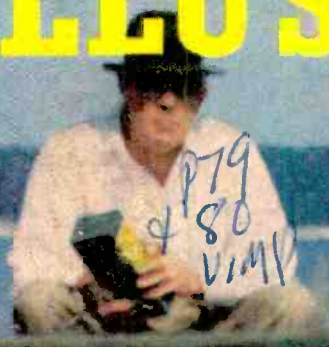
How to Build a Bass Reflex Enclosure

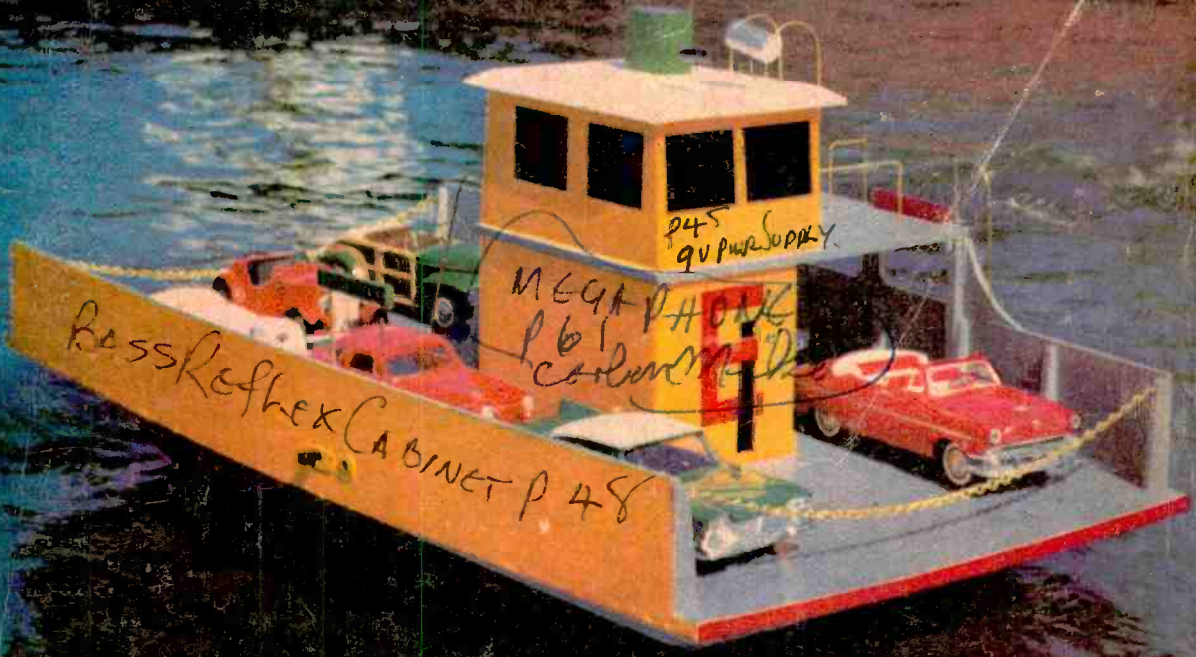
ELECTRONICS ILLUSTRATED



25¢
MAY

Weather Forecaster
Transistor Megaphone
Ham Transmitter

Also:
Hi-Fi Amplifier Kit Report



Have Fun With This Radio Controlled Ferry

NATIONAL'S NEW NC-66

FOR 'ROUND THE WORLD LISTENING

YOURS FOR ONLY $12.95 DOWN

Most versatile all-wave receiver! Portable; AC/DC/Battery operation. Thrill to radio shows from world wide points. Hear messages from ships at sea, planes in flight! Excellent for boatsmen, businessmen, travelers, armed forces personnel, outdoorsmen, hobbyists, and for foreign language broadcasts. Use it at home or away . . . indoors or out. Five band coverage: Enjoy hours of fun listening to standard broadcasts, shortwave programs, amateur (ham) conversations. Also DF beacon service for marine use.

Receives voice or code, salt spray tested, two antennas, provisions for National's RDF-66 direction finder accessory for marine use. Two-tone gray finish, chrome trim. Weighs only 16 lbs. (less batteries), 12-5/16" x 9-11/16" x 10".

* Only $12.95 down
Up to 20 months to pay at most receiver distributors.
* Suggested price: $129.95**
** Prices slightly higher west of Rockies and outside U. S. A.

National NC®

Since 1914

tuned to tomorrow

Malden 48, Mass.

NC-188: National's new budget-priced general coverage receiver . . . ideal for short wave and amateur listening. $15.95 down, up to 20 months to pay at most receiver distributors. Suggested price: $159.95, prices slightly higher west of Rockies and outside U. S. A.

BURTON BROWNE/New York

Learn at Home IN YOUR SPARE TIME to Fix Electrical Appliances

To build a better future, get into a field where there's much important work and the security that comes from knowing a good trade. Servicing electrical appliances offers that OPPORTUNITY. Every wired home has many electrical appliances and millions and millions of new appliances are sold every year. Owners pay well to keep them in repair. That's making a fast-growing need for trained men.

Add To Your Income Starting Soon

Need For Service Technicians Increasing

Make extra money in your spare time. Start soon to fix electric toasters, fans, clocks, vacuum cleaners, and other electric appliances for your neighbors and friends. Work in your basement, garage or spare room. It's easy to increase your earning power—to pay for your training many times over—to have extra money to buy things you need.

Learn and Earn with Multi-Use Tester Built with Parts We Send

This course includes the parts to build a portable, sturdy Appliance Tester that helps you locate electrical defects quickly and easily. You use it to learn and do actual electrical appliance repair jobs. If you want better pay learn this good trade. No need to give up your present job. You can train at home in your spare time for only $3.00 down and $6.00 a month. A small price to pay for increased earnings, a more secure future. Paste coupon below on a postal or mail in envelope for free book and sample lesson. Address **National Radio Institute, Dept. KE9, Washington 16, D. C.**

MAILING THIS COUPON MAY START YOU TO SUCCESS

LESSON AND BOOK FREE

NATIONAL RADIO INSTITUTE, Dept. KE9, Washington16, D. C.

Please send me Electric Appliance Training lesson and book free. (No salesman will call.)

Name ..... Age .....

Address .....

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

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

ELECTRONICS ILLUSTRATED

A FAWCETT PUBLICATION

Vol. 2, No. 5 MAY, 1959

Contents

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.

Entered as second class matter at the Post Office at Greenwich, Conn. under the Act of March 3, 1879 with additional entry at Louisville, Ky.

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.

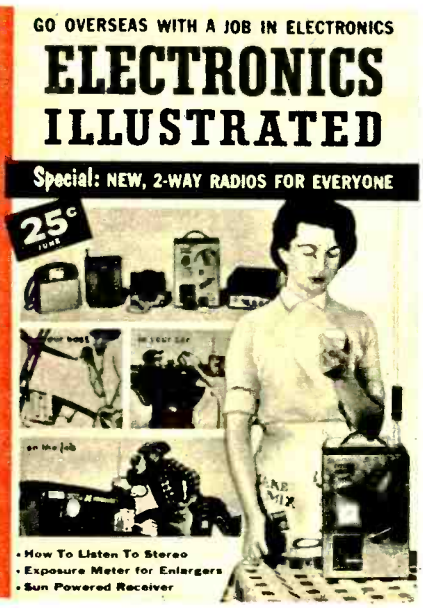
Printed in U.S.A.

A Message From the Editor

I've just finished a hurried tour of a portion of our Far Western electronics industry and I was greatly impressed by its vitality. For years we have thought of the electronics industry as centralized about Chicago and New York City – but the Far West is pushing hard. Much of the production is for airplane and missile manufacturers with their huge electronic gear requirements, however, hi-fi equipment, basic components (transistors, rectifiers, etc.) and communications gear are being produced in ever increasing quantity.

Of great interest to me was how electronic technicians and engineers live and work in the Far West. Most of the newer factories and research facilities are palm-tree surrounded. Most companies I visited were understaffed in the engineer and some other categories. I did not survey the intentions of the personnel departments but I can only assume that more, many more, electronics technicians will be needed by the Far West to allow them to expand as they give every indication of doing. The number of new companies originating in the West will undoubtedly keep pace, if not outstrip, the number of branch operations large midwestern and eastern companies are opening there. G-E, Motorola, RCA, IBM and Sprague are just a few of the eastern and midwestern companies who have branches in the Far West. Hughes Electronics, Hoffman, Ramo-Wooldridge, International Rectifier are just four of many wholly western concerns.

Special 2-way radio roundup next month.



The cost of living and the way of life in California, Arizona and other far western locations are also different in many respects from those in other areas of the country. If enough of our readers are interested in a complete job and living survey of California, we will do one. Let us hear from you.

I can't urge you strongly enough to read the next (June) issue of *EI*. This will be a special issue with many articles devoted to the new 2-way radio band just opened to all citizens and the low-cost equipment you can buy or assemble for this purpose. I think this is the most important and far reaching occurrence of interest to everyone since television, and in time will be as wide-

SOMETHING **NEW*** HAS BEEN ADDED TO THE DeVRY TECH TRAINING PROGRAM

Prepare in Spare Time At Home for a

JOB THAT PAYS REAL MONEY

in TELEVISION-RADIO-ELECTRONICS

Many DeVry-trained men who now hold good jobs paying real money were once looking for opportunity, yet wondering if they needed advanced schooling, special experience, or higher math. They clipped a DeVry Tech coupon, mailed it in—and were pleasantly SURPRISED! Now they work in one of today's fastest-growing fields—TELEVISION-RADIO-ELECTRONICS. Many have their own profitable service shops. DeVry Tech's "Learn-by-Seeing," "Learn-by-Reading," "Learn-by-Doing" training made the difference! You, too, may train at home the DeVry Tech way with wonderful, helpful movies, clear texts and valuable home laboratory equipment—or in our well-equipped Chicago or Toronto Training Centers.

Now something NEW* has been added to help you learn more by "doing." You can choose to build and keep your own top quality 6-speaker STEREOPHONIC SOUND SYSTEM that will provide thrilling enjoyment for years to come. Plans are furnished so that you can also build your own speaker cabinets—or we can tell you where to buy them. DeVry Tech's specially designed Stereo System includes:

- Turntable with Stereo cartridge
- Stereo Amplifier
- Stereo Pre-Amplifier
- 2 Cross-Over Networks
- Six Speakers: two 12-in., two 8-in., two 3-in.

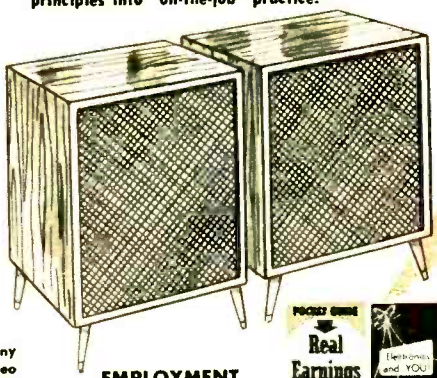
When you build your own equipment, you learn about the working parts. You can repair, adjust, maintain. You learn by *doing*—the DeVry Tech way. You put basic principles into "on-the-job" practice.

VACUUM TUBE VOLT METER

5-INCH WIDE BAND OSCILLOSCOPE

***NEW!**
Build Your Own 6-Speaker HIGH FIDELITY STEREOPHONIC SOUND SYSTEM
. . . another wonderful DeVry advantage

Special SHORT COURSE in High Fidelity Sound Reproduction including Stereophonic Systems also available. Ideal for hobbyists, music lovers and those wanting to ADD to their systems.



GET 2 FREE BOOKLETS!

Clip the coupon now for two booklets that answer many questions about your chances for success in this field. "Electronics and YOU" and the remarkable "Pocket Guide to Real Earnings" (just off the press) are yours without obligation.

MANY OPTIONS!

NOW . . . DeVry Tech men can take their choice of any or all of the quality equipment shown above: The *Stereo System* . . . the *Scope* and *Meter* . . . a 21-inch *TV Set* (not pictured) . . . or ALL THREE. But no matter which way you do it, you get practical home training at its best . . . the kind you need to get started in the fast-moving Electronics field. Send coupon for details.

EMPLOYMENT SERVICE

DeVry Tech offers real, down-to-earth employment service to help you toward a good job after graduation — even provides help in starting your own servicing business.

"One of North America's Foremost Electronics Training Centers"

Accredited Member of National Home Study Council

MAIL TODAY FOR FREE FACTS

DeVry Technical Institute
4141 Belmont Ave., Chicago 41, Ill., Dept. EI-5-P

Please give me your two FREE booklets, "Pocket Guide to Real Earnings" and "Electronics and You," and tell me how to prepare to enter one or more branches of Electronics.

NAME _____ AGE ____
PLEASE PRINT

STREET _____ APT. ____

CITY _____ ZONE ____ STATE _____

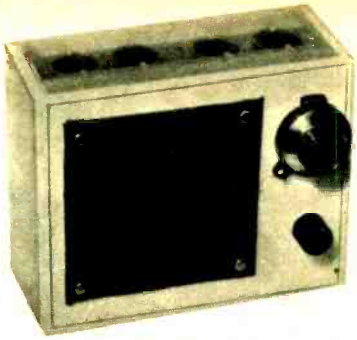
☐ Check here if subject to military training.

DeVry Tech's Canadian Training Center is located at 626 Roselawn Avenue, Toronto 12, Ontario

2053

DeVRY TECHNICAL INSTITUTE

4141 BELMONT • CHICAGO 41, ILL. • Formerly DeFOREST'S TRAINING, Inc.



Sun-powered all-transistor radio in next issue.

spread. You can use this radio from your car to your home, on your job, in your hobby—just about everywhere. And the low v.h.f. frequency makes possible a range up to 20 miles or more. Be sure to be with us when we unlock the wonderful world of 2-way radio for you.

Talking about job opportunities in California and the Far West, leads me to the authoritative article we have in our next issue on job opportunities overseas. If you have a background in electronics and are interested in overseas travel, why not let electronics pay your fare?

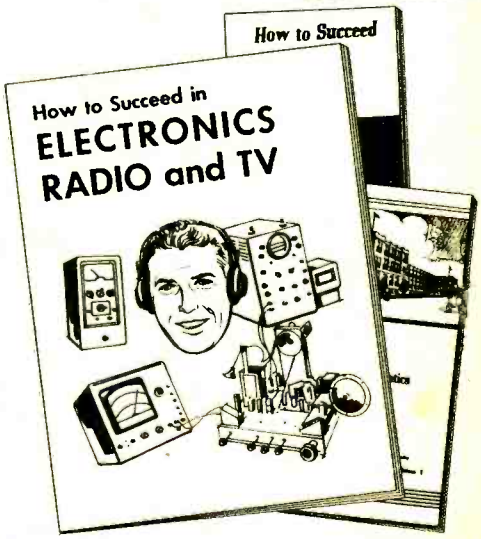
One of our authors has done a lot of experimenting in stereo listening. The results are contained in an article on how to listen to stereo, in our June issue. You will learn all about speaker placement and balancing for the best stereo sound. For the do-it-yourselfer we will describe a relatively low cost sun powered radio that sounds as good if not better than most pocket radios sold today—and the power is all free. We have tested this project, as we should remind you, we do all of the build-it-yourself projects published in *EI*.

The First U. S. Army, New York University and Polytechnical Institute are jointly sponsoring a series of seminars on rocket science open to amateur rocketeers. These are held on Saturdays on the Bronx campus of New York University. For more information and reservation requests write to Capt. Brinley, 1st Army Headquarters, Governor s Island, New York.

Charles Tuttle

TAKE A LOOK AT YOUR FUTURE IN RADIO-TV-ELECTRONICS—FREE!

I.C.S. Career Kit tells you where the big-pay jobs are... who are the industry's most wanted men ...how you can "cash in" in a big way on your own future.



Here's your chance to find out where you're going—fast! And it won't cost you a thing except the time it takes to clip and mail the coupon at the bottom of this page.

Radio-TV-Electronics is the fastest growing industry of all time. Opportunity for men in this field is almost unlimited. The rewards are great.

But to "cash in" you must be properly trained. You must know more than simply wires and tubes. You must be able to understand and apply the principles of Radio-TV-Electronics.

That's where I. C. S. comes in . . . the world's oldest and largest technical training school. Here are the people who know—who can tell you—what you need to go places in Radio-TV-Electronics.

You get the full story with your free I. C. S. Career Kit.

So take a minute now to get a look at your future in Radio-TV-Electronics. Send for your free I. C. S. Career Kit. You have nothing to lose. You can gain an exciting, well-paid career in a vital industry.

Send the coupon below for your *free* I. C. S. Career Kit!

1. "How to Succeed," 36-page guide to advancement
2. Electronics, Radio and TV handbook or the field of your choice
3. Sample lesson (Math) to demonstrate I. C. S. Method

For Real Job Security—Get an I.C.S. Diploma! **I.C.S., Scranton 15, Penna.**

Accredited Member, National Home Study Council

INTERNATIONAL CORRESPONDENCE SCHOOLS

ICS

BOX 91423D, SCRANTON 15, PENNA. (Partial list of 259 courses)

Without cost or obligation, send me "How to Succeed" and the opportunity booklet about the field BEFORE which I have marked X (plus sample lesson):

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

BUSINESS
- ☐ Cost Accounting
- ☐ Managing a Small Business
- ☐ Purchasing Agent

DRAFTING
- ☐ Electrical Drafting

HIGH SCHOOL
- ☐ High School Diploma
- ☐ Good English
- ☐ High School Mathematics

ELECTRICAL
- ☐ Electrical Engineering
- ☐ Elec. Engr. Technician
- ☐ Elec. Light and Power
- ☐ Practical Electrician
- ☐ Professional Engineer (Elec.)

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

Name_____ Age____ Home Address_____

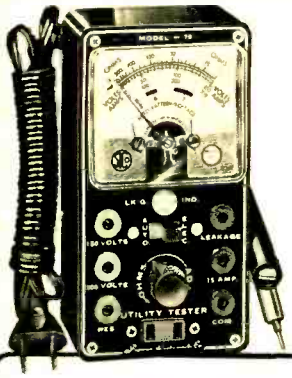
City_____ Zone____ State_____ Working Hours____ A.M. to____ P.M.

Occupation_____

Canadian residents send coupon to International Correspondence Schools, Canadian, Ltd., Montreal, Canada. . . . Special tuition rates to members of the U. S. Armed Forces.

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 explanation 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 consumption *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—proctically a condensed course in electricity. Learn by doing.*

Just read the following partial list of contents: What is electricity? • Simplified version of Ohms 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

Only $15.85

Superior's New Model 82A

A truly do-it-yourself type TUBE TESTER

Model 82A—TUBE TESTER . . . Total Price $36.50—Terms: $6.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

TEST ANY TUBE IN 10 SECONDS FLAT!

1. **Turn the filament selector switch to position specified.**
2. **Insert tube 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.

Model 82A comes housed in handsome, portable Saddle-Stitched Texon case.
Only $36.50
(Picture Tube Adapter available for $5.50 additional)

EXAMINE BEFORE YOU BUY!

USE APPROVAL FORM ON NEXT PAGE

RCA RADIATION COUNTER

MADE TO SELL FOR $160 – OFFERED FOR ONLY $47.50 NET

(Much less than cost of Manufacture.)

INDICATES RADIOACTIVITY IN 3 WAYS!

1—BY NEON
2—BY PHONE
3—BY METER

Endless experiments and discoveries in the new exciting field of nuclear energy are made possible when you acquire this finely built and engineered device. In the past, a rugged counter which was suitable for the prospecting of radio-active ores such as uranium, thorium and radium, was unsuitable for laboratory work due to the inability of combining accuracy with ruggedness. Conversely, a laboratory counter, while being extremely sensitive, could not withstand use in the field where it would be subjected to abuse and abnormally hard knocks.

In the laboratory where determination of intensity (counts) of a reading are necessary, the WF-11AWB provides sensitivity far surpassing many laboratory counters.

RADIOACTIVE SPECIMEN

Model WF-11AWB RADIATION COUNTER . . . 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.

Specifications

- Employs the extra sensitive 6306 Bismuth Type Geiger Counter Tube. Sensitivity is .015 Roentgens per hour (1 MR/HR = 6600 counts per minute).
- Three counting ranges: 0-200/2,000/20,000 counts per minute.
- Handy reset button.
- Ideal for survey work because the complete unit weighs only 5½ lbs.
- Sight and sound indications by neon flashes and headphone. Then when an indication is obtained you switch to meter reading for exact measurements.
- Decontamination easy with damp cloth applied to the weather-proofed aluminum case.
- A radioactive specimen is included for instrument checking and experiments.
- Included at no extra charge—U. S. Atomic Energy Commission booklet titled "Prospecting with a Counter."
- R.C.A. Model WF-11AWB comes complete with self-contained batteries which provide over 200 hours of intermittent operation.

Comes with complete set of batteries, carrying strap, headphone, radioactive specimen and A.E.C. booklet. Only . . . **$47.50 NET**

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-592, 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 obligations.

Name.....

Address.....

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

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

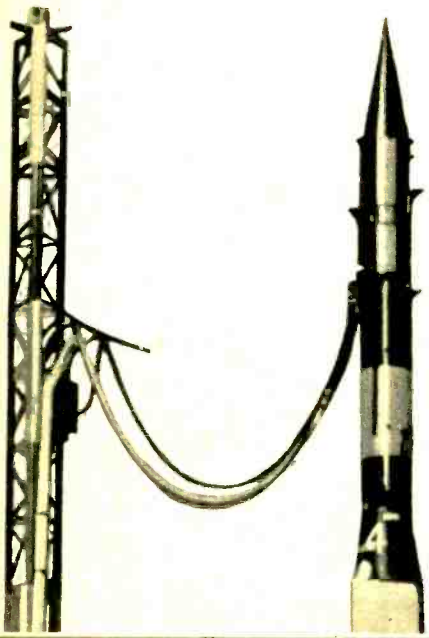
☐ Model 70.....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.

☐ Model 82A.....Total Price $36.50 $6.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ Include Model 82A Picture Tube Adapter at $5.50.

☐ Model WF-11AWB.....Total Price $47.50. $11.50 within 10 days. Balance $6.00 monthly for 6 months.

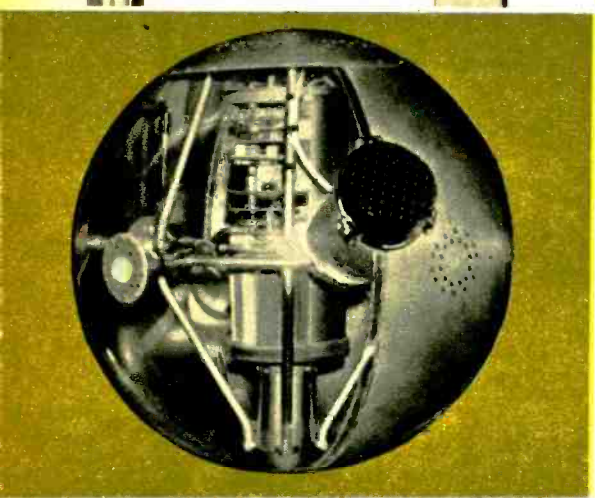
Electronics in the News

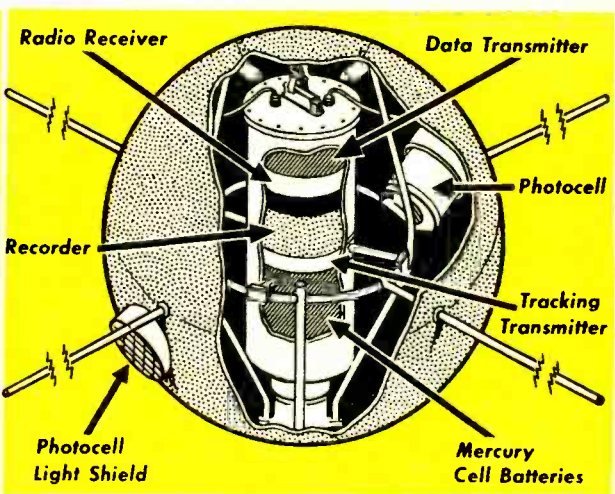


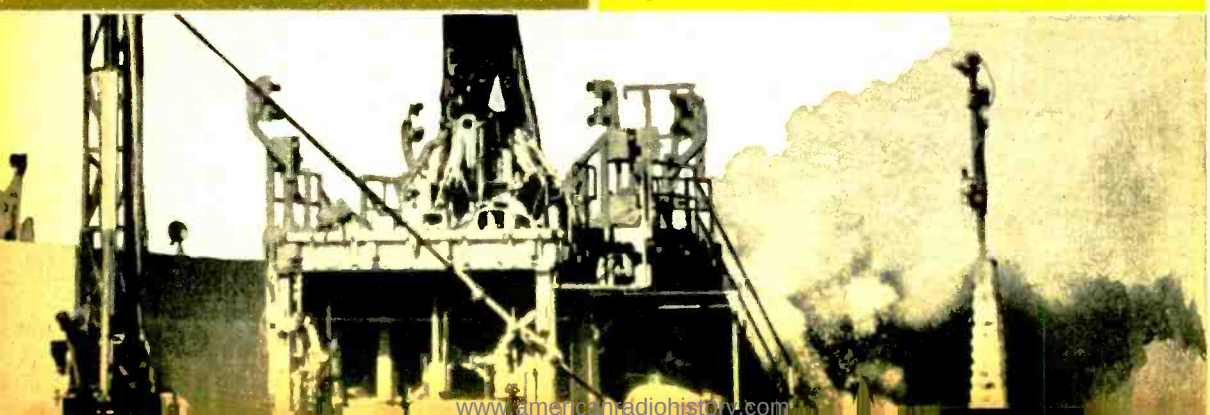
WITH the blast-off of this Vanguard missile, the US launched its first "weather-eye" satellite into orbit. This was done by the National Aeronautics and Space Administration in February. The 21½-pound sphere named "Cloud Cover" transmitted a constant tracking signal as well as a record of the sun's reflection from clouds, water and earth as picked up by photocells on its surface. This information may be used to predict on-coming weather conditions. A miniature 5½" wide tape recorder (the same as the one in the Atlas) recorded and then transmitted this information to a ground station after each trip around the earth.

This "Cloud Cover" is the first of a series of moonlets to be used for weather reporting. The others, unlike this one, will be solar powered.

Wide World Photos



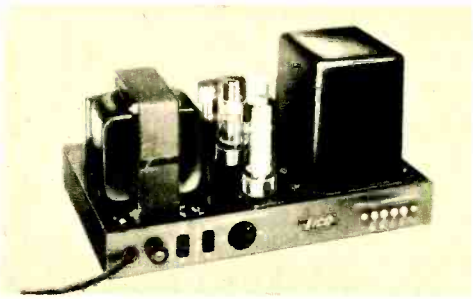




. . . News

The Windhaven Speaker System is used to expand the limited speaker quality of your table model radio or small speaker TV. It operates from an ordinary radio or TV set.

The kit includes; 8″ speaker, pre-cut cabinet parts of ½″ white birch plywood, 16″ tapered wood legs, grill cloth, acoustic lining, and illustrated step-by-step instructions. The kit may be obtained from Windhaven Radio Co., P. O. Box 74, Baroda, Michigan for $29.50 complete, shipped express collect.



Eico has announced production of its new model HF35 35-watt Ultra-Linear High Fidelity Power Amplifier. It features a low-noise EF86 pentode voltage amplifier. The rectifier is the slow warm-up GZ34 which eliminates high starting voltages. An octal socket is provided for powering the HF65A and HF61A preamplifiers.

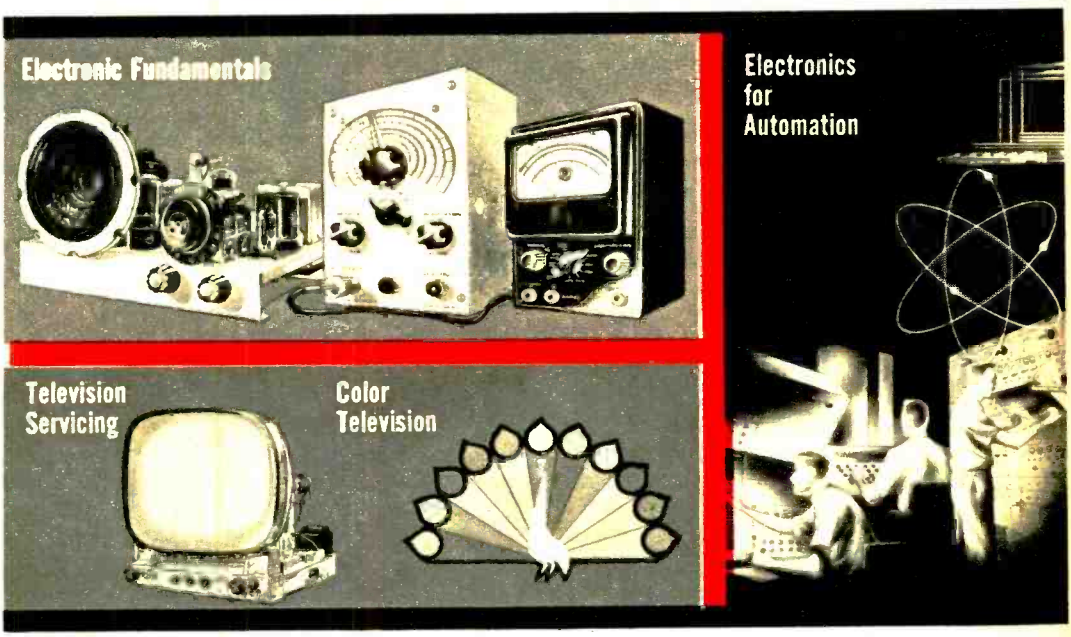
Kit is $47.95. Wired model is $72.95.

LET RCA TRAIN YOU IN ELECTRONICS

RCA Institutes celebrates Fifty Years of Electronic Training by introducing its newest Home Study Course . . .

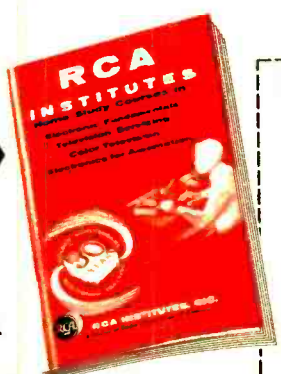
ELECTRONICS FOR AUTOMATION

. . . Now you have *four* comprehensive courses for your electronic training . . . from basic electronic theory to the more advanced principles of color TV and Automation.



Practical work with the very first lesson. Pay-as-you-learn. You need pay for only one study group at a time.

Send for our 64 page Home Study Catalog FREE!



FOR RESIDENT SCHOOL COURSES SEE AD ON OPPOSITE PAGE

RCA INSTITUTES, Inc. Home Study School, Dept. EI-59
A Service of Radio Corporation of America
350 West Fourth Street, New York 14, N. Y.

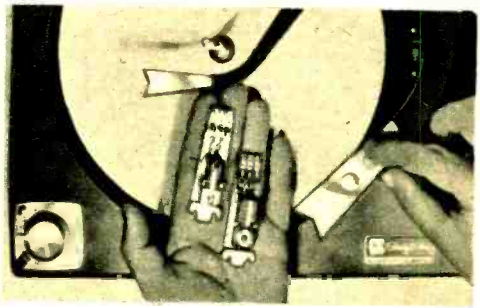
Without obligation, send me the FREE catalog of Home Study Courses. No salesman will call.

Name .....
Please print
Address .....
City ..... Zone ..... State .....
Korean Vets! Enter Discharge Date .....

CANADIANS — Take advantage of these same RCA courses at no additional cost. No postage, no customs, no delay. Send coupon to: RCA Victor Company, Ltd., 5001 Cote de Liesse Rd., Montreal 9, Quebec

To save time, paste coupon on postcard.

. . . News



The new stereo version of the Glaser-Steers' GS Seventy-Seven record changer features a solid tone arm with quick-change cartridge holders for switching from stereo to monophonic. Finger points to quick-change knob.

The four-wire stereo hookup, for minimum hum, includes the three silverplated spring contacts seen on holders, with the tone-arm—which is isolated from the changer deck—as the fourth lead. $59.50 Net.

—o—

The world's largest military closed-circuit educational TV system is in operation at the U. S. Army Signal School. A seven-channel system employing RCA television cameras brings TV instruction to about 450 classroom receivers, and can be viewed by as many as 15,000 people. Statistics prove that the average grade for a TV-trained student is considerably higher than that of the non-TV student.

—o—

Dr. Mergler of the Case Institute of Technology is perfecting system whereby digital data, transmitted at extremely high speeds (10,000 pieces of information per second) will arrive at its destination without distortion.

The process involves reversing the message in transit. This method may be used over wire or wireless and can be employed in the transmission of digital information to a satellite for rebroadcast back to earth. The signal received back from the satellite could be of the same fidelity as the one sent.

Build the best... build knight®-kits

A PRODUCT OF ALLIED RADIO

Featured in ALLIED'S 1959 Catalog **free!**

with exclusive **"CONVENIENCE ENGINEERING"**

Send for catalog describing in detail the complete KNIGHT-KIT line. See **everything** in Hi-Fi, Hobby, Test Instrument and Amateur kits. KNIGHT-KITS are lowest in cost, "convenience engineered" for easiest building, latest in design—the kits with guaranteed specifications that assure superior performance. Get the latest Allied Catalog—see the new, outstanding 1959 KNIGHT-KITS...

SAVE UP TO 50%

EASY TERMS ON ORDERS AS LOW AS $20

send for it... **SEE DOZENS OF TYPICAL knight-kit VALUES LIKE THESE**

Top Value 12-Watt Complete Hi-Fi Amplifier Kit

Model Y-784 **$19.95** (less cover) **$2.00 down**

Never before has there been so much solid hi-fi value and quality performance at such low cost. **Guaranteed specifications:** frequency response, 30-15,000 cps ±1½ db at half power; less than 1% distortion at full power. **Has 15 db of inverse feedback.** With preamp stage equalized for magnetic cartridge; inputs for phono and tuner; separate bass and treble with boost and attenuation. 5 x 9¾ x 7" with cover (cover $3.95 extra). 7½ lbs.

Thrilling "Space Spanner" Receiver Kit

Model Y-259 **$18.95**

Thrilling 2-band receiver, easy to build, fun to operate—a terrific value. Bandswitch selects exciting short-wave, including foreign broadcasts, amateur, aircraft and marine radio (6.5 to 17 mc), and standard broadcast. Highly sensitive regenerative circuit. Built-in 4" PM speaker and beam power output for strong volume. Headphone jacks and switch to cut out speaker. Handsome cabinet, 7 x 10½ x 6". AC or DC operation. 7½ lbs.

there is a money-saving knight-kit for every electronic need

HI-FI KITS
60-Watt Stereo Amplifier
Stereo Deluxe Preamp
Stereo Control
18-Watt Amplifier
25-Watt Basic Amplifier
30-Watt Amplifier
FM-AM Tuner
FM Tuner
Hi-Fi Preamplifier
Speaker Systems, etc.

HOBBY KITS
"Span Master" 4-Band Receiver
"Ranger" Radios
Clock-Radio
Radio-Intercom
"Ocean Hopper" Radio
5-Transistor Portable
2-Transistor Pocket Radio
1-Transistor Radio
Electronic Lab Kits
Photoelectronic System, etc.

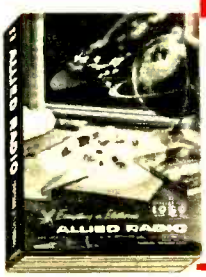
INSTRUMENT KITS
Tube Checkers
5" Oscilloscopes
VTVM
VOM's
RF Signal Generator
Signal Tracer
Audio Generator
Sweep Generator
Capacitor Checker
R/C Tester
Transistor Checker
Flyback Checker
Battery Eliminator, etc.

AMATEUR KITS
Communications Receiver
50-Watt Transmitter
Self-Powered VFO
100 kc Crystal Calibrator
RF "Z" Bridge
Code Practice Oscillator

452 PAGE 1959 ALLIED CATALOG **FREE**

Send for this value-packed catalog featuring the complete KNIGHT-KIT line, as well as the world's largest stocks of **everything** in Electronics. It's the leading, money-saving Buying Guide.

WRITE FOR YOUR **FREE** COPY TODAY!



ALLIED RADIO

ALLIED RADIO CORP., Dept. 133-E9
100 N. Western Ave., Chicago 80, Ill.

Ship the following KNIGHT-KITS _____

_____ $_____ Enclosed

☐ Send FREE 1959 ALLIED 452-Page Catalog

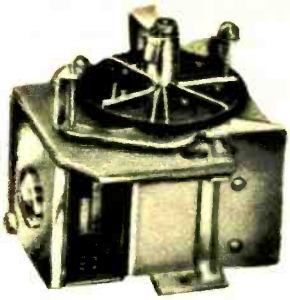
Name _____

Address _____

City _____ Zone _____ State _____

. . .News

New wall-mounted cabinets for hi-fi and stereo were recently shown by Bogen-Presto at the Los Angeles High Fidelity Show. The cabinets may be used to house a stereophonic record system and FM-AM tuner. Each walnut cabinet is 28″x18″x9″ at $69.50.



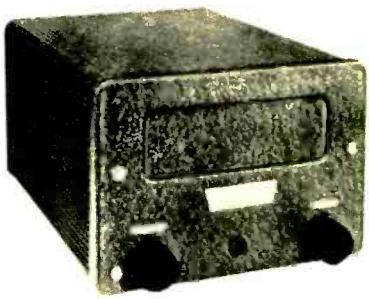
With this small gadget, capable of being set to respond to 20,000,000 numbers, it will be possible to dial directly to any point in the U. S. without the aid of an operator. The Secode decoder is a dialing switch for a mobile telephone and has been used in railroad, power line and other private radiophone systems. It will allow mobile stations to reach others at distant locations by direct dialing. Each unit will have its own number (from 1 to 7 digits) which will not be duplicated by any other unit, thus making direct dialing to any point possible. Made by Secode Corp., 555 Minnesota Street, San Francisco, Calif.

. . . News

Bell Telephone Labs is developing a system, TASI, whereby underseas telephone cables may carry twice the number of telephone conversations than ordinarily. For instance 72 conversations may go over 36 channels.

During a conversation there are gaps and pauses during which the equipment switches another party to that particular channel. When the conversation resumes, the speaker's voice activates an unused channel in about 10 milliseconds, and the speaker continues talking without any interruption.

—o—



Monitoradio Division has made available two new crystal-controlled mobile receivers for continuous monitoring of any single frequency in the 30-50 or 152-174 mc FM bands. This receiver is suited for anyone who has need to monitor the transmissions of a specific station.

Both receivers have double conversion, built-in squelch and 4" pm speaker. Available from 7900 Pendleton Pike, Indianapolis, Ind. $114.50 including crystal.

BUILD 16 RADIO CIRCUITS AT HOME

with the New Deluxe 1959 PROGRESSIVE RADIO "EDU-KIT"®

Reg. U.S. Pat. Off.

only **$22.95**

A Practical Home Radio Course

Now Includes

- ★ TRANSMITTER
- ★ SIGNAL TRACER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ EXCELLENT BACKGROUND FOR TV
- ★ School Inquiries Invited
- ★ SOLD IN 79 COUNTRIES

YOU DON'T HAVE TO SPEND HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding **PRACTICAL HOME RADIO COURSE** at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. **THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.**

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner, how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, 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

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—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio.

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

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

THE "EDU-KIT" IS COMPLETE

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

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

FREE EXTRAS

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

SERVICING LESSONS

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

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

FROM OUR MAIL BAG

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

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

UNCONDITIONAL MONEY-BACK GUARANTEE

The Progressive Radio "Edu-Kit" has been sold to many thousands of individuals, schools and organizations, public and private, throughout the world. It is recognized internationally as the ideal radio course.

