



# FIRST ALL-NEW, LOW-PRICED, SHORTWAVE RECEIVER IN OVER TEN YEARS!!!

BURTON BROWNE/New York



Fred Shuman  
Managing Editor, RADIO-ELECTRONICS...  
"Neat combination of design and technical features."



Charles Tepler  
Editor, ILLUSTRATIONS...  
"It looks modern and pulls in the SW stations, a pleasure to recommend."



Oliver Read, Ph.D.  
Publisher of Electronics Div., POPULAR ELECTRONICS...  
"This looks like a real winner."



William A. Stocklin  
Editor, RADIO & TV NEWS...  
"Easily read dial, a boon to the shortwave listener."

**NEW NATIONAL NC-60 Special . . .** covers .54 to 31 mcs in 4 bands with full electrical bandsread on all frequencies. Features exceptional sensitivity with separate tuning coils for each band. Separate general coverage and bandsread tuning capacitors. Front panel phone-jack. Standard broadcast, civil defense, WWV, marine, aircraft, amateur and world-wide shortwave frequencies are clearly marked on dial. Built-in speaker.

**Only \$5.95 down\*** Suggested price only \$59.95\*\* (slightly higher west of the Rockies and outside the U.S.A.)\*  
\*Most National distributors offer budget terms and trade-in allowances.



Model NC-66 . . . use this rugged portable 4 ways: as a ham receiver, a 3-way portable, a marine receiver, and as an SWL receiver. Rugged and handsome, the NC-66 has a sturdy case with carrying handle. Only \$13.00 down\* Suggested price only \$129.95\*\*



Model NC-188 . . . a quality receiver for budget-conscious amateurs—featuring National's new styling. It is directly calibrated for the four general coverage ranges and five bandsread ranges for the amateur bands (80-10 meters). Only \$16.00 down\* Suggested price only \$159.95\*\*

**SEND 50¢ FOR EXCITING NEW BOOK ON SHORTWAVE LISTENING . . .**

tells when, where and how to tune over two million shortwave stations in over 260 foreign countries. Provides log for listing stations your hear. Send 50¢ to NATIONAL COMPANY, INC., Malden 48, Mass.

# National

NATIONAL COMPANY, INC., MALDEN 48, MASS.





**A HIGHLY  
RESPECTED TRADE—  
START SOON TO  
EARN EXTRA MONEY  
IN SPARE TIME**

# 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 an average of 8 electrical appliances. Up to 10 million new appliances are sold every year and 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. KM8, Washington 16, D. C.**

**MAILING THIS  
COUPON MAY START  
YOU TO SUCCESS  
LESSON AND BOOK  
FREE**



**NATIONAL RADIO INSTITUTE, Dept. KM8, Washington 16, 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

November, 1958

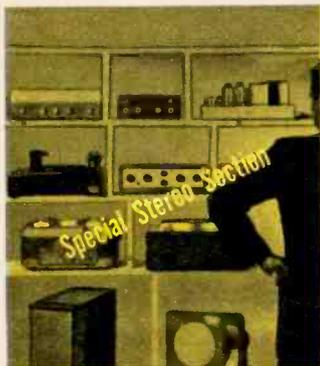
# ELECTRONICS ILLUSTRATED

A Fawcett Publication

Nov. 1958

Vol. 1 No. 5

## Contents



Electronics Illustrated's Stereo Report .....	27
Stereo Survey .....	28
Stereo Records: An Appraisal .....	35
Stereo on a Shoestring—2. ....	38
Convert Your Record Player to Stereo .....	42
All About FM Multiplex .....	44
EI Assembles a Stereo Preamplifier Kit .....	48
Shelves For Your Hi-Fi .....	52
For Stereophiles Only .....	53

A Message From The Editor .....	4
Electronics in the News .....	8
Hi-Fi Clinic .....	54
Shooting For The Moon .....	56
Launching Your Model Missile .....	60
How To Fix Your TV Set .....	63
We Try For A Radio Controlled Model Airplane Record .....	66
Fun With A Sun-Powered Motor .....	69
The Skywatcher .....	72
Revive Your Speedlight .....	76
ABC's of Electronics .....	79
Knight 5-Transistor Portable .....	82
Electronic Brain .....	84



The new stereo hi-fi products on our cover are, from left to right and from top to bottom: Bogen DB212 preamp amplifier, McIntosh C85 preamp control, Leak Stereo 50 amplifier, Garrard RC88 record changer, Eico HF81 preamp-amplifier, Scott 330C AM-FM tuner, Norelco Stereo Continental tape recorder, Rek-O-Kut 8-12GH turntable, Electro-Voice Stereon speaker and enclosure and Jensen DA-3 Director speakers.

Cover Photo by Mike Bonvino

CHARLES TEPFER.....Editor  
Leonard Buckwalter.....Associate Editor  
Edward Nanas.....Feature Editor  
Murray Cooper.....Art Editor  
John M. Kane.....Art Associate  
Lois Bianchi.....Editorial Assistant

Lorry Eisinger.....Editor-in-Chief  
Phyllis Goodman.....Production Editor  
Nancy Koy.....Assistant Production Editor  
John F. Webster.....Advertising Manager

Ralph Daigh.....Editorial Director  
James Boynton.....Advertising Director  
Al Allard.....Art Director  
Ralph Mattison.....Associate Art Director  
Annette Packer.....Production Director

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. Price 25¢ a copy. Subscription price, 12 issues for \$3.00 in U. S. and Possessions and Canada. Copyright 1958 by Fawcett Publications, Inc. Printed in the U.S.A. Permission hereby granted to quote from this issue of this magazine on radio or television provided a total of not more than 1,000 words is quoted and credit is given to the title of the magazine and issue, as well as the statement, copyright 1958, by Fawcett Publications, Inc.

