7034-7082 KC), 6 meters (8335-8650 KC) within 1 KC
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Pin spacing 1/2" Pin diameter .093

Matched pairs ± 15 cycles \$2.50 per pair
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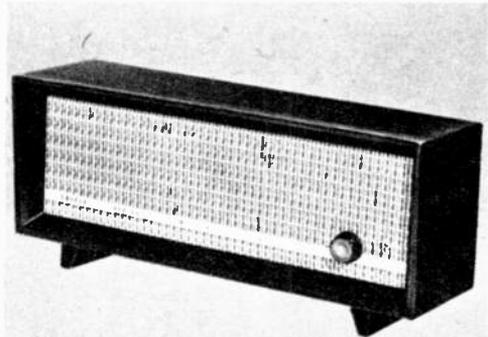
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...News



A new Knight stereo amplifier providing 28 watts of stereo or monophonic sound with peak rating of 56 watts has been announced by Allied Radio.

The KN-728 features master volume, single knob balance, stereo reverse and rumble filter controls. There are 5 inputs per channel for tape head, magnetic and ceramic phono, tuner and auxiliary. An input paralleling switch permits switching from stereo to monophonic operation. The amplifier is finished in charcoal brown with brown leather tone case. The KN-728 amplifier is listed under Stock No. 92 SU 433 and priced at \$82.50. Further specs available from Allied Radio, 100 N. Western Avenue, Chicago, Ill.



A new Shield variable tweeter has been announced by Olson Radio Corp. The 15 watt tweeter has a variable crossover network. Olson claims the response is from 1200 to 15,000 cps. The enclosure measures 3 3/8" x 11" x 4 3/4". Model S-348 is available from Olson at 260 Forge Street, Akron, Ohio and priced at \$8.88 for 1 or 3 for \$25.50.

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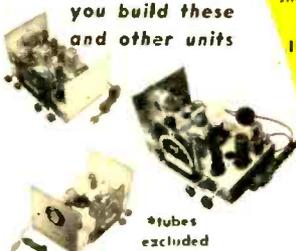
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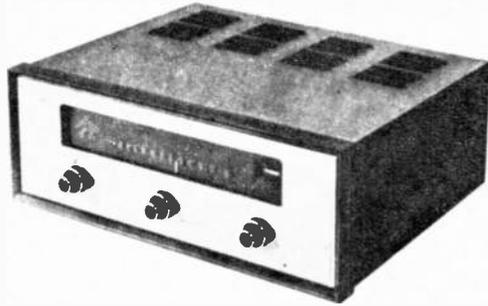
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...News



A newly developed Fisher tuner with provision for multiplex has just been placed on the market. It has four wide-band IF stages, and a wide-band ratio detector using matched germanium diodes. Frequency response is claimed to be 20-20,000 cps, $\pm 1/2$ db, with a full 60 db signal-to-noise ratio for 100 micro-volt input, and less than 0.5% distortion at full modulation. A multiplex separation control is included on the front panel. Two outputs in each channel plus one for the multiplex adapter are provided. One output is for an audio control or audio-control amplifier, and the second is for use with a tape recorder for off-the-air recording. The size of the tuner is $4\frac{3}{4}$ "x13"x15 $\frac{1}{8}$ ". The price is \$159.50. A metal case in a leather finish (MC-1) is available for \$15.95. Fisher Radio Corp., 21-21 44th Drive, Long Island City, New York.

Admiral Corporation adamantly protested the Russians' display of TV sets bearing the Admiral trademark in the Soviet Exhibition of Science, Technology and Culture which toured the United States recently. Ross D. Siragusa, the president of Admiral said: "We have no intention of starting an international incident, but we definitely want to safeguard our trademark. While we manufacture and sell Admiral television receivers and other products in 90 countries throughout the world, we do not want anyone to think we are manufacturing or offering our products for sale in Russia."

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The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL. You will learn how to build radios, using regular schematic; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis. You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, 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.

THE KIT FOR EVERYONE

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

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

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, and receive 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, a Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.



Reg. U.S. Pat. Off.

Unconditional Money-Back Guarantee

It is understood and agreed that should the Progressive Radio "Edu-Kit" be returned to Progressive "Edu-Kits" Inc. for any reason whatever, the purchase price will be refunded in full, without quibble or question, and without delay.

The high recognition which Progressive "Edu-Kits" Inc. has earned through its many years of service to the public is due to its unconditional insistence upon the maintenance of perfect engineering, the highest instructional standards, and 100% adherence to its Unconditional Money-Back Guarantee. As a result, we do not have a single dissatisfied customer throughout the entire world.

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- PRINTED CIRCUITRY

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J. Statalitis, 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 Testers. Equipment that 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 you'd 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 a real find. It saves a lot of trouble, if there is any to be found."

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

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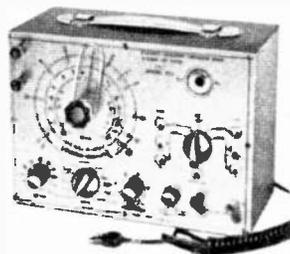


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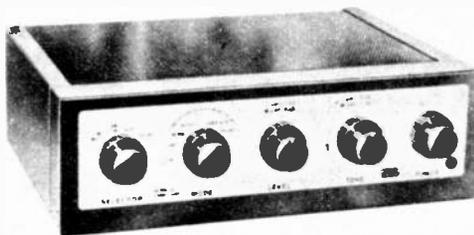
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...News



A new kit has been announced by EICO. It is the AF-4 stereophonic dual amplifier. This \$38.95 kit employs a moderate single tone control so that available gain is converted into distortion-reducing negative feedback. Thus the problem of distortion, created where the available gain is expanded on severe bass and treble boost control, is avoided. Five front panel controls are featured: input selector; mode; level; tone; power on-off. Five pairs of separate inputs are provided for ceramic or crystal cartridges, stereo tape transport, AM tuner, FM tuner and multiplex adapter. The input selector switch has positions for feeding the FM tuner output to one channel and the AM tuner output to the other, or feeding the FM tuner to one channel and the multiplex adapter to the other. The mode control allows for stereo balancing and mixing, and has a stereo reverse position. Also included with the kit are tape output jacks, panel mounted fuse, pilot lamp, and power take-off socket for preamplifiers. Further specifications are available from EICO, 33-00 Northern Blvd., Long Island City 1, New York. Factory wired model is \$64.95.



New Bulletins and Catalogs. . .

"Thyratrons Are Different," a new technical bulletin by Bud Tomer of CBS Electronics tells how these work-horse tubes differ from conventional amplifier types. The mechanism of ionization, critical characteristic curve and effects of temperature are explained. Bulletin PA-233 available free from CBS-Electronics, Advertising Service, Parker Street, Newburyport, Mass.

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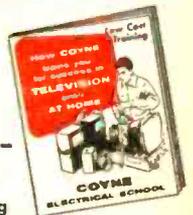
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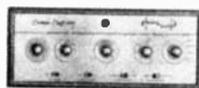


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harmonic distortion at full rated output. Stereo or monophonic inputs. Internal audible stereo test signal for channel and speaker balance adjustment. 9 separate front-panel controls. 4, 8 and 16 ohm outputs for single, double, or triple audiophile net with enclosure \$49.95



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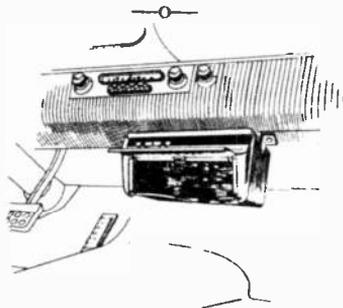
SONIC INDUSTRIES, INC. 19 Wilbur Street, Lynbrook, N. Y.

...News

"Technical Reporters," bulletins explaining Jerrold antenna outlets have been offered to the public on a free subscription basis. Write to Jerrold Electronics, 15th and Lehigh Ave., Philadelphia 32, Pennsylvania.

The 1960 Lafayette Radio catalog is available for the asking from Lafayette, 165-08 Liberty Avenue, Jamaica 33, New York.

A wall size television picture tube comparison chart showing basic diagrams and a pocket picture tube selector guide have been made available by Sylvania, 1100 Main Street, Buffalo, New York.



Would you like to listen to your favorite records while driving? Chrysler Corporation, with the help of RCA, has now made it possible. Starting with the 1960 Plymouths, an extra accessory will be added to the list of optional equipment. It is a 45 rpm phonograph inverted so that the tone arm is below the record. The changer holds up to 14 records, two hours of playing time. It unloads the records as they are played and stores them. RCA claims that the mechanism is balanced and suspended so precisely that even extreme cornering, braking and accelerating forces will rarely dislodge the stylus from the record groove or cause a noticeable change in pitch. Volume and tone control adjustments are made by means of the radio controls. The record players can be plugged into a built-in jack included in all Plymouth radios. It fits below the center of the instrument panel where it is convenient to driver and front-seat passenger.

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Bert Kluwe, P.O. Box 169, Opp, Alabama	1st	15
Donald R. Titus, 270 Park Terrace, Hartford 6, Conn.	1st	12
Robin O. Okinishi, P.O. Box 375, Hanalei, Hawaii	1st	12
Billy R. Kirby, Route 23, Smithfield, N. C.	1st	9
J. H. Reeves, 10621 Buthelev, Los Angeles 47, Calif.	1st	12
Donald H. Ford, Hyannis Rd. (Cape Cod), Barnstable, Mass.	1st	12
James D. Hough, 400 S. Church St., East Troy, Wis.	1st	12

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...News



A new stereo amplifier is available from H. H. Scott. Model 222 has two separate 12 watt channels, a stereo balance system and a third channel provision. The amplifier features a scratch filter, equalization switch, separate bass and treble controls on each channel and a master volume control that adjusts the volume of both channels simultaneously. Input facilities are provided for stereo or monophonic tape recorders, tuners, cartridges and tape heads. \$139.95 from 111 Powdermill Rd., Maynard, Mass.

RCA has announced a diode-triode transistor—the first semiconductor device to combine two different units in one metal case. The diode and triode are constructed in one germanium pellet so that the n-type base region is common to both units. This construction provides direct connection between the diode unit and the triode unit and thus permits the use of a minimum number of circuit components.

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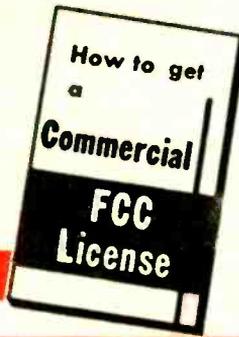
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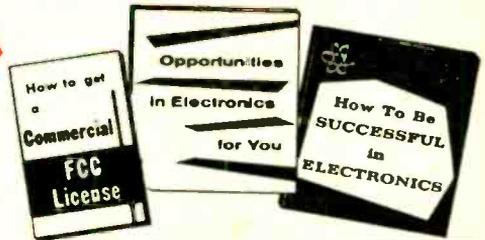


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EI-15

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Cordomatic has announced production of two new devices to simplify lighting and where-to-plug-it problems. The lamp above may be placed up to 20 feet from the socket without hazardous wires strewn about.

There is also a Cordomatic extension reel with a three-way outlet at the end. Both reels contain 20 feet of 7 amp safety-rated cable which may be pulled to any length and will lock until work



Build an eight transistor radio with this kit from Tri-Phi, Inc. "Technikit" comes complete with printed circuit board. The all-transistor amplifier uses two IF stages. The TRK-8 also features a gold trimmed leather carrying case. \$49.95 from Tri-Phi, Inc., Ellenville, New York.

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6-TRANSISTOR RADIO RA-6

Kit \$29.95 Wired \$49.95

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Kit \$79.95 Wired \$119.95

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Kit \$49.95 Wired \$79.95

Cover E-5 \$4.50

Delivers 50W undistorted audio. Modulates transmitters having r.f. inputs up to 100W. Unique over-modulation indicator. Output transformer matches 500-10,000 ohms. Low-level speech clipping & filtering. Inputs for xtal or dynamic mikes, phone patch, etc. 7 tubes. 8" h, 14" w, 8" d.

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- 9.4% of the civilians were technical representatives—field engineers who were school- or factory-trained to help install, maintain, service and teach the use and operation of electronic equipment. Average pay: \$525 per month. Median age: 28.
- 6.5% of the civilians held college degrees, most in a field more or less related to electronics (engineering,

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• The remainder of the civilians were small groups of small percentages.

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◀ See Page 26 for EICO'S BEST BUYS in "HAM" GEAR and TRANSISTOR RADIOS.

how you can get

Surplus Bargains

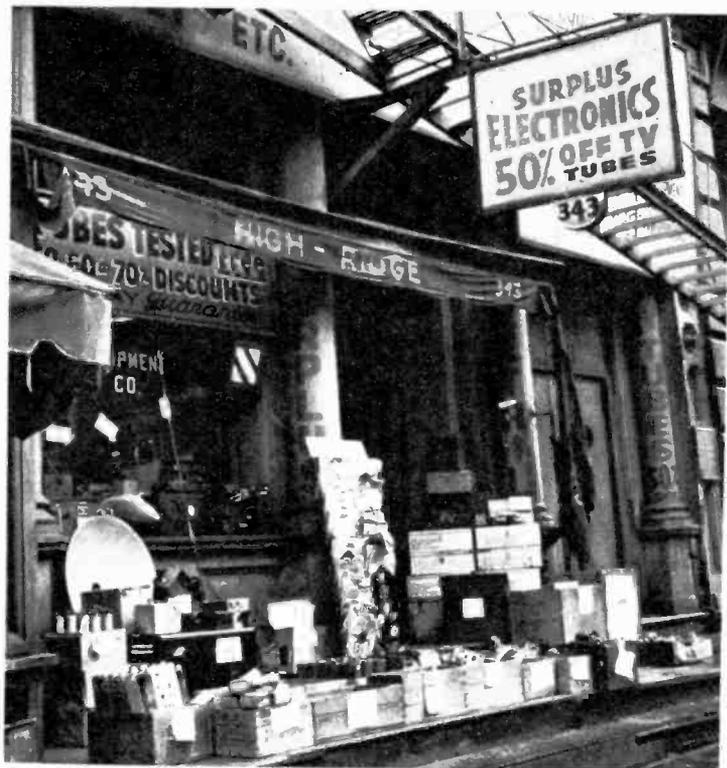
By Harry Kursh

Here's how you can get valuable electronic gear at sensational bargain prices. Some of it's free!



Surplus communications equipment, such as above, is available directly from government or from dealers who buy in quantity, then sell over the counter.

TO insiders who know something about electronics and the art of buying Uncle Sam's surplus, there are sensational bargains to be had almost every day in the week. In fact, the opportunities in surplus bargains have never been greater, particularly for electronics buyers. The U. S. government is currently disposing of a record-breaking \$8-billion worth of surplus property annually and an overwhelming proportion, thanks to rapidly advancing electronics technology and science, consists of electronics equipment and components.

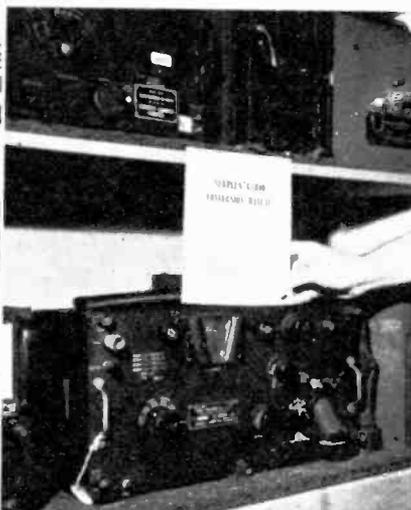


Communications Equipment Co. on Canal Street in New York City is typical of surplus retail store. Inside and out, you'll find everything from radar to phone jack.

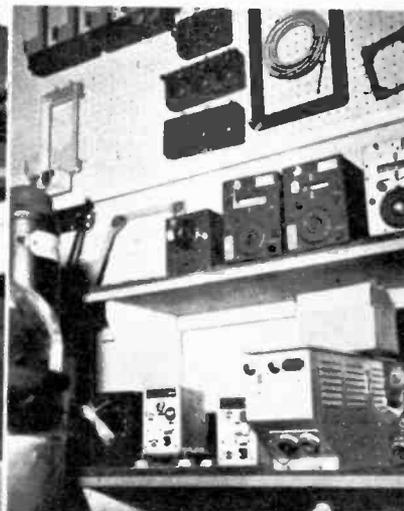
Photos below courtesy G&G Electronics, N. Y.



Large variety of surplus electronics equipment is available to the consumer. Hams have long known about surplus bargains to be had. On these shelves are handsets and meters that once belonged to Uncle Sam.



Here is a surplus BC-312 communications receiver. With a minor conversion, it makes an excellent ham receiver. It originally cost the government many hundreds of dollars, but can now be purchased for less than \$75.



The ARC-5 series of aeronautical receivers (top shelf) can also be useful to the radio amateur who wants to go mobile. Some will work directly on 40 and 80 meters, while others might require conversion.

SYNOPSIS OF U. S. GOVERNMENT PROPOSED PROCUREMENT, SALES AND CONTRACT AWARDS

PROPOSED PROCUREMENT

... issued by the various
... is compiled and

Procurement Continued

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... of the Small Business Act

... (SARAH), P.O. Box 8617, Johannesburg.*

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... 2, broad based, galvanized steel; bid
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... Director General of Supply and De-

... t No. 360; bids invited until
... the Committee, New Zealand.

... September 10 by Stores
... Wellington, Specia-
... nior Trade Com-
... C.

SYNOPSIS of PROPOSED SALES of SURPLUS PROPERTY

The following is a list of the principal sales of surplus personal property of all executive agencies of the Government in which the estimate acquisition cost of property to be sold at one time at one location is \$25,000 (on military property \$250,000) or more, and when the property is located in Continental United States, Hawaii, Alaska, Puerto Rico, or the Virgin Islands.

This section also contains proposed sales of real property offered by the General Services Administration, which is charged with the responsibility for handling sales of such property. Sales of real property are frequent, but when such offerings are made they will be listed.

Potential bidders may obtain copies of sales offerings by sealed bid or spot bid sales, and copies of sales literature, as issued, in the case of auction sales, by communication, as named in the notice listed herein at the address shown. The bid invitation or the auction sale by invitation, as named in the notice of the Invitation or Sale and the address where the bid will contain the following information:

This publication is issued five days a week by the Department of Commerce and lists all U.S. Government surplus sales, both military and civilian agencies.

First of all, just what is surplus property? Simply, it is anything the government decides it no longer needs. It could be brand new equipment lying in a warehouse, but now made obsolete by some new invention. It might be something actually in use and in need of repair, but uneconomical, as far as Uncle Sam is concerned, to have repaired. Or it could be something no longer needed because a certain government operation has been curtailed. The major reason for declaring property surplus is obsolescence. But what may be considered obsolete by the government may have many life-long uses in the hands of private citizens.

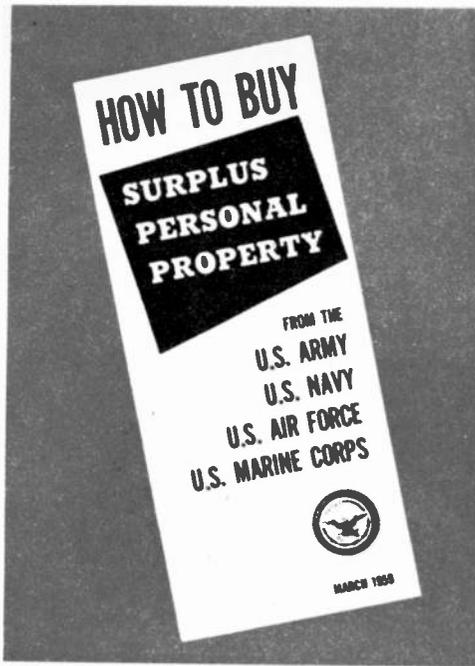
All U. S. surplus sales are open to the public and, as we shall see, some of it is available absolutely free! There is something for everyone: Sonar depth-finding

instruments for small boat fans; walkie-talkies for hams; TV sets and parts; test instruments; yes, even electronic computers!

Getting Surplus Free

How does one get surplus property free? As an individual, you cannot. However, if you are civic-minded, or if you happen to be a school teacher or researcher, you can perhaps do your community a big favor. Here's how:

Before any of Uncle Sam's property can be declared surplus and sold, it must go through a central clearing organization, the General Services Administration (GSA), the government's "housekeeper." GSA first tries to find out whether surplus property in one part of the government cannot be used in some other agency. If this is not pos-



The above booklet is available for 15¢ from the Government Printing Office, Wash., D.C. It tells you just about all you'll need to know.

Student at the University of North Carolina checks out radio transmitter received through Dept. of Health, Education and Welfare.

sible, then the next step for GSA is to inform the Department of Health, Education and Welfare so that the property can be given away under a little known law called the "surplus property donation program."

Under this law, certain non-profit, tax-supported and accredited institutions, such as hospitals, clinics, health research projects, schools, colleges, civil defense units, adult education groups are entitled to receive just about any and all forms of surplus property free. Most people do not even know that this law exists, yet in each state there is a special office set up to help eligible groups get free surplus. In many states there are even warehouses in which huge amounts of surplus are stored, so that eligibles can come around, pick out what they need, and haul it away.

Ironically, as Arthur S. Flemming, Secretary of Health, Education and



Student at St. Mary's U. in Texas is working with test gear acquired at no cost to the school through little-known "donation" program.



Welfare, pointed out to us, when eligible institutions do not apply for this surplus, it is eventually sold to dealers who turn right around and sell it to the very institutions that could have gotten it free.

"Students in a Kentucky high school," says Secretary Flemming, "operate a ham radio station put together with surplus property—and students in a Virginia technical school operate their own TV station, also assembled from surplus property."

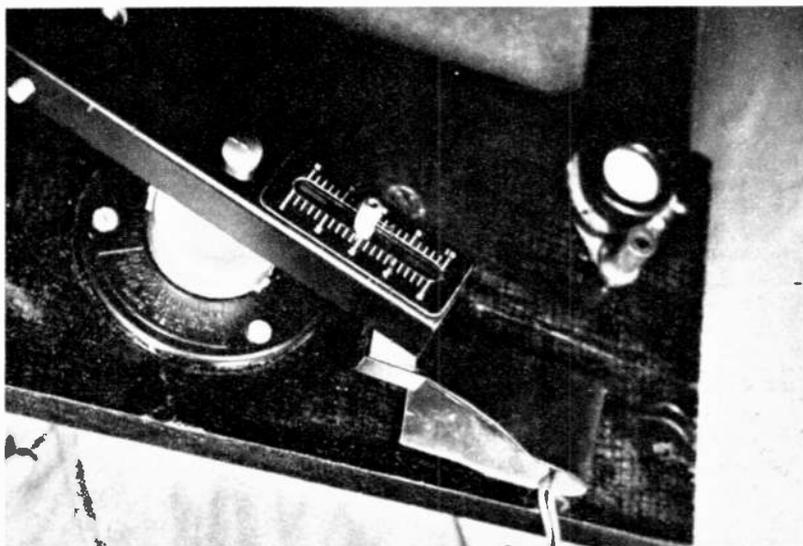
You can get to know the entire surplus donation program by simply sending 15¢ to the *Government Printing Office, Washington, D. C.*, and asking for the booklet, "Acquiring Surplus Property for Health, Educational or Civil Defense Use."

The bulk of surplus property comes from the various Department of Defense
[Continued on page 93]

Automatic Shut-Off for Hi-Fi

By Steve Hahn

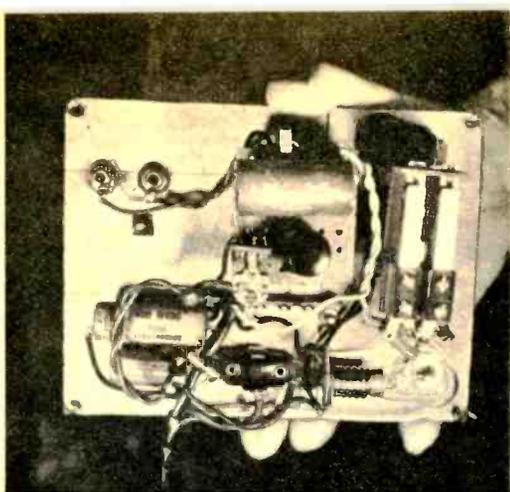
Add this to a turntable if it doesn't switch power off at the end of a record—works on a light beam!



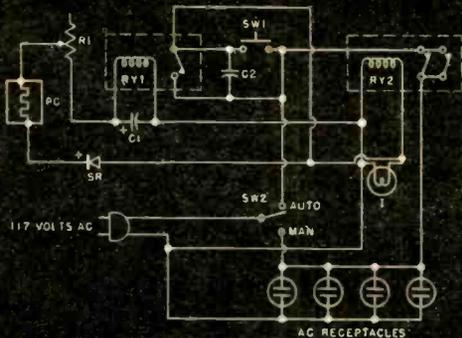
The U-shaped bracket at lower right supports the photocell. At the end of the recording, rear end of tone arm swings over the cell, eclipsing the light.

EVERY high fidelity enthusiast has placed his favorite record on the turntable, only to come back an hour or two later to find that precious, critically-balanced arm, skating around the end groove, not unlike the cutting tool of a lathe. At times like these, one wishes he had his old changer back, complete with rumble, wow and an arm which was heavily loaded by the tripping mechanism. Of course, such heretical thoughts are only momentary. The arm is lifted off the end groove and you realize that you can't have everything and you will just have to remember your turntable at the end of every record.

Here is a little device costing about \$15 which will stop the entire hi-fi set, turntable and all, at the end of the record. What's more important, it in no way loads the tone arm mechanically and won't disturb the carefully balanced system. The device consists of a photocell which is placed in a strategic position, just below the counterweight portion of the arm in back of the center pivot. Obviously, as the arm moves across the record, the counterweight moves in an opposite direction. The photocell is placed in such a manner that when the arm reaches the innermost groove of the record, the counterweight portion of the arm eclipses the photocell so that no light can reach it. Thus, if the output from this photocell is fed into an amplifier and a relay, this photo electrical on-off

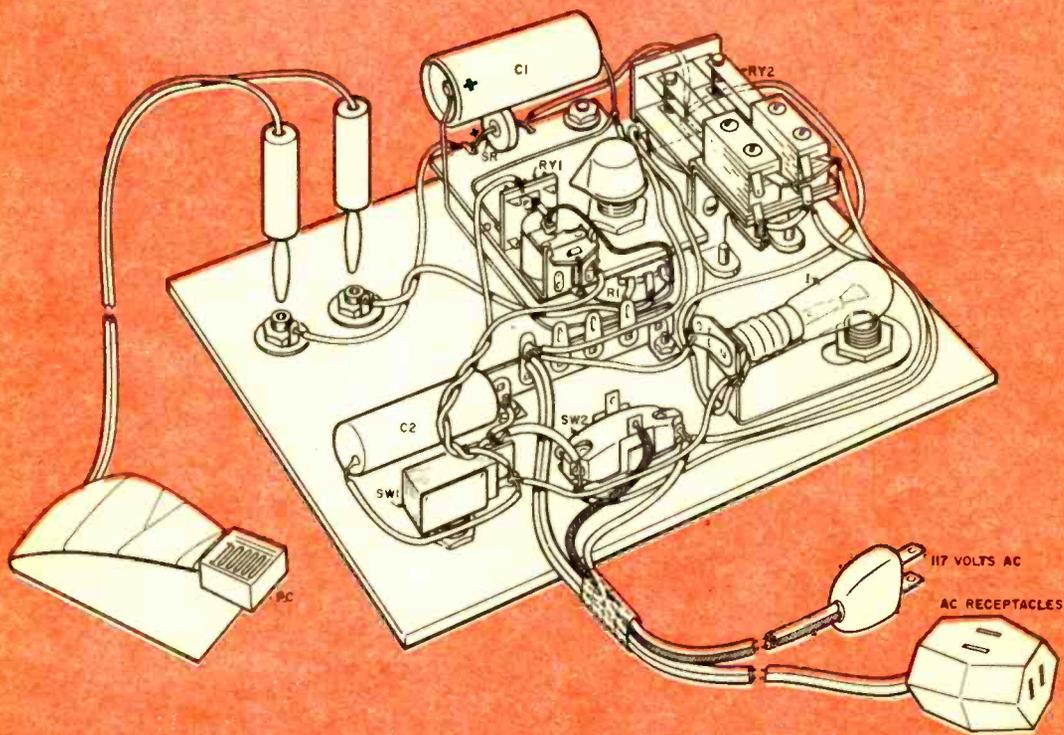


Parts fasten to front panel, seen in this rear view. Black knob, center, adjusts sensitivity.

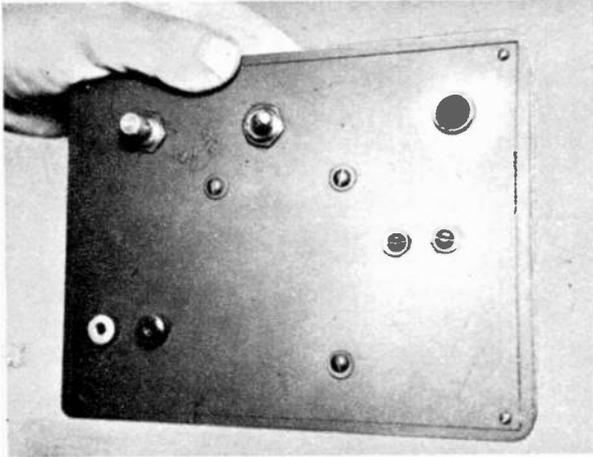


Schematic. Resistance of photocell PC at left varies with light, controls current to RY1.

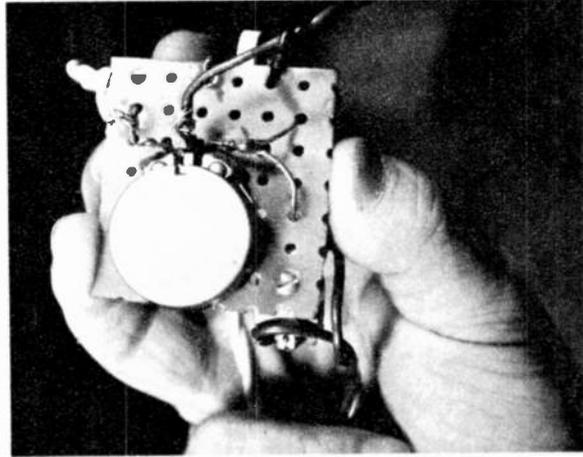
Note shaded wire entering terminal block of RY1. It connects to the lowermost right lug on relay.



Bakelite case houses unit. PC plugs in at lower left. SW1 is top left, SW2 adjacent.



2-inch square sub-assembly board showing R1, RY1, C1 and SR mount on other side of it.



system can be used to turn off the high fidelity system at the end of the record.

The photocell relay, by itself, cannot handle the comparatively large power which is consumed by the hi-fi set. Consequently, the sensitive relay controls a heavy-duty relay whose contacts are rated at 115 volts, 12.5 amperes.