By popular demand, the Progressive Radio "Edu-Kit" is now available in Spanish as well as English.

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.

ORDER DIRECT FROM AD—RECEIVE FREE BONUS RESISTOR AND CONDENSER KITS WORTH $7

☐ Send "Edu-Kit" Postpaid. I enclose full payment of $22.95.
☐ Send "Edu-Kit" C.O.D. I will pay $22.95 plus postage.
☐ Send me FREE additional information describing "Edu-Kit."

Name .....

Address .....

.....

PROGRESSIVE "EDU-KITS" INC.
1186 BROADWAY, DEPT. 511AE, HEWLETT, N. Y.

. . . News

This is the Yardney Electronic Corporation's Silcad battery which is now being used to power experimental portable TV sets. The battery has silver and cadmium plates and weighs 3¼ pounds. It is recharged when the TV set is plugged into an electric outlet for home use.

—o—

New Booklets and Catalogs:

"Theme and Variations," a booklet containing information on FM antennas and their installations may be obtained for 25c from Apparatus Development Co., Inc., Drawer 153, Wethersfield 9, Conn.

Bogen-Presto has published the stereo edition of "Understanding High Fidelity." This handbook describes the components required for hi-fi, and distinguishes between stereophonic and monophonic systems in relation to the results which may be expected from each. Glossary of technical terms included. The 64-page booklet is available for 25c from Box 500, Paramus, N. J.

"Techni-Topics," a booklet containing a brief technical discussion of basic magnetic amplifier theory, circuitry and applications, is available from Magnetic Controls Co., Dept. KP, 6405 Cambridge St., Minneapolis 16, Minn.

"Stereo Simplifier" is a booklet explaining just what name implies. Available from any Sonotone Hi-Fi dealer.

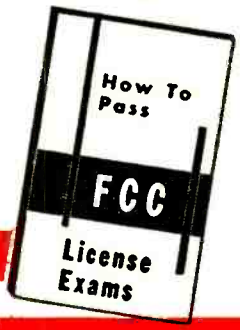
An informative guide to high fidelity stereo and monophonic speaker systems and components may be obtained from University Loudspeakers, Inc., 80 So. Kensico Ave., White Plains, N. Y.

A new test equipment catalog, No. 38-T, is available from Triplett Electronic Instrument Co., Bluffton, Ohio.

Accredited by the National Home Study Council

good training doesn't cost . . . it pays!

How To Pass



FCC COMMERCIAL License Exams

Get Your FCC License Quickly

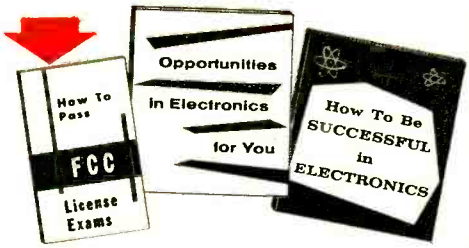
We Guarantee to train you until you receive Your FCC License

We guarantee

to train you until you receive

Your FCC License

—or your money back



The Master Course in Electronics will provide you with the mental tools of the electronics technician and prepare you for a First Class FCC License (Commercial) with a radar endorsement. When you successfully complete the Master Course, if you fail to pass the FCC examination, you will receive a full refund of all tuition payments.

Cleveland Institute of Radio Electronics
Desk EI-8, 4900 Euclid Ave., Cleveland 3, Ohio

Cleveland Institute training results in job offers like these:

Radio Operators & Technicians

American Airlines—Chicago, Detroit, St. Louis, Cincinnati and Cleveland—has openings for radio operators and radio mechanics. Operators must have a 2nd class FCC license and ability to type 40 wpm. Many company benefits.

Service Technician

Man needed in Cleveland, Ohio, to service and maintain electronic medical instruments and equipment. Must have a solid knowledge of electronic fundamentals. A car is required. Company benefits include retirement plan.

And our trainees get good jobs

"Investment in training really pays off"

"Thought you would like to know that in almost two years since I completed your course and obtained my first phone license, my pay has increased $5 per week every six months. I don't believe any other investment could pay off as well as this one did."

Harold E. Phipps, North Augusta, S. C.

Cleveland Institute of Radio Electronics
4900 Euclid Ave. Desk EI-8 Cleveland 3, Ohio

Please send Free Booklets prepared to help me get ahead in Electronics. I have had training or experience in Electronics as indicated below:

- ☐ Military
- ☐ Broadcasting
- ☐ Radio-TV Servicing
- ☐ Home Experimenting
- ☐ Manufacturing
- ☐ Telephone Company
- ☐ Amateur Radio
- ☐ Other .....

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

In what branch of Electronics are you interested? .....

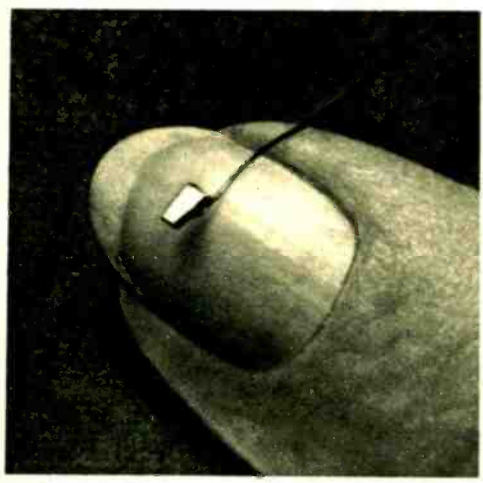
Name ..... Age.....

Address .....

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

EI-8

. . . News



Westinghouse atomic scientists have perfected the "Tom Thumb," a neutron detector that can see into tight, out-of-the-way places that have been inaccessible to any direct reading instrument. The detector is composed of a tiny slice of silicon or germanium having a sensitive junction or layer near the top surface of the slab. A millionth of an ounce of uranium (the same kind used in a nuclear reactor) is deposited on the surface of this semiconductor diode. When the thermal neutrons hit the surface they cause the U-235 atoms to split apart as they do in a nuclear reactor. These particles crash through the junction of the diode detector and upset its electrical balance. This causes an electrical pulse that can be detected and counted.

The "Tom Thumb" may pave the way for improved reactor design.

—o—

A double postcard designed to confirm contacts made by amateur radio operators applying for such awards as "Worked All Continents," etc., is now available from Hart Industries, 467 Park Avenue, Birmingham, Michigan.

Instructions for the QSL form are written in English, French and Spanish on the card and may be mailed in any country with postage of 5c. Further information and a sample Reply-Paid QSL card may be obtained by writing to the above address.

. . . News

A new stereo preamplifier kit has been announced by Allied Radio Corp. The unit provides flexible control of any stereophonic or monaural high-fidelity system. This Knight Kit, No. 83YX776, features five pairs of stereo inputs; four monaural inputs; concentric clutch-type bass, treble and volume controls which permit adjustment of each channel separately or both channels simultaneously; and scratch and rumble filters. DC is used on all tube filaments for low hum. A cathode-follower output permits placing the unit at a considerable distance from the amplifier.

Printed circuit boards and a printed circuit "plug-in" switch are included. $62.50 Net. Available from Allied Radio, 100 N. Western Ave., Chicago, Ill.

—o—

Bendix Aviation Corp. has launched a project designed to test the latest inventions in scientific sensing and electronic equipment in the Boeing 707 jet transport plane. Weather data from the ground up to 150,000 feet will be continuously collected, analyzed and transmitted to the ground. The object is to provide meteorological and geophysical data continuously around the world. All collected data will be permanently recorded on magnetic tape and processed through a digital computer for correction, computation and correlation.

—o—

The Knight Stereo Preamp Control, KN-700A, described on page 14 of the March issue is a factory-wired component for $89.95 not a kit as was incorrectly stated.

WE'RE MAKING IT EASIER THAN EVER TO BECOME A WELL PAID

RADIO-TELEVISION SERVICE TECHNICIAN

NOW — Just $6 Starts You Training in RADIO-TELEVISION

the SPRAYBERRY "Learn-by-Doing" Way . . .

25 BIG, COMPLETE KITS of PARTS & EQUIPMENT

To help you learn *fast* the practical side of Radio-Television, we send you expertly engineered training kits to test and assemble for interesting, valuable shop-bench practice!

- The new Sprayberry Training Television Receiver built and tested in 5 sections.
- Now offered . . . this fine modern oscilloscope.
- You build this powerful two-band superheterodyne radio receiver.

You build the new Sprayberry tester—a complete 18-range Volt-Ohm-Milliammeter test meter.

★ ★ ★ ★ This great industry is begging for trained men . . . to step into good paying jobs or a profitable business of their own! Our new plan opens the doors of Radio-Television wide to every ambitious man who is ready to act at once!

Men by the thousands . . . trained Radio-Television Service Technicians . . . are needed at once! Perhaps you've thought about entering this interesting, top paying field, but lack of ready money held you back. Now — *just $6 enrolls you* for America's finest, most up to date home study training in Radio-Television! Unbelievable? No, the explanation is simple! We believe Radio-Television *must* have the additional men it needs as quickly as possible. We are willing to do our part by making Sprayberry Training available for less money down and on easier terms than ever before. This is your big opportunity to get the training you need . . . to step into a fine job or your own Radio-Television Service Business.

Complete Facts Free—Act Now; Offer Limited

Only a limited number of students may be accepted on this liberal and unusual basis. We urge you to act at once . . . mail the coupon below and get complete details plus our big new catalog and an actual sample lesson—*all free*. No obligation . . . no salesman will bother you.

HOME STUDY TRAINING IN SPARE TIME

Under world-famous 27-year old Sprayberry Plan, you learn entirely at home in spare time. You keep on with your present job and income. You train as fast or as slowly as you wish. You get valuable kits of parts and equipment for priceless shop-bench practice. And everything you receive, lessons and equipment alike, is all yours to keep.

LET US PROVE HOW EASILY YOU CAN LEARN!

Radio-Television needs YOU! And Sprayberry is ready to train you on better, easier terms, that any ambitious man can afford. *Just $6 starts you!* Mail coupon today . . . let the facts speak for themselves. You have everything to gain. Let us prove the kind of opportunity in store for you!

Big New CATALOG AND Sample Lesson FREE!

SPRAYBERRY Academy of Radio-Television
1512 Jarvis Avenue, Dept. 120-U Chicago 26, Illinois

Mail This Coupon Now—No Salesman Will Call

Sprayberry Academy of Radio-Television
Dept. 120-U, 1512 W. Jarvis Ave., Chicago 26, Ill.

Please rush all information on your ALL-NEW Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me. Include New Catalog and Sample Lesson FREE.

NAME ..... Age .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

◀ See Page 24 for EICO'S BEST BUYS in "HAM" GEAR.

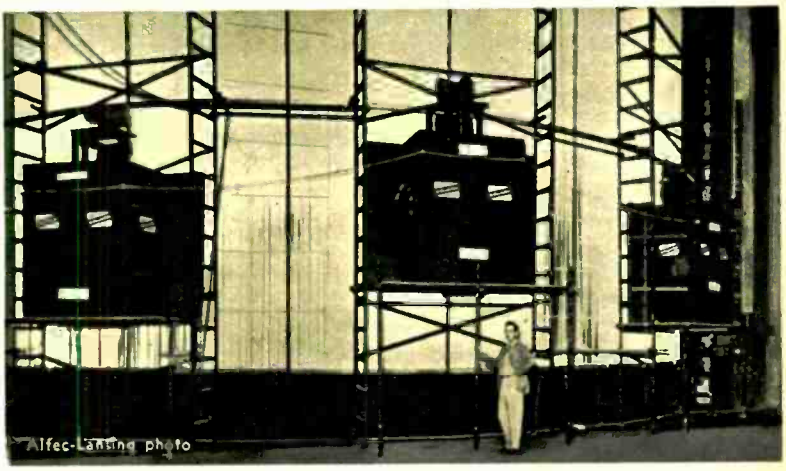
Movies and Stereo Sound

By Norman H. Crowhurst

Wide screens do not mean stereo. Here's the story behind the marriage of movies and dynamic sound.

SINCE photography changed theater entertainment by introducing motion pictures, electronics has done more than meets the eye to make movies an integral part of our leisure time. The biggest single step was adding a synchronized sound track right on the film. But further refinements have proved necessary to enable the sound to keep pace with bigger, wider pictures.

Not only must new developments allow fuller, richer, more



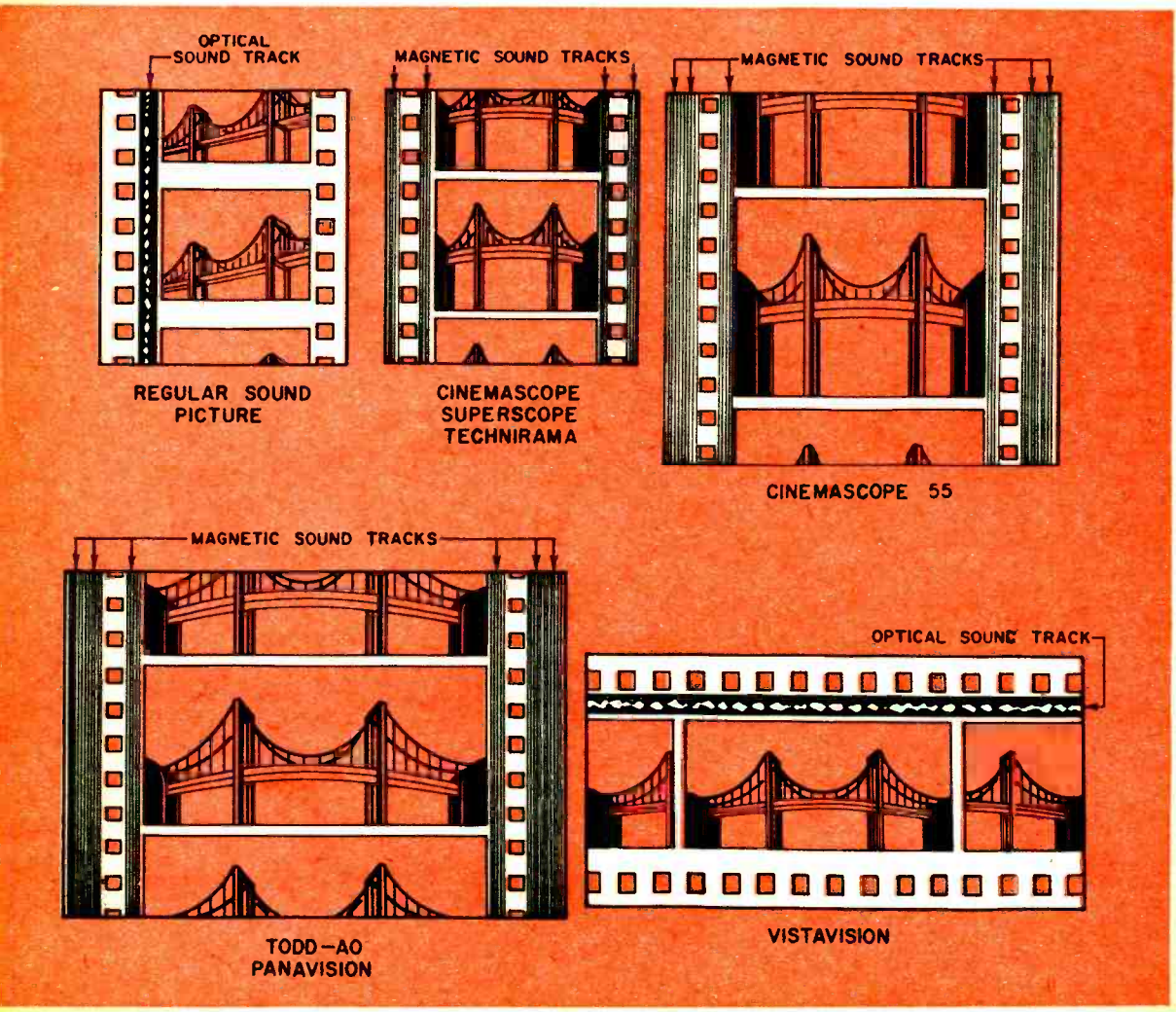
Good theater stereo generally requires special installations such as this gigantic behind-the-screen loudspeaker set-up for seven-track Cinerama.

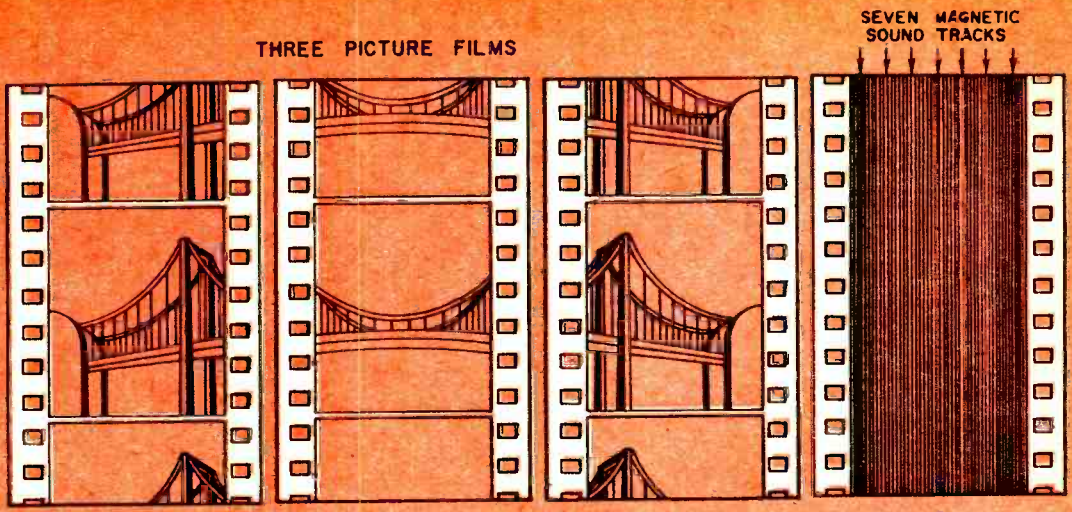
realistic sound, but they must be "foolproof." It is one thing to achieve almost perfect stereo sound in a specially designed theater with specially trained operators. But it is quite another to utilize such a system in a remote theater where the only operators available do not have any special training.

The earliest attempt to achieve stereophonic sound in the movie theater was with Walt Disney's "Fantasia." The Disney studios provided some picture fantasy, while Bell Labs technicians and Leopold Stokowski's musicians provided the sound. This was transcribed on multiple optical sound tracks which fed loudspeakers located all round the theater. This literally surrounded the audience with "a new experience in sound."

But back in the 1930s, this experiment was a bit premature. In most of the theaters where it was shown, the whole stereo effect was lost through the use of a simplified version that only utilized the regular behind-the-screen loudspeaker. The announcement on the film, introducing the audience to "a

Various methods of reproducing pictures and sound are shown here. Drawings are slightly smaller than actual size. Note side-feed Vistavision (below) and separate sound film for Cinerama, right.



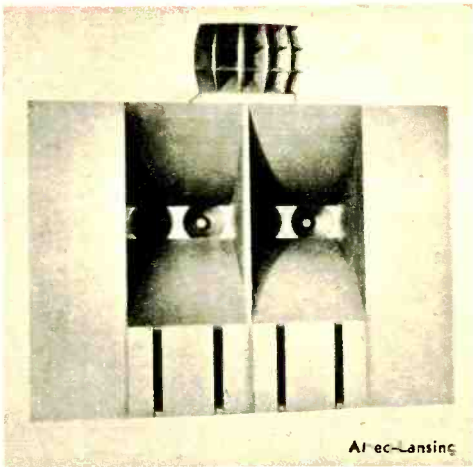


new experience in entertainment" that "surrounded them with sound," became meaningless, because theater managements could not be persuaded to install the necessary elaborate sound system. In those days the box office brought in enough without such refinements.

So, until the late 1940s, movies continued on the standard screen with "standard" sound from standard optical tracks. The industry tried to improve their presentations by improving color film. There were some improved sound tracks that reduced the background "mush" that had been so unpleasant on earlier "talkies."

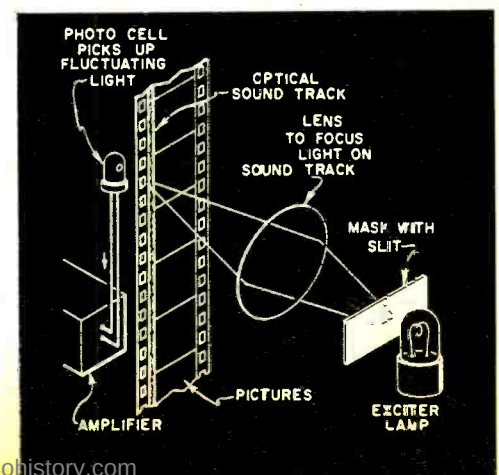
The sound track used to this time exclusively consisted of a photographically reproduced strip running along the edge of the pictures. The fluctuating width of the clear part of this track varies the amount of light passing through it from the exciter lamp. This produces a fluctuating output to a photo-cell. This system has always had its problems. Blemishes in the film showed up as background noise. This had been minimized as much as possible by special controls in making the film, but dynamic range or frequency response were not what we would call hi-fi today.

About 1948, theater attendance began to drop off as television became popular. The movie industry could make films for television, but this would not help the theaters stay in business.



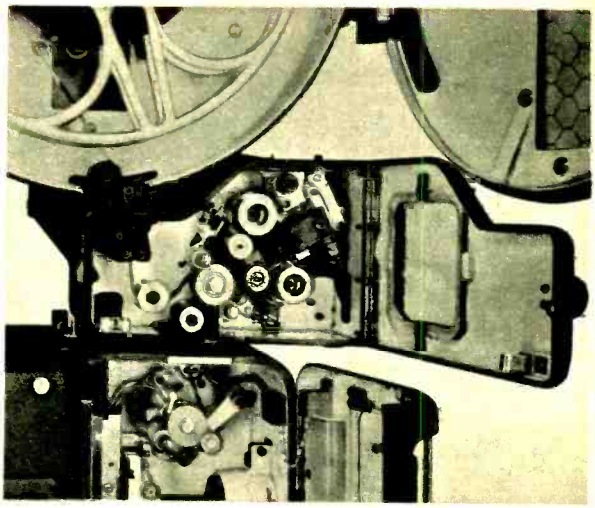
Typical loudspeaker installation in movie house has baffles, separate woofer and tweeter units.

Illustrated below is the old standard motion picture optical sound reproduction system.



Here is final sound-scoring studio. Note the elaborate consoles, large VU meters on stage.

Westrex Corp.



This is an add-on unit for converting to CinemaScope. It features magnetic head assembly.

Simplex

Movie makers agreed that the movie theater still had a place in the entertainment world. But to hold that place, it must improve its fare.

Technical advances became necessary at the theater as well as at the producing end. Several different systems were being developed at the same time. First to appear was a "road show" type of presentation. Requiring a very elaborate special theater arrangement, it cannot be presented at the neighborhood picture house. This is Cinerama. Along with three cross-fired pictures filling a composite wide-angle screen, a fourth film, synchronized with the other three, carries no less than seven magnetic sound tracks. Two of these feed different sections of the auditorium, while five are spread across the enormous screen.

"This is Cinerama," opened in New York on September 30, 1952. Since then other Cinerama theaters have opened in strategic locations.

Cinemiracle, which recently opened with "Windjammer" is similar to Cinerama, except that a single projection booth is used instead of three.

CinemaScope uses a single film of standard size, but the picture on that film is compressed sideways by an anamorphic lens. Four magnetic sound tracks are placed in the narrow "blank" spaces at the edges and between the picture and sprocket holes. This can be shown in any theater by installing a wide screen and the necessary extra sound system. CinemaScope opened with "The Robe" in New York almost a year after Cinerama, on September 16, 1953. By using a standard old-fashioned optical sound track, all that is needed is the wide screen. Many theaters showed CinemaScope that way, rather than investing in the additional sound equipment.

Todd-AO, another "road show" presentation, also requires special theater construction. A single camera and projector is used, but the film is twice as wide as regular movie film. Sound comes from six magnetic tracks that feed behind-the-screen speakers and a number of speakers around the theater. Todd-AO is now being exhibited in over 40 theaters throughout the world.

Various other systems, detailed in the accompanying diagrams, use combinations that differ mainly in picture arrangement and where the sound tracks are placed. CinemaScope has achieved the only wide scale distribution among stereo sound systems. To make the CinemaScope presentation "universal," "Magoptical" sound tracks were introduced and are widely used today. The

[*Continued on page* 94]

How To Tape Off The Air

An attenuator box, patching cords, and a simple mixer will improve your tape recording technique.

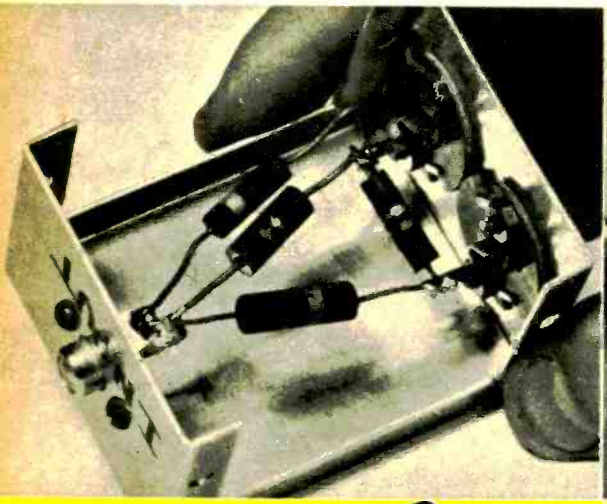
MANY owners of tape recorders like to record radio programs, musical shows or transfer phonograph music onto tape. A few problems arise such as noise pickup and the use of various connecting cables.

The home table model radio is probably the most familiar source of music, news and home entertainment. If you wish to tape a program, you could place the microphone in front of the loudspeaker. This system will work, but it is not very satisfactory since the mike will pick up stray noises. One way to eliminate this is to connect the voice coil of the radio speaker directly to the recorder. A simple connecting cable can be made by using ordinary lamp cord, two alligator clips and a male plug to fit the input jack of your recorder.

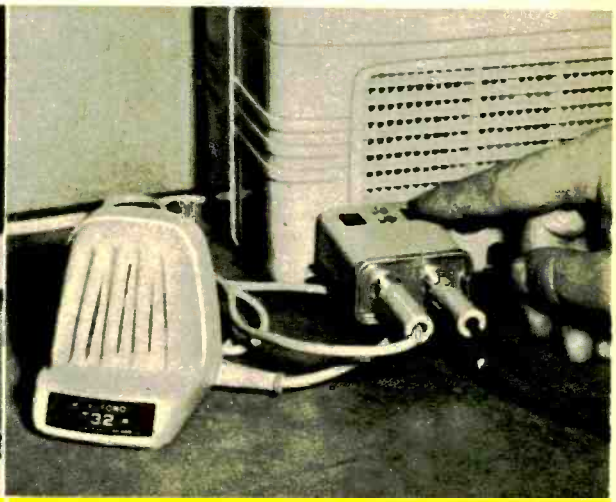
The output signal from the radio might cause distortion or overloading of the recorder if it is too strong. In order to reduce or attenuate the signal, it may be necessary to add two small resistors to the connecting cable as shown in the diagrams. This patch cord can be used to record from the loudspeaker in your hi-fi system or phonograph. The fidelity of the recording is determined by the quality of reproduction within the audio

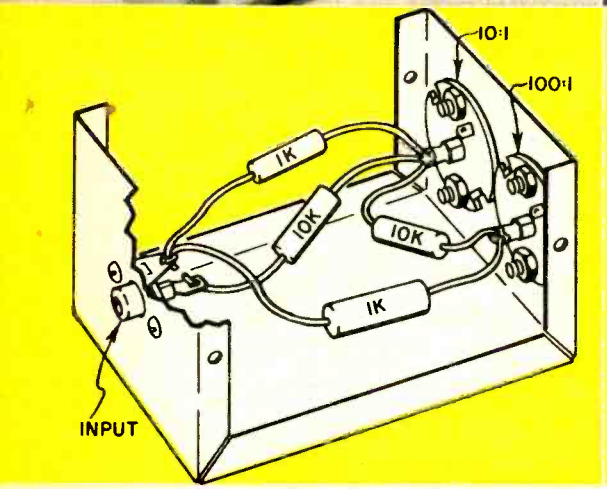
If your tape recorder has only one input, it is usually a low level type for a mike. The attenuator box reduces high level signals to a suitable level.

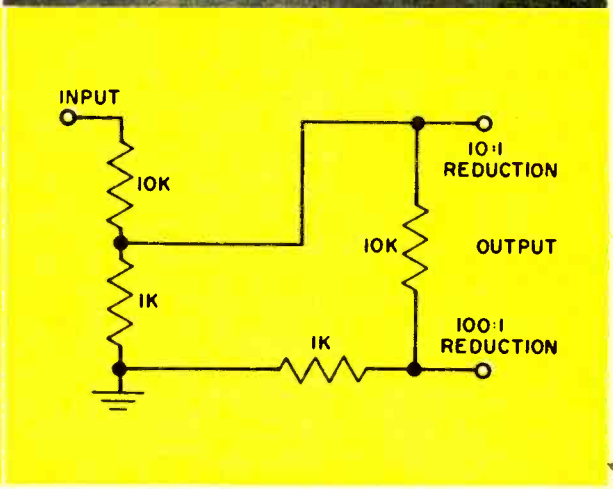
Inside of attenuator box. Input from source (tuner, crystal phono) plugs in jack at left.



With Switchcraft mixer two signals can be fed to recorder at once, each with gain control.







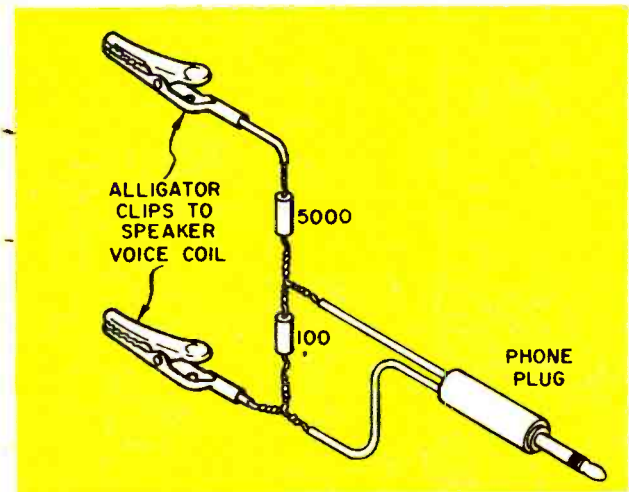
Follow this guide for wiring the attenuator. Each of the four resistors may be ½ watt.

Choose the output that cuts high level signal so it won't overload recorder—10 or 100:1.

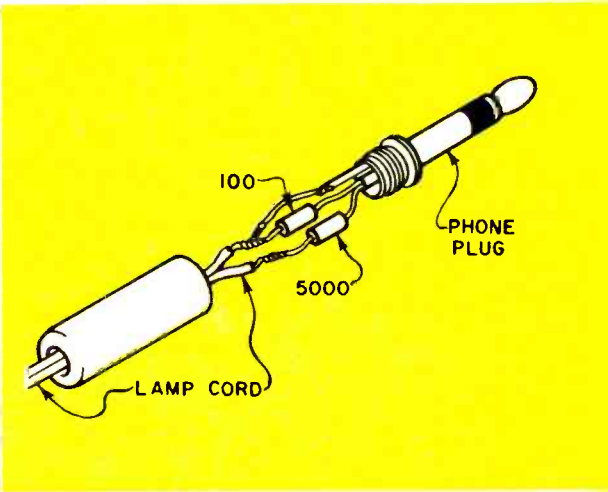
amplifier of your sound system. The loudspeaker of the system or radio will serve as a monitor to allow you to hear what you are recording on tape.

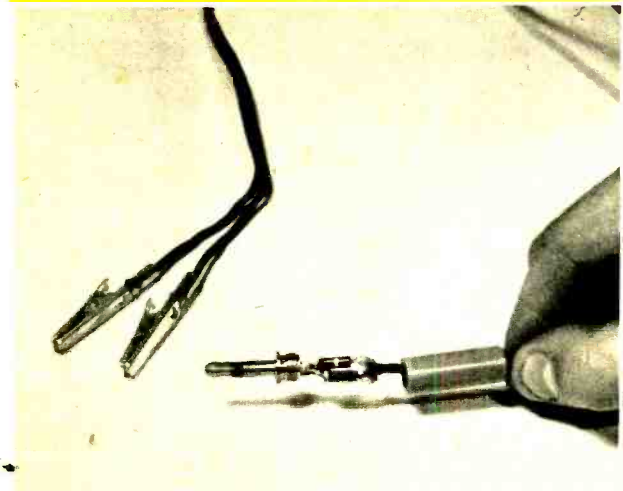
Many hi-fi systems incorporate the use of a preamplifier control center where signals are fed from an FM tuner or phonograph pickup arm. The majority of preamps have a jack located on the rear of the chassis especially designed to feed an audio signal to a tape recorder. It will probably be marked TAPE OUTPUT. The only cable needed in this case will be one with a phono plug on one end and a suitable plug to fit the input jack of your recorder on the other end. All record equalization and tone controls can be adjusted at the preamp before the signals are sent to the recorder. The preamp must be used while making recordings from a pickup arm using a magnetic cartridge. Some recorders have a special input jack just for magnetic cartridges. The output from a crystal or ceramic cartridge could be connected directly to the re-

High level signals picked up from a speaker voice coil are reduced by these resistors.

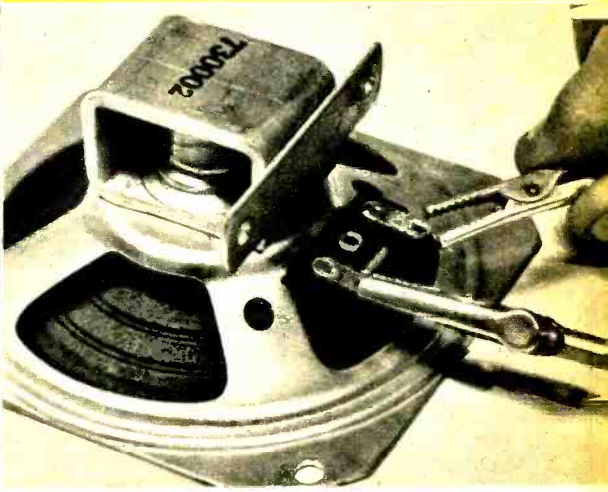


Resistors will fit inside phone plug. All bare wire must be taped to avoid any shorts.





Complete patch cord terminates in alligator clips on one end for attaching to speaker.



Clip on to hi-fi or table radio speaker (shown removed from its cabinet) for signal pickup.

corder because they generate sufficient audio voltage (high level).

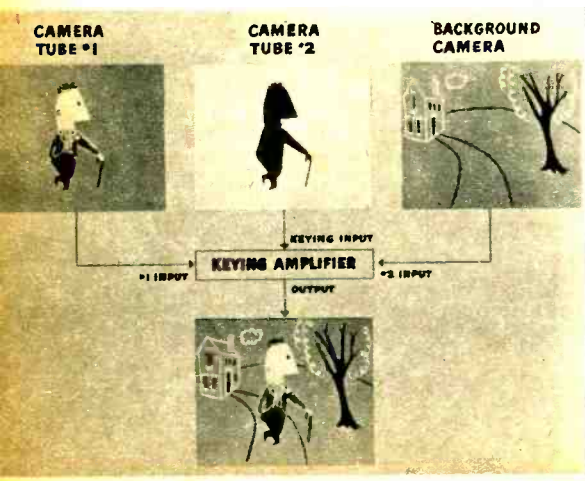
The majority of recorders have only one input jack usually marked MIKE-RADIO-PHONO. The recorder will operate on these inputs provided they are not at too high a level so as to cause overloading of the recorder's amplifier.

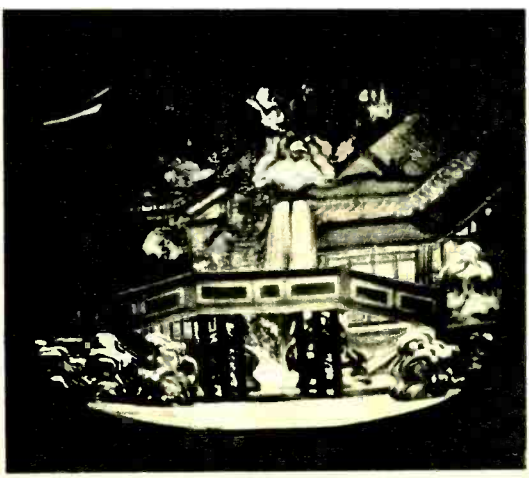
A suitable method to reduce certain high level outputs is to use the attenuator network shown on page 32. It is mounted in a small metal box (Bud CU-3000). Two levels of attenuation are available: one is a 10:1 reduction of the signal and the other is 100:1. This box can be used in place of the network built into the alligator clip and plug.

Occasionally a recording is made which uses two inputs at the same time. You might want to tape your own disc jockey program by announcing the title of a record and then playing the disc. Both sound sources can be fed to a "mixer" which funnels the signals to the recorder input. Simple tubeless

[*Continued on page* 107]

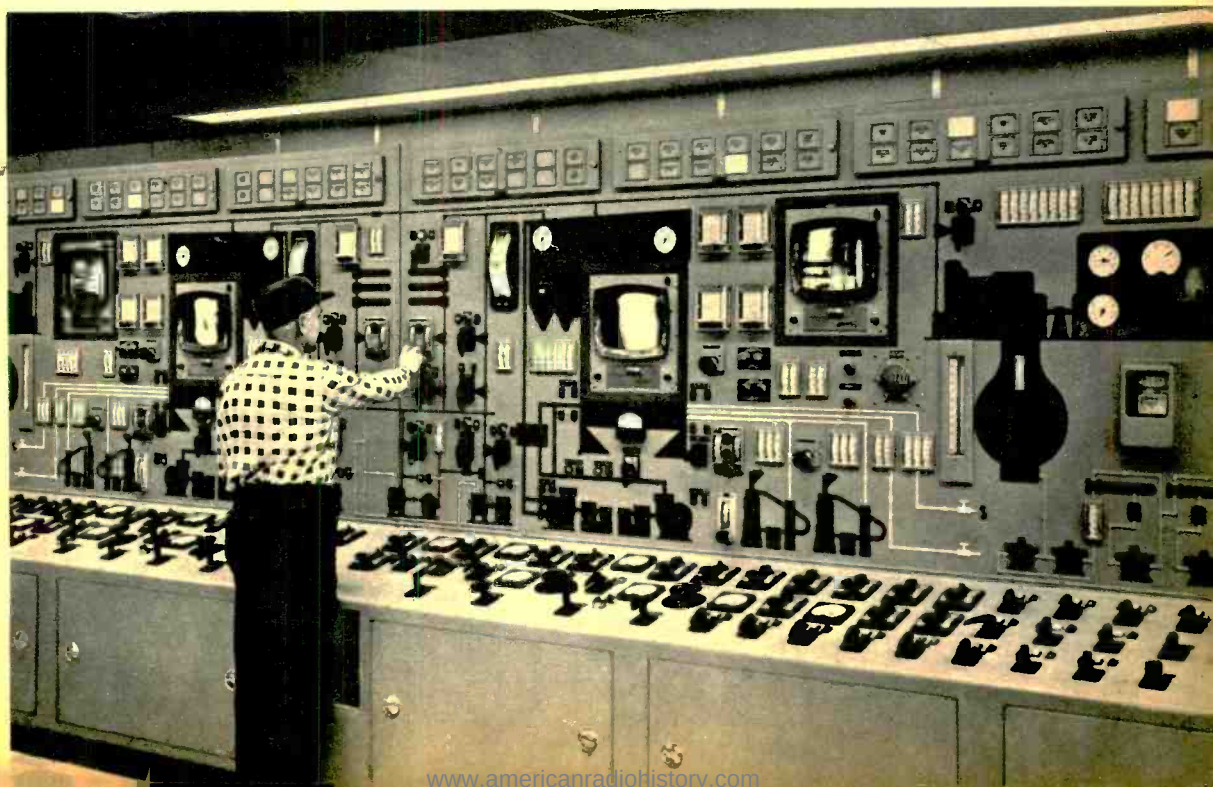
Singer Miyoshi Umeki views small set that is blended with her "live" action on CBS television (below) for realistic illusion. Called VideoScene, new production tool uses single camera to cover blank stage and actor, while a synchronized camera pictures background. Portion of background "behind" singer is keyed out. System allows use of many locations, eliminates huge settings.