Train in Big  
**COYNE**  
Shops

# GREAT OPPORTUNITY FIELDS!



Instructor helping students check the wiring and trace the circuits of television receivers.

This big fire-proof building is occupied entirely by Coyne.

Instructor explaining operation and testing of a large Motor Generator.

## TELEVISION-RADIO COLOR TV

Here at COYNE you're trained for Testing, Trouble-Shooting and Servicing on AM and FM Radio Units, Auto Radio, Television, etc. Thousands of Coyne trained men in good jobs or own well paying TV-Radio businesses.

## ELECTRICITY ELECTRONICS

Big opportunities everywhere—city, town and country, in Power Plant Work, Motors, Industrial Electronics, Armature Winding, Home and Factory Wiring, Appliances, Refrigeration, Maintenance, Illumination, etc.

**OLDEST AND BEST  
EQUIPPED SCHOOL OF  
ITS KIND IN THE U.S.**

Send Coupon  
Below for  
**BIG FREE  
BOOK**



"Guide to Careers in ELECTRICITY-ELECTRONICS and TELEVISION-RADIO" Book and details come to you by return mail. No salesman will call.

## WE TRAIN YOU IN CHICAGO

Our famous Practical-Technical method gives you practical experience on a massive outlay of equipment plus necessary technical training right here in the great Coyne shops.

*Training in Refrigeration and Electric Appliances can be included.*

Training offered  
to **VETERANS** and  
**NON-VETS** alike

### START NOW—PAY LATER

Enroll now, pay most of tuition later. Part time employment help for students. Lifetime employment service to Graduates. Frequent starting dates.

B. W. COOKE, JR., President

**COYNE**  
ELECTRICAL SCHOOL

FOUNDED 1899

A TECHNICAL TRADE INSTITUTE OPERATED NOT FOR PROFIT  
500 S. PAULINA STREET, CHICAGO, Dept. 88-8C

ELECTRICITY ★ RADIO ★ TELEVISION ★ REFRIGERATION ★ ELECTRONICS

## MAIL COUPON TODAY

COYNE ELECTRICAL SCHOOL  
500 S. Paulina St., Chicago 12, Ill., Dept. 88-8C

Send **BIG FREE** book and details of all the training you offer. This does not obligate me and no salesman will call. I am especially interested in:

ELECTRICITY-Electronics  TELEVISION-Radio-Color TV

Name.....

Address.....

City.....State.....

# A Message From the Editor

This is the first issue of **ELECTRONICS ILLUSTRATED** which contains a special section devoted to one subject—Stereo Hi-Fi. You'll be reading more and more in magazines and newspapers about this new way of enjoying recorded music at home. We're bringing our report to you now because this is the time when manufacturers and retailers of hi-fi components announce and display their new wares. Stereo components will be in the place of honor and you may want to keep our special report to use as a buying guide.

Last month we brought you a report on eleven pickup cartridges designed to play stereo records. This month you'll learn all about the special tuners, preamps, amplifiers, converters and speakers that you'll need to complete a component stereo system.

Be sure to read the article on FM multiplex. You will be hearing more about this new method of free, off-the-air stereo broadcasts fairly soon, and will want to use it.

This issue winds up the series on "How To Build A Safe Model Missile." In the future we will have information with our unique wiring guides on how to add electronic speed and height indicators and telemetering equipment to small rockets for further experiments. Many amateur rocketeers have become alarmed over the tendency of towns and cities to prohibit the firing of small rockets. Realizing the importance of this amateur activity to the production of future rocket scientists, the Department of Defense is now trying to interest many localities in building safe rocket launching facilities for the use of amateur rocketeers. Additional information on this can be obtained by writing to the Army Headquarters for your area, or to the Department of Defense in Washington, D. C.

Commander William R. Anderson, Captain of the atomic-powered submarine *Nautilus*, recently accomplished a feat that

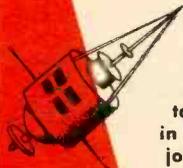
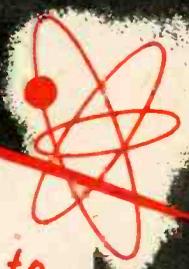


**Norm Eisenberg**, author of Stereo Survey on page 28, is right at home in evaluating and describing hi-fi products. After working for an audio manufacturer he raised his banner for the consumer and joined a highly respected testing agency. Your Editor took a hand in the testing, and found stereo exciting.

# Men 17 to 55—GET FREE FACTS!

See How **DeVry Tech** Can Prepare You For A Profitable Future In Many Fields

## from **Communications** to **Guided Missiles, etc.**



**No Previous Technical Experience Or Advanced Education Needed!**

Laborers and bookkeepers, store clerks, shop men, farmers, salesmen—men of nearly every calling—have taken the DeVry Tech program and today have good jobs or service shops of their own in Electronics. You don't have to quit your present job. If you are 17 to 55, see how you may get yourself ready for a future in the fast-growing Electronics field.

Whether you prepare at home or in our well-equipped Chicago or Toronto Laboratories, you get sound, basic training in both principles and practice. At home, you use educational movies. You build actual circuits and test equipment. You read simple directions, follow clear illustrations. When you finish, you are prepared to step into a good job in this excitingly different field. You may even start a service shop of your own. Mail coupon for free facts today.

Get **FREE** Booklet!

We'll give you a free copy of an interesting booklet, "Electronics and YOU." See for yourself how you may take advantage of the opportunities in this fast-growing field.