In most installations, ordinary room illumination, tungsten or daylight, will provide sufficient light to run the unit. If the light is found to be insufficient, a small table lamp should be placed near (and above) the photocell.

The only critical adjustment in the entire unit is the setting of the sensitivity potentiometer. This control must initially be adjusted so the photocell is energized with existing room light conditions and de-energized when eclipsed. The final adjustment is best made over an hour or two of testing.

In addition to a sensitivity control, the unit has two other controls: a start pushbutton and a manual-automatic switch. When this switch is in the manual position, the photocell circuit is turned off and bypassed. The high fidelity components can then be turned on or off in the usual manner. In the automatic position, the photo electric circuit takes over. The start button is depressed momentarily, the photo electric circuit and associated relays are

energized, and power is fed to the high fidelity set. The arm is placed on the record and slowly travels across it. As soon as the counterweight eclipses the photocell, the photo electric circuit is de-energized and power is removed from the entire high fidelity set, including the photo electric circuit. In order to start the system up again, the arm must be placed in the rest position and the start button depressed once more.

Construction

The electronic sub-assembly is wired first on a piece of phenolic fiber board measuring 2" x 2". This board mounts the rectifier, filter capacitor, the sensitive plate relay, and the sensitivity po-

[Continued on page 112]

PARTS LIST

- R1—50,000 ohm potentiometer
- C1—30 mfd electrolytic capacitor 150 volt
- C2—.1 mfd paper capacitor 400 volt
- RY1—5000 ohm plate relay (Argonne 5000)
- RY2—115 volt AC relay DPDT (Guardian Series 200 with 12.5 amp contacts)
- PC—Cadmium Sulphide photocell (Lafayette CDS 10)
- SR—Silicon or selenium rectifier 50 ma
- SW1—Pushbutton switch normally open SPST
- SW2—SPDT switch
- L—117 volt pilot lamp (neon lamp may be used if preferred)
- Misc.—AC receptacles, AC line cord, 2-inch square perforated board, Bakelite case 6¼"x5¼"x2¼" (standard meter case used in author's model, but may be metal case. Keep all leads insulated from case.), terminal strip with one insulated lug



Gun emits pulse of light. Sensitive target area is $\frac{1}{2}$ " in diameter, visible near top of right photo. Circles (near gun) light when hit is scored.

build a **Photo Target**

By R. L. Winklepleck

Improve your marksmanship on a moving target!

Use it as a game or for serious target practice.

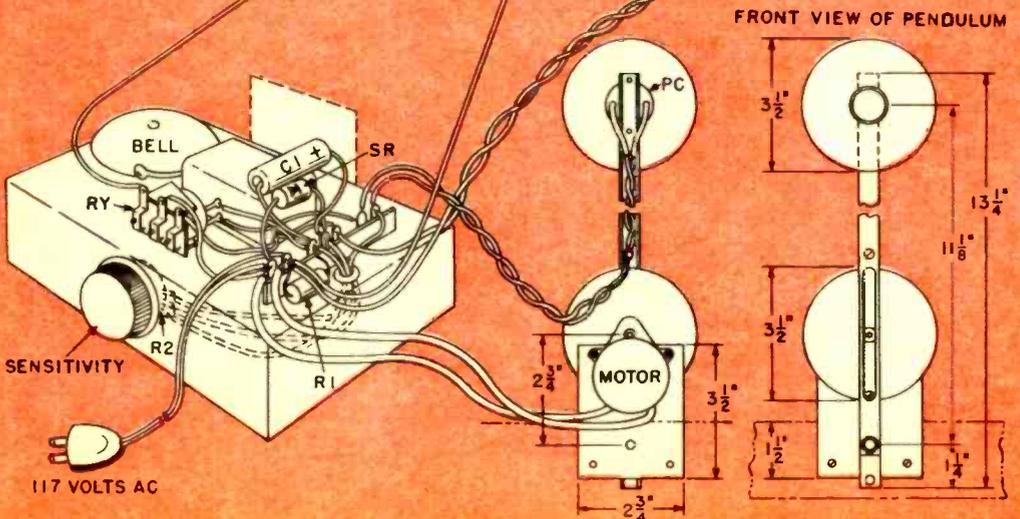
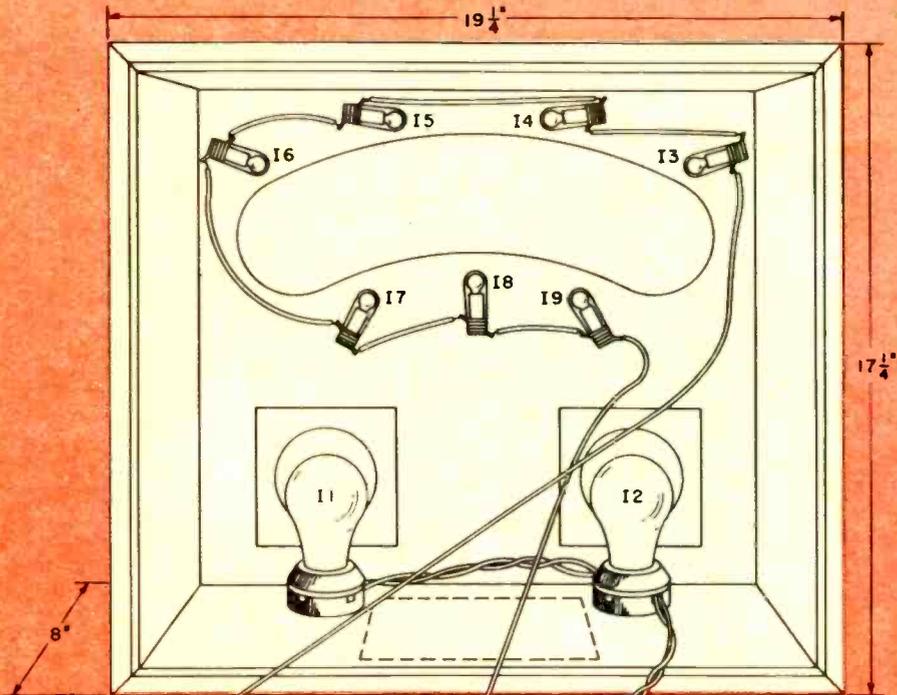
TARGET shooting is a fascinating sport for both young and old but crowded urban conditions have restricted it almost entirely to the amusement park. Even the spring-propelled and gas-propelled pellet guns can be dangerous to use and we read occasionally of dart game injuries.

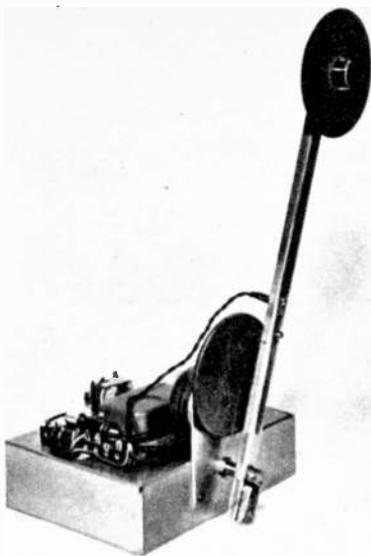
A very satisfactory solution which eliminates all chance of accident and still permits target practice is a gun which shoots bright pulses of light and a target which indicates each "bullseye." Such equipment can be a popular and interesting game or, if carefully constructed, it can offer the opportunity for serious target practice. The basic components required for both gun and target can be purchased by careful shopping for approximately fifteen dollars.

The one shown in the illustrations isn't offered as the last word but only as an example. In operation the target swings back and forth through a broad arc about four times per minute and is illuminated by a series of pilot lights, the red jewels of which surround the opening. When the one-half inch center of the target is hit by a pulse of light from the gun, these pilot lights blink out, a bell rings and two bright bullseye targets

Rear view with panel removed shows actual placement of major parts.

Chassis and pendulum arm are shown removed from the box for clarity.

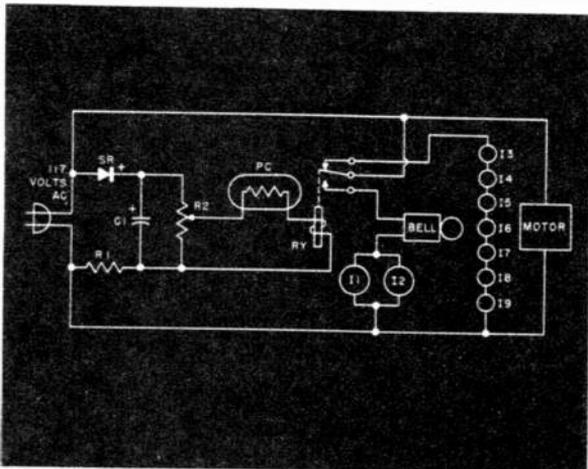




Front of target mechanism, mounted on chassis. Counterbalance is at lower end of pendulum.

Schematic is at lower left. To avoid shock hazard don't connect wires to the metal chassis.

Rear view. Lower disk, rotated by the small AC motor, drives the pendulum back and forth.



flash brilliantly. The gun is a plastic, life-size model of a .45 caliber automatic pistol which shoots a single bright burst of light each time the trigger is pulled. It's a lot of fun as a game and it takes real skill to hit the tiny moving target from across the room. By carefully aligning the light beam with the sights and weighting the pistol to simulate the real thing it's entirely possible to use this outfit for serious, helpful target practice.

Refer to the schematic and note that the DC power supply consists simply of a rectifier and a filter capacitor. Any rectifier, silicon or selenium, rated at twenty milliamperes or more will be satisfactory and any electrolytic of at least

200 volts and 10 mfd or more can be used. R1 merely protects the rectifier from high surge currents when the unit is first turned on and can have any value from twenty to several hundred ohms. R2 is a voltage divider which controls sensitivity by varying the voltage to the photocell. It may be 15,000 to 25,000 ohms and should be a wirewound with a rating of at least two watts. The relay may be any plate circuit relay which will operate on one milliampere or slightly more. There are a number of very inexpensive surplus relays on the market that are satisfactory. The photocell is the only component not subject to substitution but it costs only \$2.40 plus postage. The motor is a surplus

four rpm unit. Any number of different motors are suitable and you might prefer a different speed. Pilot lights I3 through I9 are the ones around the opening which illuminate the target. They are 18 volt bulbs so they may be connected in series and operated directly off the 117-volt supply line. A "hit" is indicated by an ordinary door bell in series with two 40-watt lamps which are connected in parallel and act as a voltage dropping resistor for the bell.

Little freedom of choice is possible if you use the plastic gun shown in the illustrations since the space is limited. Some of the new plastic toy rifles are much more roomy and would be easier to convert. It is possible, with some modification, to mount the "gun" portion on an actual gun or rifle. The bulb and lens combination could be enclosed in a tube fastened to the muzzle of the

gun. The other parts would be taped on in a convenient location.

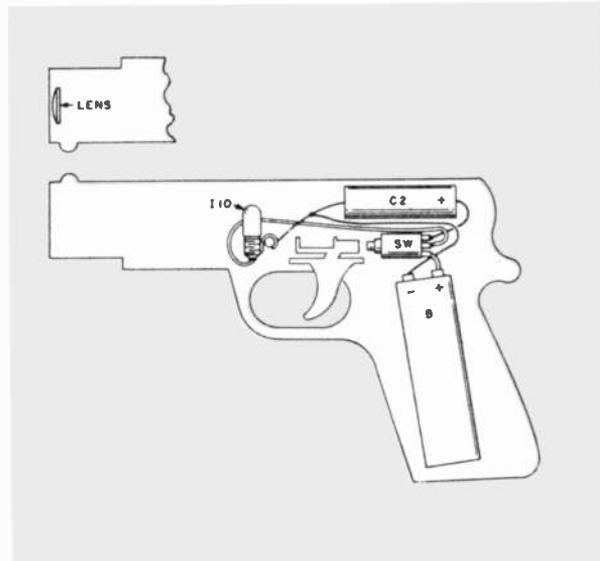
The 45-volt battery charges the 100 mfd capacitor through the normally
[Continued on page 96]

PARTS LIST

- C1—20 mfd electrolytic capacitor 200 volt
- C2—100 mfd electrolytic capacitor 50 volt
- R1—56 ohm resistor 1 watt
- R2—15,000 ohm wirewound potentiometer 5 watt
- SR—Silicon rectifier 20 ma
- PC—Photoconductive cell, NSL-6 Andrews & Andrews, 43 Kent Rd., Tenafly, N. J.
- RY—Sensitive plate relay (Advance SO/1C/10,000D)
- B—45 volt battery (RCA VS066 or equiv.)
- SW—Pushbutton switch SPDT spring return (Switchcraft # 733)
- I1, I2—40 watt Mazda lamps
- I3 through I9—18 volt pilot lamps # 432
- I10—6 volt pilot lamp # 47
- Misc.—Aluminum chassis 2"x5"x7" (Bud AC402), 4 rpm synchronous motor (Herbach & Rademan, Inc., 1204 Arch St., Phila. 7, Pa.), wood for cabinet, gun and lens (see text)

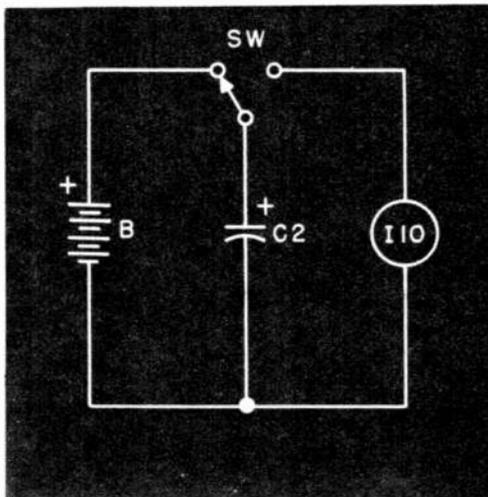


Separating two halves of the gun permits parts installation. Lens is in barrel of upper half.



Mount lens and components in positions shown in drawing. Observe polarity of C2, battery.

Battery charges C2 through SW. When trigger is pulled C2 discharges through bulb I10.





By Myron B. Gubitz

Up where man has never been before sits a lone man in a tiny rocketship—first flight into space.

A UTAH morning, clear and dry. At 38,000 feet above Wendover Air Force Base, a giant B-52 jet bomber streaks across the cloudless sky.

Nestled under the B-52's right wing, attached by a special pylon, is a black, needle-nosed aircraft called X-15. Tiny by comparison to the mother ship, the X-15 nevertheless has the look of power—sleek body, short wings. Far forward in the cockpit—is a man in a helmet and silvery pressure suit.

Tension runs high in both mother ship and X-15. Suddenly the voice of the control panel operator in the B-52 comes through the lone man's headset. The operator, watching a TV screen and a bank of instruments, has regulated the flow of explosive liquid oxygen into the tiny ship's tanks and now all is ready.

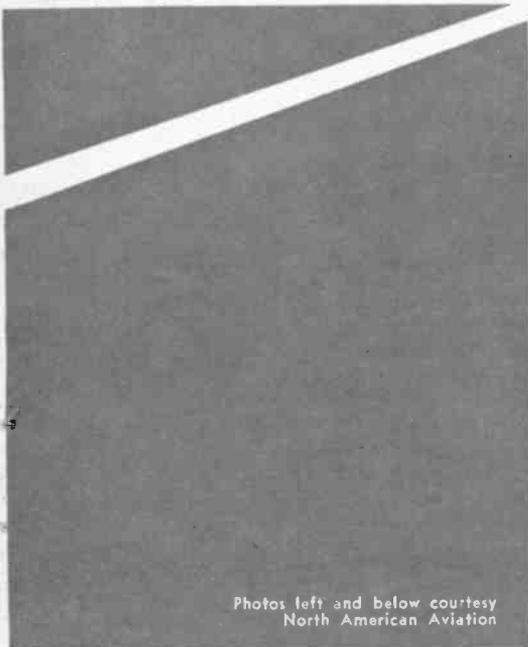
"Clear to drop?"

"All clear," is the reply.

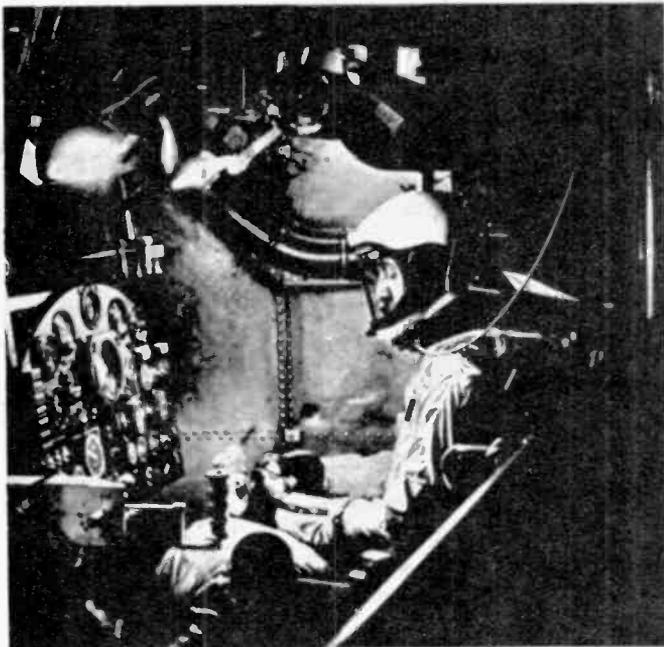
"Okay, here's the countdown."

One by one and backwards—"... 5 ... 4 ... 3 ..."—the young man in the black rocketship hears the seconds tick off. With each count he feels his muscles tighten. He becomes suddenly aware of the vastness of space around him.

The word "DROP!" signals history in the making. X-15, North American Aviation's rocketship, is flying free, set to take a man to the very edge of the earth's atmosphere—100 miles up! Speed: 3600 mph. This is it—the first maximum stress flight for both plane and man.



Photos left and below courtesy
North American Aviation



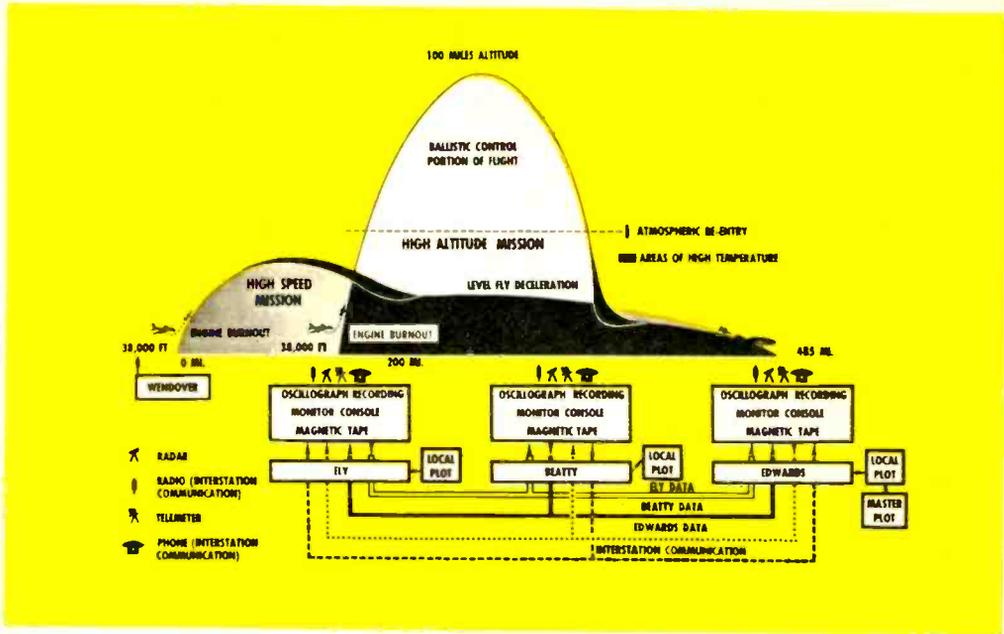
Gravity: seven times normal. Speed: 3,600 mph. Soon to come: weightlessness, re-entry heating. Man, a plane and electronics meet rigors of spaceflight.

High in Nevada mountains near Ely, telemeter antenna reaches for radio data from X-15.



Engineers at High Range station check plot board as they huddle over aerial map on floor.





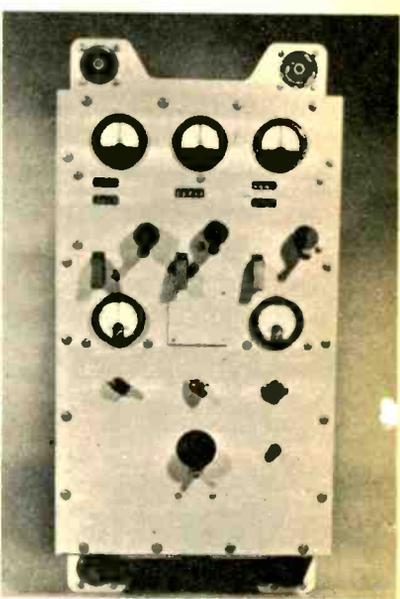
High altitude and high speed missions of X-15 are diagrammed above. Note radar, telemetry, UHF radio and recording installations at each of the three tracking and data-gathering facilities.



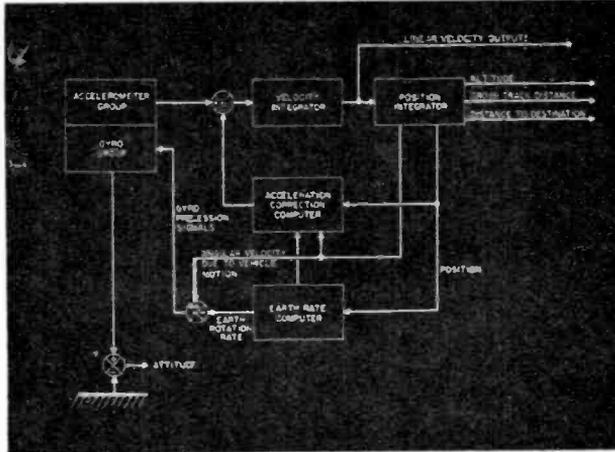
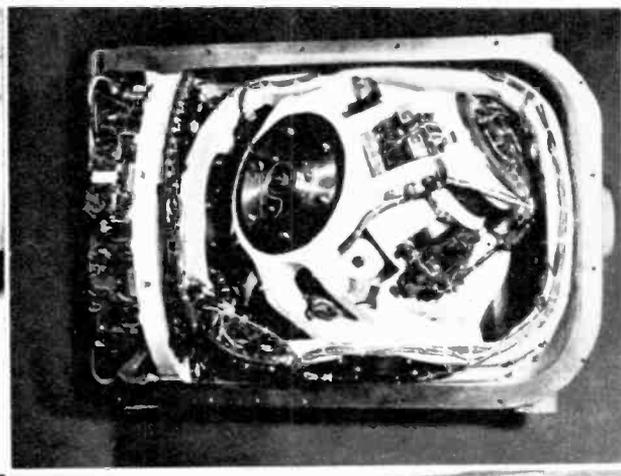
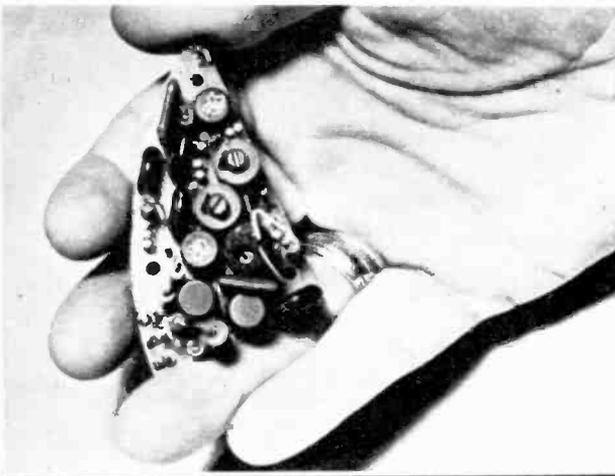
Advanced radar equipment is operated by a NASA technician in communication with two tracking stations.



Major Bob White, USAF, is suited out in space garb containing 24 transducers to pick up heartbeats, etc.



Control panel in B-52 sets X-15's inertial navigation system before drop. Dials monitor for malfunctions.



Top left: Subminiature accelerometer amplifier is just one of ten in X-15's inertial unit. Pictured here is 100 kc stagger-tuned amplifier. All-attitude stabilizer for inertial system (top right), tells pilot angles of flight. It contains its own amplifiers, power supplies, gyros and accelerometers. Lower left: Block diagram of X-15 inertial system. Lower right: Special cockpit indicators for inertial speed, rate of climb and altitude.

Sperry Gyroscope Co. photos

Three ground stations form the all-important tracking and data-gathering system known as High Range. At Beatty and Ely, Nevada, and Edwards Air Force Base in California, are stations fitted with the most advanced radar and communications gear, fool-proof telemetering and recording equipment.

At the High Range stations they hear the countdown in the air far above. Technicians at each station have already received the command: "Start your tapes."

The X-15 plummets forward and down as it breaks free from the mother ship. The pilot, automatically, adjusts control after control. His eyes move steadily over the instruments be-

fore him. His gloved hand reaches for one final switch. A deafening roar comes from the tail pipe. Fifty-thousand pounds of rocket thrust have started the X-15 up—up toward where no man has been before.

It isn't long before the rocket engine cuts out. No more fuel. But the X-15's tremendous momentum continues to carry it upward. Major Robert M. White dares not take his eyes off his instrument panel. This is a controlled flight into space, and he, as pilot, must have perfect knowledge of his position and speed each moment he is airborne. He gets this information from the X-15's compact, super-accurate inertial navigator system.

[Continued on page 92]

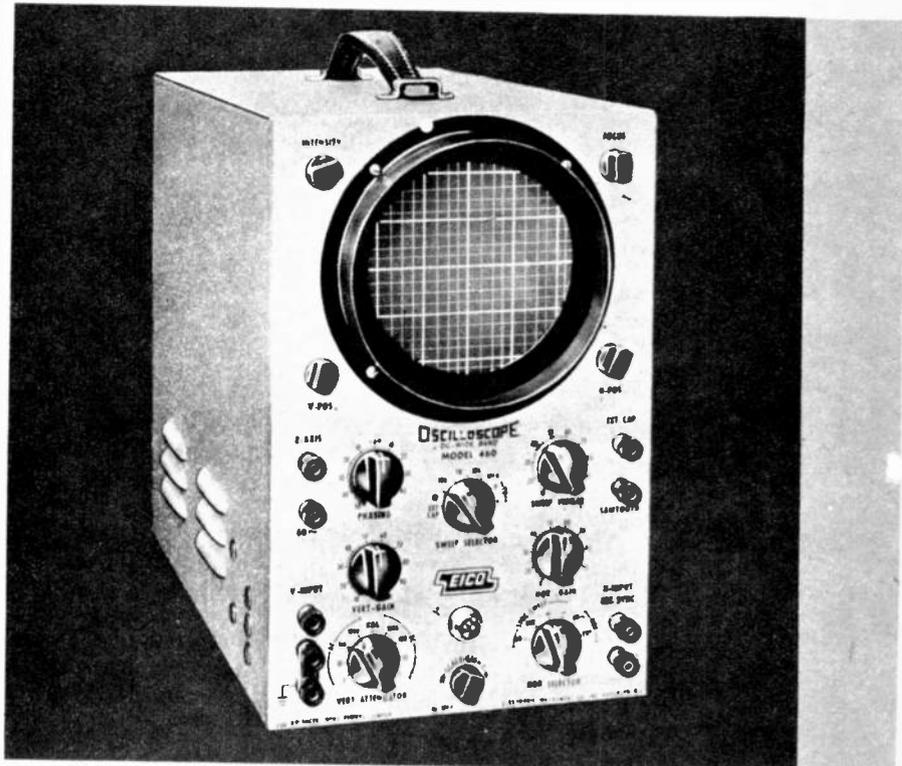
Milt Kiver on Oscilloscopes-2

Here is how to adjust controls on an oscilloscope—the first step for reading traces on the screen.

THE controls on the front panel of an oscilloscope present a formidable appearance, if for no other reason than because there are so many of them. However, as we noted last month, many of these controls are similar in their function to certain controls on a television receiver and should not pose any problem to anyone having a television receiver in his home. In the discussion to follow, we will examine a number of oscilloscopes noting the controls each has in common and which controls may be found only on some of these instruments.

The first control which is ordinarily manipulated on an oscilloscope is the ON-OFF control. In the majority of oscilloscopes this is combined with the INTENSITY control, with the OFF position occurring when the control is turned completely counterclockwise. This is similar in operation to the combined ON-OFF volume control on radio and television receivers.

Fig. 1. On-Off switch in this scope is combined with SCALE LIGHT at bottom center. Scale is calibration lines on screen. Sweep selector is under screen.



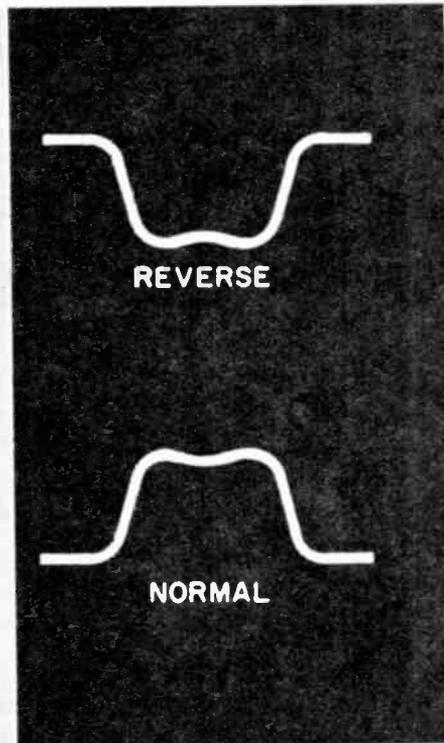
To adjust the INTENSITY control, turn the instrument on and permit it to warm up for several minutes. Rotate the control clockwise until a trace, either a line or a dot, appears on the oscilloscope screen. (Failure to turn up the INTENSITY control may lead you to believe that the instrument is not operating, when in fact it is.)