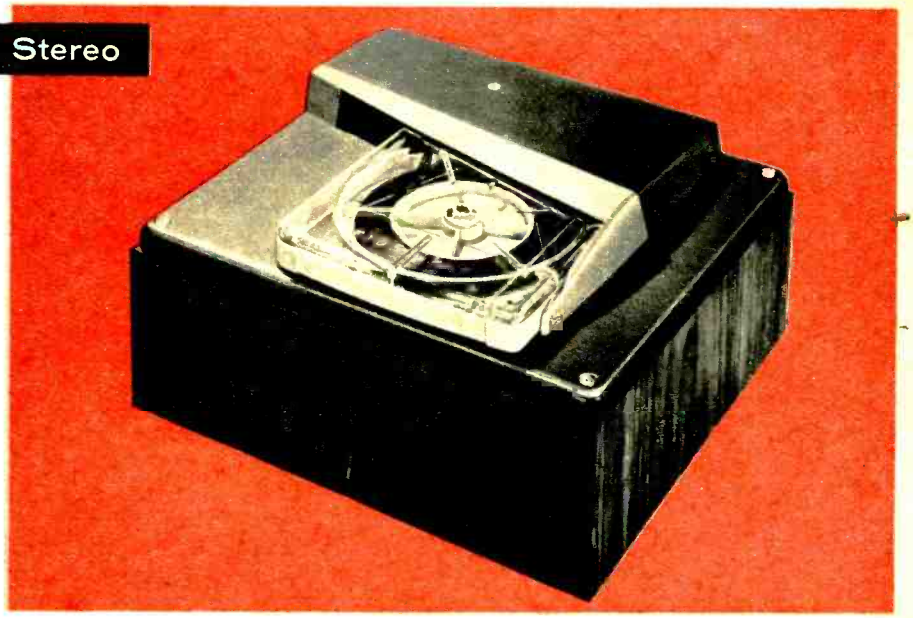


First brain operation in history without opening the patient's skull was performed by Prof. Lars Leskell (left) in Sweden using an American "atomic knife." Actually a powerful beam of protons from a synchrotron, the "knife" successfully severed two nerve tracts in brain of a 55-year-old man without affecting other portions of brain.

Main control panel at a Kansas power station near Topeka features four General Electric closed-circuit TV monitors. The camera lenses, which check on the boiler flames, are cooled by compressed air.



Brand New in Stereo



Recently unveiled, Fidelivox player features transistorized preamps and is designed to adapt any existing disc stereo system to 2- or 4-track tape.

tape makes a comeback with this

Stereo Tape Cartridge Player

ONCE again the pre-recorded stereo tape cartridge (magazine) moves into the hi-fi spotlight—with some unusual twists. Fidelipac, as the magazine is called, is a continuously playing, single-reel tape container that can be heard simply by inserting it into a new, comparatively low-priced tape player. The companion machine, Fidelivox, plugs into most any existing stereo disc system, thereby adapting it for stereo tape, *a la* Fidelipac.

Designed to eliminate tape handling, Fidelipac has only a single plastic-enclosed spool. Once started, it will play continuously. This feat is accomplished by forming the recorded tape into an endless loop which is pulled from the spool at the *center* and simultaneously rewound on the outside. A single twist in the tape before the ends are spliced creates a Mobius loop. This loop, in effect, turns the tape over inside the cartridge, permitting utilization of both tracks on the tape without flipping. It doubles playing time. Four-track cartridges for extended-time stereo are also available. Tape speed is 3¾ ips and Fidelipacs have three capacities—400′, 700′ and 1700′—yielding up to two hours of unrepeated sound. This cartridge has been used in the message repeater and background music field for some time.

Fidelivox, the plug-in tape player, is just as unusual as the magazine. Each channel [*Continued on page* 107]

Inner workings are compact. Four-pole motor, balanced flywheel drive the tape at 3¾ ips.

No flipping with this tape magazine. One-spool design and Mobius loop permit continuous play.

Operation of Fidelivox is child-proof because child never touches the tape—no threading or rewinding. Cartridge is merely inserted into the player and the tape starts playing. Unit is made so that there is only one way to insert magazine into the player.

captain your own

Radio Controlled Ferry Boat

By William Winter

The *Miss EI* is easy to build and will use any type of RC gear. For novelty and fun it is hard to beat.

NOW that radio control is possible on seven examination-free frequencies, why not try out your electronic wizardry with this simple semi-scale model of an open top ferry? For the model hobbyist bent on RC, the *Miss EI* is a welcome change from model airplanes, cabin cruisers and tug boats. For the chap whose first love is radio, the slow moving ferry is ideal for trying out receivers and gadgetry.

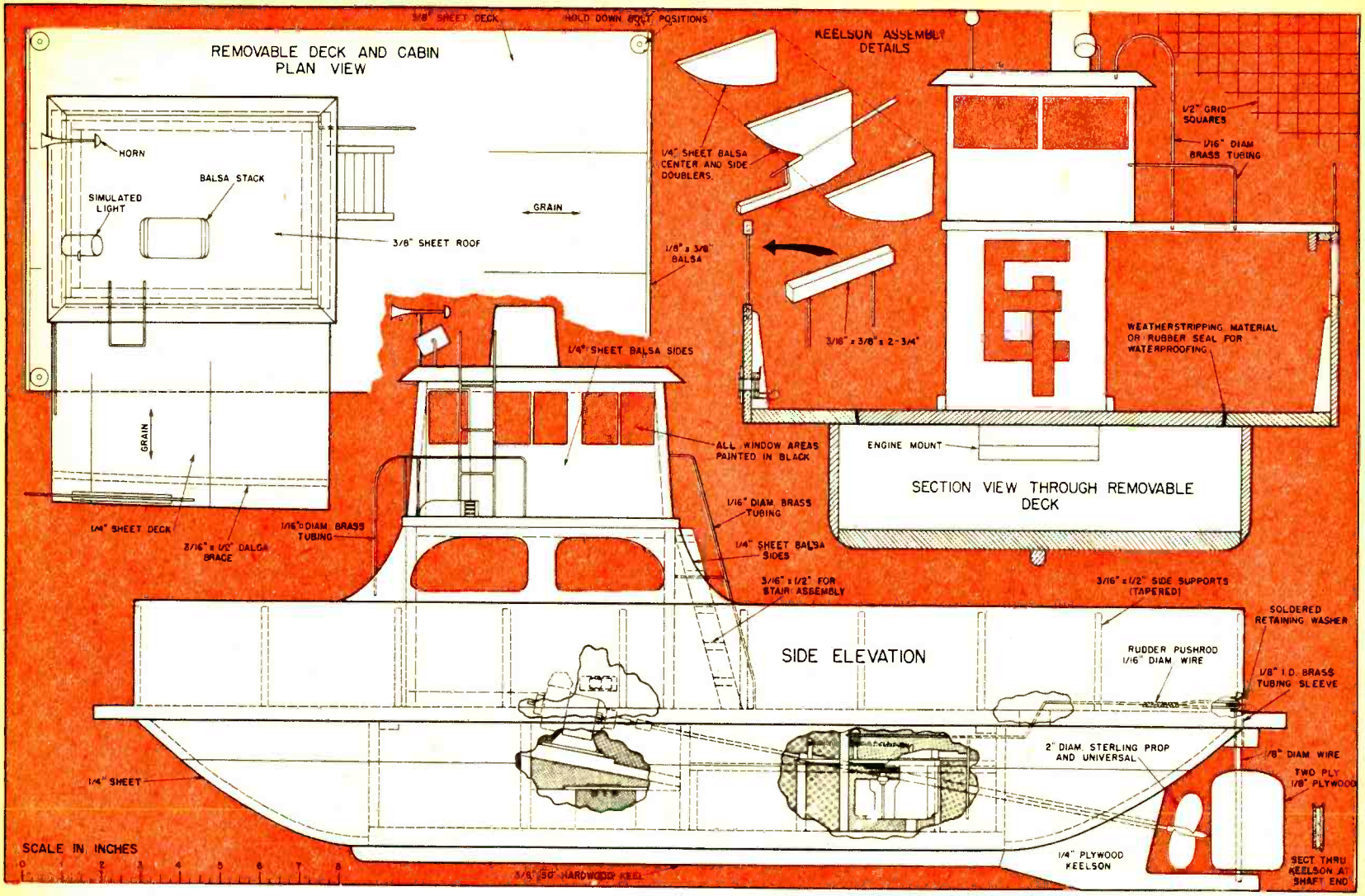
The boat, as shown on the plans, is built from easy-to-get hobby shop materials: balsa wood, model cement, brass tubing, wood fillers, colored dopes, and so on. Balsa is soft, light, easy to work with. However, the man with power tools can make a more durable craft in much less time by substituting plywood, pine, etc., in more convenient widths. The hull will be sufficiently buoyant when made from sturdier, heavier woods.

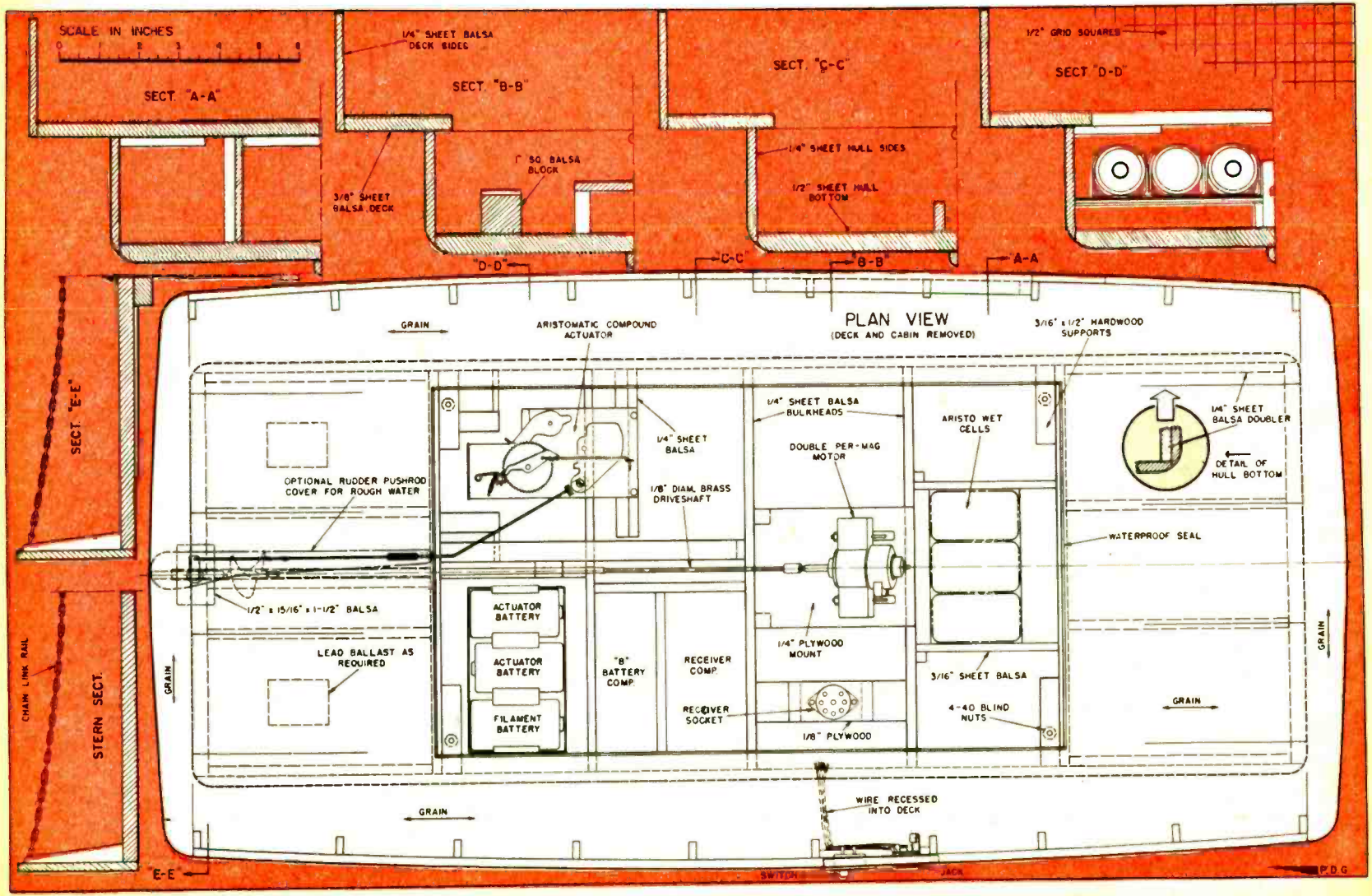
A typical radio installation is shown. Actually, dozens of

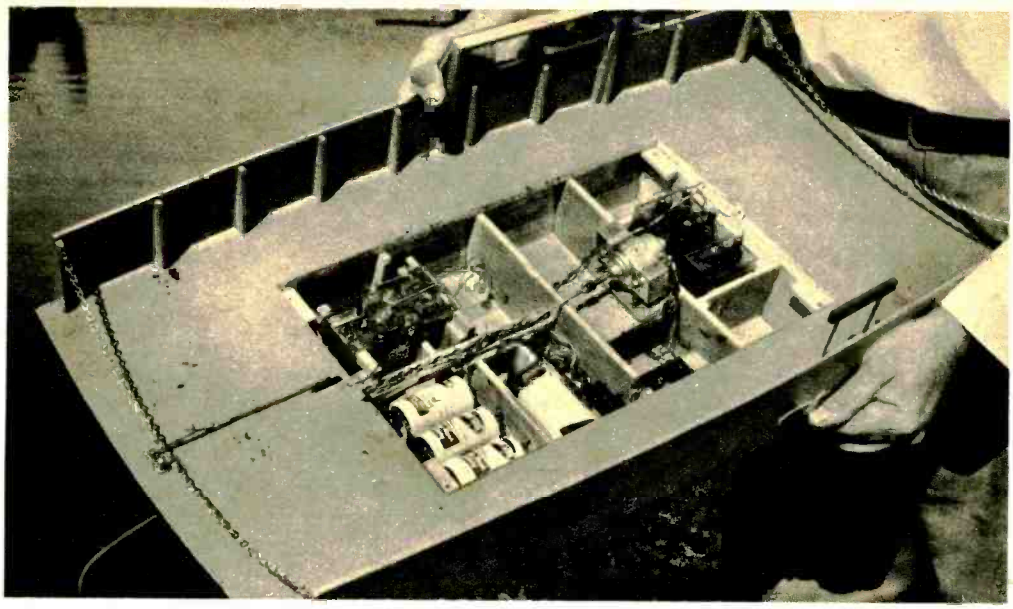
Rear view of the sedate radio-controlled model ferryboat with model cars aboard. The complete plans for this semi-scale model are on the following two pages. Easy-to-handle balsa wood is used throughout but other materials may be used if desired. For trim, author used brass tubing.

Bottom of ferryboat shows keelson, rudder and propeller. Any number of motors may be used; this one uses an electric motor. Author is not straining—boat is very light. Waterproof dope is used on hull after it is sealed and sanded. Waterline is traced after boat is put into water and position fixed.

Superstructure lifts off deck to reveal motor and radio gear. If boat is to be used in rough water, waterproof seal must be used; radio may be enclosed in plastic bag. Commercial or homemade single-channel receiver and compound actuator give adequate maneuvers. Multichannel receivers give more.







Closeup of hull shows: compound boat actuator, upper left, radio receiver, center, electric motor and rechargeable wet cells, right. On side of hull are the on-off slide switch and metering jack.

different radios and actuators (servos or escapements) exist. These can be arranged inside the hull to suit the individual builder's requirements.

As shown, the ferry is intended for sedate smooth water cruising. It isn't necessary to make a watertight seal around the lift-off super-structure and deck unless you expect to handle rough water.

About Equipment

A single-channel hard tube receiver is used in the author's model. The Aristomatic compound boat actuator enables this one channel receiver to operate left and right rudder, while providing contacts for forward, stop, and reverse, for working lights, blowing horns, or anything else that captures the fancy. Two- and three-channel radios will work left and right from a motor driven multi-servo, such as those made by DMECO, Bonner, and Cobb, leaving one channel free to operate a Babcock sequence switcher for motor speed and additional controls.

The electric motor shown is a No. 45 Double-Per Mag, working from three Aristo Type 23 wet cells (rechargeable). Numerous motors, in various sizes and shapes, are available, and other wet cells can be substituted. Filament current for the receiver can be tapped from the wet cells, but it is better to supply independent batteries for the radio. Flashlight cells and appropriate B batteries can be placed anywhere convenient, preferably toward the stern for balance.

Boat "hardware sets" consisting of coupling, drive shaft, stuffing box, etc., come in many sizes and makes. The one on the plan is made by Sterling and features a nylon propeller. The stuffing box actually is a loose fitting piece of brass tubing.

Construction

The hull is a glorified box. Its bottom is made by gluing side by side

[*Continued on page* 95]

A set of full scale plans for the *Miss El* are available for $1.50. Send money or check with your order to Plans Department, Electronics Illustrated, Fawcett Publications, Inc., Fawcett Place, Greenwich, Conn.

for your transistor radio

An AC "Battery"

By Dan Horowitz

Save batteries by using your portable on house current. This power supply fits into battery case.

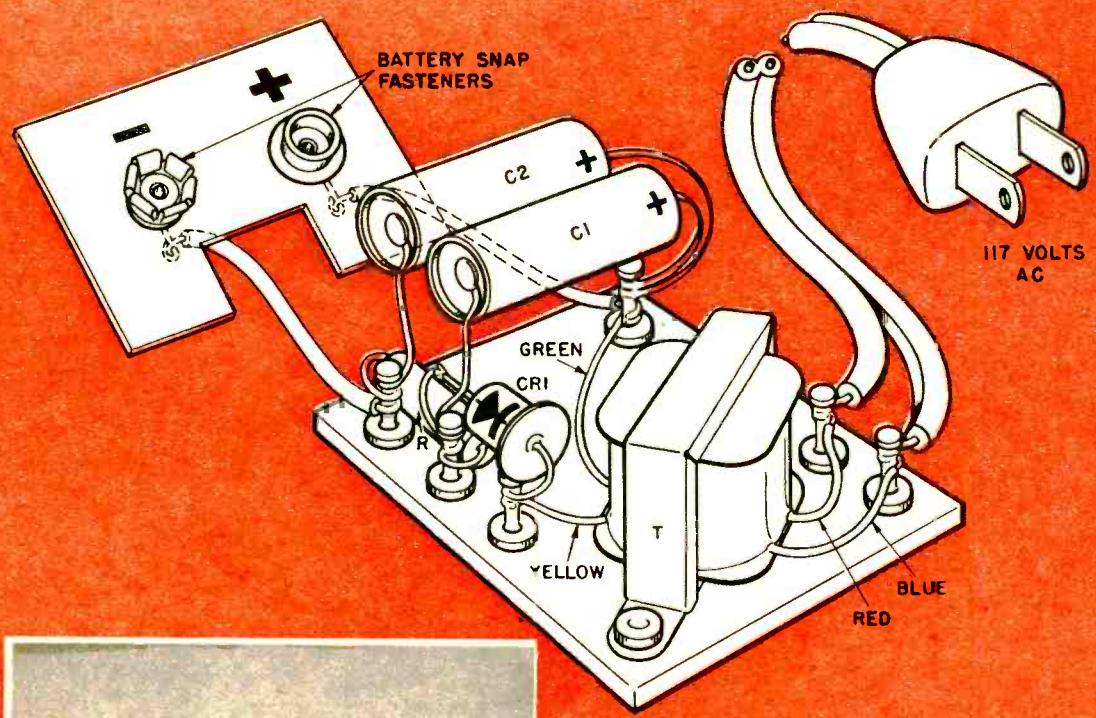
IF YOU want to use your transistor portable at home for long periods of time, here's a way to eliminate the battery. It pays for itself in a short period of time and doesn't require any rewiring of the radio, or sacrifice to its normal battery operation. For all appearances the battery eliminator is identical to a 9 volt dry cell, a common size in these sets.

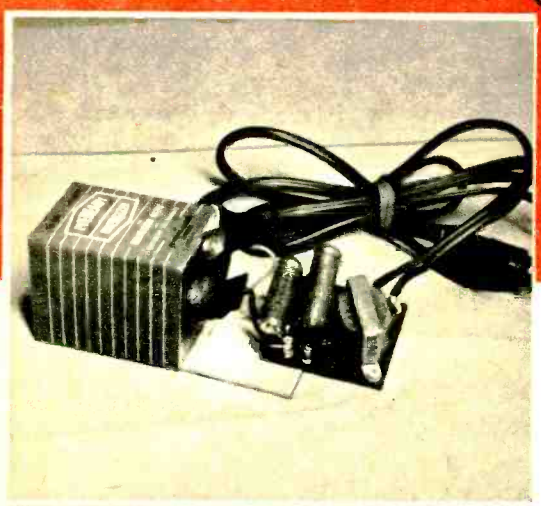
The unit fits into a case salvaged from a wornout battery. The small size of the power supply is made possible through the use of miniature transformer and capacitors. Although the transformer was not originally intended for this purpose, it was found to work well.

In operation the unit is placed in the same position in the set

At left, a tiny power transformer and filter capacitor are visible inside the battery case.

Power supply, lower right, appears like the original dry cell, except for AC line cord.





In wiring guide above, follow color code on transformer wires, observe polarities.

The complete supply, mounted on a phenolic board, will slide easily into battery case.

To prepare the case, push out the insides of a wornout battery with a screwdriver.

Electronics Illustrated

as the battery. The line cord is then run to the outside of the case and plugged into the wall. The battery clips, also recovered from the old battery are used in the same manner as before. If your radio does not use the same size battery case as shown here, it is possible to build the unit with a different layout. The wiring isn't critical and it could be sized to fit in any but the tiniest set.

The first step in construction is to take an old battery and cut open the cardboard at the bottom end, opposite from the battery clips. By gently squeezing the case, separate the insides of the battery from the cardboard. Push out the inside cells as shown in the photo. Then remove the top plate with its snap fasteners, cutting the two wires at the point where they connect to the cells.

The circuit of the power supply is simple. It consists of a step-down transformer, a crystal diode rectifier, and a resistance-capacitor filter. The output voltage varies with the current drain of the set, and is somewhere between 7 and 10 volts. The unit works with any transistor radio that uses a 9 volt battery.

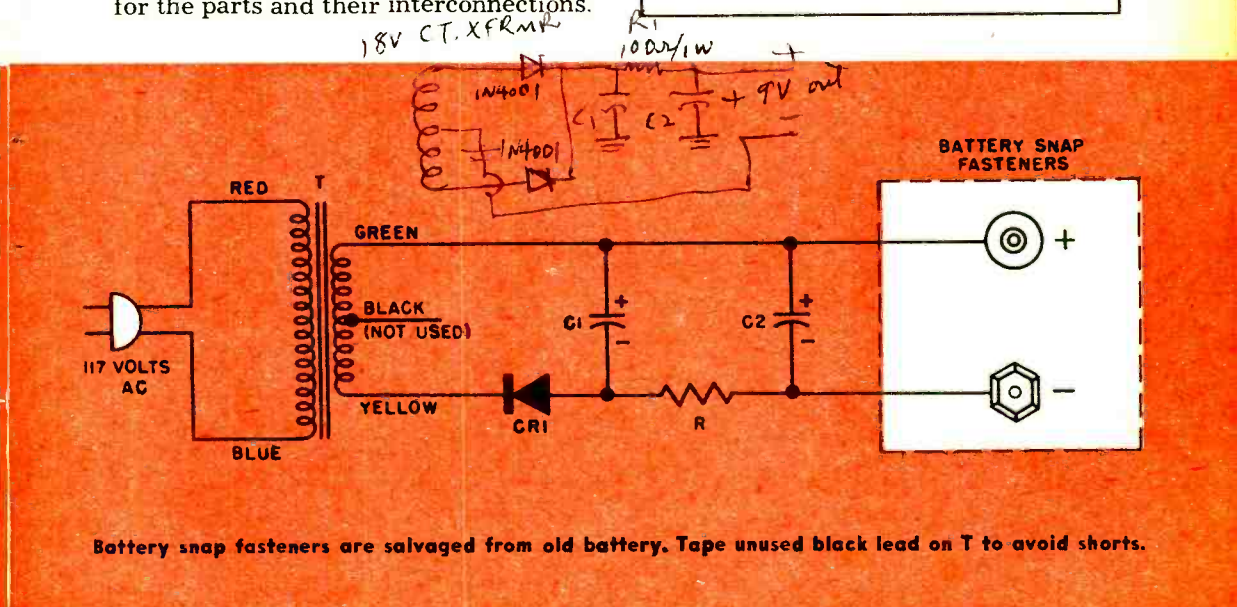
A phenolic board or perforated Bakelite board is first cut to size and the various parts mounted on it. Terminal lugs provide convenient anchor points for the parts and their interconnections. Take care to tape any bare connections that might touch and cause shorting. After the unit has been wired, it is slid into the cardboard case. The battery snap fasteners are mounted in the same position as the regular dry cell. Be sure that the polarity is correct and agrees with the original fastener arrangement. Finally, tape the open flap of the case and insert it into position in the set and clip onto the radio's snap fasteners.

If it is impossible to fit the power supply inside of the dry cell case, its form may be altered. The final possibility is to use it external to the radio, in a small plastic case.

The portable radio shown in the photos had a leather case and no problem was encountered in running the AC line cord from the supply to outside the case. When it was closed the cable did not bind. However, if your radio uses a plastic case it might be necessary to file a small nick in the case to permit the cable to emerge.

PARTS LIST

C1,C2—100 mfd, 15 volt ultraminiature electrolytic capacitors
R—100 ohm, 1 watt resistor
T—Transistor transformer (Argonne AR-144)
CR1—Crystal rectifier 1N91
Misc.—Perforated Bakelite board cut to size, line cord, terminal lugs, wornout 9 volt battery



Battery snap fasteners are salvaged from old battery. Tape unused black lead on T to avoid shorts.

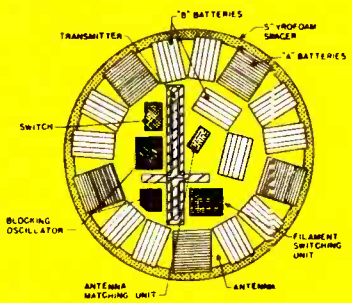
Distress beacon is displayed alongside plastic foam airfoil housing, which is attached to skin of plane. Note unit fastened atop rear section of plane in photo. Crash causes device to fly clear.

Airplanes that crash in rugged country can now be found with the help of this automatic . . .

Crash Position Transmitter

AIRPLANE crashes in unpopulated areas are usually difficult to locate, especially if there are no survivors. In the Canadian Northland, for example, expensive air searches often fail to find the crashed plane, to say nothing of rescuing survivors. This has led the National Research Council of Canada to develop the completely automatic "crash position indicator," a distress beacon that can be attached to any aircraft. Should a crash occur, this device floats clear of the wreckage and transmits radio signals to guide search planes that come within 50 miles. Able to operate on batteries for several days in temperatures down to —50°F, the transmitter, antenna, transistorized oscillator, filament switching unit, and batteries are embedded in plastic foam inside a scoop-shaped airfoil. Any impact other than a normal landing causes the unit to detach itself, spin through the air and land out of danger of explosion and fire

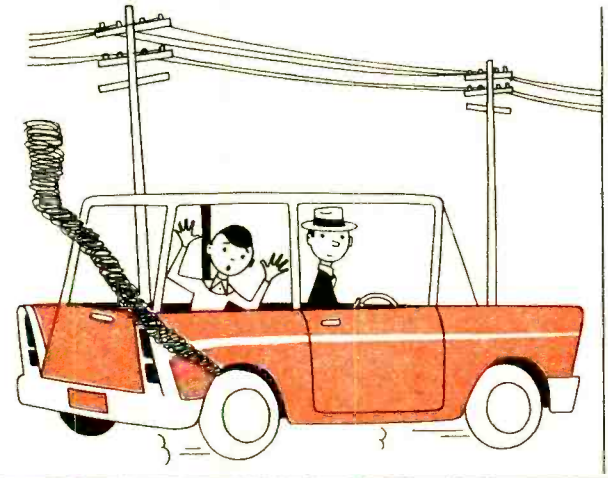
DC-7 model in collision with ground shows trajectory of low drain pulsed radio as it spins from wreckage. Right: Diagram of beacon's operating parts.

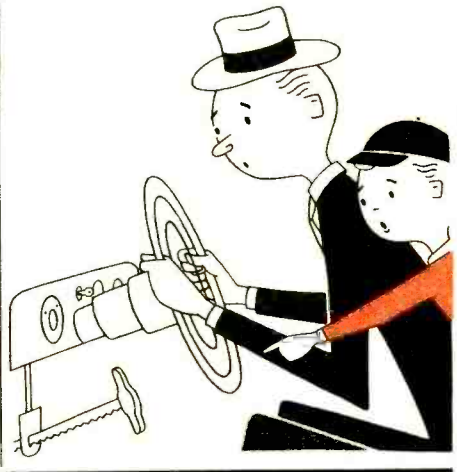


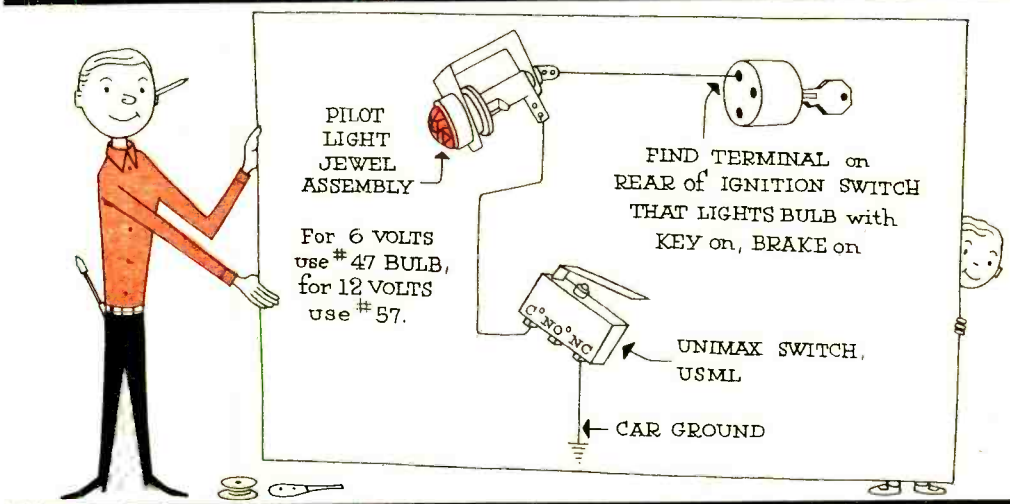
Henry and Me

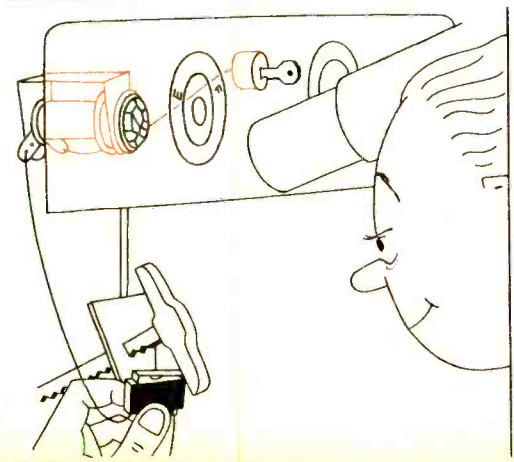
Electronic Handymen

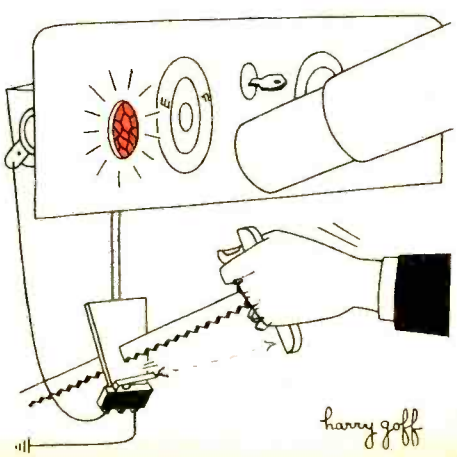
EI will pay $10 for each practical electronic idea used for Henry and Me. Send them to Electronics Illustrated, 67 W. 44th St., NY 36, NY.











Build A Bass Reflex

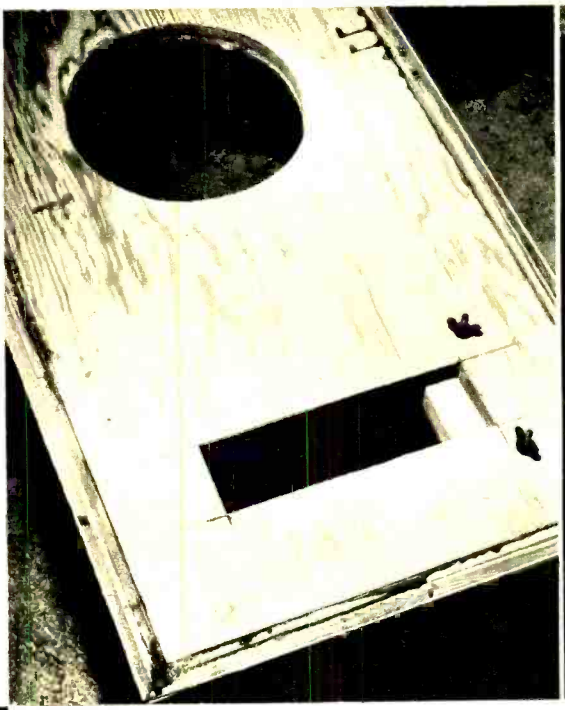
By Sidney Norris

With the dimensions given here you can build and tune an enclosure for popular-size speakers.

AFTER some 27 years the bass reflex remains a favorite among audiophiles. Its popularity stems from several reasons: its efficiency—even a 10 watt amplifier, if it's a good one, works well with it; the clean bass it delivers when properly built *and tuned to its speaker;* and its compact size as well as ease and economy of construction.

Understanding the bass reflex is not difficult. If we hold a speaker in free air it sounds tinny, thin—with few bass tones audible. That's because the low frequency sound waves produced by the front of the cone are cancelled out by those from the back. If we are to hear the lows, we must prevent such cancellation. One way is to mount the speaker facing out of a closed box, so that the back waves are baffled, or prevented from reaching the front. But, if the closed box is airtight, as it must

The completed enclosure may be finished with paint, stain, or veneer. Use plastic grill cloth. Complete drawings for this enclosure for different size speaker are on page 50.



On front panel, 2 wing nuts enable sliding panel to be moved during tuning procedure.

Interior view shows diagonal strip to prevent vibration, and fiberglas damping material.

be, we lose the entire back wave, or half the speaker's sound output.

The bass reflex does it in a more efficient way. The bass reflex box has a port, so that we don't lose the back wave. The trick that the box and port perform is to *invert* a vital band of the low frequency sound waves issuing from the back of the speaker so that they *add* to, rather than cancel, the waves from the front.

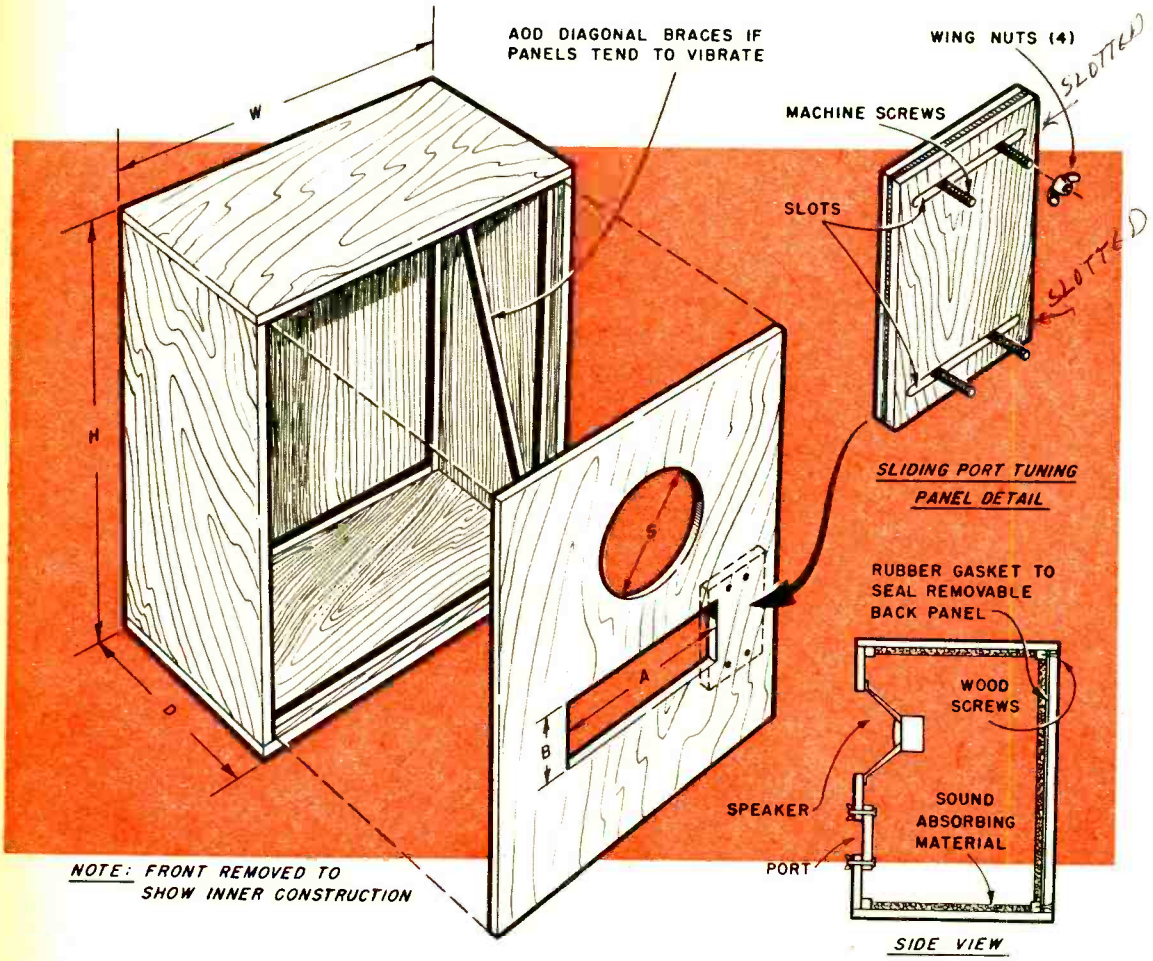
In other words, with the speaker mounted in the enclosure, each "pull" wave inside the box is transformed so that it emanates from the port as a "push." In audio terms, its phase is inverted when it leaves the port. Thus it adds to, or reinforces, the sound from the front of the speaker.