**Radar**



**Automation Electronics**



**Television**



**Micro-Waves**



**Computers**



**Broadcasting**



**Your Own Service Shop**

**FREE EMPLOYMENT SERVICE**

Puts you in touch with job opportunities—or helps you toward a better position in the plant where you are now employed.

**Draft Age?**

We have valuable information for every man of draft age, so if you are subject to military service, be sure to check the coupon.

# DeVry Technical INSTITUTE

**Chicago 41, Illinois**

**Formerly DeFOREST'S TRAINING, INC.**

"One of North America's Foremost Electronics Training Centers"  
Accredited Member of National Home Study Council



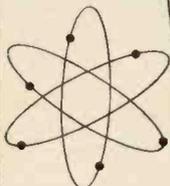
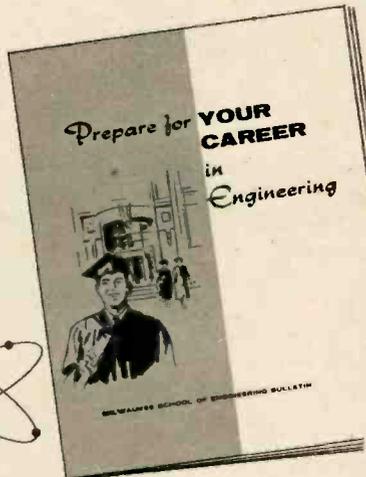
DeVry Technical Institute  
4141 Belmont Ave., Chicago 41, Ill., Dept. E1-11-0  
Please give me your FREE booklet, "Electronics and YOU," and tell me how I may prepare to enter one or more branches of Electronics as listed above.

Name \_\_\_\_\_ Age \_\_\_\_\_  
Street \_\_\_\_\_ Please Print \_\_\_\_\_ 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

2040

Interesting, Pictorial  
**FREE**  
**BOOKLET**



to help you decide on  
your career in  
**ELECTRONICS**  
**RADIO-TV**  
**COMPUTERS**

Here is a graphic story about preparing for your career as an engineer or engineering technician in electronics, radio, television, computers, etc. Booklet tells about:

- Wide variety of job opportunities
- Courses offered, degrees you can earn
- Pictures of the Milwaukee School of Engineering and its facilities
- Recreation and fraternities
- Scholarships; part-time work

—plus other interesting and informative facts to help you make a sound decision on your career.

MS-90

**Milwaukee School of Engineering**  
— dedicated to serving young men and industry

**SEND COUPON TODAY!**

**Milwaukee School of Engineering**  
Dept. EI 1150, 1025 N. Milwaukee St., Milwaukee, Wis.

Please send me free new booklet  
"Prepare for Your Career in Engineering"

I'm interested in  Electrical Engineering  
 Mechanical Engineering

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

Address .....

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

I am  I am not eligible for veterans educational benefits. (discharge date)



**Cmdr. Anderson and Lt. Jenks of the Nautilus**  
were interviewed by EI. Read it next month.

won world-wide admiration for himself and his crew. Many newspaper stories and magazine articles have been written on the Nautilus' trip under the North pole. But, we think we have the most complete story on how the Nautilus really did it. We interviewed Cdr. Anderson and his navigator, Lieutenant "Shep" Jenks, aboard the Nautilus, and were amazed at the complexity and the accuracy of the electronic equipment aboard. Modern submarines are truly up-to-date electronic laboratories of the most advanced type. If you really want to know how this little self-contained universe was able to navigate through the eerily isolated world beneath the ice packs, read our next issue.

We'll also have a step-by-step explanation on how to add sound to your home movies, and ten ways to get more out of your tape recorder. For the build-it-yourself fans we have a child's radio phone which will make a much appreciated and original gift for your child around Christmastime.

As a special dividend we've gotten Jack Gould, widely quoted and authoritative Radio and TV editor of the New York Times—and an active short wave listener—to write a series for us on the pleasures and romance of tuning into the world. Jack will give you practical hints on how and where to tune. Tying in with this, is an article on how to convert a common AC-DC table model radio to short wave reception, for the beginner.

In addition, we'll have the Electronic Brain and Hi-Fi Clinic, a small portable radio that is sun-powered, and much, much more.

*Charles Tupper*

# 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.

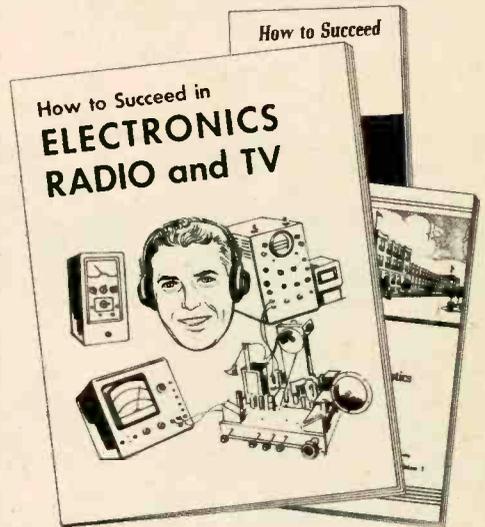
Radio-TV-Electronics is the fastest growing industry of all time. Opportunity for men in this field is almost unlimited. The rewards are great.

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



BOX 91313K, 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.

# Electronics in the News



Electronics makes its stage debut at the University of Buffalo Opera Theatre. Though the orchestra is in the balcony, the maestro, left, is televised onto receivers directly in front of the stage. A TV monitor backstage, right, gives entrance cues, alerts technicians to lighting changes.