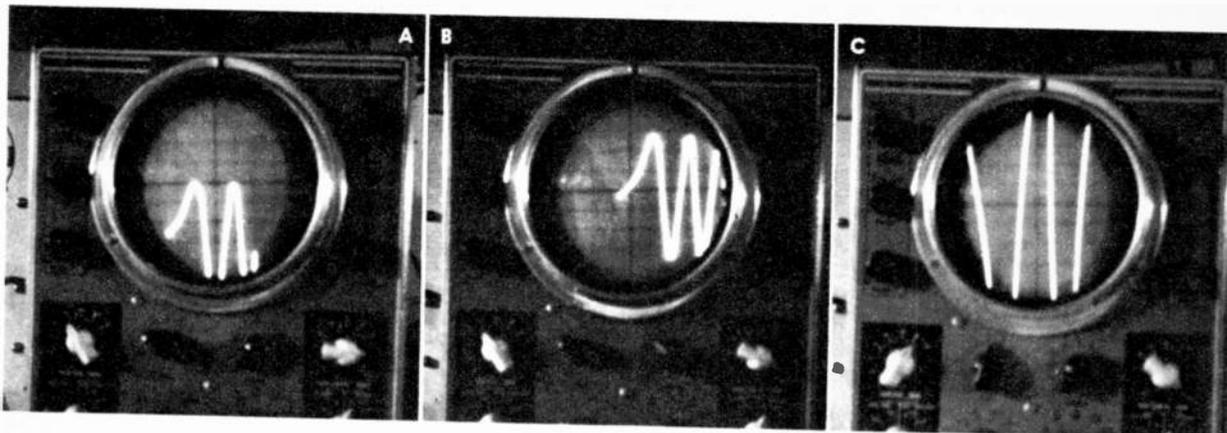
On some oscilloscopes, a separate ON-OFF switch is employed. This is frequently labeled POWER and is a single-pole, double-throw toggle switch. On one oscilloscope, shown in Fig. 1, the ON-OFF switch is combined with a potentiometer which controls the intensity of a lamp which edge-lights the plexiglass scale covering the screen. This control is labeled "SCALE LIGHT" and it has nothing to do with the intensity of any trace that may appear.

Once the intensity of the trace on the screen has been set at the desired level, the next step is to check the centering

controls. All oscilloscopes have two centering controls; one labeled VERTICAL and the other HORIZONTAL. (To save space, VERTICAL is generally shortened to VERT, and HORIZONTAL to HORIZ., HOR., or just H.) Rotating the VERT CENTERING control will move the beam trace or dot up and down. Rotating the HOR CENTERING control will move the beam right or left. Both controls are adjusted until the trace is centered vertically and horizontally. It can happen that one of these centering controls has been turned completely clockwise or completely counterclockwise so that when the instrument is first turned on, no trace is visible on the screen. If, after an instrument has been turned on and permitted to warm up, no trace appears on the screen, check the positioning controls (as well as the INTENSITY control). As a good general rule, position both controls at the center of their ro-

Fig. 2. Vertical input attenuator is along lower left edge of panel. Fig. 3 is at right. A vertical polarity switch will reverse the pattern.





tational range. If a beam is reaching the screen, it will become visible with the centering control in this position.

On some oscilloscopes, the words "HOR and VERT POSITIONING" are used instead of "CENTERING."

With the beam possessing the desired intensity and properly positioned, the FOCUS control is adjusted next. This should be rotated until the beam trace (or dot) is as sharp as it can be made. On either side of this position, the trace will become fuzzy.

For most applications, a straight horizontal trace is desired before any voltages are applied to the vertical input terminals of the instrument. If, instead of a line, you get a dot, it means that the sweep generator within the oscilloscope is not feeding its voltage into the horizontal deflection system. In order to make this connection, rotate a control labeled HORIZONTAL SELECTOR SWITCH (HOR. SEL. SW) to some position possessing a number, such as 10, 100, 1000, etc. This figure indicates the number of times that the beam will sweep back and forth across the screen and represents the horizontal sweeping frequency.

Initially, it makes no difference which position is selected for this control. What you desire primarily is to have a sweep voltage fed into the horizontal system so that a line trace appears on the screen. On most oscilloscopes, the horizontal selector control also has a position where the sweep generator is disconnected from the horizontal deflection system. This position might be

labeled "HOR. INPUT," "EXTERNAL SWEEP," or simply "HOR. OFF." If it is labeled "HOR. INPUT," it means that the horizontal deflection system is connected directly to the horizontal input terminals on the front of the panel and that an external sweeping voltage would have to be applied to these terminals to sweep the beam back and forth across the screen. EXTERNAL SWEEP means the same thing.

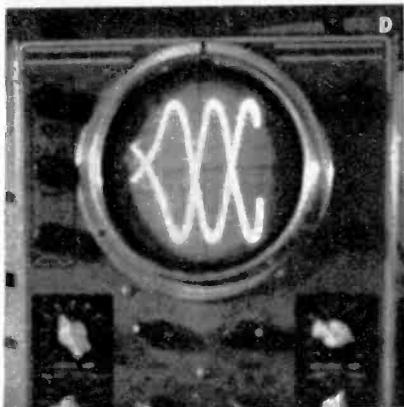
To recapitulate, then, if a dot appears on the screen in place of a horizontal line, the HOR. SEL. control should be turned to some sweeping frequency. When this is done, a line will appear.

Other names for the HOR. SEL. control include the following: SWEEP SELECTOR; COARSE FREQUENCY, and just the word SWEEP. All mean the same thing.

One further word about HOR. SEL. controls. If a single figure is indicated at each position, it does not mean only that sweep frequency is being generated. Rather, the figures just above and below a marker represent the approximate upper and lower limits of the band. For example, in Fig. 1, the four positions, reading from left to right are 10-100 cps; 100 cps-1 kc; 1-10 kc; and 10-100 kc. In other instruments, the actual bands limits for each position are given at each marker.

A VERNIER control for the HORIZONTAL SELECTOR is also common to all oscilloscopes. Its purpose is to vary the sweep frequency within the range indicated on the selector switch. Thus,

[Continued on page 89]



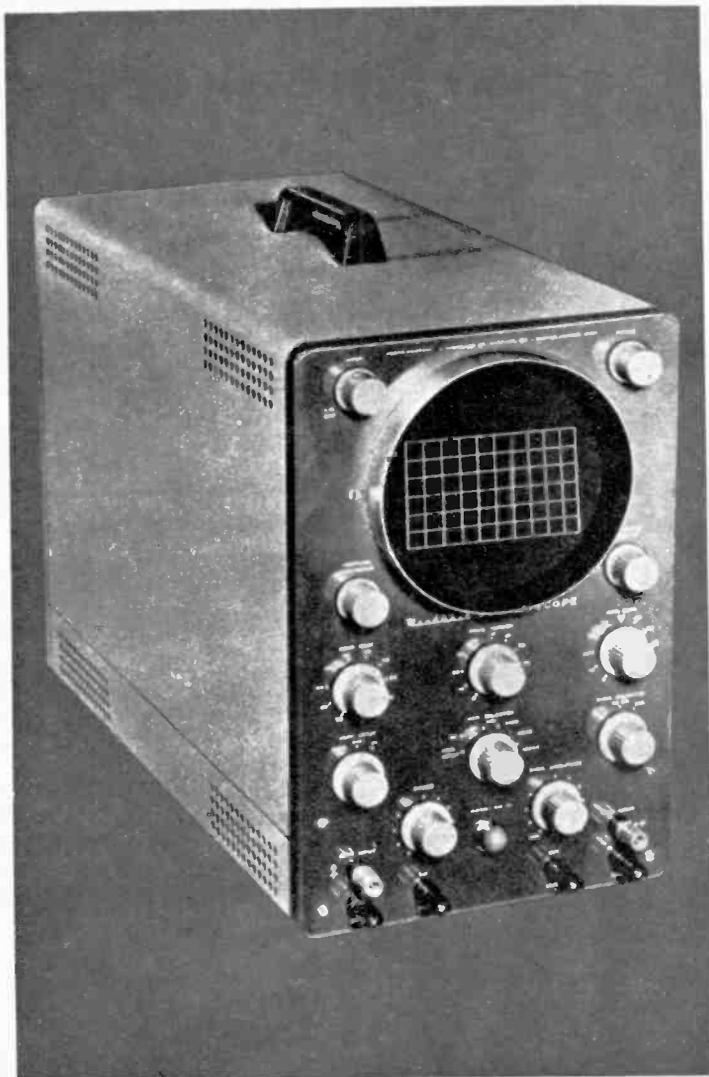
A. First oscilloscope trace, at far left, reveals improper setting of vertical centering control. Pattern is too low.

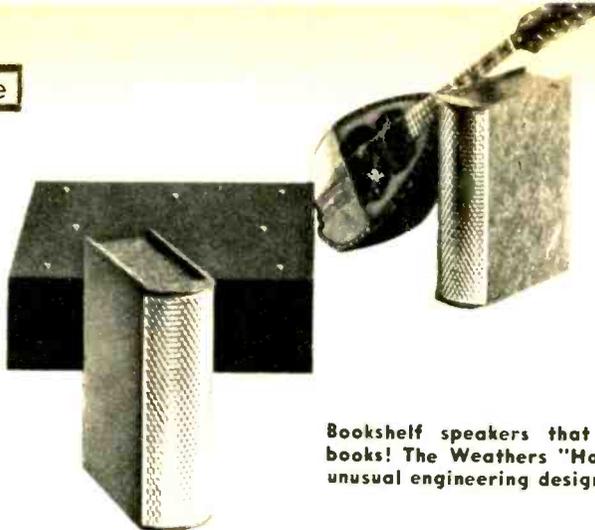
B. Pattern, two complete AC cycles, is vertically centered but too far right. Horiz. centering corrects it.

C. Top and bottom of waveform are cut off here. Adjusting the vertical gain will reduce pattern to proper size.

D. Double pattern appears when signal is not synchronized with scope sweep. Adjust the horizontal sweep.

This scope combines on-off and intensity control in knob at top left. Intensity affects brightness.



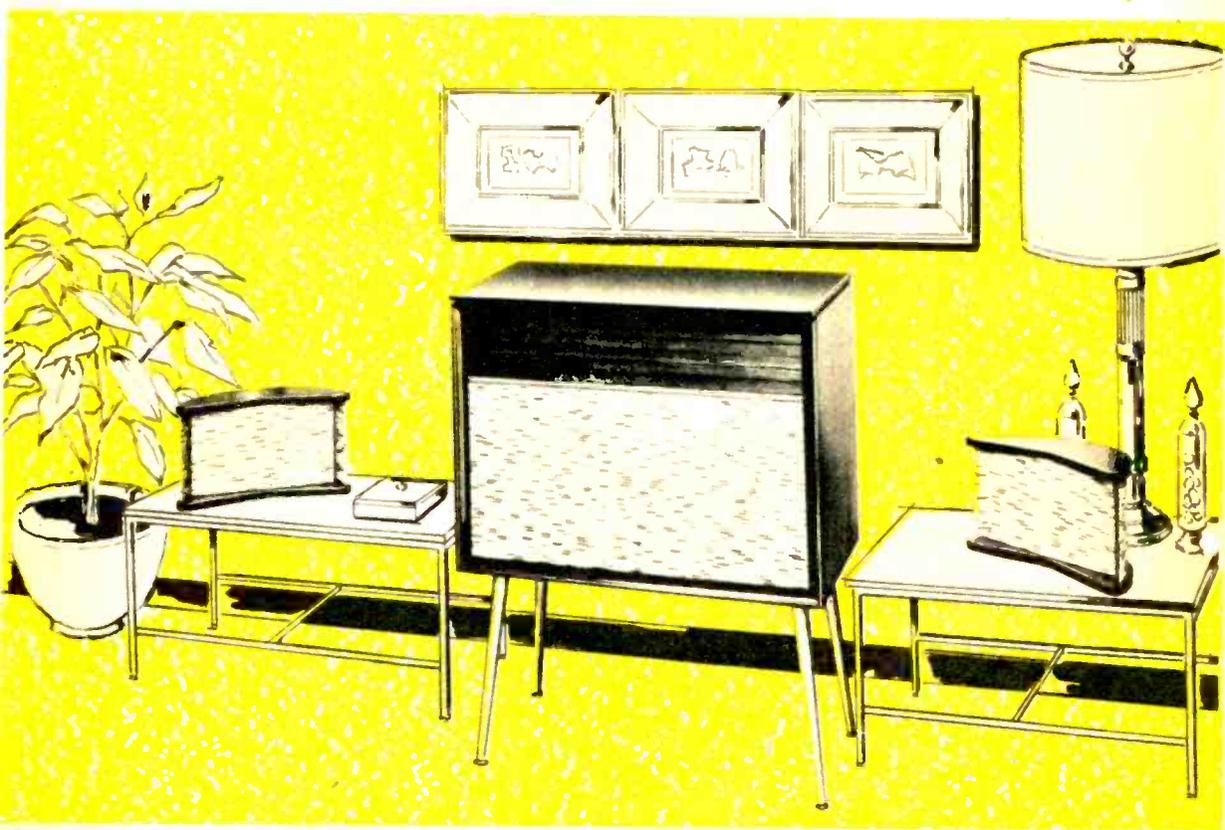


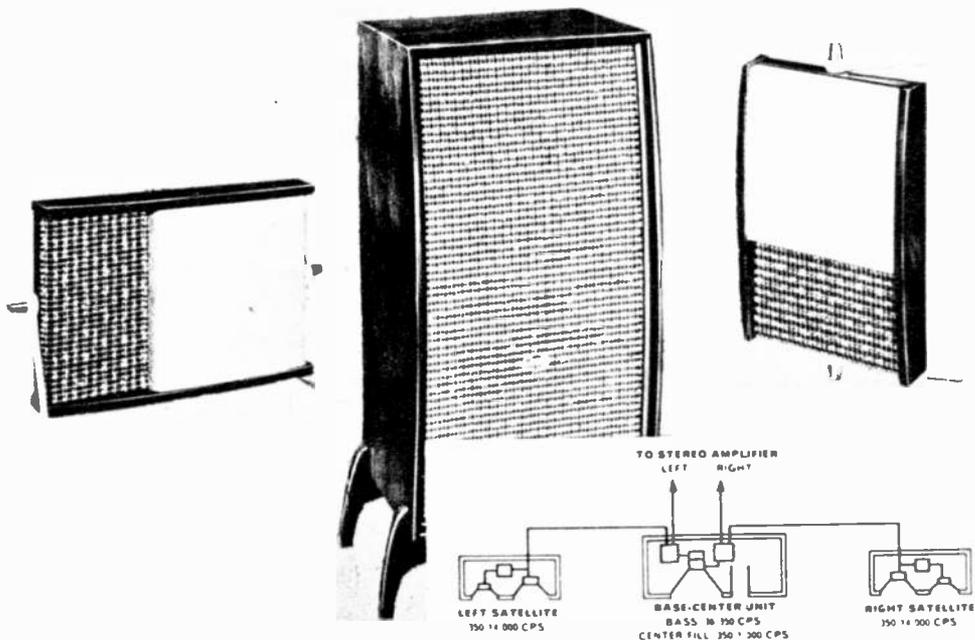
Bookshelf speakers that actually look like books! The Weathers "Harmony" series have unusual engineering design, "Hideaway" bass.

continuing the EI roundup of . . .

Special Speakers for Stereo

Heathkit SD-1 is a complete stereo record system. It includes the small stereo "outboard" tweeters, bass speaker in the main cabinet, crossover network, "sum and difference" stereo amplifier, automatic record changer.



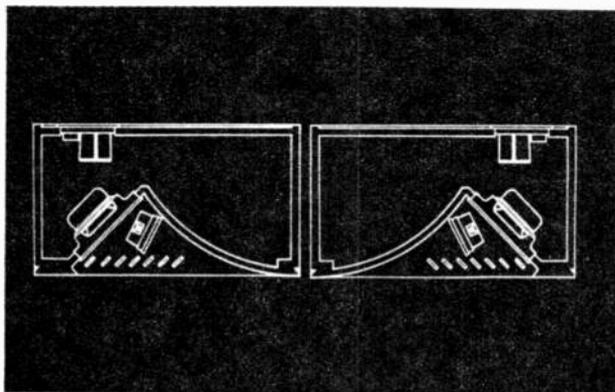


Jensen's Galaxy II speaker system for stereo consists of a bookshelf-size bass center unit that may be stood on floor, plus satellite speakers in a swivel-mount housing that can be positioned on shelf, wall or furniture.

WHEN you speak about loudspeakers nowadays you almost always have to speak of them in plural, for you just can't squeeze stereo out of one loudspeaker anymore than you can squeeze orange juice out of a lemon.

Stereo, at most, is an illusion, albeit an often pleasant one. There's no way in the world you can bring an entire symphony orchestra into your home electronically, but recorded and played back in stereo, music does sound live. How live depends to a large extent on your selection and placement of speakers. *EI* reported on several speaker systems especially designed for stereo when they were first announced. Here is a roundup of new ones marketed since our last report.

Perhaps the widest departure in stereo speaker design to date is Weathers' "Harmony" series. Bookshelf is hardly the word for the "full-range" units in the system. They actually look like medium size books. The speaker rim is an elongated ellipse, flat enough to fit into the dictionary-shaped housing. Stuffed into the cone itself is a special acoustical padding material which serves as a mechanical crossover. At higher frequencies only the area of the cone around the voice coil vibrates. This area is minus the damping material. Any vibration by the rest of the cone is absorbed by the padding preventing cone breakup and distortion. At middle and low frequencies, the whole cone responds. damping material or no!



In order to achieve a broad sound front for stereo rather than highly directional audio, JBL-Ranger "Minigon" speaker enclosures are carefully baffled and designed so that two may be placed side by side or separated somewhat. Diagram shows the S-5 installation.



The bass extension speaker, called "Hideaway," also employs this "variable mass" principle. The sound comes out the front of the damped speaker, which is aimed upward. There is no opening at the top of the box—rather the sound waves are conducted along the top of the speaker housing, down the sides and then exit at ports very close to the floor itself. Each book style unit lists for \$29.75. All three components of a stereo speaker system cost \$114.95.

Although our concern here is primarily with speakers, Heathkit's model SD-1 is really a complete stereo system: "Sum-and-difference" stereo amplifier; record changer; two "wing" speakers; and a woofer. First a word or two about the amplifier. Originally developed by CBS, this single amplifier has the ability of amplifying both channels and then separating them at the speaker output.

The 8" woofer is housed in a ducted port enclosure beneath the record changer and amplifier. The twin stereo speakers are 6" by 9" dual cone ovals

that can be placed on end tables or almost anywhere. The crossover network frequency is 250 cps and the entire system (kit form) sells for \$179.95.

The Jensen Galaxy II stereo speaker system has two satellite speakers in a configuration that either bolts to the wall, like a pin-up lamp, or sits on a shelf or some furniture. Inside each satellite unit are a mid-range speaker that handles 350-2000 cps and a tweeter which extends the range to about 14,000 cps.

The bass center unit is housed in a slightly larger cabinet that may be placed on the floor, bookshelf or table. An 8" "Flexair" woofer takes care of the base and center-fill middle frequencies from both channels. The entire system retails for \$169.50, but you can get it all in kit form for \$92.50.

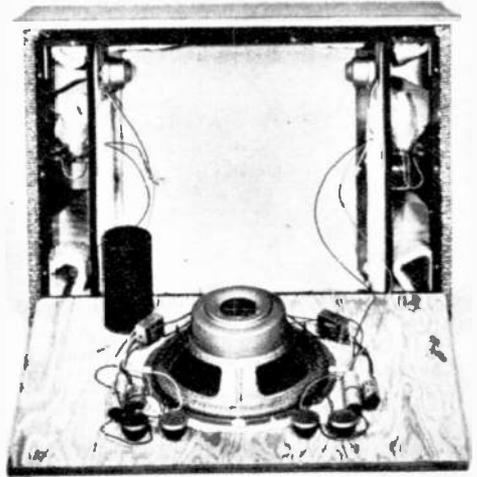
James B. Lansing Sound, with the JBL-Ranger "Minigon," is aiming at a broad sound. One version of the Minigon houses an 8" full range speaker (\$177 each unit) and a second version, the

[Continued on page 105]

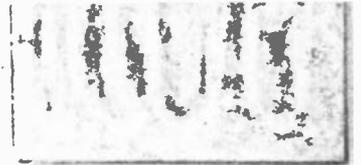
There are five University speakers in this single TMS-2 enclosure engineered primarily for stereophonic listening.

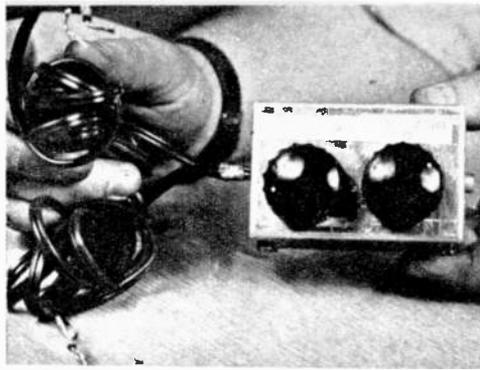


Both tweeters and mid-range speakers are mounted at the sides of the cabinet, while bass speaker faces wall or corner.



With doors open and positioned, sound from side speakers is reflected toward walls. Sound spread may be controlled.





Cables from speaker terminals of stereo amplifiers enter at left. Note blend and level knobs on front.

convert to 3-Channel Stereo

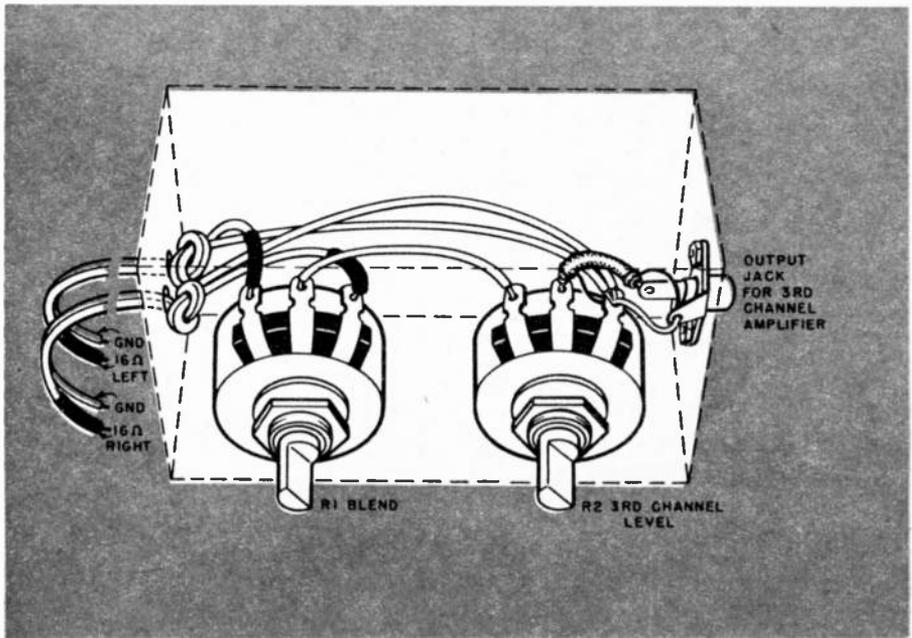
By Leonard Feldman

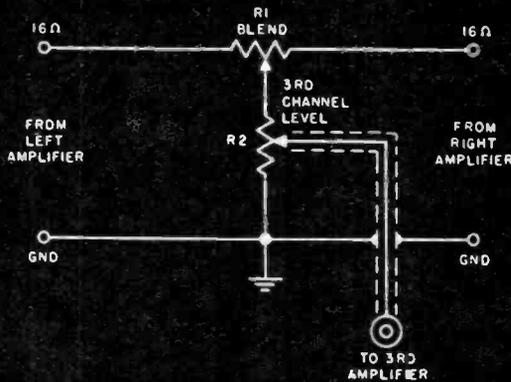
A simple blender, basic amplifier and speaker will eliminate the stereo "hole-in-the-middle" effect.

MANY of the stereo recordings available today tend to exaggerate the separation between channels. This leads to what some have termed the "hole-in-the-middle" effect which detracts from the desired illusion. In an effort to minimize this, a simple third channel blender has been devised. It allows mixing of the left and right channels which are then fed to a basic amplifier and speaker system.

Outputs from the speaker terminals of left and right amplifiers are connected to either end of a 100K potentiometer, R1. As noted in the diagrams this is the "Blend" control. Ground or common wires of each amplifier are tied together to establish a return point. The arm of the control, when set at mid-point, will pick off equal amounts of left and right channel signals. The second potentiometer is simply a level control to regulate the

R1 and R2 are 100K ohm carbon potentiometers. Jack is phono type. Case is Minibox.

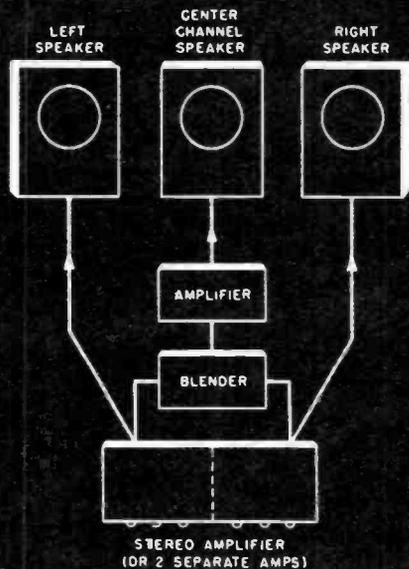
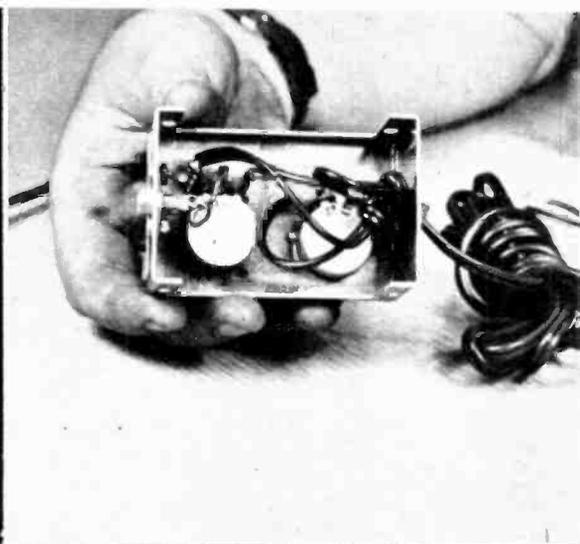




In schematic above, shielded lead going to 3rd amplifier should end in a phono plug. It plugs into "Tuner" or other high level input.

Photo shows case open, revealing rear of front panel. Frame of output jack, on left side, should ground to case. Scrape paint if necessary.

Layout of complete 3-channel system. Blender picks up signals from same speaker terminals that feed left and right speaker channels.



volume of the third, or center channel, with respect to the left and right amplifiers.

The third amplifier may be modest in price and power since it will not be called upon to provide the major portion of sound. You will find that even a very small amount of sound from the center corrects the hole-in-the-middle. The greatest improvement is usually noted in recordings involving a solo instrument or voice which presumably is at "center stage."

A word of caution regarding cable lengths—the distance from the side channel outputs to the blender is not at all critical and any type of two-con-

ductor cable (lamp cord, for example) may be used. The distance from the blender, however, to the third amplifier it feeds should be as short as possible. A shielded cable terminated in a phono plug should be four feet or less in length. The shielded braid of this cable grounds to the common point of the left and right channels. This is all shown in the pictorial wiring guide and schematic.

After making the necessary connections, turn on your system and play a stereo record which previously lacked a uniform spread of sound. Start with the blend control in the center and the level control at minimum. Balance the
 [Continued on page 100]



Illustrated by James Triggs

The First Guided Missile

By W. A. Gregory

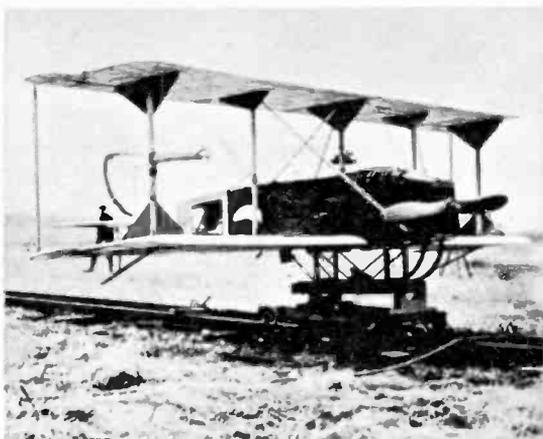
Long before moon probes and ICBM's, the United States had a successful radio-controlled missile.

THE first successful guided missile was launched for the United States Navy on September 11, 1916. In the light of today's satellites, moon rockets and ICBM's, not to mention the German V-1's of World War II, the "missile" of 1916 was not very sophisticated. In fact, it was simply a Curtiss flying boat with automatic controls.

Automatic control—there's the key! From automatic control, to radio control, then—well, let's not get too far ahead of the story.



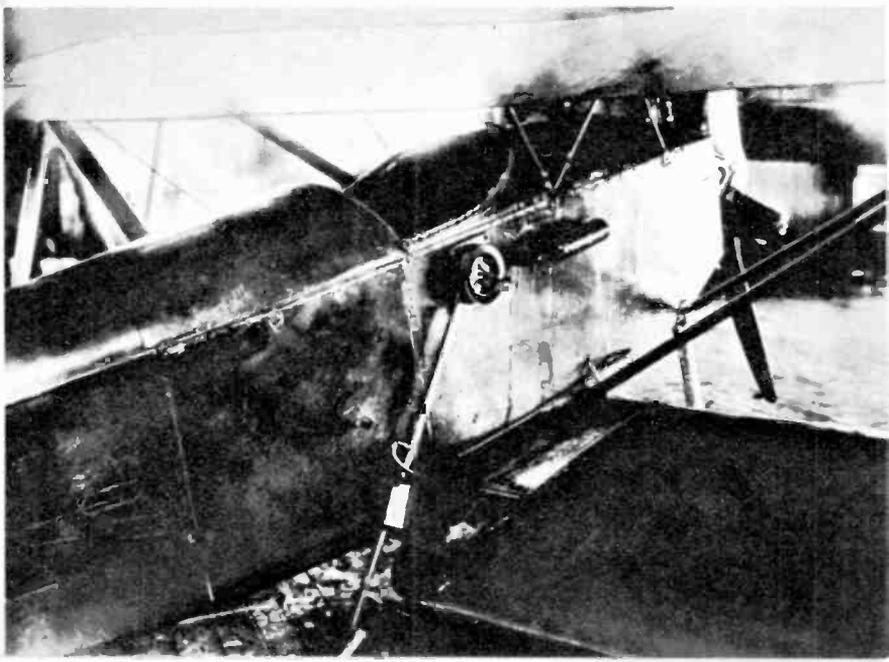
On track ready for launch is special airframe containing early gyro stabilization, first step in automatic flight control.

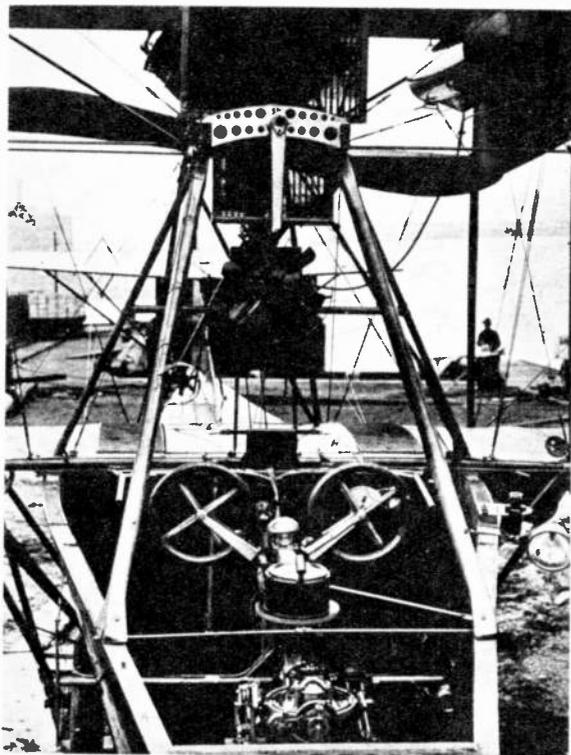


Curtiss F-boat is rigged for automatic flight. Pre-set flight plan worked, but plane was not designed to carry the required bomb load.