The bass reflex also contributes certain other benefits. It adds nearly a half-octave of bass below the speaker's free air resonant point, where speaker output otherwise drops off sharply. Resonant point for an 8″ speaker is usually somewhere between 60 and 80 cycles; for a 12″ speaker, 20 to 50 cycles. The compressible air inside the box "loads" the speaker, preventing violent excursions of the cone at resonance and consequent harsh peaks in music; and throughout the low range, this loading helps to maintain clean sound and good separation between orchestral instruments.

But the bass reflex does its job well only if it is correctly tuned to the resonant frequency of its speaker. Otherwise, it sounds boomy and harsh.

If you already have a bass reflex you'll be interested only in the tuning procedure. If you are out to build one, typical dimensions for 8″, 10″, and 12″ speakers, as well as construction details, are shown. Cabinet panels must be heavy. Use at least ¾″ plywood. You may have to brace the panels with heavy strips glued and screwed on edge diagonally across each interior surface in order to prevent vibration from the heavy sound pressures built up inside the box. All joints must be airtight. Lock-mitre joints are best, but simple

[*Continued on page* 106]



BASS REFLEX ENCLOSURE DIMENSIONS							
SPEAKER SIZE	SPEAKER CUTOUT S	OUTSIDE CABINET DIMENSIONS W	D	H	PORT DIMENSIONS A	B	
8"	6-1/2"	17-3/4"	10-1/4"	23"	9-1/4"	3"	
		INTERIOR VOLUME 1.62 CU. FT.			AREA 28 SQ.IN.		
10"	8-1/2"	22"	12-1/2"	28-1/2"	12-1/2"	4"	
		INTERIOR VOLUME 3.3 CU. FT.			AREA 50 SQ.IN.		
12"	10-1/2"	26"	14-3/4"	34"	16-1/2"	5-1/4"	
		INTERIOR VOLUME 5.8 CU. FT.			AREA 86 SQ.IN.		

NOTE: 3/4" PLYWOOD USED THROUGHOUT.
ALL DIMENSIONS ARE TYPICAL FOR NORMAL 8", 10" AND 12" LOUDSPEAKERS

Note that the sliding port panel is shown here with 4 wingnuts, 2 may be used. The enclosure should be made airtight by using glue and screws. A rubber gasket is used on the rear panel.

Hi-Fi Clinic

Send in your questions on hi-fi, the clinic answers each one by mail. If of general interest, they will appear in this column.

Output Tubes

I recently completed an amplifier kit that appears to operate properly. However, I notice a blue glow inside the two power output tubes. Does this mean they are gassy?

Melvin Robinson, Des Moines, Iowa

It is quite common that power tubes carrying heavy currents will display a blue glow and have a perfectly good vacuum. Strangely enough, a gassy tube will also glow blue—with one important difference. The gassy tube will show a uniform, spread out blue haze between its internal elements. The good tube however, often displays fingerlike tinges just inside its glass surfaces, and not deep within its elements.

If you have a sensitive voltmeter a gassy tube can usually be detected by measuring the grid of the tube to ground. Often it will read a positive voltage and thus must be replaced.

Speaker Repair

I have an old speaker that I want to use, but it has a small tear in the paper cone. Can anything be done about this?

Ross J. Benton, Chicago, Ill.

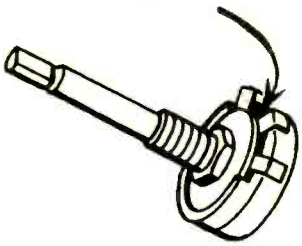
Yes, if the tear is not too extensive. The edges of the rip may simply be sealed together by Duco household cement. If there is a hole of a puncture type made by a nail or screw, try gluing on a small paper patch. However, when a paper cone becomes shredded it must be reconed, if you feel the speaker is good enough to warrant the expense.

Faulty Volume Control

Every once in a while the sound in my hi-fi speaker drops to a very low level. When I readjust the volume control, even slightly, the level returns to normal. Does this mean the control should be replaced?

Charles Stuart, Jacksonville, Fla.

APPLY CLEANER HERE



Long before a volume control has outlived its usefulness dust will accumulate inside it and cause such a difficulty. Several types of volume control cleaners are available with special applicators that make the job easy. The chassis must be removed from its cabinet and the cleaner squirted into the control where its three contact lugs emerge. The knob of the control is rotated rapidly back and forth as the liquid enters the control.

While performing the above, it's a good idea to treat all the other controls in the same manner since any carbon potentiometer is subject to the same trouble; bass, treble, loudness, etc.

IM Distortion

What does the term IM, often found in hi-fi literature, mean?

Jack T. Simms, New York, N. Y.

This means Intermodulation, a type of distortion that results when an amplifier is not linear, or capable of faithfully reproducing what is fed into it. Two or more of the desired tones may mix and produce products which are harsh and unpleasant, depending on the degree of mixture. IM should be under 4% for good reproduction.

Special Report

Focus On Sunspots

By O. O. Binder

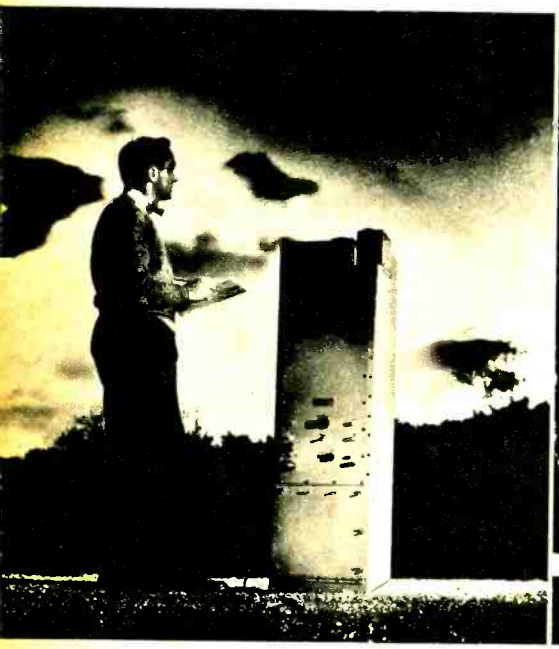
Giant solar eruptions affect our radio, television, radar—and here's how we're trying to beat them.

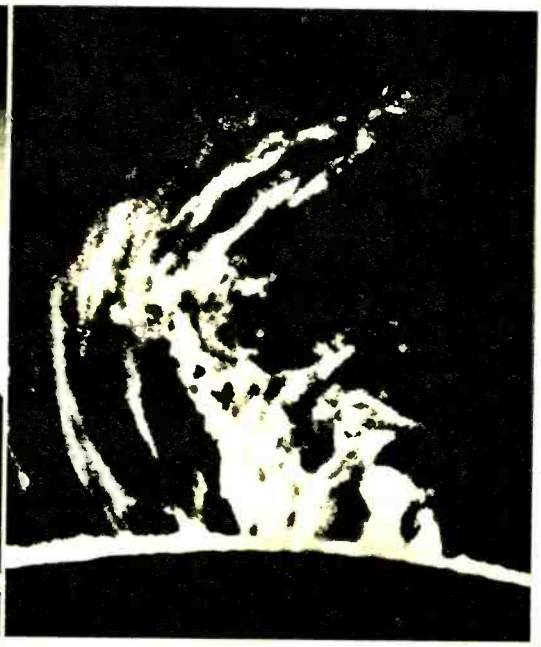
A CHICAGO police squad car radio, with a normal range of 15 miles, is suddenly picked up loud and clear in St. Louis—250 miles away. RCA engineers in Riverhead, Long Island, tune in fuzzy but unmistakable television images from the BBC—an ocean away in London. A ham in New Jersey abruptly loses contact with a CQ pal in California and can only hear the remotest hams in Australia—12,000 miles away. An ITT radio-teletype operator stares puzzled at the oscilloscope as meaningless gibberish prints out on the machine.

These communications surprises—and many more—have happened repeatedly during the last two years and will continue with diminishing frequency for about three more years. Why? Because some 93,000,000 miles out in space, explosive activity on our sun had reached a cyclic peak. We call this sunspot activity. Communications people and IGY scientists the world over are very interested in sunspots, for they greatly affect us here on earth.

During peak sunspot periods, ships at sea have difficulty calling

Notebook in hand, member of IGY aurora patrol stands by recording spectrograph which takes horizon-to-horizon photos of sun's auroral spectrum. Photo of solar flare, right, was taken with coronagraph. Gases, radioactive debris reach 100,000 miles above sun's surface.

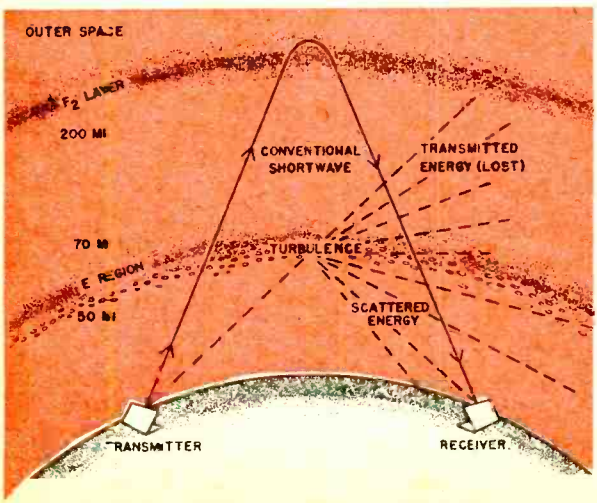




National Academy of Sciences—IGY photo

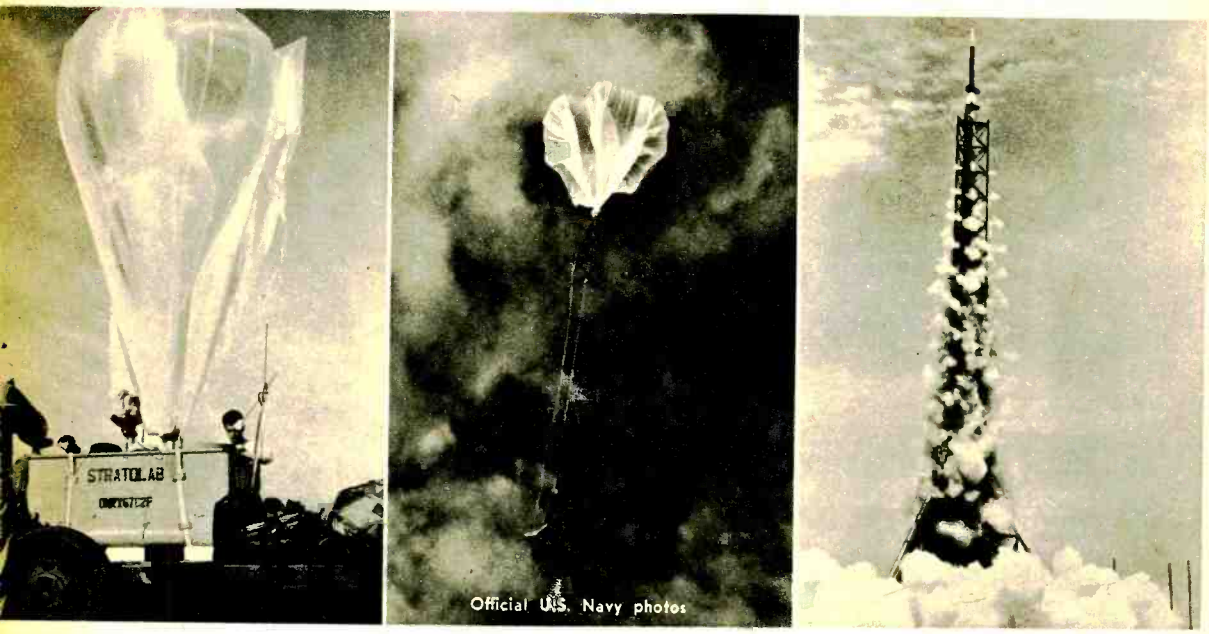
Filters on flare patrol unit allow flares (hydrogen) to be observed against dark background.

Sunspot radiation beefs-up ionosphere, shifts radio reflection patterns. Note sporadic-E.



Daily summary of solar radio noise aids in forecasting radio propagation disturbances.


National Academy of Sciences—IGY photo



New methods of studying sunspots beyond earth's murky atmosphere include skyhook balloon, left. Note cameras and antenna mounted on gondola. Center photo shows a rockoon ascending. It is a combination of a radio-equipped balloon and a high-firing instrumented rocket for high altitude observation. At right is standard Aerobee-Hi research rocket starting on ionospheric journey.

other ships and shore stations. Transoceanic airliners are often cut off from airfields. Short range mobile units of fire departments are isolated in silence. News services relying on radio-teletype, as well as many other radio users are in trouble when their normal ranges are quixotically shifted around.

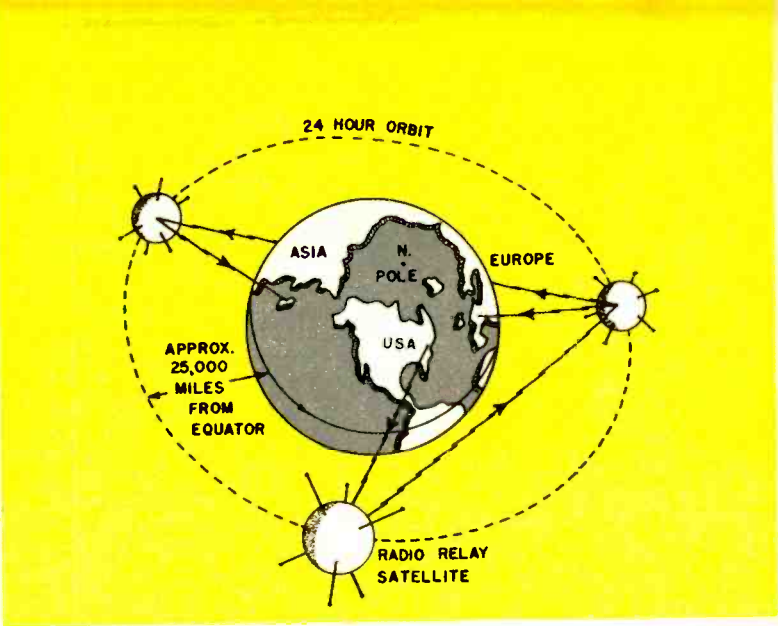
Our DEW line radar, vital to national defense, also has its king-sized headaches when the super-charged ionosphere tricks the scanning beams. Flying saucers, enemy bombers, ICBMs and other unidentified flying objects are picked up by excited radarmen. These contacts are almost always ionospheric illusions on the radar scope.

The IGY sent up 194 instrumented rockets, such as the Aerobee-Hi, to measure sunspot radiations and their effect on the ionosphere. Skyhook balloons have taken larger radio transmitters and instruments aloft, including small telescopic cameras to take supersharp photos of the sun beyond the earth's murky atmosphere. Rockoons, a new combination of balloon and high-firing rocket, have investigated the outer fringes of the ionosphere up to 2000 miles. Yet all this may not help much in changing the fact that sunspots mean a bad time for radio.

Without such advanced devices, the early Chinese first saw that the sun at times looked like a smallpox victim. In 1612, Galileo turned his newly-invented telescope at the sun and confirmed the existence of sunspots. By 1843, a German named Schwabe noticed that in some years there were few spots, in other years a great many. He also discovered they came in more-or-less regular cycles, reaching a maximum every 11.2 years.

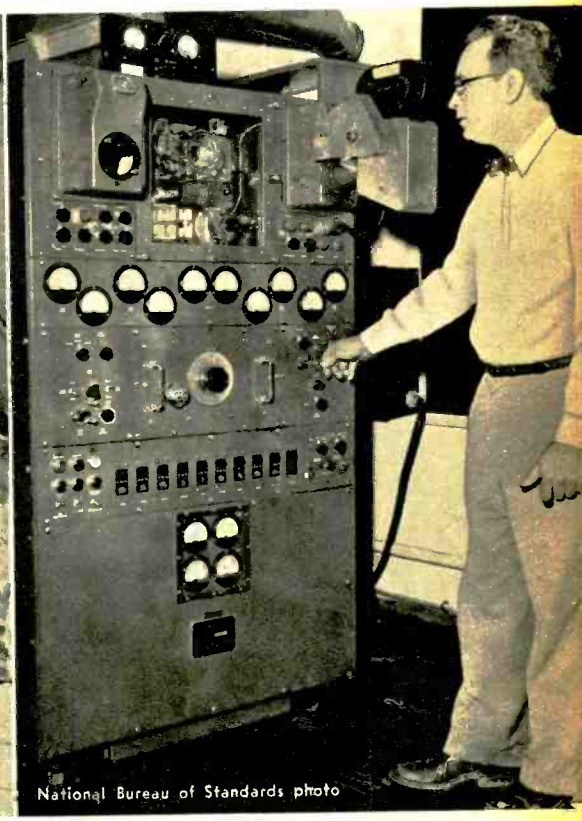
These sunspot peaks quickly gained notoriety and were blamed for wars, droughts, disease epidemics, divorces, increased suicides, and almost everything under the sun-spotted sun. When the sun breaks out, compass needles may point the wrong way or whirl like dervishes, magnetic storms are particularly violent, weather may change for the worse, auroras at the poles become fantastically brilliant.

[*Continued on page 98*]

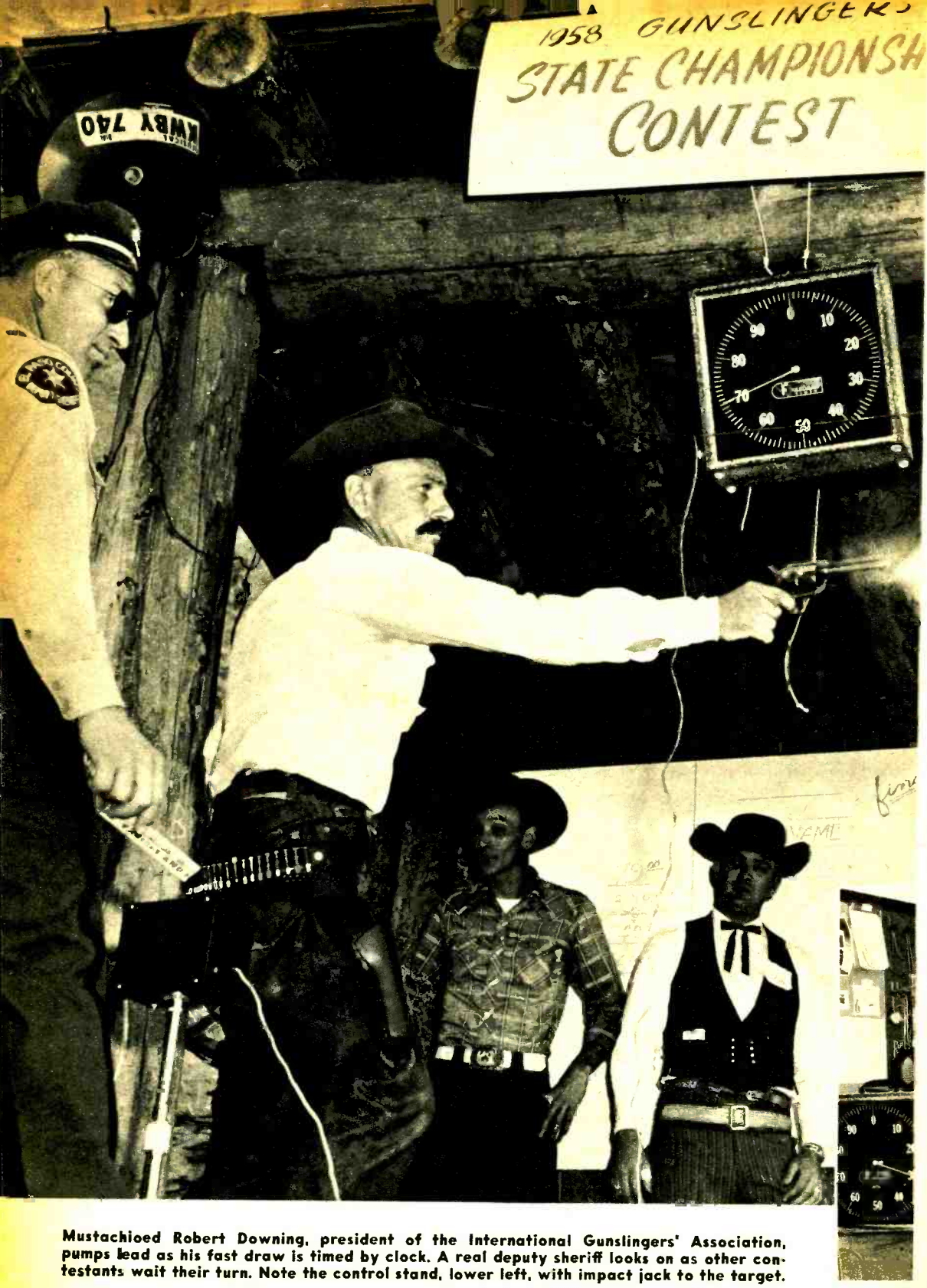


Man-made systems for avoiding sunspotty, unreliable ionosphere and still achieve worldwide communications are under development. By 1960, the United States will have launched three relay satellites to cover the globe.

Electronic controls, timing devices help focus and activate coronagraph at the University of Colorado high altitude observatory.



NBS-IGY units check for unusual radio disturbances with Ionosonde, which sounds out the charged upper atmosphere via radio waves.



Mustachioed Robert Downing, president of the International Gunslingers' Association, pumps lead as his fast draw is timed by clock. A real deputy sheriff looks on as other contestants wait their turn. Note the control stand, lower left, with impact jack to the target.

How Fast Is Your Draw?

Gunslingers now check their hip-slappin' talents against a hundredths-of-a-second electronic timer.

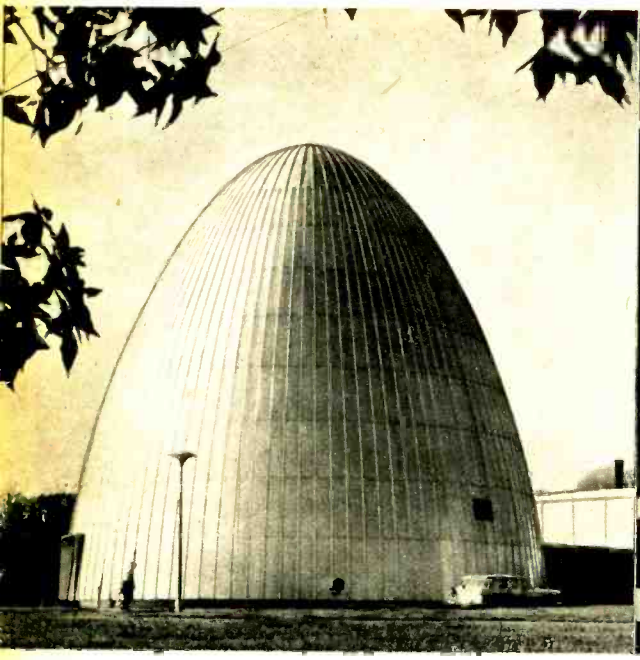
HEROES and badmen of the Old West who claimed to be the "fastest gun alive" would have a hard time convincing some of today's expert gunslingers. A new, impartial electronic judge is on the market that can settle all such arguments—and no one is needed to clean up the corpses after the shooting.

Called the Fasdraw Timer, this device has been selected as the official timekeeping instrument of the International Gunslingers' Competition. It can record down to 1/100th of a second the time required for a man to draw his gun from his holster and squeeze the trigger. Here's how it works:

The shooter presses a button atop a little black box adjusted to the height of his hip. When he releases the button as he reaches for his gun, the positive clutch action clock starts at jackrabbit speed. The sound of the gun blast is picked up by a microphone in the control stand, fed through a specially designed amplifier to the DC actuated stopping mechanism. The operating lag is less than three milliseconds.

Exceptionally fast gunmen can shoot around 15/100ths of a second. But speed is not always the deciding factor. The control box is also equipped with a jack for impact timing. When this is used, accurate shooting counts just as much as speed. The clock does not stop at the sound the gun, but rather when the bullet hits an impact trigger connected to the target.

Fast draw practice and contents are popular with lawmen and gun fans alike. They take their cue for this new sport from the rough-and-tumble Old West, and contestants, such as gunslingers below, often dress to fit the part. At left is Marshall Faber, the man who designed electronic timing device. Clock and microphone/control box sell for $129.50, FOB Lakewood, Colo.



This unique 87-foot aluminum dome houses the major portion of the new industrial reactor.

Down at the bottom of the "swimming pool" is the reactor core, capable of 5-million watts.

new look for

Atom Power

THE nuclear reactor is perhaps the most powerful tool of modern research and promises to make many additional contributions to basic scientific knowledge upon which our future progress depends. All too often, large and expensive reactors have been beyond the reach of private industry, which is constantly trying to develop radically new and improved products.

But now, 10 of America's leading firms, ranging from an electronics leader to a tobacco company, have banded together to build the world's largest nuclear research reactor entirely owned and operated by private industry.

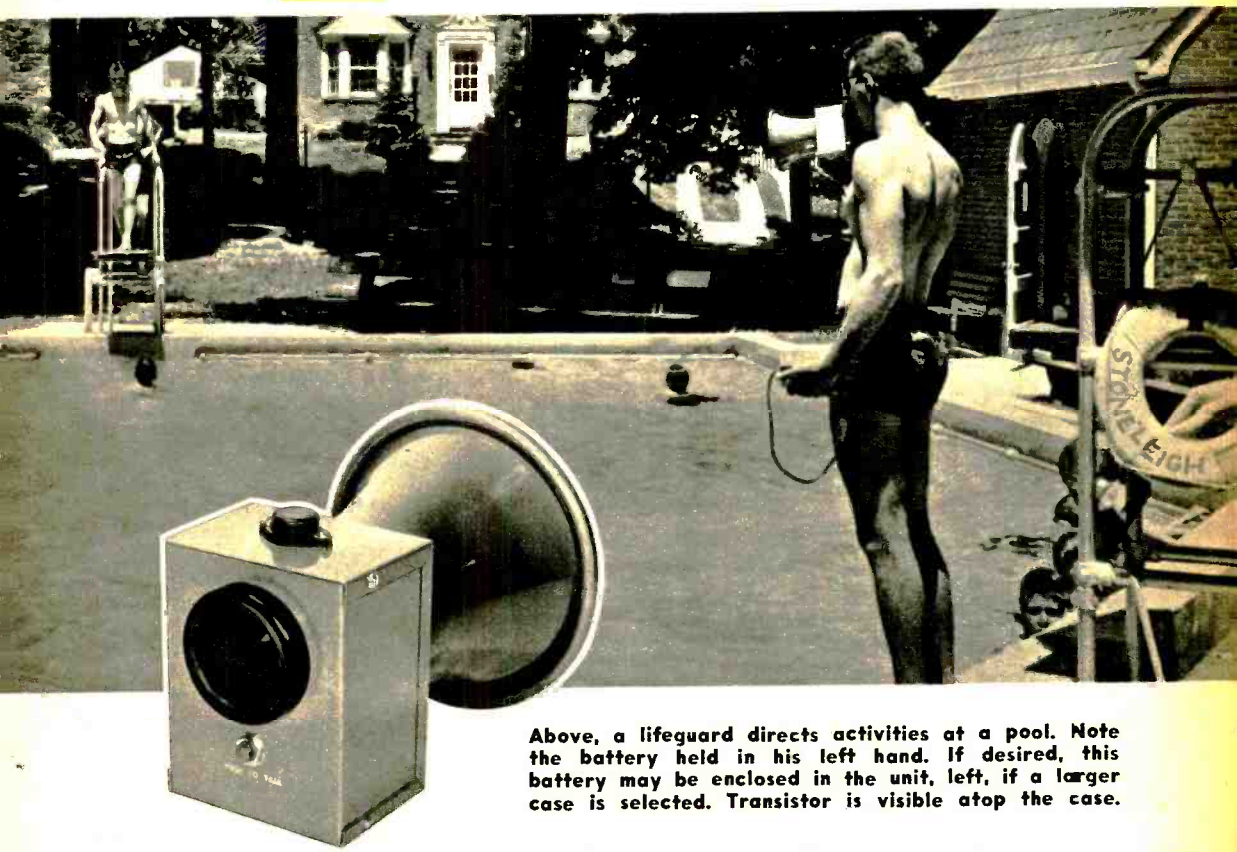
Operated by Industrial Reactor Laboratories at Plainsboro, N. J., the reactor consists of a special 32′ deep swimming pool under a "beehive" dome. The uranium fuel core at the bottom of the pool is cooled and shielded by circulating water. A platform around the top of the pool contains the control room. Adjoining the reactor are several shielded rooms for remote handling of radioactive materials by means of robots, and special laboratories for each of the ten participating companies are also provided near the reactor. Cost of construction: $4,500,000.

Designed for maximum safety, the pool's walls are constructed of magnetite (iron ore) concrete up to 10-feet thick. The control console also acts as an electronic brain which can detect malfunctions and immediately shut down the reactor.

A Transistor Megaphone

By R. L. Winklepleck

Direct crowds or talk at a distance with this voice booster powered by dry cells or your car battery.



Above, a lifeguard directs activities at a pool. Note the battery held in his left hand. If desired, this battery may be enclosed in the unit, left, if a larger case is selected. Transistor is visible atop the case.

HERE is a small, highly portable unit that has been stripped down to the bare essentials for the sake of compactness, ease of construction and economy. It is completely free of frills, and yet, surprisingly little in the way of performance has been sacrificed. The unit pictured was built for a bit under twenty-three dollars and the speaker itself was over two-thirds of that cost.

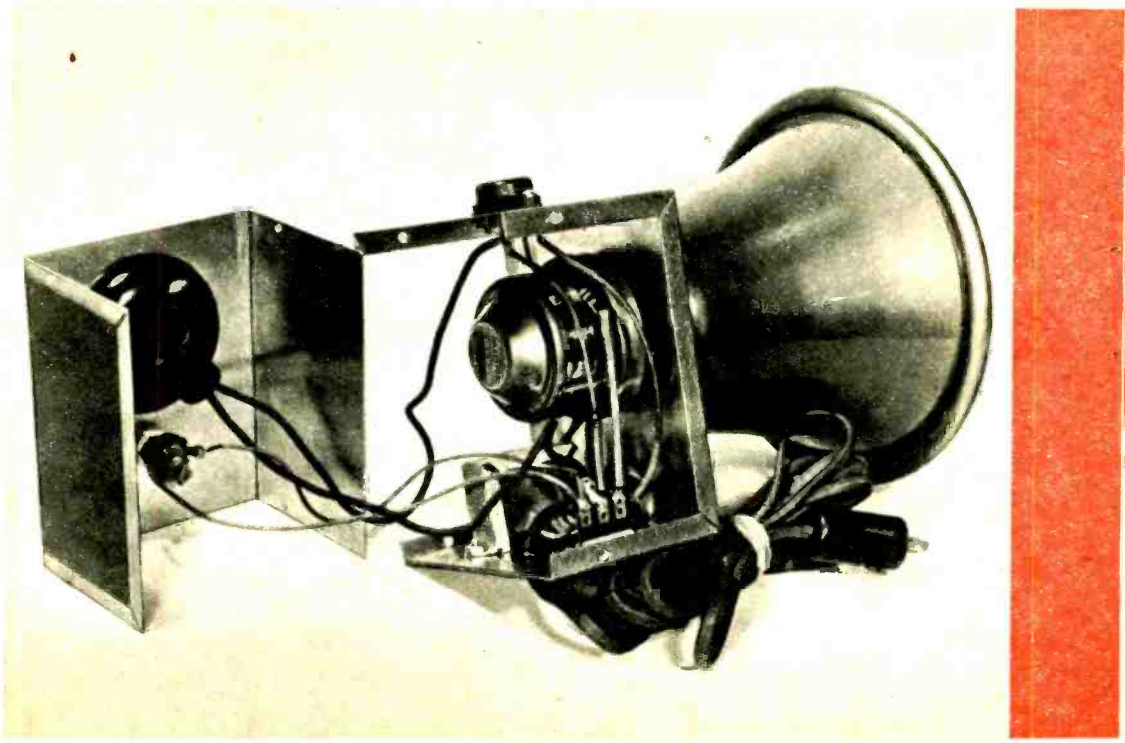
This voice amplifier was designed to be used for instructing agricultural field hands, and in connection with field trips where one can stand beside his automobile and address the group at each stop. For this reason the power cord terminates in a plug to fit the auto's cigarette lighter and power is derived from the auto battery. It could be made entirely portable by terminating a short power cord with a six volt battery. Also, there's no reason why the housing couldn't be made a bit larger to accom-

modate the battery. A stationary installation might be desirable where it could be used as a paging system in office, shop or school. Any number of modifications in physical layout are practical to adapt the unit to specific applications.

As noted in the photographs, the speaker was partially disassembled and a 3"x4"x5" Minibox was attached with the speaker driver inside the box. The output transformer and resistors are mounted in the same half of the box and the power transistor is mounted externally on top. The transistor should be insulated from the box with a thin sheet of plastic or mica and composition shoulder washers. A tie strip provides a convenient anchor for several of the leads. The carbon microphone from a surplus chest set is mounted through a hole in the other half of the box and positioned directly opposite the speaker driver. The push button switch is mounted below it. A length of two-conductor wire emerges from the bottom of the box and connects with the battery. The unit is light in weight and can be conveniently held in one hand with the thumb actuating the push-to-talk switch.

Several substitutions are possible. The speaker is the major cost item. An ordinary cone speaker would be much cheaper and equally suitable for some applications. The horn speaker, however, is much more efficient in converting electrical energy into sound. It is a bit more convenient for portable use, is weather resistant and has the advantage of a relatively narrow angle of sound projection. Any carbon mike with a nominal DC resistance of 75-100 ohms is satisfactory. The familiar and inexpensive F-1 carbon button can be used by designing a suitable housing. A number of different power transistors can be used but the one suggested is a good compromise between performance and price. If a different output trans-

With cover of case removed, the carbon mike and push-to-talk button are seen to the left. The large speaker horn enters the case at right and is held in place by its driver mounted inside case.



former is used it should have a primary impedance of fifteen to twenty ohms and a DC resistance of one or two ohms, a secondary to match the speaker and a rating of at least five watts.

It would be difficult to find a more simple circuit. The power transistor is used in the well known common emitter configuration. The carbon mike serves a dual purpose as part of the voltage divider with resistor R1 to supply transistor base bias and also as the source of the audio voltage. Resistor R2, a three-quarter inch length of coiled heater replacement wire, serves to prevent transistor runaway. The output transformer approximately matches the output impedance of the transistor to the impedance of the speaker. There's no merit in grounding the box and it might be a disadvantage in some instances. The circuit is designed for a 12 volt power supply and, though it draws quite a few milliamperes while operating, it's economical since it uses no current except when the push-to-

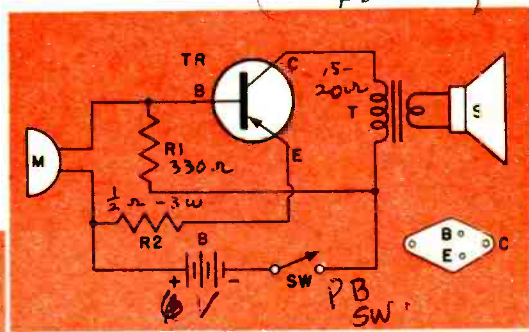
[*Continued on page 106*]

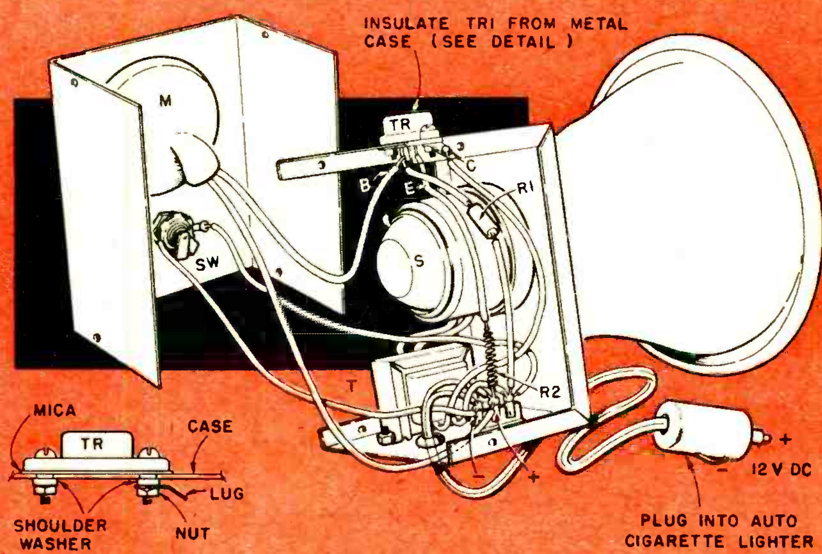
PARTS LIST

R1—330 ohm 1/2 w resistor
R2—1/2 ohm 3 w resistor (See text)
TR—2N256 power transistor (CBS)
T—Audio output transformer (Stancor TA-12)
S—8 ohm speaker, horn type (University MIL-8)
B—6 or 12 volt battery
SW—Pushbutton switch, spst
M—Carbon microphone, F-1 button type (available from surplus AT-26 chest mike)
Case—Aluminum Minibox 3" x 4" x 5"
Misc.—Mica for insulating TR, shoulder washers (fiber), auto cigarette lighter plug, 3-lug terminal strip.

Schematic at right shows simplicity of the circuit. The battery (B) may be either a 6 or 12 volt cell as explained in the text.

Wiring guide below shows unit equipped with a plug for use in auto. Batteries may be used in place of plug for portability.

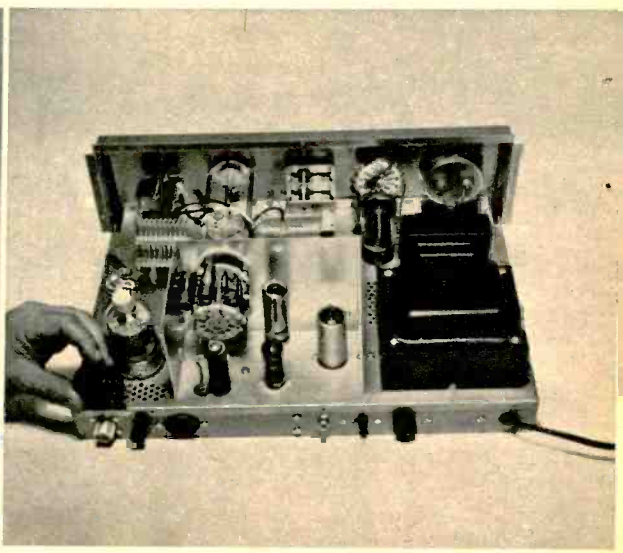




The transmitter is compact with low silhouette. The crystal socket is at bottom of panel. Meter is calibrated for 75 watt Novice operation.

Layout of major components supplied with the kit. Punched chassis is copper plated steel.

Octal socket on rear apron supplies AC for an antenna relay, takes audio from a modulator.