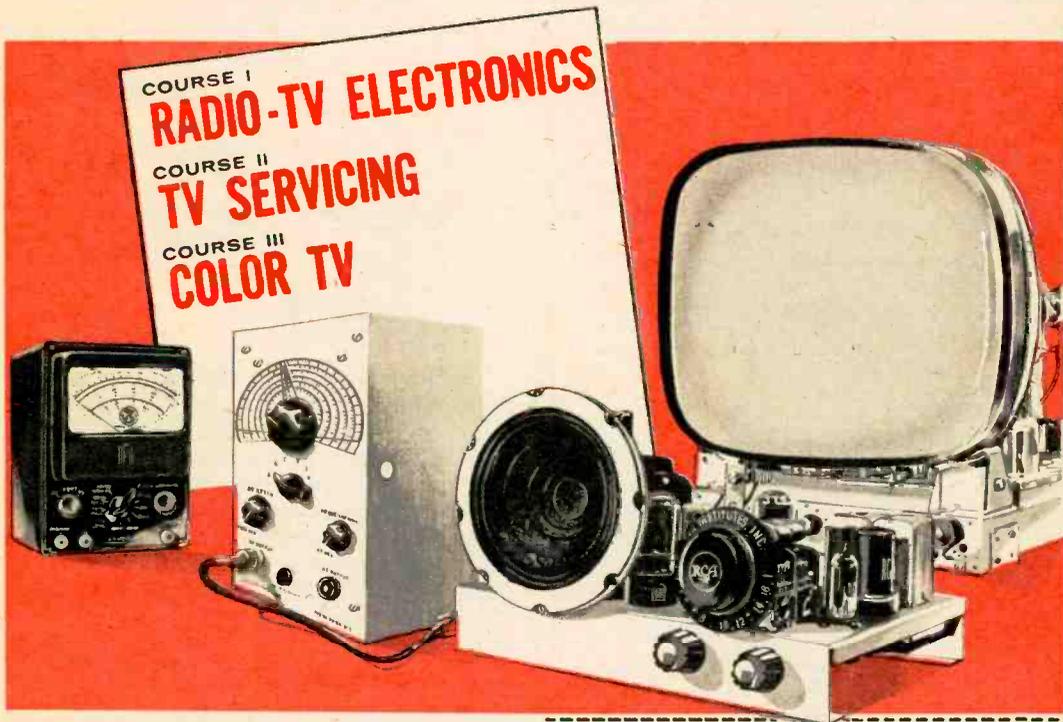
Movie-makers have brought electronics into the act also, with a closed circuit TV system for composing background music for sound tracks. Composer Raymond Scott sits at a "Videola", which includes a Blonder-Tongue Monitor TV receiver. A tape recorder at his left records his music; the TV monitor shows film for which it is intended; and at his right are push buttons for indicating film footage, volume meters, and selector buttons for watching the film and/or listening to the dialogue.



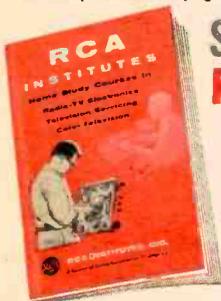
# RCA INSTITUTES



# OFFERS YOU THE FINEST OF HOME STUDY TRAINING



The equipment illustrated and text material you get with each course is yours to keep. Practical work with very first lesson. Courses for the beginner and the advanced student. Pay-as-you-learn. You need pay for only one study group at a time.



## SEND FOR THIS FREE BOOK NOW

Resident School courses in New York City offer comprehensive training in Television and Electronics. Day and evening classes start four times each year. Detailed information on request.

**RCA Institutes, Inc.** Home Study Dept. EI-118  
A Service of Radio Corporation of America  
350 West Fourth Street, New York 14, N. Y.

Without obligation, send me FREE 52 page CATALOG on Home Study Courses in Radio, Television and Color TV. 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, Que.

To save time, paste coupon on postcard

*Get*  
Your First Class Commercial  
**F.C.C. LICENSE**  
in  
**12 Weeks**

**F.C.C. LICENSE — THE KEY TO BETTER JOBS —** An F.C.C. commercial (not amateur) license is your ticket to higher pay and more interesting employment. This license is Federal Government evidence of your qualifications in electronics. Employers are eager to hire licensed technicians.

**GRANTHAM TRAINING PREPARES YOU —** Grantham School of Electronics specializes in preparing students to pass F.C.C. examinations. Training is available either by correspondence or in resident classes—NO previous training required. A beginner may qualify for his first class F.C.C. license in as little as 12 weeks.

**THREE COMPLETE SCHOOLS:** To better serve our many students throughout the entire country, Grantham School of Electronics maintains three complete schools—one in Washington, D. C., one in Hollywood, Calif., and one in Seattle, Wash. All schools offer the same rapid courses in FCC license preparation, either home study or resident classes.

**MAIL COUPON FOR FREE BOOKLET:** Our free booklet, *Careers in Electronics*, gives details of how you can prepare quickly for your FCC license. For your free copy of this booklet, clip the coupon below and mail it to the Grantham School nearest you.

**WASHINGTON D.C.** Grantham School of Electronics  
821-19th Street, N. W.  
Washington 6, D. C.

**HOLLYWOOD CALIF.** Grantham School of Electronics  
1505 N. Western Avenue  
Hollywood 27, California

**SEATTLE WASH.** Grantham School of Electronics  
408 Marion Street  
Seattle, Washington

(Mail in envelope or paste on postal card)

To: **GRANTHAM SCHOOL OF ELECTRONICS**  
Desk 88-S • Washington • Hollywood • Seattle

Gentlemen:

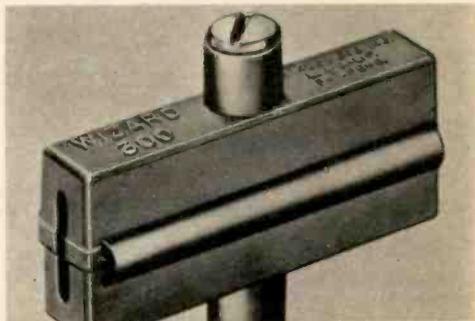
Please send me your free booklet telling how I can get my commercial F.C.C. license quickly. I understand there is no obligation and no salesman will call.