Ultimate success was achieved with Standard E-1. Note crank-down antenna for radio control mounted on cockpit. This plane was flown by radio to targets as far as 90 miles from take-off.





This is the Curtiss F-boat which was flown by gyro and servomechanisms while young Lawrence Sperry sat in the cockpit not touching the controls until crash was imminent. In the background is the famous Brooklyn Bridge.

The fact remains that in the Autumn of 1916, the United States had an airborne guided missile.

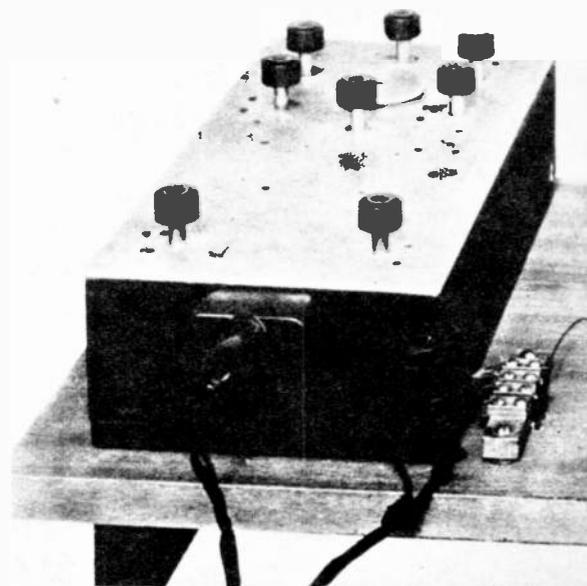
Lieutenant T. S. Wilkinson, reporting to the Secretary of the Navy and the Chief, Bureau of Ordnance, said: "The plane left the water under automatic control, reached a pre-set height, took and maintained a satisfactory compass course and, after traveling a distance set by a distance gear, took a sharp dive downward and would have crashed to earth in accordance with its design had not Mr. Sperry, in the cockpit, quickly taken up hand control and brought the plane back to its starting point."

"Mr. Sperry" was Lawrence Sperry, son of the inventor of the marine gyroscope, Elmer Sperry. The two might well be called the "father and son" of the "aerial torpedo" or "flying bomb," as the early guided missiles were called.

Aviation before World War I was considered a dangerous sport having no commercial prospects and little military value. Until 1914, airplanes were



Billy Mitchell, then a major, expressed interest in a 1916 demonstration of the aerial torpedo. This particular flight was actually sponsored by the Navy and test ended with a crash.



Assembled radio control mechanism for inclusion in plane did not take up much room, but it was not efficient enough to control aircraft that were carrying bomb loads to 1000 lbs.

usually under-powered, always unstable, and frequently uncontrollable. How then could anything approaching a precision automatic flight be achieved?

The answer was found in the elder Sperry's invention of the automatic gyro stabilizer. By 1914 he had discovered a system of four small AC gyros in a gimbal suspension which, through connections with servo motors and pneumatic pistons, could automatically control the ailerons and elevators.

Now the gyro stabilizer maintained the plane in level flight and the first requisite for an A.T. (aerial torpedo), automatic stability and control, had been achieved.

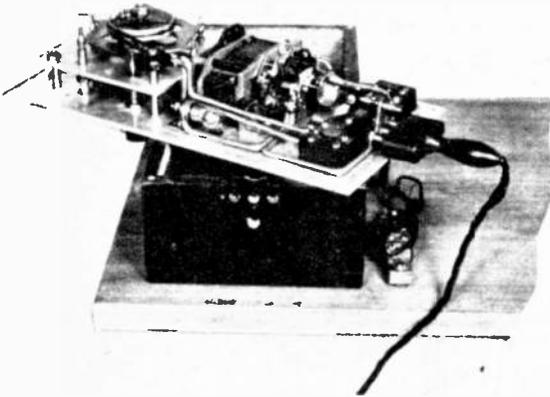
The Sperrys began work in earnest on the A.T. a year later as world tension grew. They turned to the problems involved in automatic directional and altitude control and automatic distance measuring. To solve the first of these puzzles, the gyro was again brought into play, this time to detect changes in azimuth. Then the semi-secret A.T.

project was moved from the Brooklyn Navy Yard to a site on Great South Bay at Amityville, Long Island. Here the automatic altitude control cam and the distance gears were perfected.

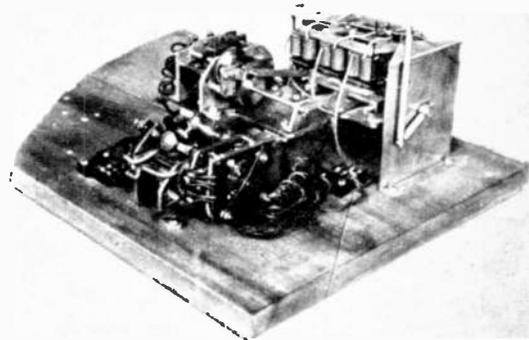
Demonstration flights were seldom completely successful. Many planes were spun into the water, parts salvaged and planes rebuilt.

This was September 1916. Wireless (radio) was beginning to capture the imaginations of men with vision, and the Sperrys were quick to see that radio control of the A.T. would solve a great many control problems. When war was declared in April 1917, the Secretary of the Navy gave his official approval of the Sperry A.T. project and the first Navy guided missile program was under way.

The Sperry site at Amityville was turned over to the Navy together with a new Curtiss F-boat that would serve as an experimental vehicle until five Curtiss N-9's could be converted to land
[Continued on page 100]



Various escapements were designed to be triggered by a radio pulse. Plane after plane was spun into Great South Bay. This gear was developed about 1919, too late for war.



Relays were to be used in conjunction with servo motors and gyros to control pilotless planes. It wasn't until 1922 that the Army Signal Corps came up with suitable R/C gear.

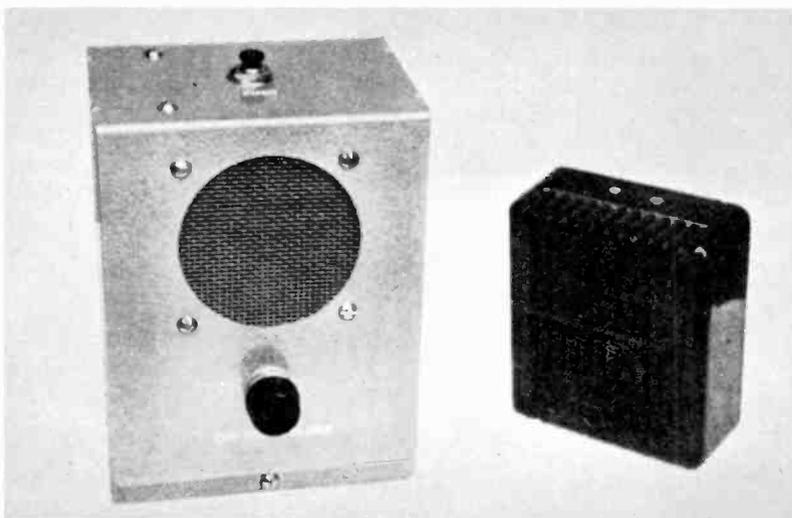
Transistor Intercom

By Don A. Smith

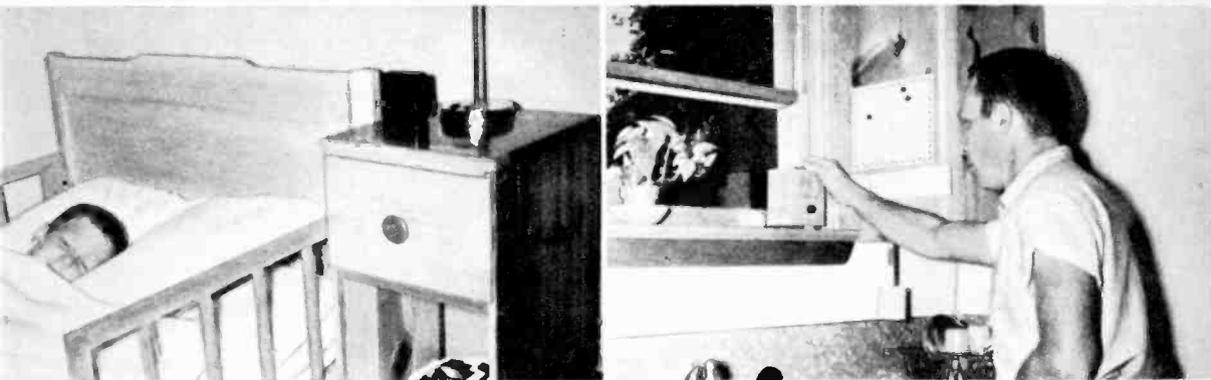
Use this portable unit anywhere—it needs no house current. Serves as an electronic "baby-sitter," too.

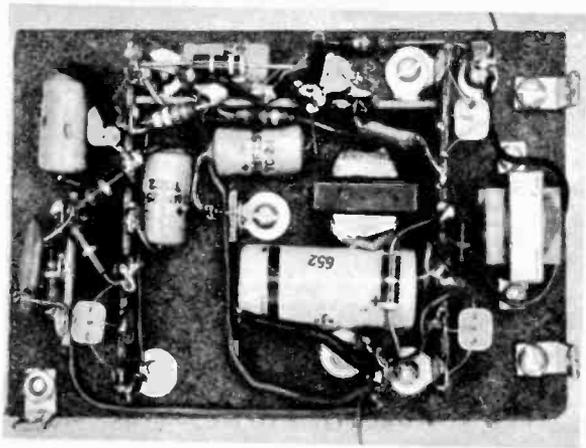
HERE is an intercom that requires no tubes, house current, and is completely free from shock hazard. It uses five low-cost transistors and may be constructed for approximately twenty dollars. The parts are standard and easily available through local electronic distributors or mail-order catalogs.

Construction is started by cutting a piece of Masonite, or other non-metallic material, for the chassis board on which most of the small parts will mount. Follow the layout shown in the

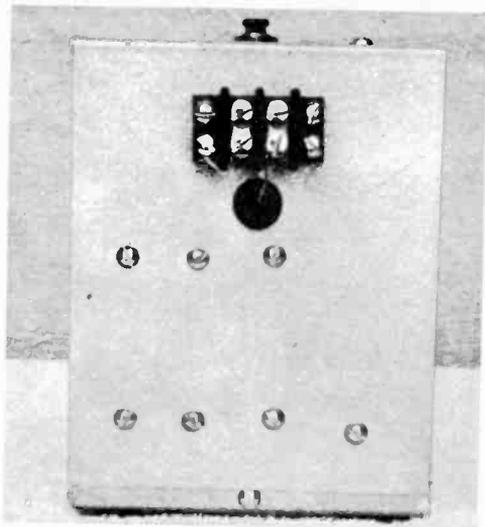


Master unit is above left, push-to-talk button atop its case. Remote is beside it. Below, system is used as a baby-sitter, with remote on night table.

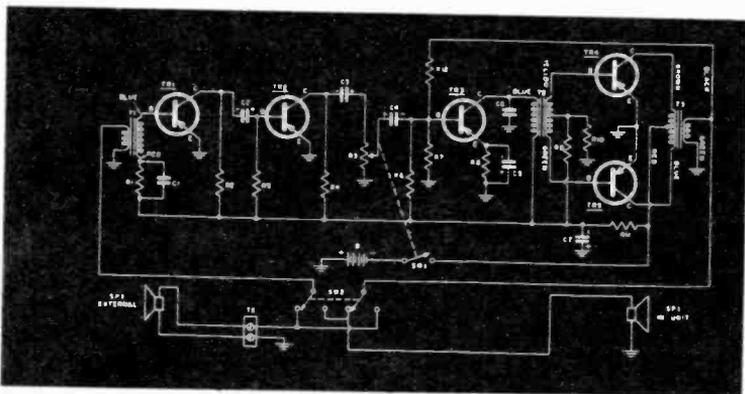




Small parts mount on Masonite board. L-brackets at lower and right edge hold board to case.



Rear view of master shows terminals for the remote speaker wires.



Schematic. 5-transistor circuit has push-pull output (TR4, TR5).

photos and drawings. All wiring is done on one side of the board. However, the nuts and bolts that hold various components protrude through the other side of the board and possibly could short out against the metal case when the board is mounted in place. The remedy is simple. Glue a thin piece of cardboard inside the metal case. Its position should be opposite the board.

The transistors are soldered directly in place so observe the usual precaution of supplying a heat sink while soldering their leads. Grasping each lead with a long-nose pliers should draw sufficient heat away from the body of transistor.

After the board has been wired, drill the necessary holes in the metal case. The speaker hole in the master is $2\frac{1}{4}$ ".

[Continued on page 105]

PARTS LIST

- R1, R3—270,000 ohm resistor (All resistors $\frac{1}{2}$ watt)
- R2—8,200 ohm resistor; R4—6,800 ohm resistor
- R5—50,000 ohm vol. control with SPST switch SW1
- R6—10,000 ohm resistor
- R7—3,900 ohm resistor
- R8—820 ohm resistor
- R9—4,700 ohm resistor
- R10—120 ohm resistor
- R11—100 ohm resistor
- R12—20,000 ohm resistor
- C1—.01 mfd disc ceramic capacitor
- C2, C3—10 mfd electrolytic capacitor 25 volts
- C4, C5—25 mfd electrolytic capacitor 25 volts
- C6—.005 mfd disc ceramic capacitor
- C7—50 mfd electrolytic capacitor 25 volts
- T1—Audio transformer (Stancor A-3332 or equiv.)
- T2—Driver transformer (Thoradson TR-7 or equiv.)
- T3—Output transformer (Lafayette TR-95 or equiv.)
- TR1, TR2, TR3, TR4, TR5—CK722 transistors (Raytheon)
- SW2—Pushbutton switch DPDT (Switchcraft 1006)
- SP1—Master speaker, $2\frac{1}{2}$ " with 3.2 ohm voice coil
- SP2—Remote speaker, 3.2 ohm voice coil, any size
- B—6 volt battery (Eveready 724), with holder
- T5—Terminal Block (Cinch-Jones 2-140)
- Misc.—Metal case (LMB box #140, $3" \times 4" \times 5"$), piece of Masonite $3" \times 4\frac{3}{4}" \times \frac{1}{8}"$, Terminal strips; one 4-lug, one 3-lug, two 7-lug, one 1-lug, one ground lug

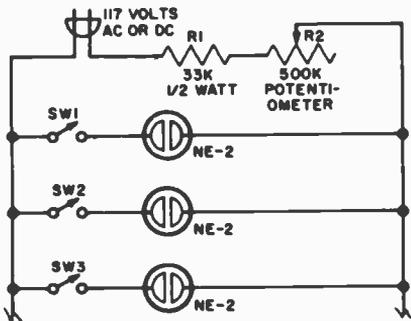
Electronic Brain

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

Neon Signal

In certain types of quiz contests involving team play, the first person who signifies his willingness to answer a question gets the first chance to do so. Obviously, raising of hands or jumping from one's seat leads to arguments as to who was first. Can we do this electrically by means of switches and pilot lights?

L. Parker, Pickering, Ontario



This is a tricky problem if you confine yourself to ordinary incandescent lamps. It can be done this way if you are willing to spend a considerable amount of money on relays and fancy switches.

On the other hand, the utilization of little neon tubes such as NE-2's or NE-51's makes it very simple indeed. The accompanying diagram shows the circuit for three players, but any number can be added without limit merely by duplicating the previous connections. The switches (SW1, SW2, etc.) are ordinary single-pole, single-throw toggles or momentary pushbutton switches.

Circuit operation is explained as follows: with all switches open, none of the neon lamps are lit and no current flows through R1 and R2, hence there is no voltage drop in the circuit. When any one of the switches is closed, full line voltage is instantaneously applied to the corresponding neon tube causing it to ionize and glow. The current flowing

through this tube causes a voltage drop across R1 and R2 so that the voltage available for any of the other tubes is substantially reduced. By adjusting R2, this voltage can be made lower than the ionization potential of any of the remaining lamps. Since the extinguishing potential of a lamp already ionized is much lower than the ionization potential, the neon tube already glowing continues to glow.

Adjustment is quite easy. Merely set R2 so that the ionization of any one lamp prevents the others from ionizing. R1 is a safety resistor that protects the lamps should you inadvertently reduce R2 to zero.

Exactly the same system may be used with larger neon lamps, such as the night lights sold in hardware stores. If you want a more spectacular set of lights such as these would provide, omit R1 altogether since these neon tubes already contain a protective resistor built into the base.

Transformer Leakage

When I connect my communications receiver to a ground pipe, a spark occurs. I find about 14 volts AC between the radio chassis and ground, yet this is a transformer operated receiver. Does this indicate faulty parts, house wiring, or other connections?

Palmer Smith, 518 N. 4th Ave.,
Maywood, Ill.

This is a very common phenomenon. It merely indicates AC leakage from one of the high voltage windings of the transformer to the case, hence to the chassis. If reversing the AC plug causes the potential to disappear, then the source of leakage voltage is the primary winding of the transformer.

If the latter is the case, merely be certain that the plug is always inserted to reduce the potential between chassis and ground zero. It is worthwhile to

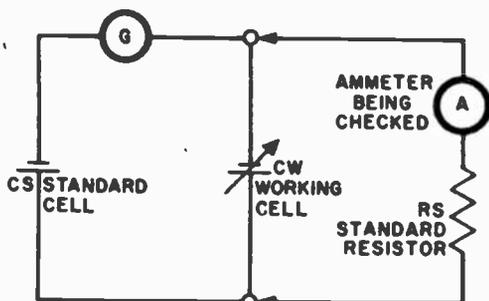
mark the plug so that it will always be inserted in the receptacle in the same manner.

This situation does not represent a hazard as long as the proper polarity as described above is observed.

Checking Ammeters

The accompanying circuit shows a test arrangement for checking ammeters used at Cape Canaveral. CW is first adjusted so that the sensitive galvanometer (G) reads zero. At this point the two voltages are equal and no current is drawn from the standard cell. The ammeter reading can now be checked by computing what it should be since we have a precise voltage and resistance in series with it. If the battery voltages are equal, why does CW supply all the current through RS? (A standard cell is accurate only for zero current conditions.)

Louis L. Andrews, Titusville, Fla.



Suppose we first picture the two-battery and galvanometer circuit as isolated from the ammeter and RS. With G reading zero, this would mean that both voltages were identical and that they are bucking each other out perfectly; the current, of course, would be zero in the galvanometer. If the ammeter and RS were now connected across CW, the galvanometer would at once go off scale because the internal resistances of the two batteries are not the same so that voltage drop across each would be vastly different. In other words, the terminal voltages of the batteries have changed due to different drops within the internal resistances. CW would then be adjusted until its

terminal voltage is again equal to that of CS as indicated by a zero G reading. For this condition, CS emf is now again perfectly bucked out so that this standard cell would supply no current whatsoever to A and RS. In other words, CW has been adjusted so that its terminal voltage is identical with that of CS despite the fact that CW is now supplying all the current to RS.

B+ Short.

Each time I put a new 5U4 rectifier tube in my television receiver, it promptly burns out and the power transformer overheats. I have checked the transformer and it seems to be perfect. What might the trouble be?

Charles Killen, Isom, Va.

The trouble you describe is indicative of a B+ to B- short circuit in the receiver. As a result of this short circuit, the rectifier is called upon to deliver a current far in excess of its normal rating.

In many cases, a low resistance between B+ and B- is the result of a very leaky or short-circuit filter capacitor in the power supply. To check these, disconnect one lead from each capacitor and measure its resistance with an ohmmeter. If the resistance measures less than 500,000 ohms, the capacitor should be replaced.

The same test should be repeated across all the screen by-pass capacitors and any others that appear connected between B+ and B-. While you are at it, you might inspect the wiring carefully to be certain that you have no frayed insulation or other bare wires in contact with each other.

Short circuits in a TV receiver can be very costly. Not only can the rectifier and power transformer burn out, but filter resistors or filter choke, too.

The obvious solution is a fuse, an expedient which has been omitted in some sets. It may easily be added to any TV receiver by installing a fuse holder (or fuse block) capable of mounting a glass tube fuse. The required amperage is in the vicinity of three amperes, a value which varies according to set. It is inserted into one leg of the AC line. ●

how to

Kill Noise In Your CB Mobile Radio

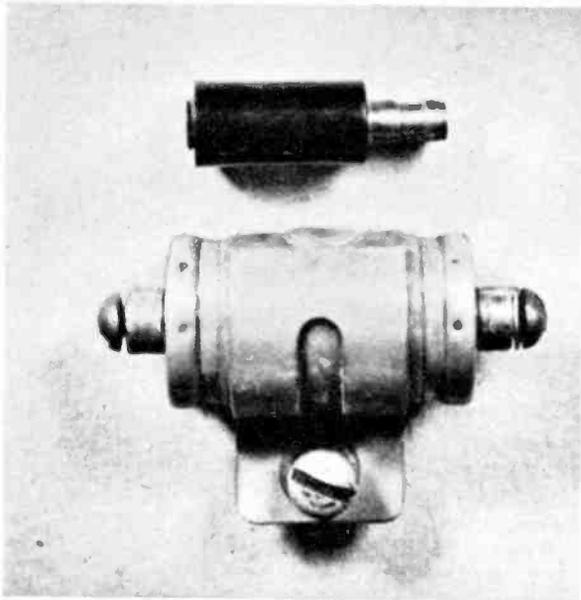
By Joe Doherty

Shield, bond and bypass. Try these techniques to reduce interference in a Citizens Band transceiver.

ONE problem peculiar to mobile radio is the reception of many varieties of noise which may mask signals sufficiently to render them unintelligible. This is especially true in the region of the 27 mc Citizens Band where the 5-watt transmitter power limitation makes reception extremely difficult under noisy conditions. Fortunately most of this noise can be reduced through proper shielding, bonding and bypassing of the offending source. These impulses are, for the most part, generated within the car.

Wheel static, generated at front axles, often varies with car speed. Spiral spring inserted into axle cap shorts out static. Below, author taps the axle cap back into place.





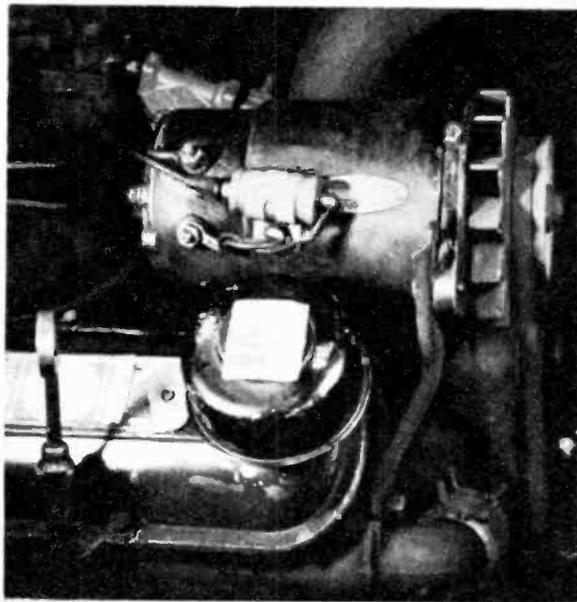
Spark plug suppressor is at top. Coaxial capacitor below has two end screws for leads.

Ignition System

A good place to start your noise clean-up campaign is at the automobile's noisiest point; the ignition system. Ignition noise may be identified by a staccato popping in the speaker which varies in rate directly with engine speed, whether the vehicle is in motion or not. Installation of spark plug suppressors or resistor spark plugs will go a long way toward silencing this type of interference. In more stubborn cases it may be necessary to install a suppressor between the center terminal of the distributor and the high tension terminal at the spark coil. There are especially designed suppressors for this application having convenient end terminals which accommodate the high voltage cable.

After suppressors have been installed, it may sometimes be necessary to retune slightly for best engine performance. Suppressors do not alter engine efficiency but they may add some delay in ignition timing.

Noise from the ignition primary circuit can be eliminated in most cases through bypassing the primary lead, using a .1 mfd coaxial capacitor. The



Capacitor mounted directly on generator, in series with armature lead (from lower bolt).

coaxial type is more expensive than other types but it provides a very effective method of bypassing this circuit. These capacitors come with a mounting lug which should be effectively grounded at a point as close as possible to the ignition coil. The insulated terminals at either end of the capacitor provide convenient connection to the primary lead, to which these terminals are series connected. The breaker points in the distributor are already bypassed by an internal distributor capacitor and any alteration from the value prescribed by the auto manufacturer could lead to trouble.

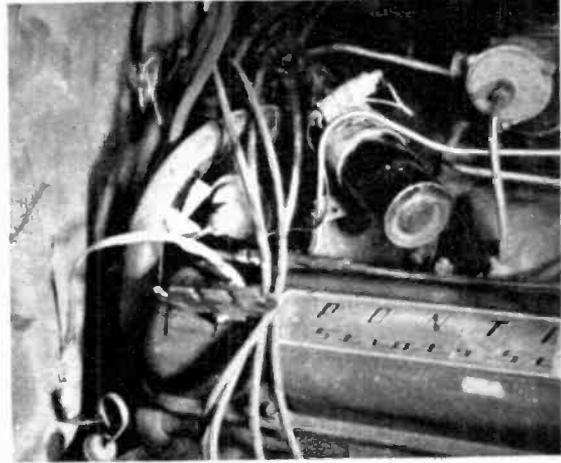
Generator and Regulator System

Noise interference from the generator can be recognized by a whine whose pitch varies directly with engine speed. In some cases the whine is far more serious than in others but it can be eliminated. This interference is due to brush sparking and may usually be reduced by placing another coaxial capacitor in the armature circuit of the generator in the same manner as in the ignition primary circuit. Its value

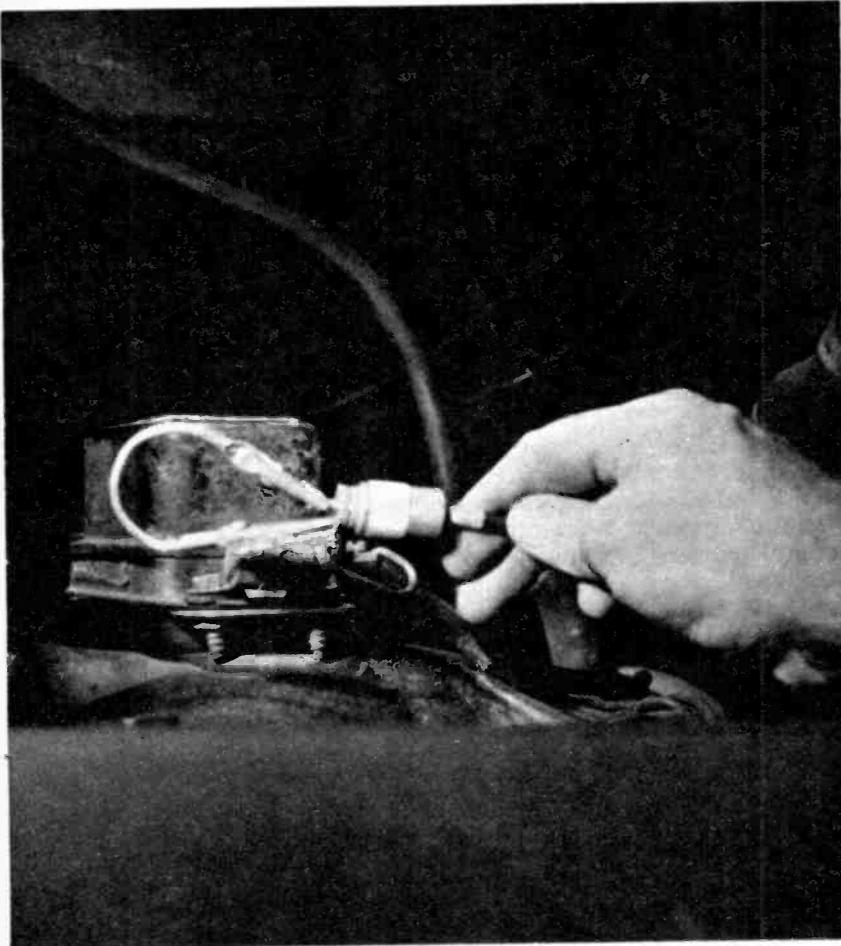
[Continued on page 111]



Capacitor mounted on coil bypasses primary circuit. Lead comes from ignition switch.



White arrow points to copper braid that bonds engine to firewall and establishes good ground.



"Sniffer" used as a probe to pinpoint source of noise—shown here next to voltage regulator.

EI'S Hi-Fi Doctor

The Hidden Specification

EVERYONE knows that low distortion is one of the most important aspects of high-fidelity reproduction. We know, and manufacturers know, that an amplifier which distorts badly isn't high-fidelity, and specification sheets pay token homage to this by studiously listing harmonic and intermodulation distortion figures.

Anyone who reads amplifier specifications, however, will have noticed that distortion ratings are nearly always stated as a function of maximum (or "rated") power output. (For example, "2% IM distortion at 30 watts output.") This is a handy guide to an amplifier's power capability, but the fact is that the *average* power an amplifier delivers under typical listening conditions is around 1 watt. In other words, the distortion that an amplifier produces at 1 watt output is the distortion we'll be listening to *most of the time*. Yet how many amplifier purveyors ever rate distortion at 1 watt output? Some do, but most of them don't.

Since an amplifier's distortion increases rapidly as it approaches its overload point, we might assume that its distortion will decrease as it is driven less and less hard. This is true, but the mistake lies in assuming that this goes on indefinitely until, at negligible power levels, distortion is also negligible.

Let's consider two "identical" competing 30 watt amplifiers, both rated at 2% IM distortion at full power. Investigation may show that one unit's distortion diminishes with diminishing power output until, at 2 watts, distortion has dropped to well below 0.1%. The same test may show that the other amplifier's distortion drops until the power is down to 10 watts, and then remains at a constant 0.5% at all lower power levels. At 1 watt, the second unit has over five times as much distortion as the first one.

And this is what doesn't show on the average specification sheet.