EI reports on a new

CW Transmitter Kit

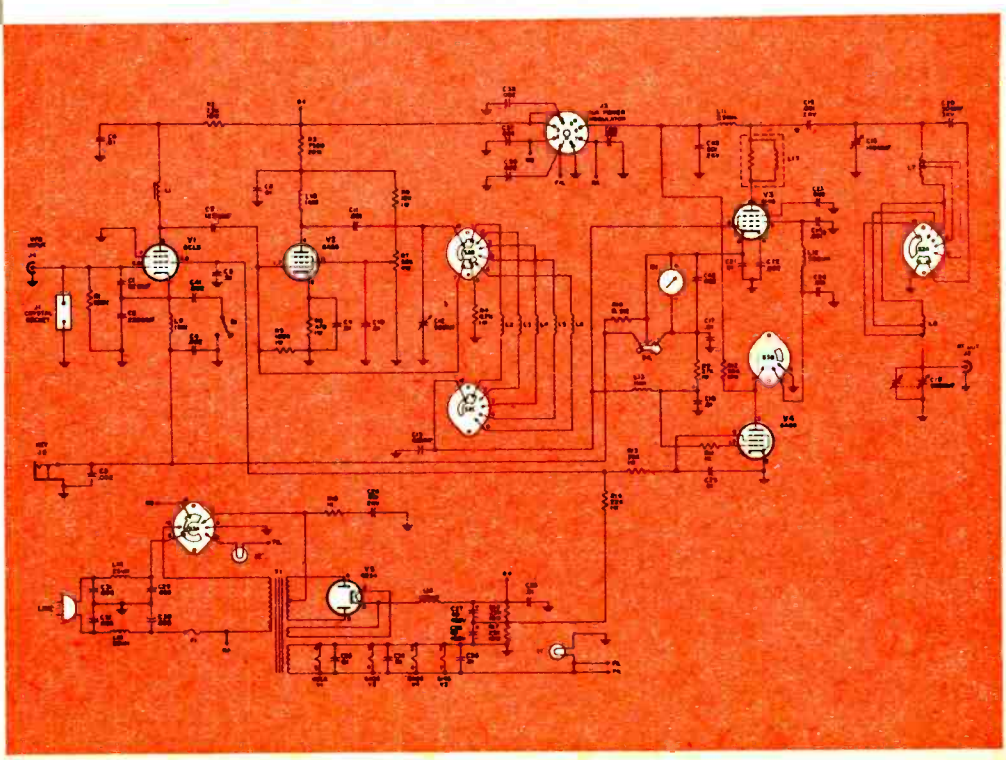
Bandswitching from 10 through 80 meters and 90 watts of input power are features of the Eico 720.

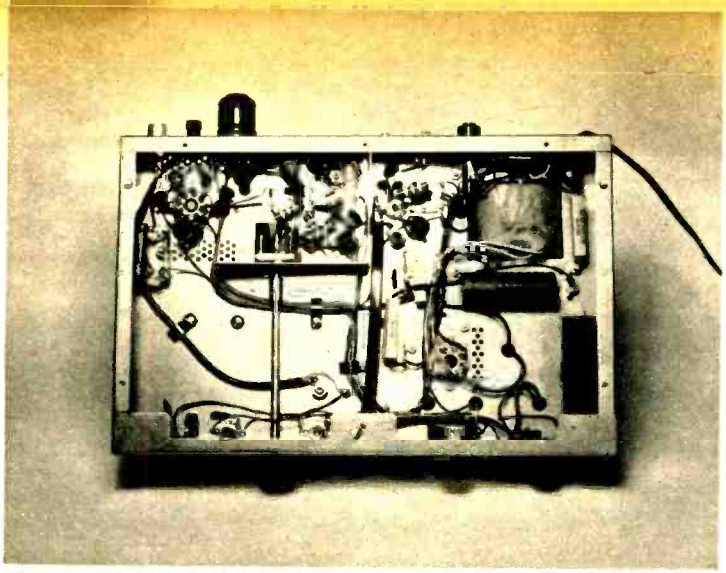
SIMPLIFIED assembly and wiring, straight forward circuitry, measures against TVI (interference to television receivers), and attractive appearance make the Eico Model 720 CW transmitter an item of interest to hams who want to get on the air in a minimum of time.

The parts are laid out in such a manner that even a rank beginner with five thumbs can put them into position and connect them together. The complete job takes about a week of evenings.

The chassis is furnished with the front panel welded to it, an assurance that the components line up properly with their mounting holes. What appears to be the front panel in the accompanying photos is really a very thin face plate that slips over the actual panel and carries the identification of the seven

The circuit employed is a tried and tested combination; V1-6CL6 crystal oscillator, V2-6AQ5 buffer-multiplier, V3-6146 power amplifier, V4-6AQ5 clamper, V5-GZ34 rectifier. The clamper tube keeps high voltage off the key and also protects the power amplifier if excitation is lost.





Underside of the chassis. At upper left corner is the RF output jack that feeds power to antenna. Leads on parts are kept as short as possible.

controls, the meter, the crystal socket and the key jack.

For a transmitter that runs comfortably cool at an input of 90 watts, the Model 720 is remarkably compact. In its cabinet it measures only 15 inches wide, 6 inches high and 9 inches deep, and it looks more like a hi-fi amplifier than a conventional ham unit. The Novice power limit of 75 watts is indicated by a red marker on the plate current scale of the front panel meter.

Frequency control is accomplished by plug-in crystals, another Novice class requirement. It takes only a couple of seconds to interchange crystals. These are not included in the kit, as frequency choice within the assigned Novice bands is a personal matter with individual operators.

When the Novice builder of the Model 720 graduates to a General or Conditional class license and therefore becomes eligible to work anywhere in the ham bands, he will undoubtedly want to use a variable frequency oscillator (VFO). A connector jack is provided for this purpose on back apron of chassis.

The transmitter is fully bandswitching from 10 through 80 meters, with self-contained antenna tuning facilities. The meter on the panel reads both the grid and plate current of the 6146. With a suitable antenna, it takes only about 30 seconds to tune up the rig.

There is no shock hazard at the key, and the full break-in keying is clean and crisp.

The TVI filtering and shielding are unusually extensive for a small transmitter, and do a very good job. Your reviewer ran it at full power on 20 meters with a half-wave antenna hanging from the same pole that holds his TV aerial, and only a faint pattern appeared on TV screen. At normal viewing distance this was hardly noticeable.

A low-pass filter in the transmitter antenna line probably would have removed all signs of interference.

An octal socket on the rear apron serves several purposes. When the transmitter's function switch is in the transmit position, two of the socket's terminals are placed across the primary AC line to energize an external antenna change-over relay. Two other contacts have 6.3 volts of AC on them, for operation of accessories. Another pair is normally short-circuited by a link in the octal plug fitting this socket, to complete the B plus circuit to the final amplifier plate. If it is desired to add voice modulation to the transmitter, the link is removed and the secondary of the external modulation transformer is connected instead. Eico has a modulator kit, the Model 730, designed to match the basic transmitter.

Your *EI* reviewer found some errors in the instruction book for the transmitter, and the manufacturer has been informed of them.

For a test, the 720 was hooked up to a ½-wave folded dipole for 20 meters. On a first try from Long Island, N. Y., we raised W4MQU in Jacksonville, Fla.

At $79.95 ($119.95 for the wired version) *EI* rates the 720 a Good Buy for both the Novice and veteran ham.

5-Pound Atomic Power Plant

HERE is a lightweight atomic device less than six inches in any dimension that can produce electricity without moving parts. It can operate for long periods under extreme temperatures, and actually increases in efficiency in extreme cold.

Called SNAP III, an acronym from the AEC project that developed it (Systems for Nuclear Auxiliary Power), it is the smallest atomic device in a practical size and with a practical power rating of 5 watts. Radiation from radioactive polonium-210 (other radioactive elements may [*Continued on page* 106]

Compact atomic power plant, hardly larger than a cantaloupe, is hooked up to a motor-driven propeller as dramatic proof that nuclear equipment can be reduced in size to provide a convenient, practical electricity supply.

Completed, Knight-kit 18-watt amplifier-preamp has separate bass and treble controls, all standard inputs and equalizations. At left, before assembly, note how resistors have been pre-sorted onto cards to aid identification.

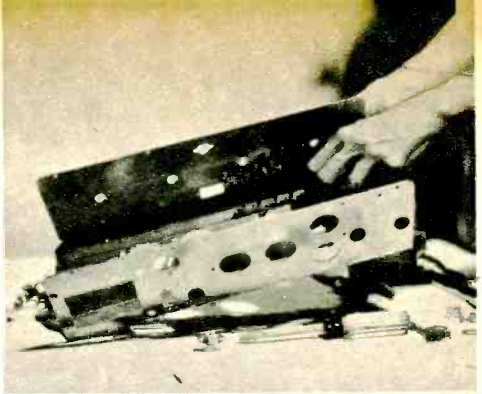
EI assembles

A Hi-Fi Amplifier

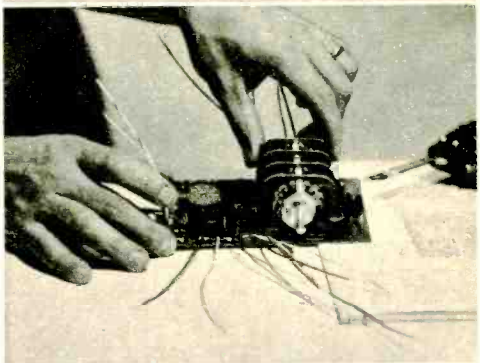
THERE are many methods to convert a monophonic hi-fi system to stereo. One of the most popular is to add an integrated pre-amp-amplifier and speaker system for the second channel. If this is your choice you would do well to consider the Knight kit model 83 YX 797 for $39.95, complete with cabinet. Because of its tape head input facility it is also ideal for the conversion of tape recorder systems to stereo.

Thanks to Knight's printed circuit switch, two printed boards and an excellent instruction booklet, this 18-watt hi-fi amplifier took less than eight hours to assemble. That includes time spent checking off parts and sorting hardware. Even the insulated wires are cut to length and stripped. The circuit of this amplifier is conventional—any troubles that may arise are easily found and corrected using the explicit instructions.

With seven equalization settings, three high gain inputs, four low gain inputs and a special tape head input with equalization, this basic unit available from Allied Radio Corp., has a versatility seldom found in low priced amplifiers. *EI* rates it a Good Buy.

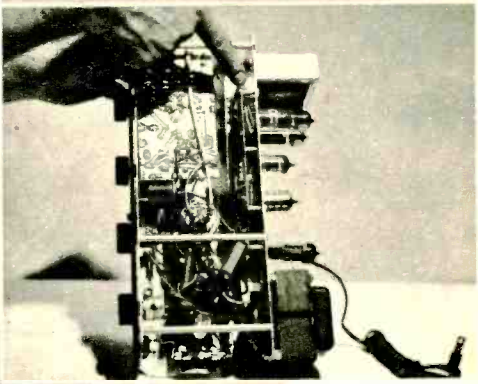


Mounting signal input jacks on chassis was tight squeeze; other parts have adequate space for access, ventilation.

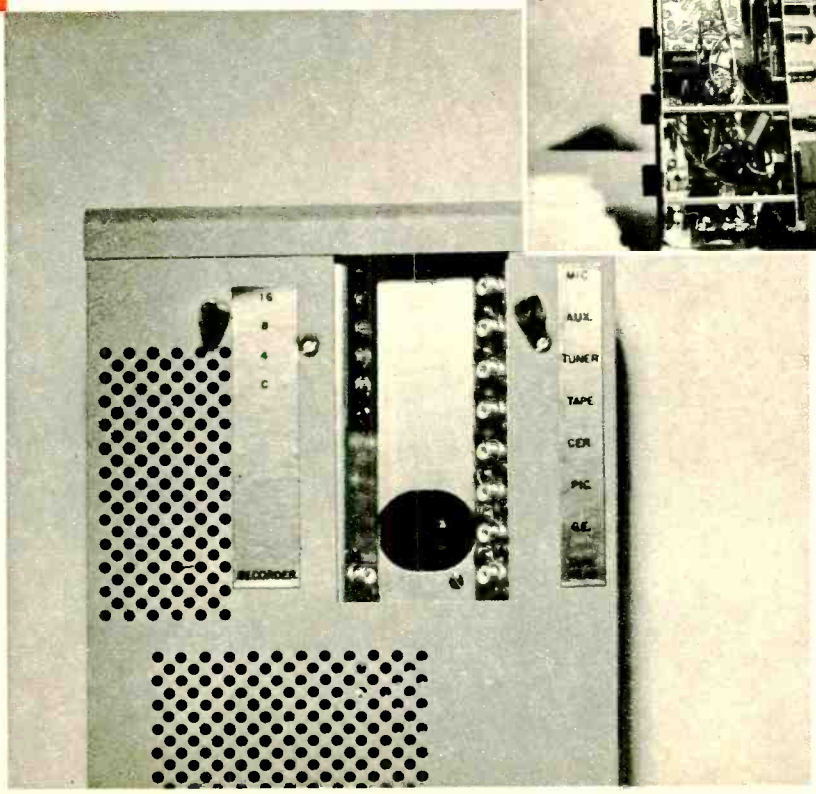


Knight's printed circuit switch fits neatly onto board, converts usual tedious wiring job into a few solder connections.

Four-tube printed board is mounted on the chassis perpendicular to one-tube board, whose underside is also visible.



Input jacks and speaker output taps are located under amplifier. Wires can come through space made by cabinet's feet.



Experimenter's Breadboard

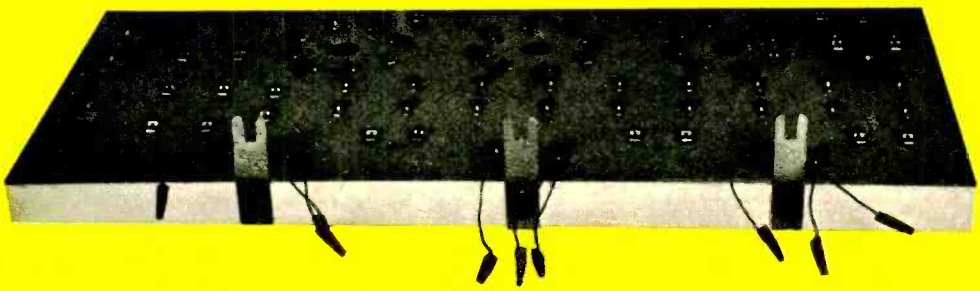
By Harvey Pollack

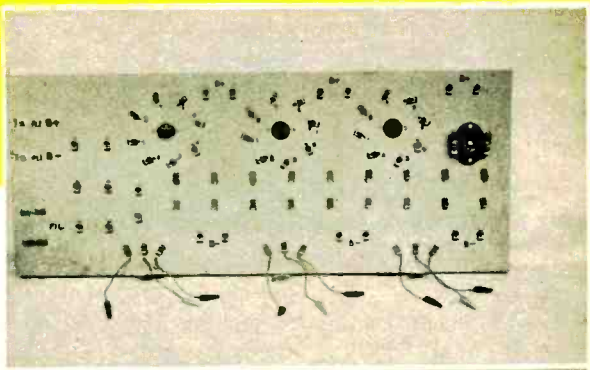
Clip a circuit together in the shortest possible time with this board and companion power supply.

IF YOU like to try out electronic circuits "in the rough" before constructing the final version you will find this "breadboard" a boon. Up to three vacuum tube stages may be assembled almost as fast as you can read a schematic diagram and without a single solder connection. After the design is finished, it can be dismantled in a jiffy. The same resistors, capacitors, coils, potentiometers, transistors, etc., can be used over and over again for other circuits. The only type of construction that is not recommended is equipment in which very high frequencies are used such as FM tuners.

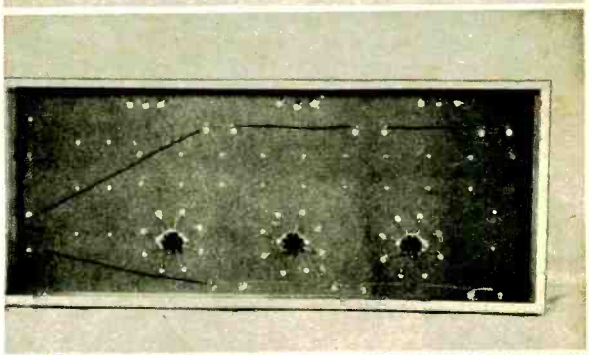
The "breadboard" itself consists of a piece of ¼" masonite measuring 30 inches by 12¼ inches mounted on four strips of fir stock that serve as aprons for the masonite "chassis." Four double Fahnestock clips are employed as power input terminals

Power supply occupies a chassis separate from the board. Knob at front varies voltage from 0 to 300 volts DC. Output appears at terminals, right.





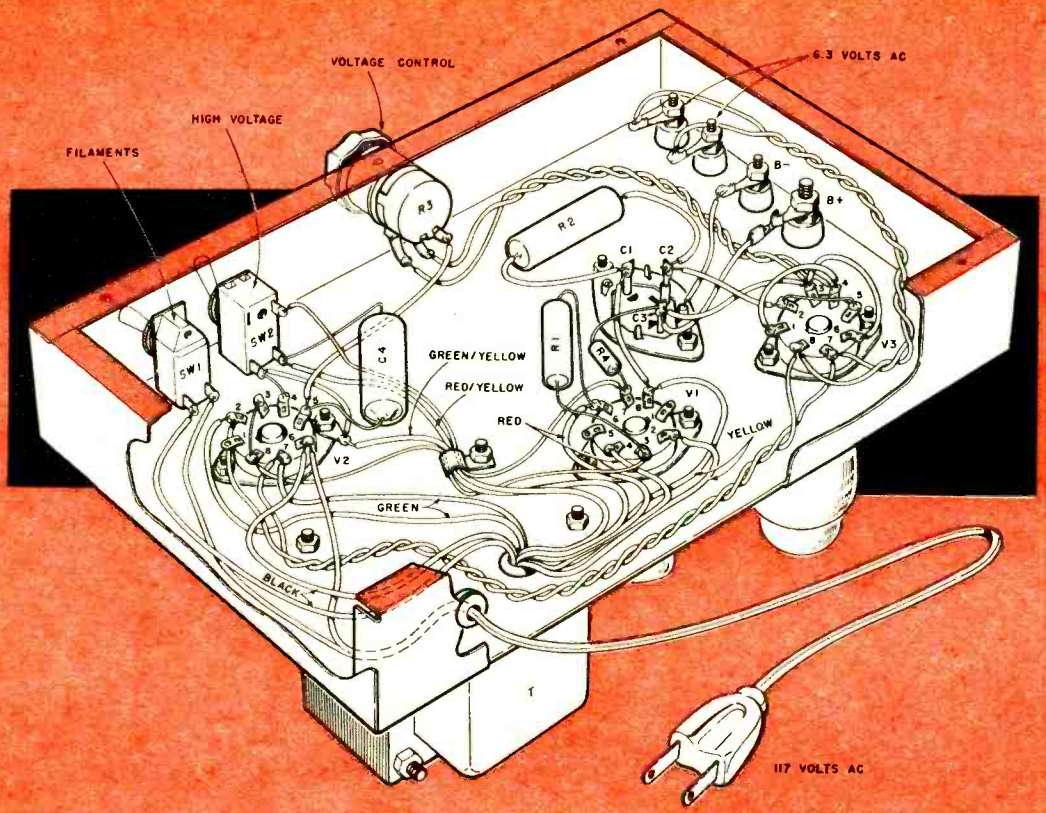
Along the front of the board above are three vertical mounts for volume, rotary switch, or other type control.



Power supply connects to clips along left side. Note 3 octal sockets, and light bulb socket at right.

The wiring underneath board carries B+ and B— to desired points. Lugs on octals are also wired to clips.

A volume control is shown mounted on the bracket. Note how miniature alligator clips fasten to its lugs.



Only wiring guide for power supply is shown. Follow photos of breadboard for layout of clips.

labeled B+, B—, and Fils respectively as may be seen in the photographs. These, and all the other Fahnestock clips, are secured to the masonite board by means of machine screws and nuts. Along the top of the board are fastened six individual clips all of which are connected under the chassis to the B+ terminal; similarly, the B— terminal is connected to a similar group of six clips along the bottom of the board. These "jumped" clips make it easy to run power connections directly to active components without the need for long leads from the input terminals.

Three octal tube sockets are mounted just as they would be on a metal chassis and are spaced so that a ring of eight clips may be arranged around each. The clips are numbered from "1" to "8" and are then soldered under the chassis to the respective socket lugs.

Along the front of the masonite board are three brackets cut from scrap chassis steel or aluminum. These are straight pieces about 4 inches by 1 inch, slotted at the top to receive a potentiometer, rotary switch, variable capacitor, or toggle switch. Each slot is $\frac{7}{16}$ inch wide and about 1¼ inches long so that any one of these parts may be slid down into place for quick connection.

Immediately behind each bracket are three Fahnestock clips to which are soldered individual leads of flexible wire about 5 inches long terminated in tiny "Minigator" clips. When the potentiometer or variable capacitor is in place, solderless connection is made to the control via the miniature clips and their associated Fahnestocks.

At the extreme right side of the chassis, a 120 volt Edison cleat receptacle is secured to the masonite by two long 6-32 screws and nuts. Double Fahnestocks are mounted on each of the two terminals of the receptacle. Thus, when you want a resistive load of almost any value, you can screw an incandescent or neon lamp of the appropriate size into

the receptacle and make connection to it instantly through its terminal clips. For example, if the maximum load current through a relay output circuit is to be limited to 100 milliamperes, then a 10 watt lamp would be used as a load. For load curents of higher value, simply substitute lamps of larger wattages.

Along the center and left end of the chassis are located 26 additional Fahne-

[*Continued on page* 104]

PARTS LIST

Breadboard

6 Fahnestock clips, double wing type
72 Fahnestock clips, single wing type
3 Octal sockets, Bakelite
1 7-pin miniature socket, Bakelite with metal flange
1 9-pin miniature socket, Bakelite with metal flange
1 Edison type cleat socket (for light bulb)
1 Masonite board, 30"x12¼"
3 Aluminum metal brackets, 4"x1", slotted 7/16" wide x 1" deep
2 Octal bases from old glass tubes
9 Miniature alligator clips (Mueller Minigator type 30) with rubber sleeves
8 ft. Wood stock ½"x1¾" for breadboard apron
Hardware 4-36 machine screws and nuts to mount clips

Power Supply

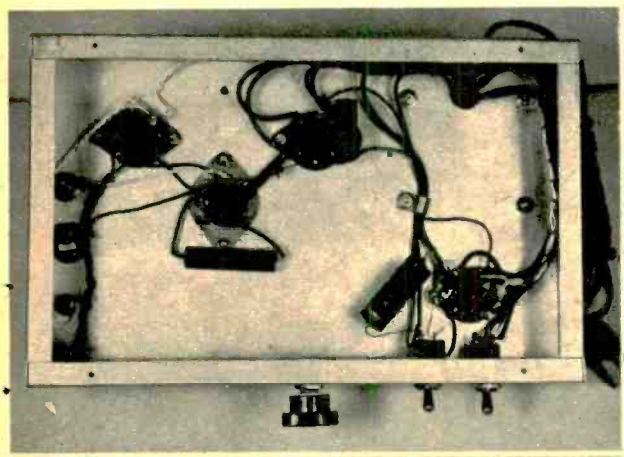
C1,C2,C3—Electrolytic capacitors, triple-unit can. C1 is 60 mfd at 400 volts, C2 is 30 mfd at 400 volts, C3 is 20 mfd at 350 volts (Tobe-Deutschmann type TDCO885)
C4—Paper capacitor 2 mfd at 200 volts
R1—10,000 ohm, 5 watt wirewound
R2—1,000 ohm 10 watt wirewound
R3—250,000 ohm potentiometer (IRC Q11-130)
R4—1,000 ohm, ½ watt
SW1—Single-pole single-throw toggle switch
SW2—Single-pole double-throw toggle switch
T—Power transformer, 270-0-270 volts at 120 ma, 6.3 volts at 3.5 amps, 5 volts at 3 amps (Stancor PC-8405)
V1—5Y3 tube
V2—6H6GT tube
V3—6AS7G tube
Misc.—4 octal sockets, 4 five-way binding posts, line cord, Chassis for power supply, aluminum chassis 7"x11"x2" (Bud AC-407)

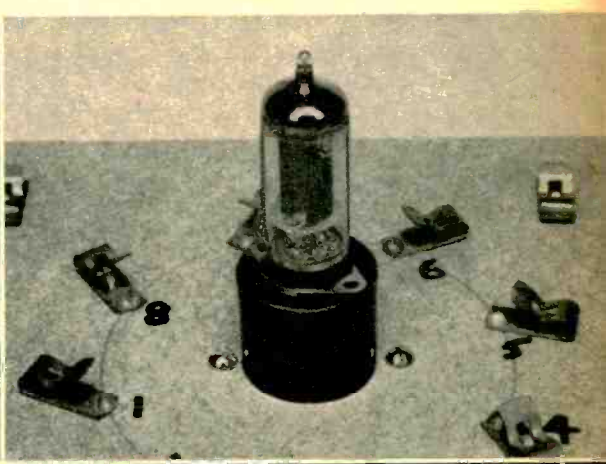
Underchassis view of power supply. Wiring, though neatly cabled here, is not critical.

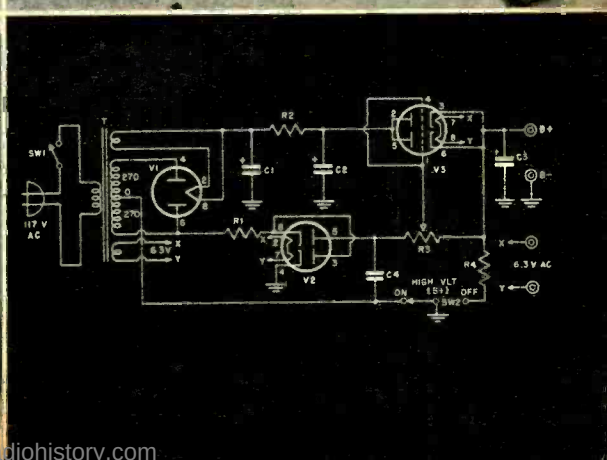
Bottom photo shows audio oscillator circuit built on breadboard. Parts clip in place.

The 7-pin adapter is plugged into one of the board's octal sockets with a miniature tube.

Power supply schematic is below. V3 is the 6AS7G electronic voltage regulator tube.







new thrills for as low as $110 with

Small Boat Depth Finders

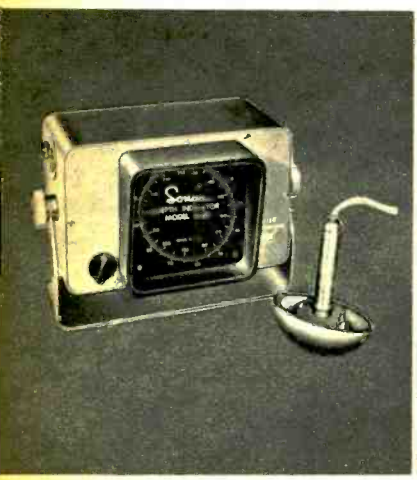
VERSATILE and reliable electronic depth finders are fast becoming popular with small boat owners. Earlier, the advantages of sonar were available only to naval vessels, large commercial ships and fishing fleets. Now there are many low-priced models on the market (most under $200 and one as low as $110) and water sportsmen can get more out of their boats than ever before. From runabout to yacht, under power or sail, electronic depth finders have added a new dimension of safety and fun to boating.

A depth finder aboard your boat is like having an electronic lead line which takes hundreds of soundings a minute. These soundings are instantly reported, giving you an accurate picture of the changing bottom—and how much water is between your keel and that bottom.

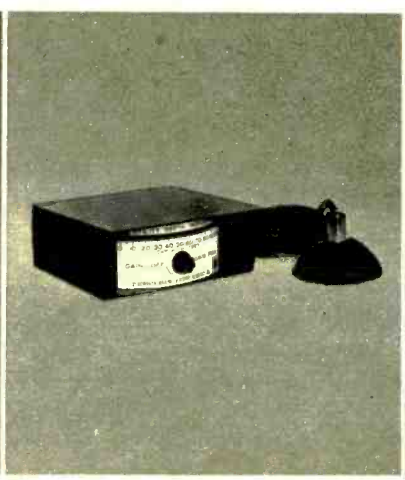
Lake, ocean, or river—water is an excellent conductor of sound and depth finders take advantage of that fact. Basically, a transmitter (oscillator) generates a single frequency between 30 and 200,000 cps, skipping those frequencies audible to humans and fish. This pulse is then fed to a three or four stage high gain DC amplifier, then to a transducer.

The transducer is usually mounted close to the keel in direct contact with the water and its purpose is to convert the pulse, through a piezo-electric substance such as barium titanate, into a sound pressure wave. This sound travels in an ever widening cone (about 15 degrees from the transducer) until it hits the bottom, or anything between the [*Continued on page* 108]

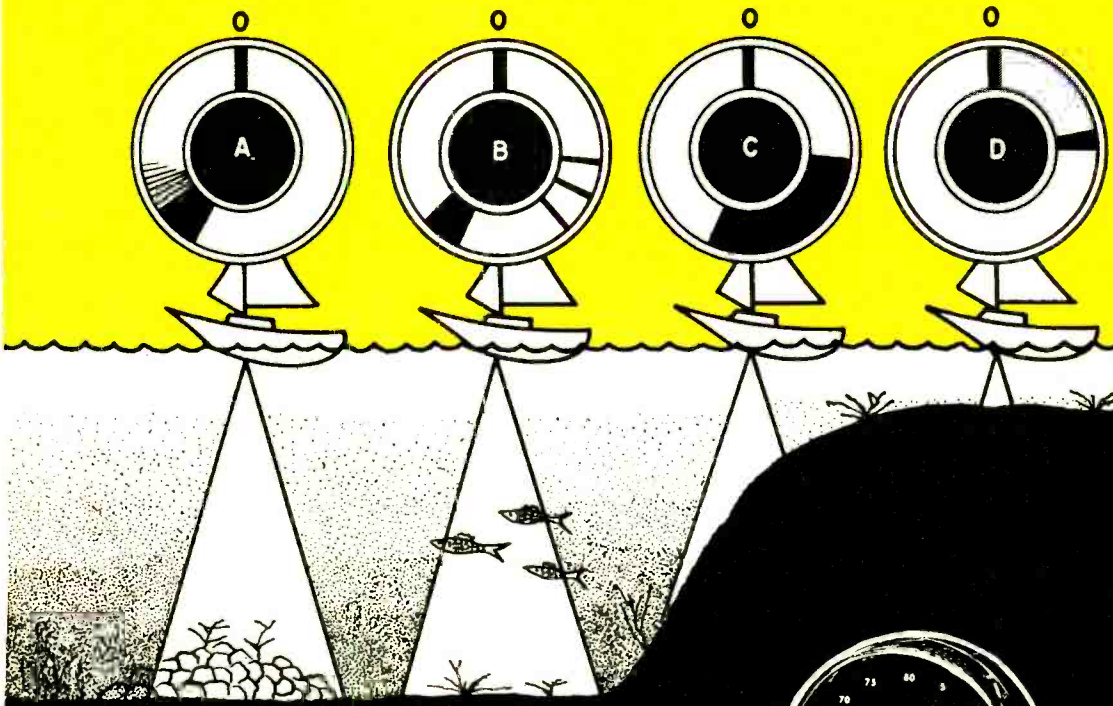
Sonar model D-120B, shown with its transducer, operates on 6 or 12 volt power supply and indicates depths from 1 to 250 ft. Under $150.



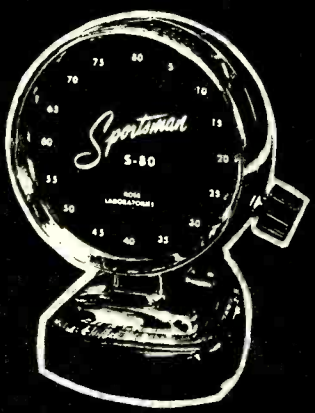
This portable, all-transistor unit for about $110 from *Bludworth Marine* uses only four 1½ volt flashlight batteries in its fiberglas case.



***Bendix* indicator is available in either fathoms or feet at same price (under $200.) It features printed circuitry and 6, 12 or 32 volt power.**



What depth readings look like: A. Wide flash indicates hard or rocky bottom; soft bottom would give narrow echo flash. B. A single fish shows up as a thin flash between zero marking and bottom indication, while a number of fish yield many sharp flashes at depths they are swimming. C. Sloping bank produces a very wide flash band. D. Be wary when you get a flash near right side of zero mark. It means you are in shallow water. At right is Ross *Sportsman* S-80 which employs a five transistor circuit and comes with 7½ volt battery.



Here is *Raytheon's* model DE-705 "Explorer" depth recorder. It can graph bottom profiles down to 120 feet, costs slightly more than some indicator types.

All About Computers-3

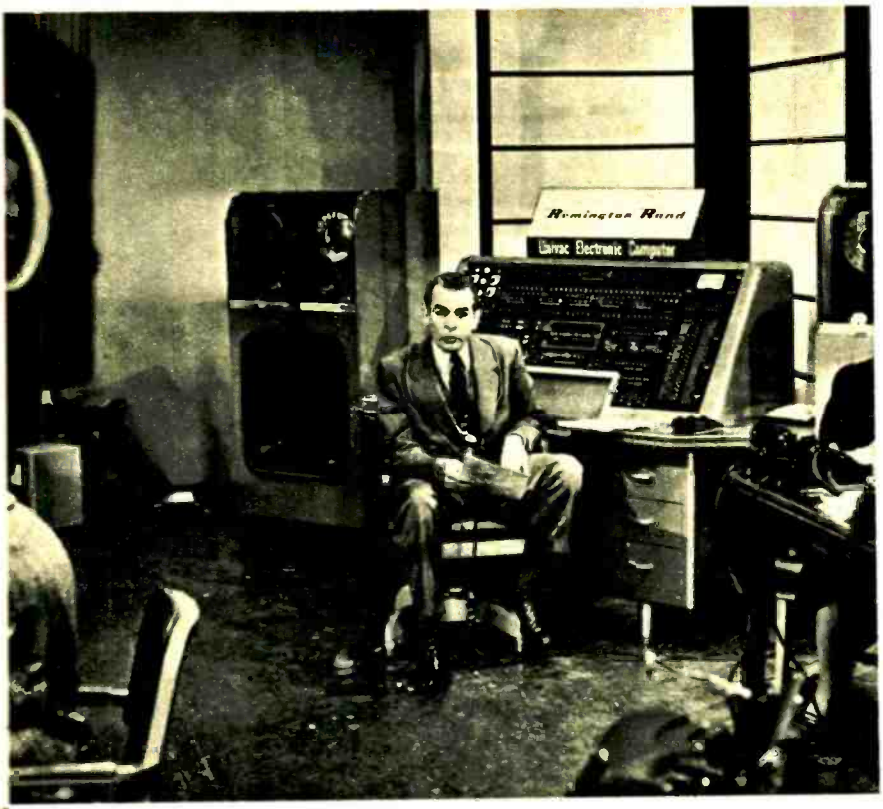
By R. W. Yates

Here's how computers have moved into our changing world, and how they contribute changes of their own.

ELECTRONIC computation, still in its infancy, is one of the fastest-growing fields the world has ever seen. In little more than a decade, the computer has emerged from relative obscurity in the research lab into a remarkably broad range of successful, practical applications. And this is only the beginning.

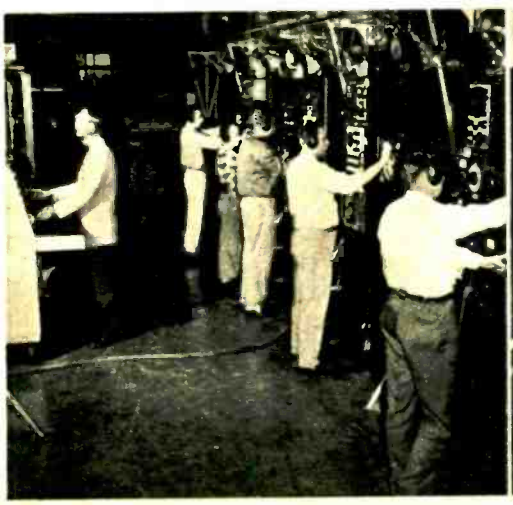
Computers can't think for themselves, but they can do just about anything short of that. When properly programmed by human brains, they can be made to solve any kind of logical problem faster and more accurately than has ever been possible before. The problem may be an equation in the dizzy realms of higher mathematics, a question of how best to guide a missile, or a matter of figuring weekly payroll deductions. A full account of all the things computers can do would require much more space than is available here, but a partial survey may afford

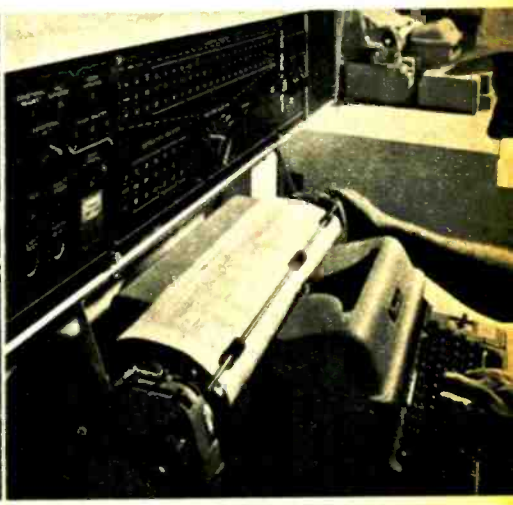
Dead Sea Scroll is examined at console of IBM 705 by Father Roberto Busa, noted scholar, while machine processes index of ancient religious writings.

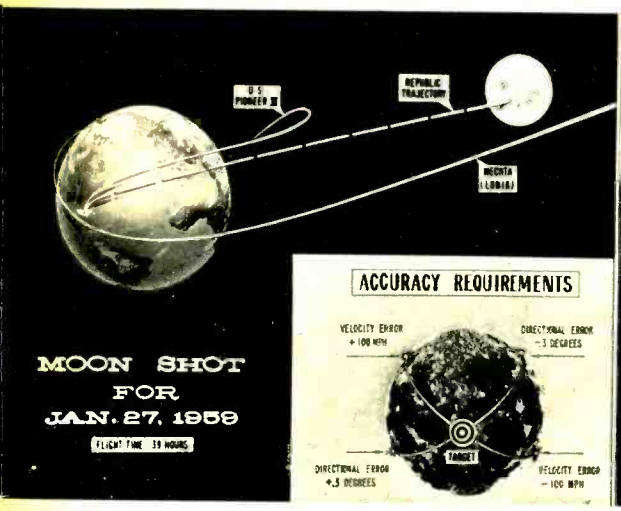


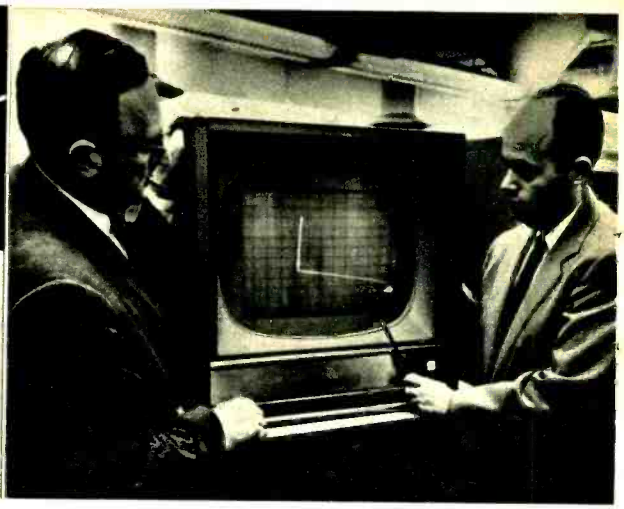
Election night in CBS television newsroom is hectic, but through it all calm computer gives 100-to-1 odds. Charles Collingswood is the announcer.

Missile and airplane testing at Bell Aircraft (left) that used to take large crews an hour to complete can now be done in two minutes by programmed analog devices. Right, instructions to automation computer at new Louisiana steam electric station are typed by worker controlling 350 points in plant.









New mathematical way to figure moon shot trajectories, accurate within one mile, has been worked out by Republic Aviation scientists and advanced computer. On cathode scope, earth is at right; vertical line is moon in orbit.

some idea of their present and future value.