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

Address .....

City ..... State .....

I am interested in:  Home Study,  Resident Classes



Blonder-Tongue of Newark, N. J. is introducing a new line of TV and FM set couplers called "Exact Match." The A-102 two-set coupler will feed two VHF (Channels 2 through 13) or FM receiver into one line. The loss in signal is 3.5 db. The A-104, four-set coupler feeds four receivers with a 7.5 db loss. Both of these units may also be connected to mix 2 or 4 antennas into one line without upsetting the impedance match. Weatherproof cases enclose both.

Operation of over 20 TV or FM sets from one antenna is claimed for the new Wizard 300 coupler from Charles Engineering, Inc., Los Angeles, Calif. This unit, requiring no power, is designed for apartment houses, motels and other multi-set applications. The coupler simply slides onto the antenna line and requires no cutting or soldering for installation. The principle of operation is electro-magnetic coupling without the use of separate coil or capacitor elements. Two models are available; the Wizard 300 for 300 ohm flat line (\$1.95 list), and the 450 for open lines with spacing of one inch or more between conductors.

Get into

# TELEVISION RADIO-ELECTRONICS



**LEARN ALL 8 PHASES  
BY SHOP METHOD**

1. Television . . . including Color TV
2. Radio . . . AM, FM
3. Industrial Electronics
4. Communications

**OF THE INDUSTRY  
HOME TRAINING**

5. Sound Recording & Hi-Fidelity
6. Automation
7. FCC License Preparation
8. Radar & Micro Waves

Let National Schools of Los Angeles, a Practical Resident Technical School for over 50 years, train you at home by Shop-Method for unlimited opportunities in All phases of TV, Electronics, Radio.

**You get 19 big kits  
of equipment!**

**GOOD JOBS . . . MORE MONEY  
SECURITY . . . ALL CAN BE YOURS**

YOU are needed in the great modern Television-Electronics industry. Trained technicians are in growing demand, at excellent pay, in sales and service, manufacturing, broadcasting, telecasting, communications, research, and many other important branches of the field. National Schools Master Shop-Method Training, with newly added lessons and equipment prepares you in your spare time right in your own home for these fascinating opportunities. **OUR OUTSTANDING METHOD IS PROVED BY THE SUCCESS OF GRADUATES ALL OVER THE WORLD!**

**YOUR TRAINING IS ALL INCLUSIVE**

We prepare you for a long list of job opportunities. Thousands of TV and Radio receivers are being sold every day—more than ever before. And, now, Color TV is here. Applications of Electronics in industry—**AUTOMATION**—are growing in tremendous strides. The whole field is alive—opening up new, important jobs rapidly. National Schools complete training program qualifies you in all phases of the industry.

**YOU EARN WHILE YOU LEARN**

Many students pay for their entire training—and more—with spare time earning. We'll show you how you can, too! Early in your course you receive material that shows you how to earn extra money servicing TV and Radio receivers, appliances, etc., for friends and acquaintances.

**YOU GET EVERYTHING YOU NEED**

Clear, profusely illustrated lessons, shop-tested manuals, modern circuit diagrams, practical job projects—all the valuable equipment shown above—many other materials and services—consultation privilege with our qualified staff, and Graduate Employment Service. **EVERYTHING YOU NEED** for outstanding success in Electronics.

**INDUSTRY NEEDS YOU. NATIONAL SCHOOLS  
WILL TRAIN YOU. SEND FOR FACTS TODAY  
NO OBLIGATION.**

**YOU LEARN BY SHOP METHOD . . .** you do servicing, circuit analysis, and do over 100 down-to-earth experiments. You build a Superhet Receiver and a modern TV Receiver, from the ground up, including a new, big screen picture tube. You also receive a professional, factory-made **MULTI-TESTER**. All of this standard equipment is yours to keep . . . at just one low tuition.

**RESIDENT TRAINING AT LOS ANGELES**

If you wish to take your training in our Resident School at Los Angeles, the world's TV capital, start NOW in our big, modern Shops, Labs and Radio-TV Studios. Here you work with latest Electronic equipment—professionally installed—finest; most complete facilities offered by any school. Expert, friendly instructors. Personal attention. Graduate Employment Service. Help in finding home near school—and part time job while you learn. Check box in coupon for full information.

Approved for  
GI Training



**NATIONAL SCHOOLS**  
LOS ANGELES 37, CALIF.

**FREE!  
VALUABLE BOOK  
& SAMPLE LESSON  
—Just Send  
Coupon!**

**SAMPLE LESSON  
RADIO TELEVISION**

**YOUR FUTURE  
IN RADIO  
TELEVISION**

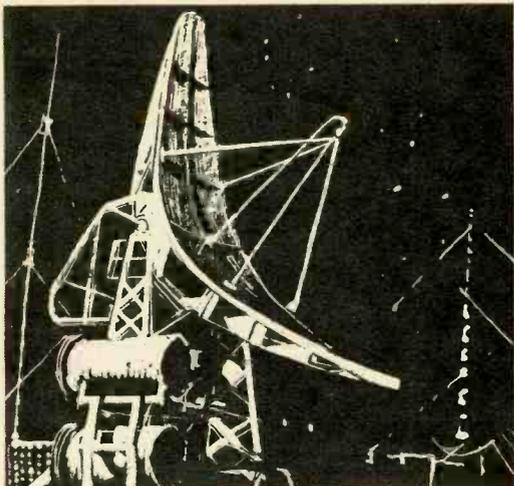
**NATIONAL SCHOOLS**

TECHNICAL TRADE TRAINING SINCE 1905  
LOS ANGELES 37, CALIFORNIA

**GET FAST SERVICE—MAIL NOW TO**  
NATIONAL SCHOOLS, DEPT. R4Y-108  
4000 S. FIGUEROA ST. LOS ANGELES 37, CALIF.  
Rush free TV-Radio "Opportunity" Book and sample lesson. No salesman will call.