The consensus among engineers with more technical know how than hearing acuity is that the human ear cannot detect intermodulation distortion of less than about 2%. This contention, although supported by numerous technical papers (most of them written prior to 1940), is unmitigated bunk. Anyone with normal hearing can appreciate the difference between a typical "hi-fi" amplifier and one with extremely low distortion, because most of us don't have access to the "perfect" test material that designers often use for their listening tests. Magnetic tape, whose purity of sound would seem to make it ideal for ear-testing of amplifiers, actually *flatters* a bad amplifier as effectively as any other kind of program material. A worn record, with its clicks and pops and inner-groove "hash," is a much more stringent test, because it takes very little distortion to exaggerate its blemishes way out of proportion to their actual severity.

The major annoyance value of worn or "dirty" records stems from the effects of distortion and transducer peaks (in the pickup and speaker) on the various noises that are picked off all records to some extent. A truly good system, with smooth transducers and less than 0.1% total IM distortion in the amplifier at most power levels, will reproduce worn records with an ease and listenability that must be heard to be appreciated.

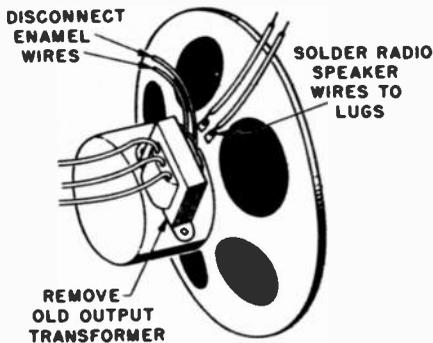
So how can we tell whether an amplifier has low residual distortion? Read specifications—manufacturers who set high standards for low-level distortion usually publish a distortion rating for 5 or 1 watt output. When low-level distortion isn't mentioned at all in a spec sheet, the amplifier may be satisfactory in this respect, but may not be.

and Clinic

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

Speaker Connection

I have an old six-inch speaker that I want to use with a table radio. Could you tell me how to wire the transformer that is mounted on the speaker frame?
Clayton McManaway, Charleston, S. C.



The transformer on the speaker frame is the audio output transformer which matches the radio's output tube to the voice coil of the speaker. Your table radio probably has an output transformer so the one on the old speaker should be removed. Unbend its mounting tabs and wire as shown in the diagram above.

Distorted Output

What causes the plate of one output tube in my amplifier to glow red? I have replaced the coupling capacitors with no success. The tube works alright in the other side of the output.
Harrison Traylor, Dayton, O.

A possible source of your difficulty is in the cathode circuit of the tube. The cathode goes to ground through a resistor and electrolytic capacitor. A disturbance in these components could upset the tube's bias and cause it to conduct an excessive amount of current. Check for the correct value of positive voltage between cathode and ground.

Needle Talk

While playing certain records on my changer I hear objectionable "needle talk." Can anything be done to reduce or prevent this? The cartridge is a G-E.
Mitchell B. Lazarus, Montreal, Que.

Check the stylus force with an accurate gauge. If it is excessive, adjust it according to the manufacturer's recommendation.

Also check the damping blocks, just under the stylus, for correct position, and whether they have hardened with age.

Needle talk is the result of acoustical radiation; the needle acting as a "speaker." It has been found that anything that reduces the compliance of the needle will aggravate this condition.

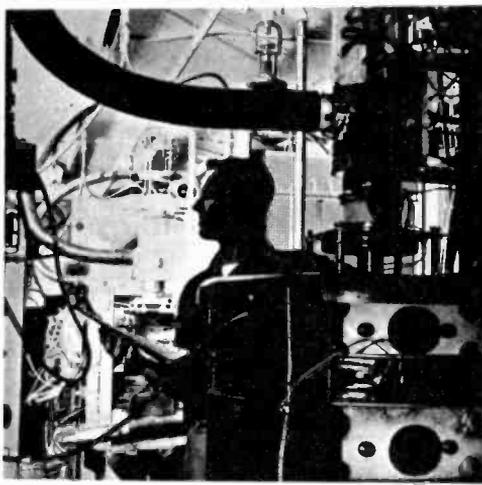
Test Equipment

I would like to buy a basic collection of test instruments that I can use to maintain my hi-fi system in peak condition. What would you suggest as the minimum complement of instruments for this purpose?
Wayne Felton, Pittsburgh, Pa.

The single, most important piece of test equipment, is the multimeter. It is used for voltage and resistance measurements. An informative series on meters started in the August, 1959 issue of *EI*. It details the differences between the various basic types of meters. The vacuum-tube voltmeter seems to be the unit that will fill your needs.

Add an audio oscillator and you'll be able to run frequency response checks and inject signals useful in troubleshooting.

More elaborate equipment for hi-fi servicing would include: audio voltmeter, square wave generator, oscilloscope, intermodulation distortion analyzer, harmonic distortion analyzer, and RF sweep generator for tuner service.



Exciting new radio communications equipment, such as this tropospheric scatter transmitter which employs huge megawatt klystrons, are operated and maintained by FCC licensed technicians and engineers.

Your Ticket to a Career

By Leo G. Sands

FCC commercial radiotelephone or radiotelegraph license can be your insurance of a secure future.

SOME one million vehicles are equipped with radiotelephones. About 80,000 boats, from rowboats to ocean liners are equipped with marine radiotelephones. More than 80,000 aircraft carry radiotelephones; many also carry radar. According to the

Shipboard radio operators are well paid and enjoy fine working conditions. In addition to knowing radio theory, they must master Morse code.



most recent FCC annual report, there are almost 10,000 AM, FM and TV broadcasting stations. There are also numerous TV translator stations which extend TV reception to areas out of direct range of regular TV stations. There are hundreds of microwave repeater and terminal stations in use.

In addition to the 1,400,000 transmitters licensed for private use, telephone companies and around 600 miscellaneous common carriers provide radiotelephone service to the public on a fee basis. All this radio equipment requires both operation and servicing. In most cases, you need an FCC radiotelephone license to do either—and that license could be your ticket to a fine career.

Swelling the demand for licensed radio technicians is the recent boom in Citizens Radio. While an operator license does not require the taking of an FCC exam, certain adjustments and parts replacements which can affect transmitter frequency or cause an in-

crease in power beyond the prescribed limits can only be performed by a person with a commercial operator license.

But, you don't have to learn the code to get a commercial radio operator license unless you want to become a ship-board radio operator.

If you are interested only in repair and installation of two-way radio transmitters, a second class radiotelephone operator license will suffice. But if you want to take charge of a broadcasting station, you should have a first class "ticket."

To get a second class license you must be a citizen of the United States, be able to speak English and pass three written examinations. For a first class license you must pass an additional exam.

For the glamorous radiotelegraph license you must be able to transmit and receive 16 code groups per minute (second or third class license), or 20 code groups (25 words) per minute (first class license).

Telephone companies and television booster systems often employ microwave relay. Recent expansion of facilities has created demand for people to operate and service equipment.

For FCC commercial license examinations, you would be smart to bone up on electrical and electronic formulas and schematic diagrams. Various license manuals can be of much help.



You must pass the following FCC examinations for a license to perform the jobs listed below:

KIND OF JOB	FCC EXAMINATION ELEMENTS (1)							
	1	2	3	4	5	6	8	
Mobile radiotelephone servicing	*	*	*					
Marine radiotelephone servicing	*	*	*					
Aviation radiotelephone servicing	*	*	*					
Citizens radio servicing	*	*	*					
Radar speed meter servicing	*	*						
Radar vehicle detector servicing	*	*	*					
Marine radar servicing	*	*	2		2	2	*	
TV station operator	*	*	*	*				
AM broadcasting station operator	*	*	*	*				
FM broadcasting station operator	*	*	*	*				
Non-commercial (under 1 kw) FM broadcasting station operator	*	*	*	*				
Passenger or cargo ship radio operator	*	*			*	*		

(1) See text for description of examination elements.

(2) Radar endorsement on first or second class radiotelephone or radiotelegraph operator license is satisfactory.

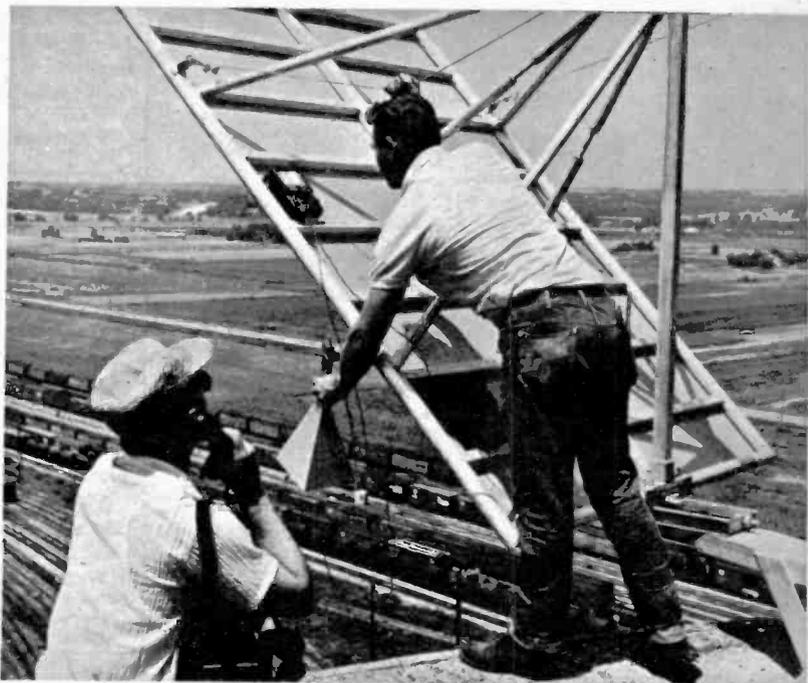
TV transmitter operator at WRCV-TV, Phila., sits at control console and brings station log up to the minute. For work of this nature, first 'phone license is generally required.



Thousands of private planes are equipped with radiotelephones which require licensed servicing. Here technician from San Jose Avionics moves in to install and check out plane radio.



What are these men doing? Flat reflector serves as a mirror to bounce microwave signals from railroad communications system to another antenna miles away. Man at right is adjusting the small microwave horn antenna with left hand while co-worker uses walkie-talkie to instruct men below in adjusting a ground-level transmitter.



Operator license tests are given at any of the Federal Communications Commission field offices. Before going to one of the field offices, you should get a copy of FCC rules, part 13, obtainable from the Supt. of Documents, U. S. Government Printing Office, Washington, D. C. for 15 cents. When you think you are ready, write or call the FCC field office nearest you for time and date when you can take the examination. Plan on spending the better part of the day at the field office.

Long before you take your tests, start boning up, even if you have plenty of electronics experience. It isn't that the tests are very tough or tricky, but that most of us soon forget many of the equations dealing with electrical and electronic circuits. If you know how to use a slide rule you may find it a big time-saver. But you cannot bring along notes or lists of equations.

All applicants are not given the same
[Continued on page 102]



This CBS-TV transmitter operator not only controls his station's signals at the transmitter site, but must be prepared to make any necessary equipment repairs. Note scope.

Local radio stations, employing comparatively low power, are good starting places for men who want to break into commercial radio-TV.

Girls also find jobs in radio. Restricted radio-telephone ticket is all that is required to give this gal authority over station, mobile units.





Above, AM tuner is seen unplugged from other units. At left, project plugged together. Preamp is left of tuner.

the El

Build-it Course-4

Theory and practice are combined in this month's project—an AM tuner to plug into previous projects.

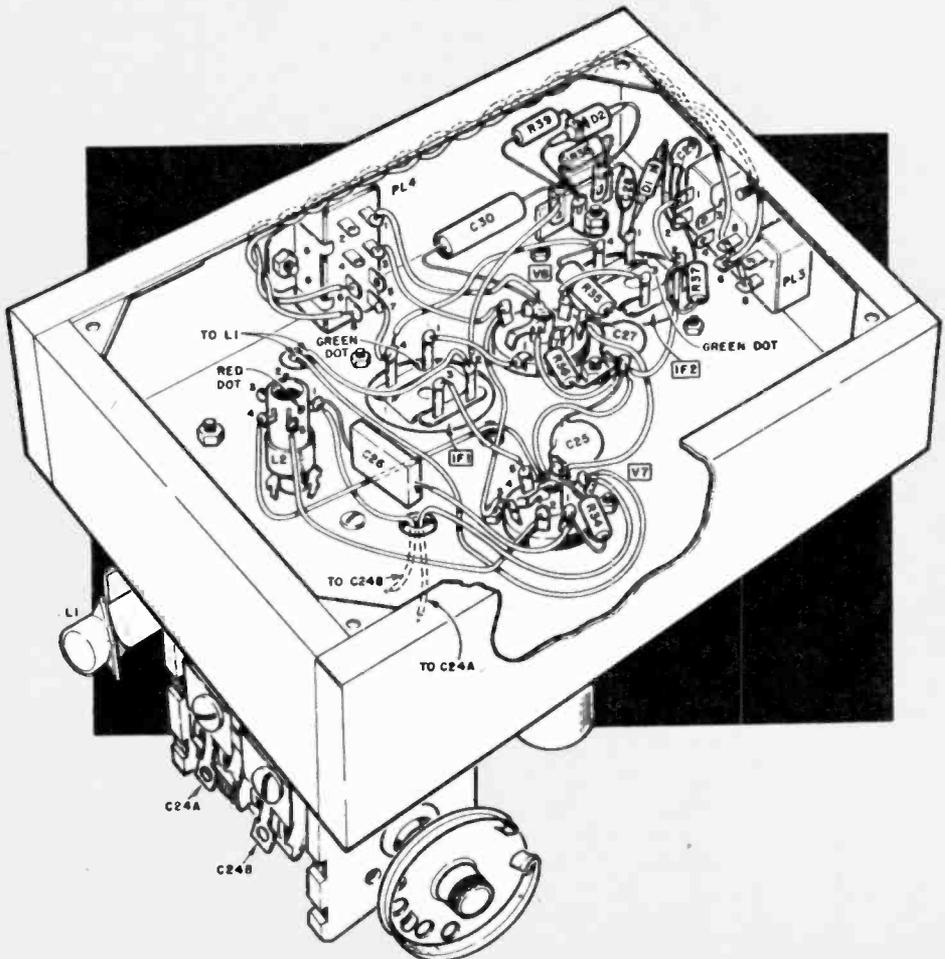
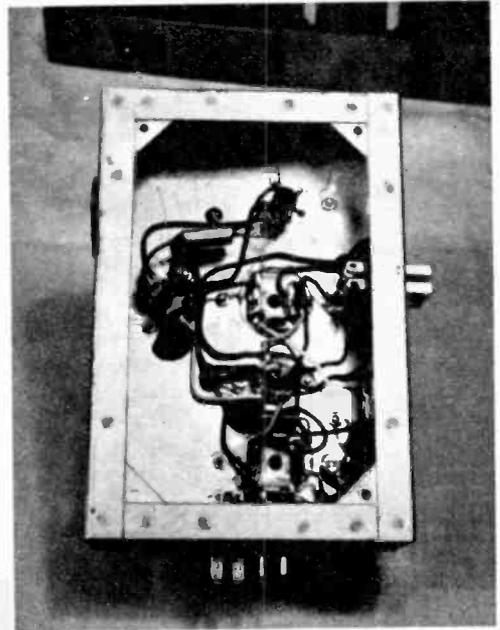
PART 4 of this series is devoted to the AM tuner. It is treated in the same manner as the projects in the first three parts. Complete constructional details are given, along with the theory of its operation. The unit is designed along basic lines and is capable of rendering good performance.

It utilizes the plug-in arrangement. This enables it to pick up power from the power supply (project 1) and feed its output signals to the preamplifier (project 3 in the series). For those who wish to build the tuner minus the plug-in feature, the operating voltages are given below the schematic diagram.

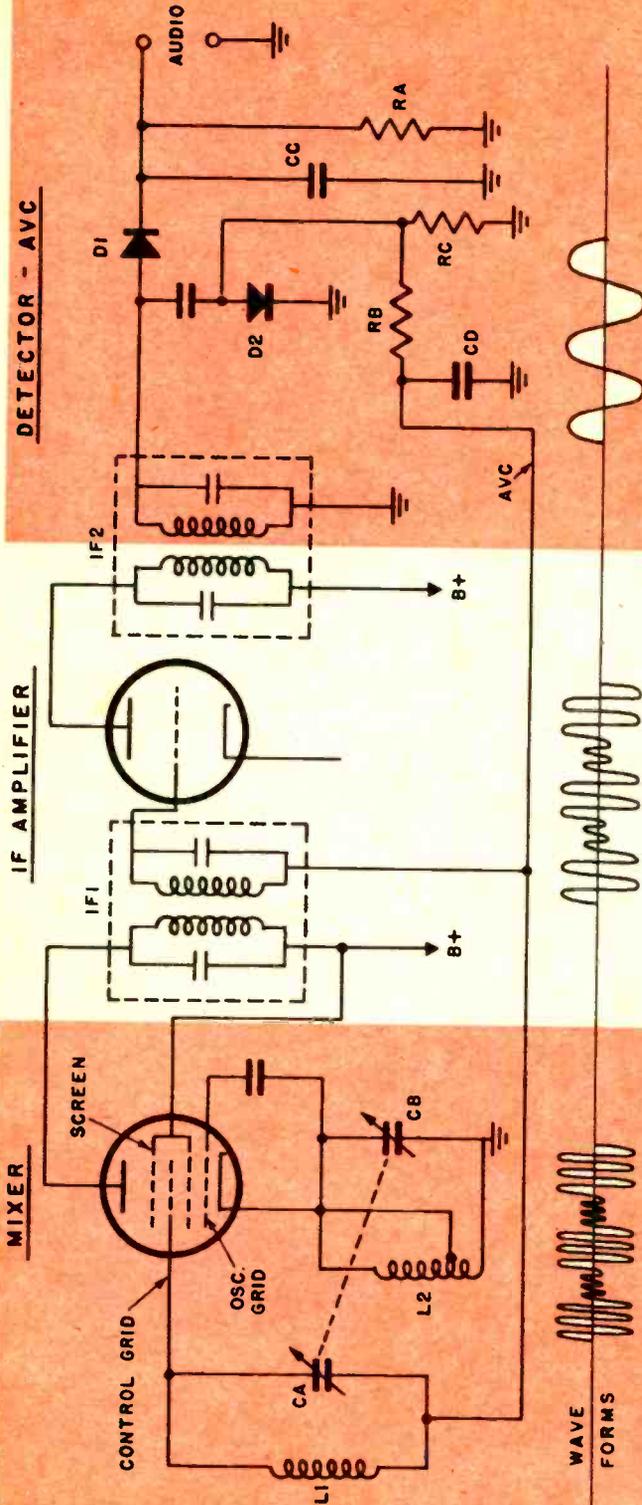
AM is amplitude modulation. It is the system used on the standard broadcast band for the transmission of intelligence—voice and music. Stations are assigned carrier frequencies within the band of 550 kc to 1600 kc. A carrier, or radio wave, may be varied in many ways for the superimposition of intelligence. In AM, the variable factor is the strength of the signal. If a 1000 cycle tone (within the audible range) modulates a carrier, the result is a radio wave that rises in strength and falls to zero 1000 times per second.

Underside view of tuner. Plug at bottom is PL3, which goes to preamp. PL4 is at right.

Follow wiring guide during construction. Don't overheat D1, D2, top right, while soldering.



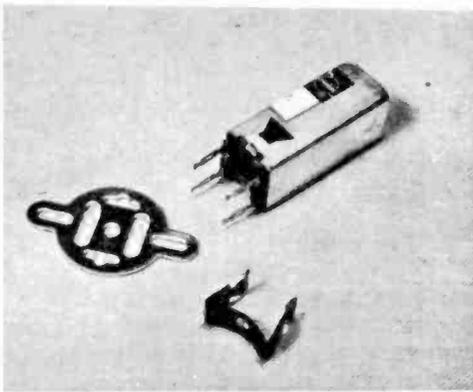
HOW THE AM TUNER WORKS



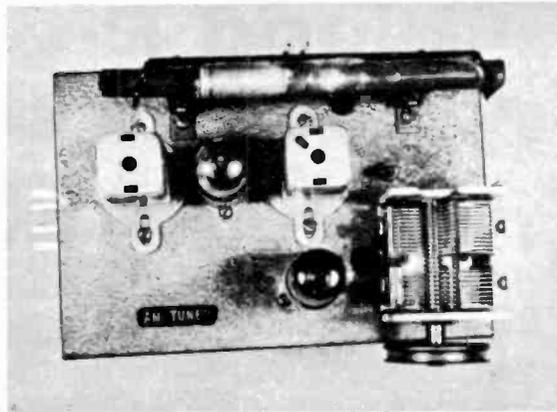
Loopstick L1 and variable capacitor CA tune in desired signal which goes to control grid. Electrons in tube vary according to signal. L2-CB form an oscillator circuit with the screen and oscillator grid. Thus, electrons from cathode vary under the influence of control and oscillator grids. Oscillator (see text) always produces a signal 455 kc higher than received signal. CA and CB are mechanically ganged together (dotted line), turn simultaneously.

Signals from the mixer include the received frequency, oscillator frequency and the products resulting from a mixture of these. The important one is the difference frequency between the oscillator and received frequency—always 455 kc. IF1 is the input intermediate frequency transformer. It is fixed tuned to 455 kc. The tube amplifies this frequency and passes it to output IF2 which is also resonant to 455 kc.

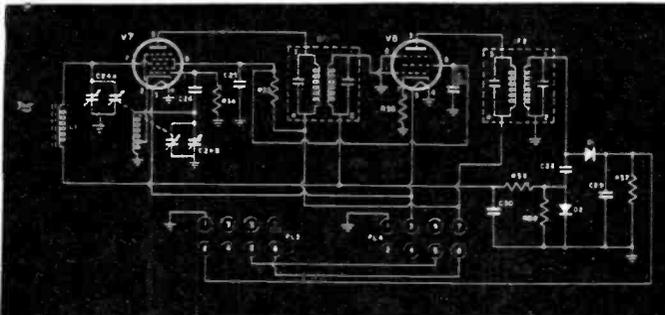
Here, 455 kc radio frequency changes to audio by detection. Diode D1 rectifies the 455 kc, permitting only the positive pulses to go through it. Filter CC-RA fills in the gaps between RF pulses and resulting waveform is audio. Diode D2 rectifies some of the signal to supply negative AVC, filtered by RC-RB-CD. AVC controls gain of IF amplifier and mixer. If, for example, a strong signal is received, a large negative AVC voltage is produced which biases the first 2 stages to prevent overload.



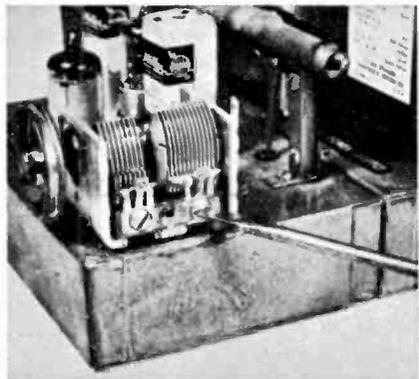
1-inch hole is drilled in chassis and plate (left) bolted on. U-clip holds transformer to plate.



Note alignment holes at top of two IF transformers, also tuned under chassis.



Schematic. Power supply feeds 250 VDC to pin 7 on PL4, 6.3 VAC to pin 3. Audio output is on pin 2 of PL3.



At right, screwdriver tunes C24A, main tuning capacitor. Adjacent screw is trimmer on C24B, in oscillator.

The tuner is on the receiving end. Its job is to *tune, amplify* and *detect*. We'll consider these functions separately in a moment. From the variety of circuits that have been used in receivers, the superheterodyne has emerged as the most popular. It fills two important requirements—selectivity and sensitivity. Selectivity is the tuner's ability to reject noise and interfering stations. Good sensitivity enables it to boost a signal without unduly amplifying atmospheric noise along with it.

For a detailed description of the signal pathways through the tuner's circuits, see the full-page theory diagram.

The term "tuner," as generally applied, is a misnomer. Actual tuning occurs in the section of the unit often called the "front end." The first impor-
[Continued on page 104]

PARTS LIST

- (Numbers continue from last month's project)
- R34—24,000 ohm resistor 1/2 watt
 - R35—15,000 ohm resistor 1 watt
 - R36—100 ohm resistor 1/2 watt
 - R37—20,000 ohm resistor 1/2 watt
 - R38—10 megohm resistor 1/2 watt
 - R39—1 megohm resistor 1/2 watt
 - C24A, C24B—Dual-section broadcast tuning capacitor [Allied #61HO65]
 - C25, C27—.033 mfd ceramic disc capacitor (all capacitors 400 volts or higher)
 - C26—47 mmd mica capacitor
 - C28—330 mmd disc ceramic capacitor
 - C29—.002 mfd disc ceramic capacitor
 - C30—.1 mfd paper capacitor
 - L1—Ferriloopstick (5" Superex or equiv.)
 - L2—Miniature oscillator coil (Miller 70-OSC)
 - V7—6BE6 tube
 - V8—6BA6 tube
 - IF1—455 kc IF input transformer (Miller 12-C1)
 - IF2—455 kc IF output transformer (Miller 12-C2)
 - D1, D2—1N34 crystal diode
 - PL3, PL4—8-pin chassis mount plug (Cinch-Jones P308A)
 - Misc.—Two 7-pin tube sockets with center posts, aluminum chassis 4"x6"x1 1/2" (Premier ACH-436)

Blood Pressure- Electronically

SURGEONS may now get a continuous reading of a patient's blood pressure and at the same time regulate the supply of controlling drugs to maintain a pre-determined pressure level, thanks to a new electronic device developed in England.

The blood pressure follower, as it is called, does not use the usual arm cuff and stethoscope. (The stethoscope picks up arterial pulsation). The new instrument only requires that a small digital cuff, with a crystal microphone inside be fitted over the patient's finger.

[Continued on page 107]



In photos above, pneumatic cuff is slipped over patient's finger prior to operation. Piezo-electric crystal inside cuff performs functions of stethoscope. Small unit causes no discomfort, may be left on for continuous readings.

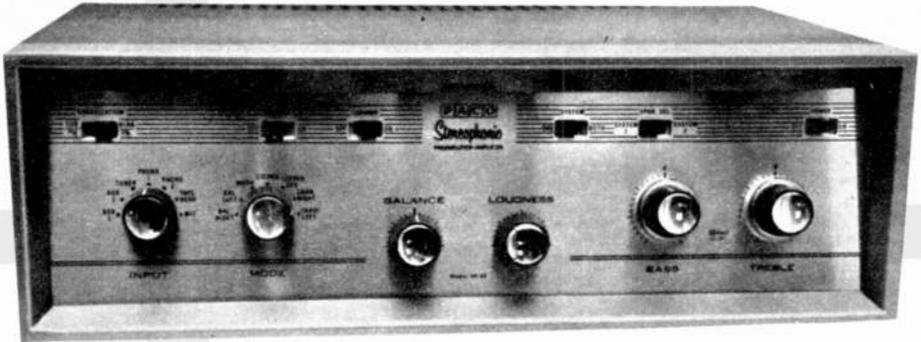


Anesthesia is administered to patient during operation and constant check on blood pressure is maintained all the while. Machine also governs the administration of drugs to keep blood pressure at a pre-determined level.

E I reports on the

Paco Stereo Preamplifier-Amplifier

Two preamplifiers and 20 watt amplifiers are contained in one cabinet in this integrated stereo kit.



Completed kit is above, showing operating controls on front panel. Parts, prior to assembly are below. Plastic bags along bottom contain small parts.

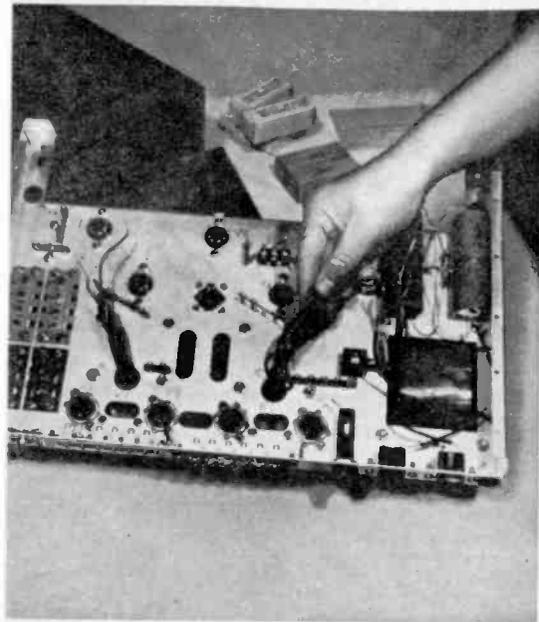


THE key word in describing the Precision Apparatus Company's SA-40 is "integrated." One chassis contains most of the electronics for reproducing stereo program material. Two separate preamplifiers and power amplifiers unified in such a way can serve two important purposes. First is cost. Tally up the expense of the four components purchased individually and you'll probably

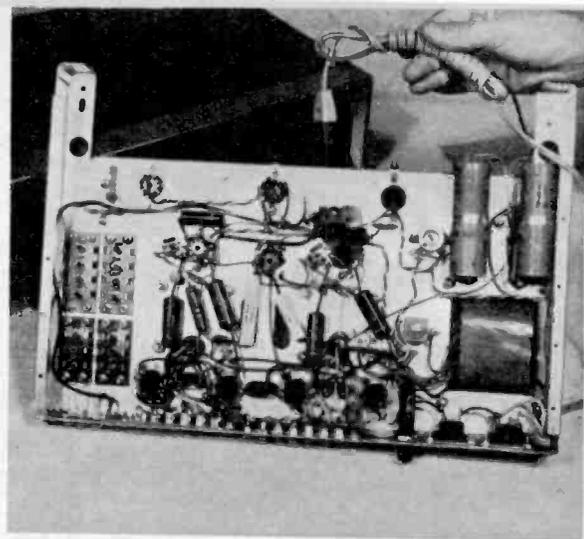
exceed the SA-40's. Factory wired, it amounts to \$129.95; for the kit it is \$79.95.

Second consideration; it's neater. There's no need to stack a group of cabinets. The overall physical volume is inclined to be less, too. And all operating controls appear on a single panel.

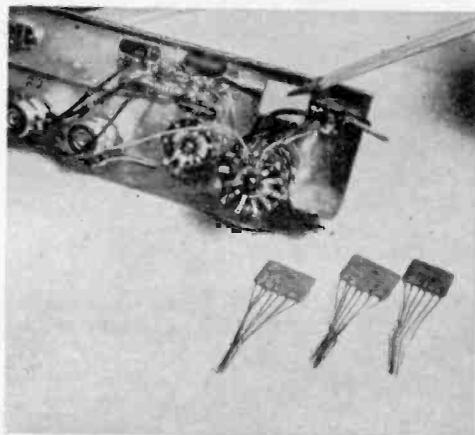
On the debit side arises the question: "What do I do with my present equipment?" Owners of good monophonic hi-fi gear



Underside of main chassis after mounting parts. Hand holds output transformer leads.



After wiring power amplifiers and the power supply, AC cord is plugged in for checkout.



Above, printed circuits are used in tone and equalizer circuits. Pencil shows one installed.