Analog computers (which differ basically from digital systems in that they work from varying physical magnitudes rather than from pulses representing actual numbers and letters) have had a revolutionary effect on the handling of many scientific, military, and engineering problems. They have vastly improved the accuracy of artillery and submarine warfare by eliminating the need for human fire-control calculations, and they have greatly simplified the work of air and sea navigation. They serve as internal and external guidance systems for a variety of new military missiles. They control chemical processes by registering the changing sensitivity of substances to pressure, temperature, etc. They speed the work of engineers not only by solving equations, but by simulating the behavior of projected designs under theoretical stress conditions. This means that costly pilot models need not be built.

Sperry Gyroscope Company, a pioneer and leader in the special-purpose analog field, recently announced the development of a lightweight airborne computer that will automatically guide a Navy helicopter pilot to an unmarked location at sea and "remember" the way back home—even when its home is a fast moving ship that may have traveled many miles since the pilot's take-off.

Before the flight, the pilot manually sets the ship's course and speed into the computer, along with available target and wind data. The system starts at take-off. The "output" is a single indicator showing the aircraft's position, distance, from target and flight path. The computer uses radar and radio data to correct itself continuously during the flight, meanwhile computing and reporting the correct wind information. The pilot can set in new destinations or cancel others during the trip, and the system will instantly adjust to the new flight plan. When it's time to turn back, the pilot touches another button and the indicator shows his return route and distance to his ship's new position.

Digital computers, with great speed and versatility, can handle any problem that can be broken down into a sequence of distinct arithmetical steps. Remington Rand's Univac computer first came into national prominence in 1952 when it predicted President Eisenhower's election and gave odds of 100-to-one many hours before there were enough returns to hazard a guess by any other known forecasting method. It has done equally well in the three national

[*Continued on page* 102]

2. Nerve center of the system is the SAGE computer. It tracks the hostile aircraft; it distinguishes it from friendly aircraft; on command, it fires the missile automatically; and it guides the missile in flight to the intercept.

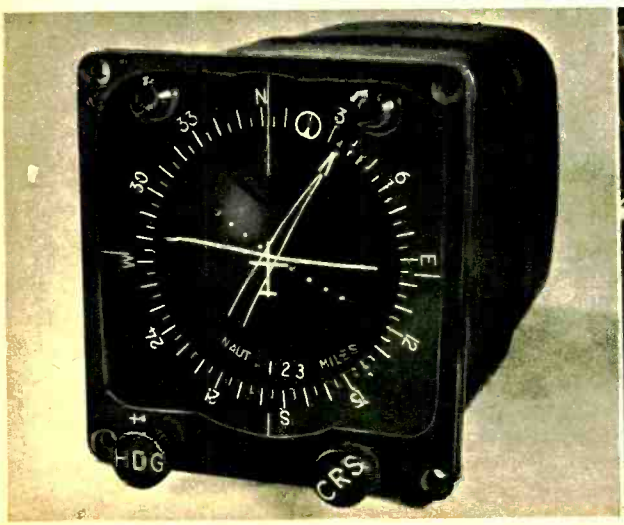
3. The BOMARC is launched automatically on a signal from the computer. During its supersonic flight to the target it is guided in course by the computer. Instructions from the computer go by land-line to a transmitter near the missile base and by radio to the missile.

4. When the BOMARC nears its flying target, it is tipped into a steep dive by the SAGE computer which then relinquishes control of the missile. Missile seeker system "locks on" the target and "homes" the missile to intercept.

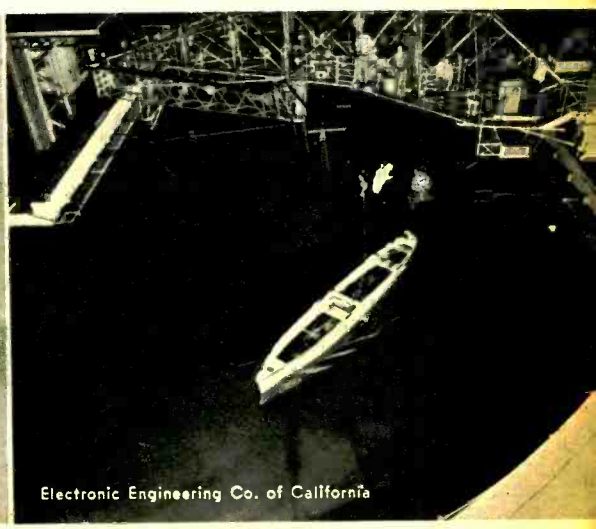
1. Radar detects approach of hostile aircraft. It obtains positional data on range and bearing. This information goes via telephone line to an IBM computer at the SAGE installation.

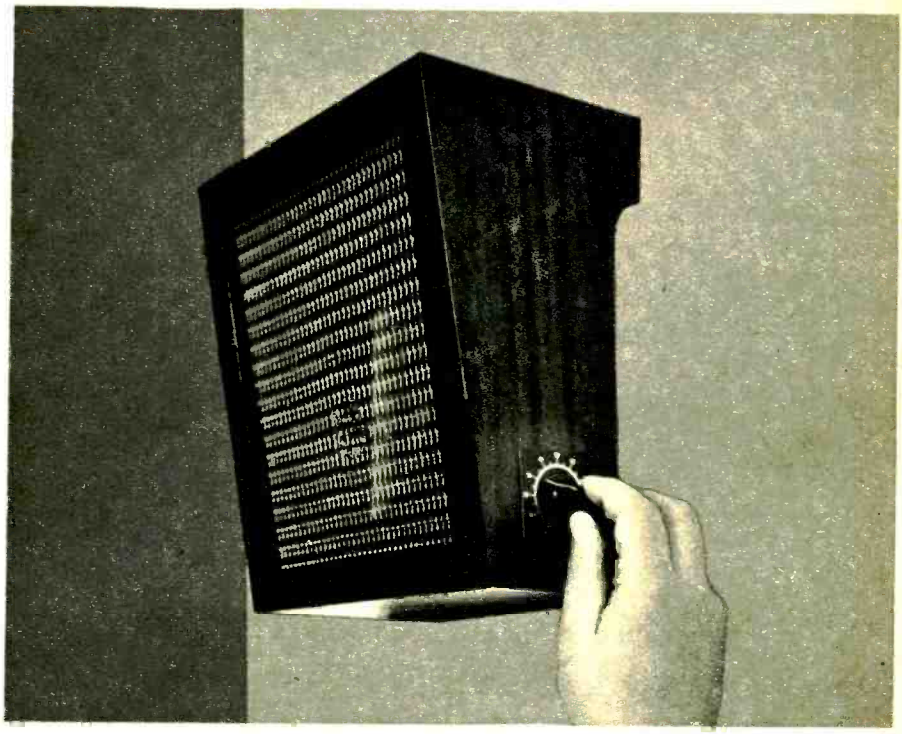
First fully automated air defense missile, the supersonic Bomarc, has been added to the SAGE system for push-button air defense of the United States. Heart of the completely automatic Air Force installation is an IBM computer.

This cockpit indicator, part of Sperry's all-weather helicopter computer system, gives craft's position with respect to ship and target.



Major hull designs are tested at Taylor model basin. Univac, IBM 704 tally and feed each other data by computer language translator.





Photos by Mike Bonvino

how to add a

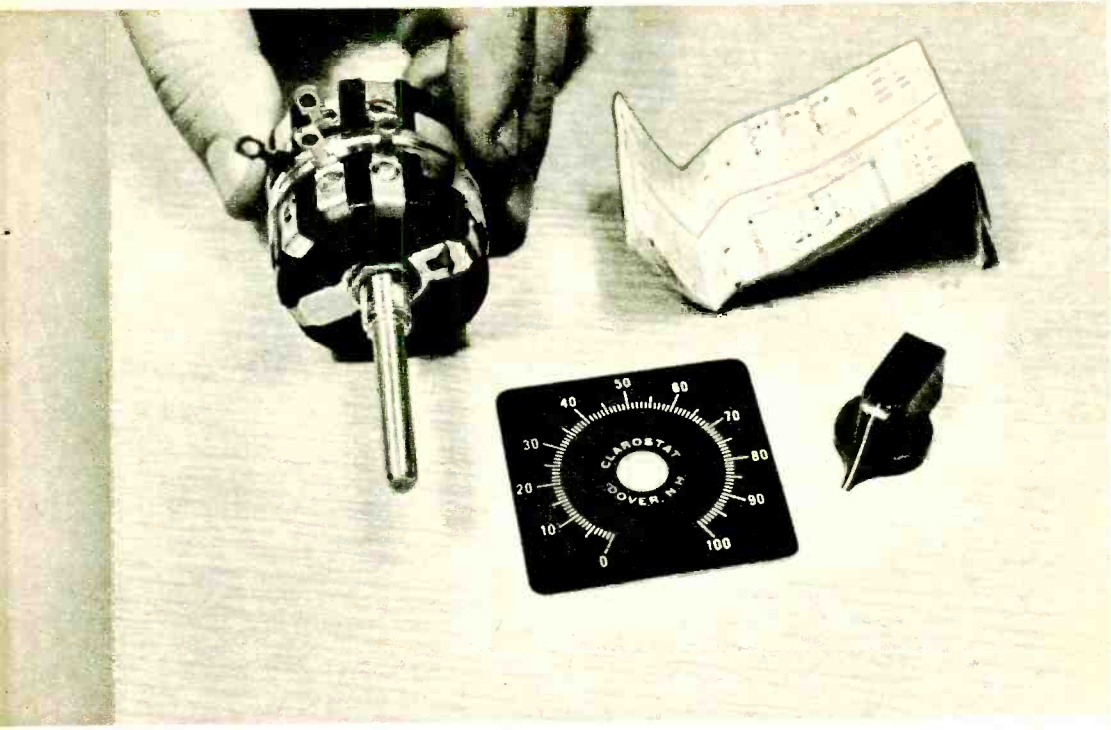
Volume Control To A Remote Speaker

By Len Buckwalter
Associate Editor

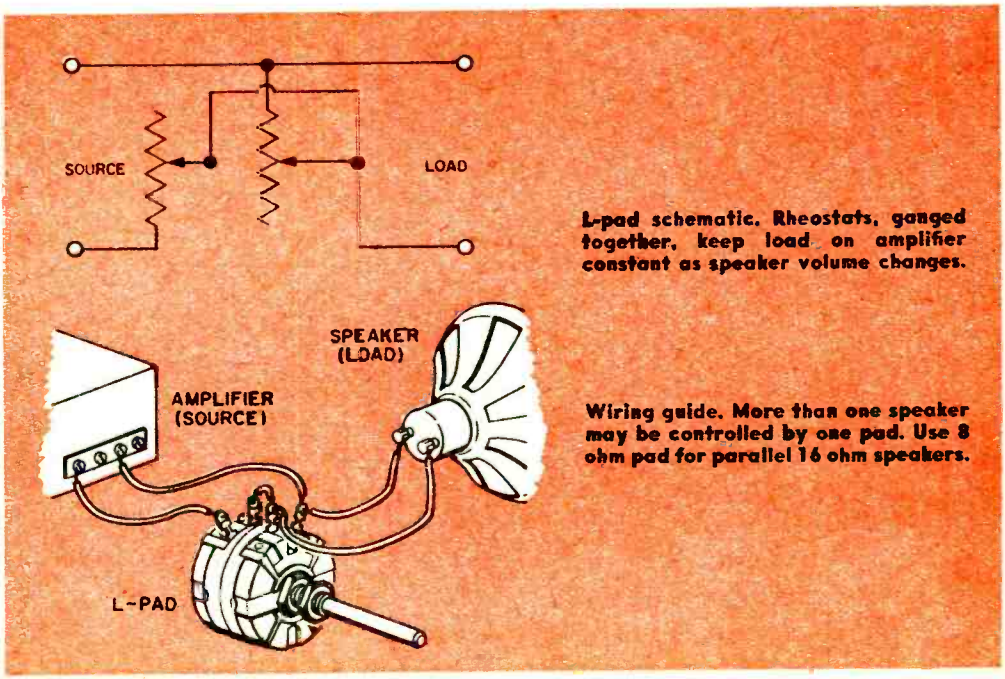
Use an L-pad to adjust the volume of two or more loudspeakers individually, with no interaction.

IF YOU plan to locate speakers in different rooms of your home, individual volume controls are a convenience. One of the most effective ways to do this is with an L-pad close to each speaker. The volume may then be adjusted to a comfortable level (or off altogether) without affecting any other speakers on the same line.

L-pads are available in many different values. Choose its resistance to match the speaker impedance, that is, an 8 ohm unit for an 8 ohm speaker. When several speakers are wired to an amplifier, each with a pad, the system must be properly matched. For example, two 8 ohm pads in parallel (use the "Source" leads) go to the 4 ohm amplifier tap, in series—to the 16 ohm tap.



The Clarostat CIL-8 comes with dial plate, knob, and diagram, and is capable of handling up to 10 watts of audio power. Its long shaft may be cut with a hacksaw to the desired length. The range of the pad is from "off" when the knob is at 0 on the dial plate, to .5 db when at 100.



L-pad schematic. Rheostats, ganged together, keep load on amplifier constant as speaker volume changes.

Wiring guide. More than one speaker may be controlled by one pad. Use 8 ohm pad for parallel 16 ohm speakers.

The ABC's of Electronics -11

By Donald Hoefler

This part describes the operation of a control grid in the triode, a three-element vacuum tube.

THE diode tube, explained last month, is useful for detection and rectification, but the list ends right about there. The electronic art therefore didn't really begin to get off the ground until Dr. Lee DeForest conceived the idea of a third element for the electron tube called the *grid*. With this, all sorts of new applications for tubes were discovered and electronics rapidly expanded.

All of these applications are based on the three principle types illustrated in Figures 1, 2, and 3. The triode can be used as a detector of audio or video modulation, as an amplifier of audio, video, or radio signals, and as a generator of any of these frequencies. And these three fundamental applications form the basis for almost entire the electronic art.

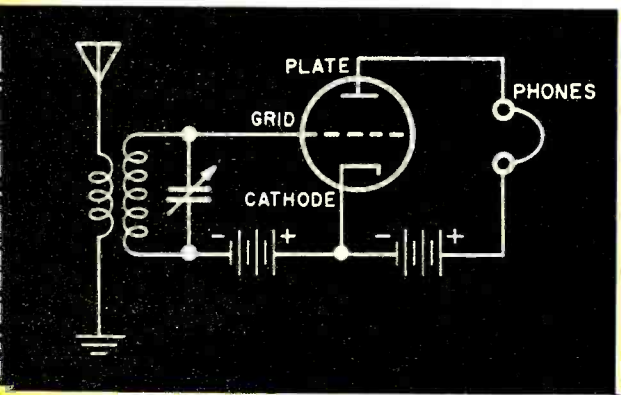
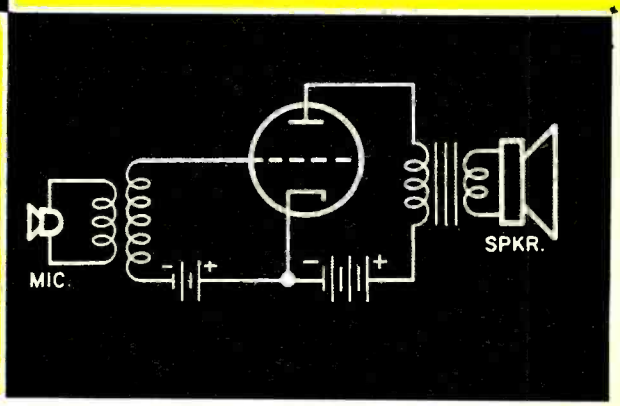


Fig. 1. Grid in an actual triode is located very close to the cathode to control plate current. A simple receiver is shown here.

Fig. 2. In this amplifier the microphone impresses a weak voltage on the grid of the triode to control a large plate current flow.



Centrally located in the triode is an electron-emitting cathode, which may be either a directly heated filament, or an indirectly heated cathode. Surrounding the cathode is the grid. This is usually a spiral winding of wire, whose turns are so spaced that the grid offers little physical obstruction to the electrons flowing from cathode to plate. Outside the grid is the plate, usually a cylindrical piece of metal. Electrical connection to each of the elements is made through wires leading to the prongs in the tube base.

The grid may be thought of as a gate, which can be electrically varied to control the rate of electron flow between cathode and plate. For this reason, in multi-element tubes having two or more grids, this one is known as the *control* grid.

The particular value of this grid is the fact that a voltage change in the grid circuit will produce a much larger change in plate current than can be caused by the same amount of voltage change in the plate circuit itself. For example, refer again to Fig. 2. We see that there are two batteries in this circuit, one providing a fixed voltage between plate and cathode, the other providing a fixed voltage between grid and cathode.

The AC voltage generated by the microphone will appear across the secondary of the audio transformer, where it may either add to or subtract from the negative *bias* voltage of the grid battery. Now suppose that the grid battery delivers minus 8 volts, and that at a given instant a negative signal adds another volt to it. Then, the total voltage appearing between cathode and grid at that instant will be 9 volts negative.

When this grid voltage changes from 8 to 9 volts, the plate current flowing through the primary of the output transformer will also change, perhaps in this case decreasing by 4 milliamperes. But now if we tried increasing the voltage of the plate battery by the same amount (1 volt) the plate current won't

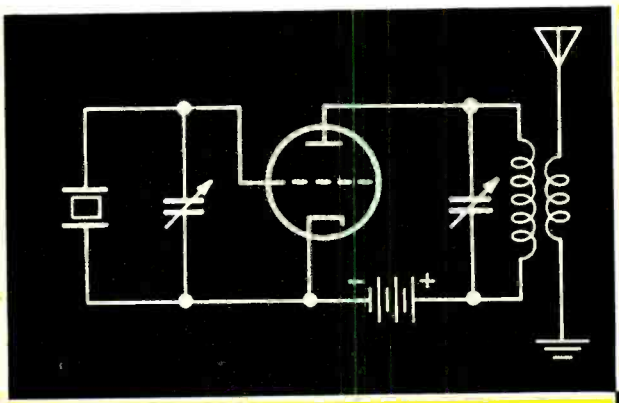


Fig. 3. Voltage produced by a crystal is amplified in tube. If some output is fed back to grid, sustained oscillation results.

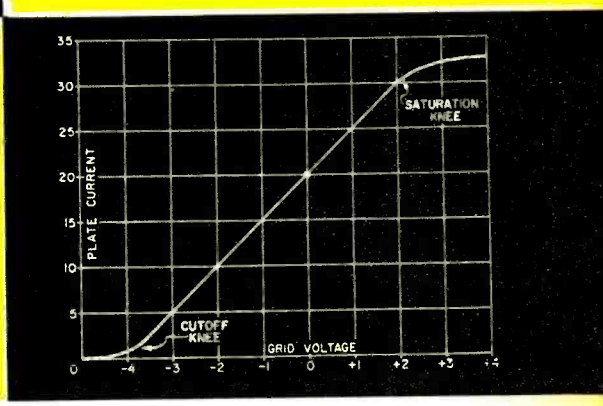


Fig. 4. Curve on this graph shows influence grid voltage on plate current. Note that —4.5 volts cuts off tube, +3 saturates it.

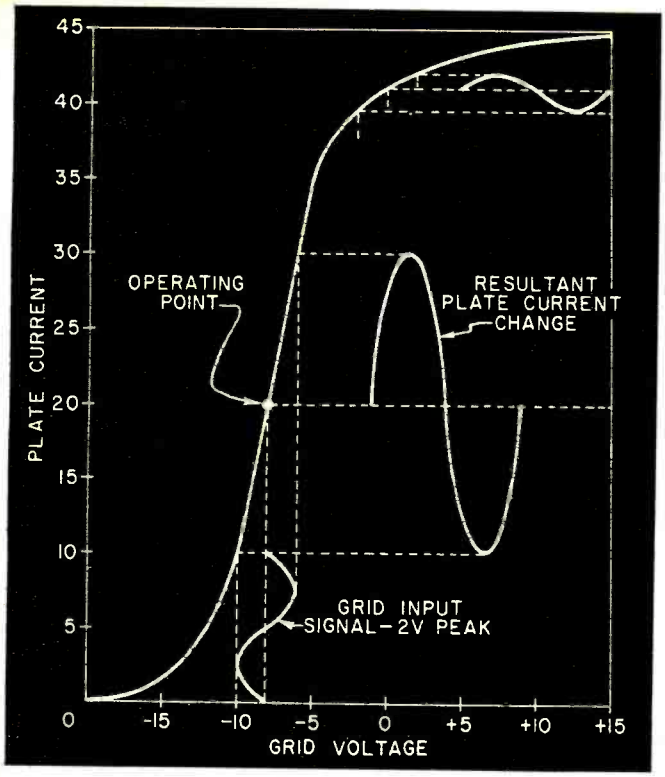


Fig. 5. As described in text, this tube characteristic curve demonstrates the purpose of using a negative grid bias.

go back up by 4 milliamperes, but possibly only a half a milliampere.

Furthermore, the change in plate current will also cause a change in the voltage appearing across the primary of the output transformer. In this case the current change of 4 milliamperes might result in a voltage change of 10 volts. But this whole process was initiated by a small 1 volt change on the grid. Obviously the tube has acted as an *amplifier,* delivering a change of 10 volts at the output when it received a change of only 1 volt at the input.

To understand how it works, let's go back a little and assume the triode to have correct operating voltages on the plate and cathode, but with the grid circuit open. Thus the grid is just hanging in space, with no voltage on it. Under these conditions the triode tube is practically the same as a diode. Except for the few electrons which collide directly with it in their flight from cathode to plate, the grid will have no effect whatever.

Now suppose we apply a small positive voltage to the grid. Since the electrons are negative, they will be attracted toward the positive grid. But since the grid has such an open structure, most of the electrons will fly right on past it and come under the influence of the plate. Some grid current will flow, but the most important effect will be a net increase in plate current, because more electrons will leave the cathode by the attraction of the positive grid, and then move through the grid and onto the plate.

A point will ultimately be reached where further increases in grid voltage will be ineffectual in boosting the plate current. This is indicated by the top bend in the curve of Fig. 4. The tube is then operating at its maximum capacity for delivering electrons under the existing conditions. This is one form of plate *saturation.*

Next let's apply a *negative* voltage to the grid of the same tube. Now the electrons coming out from the cathode will tend to be repelled by the grid,

[*Continued on page* 108]

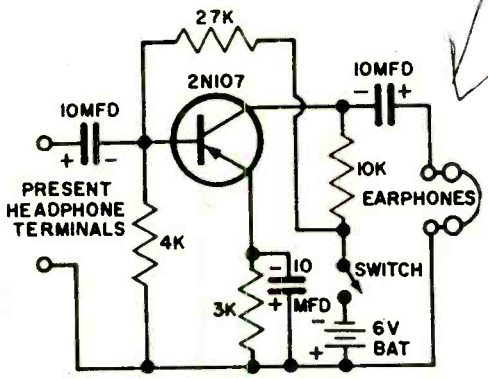
The Electronic Brain

Send in any questions on electronics. All queries will be answered either in this column or by mail.

Crystal Set Amplifier

Is there a way of boosting the volume of a crystal set with an amplifier? I do not wish to spend more than 5 dollars for extra parts.

Tom Shudic, Burbank, Calif.



The volume of your crystal set can be more than doubled for headphone use by incorporating a single stage of transistor amplification. It will be necessary to add a small battery, transistor, and other parts which should not cost more than three dollars. Be sure to keep the battery polarity correct as shown in the diagram.

Increasing Mine Detector Range

Can an Army mine detector rated at a penetration of three to five inches be converted so that it is effective for detecting metals at depths of six feet or more?

Gordon Broussard, Jasper, Texas

There is probably no other electronic device that equals the metal locater for sheer question-raising potential! Extravagant claims made by enthusiastic amateur constructors and sometimes even by sales-conscious manufacturers, have led to all kinds of misconceptions about these excellent devices.

The mine detector you describe is a beat-frequency oscillator type. As might be expected, the armed service that used it stated its penetration range conservatively. But even at that, few portable metal locaters are dependable beyond a foot or two at the most, especially under poor soil conditions. Soil texture, moisture content, the presence of mineral deposits—all affect the reliability of determinations made by using the BFO locater.

The range may be increased somewhat by using higher power; on the other hand, this requires larger tubes and heavy, expensive batteries. Worst of all, the law of diminishing returns is at work: an increase of 100% in cost may result in only a 5% improvement in performance.

The problem of detecting metal from 6 to 10 feet underground is not insoluble, however, provided that a sufficient mass of the metal exists. Another type of metal locater using crossed-hoops, based upon the principle of field rotation by conductors, is commercially available. The crossed-hoop variety can be used up to 20 or 30 feet under ideal soil conditions. These locaters, however, are quite bulky and expensive.

If you are interested, you could write to the Goldak Co., 1544 W. Glenoaks Blvd., Glendale 1, Calif. for information.

Component Values

In a parts list that accompanied one of your articles a 25 mmfd variable capacitor appeared. In the catalog, the variable capacitors are given with a maximum and minimum value. To which category does the 25 mmfd figure apply?

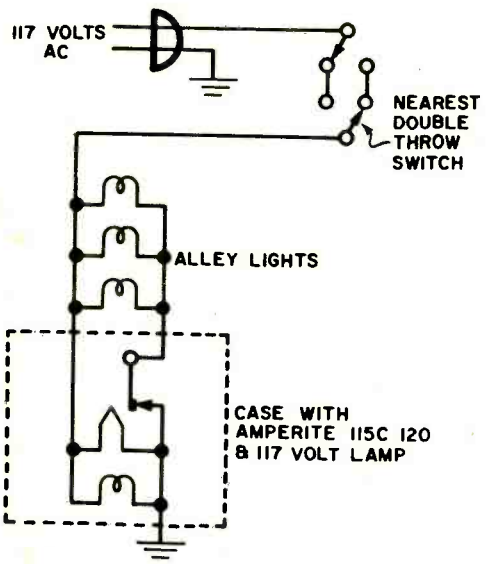
Dan Watts, Greenwich, Ohio

The value given in parts lists for variable capacitors is always the *maximum* value. The same holds true for the inductance value of coils that are tunable, usually by a slug.

Automatic Light Switch

My alleyway has three lights in parallel operated by three-way switches. Very often these lights are left on by the users, causing annoyance to others in the house. Can you tell me how to make these go off automatically after a reasonable period of time?

William J. Benson, New Orleans, La.



The diagram supplies a solution to your problem.

The principle of operation involves the use of a normally-closed thermal time delay relay having a lag of two minutes. This is more than enough time for anyone walking at a normal rate to cover a distance of 150 feet.

When the alley lights come on, the 117 volt heater of the relay is energized and the pilot light also comes on. After two minutes of delay, the contacts of the relay open, breaking the ground-return AC leg of the system. This turns out the alley lights, but the pilot light remains on. The relay heater will continue to hold the contacts open as long as the switches are in the ON relationship. The idea of the pilot light is to inform the next user that the switches are *wrongly* set so that they may restore the circuit to the OFF relationship. When restoration is accomplished, a wait of about thirty seconds will be required until the thermal relay has reset itself for the two minute delay period.

Perhaps this short wait (which, of course, represents a slight inconvenience) will discourage the users from leaving the switches on as they now do. The Amperite relay type 115C120 costs $2.35 and is available in delay periods starting at two seconds all the way to two minutes. If the two minute interval is too long, you can substitute one of the others.

TV Antenna Hints

I would appreciate constructional details for a TV antenna to cover channels 2 through 12. I am in a fringe area and quite close to a high steel water tower that affects the signals.

Clifford Cardwell, Fort Worth, Texas

Television receiving conditions in fringe areas are such that a "cover-all" antenna for channels 2 through 12 is generally unsatisfactory. When there is a metallic obstruction, the difficulties are intensified many fold. A home-made antenna in such a situation is, therefore, almost doomed to failure from the start.

There are ways to improve matters, however. The method or methods used depend entirely upon local conditions; unfortunately, these can be determined only by intelligent experimentation. Have you considered one or more of the following alternatives?

(1) A Yagi or beam antenna cut for those channels that provide the poorest reception at present. Such antennas are of appreciable help in fringe areas but are good for only one, or at the most, two channels.

(2) An antenna rotator used with a general coverage antenna such as a folded dipole-reflector-director type or the so-called "flying V." Rotation is often the only way to cure troubles caused by metal obstructions.

(3) A tunable TV booster.

EI is planning an article, to appear in the near future, that will give complete constructional details for a TV beam antenna. It will describe a dipole with a director and reflector, and how to figure out their lengths and spacing.

build your own

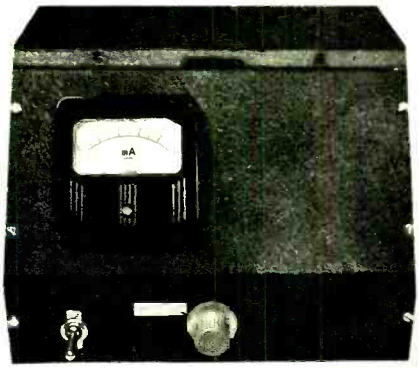
Weather Station-1

By Paul Hertzberg

Start with wind velocity, then add wind direction, humidity and temperature indicators, described later.

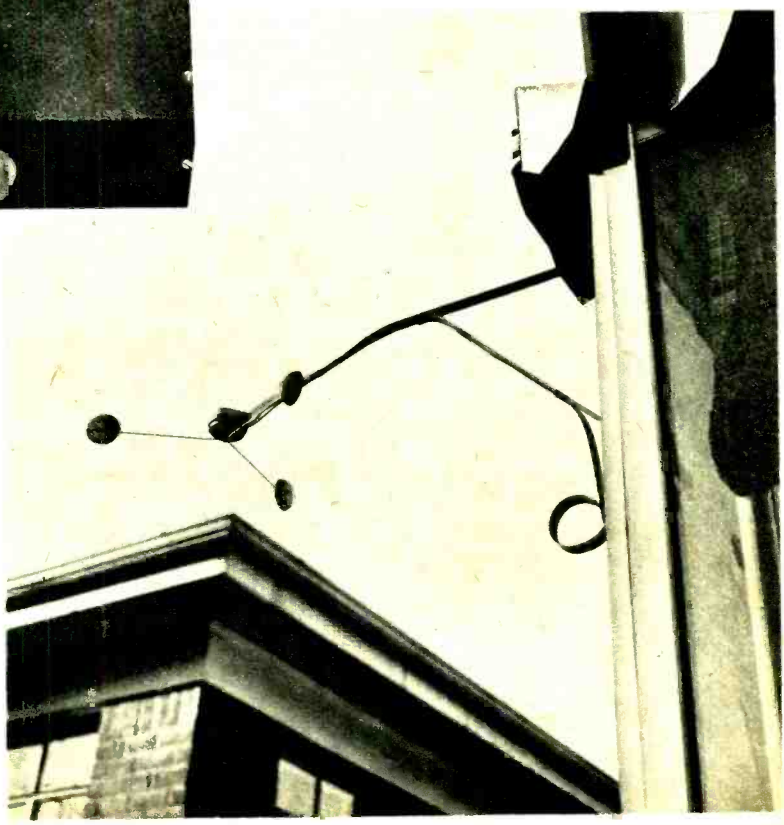
HOW'S the breeze for sail boating today? Is it too windy for flying model airplanes? An old AC clock motor, a transistor, meter, and some spare parts will give you a very good idea of the wind velocity. The heart of this system is an electric clock motor rotated by a wind catching device, the motor acting as an AC generator. Wind speed is then read off the meter.

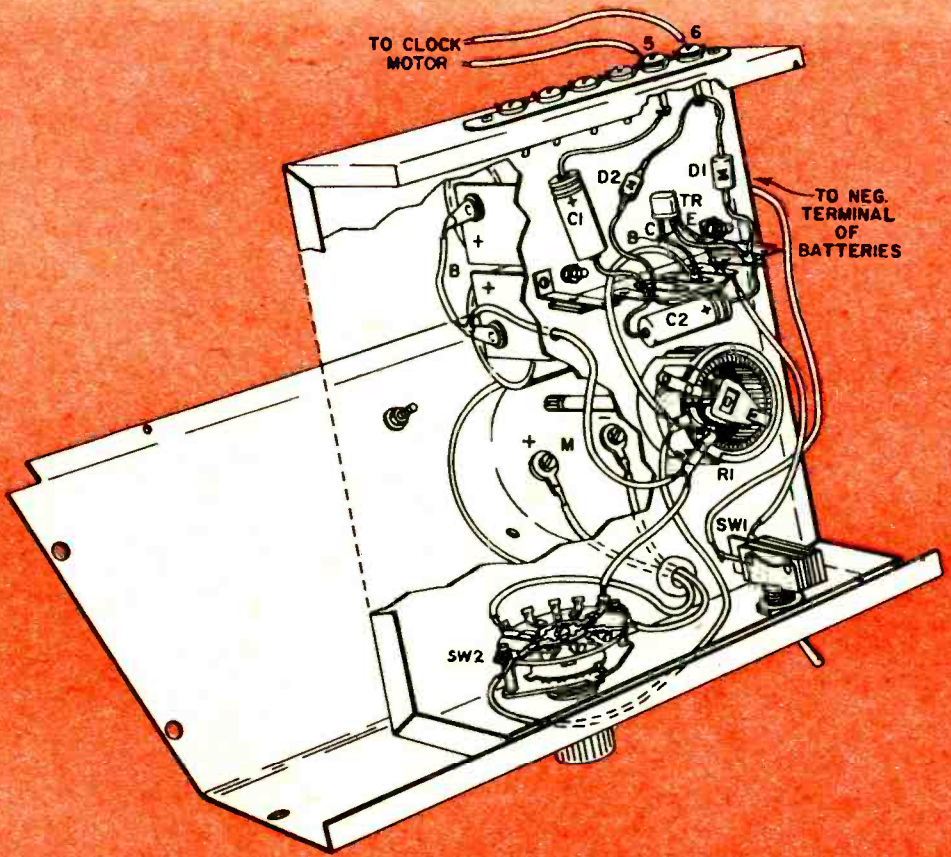
Clock motors can be purchased from numerous surplus houses

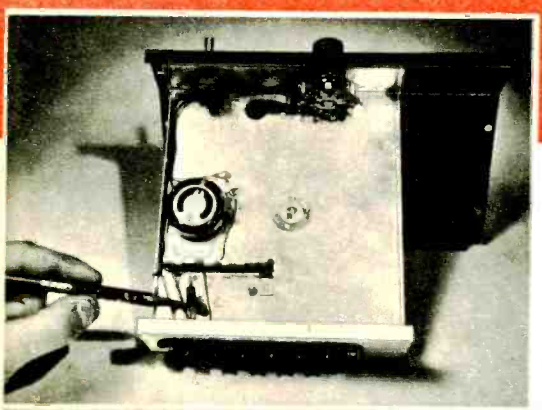


Meter at left indicates wind speed. The numbers will represent miles per hour, according to the motor used.

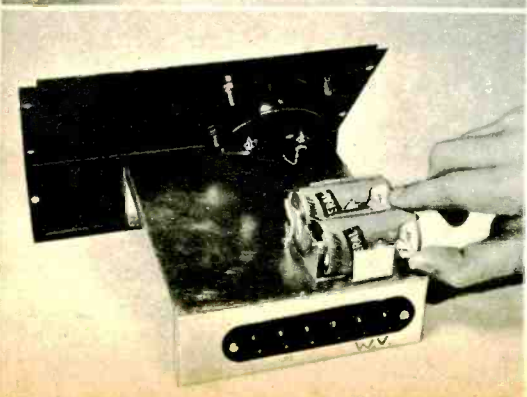
Three plastic cups drive the AC clock motor. TV-type twinlead is taped to bracket and brings voltage inside.







In guide above, large areas of unused panel and chassis space will accommodate other circuits to be described in future issues.



Underside of chassis (pointing to TR). The wiring, although the same as in guide above, has been cabled and run along chassis sides.

1.5 volt batteries in parallel power the transistor. Below, on terminal strip, "WV" (wind velocity) receives AC from motor.

for approximately one to two dollars, or one can be removed from an old clock and the gears discarded. To test the motor (now acting as an AC generator) connect it to the low AC voltage range of a VTVM or multimeter and spin the shaft by hand. The output will be higher when spun in one direction or the other. Mark the direction on the motor which gives the higher output. A quick spin on the motor used here produced 2½ volts!

The easiest method to mount the meter on the cabinet is to drill a series of small holes, use a chisel to rough out the hole and finish file the edges. The wind catching cups are made from three tablespoon-size plastic measuring spoons. The handles are cut off, leaving the concave cups. The hub is made from a short length of ¼" round brass. A small hole is drilled in one end to snugly fit the motor shaft. Three arms are made from $\frac{1}{16}$"x7" piano wire spaced 120 degrees apart and sweat soldered into small holes drilled in the brass hub. The cups are attached to the ends of the wires by means of two small holes in the cup's rim and held in place with Duco cement. Make sure the cups are all faced properly to catch the wind and turn the hub of the generator in the direction previously marked. The shape and style of the generator holder is left to the imagination of the builder but provisions for weatherproofing should be made. A decorative wrought iron bracket is shown in the photos and fastened to the edge of the house where it will receive the full force of any wind that is blowing.

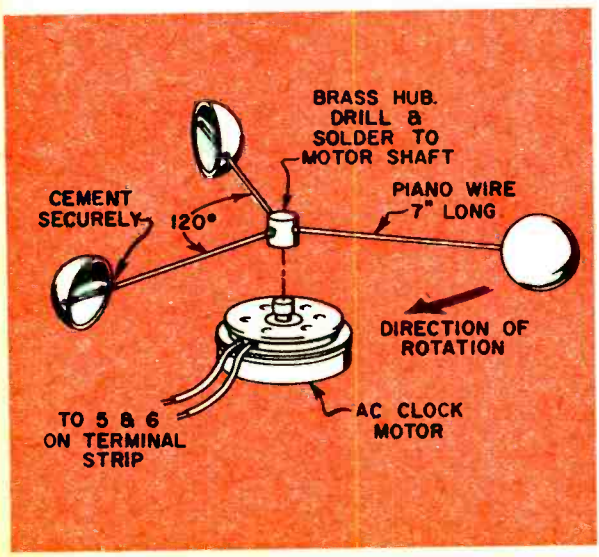
The AC output from the generator is sent to the voltage double rectifier circuit and filtered. The resulting DC is applied to the transistor amplifier circuit using a 0-1 ma DC meter that will read full scale with an input of .15 volts. The full range of the meter needle is

[*Continued on page* 105]

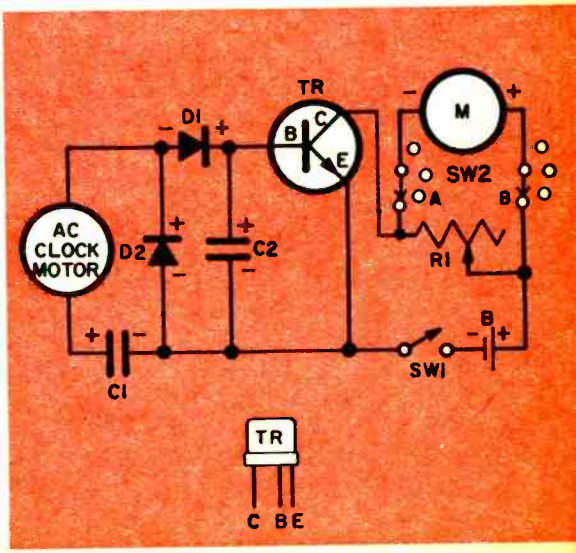
PARTS LIST

C1,C2—50 mfd, 15 volt electrolytic capacitors
R1—500 ohm potentiometer, ½ watt
D1,D2—1N34A diode
TR—2N35 transistor
SW1—SPST toggle switch
SW2—Rotary switch 2-pole 4-position
M—0-1 ma DC meter
Clock Motor—AC synchronous type (designed for 117 volts AC, 60 cycles)
B—2 size D flashlight cells, 1.5 volts each
Misc.—Cabinet and chassis (Bud #CI585B with chassis #C-38), battery holder, terminal strip, screw type terminal strip, twinlead

Detail of wind cups and mounting. Use sealing wax on the motor case to keep out moisture.