NAME \_\_\_\_\_ AGE \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

Check if interested ONLY in Resident School training at Los Angeles.  
VETERANS: Give date of Discharge.



PREPARE NOW  
for a future in

## ELECTRONICS

**No previous technical experience  
or advanced education needed!**

Whatever your work is at the present time, you can take advantage of our new **ELECTRONICS TRAINING PROGRAM**. If you are 17 to 55, see how you can become an **ELECTRONICS TECHNICIAN**. You may prepare at home in your spare time.

**GRADUATE PLACEMENT SERVICE.** Our nation-wide placement service keep us in touch with the needs of hundreds of firms. We help place you in the area and job you prefer.

**HELP GIVEN IN FINANCING TRAINING.** We arrange easy terms—so don't let lack of money hold you back! We have helped thousands of others. Let us help you!

**OPPORTUNITIES ARE GREAT IN  
MANY DIFFERENT FIELDS...**

**ELECTRONICS • RADAR • MANUFACTURING  
INDUSTRIAL ELECTRONICS • TELEVISION  
AERONAUTICAL • COMPUTERS • SERVICING  
BROADCASTING . . . and hundreds of others**

**Send today for full information**

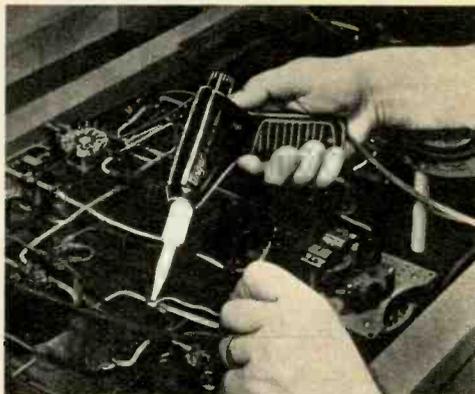
**ELECTRONICS DIVISION—Northwest Schools**  
Portland • Chicago • Hollywood (Dept. E-2)  
Home office: 1221 N. W. 21st Avenue, Portland, Oregon

Name

Address

City

Phone  Age



Ungar Electric Tools, Inc., has introduced the No. 260 Soldering Pistol featuring a comfortable hand fitted grip, light weight and perfect balance. Adjustment knob permits 180° turn of 2½" Tellurium copper chisel tip. \$4.50.



A series of "beeps" coming from your radio may mean a tornado is on its way, if you own one of the Sferics, Inc. severe weather warning devices. Designed as part of a standard radio, this unit operates on the electrical discharge principle, not as a barometric unit. It can indicate a tornado within 40 miles of the set, and shows the storm's progress on an alarm meter. List price \$84.50.



An invisible electromagnetic shield for our first supersonic bomber, the Air Force's B-58 Hustler, has been tested by Sylvania. Protecting against electronically guided weapons, it is the first automatic defense system specifically designed to suit one particular type of plane.



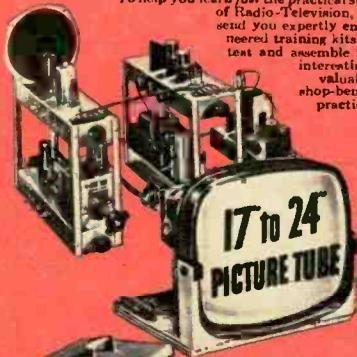
*Electronics Illustrated*

**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 6 sections.
- Now offered... this fine modern oscilloscope.
- You build this powerful two-band superheterodyne radio receiver



**Big New  
CATALOG  
AND  
Sample Lesson  
FREE!**



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!

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

**Mail This Coupon Now—No Salesman Will Call**

**Sprayberry Academy of Radio-Television**  
Dept. 120-N, 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.....

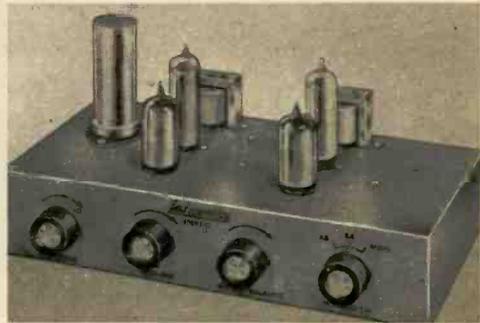
CITY..... ZONE..... STATE.....





An electronic "eye" which can see in near darkness may provide the key to observation of previously unseen details of planets and nebulae. The device is RCA's new camera tube based on television principles and known as the Intensifier Orthicon. The extreme sensitivity of the tube is achieved by two "intensifier" stages built into the tube between the light-sensitivity pickup surface at the front and the signal output assembly at the rear. Electrons emitted into the tube from a sensitive surface do not go directly to the target

but to these intensifier screens. When two such screens are used, approximately 300 electrons are produced for every one released originally by the image on the sensitive surface.



A small, economy stereo amplifier in kit form, is the KT 126 from Lafayette Radio. This compact unit has an output of 2 watts per channel or 4 watts when monaurally operated, with separate volume controls for each channel, ganged tone control, stereo-monaural and phasing switch. \$17.95.