At left, switches and controls used in the preamps are mounted to separate sub-chassis.

would probably elect to add on components to achieve stereo.

Construction time for the kit ran close to thirty hours. This figure includes adjustments, and a checkout of each power supply voltage on the schematic. If the kit builder owns a meter, this final step should be done. It could reveal a wiring error. Assuming that the kit performs perfectly, measure the voltages and pencil them in next to the values printed on the schematic. You'll find that what

you measure may vary as much as 20 per cent (up or down) from the recommended voltages. If the unit needs troubleshooting at a future date, the notations will prove valuable. Also, this kind of checkout enables you to become more familiar with the circuitry.

Building the kit is not difficult—but it is extensive. Paco's manual, a 90-page book, assumes that it will be assembled by a rank beginner. A large section is devoted not only to the technique of

soldering, but types of solder, irons, etc. Clear photos illustrate this.

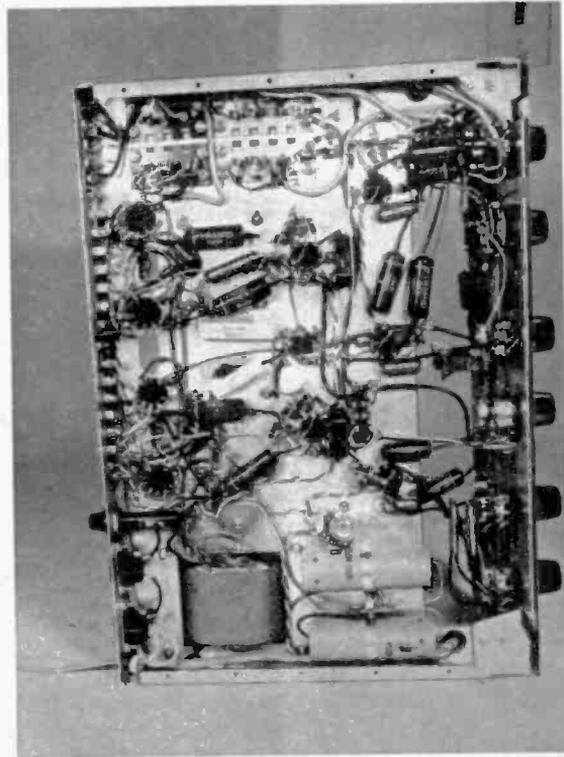
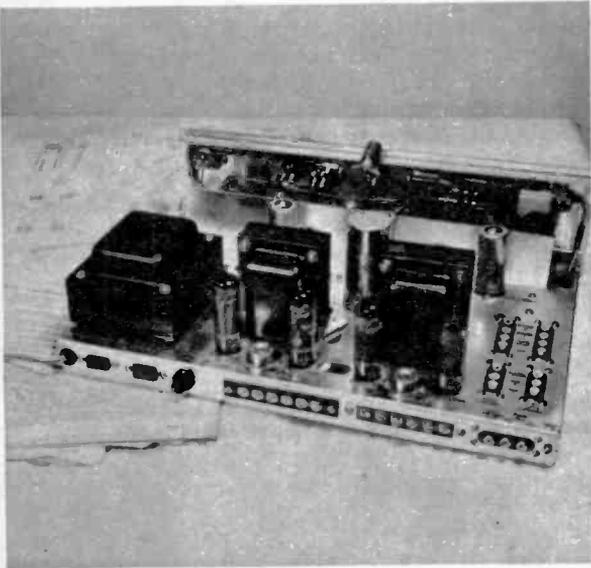
We do, however, recommend that the builder have at least some experience with kits under his belt before tackling this one.

There is one innovation in wiring this piece of equipment that should be more common in kit construction where possible. That is, actually operating part of the circuit to detect errors before all the wiring is complete. It's especially helpful in a unit with extensive circuitry.

Here's how it's applied in the SA-40. The two power amplifiers and power supply are wired. A speaker is hooked to the output and a signal from a tuner or crystal cartridge fed to the input. If the quality sounds good, wiring of the preamplifiers proceeds. The advantages here are obvious.

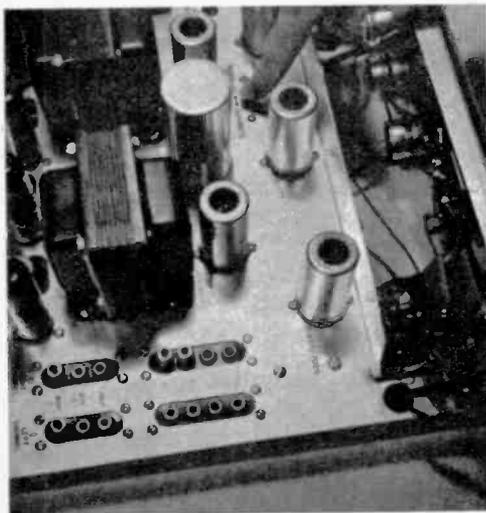
The major steps in construction are shown in the photographs. The designers of this kit took pains to keep the numerous ground points centralized.

[Continued on page 103]



Above left, chassis ready for cabinet. Inputs are jacks at right, speaker strips along rear.

Above shows wiring completed. Preamp control panel, right, is fastened to main chassis.



Parallel-Separate switch (near top) is thrown to Parallel for 40 watt monophonic output.

EI assemblies

A Signal Tracer Kit

Visual and aural indications from this unit will pinpoint loss of signal in audio or radio circuits.

THE Knight Signal Tracer is a valuable instrument for the radio and TV technician, hi-fi enthusiast or electronics experimenter. It is basically a high-gain amplifier which allows both visual and aural indication of a modulated RF (radio frequency) or audio signal.

Construction proceeds with mounting the various controls, tube sockets and terminal strips. Wire leads are already precut to length, color coded and have the ends stripped for connecting and soldering. The assembly is done in three wiring stages. All resistors are conveniently mounted on cards and identified with a code number. It is not necessary to know the color code for finding any resistor.

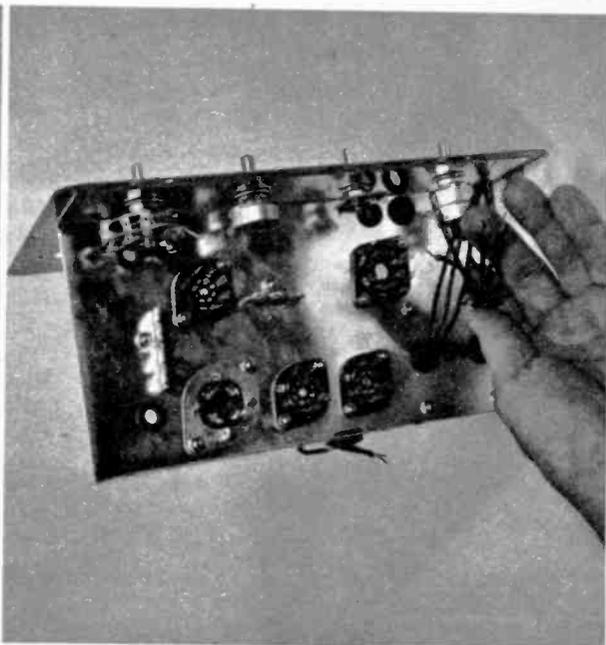
The total time of construction from opening the packing box to operating the tracer was six hours.

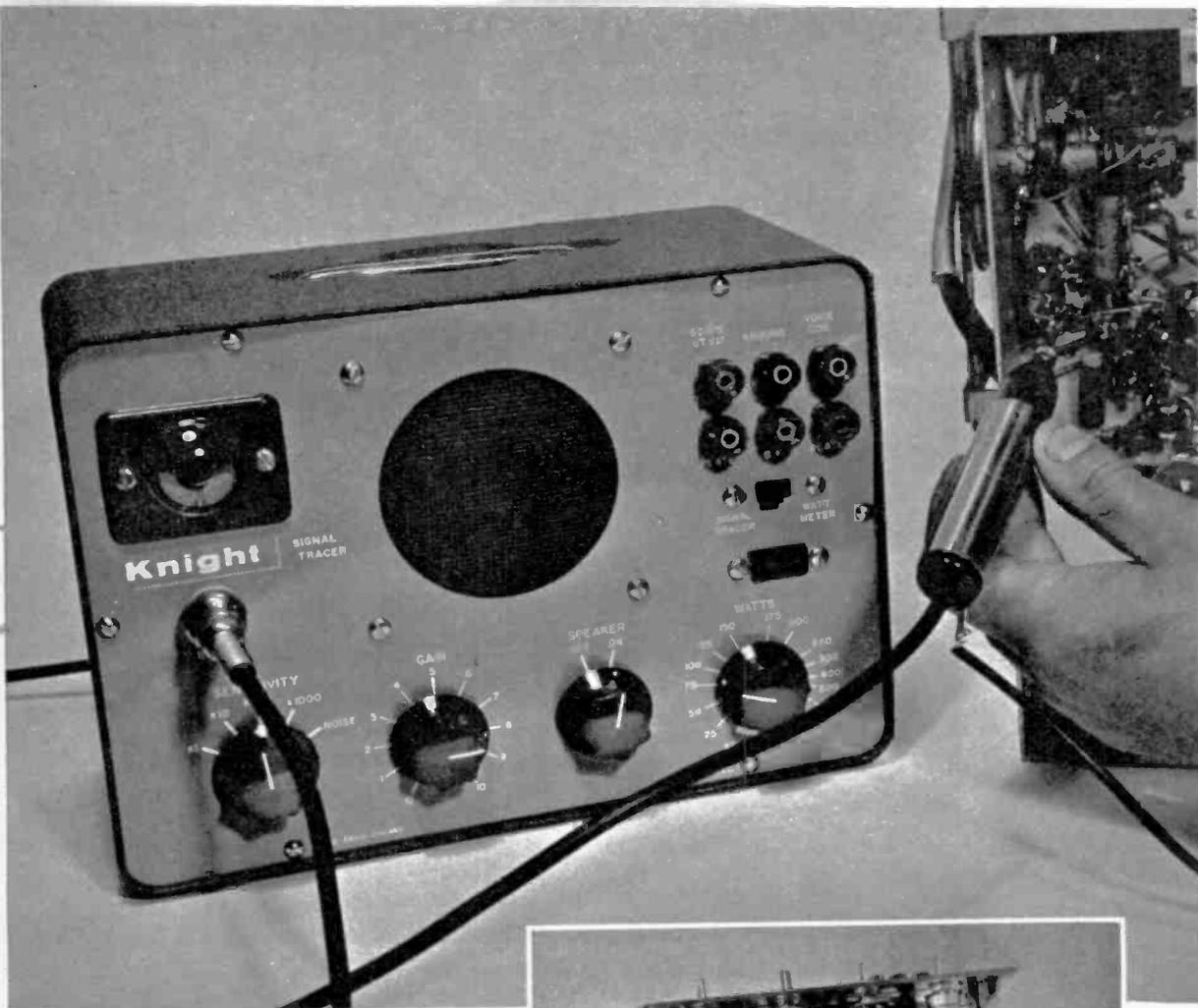
The signal tracer can be applied to trace signals in a receiver by using the RF probe. The probe is placed on the antenna lead and several stations should

[Continued on page 107]

Layout of parts prior to assembly and wiring. Small components are packed in plastic bags.

Underchassis view with large parts mounted. Hand is holding the power transformer leads.

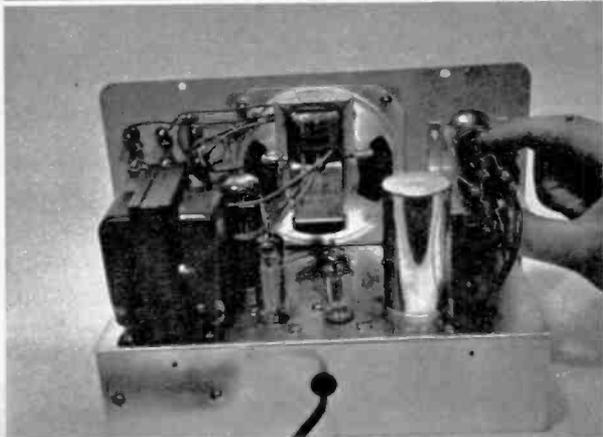
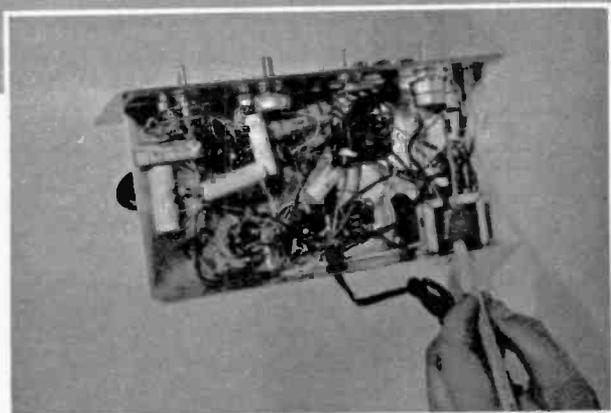




Probe is used to check for dead stage in FM tuner. Eye indicator is top left, speaker at center.

Wiring underchassis is complete. Pencil points to special wattmeter transformer for measuring power.

Top wiring is finished and magic eye tube properly positioned in its bracket to right of speaker.



El surveys

FM Radios for Your Car

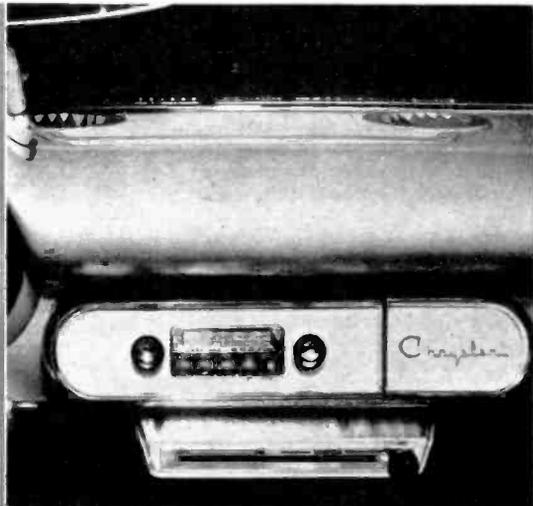
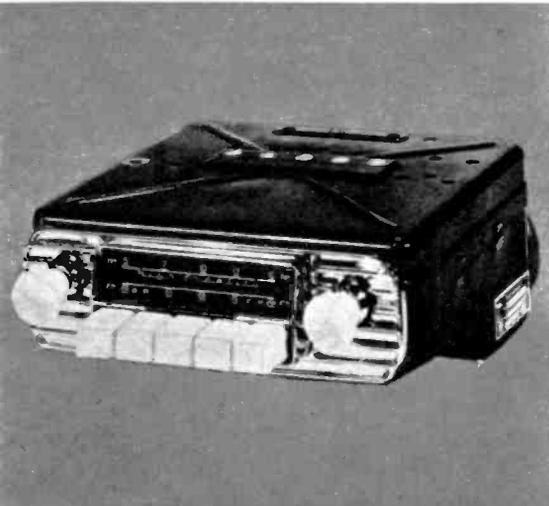
Why are there so few FM tuners for your auto? Why are they so expensive? Just how good is FM mobile?



Here is the unique Gonset mobile FM converter that simply plugs into your existing AM auto radio. It detects FM signal, then converts it to 800 kc.

German-made Becker AM-FM auto radio operates on 6 or 12 volts, has push buttons.

Blaupunkt "Frankfurt" model, made by the Robert Bosch Co., has AM, FM, long wave.



MOTOROLA INC.



Mr. Ed Nanas
Feature Editor
Electronics Illustrated
67 West 44th Street
New York 36, New York

Dear Mr. Nanas:

At Motorola we have no plans for an FM car radio as we have never felt a practical application of FM.



DELCO RADIO DIVISION

General Motors Corporation

Kokomo, Indiana

Mr. Ed Nanas
Feature Editor
ELECTRONICS ILLUSTRATED
67 West 44th Street
New York 36, New York

Dear Mr. Nanas:

We have done continuing experimentation in the FM field as it relates to automobile radios.

We have, however, found that there is no public demand for either FM car radios or converters. The only indication of interest we find are in the big metropolitan areas such as New York or Los Angeles.

PHILCO
PHI
PHI
Mr. Ed Nanas
Electronics Illustrated
67 West 44th Street
New York 36, New York

Dear Ed:

We will not be producing an Fr.

Here is a sampling of responses concerning the manufacture of mobile FM radios. Every American manufacturer, except Gonset, replied in negative.

HIGH fidelity in the home is pretty much taken for granted. But what happens when a person who is accustomed to the "utmost" living room audio steps into his car? Well, we've been hearing quite a few grumbles about AM in automobiles. "Too much rock 'n roll." "Terrible static, even when there's no thunderstorm." "I was listening to a violin concerto, drove over a long bridge, and when I landed on the other side the concerto was over and some guy was selling soap."

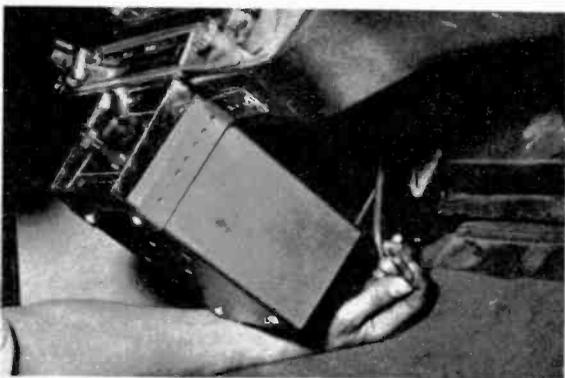
One would think the answer would be FM radio. But there's precious little in the way of FM automobile radios available. What is available, though, is darn good, as our in-the-car tests proved. There are two West German radios with FM, the Blaupunkt and the Becker, and joining them on the market is the new Gonset tuner, an American made unit.



Installation of the Gonset converter starts with the major unit and the metal strap.



Strap is fitted on the underside of the tuner, then is bent to conform to the dashboard.



Two screws support the tuner. Jack goes to antenna receptacle on the car's AM radio.

Rupert Alberga of Custom Auto Radio, Queens, N. Y., checks the antenna height.



Why so few? After all, the fidelity of FM is potentially superior to AM because of its wider bandwidth. FM program schedules are generally agreed to be "more adult"—classical music, serious discussion, rebroadcasts of interesting foreign programs. Most major stations in large cities, network and independent, "simulcast" their schedules on both AM and FM, so the FM-only listener seldom has to worry about missing a network show.

Many college and university stations are on FM, as are other non-commercial, public service stations. The shorter wavelengths of FM can be received while driving through short tunnels and across steel bridges, whereas AM is usually knocked out entirely. And static

limiting circuits in FM sets let you listen almost entirely without annoyance during electrical storms.

If mobile FM is so good, why the apparent lack of interest here in America? We queried just about every major automobile manufacturer about their plans for including FM in their 1960 models. We didn't get any affirmative answers. We queried all the auto radio manufacturers. Again negative answers (excerpts of which are reproduced on these pages).

The objections of the American manufacturers are well taken. After all, they are in business to make money and there just isn't any sense in their manufacturing a product they think won't

[Continued on page 108]



Here's Hank Holbrook at his listening post in Bethesda, Md. He is perhaps top LW-MW listener, having received verifications from 470 LW stations and 1,958 MW stations. The two receivers are the National RBL-2 on the left (15 to 630 kc in 6 bands), and a Hammarlund HQ-129X which tunes from 540 kc to 30 mc.

can you log 'em?

Radio Beacons-Rare DX

By C. M. Stanbury II

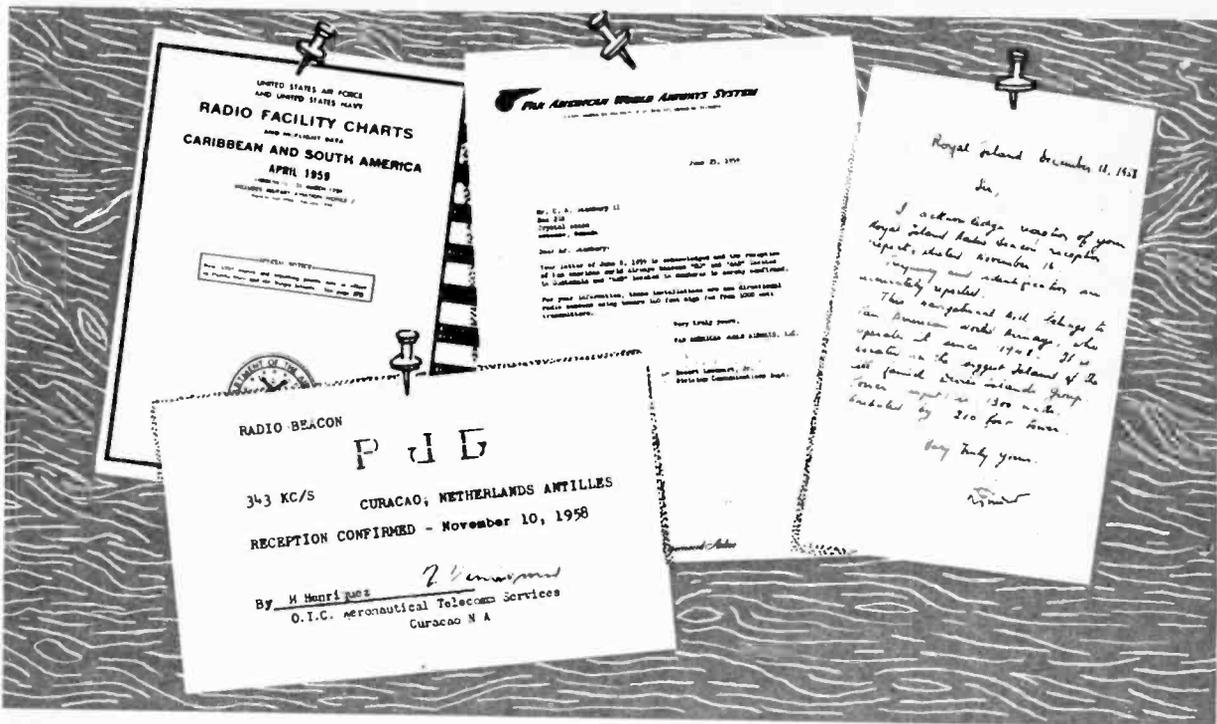
CHANCES are you've pushed your radio dial above the edge of the standard broadcast band and heard a high-pitched tone transmitting RAB continuously in International Morse code. But then you probably went elsewhere, as this kind of "programming" becomes boring fast.

On the other hand, maybe this unusual sound stirred your inquisitive nature and after a little research you learned that RAB's signals were coming from Guatemala, and that RAB's purpose was to serve as a radio beacon to guide aircraft north from Guatemala City. Now assuming you're interested in DX (confirmed reception of distant stations), it probably hit home quickly that this is the easiest way to log Guatemala and Central America on medium wave.

What are the DX potentials of beacon stations? First we'll need a long wave receiver since many such stations operate between 200 and 414 kc. Now those of you who have already done a little



Here is the transmitter building of range station located at Muskoka Airport, Bracebridge, Canada. Poles are part of antenna system. Identifies as QA on 272 kc, 400 watts. Official call is VFM9. It operates 24 hours a day.



Left to right: Radio Facility Charts can be valuable aid in identifying stations; prepared QSL card from Curacao; letter QSL from PAA regional office; personal reply from PAA beacon on one of ill-famed Devil's Island locations.

LW listening please stand by while the other readers catch up with you.

After a few days monitoring low frequencies, you will become used to an unending series of squeals (technically known as tone or A2 modulation) from one end of the band to the other. You will also notice that most stations operate continuously and there are very few clear channels. From late spring to early fall static is quite heavy.

Sounds like a DX nightmare, doesn't it? Well, before you tune out, let's dig a little deeper. Truth is the beacons can be a DXer's paradise—when he knows how to handle them.

Why a paradise? Three top-notch reasons. First that tone, or A2 modulation—any veteran DXer will tell you it's twice as effective as voice transmission. For example broadcast band stations conducting DX tests on crowded channels will frequently use tone to cut through the interference.

Second, and even more important,

most beacon stations identify continuously. Thus a station may be heard for only a few seconds, yet be logged and reported. Suppose you don't read code. You don't have to! These stations transmit their call so slowly that, if necessary, the dots and dashes can be copied down and decoded later.

The above reasons more than make up for crowded channels, low frequencies and a six month listening season. So the third reason is the clincher—really rare DX targets. HYI, for instance, is on the famous, or infamous Devil's Island.

The best buys in LW receivers are military surplus receivers. But they're a little tricky to locate and sometimes require conversion. Conversion manuals are available commercially. Check with some of the large mail order houses specializing in such equipment. On the other hand, most communications receiver manufacturers make suitable

[Continued on page 108]

TIMES TO TUNE

These time periods represent only peak periods. DX reception is possible on long wave anytime during hours of darkness. Sunset skip from a given station rarely lasts more than one-half hour.

FREQ. (KCS)	SUNSET SKIP	NORMAL RECEPTION
1605-1750	1 hour before to 1 hour after sunset	After midnight
505-535	2-3 hours after sunset	After 0200
300-415	2200-0200	After 0400
200-300	none	After 0400

LONG WAVE DX GUIDE

Stations in **BLACK** are easily heard in United States and Canada.
Stations in **RED** are more difficult to log, excellent DX catches.

FREQ. (KCS)	STATION CALL	LOCATION	ADDRESS AND NOTES
528	KB	Kindley AFB, Bermuda	Officer-in-Charge, Radio Facility KB. Prepare own verification card.
419	GYE	Guayaquil, Ecuador	Braniff International Airways, Guayaquil. Frequently has clear channel.
415	HMO	Hermosillo, Mexico	Jefe, Depto. de Comunicaciones, Cia. Mexicana de Aviacion, Mexico, D.F.
406	SWA	Swan Island	Federal Aviation Agency, Swan Island, via Tampa, Florida.
405	HYI	Devil's Island	O-in-C, Radio Beacon HYI, c/o Pan American World Airways, Cayenne, French Guiana.
400	SG HIV	San Jose, Guatemala Ciudad Trujillo, D.R.	Pan American World Airways.
391	SJU	San Juan, Puerto Rico	Federal Aviation Agency.
385	ESM	Esmeraldas, Ecuador	Pan American Grace Airways, Esmeraldas.
382	ZQC	Piarco, Trinidad	Internacional Aeradio (Car.) Ltd. Prepare own verification card.
380	TIKY	Puerto Limon, C.R.	Pan American World Airways, San Jose, C.R.
350	ASN	Ascension Island	O-in-C, Radio Facility ASN, Ascension AAFB, c/o Patrick AFB, Florida.
347	BQN	Ramey AFB, P.R.	O-in-C, Radio Facility BQN. Prepare own verification card.
343	PJG	Curacao, Netherlands Antilles	O-in-C, Aeronautical Telecommunications Services, Dr. Albert Plesman, Aerodrome, Curacao.
326	NW	Cape San Blas, Panama	Pan American World Airways.
296	V	Sable Island	O-in-C, DOT Radio Station VGF, c/o P.O. Box 790, Halifax, Nova Scotia.
	M	Cape Mala, Panama	O-in-C, Radio NMR19, c/o U.S. Coast Guard, San Juan, P.R. Prepare own verification card.
292	MIQ	Maiquetia, Venezuela	Pan American World Airways.
280	MID	Merida, Mexico	Jefe, Depto. de Comunicaciones, Cia. Mexicana de Aviacion, Mexico, D.F.
260	CM	S. Caicos Island, Turks and Caicos Islands	Pan American World Airways.

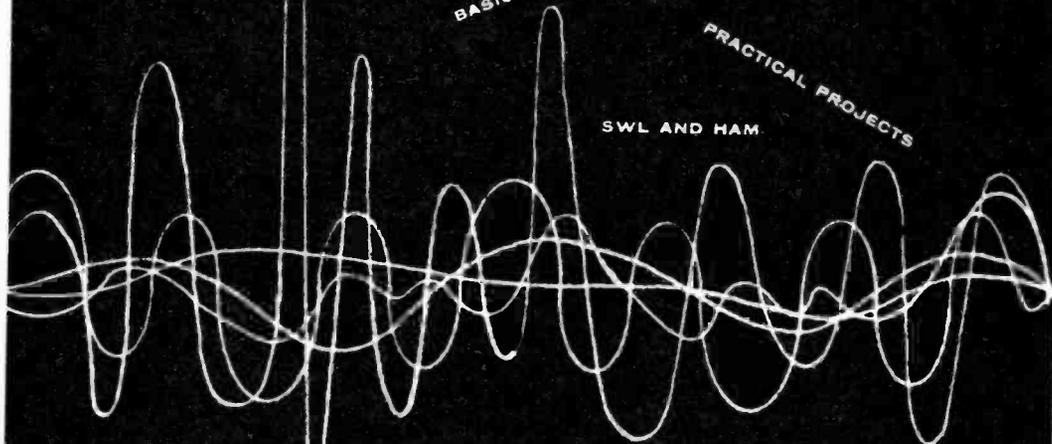
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ELECTRONICS ILLUSTRATED

Fawcett Building, Greenwich, Conn.

Oscilloscopes

Continued from page 46

if the sweep selector switch is set to the position "10-70," then by rotating the sweep VERNIER control you can obtain any frequency within this range. If the selector switch is set at some other value, say 500-4000, rotation of the sweep vernier will enable you to obtain a desired sweep frequency within this range. The reason such a control is available is to enable the user to obtain a specific number of waveforms on the screen. For example, suppose you are feeding a wave into the vertical input system which has a frequency of 1,000 cycles. In order to get one cycle of this wave on the screen, the sweep should have a repetition frequency of 1,000 cycles per second. If you want two complete cycles to appear on the screen, the sweep selector and sweep vernier controls are adjusted until the beam is sweeping at half this rate, or 500 times a second. In most applications involving the oscilloscope, it is generally desirable to have two or three cycles of the input wave displayed to eliminate reading errors.

Other names for the sweep vernier control are; FINE FREQUENCY, FREQUENCY VERNIER, and SWEEP VERNIER.

Every oscilloscope has a vertical gain control and a horizontal gain control. These adjust the height and width of any pattern on the screen. There is no difficulty at all in their use. Associated with the vertical gain control on some oscilloscopes is a vertical attenuator. This is a 3 or 4 position selector switch designed to attenuate strong input signals so that the entire pattern will be seen on the screen. In short, it prevents the input stages from being overloaded. When a signal is applied to the vertical input terminals, the attenuator control is set to the position that gives a pattern of desired height on the screen; then, by adjusting the gain control, we can make the pattern either larger or smaller.

This control is frequently marked "X100," "X10" and "X1." This stands

for attenuation of 100:1, 10:1 and 1:1. When it is in the X1 position, the input wave is applied directly to the vertical input system without any attenuation. If it is desired to reduce the signal by a factor of 10, the control would be rotated to the X10 position. If further signal reduction is required, the attenuator control would be rotated to the X100 position.