Schematic and pin arrangement of TR. Empty contacts on SW2 will be used for other devices.



IMPORTANT!

Fill out and mail this Postage-Free card today
(attached below)
for your copy of the fact-packed CREI booklet

First Class
Permit No. 288-R
Washington, D. C.

BUSINESS REPLY MAIL
No Postage Stamp Necessary If Mailed in United States

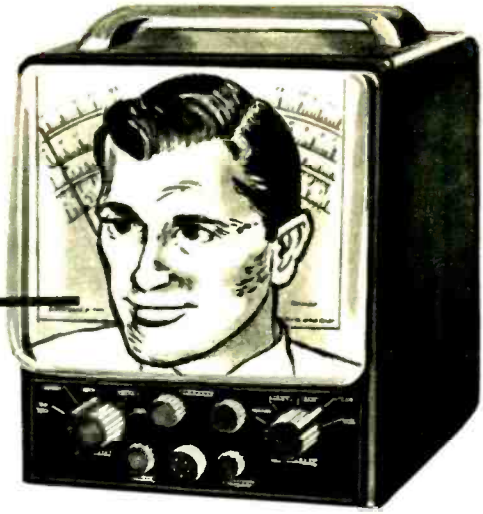
Postage Will Be Paid By

CREI
CAPITOL RADIO ENGINEERING INSTITUTE

3224 SIXTEENTH STREET, N.W.
WASHINGTON 10, D. C.

3-234-7

TEST YOURSELF



Is your future in ELECTRONICS hit-and-miss? Or is it solidly based on knowledge of Electronic Engineering Technology?

CREI Home Study Removes the Guess-Work. No matter what your present work is, if you have had electronic experience, avocational or vocational, and a high school education, CREI training will prepare you for a secure, successful career. Enjoy the increased income, job security and satisfaction that come only to trained men.

Benefits Felt Right Away. Almost immediately after enrollment you feel the benefits of CREI training. Your employer, when informed of your step toward advancement (only at your request), is certain to take new interest in you and your future. What you learn in CREI Home Study can start helping you do a better job immediately, or pave the way for you to get into the wonderful world of electronics . . . on a *paying* basis.

CREI HOME Study—The Sure Way. Since 1927 CREI has given thousands of ambitious men the technical knowledge that leads to more money and security. It takes just one $10-a-week raise to repay your investment in CREI training, and leave you a substantial bonus the first year. Lessons are prepared by experts. They are easy to understand. There is a course geared to the field in which you want to specialize (see postcard). You study at your own speed. The active student body today numbers more than 10,000. Students are all over the world—in every phase of military and civilian electronics.

Industry-Recognized. As a graduate of CREI you'll find your diploma the key to success, a door-opener to the vast field of electronics. Leading firms recommend CREI training for their own personnel. Among them are All American Cables and Radio, Inc.; Canadian Broadcasting Corp.; CBS; Gates Radio Co.; Federal Electric Corp.; The Martin Co.; Douglas Aircraft Co.; Voice of America; Canadair Ltd.; Trans-Canada Air Lines; United Air Lines. Their choice for training of their own personnel is a good cue for *your* choice of a school.

Placement Bureau. CREI maintains constant contact with industry, and cooperates with employers and graduates in making satisfactory placements. This free service is available to students as well as graduates.

High School Education Essential. This is professional training, but you don't have to be a college graduate to benefit. You do have to be willing to study at home. You can do it while holding down a full-time job. Thousands have. For example—"In less than two years I have almost doubled my salary and have gone from wire-man to engineering assistant and now to Junior Engineer. I have CREI to thank."—Frank A. Eckert, 22 Clover Lane, Levittown, Pa.

Electronics experience is not required for admission to CREI Residence School, offered at the same high technical level. Day and evening classes start at regular intervals. Qualified graduates earn "Associate in Applied Science" degree.

What you do in the next few months may well decide your success in electronics. One thing is certain—the longer you delay, the longer you defer your sure rewards. Write today for "Your Future in the New World of Electronics." Use post card at left. Tuition is reasonable, terms easy. Available to veterans under GI bill.

CAPITOL RADIO ENGINEERING INSTITUTE

ECPD Accredited Technical Institute Curricula
Founded 1927

Dept. 175-F
3224 16th St., N.W.,
Washington 10, D. C.

Fastest Airborne Brain

At twice the speed of sound, B-58 relies on compact electronic package to keep from destroying itself.

WHEN the Air Force set out to build the world's fastest manned bomber, only part of the problem was aircraft design. That was solved by Convair with four turbojets and the needle-nose, delta-wing B-58 (Hustler), capable of more than twice the speed of sound (Mach 2). But who could be expected to pilot a plane flying literally "out of this world" at temperatures and altitudes and speeds never before reached by man? Certainly not man alone, for even a slight error in judgment would cause the aircraft to disintegrate in a violent maneuver.

The answer was that the Hustler and futuristic aircraft to follow needed a flight control system to cover all possible flight conditions including all altitudes and speeds. The system would actually have to *think ahead* of the pilot—human or automatic. It would have to perform a multitude of calculations beyond human capability and then translate these into just the right deflection of the plane's rudder and elevons. (Elevons on the delta-wing Hustler combine the functions of elevators and ailerons on more conventional aircraft.)

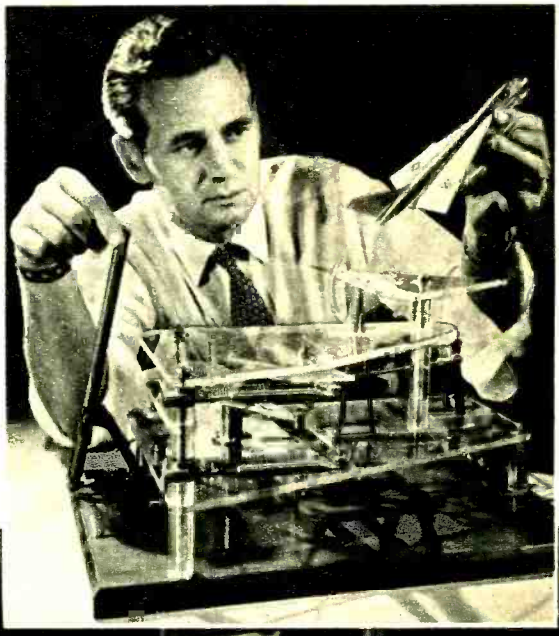
This "power thinking" flight control system definitely was not a "do-it-yourself" project. It took over 600 persons at Bendix Aviation's Eclipse-Pioneer division three years to perfect—not bad time when you consider that the amplifier computer, the "brain" of the B-58, is packed with 140 transistors, more than 2,000 resistors and condensers, three miles of wire, 14 motors, 60 potentiometers, 15 synchros and assorted gears. All in a space of 2.2 cubic feet!

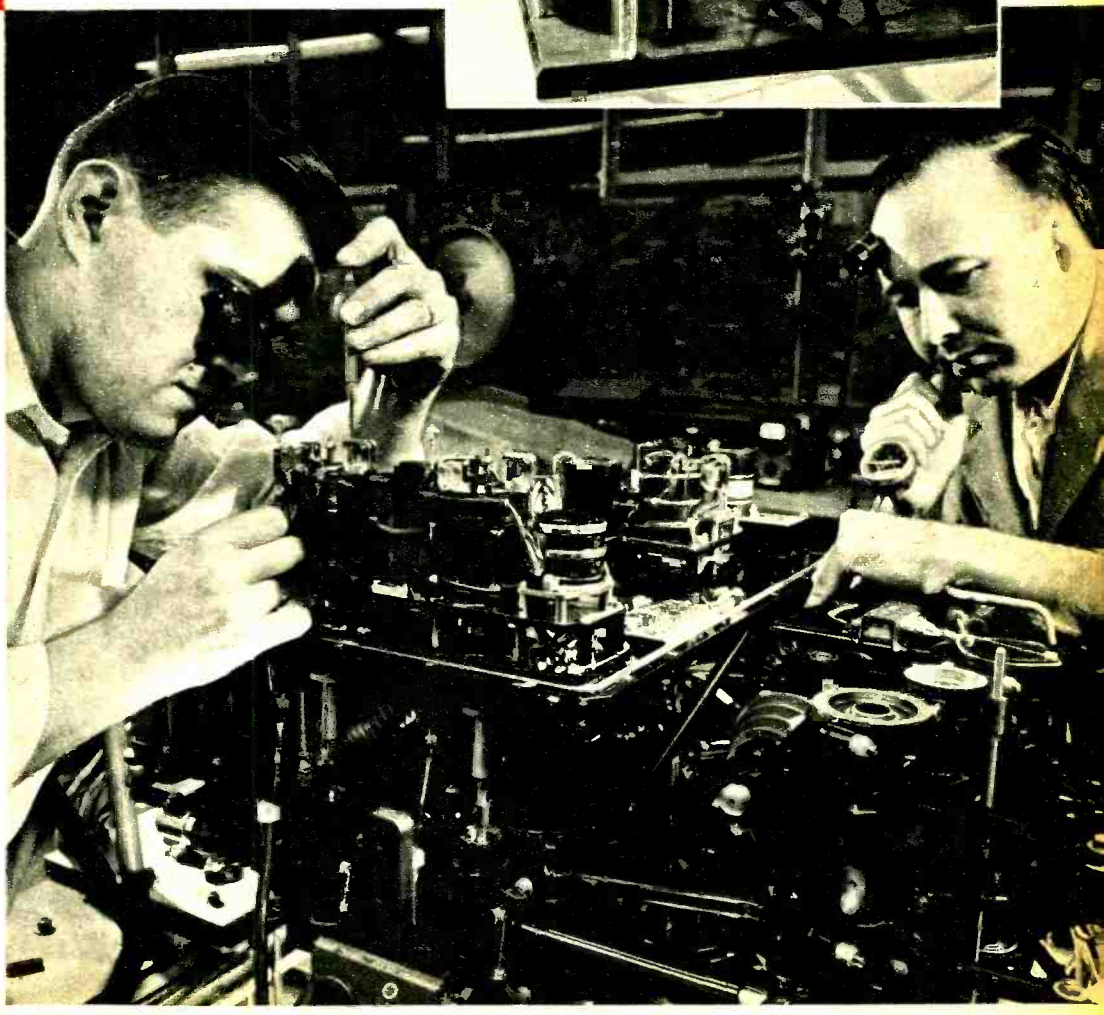
Wouldn't it have been cheaper and faster to have employed a flight control system already [*Continued on page* 113]

B-58, on takeoff run at left, is first plane man cannot fly without control system that thinks ahead of pilot.

Pilot's control stick motions pass through linkage system after ratios are figured by electronic computer.

Electromechanical unit below, part of Hustler's brain system, translates electronic signals into linear motion.





Movies and Stereo Sound

Continued from page 30

magnetic tracks occupy the regular CinemaScope positions and there is a half-width optical track where standard optical tracks are usually found. This optical track is not stereo, but allows the one film to be used in any theater.

Several multitrack sound systems use some kind of code impulse on the film to "key" the loudspeakers in and out of action. This adds to their effectiveness by keeping the loudspeakers quiet until they need to be used.

Another way of making stereophonic sound is aimed at overcoming the problem of converting projectors to "read" the sound. Perspecta Sound, as it is called, uses only one sound track, but this track carries inaudible code frequencies that actually cue automatic electronic controls so individual sounds come from where they should, using three loudspeaker channels, all behind the screen. This was used to some extent with both CinemaScope and Vistavision, more for overseas showing than in the United States.

Had it come sooner than its first appearance in 1955 it might have saved theater owners some of their investment. But it arrived too late for the home market.

Right now, the movie industry is moving off in two directions. The Cinerama and Todd-AO "road show" presentations make movies a de-luxe affair, requiring very expensive equipment and are designed for people looking to spend an evening "on the town." Most other theaters have let stereo lapse. They are merely showing the single sound track version with wide-screen pictures.

The public is used to wide screens and it must have them. It's what makes the movie theater "more" than they can get on their home TV. This fact gives us a clue to probable future development.

In the home, stereo is new. It has not fully arrived, although it is well on the way to public acceptance. This development will in due course, reflect in theater requirements. The public's ears will become educated to stereo sound in the home just as their eyes have become accustomed to pictures via television in their homes. At that time one-track sound in the theater will permanently lose its satisfaction.

When you can get good stereo sound in your living room, the theater will have to give you something "extra" in stereo sound. The "road show" presentations are undoubtedly effective in this respect, and will continue to expand their activities. But they can never effectively serve all the smaller communities previously served by the local movie houses.

The magnetic track used by CinemaScope and others has definite advantages over the old optical track. Apart from making the picture producer's job easier by enabling him to play back a sound track immediately without processing delays, it extends the quality possible in the theater. Both frequency and dynamic range can be extended by changing from optical to magnetic.

But in the original hurry to "marry" stereo sound to wide-screen pictures, full advantage was not taken of this possible improvement. At the same time, the Perspecta approach managed to improve the quality of the sound and put stereo into a single track, saving money, unfortunately, after it had been spent.

Both systems have become practically dormant, partly because they did not realize their full possibilities and failed to make a satisfactory combination for really superb performance, and partly because the audience was not fully ready to appreciate the contribution of stereophonic sound. Too much improvement had been going on in too many directions at once for the average person to keep pace.

The continued success of Cinerama and Todd-AO proves that stereo, properly done, will pull in audiences. Progress on the "home front" with stereo sound will once more increase the theater incentive and bring into being some dramatic improvements in your neighborhood houses. Stereo in the theater has possibilities stereo in the home cannot touch in the way of special effects that need an auditorium for presentation. What Disney's "Fantasia" attempted to bring to audiences in sound that surrounds will yet be achieved—and surpassed.

Radio Controlled Ferry Boat

Continued from page 42

pieces of ½" thick sheet balsa. On this, erect the two end bulkheads of ¼" sheet balsa, then add the two sides of the same material. Install the remaining bulkheads. Curved up extension pieces of ¼" sheet are added at either end, and the bottom sheeting added at either end of the hull. All joints are by glue only. Note the construction of the extension pieces through which the drive shaft bearing passes. The keel, prop housing, and keelson, can be added when convenient.

The main deck is next. Glue side by side the necessary pieces of ⅜" sheet balsa. When dry, even off both ends, and add the crosswise end pieces which prevent warping. The lift-off section of the deck is cut out by using a balsa knife or single-edge razor blade. When it can be removed, even off the ends, removing enough material to allow the addition of the crosswise pieces shown to prevent warping. If the motor or batteries project up through the deck in your installation, cut the necessary hole directly under the cabin portion.

The two-level cabin is made from ¼" sheet balsa. The lower level is simply a box, with the upper deck added (made from ¼" sheet balsa pieces glued side by side), and then the upper cabin added. This upper cabin also is ¼" sheet balsa. Note that its front and back ends slope in toward the roof. The roof edges are beveled with a sandpaper block. Finally, the main deck lift-out portion, and the two cabins, one atop the other, are glued together as a unit.

For smooth sanding, it is best to sand the hull, the deck pieces, and the cabins, before assembly. Balsa sanding sealer can be brushed on after the first sanding. Sand the sealer with fine paper until high spots show bare wood. Then follow up with as many coats of sealer and sandings as desired. Six coats and sandings give a smooth foundation for painting.

Before painting be sure the keel and other structural members are complete. The ladder and brass railings can be added afterward. The $\frac{1}{16}$" brass tubing used for the railings can be bent easily around a small bottle. Joints are soldered.

The hull is painted white above the water line, red below. The deck sides and cabins are yellow with black windows. The stack is green and the two decks and insides of the deck sides, gray. Use light colors first then, with masking tape, put on the darker colors.

For a neat finish at least three coats of colored dopes are required. Sand after the first and second coats with wet-and-dry paper. A top finish requires at least six coats of color. If harder woods are used other types of paint may be substituted.

As a final check float test the boat in the bath tub. It should ride down at the bow; this is because of the weight of the motor and wet cell batteries

BILL OF MATERIALS

Quantity	*Specification*	*Material*	*Use*
2	½"x3"x36"	sheet balsa	hull bottom
6	⅜"x3"x36"	sheet balsa	deck
7	¼"x3"x36"	sheet balsa	sides of hull, bulkheads, fore and aft bottom sheeting, cabin sides, top deck
2	3/16"x3"x36"	sheet balsa	sides above deck, various small pieces as required
2	1 sq. x 1"	balsa block	supports socket plate (optional)
1	1¾"x1½"x1"	balsa block	stack
1	10"x¼"x2"	pine or hd. wood	blind nut plates
1	1½"x1"x2"	pine or hd. wood	rudder support
1	⅜"x2⅝"x6½"	plywood	rudder housing keelson

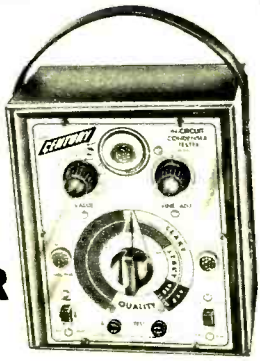
(use scraps from above sheet balsa for other parts not called out)

Miscellaneous: 30 in. of 1/16 brass tubing; 2 in. Sterling nylon propeller and shaft set; 1 universal; 4¾ in. of 3/16 brass tubing; set of (4) 4-40 blind nuts and machine screws; battery boxes, switches, jacks, sockets, actuator—depending on radio used and builder's choice; 2 pt. cans balsa sanding sealer; 2 4-oz. bottles white dope; 2 4-oz. bottles red dope; 1 4-oz. bottle yellow dope; 1 4-oz. bottle gray dope; 1 4-oz. bottle black dope; one #45 Double-Per Mag/electric motor or motor of choice; 3 #23 Aristo wet cell batteries; batteries to suit radio; 6-oz. cement (tubes).

SHIPPED ON APPROVAL

an IN-CIRCUIT CONDENSER TESTER *THAT DOES THE WHOLE JOB!*

The CT-1 actually steps in and takes over where all other in-circuit condenser testers 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 CONDENSER TESTER Model CT-1

Model CT-1 — housed in sturdy hammertone finish steel case complete with test leads only **$34.50** Net

in-circuit checks:

- Quality of over 80% of all condensers even with circuit shunt resistance present . . . (leakage, shorts, opens, intermittents)
- Value of all condensers from 200 mmfd. 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 100% of all condensers . . . (leakage, shorts, opens and intermittents)
- Value of all condensers from 50 mmfd. 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 precision 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 even greater accuracy
- Isolated power line

Check all power rectifiers in-circuit whether SELENIUM, GERMANIUM, SILICON, etc. with the

IN-CIRCUIT RECTIFIER TESTER Model SRT-1

Model SRT-1—housed in sturdy hammertone finish steel case complete with test leads ..... only **$29.50** Net

With the growing trend towards compactness, portability and low price, TV manufacturers are resorting more and more to producing series-string TV sets employing selenium, germanium or silicon power rectifiers. Now the need for an in-circuit rectifier tester is greater than ever.

THE SRT-1 CHECKS ALL POWER RECTIFIERS IN-CIRCUIT AND OUT-OF-CIRCUIT WITH 100% EFFECTIVENESS FOR:

✓ Quality ✓ Fading ✓ Shorts ✓ Opens ✓ Arcing ✓ Life Expectancy

OUTSTANDING FEATURES

- Checks all types of power rectifiers rated from 10 ma. to 500 ma. (selenium, germanium, silicon, etc.) both in-circuit or out-of-circuit.
- Will not blow fuses even when connected to a dead short.
- Large 3" highly accurate multi-color meter . . . sensitive yet rugged.
- Separate meter scales for in-circuit and out-of-circuit tests.
- Cannot damage or over heat rectifier being tested.

SIMPLE TO OPERATE

Just clip SRT-1 test leads across rectifier under test right in the circuit without disconnecting rectifier from circuit. Press test switch and get an instant indication on the easy-to-read three-color meter scales . . .

ALL CENTURY INSTRUMENTS ARE GUARANTEED FOR ONE FULL YEAR

The extremely low prices are made possible because you are buying direct from the manufacturer.

TRANSISTOR TESTER Model TT-2

Every day more and more manufacturers are using transistors in home portable and car radios . . . in hearing aids, intercoms, amplifiers, industrial devices, etc. Since transistors go bad the need for TRANSISTOR TESTER is great. They can develop excessive leakage, poor gain, shorts or opens.

The TT-2 is an inexpensive quality instrument designed for accurate and dependable tests of all transistors and diodes — quickly and accurately.

OUTSTANDING FEATURES

- Checks all transistors, including car radio, power output, triode, tetrode and unijunction types for current gain, leakage, opens, shorts, cut-off current
- Checks all diodes for forward to reverse current gain
- All tests can be made even if manufacturers' rated gain is not available
- Less than half a minute required for tests of either transistors or diodes
- Large 3" meter is extremely sensitive yet rugged . . . with multi-color scales designed for quick easy readings
- Power is supplied by an easy to replace 6-volt battery — current drain so small, service life almost equal to shelf life. Battery cannot be drained due to accidental shorting of test leads
- Cannot burn-out its own meter or damage transistor or diode under test
- Long test leads and insulated test clips enable tests without entirely removing transistor from circuit
- Test leads are identified by E.I.A. color code so that connection to the correct terminal is assured
- Comes complete with replaceable transistor set-up chart that fits into a special rear compartment.

Model TT-2 — housed in sturdy hammertone finish steel case complete with test leads . . . only **$24.50** Net

IMPORTANT FEATURE: The TT-2 cannot become obsolete as the circuitry is engineered to enable you to check all new type transistors as they are introduced. New listings will be furnished at no cost.

EASY TO BUY IF SATISFIED
see order form on facing page

FOR 10 DAY *FREE* TRIAL

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.

Convince yourself at no risk that CENTURY instruments are indispensable in your every day work. Send for instruments of your choice without obligation . . .

STILL THE BEST SELLING TUBE TESTER IN THE FIELD

FAST-CHECK TUBE TESTER

Model FC-2

The greatest testimonial ever paid an instrument . . . over 20,000 sold in a little more than a year—and still selling as fast as we can produce them. See for yourself at no risk why so many servicemen choose the FAST-CHECK above all other tube testers — regardless of price.

Model FC-2 — housed in hand-rubbed oak carrying case complete with CRT adapter . . . only **$69.50** Net

SIZE: W: 14⅝" H: 11¼" D: 4⅜"

Just 2 settings on the FAST-CHECK TUBE TESTER tests over 700 tube types completely, accurately — AND IN SECONDS!

PICTURE TUBE TEST ADAPTER INCLUDED WITH FAST-CHECK

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

No other tube tester made at any price can match the value of the FAST-CHECK.

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. 0Z4s, 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.

IMPORTANT FEATURES

● No time consuming multiple switching . . . only two settings are required instead of banks of switches on conventional testers ● No annoying roll chart checking . . . tube chart listing over 700 tube types is located inside cover. New listings are added without costly roll chart replacement ● Checks each section of multi-section tubes and if only one section is defective the tube will read "Bad" on the meter scale ● 41 phosphor bronze beryllium tube sockets never need replacement ● 7-pin and 9-pin straighteners mounted on panel ● Large 4½" 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 line voltage variation ● 12 filament positions ● Separate gas and short jewel indicators ● Line isolated — 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.

NEW . . . For those looking for a real ECONOMY MULTIPLE SOCKET TUBE TESTER without sacrificing *ACCURACY, SPEED and VERSATILITY*

MINI-CHECK TUBE TESTER

Model MC-1

Here is a multiple socket tube tester designed to meet limited budgets. Although low in price it boasts a unique circuitry that enables you to check over 600 tube types — and has a range of operation that far exceeds others in its price class.

Model MC-1 — housed in sturdy wrinkle finish steel case ..... only **$39.50** Net

SIZE: W: 9" H: 8½" D: 2¾"

OUTSTANDING FEATURES

● Checks emission, inter-element shorts and leakage of over 600 tube types. This covers 0Z4s, series-string TV tubes, gas regulators, auto 12 plate volt, hi-fi and foreign tubes ● 3 settings enable a test of any tube in less than 10 seconds ● Employs dynamic cathode emission test principle ● 3½" D'Arsonval type meter — most accurate type available . . . its greater sensitivity means more accuracy . . . its jewel bearing means longer life ● 17 long lasting phosphor bronze tube sockets ● Combination gas and short jewel indicator ● 9 filament positions ● Handy tube chart contained in special back compartment ● New tube listings furnished periodically at no cost ● Detachable line cord

plus these BONUS FEATURES . . . found in no other low price tube tester

✓ Checks for cathode to heater shorts ✓ Checks for gas content ✓ Checks all sections of multiple purpose tubes . . . will pickup tubes with one "Bad" section ✓ Line isolated — no shock hazard ✓ Variable load control enables you to get accurate results on all tubes ✓ Positively cannot become obsolete as new tube types are introduced.

CONVENIENT TIME PAYMENT PLAN — NO INTEREST OR FINANCING CHARGES

CENTURY ELECTRONICS CO., INC.

CHECK INSTRUMENTS DESIRED

- ☐ Model CT-1 In-Circuit Condenser Tester ..... $34.50 — $9.50 within 10 days. Balance $5 monthly for 5 months.
- ☐ Model SRT-1 In-Circuit Rectifier Tester ..... $29.50 — $4.50 within 10 days. Balance $5 monthly for 5 months.
- ☐ Model TT-2 Transistor Tester ..... $24.50 — $4.50 within 10 days. Balance $5 monthly for 4 months.
- ☐ Model FC-2 Fast-Check Tube Tester ..... $69.50 — $14.50 within 10 days. Balance $11 monthly for 5 months.
- ☐ Model MC-1 Mini-Check Tube Tester ..... $39.50 — $9.50 within 10 days. Balance $6 monthly for 5 months.

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

111 Roosevelt Avenue, Dept. 405, 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 .....

which, due to their size, had to be located as shown on the plans—under the cabin. To make the boat float level, add lead ballast toward the stern. A pound or more of lead might be required in a severe case. This weight means nothing to the boat which then rides just a speck deeper in the water.

This flotation test is a good time to pinpoint the exact location of the water line as a guide to the under-water portion of the paint scheme.

To insure a tight fit of the removable portion of the deck, "blind nuts" can be installed under hardwood blocks beneath each of the four corners; four machine screws with large washers to prevent the heads pulling through, can be inserted through holes drilled in this part of the deck, and down into the blind nuts. When tightened, these screws pull the deck down tightly and will compress any watertight seal made of rubber, thin rubber weather stripping, etc.

Focus On Sunspots

Continued from page 55

Most significant, however, was the discovery by radio operators in the early 1930s that radio reception turned freakish every 11.2 years, too. Sunspots are thought to be solar cyclones on the gaseous surface of the sun. They appear dark because they are about 1500 degrees cooler than the sun's surrounding skin temperature of 11,000°F. In size, the spots range from a comparatively small 500-mile width, to an enormous 50,000 miles.

When the sunspot cycle reaches its low point (the last was in April 1954) there are days or weeks in which not a single spot mars the sun's blinding disk. Conversely, at the recent peak, one month alone (October 1957) saw a count of 269 spots. This was a resounding solar salute to the International Geophysical Year, which had purposely set its opening date of July 1, 1957, to coincide with the expected sunspot maximum.

In fact, July 1 itself featured one of the greatest solar flares to erupt from the sun's surface. It tossed flaming gases 100,000 miles into space at a speed of 700 miles per second with a force equal to 100-million H-bombs. What causes solar flares? The sun, as a gigantic atomic reactor, spews radiations and nuclear debris out of its spots. The spots themselves may be looked upon as magnetic whirlpools (4000 gauss) which churn up the sun's chromosphere until it blows its top.

Those solar flares, born out of sunspots, are what affect radio, television and radar systems. The IGY, in conjunction with the United States Bureau of Standards, has set up a permanent world warning center at Fort Belvoir, Virginia. Reports of flares by International Flare Patrol observatories come into the center, which alerts all earth to expect disruptions in communications.

The disruptions come in various stages. Within eight minutes, at the speed of light, ultra-violet and X-rays span space and reach the earth's upper atmosphere. Absorbed there, they usually cause a sudden blackout of radio reception that may last for a few hours. Later, clouds of electrons bombard earth, causing magnetic storms that also result in fading radio signals, plus increased static from lightning. About two days later, a barrage of subatomic particles hits the earth causing freakish changes of radio range and bewildering upsets of all radio communications.

All these barrages from the solar flares somehow work their trickery by altering the ionosphere, the shell of electrified particles that surround us 50 to 600 miles above our earth. The several major layers of the ionosphere act as mirrors which reflect radio waves angled from earth. These reflections can, in turn, be reflected back to the ionosphere many times until they bounce around the world.

The layers are somewhat selective as to wavelength. The D layer, not usually considered a true part of the ionosphere, circles the earth 35 to 50 miles high and reflects only extremely long waves of low frequency. This is not too important to worldwide communications since these longwave frequencies are seldom used.

The E layer, 55 to 85 miles high, bounces back the AM broadcast band. Clouds of relatively dense ionization sometimes appear at the height of the E

Lafayette - ELECTRONIC PROJECT HEADQUARTERS FOR THE EXPERIMENTER AND HOBBYIST

6 TRANSISTOR SUPERHET RECEIVER KIT
with LATEST NPN-PNP TRANSISTORS

- GE 2N188A AUDIO TRANSISTORS IN PUSH-PULL OUTPUT
- 100% SUBMINIATURIZED
- NEW 28 PAGE INSTRUCTION MANUAL

NEW 27.50 Less Case and Battery

This transistor set provides superior commercial quality. Circuitry features 6 transistors and diode, matched loop, oscillator coil and IF's and transformer coupled push-pull audio. Speaker and earphone jack for private listening. Complete kit includes detailed instructions. 6½ x 3½ x 1⅝". Shpg. wt., 3 lbs.

KT-119A —Complete Kit—Less Battery and Case ..... Net 27.50
BATTERY — BURGESS 2N6 .. Net 1.30
MS-339A-Brown leather case with carrying strap ..... Net 2.95
MS-366—Sensitive Matching earphone ..... Net 1.29

3 TRANSISTOR SUPERHET POCKET RADIO KIT

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

A truly sensitive, super-selective pocket superhet receiver. Features matched components, built-in ferrite antenna, compact circuitry and commercial appearance. Complete kit with detailed instructions. 4⅛ x 2⅝ x 1-1/16". Shpg. wt., 1 lb.

KT- 116— Complete Kit, less earphone and battery ..... Net 14.95
MS-260—Super Power Dynamic Earphone ..... Net 3.95
or MS-368—Sensitive Economy Dynamic Earphone ..... Net 1.44
Battery 9V. RCA V5309 ..... Net 1.13

4 TRANSISTOR TELEPHONE PICKUP AMPLIFIER KIT

- FOR GROUP LISTENING OF PHONE CONVERSATIONS

Extra-sensitive 4 transistor telephone pickup amplifier with "class "B" push-pull output for efficient speaker operation. Merely requires pickup coil under or near phone. Also may be used as high gain amplifier for phono and mike. Easy-to-follow instructions. Size 4½ x 4¼ x 4¼". Shpg. wt., 3 lbs.

KT-131—Complete Kit Less Battery & Pickup Coil ..... Net 17.95
BATTERY RCA VS305 (9V) ..... Net 1.30
MS-16—Telephone Pickup Coil ..... Net 1.95

NEW! STEREO BALANCE INDICATOR

The Most Versatile Instrument Offered The Hi-Fi Enthusiast

- UNIQUE 2 COIL GALVANOMETER TYPE PRECISION METER MOVEMENT
- 7 RANGES OF METER SENSITIVITY
- EFFORTLESS BALANCING OF STEREO SYSTEMS
- MAY BE USED AS VU METER AND TAPE RECORDER LEVEL INDICATOR

ONLY 11.95

Solves all stereo balancing problems. Each stereo channel feeds a separate coil through a full-wave bridge rectifier. When both signals are equal and balanced there is a resultant 0 deflection. 2 slide switches permit individual channel measurement. A 7 step range control for efficient use at all amplifier power levels. Scale calibrated in Volume Units. Metal case, satin gold finish. Size 4⅝" x 5½" x 4¼".

TM-66 Stereo Balance Indicator ..... Net 11.95

NEW! LAFAYETTE PROFESSIONAL STEREO MASTER AUDIO CONTROL CENTER

KT-600
79.50
ONLY 7.95 DOWN IN KIT FORM
WIRED 134.50

Solves Every Stereo/Monaural Control Problem!

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

A REVOLUTIONARY DEVELOPMENT IN STEREO HIGH FIDELITY. Provides such unusual features as a Bridge Control, for variable cross-channel signal feed for elimination of "ping-pong" (exaggerated separation) effects and for 3d channel output volume control for 3-speaker stereo systems; 3d channel output also serves for mixing stereo to produce excellent monaural recordings. Also has full input mixing of monaural program sources, special "null" stereo balancing and calibrating system (better than meters), 24 equalization positions, all-concentric controls, rumble and scratch filters, loudness switch. Clutch type volume controls for balancing or as 1 Master Volume Control. Has channel reverse, electronic phasing, input level controls. Sensitivity 1.78 millivolts for 1 volt out. Dual low-impedance outputs (plate followers), 1300 ohms. Response 10-25,000 cps ± 0.5 db. Less than .03% IM distortion. Uses 7 new 7025 low-noise dual triodes. Size 14" x 4½" x 10⅝". Shpg. wt., 16 lbs. Complete with printed circuit board, cage, profusely illustrated instructions, all necessary parts.

LAFAYETTE KT-600 — Stereo Preamplifier kit ..... Net 79.50
LA600 Same as above completely wired ..... Net 134.50

20,000 OHM PER VOLT MULTITESTER SEMI-KIT

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

ONLY 11.95

The semi-kit is a new concept in test equipment kits. All the important or difficult parts are already mounted. All that remains to be done is to mount and wire in a few small parts — a job so simple you'll finish before you realize it, and best of all, you'll have one of the finest high sensitivity multitesters on the market. When used in a circuit, the high input resistance on all DC and AC ranges does away with the highly inaccurate readings common to low resistance testers which load the circuit. Ranges: DC Volts, 0-10-50-250-500-1000; AC Volts, 0-10-50-250-500-1000; DC CURRENT, 0-500 ua, 0-10-250 ma; OHMS, 0-10K-100K-1 meg; DECIBELS, -20 to +36; *PLUS* 0-5000 henries and 250 mmf. to .02 mfd. Black case 5¾" x 3¾" x 1⅞". Complete with test leads, all parts, and instructions. Shpg. wt. 3 lbs.

TK-10 KIT ..... Net 11.95

FREE! 1959 CATALOG

260 GIANT-SIZED PAGES

Lafayette Radio EIE9 P.O. BOX 511 JAMAICA 31, N.Y.

NAME _____

ADDRESS _____

CITY _____

ZONE _____ STATE _____

☐ Send FREE CATALOG 590

Lafayette Radio 165-08 LIBERTY AVENUE JAMAICA 33, N. Y.

NEW YORK, N.Y.	BOSTON, Mass.	BRONX, N.Y.	NEWARK, N.J.	PLAINFIELD, N.J.
100 6th Ave	110 Federal St.	542 E. Fordham Rd.	24 Central Ave	139 W. 2nd St.

layer. This is called sporadic-E ionization and it accounts for much of the night-time short distance amateur work on lower frequencies (3.5 and 7 mc). After intense sunspot activity, it can send transmissions on the 50-mc band up to 500 miles.

The F-1 layer, 100 to 125 miles high, and the F-2 layer, 155 to 220 miles, reflect shortwave bands from 4 to 30 mc. The two F layers exist together during the daytime and somewhat interfere with each other, making a poor radio wave reflector. This improves at night when the sun's daily bath of radiations is gone. The F-1 layer then vanishes and the F-2 layer, now plain F, extends lower and bounces waves sharply back to earth.

Without these ionized blankets around earth, radio broadcasts would go straight out into space and never return, except for a few signals reaching as far as the horizon. The VHF and UHF frequencies generally are not reflected by the ionosphere at all. Hence, television and radar have line-of-sight range only.

When a solar explosion, triggered by sunspots, hurls its nuclear fallout to earth the ionosphere is beefed up so heavily that the F layers can bounce back frequencies up to 60 mc. This includes television Channel 2 in the United States, as well as television channels of many foreign countries that go as low as 45 mc. Thus, for freakish intervals, television images from Europe and South America can reach our screens and vice versa. More often this phenomenon creates "ghosts" on most TV screens and is a nuisance to the viewer.

Excessive radiation in the E layer also cause fading and static in the AM broadcast frequencies, but this is a comparatively minor deviltry. The most dramatic effects are on short-wave transmissions. The solar bombardment intensifies and shifts the F layers so that their bouncing range is greatly extended. This is why police calls of one city can interfere with those in another. Paradoxically, this is "better" reception from the standpoint of distance, but for radio specifically designed for short range operation, it is an unwelcome event. When St. Louis police officers hear of a robbery in Chicago, and the Chicago police find themselves listening to a report of a shooting in Detroit . . . well, it's murder!

Perhaps radio hams alone delight in these strange antics of the hopped-up ionosphere, for it often allows them to pick up the most distant hams with comparative ease. But sunspots may also cause weird and complete blackouts of nearby radio reception. This can be tragic in the case of disaster areas where all lines are down and short-wave radio is the lone contact with the outside world.

One ham, caught in a hometown flood, found that he couldn't get through to anybody in America. But he managed to raise a ham in Japan who relayed his signal back to a city near the flood area. His trouble call went a total of 16,000 miles back and forth across the Pacific in order to reach rescue crews a few miles away.

A sunspot-proof world communications system is a high priority project of the Advanced Research Projects Agency. By mid-1961 our government expects to use satellites to relay messages around the world. Encouraged by the success of the Atlas communications satellite during the 1958 holiday season, the U. S. has made plans to launch at least three satellites specifically designed for communications, followed by four more in 1961. Early satellites will receive and transmit messages at the rate of 2000 words per minute, using 20 different radio-teletype channels on the same frequency. A worldwide TV relay network is also possible through the use of satellite stations. Establishing a satellite in orbit about 25,000 miles above the Equator, it would remain always above the same point on the rotating earth. Three such stations would cover the globe.

At that time communications people will be free of the whims of sunspots and the ionosphere. Radiomen of the future will no longer have to brace themselves every 11 years, and future hams will hear "unbelievable" stories from their fathers about how tough it was when he was a ham back in 1959 battling it out with sunspotty reception.

CAN YOU QUALIFY FOR THIS SELECT CIRCLE?

Graduate Specialist, U.S. Army

CHOOSE YOUR TECHNICAL SCHOOLING BEFORE ENLISTMENT

For high school graduates and seniors only... Developed for you by today's Army . . . a special educational program for high school graduates and seniors *only*. If you qualify for the Army Graduate Specialist Program, you can *choose* the exact technical schooling you want . . . and have your choice guaranteed *before* you enlist.

Technical training worth thousands of dollars! Graduate Specialists study and work with the select circle of Army technicians who are *pioneering* many of the exciting technological advances of our times. That's why Army Graduate Specialist schools can offer you the finest technical schooling and equipment—at no cost to you!

Pick from 107 courses . . . Successful candidates can choose from 107 valuable Graduate Specialist courses. Up-to-the-minute technical schooling in electronics, accounting, automotive repair, guided missiles, finance, atomic weapons and many more. Here's a chance to get a *real* headstart in the field that interests you most.