## NOW YOU CAN SECURE A HIGH SALARIED • TOP PRESTIGE CAREER IN ELECTRONICS IN ONLY ONE YEAR!

**ELECTRONICS** is the fastest growing industry in America today, creating unlimited opportunities for high salaries, with rapid advancement in **INDUSTRY AND THE ARMED FORCES** for Bailey Trained electronic engineering technicians.

**LARGE CORPORATIONS** from coast to coast, and **BRANCHES OF THE ARMED FORCES** send recruiters to visit each graduating class at Bailey Tech, offering unusually high starting salaries.

**BAILEY GRADUATES ARE BEING HIRED** for such fascinating and interesting work as technical salesmen, research and development of guided missiles, electronic business machines and automatically controlled manufacturing plants, etc., also good **RATINGS IN THE ARMED FORCES**.

**UP TO SEVEN TECHNICIANS** are needed for every engineer... this, plus superior training is why Bailey Graduates are being paid more to start, and are advancing more rapidly than many men who have spent four years in training.

Resident training is easier and costs less than you may think! We provide housing and part-time jobs while in school, plus free nationwide employment service for graduates. If you want to quickly enter America's fastest growing and most exciting industry, write for free booklet... no obligation.

**VETERAN APPROVED  
BAILEY TECHNICAL SCHOOLS**

1625a S. Grand • St. Louis 4, Mo.



This Minneapolis-Honeywell system controls hundreds of automatic manufacturing operations. Experience on live equipment is emphasized at Bailey and is another reason for the tremendous backlog of high pay positions waiting **BAILEY GRADUATES**.

### MAIL TODAY

Please mail immediately this free booklet without obligation

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_



# BIG 16 RADIO

Reg. U.S.  
Pat. Off.

## KITS AT HOME

only  
**\$22.95**



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

### 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 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 entire Kit! 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 are 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 capacitors, 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 connections. 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 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
- HIGH FIDELITY DISCOUNT CARD
- CERTIFICATE OF MERIT
- TESTER INSTRUCTION MANUAL
- 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.

### 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 with 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.

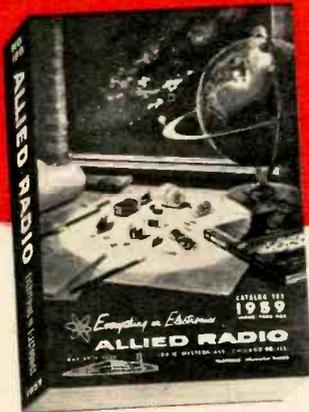
1186 Broadway, Dept. 505AE, Hewlett, N. Y.

Free!

ALLIED'S

MONEY-SAVING 1959

ELECTRONIC SUPPLY CATALOG



452

value-packed pages

send for it!

SAVE

ON EVERYTHING IN ELECTRONICS

EASY TERMS AVAILABLE

WORLD'S LARGEST STOCKS

Here is the complete guide to everything in Electronics for Experimenters, Builders, Amateurs, Servicemen, Engineers and Hi-Fi enthusiasts:

- Amazing Build-Your-Own KNIGHT-KITS
- Everything in STEREO Hi-Fi
- Hi-Fi Music Systems & Components
- Recorders & Phono Equipment
- Public Address & Paging Systems
- TV Tubes, Antennas, Accessories
- Amateur Station Equipment
- Latest Test & Lab Instruments
- Industrial Electronic Supplies
- Parts, Tubes, Transistors, Tools & Books

SAVE on everything in Electronics at ALLIED—get fast, dependable service, expert personal help, guaranteed satisfaction. Send today for your FREE 1959 ALLIED Catalog.

Everything in Electronics From One Reliable Source

OUR 38th YEAR

Send for FREE Catalog

ALLIED RADIO

- ALLIED RADIO, CORP., Dept. 86-L8
- 100 N. Western Ave., Chicago 80, Ill.
- Rush FREE 1959 ALLIED 452-Page Catalog

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



Electronics goes back to school, with an ingenious network combining a public address system, fire detection equipment, telephone-intercoms, clocks, signals and closed circuit TV. Built by DuKane Corp., the MCS (Multi-Purpose Communication and Signaling) includes a Thermodyne fire-protection system, which is a tiny sensing unit in the ceiling that detects any change in temperature and triggers a fire alarm. Flood detection and tripping of burglars can also be adapted to this system.

A new transistor characteristics and interchangeability guide is available from Sylvania Electric Products, 1100 Main St., Buffalo, N. Y., at no cost.

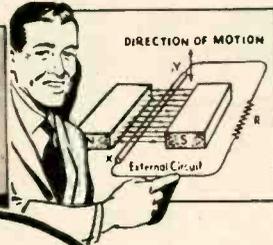
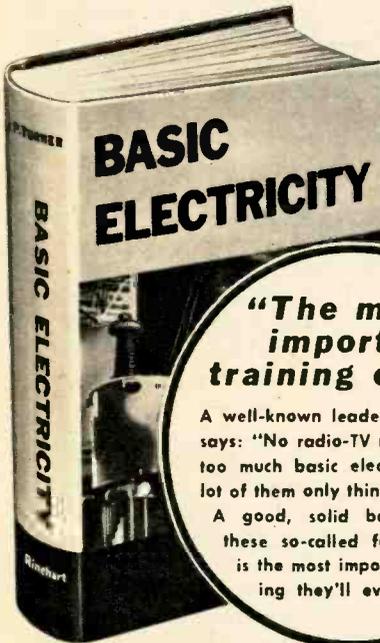
A major step toward safer and more reliable electronic equipment for the control of large nuclear reactors has been taken by Bendix Aviation Corp. with the development of a "cut-off" switch. The system, comprising more than 100 transistors, detects and warns of any abnormal condition in the reactor, and automatically shuts it down if safety requires it.