Occasionally, the positions on the attenuator would be marked .01, .1, 1. See Fig. 2. These correspond to X100, X10, and X1. Sometimes a horizontal attenuator is employed in connection with the horizontal gain control; however, this is not common and would not ordinarily be encountered.

Another vertical system control is a VERT POLARITY switch. This has two positions, normal and reverse. By flipping from one position to the other, we can reverse the polarity of any pattern present on the screen. This is particularly useful in TV alignment where a response pattern may appear upside down. By using the VERT POLARITY switch, it can be brought to the form normally shown for such patterns. See Fig. 3.

A knob marked SYNC AMPLIFIER (or SYNC AMP) takes a small portion of the input signal applied to the vertical system and applies this to the internal sweep generator of the oscilloscope. Its purpose is to lock in the sweep generator to the frequency of the input signal or to some multiple or sub-multiple of it. In this way, a stationary pattern can be obtained on the screen. To use this control, a signal is applied first to the vertical input system and displayed on the screen. Then the SYNC AMP knob is slowly rotated clockwise until the pattern becomes stationary. At this point, control rotation should be stopped. If it is advanced beyond this point, the pattern may become distorted by multiple triggering, with the result that a series of partial patterns will be obtained on the screen and the result can be confusing.

Additional names for the SYNC AMP control are: SYNC LOCK; SYNC ADJ; SYNC SIGNAL, and just plain SYNC.

SHIPPED ON APPROVAL

NEW

CRT TESTER-REACTIVATOR Model CRT-2

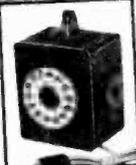
NOW . . . a TESTER-REACTIVATOR really designed to test, repair and reactivate EVERY PICTURE TUBE MADE — whether black and white or color . . . with exclusive features never before found in picture tube testers.



Housed in hand-rubbed oak carrying case—complete with MULTI-HEAD*

Model CRT-2
\$57.50
Net

TERMS: \$13.50 within 10 days. Balance \$11 monthly for 4 months.



The CRT-2 steps in and solves the limitations and shortcomings of present day CRT Testers. Unlike ordinary CRT testers that keep entering the field with a limited range of operation, the CRT-2 employs a new brilliantly engineered circuit designed to test, repair and reactivate every black and white or color picture tube made. The CRT-2 eliminates the guesswork and risk that until now, has always been present when a picture tube is reactivated. It accomplishes this by providing perfect control of either the 'Boost' or 'Shot' method of reactivation.

THE CRT-2 DOES ALL THIS RIGHT IN THE CARTON, OUT OF THE CARTON OR IN THE SET

TEST

- ✓ for quality of every black and white and color picture tube
- ✓ for all inter-element shorts and leakage up to one megohm
- ✓ for life expectancy

REPAIR

- ✓ Will clear inter-element shorts and leakage
- ✓ Will weld opens between any two elements in the tube gun

REACTIVATE

- ✓ The unique controlled 'SHOT' (high voltage pulse) method of reactivation provided by the CRT-2 will restore picture tubes to new life in lieu provided by the CRT-2 will restore picture tubes to new life in instances where it was not possible before. Furthermore the high voltage is applied without danger of stripping the cathode as you always have perfect control of the high voltage pulse.
- ✓ The 'BOOST' method of reactivation also provided by the CRT-2 is always applied on tubes with a superficially good picture but with used effectively on tubes with a superficially good picture but with poor emission and short life expectancy. It will improve definition, contrast and focus greatly and add longer life to the picture tube.

1. **THE MULTI-HEAD** (patent pending) . . . A SINGLE PLUG IN CABLE AND UNIQUE TEST HEAD — A tremendous advance over the maize of cable and adapters generally found with other testers. Enables you to test, repair and reactivate every type of picture tube with greater convenience than ever before . . . 50 degree to 110 degree types from 8" to 30" . . . whether 12 pin base, 8 pin base, 14 pin base . . . even the very latest 7 pin base. A special cable switch on the MULTI-HEAD enables you to test, repair and reactivate each of the red, green and blue color guns separately.
2. **WATCH IT REACTIVATE THE PICTURE TUBE** — You actually see and control the reactivation directly on the meter as it takes place, allowing you for the first time to properly control the reactivation voltage. This eliminates the danger of stripping the cathode of the oxide coating. It enables you to see the speed of reactivation and whether the build-up is lasting. You will see if the cathode contamination is too great and if the picture tube is too far gone to be reactivated.
3. **CONTROLLED "SHOT" WITH HIGHER VOLTAGE FOR BETTER REACTIVATION** — Stronger than any found in other testers . . . high enough to really do the job — yet controlled to avoid damage to the picture tube.
4. **UNIQUE HIGH VOLTAGE PULSE CIRCUIT** — Will burn out inter-element shorts and weld open circuits with complete safety to the picture tube.
5. **VISUAL LIFE TEST** — Enables both you and your customer to see the life expectancy of any picture tube right on the meter. The fact that your customer can see the results of four tests as you make them virtually eliminates resistance to picture tube replacement when necessary.
6. **TESTS, REPAIRS AND REACTIVATES SPECIAL LOW SCREEN VOLTAGE TUBES** — Many new type picture tubes use special low voltage of approximately 50 volts. The CRT-2 will test, repair and reactivate these types with the same thoroughness as the regular types with complete safety.
7. **SEPARATE FILAMENT VOLTAGES** — Including the very latest 2.35 volt and 8.4 volt types as well as the older 6.3 volt types.
8. **TESTS, REPAIRS AND REACTIVATES 'SF' PICTURE TUBES** — found in the newest Sylvania and Phico TV sets. These picture tubes have different base pin connections than standard picture tubes and there is always an element of risk that the tube may be burned out when tested with ordinary picture tube testers. The CRT-2 is designed to accommodate this new base pin arrangement and will test the tube with no danger of damage.

ADDITIONAL FEATURES

- Employs the time proven dynamic cathode emission test principle
- Large 4 1/2" meter with heavily damped movement for smooth action, accuracy and long life
- Provides separate shorts test for each element in the picture tube
- Filament continuity is shown on a separate glow indicator
- An easy to read instruction manual contains all the latest testing information on old and new type picture tubes
- Housed in handsome hand-rubbed oak carrying case with special compartment for MULTI-HEAD and line cord.
- patent pending

IN-CIRCUIT CONDENSER TESTER Model CT-1

Here is an IN-CIRCUIT CONDENSER that DOES THE WHOLE JOB! The CT-1 actually steps in and takes over where all other in-circuit condenser fail. The ingenious application of a dual bridge principle gives the CT-1 a tremendous range of operation . . . and makes it an absolute 'must' for every serviceman.



in-circuit checks:

- ✓ Quality of condensers even with circuit shunt resistance . . . (This includes leakage, shorts, opens, intermittents)
- ✓ Value of all condensers, from 200 mmd. to .5 mfd.
- ✓ Quality of all electrolytic condensers (the ability to hold a charge)
- ✓ Transformer, socket and wiring leakage capacity

out-of-circuit checks:

- ✓ Quality of condensers . . . (This includes leakage, shorts, opens and intermittents)
- ✓ Value of all condensers from 50 mmd. to .5 mfd.
- ✓ Quality of all electrolytic condensers (the ability to hold a charge)
- ✓ High resistance leakage up to 300 megohms
- ✓ New or unknown condensers . . . transformer, socket, component and wiring leakage capacity

OUTSTANDING FEATURES

- Ultra-sensitive 2 tube drift-free circuitry
- Multi-color direct scale readings for both quality and value . . . in-circuit or out-of-circuit
- Simultaneous readings of circuit capacity and circuit resistance
- Built-in hi-leakage indicator sensitive to over 300 megohms
- Cannot damage circuit components
- Electronic eye balance indicator for ever greater accuracy
- Isolated power line
- Housed in sturdy hammer-tone finish steel case . . . comes complete with test leads

Model CT-1
\$34.50
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TERMS: \$9.50 within 10 days. Balance \$5 monthly for 5 months.

EASY TO BUY IF SATISFIED — see order form on facing page

FOR 10 DAY FREE TRIAL

Convince yourself at no risk that CENTURY instruments are indispensable in your every day work. Send for instruments of your choice without obligation... try them for 10 days before you buy... only then, when satisfied, pay in easy-to-buy monthly installments — without any financing or carrying charges added.

NOW a Battery Operated **VACUUM TUBE VOLT METER** Model VT-1 WITH LARGE EASY-TO-READ 6" METER —

featuring the sensational new **MULTI-PROBE** — Patent Pending

- No extra probes to buy! The versatile MULTI-PROBE does the work of 4 probes
① DC Probe **② AC-Ohms Probe** **③ Lo-Cap Probe** **④ RF Probe**

The VT-1 is a tremendous achievement in test equipment. With its unique MULTI-PROBE it will do all the jobs a V.T.V.M. should do without the expense of buying additional probes. No longer do you have to cart around a maze of entangled cables, lose time alternating cables or hunting for a misplaced probe. With just a twist of the MULTI-PROBE tip you can set it to do any one of many time-saving jobs. A special holder on side of case keeps MULTI-PROBE firmly in place ready for use.

SPECIAL HANDLER

DC VOLT METER... Will measure D.C. down to 1.5 volts full scale with minimum circuit loading, and give accurate readings of scale divisions as low as .025 volts... Will measure low AC and oscillator bias voltages from 1 volts or less up to 1500 volts with consistent laboratory accuracy on all ranges... Zero center provided for all balancing measurements such as discriminator, ratio detector alignment and high amplifier balancing.

AC VOLT METER... True Peak-to-Peak measurements as low as 3 volts of any wave form including TV sync, deflection voltages, video pulses, distortion in hi-fi amplifiers, AGC and color TV gating pulses... Scale divisions are easily read down to 1 volt... Measures RMS at 1/20th the circuit loading of a V.O.M.... Unlike most other V.T.V.M.'s there is no loss in accuracy on the lowest AC range.

ELECTRONIC OHMMETER... Measures from 0 to 1000 megohms... Scale divisions are easily read down to 2 ohms... Will measure resistance values from 2 ohms to one billion ohms... Will detect high resistance leakage in electrolytic and by-pass condensers.

RF and LO-CAP MEASUREMENTS... With these extra VT-1 functions you can measure voltages in extremely high-impedance circuits such as sync and AGC pulses, driving saw tooth voltages, color TV gating pulses, output levels, I.F. stage-by-stage gain and detector inputs.

OUTSTANDING FEATURES

- Completely portable — self powered with long life batteries — permits use everywhere
- New advanced pentode amplifier circuit assures amazingly low battery drain
- Large 6" 100-microampere meter, many times more sensitive than meters used in most V.T.V.M.'s
- Laboratory accuracy performance — 2% of full scale on DC, 5% of full scale on AC
- Simplified multi-color easy-to-read 4-scale meter
- No heat operation assures rigid stability and accuracy
- Immune to power line fluctuations
- Amplifier rectifier circuit with frequency compensated attenuator — a feature found only in costly laboratory instruments
- Meter completely isolated — practically burn out proof
- Hand-crafted accuracy eliminates the service headaches of printed circuitry
- Security
- Resistors used for permanent accuracy
- Separate RF ground return for low-loss RF measurement
- Microphone type co-axial connector
- Matching cover protects instrument face — snaps on and off instantly.



Housed in hammertone steel-case complete with MULTI-PROBE

SPECIFICATIONS

- DC Volts — 0 to 1.5/6/30/150/300/600/1500 volts
- AC Volts (RMS and Peak-to-Peak) — 0 to 3/12/60/300/1200 volts
- Ohms — 0 to a billion ohms, 10 ohms center scale — R1/10/100/1K/10K/100K/1M
- RF — Peak reading demodulator supplied for use on all DC ranges
- Zero Center — available on all DC volt ranges with zero at mid-scale
- Decibels — from —10 Db to +10, 22/36/50/62 based on the Dbm unit, 0db
- IMV in 600 ohms
- Impedance — 11 megohms DC, 1 megohm AC, 10 megohms Lo-Cap
- Input Capacity — 130 mmfd. RMS, 250 mmfd. Peak-to-Peak, 25 mmfd. Lo-Cap

Model VT-1
\$58.50 Net
 TERMS: \$14.50 within 10 days, Balance \$11 monthly for 4 months.

FAST-CHECK TUBE TESTER Model FC-2

Simply set two controls... insert tube... and press quality button to test any of over 700 tube types completely, accurately... **IN JUST SECONDS!**

Over 20,000 servicemen are now using the FAST-CHECK in their every day work and are cutting servicing time way down, eliminating unprofitable call-backs and increasing their dollar earnings chose the FAST-CHECK above all other tube testers.

PICTURE TUBE TEST ADAPTER INCLUDED WITH FAST-CHECK

Enables you to check all picture tubes (including the new short-neck 110 degree type) for life emission, shorts and life expectancy... also to rejuvenate weak picture tubes.

RANGE OF OPERATION

- Checks quality of over 700 tube types, employing the time proven dynamic cathode emission test. This covers more than 99% of all tubes in use today, including the newest series-string TV tubes, auto 12 plate-volt tubes, OZs, magic eye tubes, gas regulators, special purpose hi-fi tubes and even foreign tubes.
- Checks for inter-element shorts and leakage.
- Checks for gas content.
- Checks for life-expectancy.

SPECIFICATIONS

- No time consuming multiple switching... only two settings are required instead of banks of switches located inside cover.
- No annoying roll chart checking... tube chart listing over 700 tube types is part of multi-section tubes and if only one section is defective the tube will read "Bad"
- 41 phosphor bronze beryllium tube sockets never need replacement
- Checks each sec-mounted on panel
- Large 4 1/2" D'Arsonval type meter is the most sensitive available, yet rugged — fully protected against accidental burn-out
- Special scale on meter for low current tubes — Compensation for no shock hazards
- Long lasting etched aluminum panel.

NOTE: The Fast-Check positively cannot become obsolete... circuitry is engineered to accommodate all future tube types as they come out. New tube listings are furnished periodically at no cost.



Housed in hand-rubbed oak carrying case complete with CRT adapter

Model FC-2
\$69.50 Net
 TERMS: \$14.50 within 10 days, Balance \$11 monthly for 5 months.

CONVENIENT TIME PAYMENT PLAN — NO FINANCING CHARGES

ALL CENTURY INSTRUMENTS ARE GUARANTEED FOR ONE FULL YEAR
 The extremely low prices are made possible because you are buying direct from the manufacturer.

CENTURY ELECTRONICS CO., INC.

CHECK INSTRUMENTS DESIRED

- Model CRT-2 CRT TESTER REACTIVATOR \$57.50 \$13.50 within 10 days, Balance \$11 monthly for 4 months.
- Model CT-1 In-Circuit Condenser Tester \$34.50 \$9.50 within 10 days, Balance \$5 monthly for 5 months.
- Model VT-1 Battery Vacuum Tube Volt Meter \$58.50 \$14.50 within 10 days, Balance \$11 monthly for 4 months.
- Model FC-2 Fast-Check Tube Tester \$69.50 \$14.50 within 10 days, Balance \$11 monthly for 5 months.

Prices Net F.O.B. Mineola, N. Y.

111 Roosevelt Avenue, Dept. 412, Mineola, New York

Please rush the instruments checked for a 10 day free trial. If satisfied I agree to pay the down payment within 10 days and the monthly installments as shown. If not completely satisfied I will return the instruments within 10 days and there is no further obligation. It is understood there will be NO INTEREST or FINANCING charges added.

Name _____ Please print clearly

Address _____

City _____ State _____

Continued from page 43

The ship's initial position was fed into the system before the drop; the rest is automatic. Tiny sensing devices (accelerometers) in the "stable platform" of the system "feel" the motion of the aircraft—any imbalance, any acceleration, deceleration, change in direction. The almost imperceptible and constantly varying electric currents generated by the accelerometers are amplified electronically and fed into a special computer, which converts them into an up-to-the-second display of altitude, velocity and position.

Pushing upward, the X-15 bursts through 99% of the earth's atmosphere to continue its rise in the less dense air. At 100 miles up the X-15 operates in a near vacuum. Seconds later the craft comes to the apex of its ballistic trajectory. Now White begins to feel like he is made of bird feathers. Weightlessness has set in. The force of gravity is nullified as the ship noses over. Still White must keep control. But how do you control a ship moving at five or six times the speed of sound, when there is no air around the ship and the usual aircraft controls don't work?

The answer lies in a series of "ballistic control rockets"—jets of pure hydrogen peroxide, mounted in the nose and wings of the X-15. White can activate these as required—a burst from the right wing, or from under the nose, and the ship will change course through its vacuum surroundings.

Far below, medical specialists are analyzing physical reactions of which White himself may be unaware. Electrocardiographs are being penned from radio signals transmitted from the X-15 and a small microphone near White's heart. Thousands of feet of magnetic tape race past tapeheads that are imparting telemetered data about White's respiration rate, skin temperature, psychogalvanic response. In all, 24 electrical contacts built into White's pressure suit are picking up and relaying this information. The contacts are ceramic microphone-like sensors.

Meanwhile, the X-15 has reached and passed the top of its arcing flight. Now it starts downward.

The plane descends at tremendous velocities. It has to move from a near vacuum to the greater density of our atmosphere. Extreme heat engulfs the ship, heat generated from the friction of thicker and thicker air pounding on the fuselage. Hotter and hotter . . .

White concentrates on the special attitude indicator on his instrument panel. The re-entry angle must be just right. He must aim the ship so as to encounter the least possible amount of friction. If possible he must "slide" through the atmosphere back to earth. The all-attitude indicator tells him the angle of his plane. Its information is drawn in part from the inertial system. White must read and interpret it correctly, for should he let the needle nose drop or rise so much as a degree too much, even the X-15's Iconel X alloy skin and the nitrogen cooling system may not be enough to save the plane.

The angle is right. The re-entry problem solved. Now White is back at an altitude where "chase" planes can direct him to Rogers Dry Lake, near Edwards, where he can make a landing.

He jettisons the bottom section of the X-15's vertical fin and comes in for a landing on skids and nosewheels. The flight, first of many more to come, has lasted less than 30 minutes. To busy Bob White, it might have been a lifetime.

Back at the High Range stations, tape after tape of recorded data is run through pre-programmed computers which will organize the data for future study. Here is a complete record of every phase of the flight, checked and double-checked.

Project X-15 is a tribute to superb planning and cooperation on the part of NASA, the Air Force, the Navy, North American Aviation, and countless other agencies, private companies and individuals. They have brought us much closer to tomorrow in space. Only through the work and courage of highly skilled pilots like Bob White, engineers, technicians and specialists can we move on to explore and conquer the vast frontiers of space. ●

Surplus Bargains

Continued from page 32

agencies—Army, Navy and Air Force. The remainder comes from other governmental units, such as the F.B.I., the Weather Bureau, the Federal Aviation Agency, and the U. S. Geological Survey, to name a few.

Since all surplus sales are open to the public, you have as good a chance as anyone to take part in the sales. However, there is no law that says you can't buy surplus property and resell it. Indeed, a whole industry has grown up around electronic surplus resales. Downtown New York City, for instance, is dotted with many unpretentious stores jam-packed with meters, dynamotors, scopes, receivers, diodes, capacitors, radar units, antennas, etc. Other cities have their share of electronics surplus stores and mail order surplus is sold all over the nation.

These retailers of surplus property often represent the quickest and easiest way for the ham, hobbyist or professional to get the parts he needs. The price across the counter usually will be far less than that of a comparable commercial component, even though the surplus dealer has added on his profit to his original purchase price.

But you can bid against the dealers and you don't always have to bid on huge lots, as we shall see later. Most surplus is sold to the highest bidder at public sales. There are three basic types:

1. *Sealed bid sale.* This method is used extensively. Announcements of surplus property to be sold are sent out to all interested persons on "Form 114, Sale of Government Property, Invitation, Bid and Acceptance." Description, quantity and location of the property is given, as well as how, when and where it may be inspected. Each form also contains space for bids, and you may bid on all, part or none of the surplus offered. You seal your bid and mail it back, and then all bids are opened at a specified time. If you happen to be high bidder, you are notified. Your sealed bid is tantamount to a contract, and the burden of transporting purchase is yours.

2. *Auction sale.* Catalogs specifying the conditions of sale, listing and describing the property, and giving inspection and sales dates, are distributed well in advance to all prospective buyers.

3. *Site or spot bid sale.* This is used generally when small quantities of property, consisting mainly of consumer-type items, are being offered. The prospective buyers can inspect the property and submit bids on forms provided by the selling agency on or before the day of sale. Since quantities are small, notices of these sales are usually circulated only in the immediate area.

How do you find out when and where surplus is being sold? That is simple. Some surplus sales are advertised in local newspapers, others are simply advertised by means of notices placed on bulletin boards of post offices, Federal buildings, civil service offices, court houses, and armed forces installations. But the best and quickest way to find out about a surplus sale is to *get yourself on a bidders list!*

Write to the Property Disposal Officer of Army, Navy, Air Force and Marine Corps installations anywhere in the United States. Everything you need to know to do this, plus a list of important addresses, is in the little booklet "How to Buy Surplus Personal Property from the U.S. Army, Navy, Air Force and Marine Corps."

To get a reliable line on just about all surplus sales, defense and non-defense, you should read "Synopsis of U. S. Government Proposed Procurement, Sales and Contract Awards," available to the public at all Department of Commerce field offices, or you may get a one-year subscription (252 copies) by sending check or money order for \$10 to: *U. S. Department of Commerce, Room 1300, New Post Office Building, 433 West Van Buren Street, Chicago 7, Illinois.*

Surplus property may be sold in lots, or piece by piece, depending upon what is being sold. If it's television tubes, for example, if there were 30 tubes in a lot and you bid \$1, you'd have to take all 30 tubes for \$30. So read surplus sales notices carefully. Perhaps some of your friends could pool a bid and then divide the lot *pro rata*.



Superior's New Model 77

VACUUM TUBE VOLTMETER WITH NEW 6" FULL-VIEW METER

Compare it to any peak-to-peak V. T. V. M.
made by any other manufacturer at any price!

Model 77—VACUUM TUBE VOLTMETER. . . Total Price. . . \$42.50
Terms: \$12.50 after 10 day trial, then \$6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

AS A DC VOLTMETER:

The Model 77 is indispensable in Hi-Fi Amplifier servicing and a must for Black and White and color TV Receiver servicing where circuit loading cannot be tolerated.

AS AN ELECTRONIC OHMMETER:

Because of its wide range of measurement leaky capacitors show up glaringly. Because of its sensitivity and low loading, intermittents are easily found, isolated and repaired.

- ✓ Model 77 completely wired and calibrated with accessories (including probe, test leads and portable carrying case) sells for only \$42.50.
- ✓ Model 77 employs a sensitive six inch meter. Extra large meter scale enables us to print all calibrations in large easy-to-read type.
- ✓ Model 77 uses new improved SICO printed circuitry.
- ✓ Model 77 employs a 12AU7 as D.C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability.

Model 77 uses a selenium-rectified power supply resulting in less heat and thus reducing possibility of damage or value changes of delicate components.

Model 77 meter is virtually burn-out proof. The sensitive 400 microampere meter is isolated from the measuring circuit by a balanced push-pull amplifier.

Model 77 uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

Specifications

• DC VOLTS — 0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance.
• AC VOLTS (RMS) — 0 to 3/15/75/150/300/750/1,500 volts. • AC VOLTS (Peak to Peak) — 0 to 8/40/200/400/800/2,000 volts. • ELECTRONIC OHMMETER — 0 to 1,000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms. • DECIBELS: — 10 db to + 18 db + 10 db to + 38 db. + 30 db to + 58 db. All based on 0 db = .008 watts (6 mw) into a 500 ohm line (1.73v). • ZERO CENTER METER — For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

AS AN AC VOLTMETER:

Measures RMS values if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers are easily read.

Comes complete with operating instructions, probe leads, and stream lined carrying case. Operates on 110-120 volt 60 cycle. Only..

\$42⁵⁰

Superior's New Model TV-50A GENOMETER

7 Signal Generators in One!



Model TV-50A GENOMETER. . . Total Price. . . \$47.50
Terms: \$11.50 after 10 day trial, then \$6.00 monthly for 6 months if satisfactory. Otherwise return, no explanation necessary.

- ✓ R.F. Signal Generator for A.M.
- ✓ R.F. Signal Generator for F.M.
- ✓ Audio Frequency Generator
- ✓ Bar Generator
- ✓ Cross Hatch Generator
- ✓ Color Dot Pattern Generator
- ✓ Marker Generator

This versatile All-Inclusive GENERATOR Provides ALL the Outputs for Servicing:

A.M. Radio • F.M. Radio • Amplifiers • Black and White TV Color TV

R. F. SIGNAL GENERATOR: The Model TV-50A Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: In addition to a fixed 400 cycle sine-wave audio, the Model TV-50A Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

BAR GENERATOR: The Model TV-50A projects an actual Bar Pattern on any TV Receiver Screen. Patterns will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

CROSS HATCH GENERATOR: The Model TV-50A Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting, horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

DOT PATTERN GENERATOR (FOR COLOR TV) Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50A will enable you to adjust for proper color convergence.

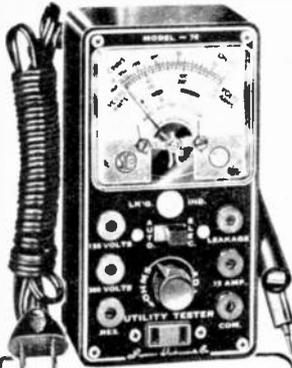
MARKER GENERATOR: The Model TV-50A includes all the most frequently needed marker points. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency).

The Model TV-50A comes absolutely complete with shielded leads and operating instructions. Only

\$47⁵⁰

EXAMINE BEFORE YOU BUY!
USE APPROVAL FORM ON NEXT PAGE

Superior's New Model 70 UTILITY TESTER® FOR REPAIRING ALL ELECTRICAL APPLIANCES and AUTOMOBILE CIRCUITS



Model 70—UTILITY TESTER
Total Price...\$15.85 —
Terms: \$3.85 after 10 day
trial, then \$4.00 monthly for
3 months, if satisfactory.
Otherwise return, no ex-
planation necessary.

As an electrical trouble shooter the Model 70:

- Will test Toasters, Irons, Broilers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorescents, Switches, Thermostats, etc.
- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakages, etc.
- Will measure current while the appliance under test is in operation.
- Incorporates a sensitive direct-reading resistance range which will measure all resistances commonly used in electrical appliances, motors, etc.
- Leakage detecting circuit will indicate continuity from zero ohms to 5 megohms (5,000,000 ohms).

As an Automotive Tester the Model 70 will test:

- Both 6 Volt and 12 Volt Storage Batteries • Generators • Starters • Distributors
- Ignition Coils • Regulators • Relays • Circuit Breakers • Cigarette Lighters • Stop Lights • Condensers • Directional Signal Systems • All Lamps and Bulbs • Fuses
- Heating Systems • Horns • Also will locate poor grounds, breaks in wiring, poor connections, etc.



INCLUDED FREE This 64-page book—practically a condensed course in electricity. Learn by doing.

Just read the following partial list of contents: What is electricity? • Simplified version of Ohm's Law • What is wattage? • Simplified wattage charts • How to measure voltage, current, resistance and leakage • How to test all electrical appliances and motors using a simplified trouble-shooting technique. • How to trace trouble in the electrical circuits and parts in automobiles and trucks.

Model 70 comes complete with 64 page book and test leads

\$15⁸⁵
only

Superior's New Model 82A A truly do-it-yourself type



Model 82A—Tube Tester
Total Price...\$36.50
Terms: \$6.50 after 10 day trial,
then \$6.00 monthly for 3 months
if satisfactory. Otherwise re-
turn, no explanation necessary.

TUBE TESTER

TEST ANY TUBE IN 10 SECONDS FLAT!

- ① Turn the filament selector switch to position specified.
- ② Insert it into a numbered socket as designated on our chart (over 600 types included).
- ③ Press down the quality button—

THAT'S ALL! Read emission quality direct on bad-good meter scale.

FEATURES:

- Tests over 600 tube types. • Tests OZ4 and other gas-filled tubes. • Employs new 4" meter with sealed air-damping chamber resulting in accurate vibrationless readings. • Use of 22 sockets permits testing all popular tube types and prevents possible obsolescence. • Dual Scale meter permits testing of low current tubes. • 7 and 9 pin straighteners mounted on panel. • All sections of multi-element tubes tested simultaneously. • Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.

Production of this Model was delayed a full year pending careful study by Superior's engineering staff of this new method of testing tubes. Don't let the low price mislead you! We claim Model 82A will outperform similar looking units which sell for much more—and as proof, we offer to ship it on our examine before you buy policy.

Only
\$36⁵⁰
Model 82A comes housed in handsome, portable Saddle-Stitched Texon case (Picture Tube Adapter available for \$5.50 additional)

SHIPPED ON APPROVAL NO MONEY WITH ORDER — NO C. O. D.

Try any of the instruments on this or the facing page for 10 days before you buy. If completely satisfied then send down payment and pay balance as indicated on coupon. **No Interest or Finance Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC, INC.

Dept. D-685, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after a 10 day trial positively cancelling all further obligation.

Name
Address
City Zone State

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

- Model 71..... Total Price \$42.50
\$12.50 within 10 days. Balance \$30.00
monthly for 3 months.
- Model TV-50A..... Total Price \$47.50
\$11.50 within 10 days. Balance \$36.00
monthly for 6 months.
- Model 70..... Total Price \$15.85
\$3.85 within 10 days. Balance \$12.00
monthly for 3 months.
- Model 82A..... Total Price \$36.50
\$6.50 within 10 days. Balance \$30.00
monthly for 3 months.
- Include Model 82A. Picture Tube
Adapter at \$5.50

Photo Target

Continued from page 39

closed contacts of the SPDT spring return switch. When the switch is operated by pulling the trigger the battery is disconnected and the charge in the capacitor is directed to the No. 47 pilot lamp which discharges the capacitor in a fraction of a second. This pilot lamp is rated at 6-8 volts. The 45 volt charge in the capacitor heats the filament to white hot brilliance producing the very bright burst of light required. The pulse is so short, however, that the filament is not destroyed as it would be in an instant if connected directly to battery.

A description of the mechanical details will probably be helpful even though you decide on an entirely different design. The dimensions used in this particular model are given in the pictorial drawing. A 2"x5"x7" aluminum chassis was selected as the base. The target arm is a length of Reynolds do-it-yourself aluminum channel, Item 16. A panel bearing for a 1/4" shaft is mounted 1 1/4" from one end of the channel, another is mounted in the side of the chassis and a piece of the shaft cut from R2 connects the two. A shaft coupling, cut in two, is attached to each end of the shaft to hold base and pendulum together. The photocell is attached to the top of the channel, a 3 1/2" cardboard target with a hole in the center is glued to the cell and a short length of black paper tube is glued over the cell as a light shield. A lead counterbalance is attached to the base of the channel if this is necessary. The motor is mounted on a small sheet of scrap aluminum which is fastened to the front of the chassis. A 3 1/2" Masonite disk is attached to the motor shaft and a machine screw with sleeve is inserted in the disk 1/4" from the edge. A slot is cut in the aluminum channel to accept this sleeved machine screw and, as the disk rotates, the channel with its attached target swings back and forth in a wide arc.