Seniors have unusual option . . . To become a Graduate Specialist, you must pass certain qualification and aptitude exams—and be a high school graduate. But seniors can apply *before* graduation and enlist *after* . . . choosing from the *widest range* of available courses.

Course guaranteed without obligation . . . When you're accepted as a Graduate Specialist, you receive a letter guaranteeing your assignment to the course you've chosen—when and if you enlist. Remember! Even with this written guarantee in your hand, you still don't have to enlist. That means you *get* the course you want . . . or you *don't* enlist!

Don't miss out! Graduate Specialist appointments in each course are *limited* and quotas for popular courses fill up quickly. *This week*, get details from your local Army recruiter.

GET CHOICE, NOT CHANCE . . .

Graduate Specialist, United States Army

Continued from page 77

elections since its first television use.

Another outstanding computer achievement was its concordance of the Holy Bible. The entire volume was read into the computer, which sorted it all out and delivered a complete alphabetical listing of the exact location of every word in the text. This was the first Biblical concordance attempted since James Strong's "Exhaustive Concordance" of 1894. Strong devoted 30 years of his life to the task. The electronic computer did it in 120 hours.

A computer was also responsible in 1955 for a series of calculations that enabled American astronomer Dr. Paul Herget to rediscover the "lost" Eighth Moon of Jupiter, a tiny satellite which had not been seen through any of the world's most powerful telescopes since 1941. The only known method for keeping track of as dim and irregularly-orbiting an asteroid as Jupiter VIII is to mathematically forecast its position a certain number of days in advance, then to focus a telescope on that precise spot and see if it's there. Using the figures of the 1941 sighting as its base, the Univac computer calculated 40 years' worth of 10-day projections spanning the period between 1940 and 1980—a job involving eight mathematical variables and a half-million separate calculations —in 20 minutes.

On January 25, 1955, when the Mt. Wilson Observatory focused its 100-inch telescope on the spot dictated by the computer, the "lost" moon of Jupiter was found. It has been estimated that a computer will need 500 man-hours to make similar 40-year predictions on all our Solar System's 1,600 asteroids, whose positions will take on added significance in this space age. The same job, done with a desk calculator, would take no less than 2,000 years.

A digital computer at the U. of Illinois has contributed to the arts by composing music for a string quartet. Random numbers become notes, rhythmic beats, etc. The rules of composition are fed in, and the machine then works everything over electronically.

Digital computers have been successfully pressed into service for long-range weather forecasting, traffic control and analysis, sports handicapping, and as ground-based controls for the initial powered flight of intercontinental ballistic missiles. IBM 704 has even been programmed to play an exciting game of chess.

Unquestionably, however, the area in which digital computers have so far been most generally applied is that of business and industry. Electronic data processing eliminates human drudgery in routine paperwork, thus freeing personnel for more productive assignments. It gives management an unprecedented degree of administrative control through its automatic creation of timely and comprehensive reports.

Manufacturers, for example, have been quick to apply the new technique to their problems of inventory and production control. Properly programmed, any general-purpose digital computer can tell a manufacturer how to keep his stocks of raw materials, parts and finished products at the best economic levels. It can also give him accurate production schedules based on projected market requirements and the availability of needed parts, and it can enable his factory to hold to that schedule by dictating the movement of the right materials to the right place at the right time—all this while taking on such routine tasks as payroll and general accounting.

Banks, insurance companies and public utilities have realized enormous savings in time and money through electronic accounting and statistical analysis. Sales and marketing organizations of all kinds use computers to keep their executives informed on the trends emerging from daily business activity. Some department stores have established control systems in which clerical and statistical automation begins the instant a sale is made, through the use of electronic reporting devices installed on the selling floor. A centralized computer gathers all the sales data behind the scenes, and by next morning the buyers are supplied with a printed analysis of the previous day's business.

What about the future of electronic computation?

For one thing, it is rapidly becoming

the present. New and better computers, both analog and digital, are being produced. Remarkable strides have been made in the miniaturization and improvement of computer components through the use of "solid-state" devices —ever-smaller transistors, resistors, diodes, and magnetic cores—which not only permit greater capacity in less space, but eliminate circuit failures inherent in the use of vacuum tubes.

As for projected future applications, they are very nearly as many and various as the imagination will allow. In medicine, for example, a computer may soon perform the work of a diagnostician: symptoms will be fed into the equipment and a reliable diagnosis, even suggested treatments will emerge from it. The Army has already contracted for the development of small, rugged, mobile computers that would give battle commanders the facts they need on a rapidly changing tactical situation.

In industry the time is not far off when a fully automatic office will issue production orders to a fully automatic factory—with computers not only dictating courses of action, but physically activating and controlling production. One pioneering step in this direction was made recently when engineers of Daystrom, Inc., began installation of a transistorized digital computing system at a Louisiana steam power station. The Daystrom computer can be programmed to provide automatic, continual control over actual plant operating conditions —precisely measuring temperatures, flows, pressures—and instantly analyzing and reporting any irregularities.

Looking further into the future, computers will play a role of paramount importance in the age of manned space travel. They will, in fact, be in the vanguard of every scientific development for many years to come.

Meanwhile, the "electronic brain" has already had a profound effect on patterns of human living. Americans of a century ago witnessed the Industrial Revolution; we are now witnessing the Computer Revolution, which may prove to be the most powerful social and scientific force ever known.

Experimenter's Breadboard

Continued from page 71

stock clips for terminating small parts such as resistors and capacitors. These are spaced about 2¼ inches apart, a convenient distance for easy connection of parts that have pigtails. These clips will also hold the leads of transistors, pilot lamps, and any other components equipped with leads normally soldered in place in finished equipment.

There is no reason why your experimentation should be limited to octal base tubes. It is easy to make up 7-pin, 9-pin, loctal, or any other socket adapter from an old tube base and a sturdy Bakelite miniature tube socket of the type you want to use. Here is the recommended procedure for making reliable adapters. Obtain a burned-out glass octal tube having all eight base pins in the base. Wrap the tube in several thicknesses of any cloth and strike the glass a sharp wrap with a hammer. Clean away the glass shards with a pair of longnose pliers, then soak the tube base in boiling water for about 5 minutes. This softens the cement inside the base and allows you to pry the remaining glass splinters away with a screwdriver. Be careful not to apply too much pressure on the thin Bakelite base lest you crack it.

Now apply a very hot iron to the outside of each base prong for a few seconds, then shake the base with a snap of the wrist to remove the solder inside each pin. Pull out residual tube base leads with the pliers and repeat the cleaning out process until you can see daylight through the hole in each pin. Next, solder a three inch lead of #24 or #26 tinned wire (bare) to each lug on the miniature socket and pass these through the corresponding numbered octal pin, pulling each lead tight until the miniature socket is snug against the top of the tube base. Finally solder each lead in its respective pin, making sure that there is no socket twisting that might allow leads in the base to touch each other. Be sure solder runs into the pin from the outside; use the solder sparingly so that you won't have to do too much filing once the job is finished. Cut the leads off flush with the end of each pin and file smooth. The hollow base may be filled with molten paraffin or sealing wax, if desired, although this is not strictly necessary. The extra pin connection for the 9-pin socket is made to a small Fahnestock clip mounted on one end of the socket cleat.

A breadboard should have a flexible source of power. The power supply described here is designed so that you can obtain any voltage from zero up to about 300 volts (at 50 ma) merely by the twist of a knob! Furthermore, it does not use any high-power rheostats or bleeders.

Layout of components and wiring is not at all critical. The power supply should be equipped, however, with clearly labelled output binding posts for easy connection to the breadboard or any other equipment under test. Five-way "Jumbo" binding posts are ideal for this particular use because they permit connection by means of a banana plug, a phone pin, a spade lug, an alligator clip, or a bare piece of wire. The power supply is also equipped with a standby switch that turns off the high voltage while the filament power remains on. (HIGH VLT on the chassis.)

To test the operation of the power supply, connect a suitable load resistor such as a 7500 ohm, 20 watt resistor across the output terminals in parallel with a voltmeter having a 0-500 volt range. With the potentiometer fully counterclockwise, turn on the FILS switch and allow the tubes to heat for 15 seconds. Then throw the HIGH VLT switch on and slowly rotate the potentiometer clockwise while you observe the voltmeter. There should be a smooth buildup of voltage from zero to maximum.

If you wish, you may connect a 110 volt, 6 watt (candelabra base) incandescent lamp across the B+ and B— terminals and perform a similar test. At full clockwise setting of the control potentiometer, the voltage will be approximately 200 volts at 70 milliamperes and the lamp will be lit like a photoflood.

A novel feature of the power supply is the method used to avoid a heavy bleeder for capacitor discharge. SW2 is a single-pole, double-throw toggle switch. When set on the ON position, it merely serves as a return path for the centertap of the transformer to ground.

When thrown to OFF, a 1000 ohm resistor automatically discharges the output capacitor almost instantly, while C1 and C2 discharge through the same resistor in about 2 seconds. Thus, the shock hazard so common in power supplies is completely eliminated without placing a drain on the system by the use of a permanent resistance bleeder.

Weather Station—1

Continued from page 87

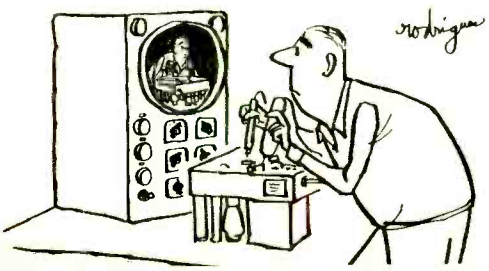
controlled by the 500 ohm variable resistor. The lower the resistance setting of this control, the lower will be the maximum needle indication.

Different motors will produce AC voltage outputs differently from that of the motor specified here. In some cases it may not be necessary to use the voltage doubler circuit. On the other hand, some motors have a very low output and will cause a full scale deflection only in a hurricane.

You can calibrate your meter against the local weather bureau forecast or by holding the bracket and its cup assembly out a car window while in motion and note the car speedometer and the meter readings. This method of calibration is entirely satisfactory when carried out on a calm day. Head or tail winds will give false meter readings.

The extra panel and chassis space will be used in the future for additional circuits and the mounting of parts for other projects using the same basic meter movement as an indicator.

Next month you will be shown how to add a wind direction indicator to your weather forecaster for very little additional expense—it lights up to indicate direction.



A Transistor Megaphone

Continued from page 61

talk switch is closed. Volume could be controlled by varying the value of resistor R2 but this isn't necessary since it can be very satisfactorily adjusted by varying the mouth-to-mike distance and the loudness of the speaking voice. Output volume is rather difficult to measure but, with a 12-volt supply, it's quite easy to drive the five watt speaker to distortion. The unit has been used with a single six-volt lantern battery carried in the hip pocket and volume, even on six volts, is adequate for many applications. Whatever power source is used, be careful to observe correct battery polarity or the transistor may be damaged. Remember that some autos have the positive battery terminal grounded.

Audio quality has not been sacrificed for the sake of economy. The output is very clear and crisp within the lower frequency limit of three or four hundred cycles set by the speaker and the upper limit of approximately nine hundred cycles set by the carbon mike. In other words, distortion is not objectionable for the speech frequencies.

5-Lb. Atomic Power Plant

Continued from page 65

be substituted) is converted directly into electricity through thermo-electrical materials, such as lead-telluride alloys, with an efficiency of 8 to 10 percent. This efficiency is far greater than that of any other known thermo-couple.

In 280 days (two half-lives) SNAP III can produce a quantity of electricity equal to 1450 pounds of the best conventional batteries available. This fact, combined with SNAP III's light weight and ability to perform in extreme cold would make it a convenient power source for space vehicles and various air and sea navigation aids, minimizing maintenance costs and increasing reliability.

Future SNAP III power plants could be mass produced at a small fraction of the original $15,000 outlay. The Martin Co., with Minnesota Mining, completed SNAP III in only four months.

Build A Bass Reflex

Continued from page 49

butt joints are fine if you glue and screw a block the full length of each joint. At least ⅔ of the interior surface should be lined with fiberglas wool or rug padding at least 1″ thick.

Tuning is accomplished by varying the size of the port with the adjustable sliding panel shown in the diagram. You'll need a test record with a slow frequency sweep from 20 cycles on up to about 200 cycles. Of course, an audio oscillator, if you have one, is ideal for the job.

Set the panel so the port is wide open. Play the record from the 20 cycle beginning, listening for a boomy peak in the sound. In fact, you may hear two such peaks. Now set the port slightly smaller and play the record again.

Repeat the procedure until boomy peaks are nearly eliminated, and lock the panel in that position with the wing nuts transferred to the inside. Stretch and fasten a layer of burlap or grill cloth over the port and listen to the frequency run once more. Add further layers over the port until any remaining peak disappears and the sound is smooth from 20 cycles all the way to the top of the run. However, be careful not to add too many layers or you will destroy the port's effectiveness as a sound source and wind up with a virtual closed-box instead of a bass reflex.

If you have a low-range AC voltmeter available, there's a more exact way of tuning the enclosure. Connect the phonograph, if you're using the test record or the audio oscillator output, through a 100 ohm resistor directly to the voice coil of the speaker. Connect the AC voltmeter also across the voice coil.

As you sweep the frequency from 20 to 200 cycles, watch the meter scale. The reading will vary with the impedance of the speaker and the enclosure. If volume of the cabinet and the position of the sliding panel are *near* correct, you'll observe two voltage peaks equally spaced above and below the speaker's resonant frequency (which you can determine from the manufacturer's specifications or by applying this same pro-

cedure to the speaker itself, unmounted and in free air). However, they won't be of equal amplitude.

On the other hand, if tuning is very far off, one peak will be *at* speaker resonance, while the other will be at the enclosure's resonance.

Tune the port until the voltage peaks are spaced equally above and below the speaker's resonant frequency, and are also equal in amplitude. Then proceed to damp out the peaks by adding burlap layers as described above.

How To Tape Off The Air

Continued from page 33

mixers are available from electronic supply houses. The levels of both inputs are adjusted by means of individual volume controls on the mixer. Both inputs to the mixer must be of the high impedance type. Consult the specifications of the equipment you are using to determine this. Mixing low level, low impedance sources usually requires a more expensive tube type mixer.

—o—

Stereo Tape Cartridge Player

Continued from page 36

of its preamp contains two low-noise transistors, and the unit is adaptable to component stereo, or a console having a stereo tape input jack and a selector switch for tape or disc. Most consoles of major manufacturers meet these specifications.

Fidelivox comes in two models: The Sonata plays ¼-track stereo magazines and is priced at about $100; the Camerata model handles half-track tapes and sells for about $30 more. Both models have 4-pole, 60 cycle motors and two drive belts to the drive capstan.

What about the availability of Fidelipac recordings? Stereophonic Automation Corp., developers of the system told us that several leading recording companies have indicated a willingness to release half- and one-hour tape albums in the Fidelipac form.

The ABC's of Electronics

Continued from page 82

which has the same polarity of charge they have themselves. Many of them will still be able to get through the grid openings, but some will be repelled and turn back. They will either return to the cathode or hang in the space between cathode and grid.

As the grid becomes increasingly negative, the plate current continues to drop. In the graph of Fig. 4, when the grid voltage drops from —2 to —3, the plate current falls from 10 to 5 milliamperes. Finally the point is reached where the grid is sufficiently negative to repel all of the electrons, and the plate current drops to zero. In this illustration, plate current *cutoff* occurs with a grid voltage of about —4.5.

Returning once again to our simple amplifier of Fig. 2, let's assume that the tube in this circuit has the characteristic shown in the curve of Fig. 5. As we are using the tube, the voltage on the grid is a combination of the fixed DC battery plus the AC signal on the transformer secondary. With an 8 volt bias then, and with a signal of 2 volts peak, the voltage on the grid relative to the cathode would vary from —10 to —6 volts.

Referring to our curve of Fig. 5, we see that when the grid voltage is —8 volts, the plate current is 20 milliamperes. When the negative peak of the signal swings the grid to —10 volts, the plate current will drop from 20 to 10 milliamperes. When the positive peak of the signal drives the grid voltage to —6, the plate current increases to 30.

If we were to plot these points along with a few intermediate ones on a graph, we'd come up with the grid voltage and plate current waveforms shown in Fig. 5, which illustrate dramatically just how a small voltage variation on the grid can effect a large variation in plate current.

Perhaps you are wondering what useful purpose is served by the fixed grid bias voltage. Why can't the signal voltage alone be applied directly to the grid? The answer to that can be seen in the small waveform at the upper right-hand corner of Fig. 5.

In this case the grid voltage is normally zero, and the signal will drive it plus-and-minus 2 volts. Then on the positive peak, the plate current will go from 41 to 42 milliamperes. And on the negative peak, it will drop from 41 to 39.5. Now we can see two distinct differences in this curve as compared with the one at the —8 volt point.

First, the amount of plate current *change* is considerably less. This means that the amplification or *gain* is much less. Furthermore, the negative plate current peak is half again as great as the positive peak. The result is *distortion*. The grid is therefore biased negatively to provide an operating point in the middle of the straight-line portion of the characteristic curve, for maximum gain and minimum distortion.

The triode vacuum tube is a one way device, in that voltages applied to the grid will cause changes in the current and voltage in the plate circuit, but changes in the plate circuit will have no effect at the grid. It is also interesting to note that while we regard the tube in this connection as being an AC amplifier, those changes are all actually DC.

When the AC signal at the grid is superimposed on the fixed grid bias, the resultant voltage is pulsating DC. Similarly, the effect at the output is a fluctuation in the DC plate current, but never a change in direction. But the waveform is the same as that of the AC input signal (unless distortion has occurred), and the pulsating DC will have the same effect on the load components in the output circuit as would a similar AC signal.

The triode tube was used extensively in all radio sets made prior to 1928. But it had a serious disadvantage when used as a radio frequency amplifier, and so another big step forward was taken three decades ago. The culprit and the means of its elimination will be described in the next installment.

Small Boat Depth Finder

Continued from page 73

transducer and the bottom, such as a school fish.

The echo is then picked up by the

transducer, which now acts like a microphone. The signal is fed to the detector stage of the amplifier and then on to a small neon tube.

Readings are usually indicated by the flashing neon tube, although more expensive models feature a permanent record of changing depths on special graph paper. The neon tube is usually mounted on the end of an arm which rotates clockwise at a constant speed governed by a synchronous motor. Each time the arm passes zero, a pulse is generated and the tube lights. When the echo returns, the tube again flashes. In the time interval, the arm (and tube) have moved under the transparent calibrated scale, and the second flash occurs under the scale at the precise depth indication.

Most seamanship handbooks urge mariners to use the lead line when approaching shores and anchorages, especially at night and in thick weather. Lead lines have two major disadvantages—they are a lot of work, and they can be inaccurate.

An electronic depth finder on the other hand involves no work and provides instantaneous, continuous depth readings which can be plotted as contours on nautical charts. Once safely in an anchorage, its readings help you compute exactly how much anchor line you have to pay out to give you a safe minimum scope (three times the water's depth). With a depth finder you can also determine the nature of the bottom—hard, soft, mud, sand, or rocks. Each type of bottom reflects a different type of echo.

During trips parallel to the shoreline at night or in bad weather, it is not necessary to know how far your boat is from shore; just how much water is under the keel.

Locating fish with a depth finder can be a profitable business or an interesting hobby. Fishing holes, schools of fish, individual "big ones", and fish-inhabited wrecks can be spotted without disturbing the submarine creatures. Fish echoes show up on the indicator between the surface mark and the reading off the bottom. Some boatmen become so proficient at fish finding that they can even tell you what kind of fish are in any given school.

What's In A Name

PEOPLE just getting into electronics usually express some curiosity about the common electrical units such as the volt, the ampere, the ohm, etc.

"Are they coined words or actual names?" they ask.

The latter. The terms were adopted to honor pioneer investigators who laid the foundation for the science of electronics as we know it today. The surprising thing is that these men achieved their fame mostly during the first half of the 19th century, long before the advent of the present age of electricity.

The *volt*, the unit of electrical pressure, is short for Volta, whose first name was Alessandro. He was born in Italy in 1745 and died in 1827, and is generally credited with the conception of the electric battery. His first model consisted of a pile of zinc and copper discs separated by moistened pieces of cardboard, and this developed enough *voltage* to give a decided shock.

A contemporary of Volta, a Frenchman named Andre Marie Ampere (1775-1836), was greatly interested in the relationship of electricity and magnetism. He was able to show that two parallel wires, carrying current and free to move, attracted each other when the currents were in the same direction and repelled each other when the currents were in opposite directions. The unit of the rate of flow of electricity, the *ampere*, is named for him.

In Germany, another great experimenter was Georg Simon Ohm (1784-1854). He propounded what was probably the first mathematical approach to electrical investigation, Ohm's Law, used to this day. This states simply that the current in amperes that flows in a circuit is equal to the pressure in volts divided by the circuit resistance in ohms.

The electrical unit of power, the *watt*, is named for a man who had virtually nothing to do with electricity in his lifetime but who had a great deal to do with power in general. He was James Watt, a Scotsman (1736-1819), whose steam engine revolutionized industry and transportation. Most heavy work was

done then by horses, and the capabilities of Watt's hissing machines were therefore expressed in terms of the equivalent horse power they saved. Even today electric motors are rated in h.p., but for other electrical functions the *watt* is used instead.

Power in watts is equal to volts times amperes. More precisely, a time factor must be included, because power is defined as the rate of doing work. Since the ampere is the rate of current flow (that is, the total number of electrons moving in one second under the push of one volt in a circuit having one ohm resistance), the term is really *watt-second*. If the circuit is kept alive for a minute, the total energy expended is a *watt-minute;* for 60 minutes, a *watt-hour*. The practical term used in industry is the *kilowatt-hour,* or one thousand watts per hour. Incidentally, 746 watts is the electrical equivalent of one horse power of mechanical work.

The *farad,* the unit of capacitance, is named for Michael Faraday of England (1791-1867), who easily rates as one of the greatest chemists and "electricians" of his century. He determined the dielectric values of glass, wax, rosin and other insulating materials used between the plates of capacitors, but actually this work was of minor importance compared with his other investigations. His crowning discovery was that of induction, whereby electricity in one wire can generate electricity in an adjacent wire through magnetic effects. This is the operating principle of all generators and transformers.

The United States is represented among the electrical terms with the *henry,* the unit of inductance. Joseph Henry of Albany, N.Y. (1797-1878), is hardly known today, but he was certainly the country's foremost physicist before and after the Civil War. He was a specialist in electro-magnetism. He invented the spool or bobbin type of winding on an iron core, giving strong, concentrated magnetic fields many times more powerful than any obtainable previously. This form of winding is universally used in generators, motors, transformers and electro-magnetic devices of many kinds.

ELECTRONICS ILLUSTRATED Classified Ads

Your advertisement can reach this mail-buying audience for only 25¢ a word. Copy for the August issue must be in our office by May 20th. Mail to ELECTRONICS ILLUSTRATED, 67 West 44th St., New York 36, N. Y.

• • • FOR SALE

MONEY SAVING Prices on tubes. TV, Radio, Transmitting and Industrial Types. New, 1st quality, guaranteed. Top name brands only. Government surplus and commercial test, lab and communications equipment in stock. Sell us your excess tubes and equipment. Unused, clean tubes of all types wanted. Send specific details in first letter. Write for "Green Sheet" catalog 25¢. Barry Electronics Corp., 512 Broadway, (Dept. El.), WA 5-7000, New York 12, N. Y.

BIGGEST BUCK Buy Anywhere Today. Over 30 New Highest Quality Radio—Electronic—TV parts (No coils or transformers)—Worth many times our Lowest ever price of $1.25 prepaid—No C.O.D.'s. ** Progress Electronics, Hudson, Wis.

GOVERNMENT SELLS — Surplus Electronics; Walkie-Talkies; Test Equipment; Oscilloscopes; Radar; Sonar; Misc. Electronics—Send for U.S. Depot Directory & Procedures $1.00. "Government Surplus Sales," Box 8-EL, Sunnyside 4, New York.

RING-VALVE JOB while driving, $6.00. Literature. Motaloy, Grantham 6, Penna.

• • • PRINTING, MULTIGRAPHING, MIMEOGRAPHING

4 LINES RUBBER Stamp $2.00. 3 Lines $1.50 Postpaid. Arlington Rubber Stamp Co., 918 Minnesota Ave., Dept. 6, Knoxville 21, Tenn.

PENNY PRINTING, Letterheads, Envelopes, penny each. Minimum 50. 109 North Adams, Burlington, Iowa.

BUSINESS CARDS. 1000 $3.99 Postpaid. Free Samples. Alexander, 1324 Alcott El, Dayton 6, Ohio.

DELUXE RUBBER Stamps. 4 lines $2.00. Box 66, Mt. Holly Springs, Pa.

• • • EMPLOYMENT OPPORTUNITIES

PRINTING - ADVERTISING SALESMEN. Excellent moneymaking sideline selling Decalcomania Name Plates. Advertising Specialties. Sign letters, Automobile initials. Free Samples. "Ralco"-El, Box L, Boston 19, Mass.

JOBS OVERSEAS! Write Janecek Development Co., 109 Hub Station, New York 55, N. Y.

• • • BUSINESS OPPORTUNITIES

WE PAY $3.50 lb. dried. Grow Mushrooms. Cellar, shed and outdoors. Spare, full time, year round. We pay $3.50 lb. Free Book. Mushroom, Dept. 315, 2954 Admiral Way, Seattle, Wash.

MAKE $25-$50 WEEK, clipping newspaper items for publishers. Some clippings worth $5.00 each. Particulars free. National, 81-EX, Knickerbocker Station, New York City.

$200. MONTHLY POSSIBLE, Sewing Babywear! No house selling! Information Free. Send name to Cuties, Warsaw 168, Ind.

LIFETIME INCOME! Free home business catalog. Guthries, 5123E Eagle Rock Boulevard, Los Angeles 41, Calif.

VENDING MACHINES—No selling. Operate a route of coin machines and earn high profits. 32-page catalog free! Parkway Machine Corp., Dept. 33, 715 Linsor St., Baltimore 2, Md.

OPERATE PROFITABLE mailorder business!! Write: Bond, T-1637 West Vernon, Phoenix, Arizona.

• • • HI-FI

UNUSUAL VALUES. Hi-Fi components, tapes and tape recorders. Free catalog El, Stereo Center, 51 W. 35 St., NYC 1.

CROSSOVER NETWORK kits. Write Watson Industries, 110 Mildred, Venice, California.

• • • TAPE RECORDERS

THE AMAZING Electronic Educator offers exciting new concept in education. Free details. Sleep-Learning Research Association, Box 24-El, Olympia, Wash.

RECORDERS TAPE Decks, Stereo Tapes, Accessories, excellent values, catalogue. Efsco Sales, 270R Concord, West Hempstead, N. Y.

TAPE RECORDERS, Hi-Fi components, Sleep Learning Equipment, tapes. Unusual values. Free catalog. Dressner 69-02 Z, 174 St. Flushing 65, N. Y.

• • • RADIO & TV

WE BELIEVE we have the most interesting illustrated catalog of Government surplus electronics, parabolic reflectors, snooperscopes, mine detectors, receivers, transmitters, and just plain junk. Absolutely crazy prices. Send 10¢ for our fantastic, amazing, surplus electronic catalog and get ready to spend your money on our junk. Meshna, 580a Lynn, Malden 48, Mass.

DIAGRAMS FOR repairing radios, amplifiers, $1.00; television $2.00. Give make, model. Diagram Service, Box 672-El, Hartford 1, Conn.

"RADIOBUILDER" MAGAZINE. Experimenters' paradise! Transistor experiments. 12 issues $2.50; copy 25¢. Radiobuilder, 1131-K Valota, Redwood City, California.

BUILDER-EXPERIMENTERS: SEND for free information. Radio Workbench Magazine. Carlsbad, New Mexico.

AMAZING ORIGINAL transistor amplifier circuit. Interesting folio of information $1.25. Ciardi, 1119-C Luzerne, Scranton, Penna.

CRYSTAL RADIO Experimenters. Write to Hulet, 305 Hope, Lakewood, N. J.

• • • EDUCATION & INSTRUCTION

ENGINEERING DEGREES Earned through Home Study. Electronics, Electrical, Mechanical, Civil, Physics. When writing, specify course desired. Pacific International College Of Arts And Sciences primarily a correspondence school. Resident classes also carried. 5719-E Santa Monica Blvd., Hollywood 38, Calif.

LEARN WHILE Asleep. Exciting details free. Sleep-Learning Research Association, Box 24-El, Olympia, Wash.

SHORTHAND IN Four Days! Learn at home. $2.98 postpaid. Take notes three times faster. Free proof. Cunningham, 81 Bailey, Lawrence, Mass.

• • • ELECTRICAL SUPPLIES & EQUIPMENT

APPLIANCE PARTS Wholesale, Catalogue 25¢. Simelco, 26 South 20 Street, Birmingham 3, Ala.

• • • PLASTICS

NEW, DO-IT-YOURSELF casting and molding Plastics! Make Beautiful and Unusual items. No Experience or Machinery Necessary. An Exciting Hobby, a Profitable Profession. Send 25¢ for Big 64 page Catalog listing Hundreds of Materials, Molds, Jewelry, Accessories and Complete Outfits. Castacraft Corp., Dept. E-74, P. O. Box 555, Palo Alto, Calif.

• • • INVENTIONS & INVENTORS

INVENTORS—SEND for free Patent Information book and Inventors Record. Registered Patent Attorney, Associate Examiner, Patent Office 1922-1929; Patent Attorney & Advisor, Navy Department 1930-1947. Gustave Miller, 59El Warner Building, Washington 4, D. C.

• • • MISCELLANEOUS

HYPNOTIZE SUCCESSFULLY! Easily learned, fast, modern methods! Author's "Instantaneous" and "Against Will" methods exposed! Complete illustrated course—including self-hypnosis and "Secret Nerve Pressure Technique" $1.00. Arthur Fowler, 851 Draper Avenue, Schenectady 6, N. Y.

"$$$$$ DUST"—FROM: Sawdust Product!! Demanded Everywhere!! Sacrificing Details: $2.00!! Guaranteed Sales/Amazing!! "Lonestar," Gallatin (656) Tennessee.

"WINEMAKING," $1.00. "STOUT, Beer, Ale Brewing," $1.00. Illustrated. Eaton Books, Box 1242-A, Santa Rosa, California.

MARRIAGE CERTIFICATE Legal Form $1. Legal form for making a "will" $1. Parker, Box 7072, Miami 55, Fla.

• • • STAMPS & COINS

UNITED NATIONS. Five different 10¢. Approvals. Anderson, 1112 Harrison, San Francisco 3, Calif.

INDIAN CENT plus Bargain Lists 10¢. Hutchinson's, Box 4747, Philadelphia 34, Penna.

• • • DETECTIVES

DETECTIVES—WORK Home—Travel. Experience unnecessary. Detective Particulars free. Write, Wagner, B-125 West 86th, New York 24.

• • • MUSIC

SONGPOEMS AND Lyrics Wanted! Mail to: Tin Pan Alley, Inc., 1650 Broadway, New York 19, N. Y.

Fastest Airborne Brain

Continued from page 93

in use? Perhaps, but it simply would not have worked because the B-58 represents a greater gain in top-speed advantage over the latest jet operational bomber than that bomber had over the Wright brothers' airplane.

Starting way up in the B-58's needle-nose, sensing units pick up data on the plane's air environment such as air speed, temperature and air density. This data is fed into the amplifier computer, which adds other variables including the plane's weight, shifting center of gravity, and whether or not it is carrying an external "pod." Incidentally, this pod is the payoff—the only reason the B-58 exists. It might be anything—a hydrogen bomb, cameras, or electronic countermeasures designed to confuse enemy radar.

"Commands" from the pilot's control stick and pedals, or those from the autopilot also feed the computer and all this data is relayed into an amazing electromechanical device called the power control linkage assembly, containing over 17,000 parts. This unit is what actually converts the computer "brainwork" to linear motion, moving rudder and elevons in just the right degree. Since the control system is power actuated, artificial "feel" is built into the system which enables the pilot to properly sense movement of his stick and pedals.

In addition to the "brain" and its associated gear, the B-58 carries Sylvania's new, lightweight electronic countermeasures system which throws an invisible electromagnetic shield around the aircraft to protect against electronically guided weapons. This shield, whose details remain classified, is designed to baffle enemy ground and airborne radar, as well as guided missiles.

In developing the Hustler's power thinking control system, scientists and engineers had to explore factors unknown or only theoretical at the time the project was begun. Now it is finished and the United States has the first supersonic manned bomber—adding up to a safer America and enormous implications for future aircraft.

he's really going places with ELECTRONICS ILLUSTRATED

It's a magic carpet ride through the wonderful world of electronics... an "open sesame" to the fun, profit and excitement of this fast-growing field.

Each month, ELECTRONICS ILLUSTRATED brings you a host of exciting features—latest news and developments in Hi-Fi; items you can build for home and hobby; easy do-it-yourself projects; tips for radio "hams," and the low-down on how and where to get the best jobs in electronics.

Now you can have ELECTRONICS ILLUSTRATED sent directly to your home, by ordering your subscription right away. A subscription to EI means big savings for you, and assures you of receiving every picture-packed issue.

get your subscription blank in the mail today!

Mail to
ELECTRONICS ILLUSTRATED,
Circulation Dept.,
Fawcett Building, Greenwich, Conn.

Make sure you never miss an issue of ELECTRONICS ILLUSTRATED

☐ ONE YEAR: $3.00 ☐ TWO YEARS: $5.00

In U. S., possessions and Canada. All other countries $6.00 per year.

NAME_____

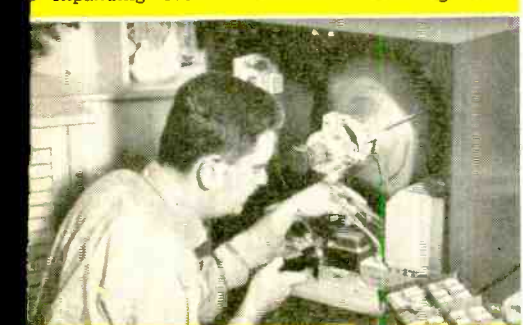
ADDRESS_____

CITY_____ ZONE____ STATE_____

FOR GOOD

Learn Ra

oadcasting offers satisfying careers. Hundreds of Radio
ion stations on the air offer interesting jobs for
d Technicians. Police, Aviation, Two-Way Comm
e expanding. Men with Radio-TV training are in



solid, proven field of opportunity for good pay i
e millions of Radio and TV sets now in use. Governm
ry, guided missile manufacturers, industry
echnicians. Color-TV, Hi-Fi are increasing the opp

National I

Washington

IT'S EASY TO LEARN

You train in your own home—keep your present job while learning. Well illustrated NRI lessons teach Radio-TV-Electronic principles. You build, test, experiment with Radio-TV circuits, get actual practice with kits NRI gives you. Graduate Vagnoni, at right, knew nothing about Radio when he enrolled.

NO EXPERIENCE NEEDED

You don't have to know anything about electricity or Radio to understand and succeed with NRI courses. Many successful NRI men did not finish high school. NRI trained men have been accepted for responsible positions throughout the United States and Canada. Graduate Barnett, for instance, is Chief Engineer with station KGCU.

NRI HAS TRAINED THOUSANDS

For over 40 years, NRI has been training men for success in Radio-TV. Start now on your road to success, get training you need for good pay and a bright future. You can get the training you need, at home in your spare time. NRI can provide it for you.

MAIL POSTAGE-FREE CARD for SAMPLE LESSON and 64-PAGE CATALOG FREE

BUSINESS REPLY CARD

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY

NATIONAL RADIO INSTITUTE

3939 Wisconsin Ave.

Washington 16, D.C.

FIRST CLASS PERMIT NO. 20-R

(Sec. 34.9 P.L. & R.)

WASHINGTON, D. C.

the stereo space problem is solved...

*with the ELECTRO-VOICE STEREON

matching Electro-Voice and all other high quality systems

Now, for the first time, you don't need two full-range speakers to enjoy the added third dimension of stereophonic sound . . . thanks to a new application by Electro-Voice engineers of a basic principle of acoustics. As early as 1934 it was learned that bass tones below 300 cps do not indicate the location of the sound source . . . therefore these tones contribute no stereo effect. This is because the ear lacks the ability to qualify direction when sound wave-lengths reach 2½ feet or more between their pressure crests. The *entire* stereo effect relies upon the directional placement of sounds *above* this point. The second sound source in stereo, therefore, need only be a system designed specifically to reproduce that directional part of the audio spectrum above 300 cps. Based upon this fact, Electro-Voice engineers developed the STEREON, an uncompromised second channel loudspeaker to match even the largest bass producer . . . a compact, functional furniture piece allowing greatest placement flexibility for optimum stereo. The STEREON is designed to complement any full-range speaker by reproducing only those frequencies required for stereo, thus eliminating your need for a second expensive bulky enclosure.

HERE'S WHAT HAPPENS:

Low bass frequencies from *both* stereo channels are properly phased through the XX3 STEREON Control Filter and channeled into your present full-range speaker to utilize its full bass reproduction capabilities; the mid-bass, treble and very high tones are fed, one channel to your full-range speaker, the other channel to the STEREON . . . to give you full dimensional stereo . . . inexpensively, compactly.

Stereo—the Electro-Voice STEREON way—gives the impact and true-to-life spaciousness of the original performance . . . puts you in the best seat in the house.

(In larger rooms, by the way, when you'll want stereo with the scope and magnitude of the latest movie processes . . . you add-on two additional STEREONS, placing them inconspicuously around the room. The two central STEREONS simply parallel each of the channels and are adjusted to a slightly lower level to make a smooth sound picture . . . providing directionality and full depth . . . the ultimate in stereo.)

Hear the remarkably versatile Electro-Voice STEREONS demonstrated at your Electro-Voice show room. After one listening you'll agree that STEREONS are THE answer to stereo in *your* home.

GO-ON TO STEREON . . . FOR SUPERLATIVE STEREO NOW . . .

For more complete information on the Stereon and other Electro-Voice ways to go Stereo, write for free booklet on choosing stereo equipment.

Electro-Voice®

ELECTRO-VOICE, Inc., DEPT. E1-5
Buchanan, Michigan

Foremost in Electro-Acoustics — *High Fidelity Loudspeakers and Enclosures for STEREO, Microphones, Phono-Cartridges and Public Address Speakers, Marine Instruments, EVI Professional Electronic Instruments and Military Material.*

STEREO'S STANDARD

STEREON III—3-way system for use with high efficiency systems. Employs MT30 mid-bass coaxial assembly and T35 VHF driver, built into integral 200 cps taper rate horn. Integral crossover network limits overall input to signals above 300 cps crosses over electrically at 3500 cps to Model T35 VHF driver. Flat response ± 2 db 300 cps to 19,000 cps. Two AT37 level controls at rear provide overall level match to full range speaker system. Quality match assured by individual control of "Presence" and "Brilliance" control. Available in mahogany, walnut, and limed oak. Size: 25" high, 17½" deep, 7½" wide. Shipping weight: 37 lbs. Net $129.50

STEREON 1A—Identical to Stereon III, for use with normal efficiency systems. Uses MT30B and T35B driver components. Shipping weight: 33 lbs. Net $99.50

XX3 STEREON CONTROL FILTER—For use with Electro-Voice Stereons. Uses matching transformer and crossover network components. Al signal of 1st channel above 300 cps feeds Stereon; all signal below 300 cps from this channel is combined with full range output from second channel to utilize full bass reproduction capabilities of a single full range system. Input impedance from both amplifiers 8 ohms, output impedance 16 ohms nominal. Size: 5½" high, 4¾" wide, 5¼" deep. Shipping weight: 8 lbs. Net $30.00

STEREO begins with the E-V totally compatible STEREO Cartridge—already the accepted standard.