The full-size .45 automatic pistol is a realistic plastic model. It is a working model designed to shoot wooden pel-

lets. To convert for this application most of the barrel must be removed and portions of the internal projections ground down. The trigger assembly is slightly modified so it will operate the switch and the two halves of the slide mechanism are glued to the respective sides of the gun proper. Thus, the gun consists of two halves as shown in the illustration. After installation of components, the halves are easily fastened.

The lens may be either a positive meniscus or a convex type. That is, one shaped like a spectacle lens or like a simple magnifying glass. It may be any convenient diameter and almost any focal length. The one used is a positive meniscus 18 mm in diameter (this is slightly larger than the opening in the gun and is easily glued in place) and has a 95 mm focal length. Thus, with the filament of the pilot bulb 95 mm or almost four inches from the lens its image would be in focus at infinity. The catalog of Edmund Scientific Company, Barrington, New Jersey, offers a wide selection of very inexpensive lenses. The correct lens to lamp distance for the lens selected is easily determined by connecting a pilot lamp to the correct voltage source and, in a darkened room, focusing the lamp on a wall at about the anticipated gun-to-target distance. The lamp to lens distance which produces sharp focus is the one which you will use in the completed gun. The #47 pilot bulb is mounted vertically in the gun with the filament parallel to the line of sight to produce the smallest possible spot of light on the target. Study the arrangement in the illustration carefully and attempt to duplicate it exactly for best results. The bulb and battery may be soldered in place since experience indicates that neither will require replacement until after months of hard use.

This target should be used under conditions of comparatively low illumination in order that the pulse of light from the gun will be significantly brighter than the background illumination. The sensitivity control R2 is adjusted at the point which just keeps the target from responding to incidental illumination but gives a positive response to light pulses from the gun. ●

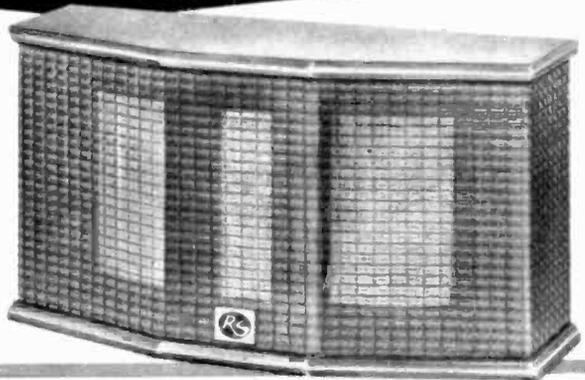
ACCOLADES AGAIN!

Again, without peer!... still the best super high frequency tweeter at any price... tested and top-rated again in September by laboratory reports!

REALISTIC ELECTROSTAT-3 **\$27⁵⁰**

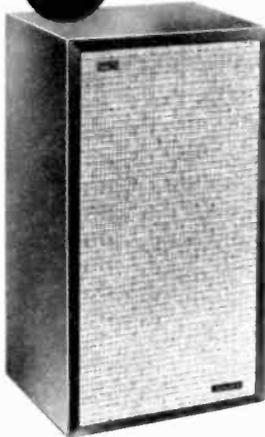
\$2 Down

Tweeters come and tweeters go—but one, and only one, is here to stay! "Best value at any price", again say the laboratory testers! (And "best tweeter I've ever heard", say literally thousands of Electrostat-3 owners!). When used with any of the better high compliance speakers—or any speaker, for that matter—Realistic's Electrostat-3 delivers a uniquely smooth response to 25,000 cps and beyond. It adds a musical transparency you've rarely, if ever, heard before! Exclusive Realistic design has 3 electrostatic elements for 120° sound dispersion, built-in double-fused AC supply for true electrostatic operation, and every unit is automatically tested for frequency response on a Bruel and Kjaer. The most vainly imitated tweeter in audio history! Complete, in handsome furniture-finish cabinet measuring 11 7/8" x 5 7/8" x 4 1/2" deep. Ship. wt. 7 lbs.



REALISTIC FULL-RANGE ELECTROSTAT-4

NEW!



\$119⁵⁰

\$5 Down

NOW... world's first and only complete-range (30-25,000 cps) speaker system incorporating and especially designed for—a built-in Electrostat-3! "Magnificence goes full-range" in a complete 3-way "pneumatic compression" speaker system built with, around and for the sensational Electrostat-3 tweeter! (With "lows" and "middles" that match the quality of those "highs"!). New Electrostat-4 features built-in Electrostat-3, new-design mid-range cone speaker, amazingly rugged, high compliance woofer, self-enclosed built-in 3-way Crossover with polarizing supply and a complete set of rear panel balance controls. Completely sealed and enclosed in fine furniture-finish cabinet 24 1/2" x 13 1/2" x 11" deep. Ship. wt. 41 lbs.



FREE Bargain Bulletins 1960 Electronic Guide

35c

Crossover Network for Electrostat-3

\$6⁹⁵



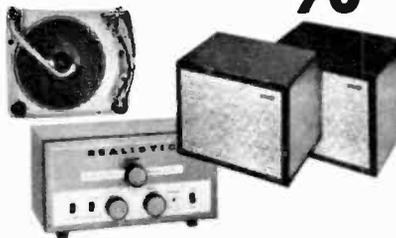
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The First Guided Missile

Continued from page 57

planes. The terms of the Navy contract were tough, calling for the delivery of a 1000-pound bomb load to targets at distances up to 100 miles. The planes and control equipment were not up to it.

Special airframes were ordered from Curtiss. These were to be launched from a truck running on railroad tracks. By December 1917, a frantic race against time was taking place. Test after test yielded disappointment after disappointment. The ballistics problems of accurately gauging wind velocity and direction were too great for pre-set gyro controls. If only the proper radio control equipment could be designed!

A report on "Flying Bomb Development" made to the Chief of Naval Operations on November 1, 1918, pinpoints the status of the project at that time. "Satisfactory control apparatus and catapult and successful automatic flights with the small planes in the light (unloaded) condition have been made. But there have been no successful wireless or automatic flights with fully loaded (1000 pounds) aircraft."

The recommendation was for continued experimentation to develop a radio control apparatus to be carried in a manned "chase" plane. However, with the war ended on November 11, 1918, the pressing need for an A.T. was gone and work at Great South Bay was stopped. By 1919 the Navy bowed out.

The United States Air Services, then a branch of the Army Signal Corps, became interested in the almost abandoned Sperry experimentation. They had developed a small, portable radio transmitter that could be powered by an aerodynamically driven dynamotor. The Army sent three Standard E-1 pursuit planes to the Sperrys for conversion to aerial torpedos and contracted for three Sperry Messenger planes with A.T. controls.

With new, improved gyros and redesigned servo motors that could be governed by radio triggered escape-ments, success loomed for the A.T. On

June 30, 1922, Lawrence Sperry climbed into one of his special Messenger planes at a site which is now Mitchell Air Force Base on Long Island. In the cockpit with him were the new Signal Corps transmitter and controls. Overhead, flying lazy circles against the sky, was a Standard E-1 equipped for radio controlled flight. Its servos were linked with a radio receiver that was getting its signals from a crank-down antenna mounted on the side of the cockpit.

Sperry's plane roared down the runway. Once airborne he became the first man to successfully fly two aircraft at the same time—his own, and the radio-controlled E-1. He guided the E-1 to three pre-designated target areas 30, 60 and 90 miles away. He could have aimed the heavy E-1 at any of the targets and locked its controls for a crash. At last, the A.T. of 1922, with radio control, was a success.

But what happened? You'd think the government would sit up and take notice. But that was not the case. While the heads of our armed forces acknowledged the potential of such a weapon, especially as a weapon against the morale of an enemy, apathy and the depression combined to bury it in official files. Development ceased. Our only military application of the first guided missile was the drone—a radio-controlled airplane used for anti-aircraft practice! ●

3-Channel Stereo

Continued from page 53

two side channels as you would normally for the best stereo effect. Gradually increase the setting of the level control until the sound begins to fill in the center, but evenly spread between the end speakers. Once you have achieved the correct levels, you may desire to vary the proportion of left and right channels feeding the center channel. This is done by rotating the blend control away from its mid-point, favoring more of the left or right signal.

If you find that certain stereo records do not need the center signal, turn down the level control completely. ●



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Your Ticket To A Career

Continued from page 71

test questions. Tests are assembled from hundreds of questions. There are several good books and license manuals available which list typical questions along with the answers. If you can master the contents of such a book, you're sure to pass the test with flying colors. There are also several correspondence, residence and night schools which offer courses to train you for passing your license exams.

After you take the test and have passed it successfully, you will be awarded a certificate that is good for five years. It can be renewed for additional five-year periods without having to take a new test.

Element 1 covers basic radio laws and is composed of questions like: "On what five grounds can the FCC suspend an operator's license or permit?" Others relate to the definition of distress and safety signals and priorities of various kinds of radio communications.

Basic operating practice is covered by element 2. Such points as how to use a microphone properly, when the station call letters should be announced, and how to protect yourself in an electrical storm are covered in this element. Nothing very difficult so far, but . . .

Element 3 (basic radiotelephone) is a bit tougher. The questions deal with Ohm's law, Kirchoff's law, electric power supplies and the characteristics of various classes of amplifiers. You will be required to draw simple schematics of oscillators, detectors, audio amplifiers and RF power amplifiers. You must know something about storage batteries, motors, generators, etc.

That's as far as you have to go unless you want a first class radiotelephone operator license, which is a handy thing to have if you plan to take charge of an AM, FM or TV broadcasting station. To get a first class ticket, you must also pass the more difficult element 4 (advanced radiotelephone).

If you are interested in servicing and installing marine radar equipment, you must also pass element 8 (but not ele-

ment 4). This element covers ship radar techniques and should be easy for anyone who has worked with military radar.

Element 5 is non-technical and deals with radiotelegraph operating practices. Element 6, however, is technical and requires considerable knowledge of electronic theory, receivers, transmitters, direction finders, loran, and even a little about radar.

Once you have a second class ticket, you can start looking for a job. A second class license will make you eligible for a job on a railroad, for example, as a communications equipment maintainer. The pay is exceptionally good for a man just starting his career, and the work is interesting. On some railroads, radio technicians may be given other work to do such as overhaul and adjustment of telegraph printers, telephone and telegraph carrier equipment, microwave systems, etc.

The Pocket List of Railroad Officials, available from 461 Eighth Avenue, New York 1, N. Y. for \$3 should give you all the "name-and-address" information you need to contact the right party.

The air lines are also seeking men with radio operator licenses to install and maintain airborne radio equipment.

Pipe lines and electric power utilities operate vast mobile radio systems, and many use microwaves, too. To get a job with a pipe line, you can write to the Petroleum Industry Electrical Association, P. O. Box 1407, Shreveport, La. As to power companies, try the personnel department of your local company.

There are overseas opportunities, too. While a United States operator license is not valid in foreign countries, it is the possession of the ticket that will tell your prospective employer that you are technically qualified.

With a first class radiotelephone operator license you are eligible to work as an operator or even chief engineer of an AM, FM or TV broadcasting station—in addition to doing all those things second class license holders can do.

The opportunities for holders of first and second class radiotelephone and radiotelegraph licenses are expanding and the field is not overcrowded. ●

Paco Stereo Kit

Continued from page 79

Shielded cables, for example, connect to the chassis at just one end.

The operating controls on the front panel permit a variety of useful functions peculiar to stereo. The input selector, corresponding to the input jacks at the rear of the unit, pick out the program source; Aux 1, Aux 2, Tuner, Phono 1, Phono 2, Tape head and Mic. The auxiliary inputs accommodate high level signals, from a TV set for example. Separate phono inputs permit two phonograph sources to be selected.

Next is the Mode switch. Its Bal Right and Bal Left positions permit rapid comparison between the volume of left and right channels. On the Bal Right position, the left speaker is silent and vice versa. The Balance knob next to the Mode switch is the variable control that favors the volume in one channel or the other.

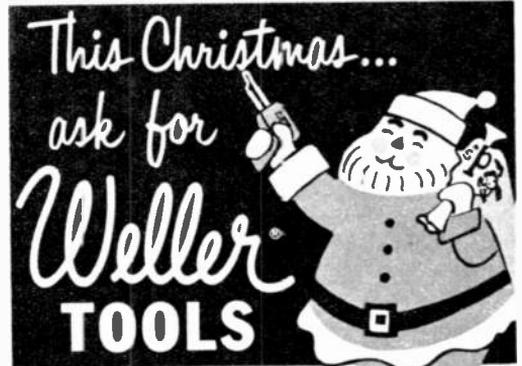
In the Mono position monophonic records may be played with a stereo cartridge. The preamplifiers are combined and the single channel is heard in both speakers.

Continuing with the Mode switch we find the Stereo Reverse position, which, as its name implies, reverses the channels heard in the speakers.

The Loudness control affects the volume in both channels simultaneously. The Balance control initially brings them to the same level. A Contour switch will boost bass tones if the Loudness knob is run at low levels. This compensates for the drop in response of the human ear when listening to sound of low intensity.

The remainder of the controls on the SA-40 are similar to those found on the conventional amplifier. Bass and treble are each dual controls concentrically mounted so they may be adjusted in unison. A two-position equalization switch selects either RIAA (common to stereo records) or old LP and 78 rpm. It also equalizes 3¾ or 7½ tape speed if a tape head is fed to the proper input.

Listening tests with the SA-40 revealed it to be a Good Buy. ☉



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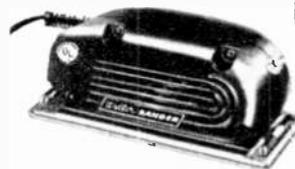
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Build-It Course—4

Continued from page 75

tant element is the antenna. It intercepts radio waves of many frequencies in its vicinity. As the waves cut across the antenna, voltages are induced. The signals are extremely low-level, on the order of microvolts—millionths of a volt. From the antenna they are led to a coil and capacitor combination that forms the heart of the tuning section.

Electrons surge in and out of the coil and capacitor according to their frequency. A station may have a carrier wave of 680 kc. Its voltage in the tuner will alternate at the rate of 680,000 times per second. The special quality of the coil and capacitor combination is *resonance*. It is this property of a tuned circuit that allows only the desired frequency to proceed through the tuner.

If the resonant frequency of the tuned circuit is the same as the incoming signal, opposition takes place—which is just what we want. Frequencies off the resonant point will be shunted to ground. The opposition presents a load to the desired signal. It causes its voltage to appear across it. This voltage is then conducted to the grid of the first tube in the circuit.

To tune in (or resonate) all the stations in the broadcast band, one of the elements of the coil-capacitor combination must be variable. In this case it is the capacitor. Its plates swing on an axle rotated by the tuning knob.

The audio could now be separated from the carrier wave and fed to a speaker. Before the advent of the superheterodyne it was done this way in a circuit called the TRF, or “tuned radio frequency.” But the TRF had its disadvantages. Its radio frequency amplifiers had to operate over a variety of frequencies.

The superhet derives its superior performance in this respect; an amplifier operating on a single frequency is more efficient than one that is designed to amplify over a whole band.

The first problem is how to convert radio frequencies that may appear anywhere in the broadcast band to a single

discrete frequency. The answer lies in the mixer, the first stage of the tuner. As its name implies, it mixes frequencies. Furthermore, the result of the mixture will always contain the same signal—the intermediate frequency, in this case 455 kc. It must be 455 kc in order to pass through the IF amplifier, the second stage in the tuner. This stage is fixed-tuned and operates with high efficiency. Now to the problem of how to convert the incoming wave to 455 kc no matter where it lies in the band.

Heterodyning is a process where two signals “beat” against each other. Several results occur; the original signals, their sum and difference frequencies and a variety of other products. We are most concerned here with the difference frequency (which, as we’ll see is 455 kc).

Assume that a station at 1000 kc has been selected by the tuning circuit and is at the control grid of the mixer tube. Note that the mixer has several grids. The additional grids, as compared with a conventional pentode, are operated as part of the *local oscillator*. The purpose of this oscillator is to provide a frequency that will mix with the station frequency and produce a 455 kc difference. How?

Similar to the main tuning capacitor, another variable capacitor rotates with the tuning knob. The job of this capacitor is to govern the local oscillator’s frequency. This “ganging” together of two capacitors is indicated in the schematic diagram by a dotted line connecting the two.

Back to our 1000 kc station. When the main tuning capacitor is set at 1000 kc, the local oscillator injects 1455 kc into the mixer. Swing the tuning knob to 560 kc and the oscillator will follow it down and generate 1015 kc. Remember that the dual-section variable capacitor simultaneously tunes the station and shifts the oscillator frequency.

The oscillator will always produce a frequency 455 kc higher than the station frequency. The signals mix in the electron stream through the tube and present their difference to the first IF transformer tuned to 455 kc. All other

[Continued on page 106]

Special Speakers for Stereo

Continued from page 50

Minigon S-5 system, contains a 10" woofer, tweeter and a crossover network. This system runs \$243 per unit.

How about stereo speakers in a single cabinet? Yes, University has enclosed a complete speaker system in a unit only 30" wide. It's called TMS-2. Projected at the rear wall is a dual voice coil woofer. On each side are an 8" mid-range speaker and a wide-angle tweeter. Additionally there are crossover networks with "presence" and "brilliance" controls.

The main feature of the design are two adjustable doors which act as baffles. By changing the angles of these doors, the stereo "spread" can be increased or decreased as desired and according to the acoustics of the listening room itself. Price: About \$260.

Transistor Intercom

Continued from page 60

The speaker grill was made from a piece of aluminum screen cut to 2 $\frac{3}{4}$ " square. Drill the holes for the L-brackets that hold the board to the case. The brackets may be made from pieces of scrap metal about $\frac{1}{4}$ " wide by $\frac{3}{4}$ " long.

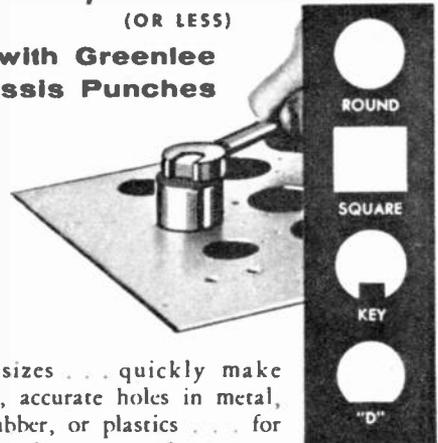
After wiring has been completed and checked out, place the battery in its holder and connect the remote speaker. Keep the two units separated by at least ten feet to prevent the annoying howl caused by feedback between the two speakers.

To talk from the master to the remote speaker, simply press the switch on top of the master. There is no switch on the remote, and consequently any sound in its vicinity will be heard in the master speaker. It is possible to connect several remotes in parallel for different locations. There will be some drop in overall volume, but the master unit was found to have plenty of reserve power to take care of the additional units. The type of wire used between stations is not at all critical. Lamp cord (No. 18 stranded) or bell wire may be used.

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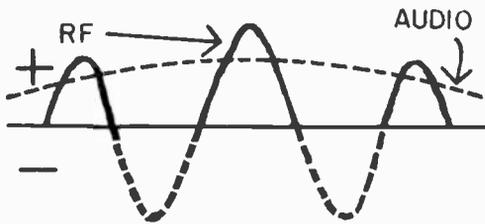
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Continued from page 104



products of mixing find it virtually impossible to resonate in the windings of this transformer.

Thus, the IF tube amplifies at the single frequency it was designed for.

Though the original station frequency has been converted to 455 kc it still has the same amplitude variations as when it was first tuned in at 1000 kc. Only the carrier frequency has been altered—the intelligence or modulation remains the same.

The next major step is *detection*. This is a process that recovers the audio “riding” on the radio wave in the shape of its amplitude. The wave has fulfilled its function of carrying intelligence over great distances. Rectification is first. One half of the radio wave (now 455 kc) must be eliminated. This will become apparent in a moment.

Filtering is next. One cycle of audio exists as many pulses of varying strength of the carrier. If the spaces between the pulses were filled in, the audio signal would result. The filter is a resistor-capacitor network that stores electrons during the pulse and discharges them into the “valleys” between them.

Why must the signal be rectified before filtering? Note that the radio wave pulse alternates between positive and negative values. If filtering were done first, the resulting audio would cancel itself out. There would be equal and opposite signals existing at the same time.

A circuit refinement in the tuner is AVC—automatic volume control. It aids in keeping the various signals entering the tuner at the same level. This prevents blasting and overloading on strong

signals, and permits maximum sensitivity for weak ones.

A portion of the 455 kc signal is changed to DC by a diode rectifier. The pulses are smoothed to steady DC by a resistor-capacitor filter. The polarity of this voltage is negative and applied to the grid of the mixer and IF amplifier tube. This negative bias varies with the strength of the incoming signal and controls the gain of the tubes. Thus, a strong signal produces a large AVC voltage and reduces gain. Conversely weak signals cause little or no AVC and the stages operate at high sensitivity. Of course this levelling effect will not enable the tuner to pull in stations “way down in the noise.”

Construction of the tuner is straightforward. There are no particularly critical wiring areas. Simply keep the leads in the tuning circuit short to avoid losses and to prevent self-oscillation due to feedback in the IF amplifier.

Circuit alignment may be done by ear if no test equipment is available. Don't tune the IF transformers until the front end is aligned. They are usually tuned to 455 kc at the factory. If no stations are heard, locate one by setting the tuning capacitor at the mid-point of its travel and tuning the local oscillator slug. The tuner must feed an audio amplifier and speaker for audible signals. Once a station is heard, move it to its proper frequency on the dial by the oscillator slug. Tune the screw on the main tuning capacitor for maximum volume.

The rest of the AM stations in your area should fall into place. Adjust the trimmers for best volume on a frequency preferably toward the high end of the dial. Note the setting of the oscillator slug. Alter its position so the stations once again fall into place. The setting with the maximum volume is the correct one. It is possible to inadvertently set the oscillator at 455 kc *below* the station frequency and affect the performance.

After the above has been done, additional gain is possible by touching up the IF transformers. Use a screwdriver that fits the slots inside the cans. Otherwise the slug material will be powdered, rendering the transformer useless. ●

A Signal Tracer Kit

Continued from page 81

be heard from the speaker of the tracer. The probe is moved to the grid of the RF amplifier or mixer and tuned to a station. Then, it is advanced from the plate of one stage to the grid of the next. The signal heard from the tracer should get louder. If the signal is not heard at any check point, trouble lies within this stage and can be spotted by taking voltage and resistance measurements.

A wattmeter section in the tracer checks the power consumption of any electrical device up to 1000 watts. A WATTS control is rotated until the "magic eye" closes. The power used by the device you have plugged into the tracer is read directly on the scale of the WATTS control.

A special noise locator circuit enables you to find a stage in a receiver which is producing unwanted noise, buzzing or frying. Noisy resistors can be checked as well as volume controls, fixed capacitors, and "cold" soldered joints.

Six binding posts on the front panel are used to connect to (1) a VTVM (vacuum tube voltmeter) or oscilloscope for precision alignment of receivers (2) the tracer's speaker as a test speaker (3) the tracer's output transformer as a substitute for single ended or push-pull circuits (4) supply B+ voltage (280 volts DC) for substitution and experimenting.

Kit is a Good Buy; price \$26.50.

Blood Pressure—Electronically

Continued from page 76

A fixed leak deflates the cuff when the cuff pressure exceeds systolic (maximum) arterial pressure. An electro-magnetic valve then opens automatically and more air is pumped into the cuff. In this manner the cycle is completed and then repeated. The cuff pressure in this way follows changes in systolic blood pressure and all such changes are revealed on the control panel. An attached solenoid device automatically controls drug intake keeping blood pressure at required level.

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FM Radios For Your Car

Continued from page 84

do just that. Summarizing their case against FM in autos, we find the following:

FM equipment is more complex to engineer than AM, hence more expensive; components, such as resistors and capacitors, have to be of the highest quality; voltage regulation is more critical in FM tuners to compensate for its frequency drift characteristics; circuit alignment is more critical.

The saturation of stations on the FM band is far less than that on AM. Whereas approximately 3,300 AM stations reach into every hamlet across the nation, only about 575 stations operate between 88 and 108 mc. This seemingly backs the reluctant manufacturers who claim that only those audiophiles who drive in metropolitan areas will be able to pick up a sufficient number of stations to make the additional cost of FM in the auto worthwhile.

FM transmission is line of sight and the ground wave of a broadcast station operating at the VHF FM frequencies does not cover any great distances. But this line of sight factor may be misleading. For instance, anticipated "dead spots" behind large buildings and hills failed to materialize in our mobile tests. It is true, however, that FM stations' coverage is usually regional and there is no clear channel service, as in AM. That the antenna is more critical at VHF frequencies is not really a factor because this involves only a minor, one-time adjustment.

The two West German radios, Blaupunkt and Becker, cover both AM and FM bands. Each lists for over \$150 and can be installed in cars having either 6 or 12 volt electrical systems. The one big trouble: If you sell your car, you will probably be selling your FM radio along with it, because AM and FM in these units are inseparable.

The American entry into the field is the clever Gonset mobile converter. This neat package plugs right into your present AM set (providing your car has a 12 volt, negatively grounded electrical

system). The accompanying pictures show how simple an installation this is. One metal strap holds the \$99.95 (list price) converter to the underside of your dash. An alligator clip on the power lead is connected to one ignition switch terminal. Your AM antenna cable is unplugged and replugged into a receptacle on the back of the converter. The only other lead goes from the converter to the AM antenna receptacle. Total installation time: 5 minutes.

There are only two switches to contend with: An AM-FM switch and a tuning dial. When the former is turned to AM, the converter is bypassed and your AM set functions as usual. When turned to FM, the converter picks up the FM signal, amplifies and demodulates it to audio which modulates an 800 kc oscillator for the standard broadcast band. From then on the remaining stages of your AM set take over. You tune your AM radio to 800 kc (approximately at the center of the band) and you hear FM programming. Setting a push button at 800 kc precludes the necessity of dial tuning. The antenna must be set at 30" from tip to grommet mounting.

In our test of this Gonset tuner, we pushed in the converter tuning dial, selected a centrally located New York City FM station, released the dial, and thereby activated the AFC. The transmitter power of the station was 6000 watts with an effective radiated power (from atop a medium-size hotel), of 18,000 watts.

We drove all over New York City and Long Island—behind skyscrapers, over hills some 35 miles from the transmitter, across major bridges, under short tunnels, and even into garages. Not once did the signal distort, fade or drop out, day or night. Motor noise never entered the picture. The only place we lost the signal at all was after we had driven some 300 feet or more into the Queens-Midtown Tunnel—hundreds of feet beneath the East River.—By Ed Nanas

Radio Beacons—Rare DX

Continued from page 86

pieces of gear extending from low to high priced units.

To start with, you must know what to expect and know the sounds of long wave, at least on the beacon band. On these frequencies there are three types of radiolocation stations. The simple beacons usually identify continuously and a few throw in long dashes between calls. Ranges stations identify only every 30 seconds. The remainder of their transmission consists either of a series of A's (-·-), N's (-·) or unbroken tone, depending upon the listener's position relative to the station. Finally, we have the CONSOLANs which identify every minute or two. At present there are only two such stations in the Americas. Most foreign stations fall into the beacon category, best for DX.

In order to identify your DX, you will need a good reference log. The best is "Radio Facility Charts—Caribbean & South America," published by ACIC, USAF, 2nd and Arsenal Streets, St. Louis 18, Missouri. A yearly subscription costs \$3.50. To pinpoint domestic stations you will need "Location Identifiers," available from the Superintendent of Documents, Washington 25, D. C., for \$1.50. There is a free supplement service which will keep it up to date.

What data will you need to authenticate your reception? Count exactly the number of seconds it takes to transmit the identifier. Your count should be accurate to the half-second. Do the same for the brief period of silence between identifications. If there is a long dash in the sequence, of course time that also.

Airlines and aeronautical agencies are generally good verifiers and will frequently QSL your reception via letter. Beacon reports may be addressed either to the airline's head office for the region in which the beacon is located (i.e. all reports on PAA beacons in Latin America may be sent to Pan American World Airways, International Airport, Miami 48, Florida), or they can be sent directly to the beacon. Send your first report directly to the beacon and request a letter of verification. If you do not receive an answer within a few months, send another copy of your report to the regional office along with a prepared QSL card for them to sign, rubber stamp and mail back to you.



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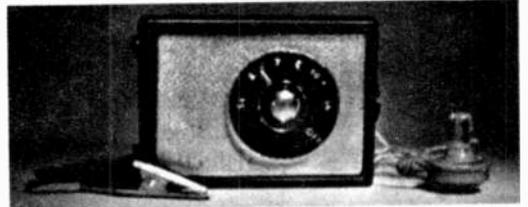
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Kill Noise In Mobile Radio

Continued from page 64

should be in the vicinity of .5 mfd with a current carrying capacity of 40 amperes. Voltage rating for this capacitor should be 50 volts. The mounting lug is securely grounded to the generator frame. Connect the capacitor as close as physically possible to the generator armature terminal for best results. Generator sparking may also be reduced by cleaning the commutator.

The voltage regulator next comes to our attention. Like the generator, some regulators are noisier than others. In some cases it may only be necessary to connect a 10 ohm 1 watt resistor from the regulator field terminal to ground. In stubborn cases more drastic means may be necessary, such as placing .1 mfd coaxial capacitors in the battery lead at the regulator battery terminal, and in the generator lead at the regulator generator terminal respectively.

Generally, any part which is not well grounded to the frame of your car with a good electrical joint may pick up electrical noises and radiate them into your antenna. In this category there are mufflers and tail pipes, wheels and control rods, insulated wires and sometimes gauges. Battery leads are often prime offenders. Any wire which comes through the firewall from the engine compartment should be suspect, and be bypassed to ground at the firewall with .05 mfd disc ceramic capacitors.

To further locate noise sources one simple method makes use of the fact that your receiver is a very sensitive noise indicator. A probe, called a "noise sniffer" is easy to put together. Simply disconnect, at the antenna, the coaxial plug to your receiver, and connect a clip lead or short loop of wire from the center terminal to the ground shield. Turn on the receiver, open the volume control to maximum, turn off the squelch or noise clipper if you have either, and tune the antenna trimmer on the receiver for maximum rush noise. Start your engine and hold the loop close to any suspected noise sources. The sniffer will locate many of them. 📌

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Continued from page 35

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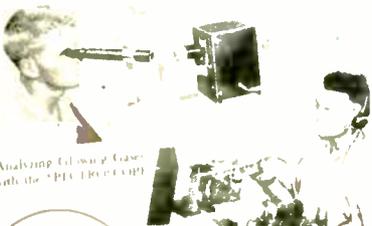
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