The Civil Aeronautics Administration operating a network of weather navigation stations on the 200-400 kc. band gives complete weather summaries and special aviation information. Write: U. S. Coast & Geodetic Survey, Washington 25, D. C., for charts of CAA stations and marine beacons.

Whatever you want to do in Radio-Electronics . . .

# LEARN BASIC ELECTRICITY

# FIRST!



**"The most important training of all!"**

A well-known leader in electronics says: "No radio-TV men ever knew too much basic electricity—and a lot of them only think they know it. A good, solid background in these so-called fundamentals is the most important training they'll ever get."

Learn your basic electricity NOW! Learn it thoroughly! Then everything else in electronics, radio, TV, communications, hi-fi, etc. comes 10 times as easy—because they are all based on the same fundamental electrical principles!

That's why this big, new 396-page BASIC ELECTRICITY manual brings you the most important training of all. It is a complete course in basic electrical subjects, including basic electronics. For the beginner, it is as necessary as oars are to rowing a boat. For the more experienced serviceman, amateur, experimenter or hi-fi enthusiast it paves the way to new and better understanding of almost any problem, circuit, component or piece of equipment.

## COMPLETE ELECTRICAL "KNOW HOW" (Including Basic Electronics) in one big, easily understood home training guide

BASIC ELECTRICITY'S down-to-earth treatment of the all-important fundamentals can quickly clear up misunderstandings and problems that may be puzzling you now.

No involved mathematics—just plain, common technical sense!

From basic circuits and currents to electro-magnetism . . . from capacitance to resistance . . . from polyphase systems to 'phone principles . . . from instruments to the whys and wherefores of electrical tests . . . from amplifiers to oscillators . . . from vacuum tubes to transistors and dozens of other subjects, this big book explains things from the beginning.

Essential elements such as motors, generators, batteries, rectifiers, transformers and subjects like polyphase and

power factor—often neglected by ordinary books—are fully, and clearly taught in a way you can hardly fail to understand.

More than 300 pictures, charts and diagrams SHOW you the how and why of things. Dozens of basic electrical problem solutions make details doubly clear. Each chapter ends with a self test review so you'll be sure not to miss out on matters it's important for you to know. A top notch instructor standing by your side could hardly do better!

Best of all, the price of this new training book is only \$6.50. If sent to you in lesson form as a correspondence course, you'd say it was a bargain at \$100!

Use coupon today! Read BASIC ELECTRICITY for 10 days. If not more than satisfied, send back the book and don't owe us a cent!

### This is the Kind of Training That Helps You Understand What Makes Electronics "Tick"

Following is a partial list of subjects:

Circuits and Currents; Magnetism and Electro-magnetism; Controls; Capacitance; Inductance; Resistance; Phase Relations; Generators; Motors; Rectifiers; Transformers; Wiring; Illumination; Instruments; Measurements; Tubes; Transistors; Amplifiers; Oscillators; X-Rays; Power Factor; Servos; Industrial Electronics; Automation . . . and many others.

### STUDY 10 DAYS FREE!

Dept. PR-118, RINEHART & CO., INC.  
232 Madison Ave., New York 16, N. Y.

Send 396-page BASIC ELECTRICITY home training manual for 10-day FREE EXAMINATION. If I like book, I will then send \$6.50 (plus postage) promptly in full payment. If not, I will return book in 10 days and owe nothing. (SAVE! Send \$6.50 with order and we pay postage. Same 10-day return privilege with money refunded.)

Name .....

Address .....

City, Zone, State.....

OUTSIDE U.S.A.—\$7.00 cash. Money back if you return book in 10 days.

**THIS CAN BE YOU**  
 earning up to  
**\$25,000 a year**



here is an amazing  
 new **BUSINESS**  
**OPPORTUNITY** for you . . .

**Self-service tube testers do all the work for you . . . just collect your profits once a week**

A basic principle for making money is to have something work for you, rather than you yourself do the work. As an operator of a **FAST-CHECK SELF SERVICE TUBE TESTER** route you can be the proud owner of a solid fast-growing business . . . earning money for you while you take life easy. Business can be operated from home and during spare time. All you do is make calls once a week to restock testers and collect profits.

**No selling required**

Century's self-service tube testers check and sell TV and radio tubes automatically 12 hours a day—7 days a week. Consumers do their own testing and defective tubes are replaced on the spot for highly profitable sales. You place testers and tube stock in stores on consignment . . . and each one can net up to \$1000 a year.

**Retail stores welcome self-service testers**

Drug stores, luncheonettes, supermarkets, candy stores, hobby stores, etc. welcome having a tube tester placed in their store because of the extra traffic it attracts and the commission they earn.

**FREE booklet tells all about this booming business**

If you are interested in starting a lifetime business, then **ACT NOW** and send for **FREE** booklet to convince yourself that this is today's greatest business opportunity.

**DON'T DELAY . . . MAIL COUPON TODAY**

**CENTURY ELECTRONICS CO., INC.**

Dept. J-11, 111 Roosevelt Ave., Mineola, N. Y.

Please send me **FREE** booklet and particulars about setting-up a self-service tube tester route.

Name   
 Address   
 City  State

**A GREAT NEW MARKET  
 FOR CLASSIFIED ADVERTISERS**

**ELECTRONICS  
 ILLUSTRATED**

Effective with the December, 1958 issue, **ELECTRONICS ILLUSTRATED** will accept classified advertisements. For only 25c per word—minimum 10 words—you can now reach a rich, compact market of mail order responsive men readers. Write for full details today to Classified Manager, **ELECTRONICS ILLUSTRATED**, 67 West 44th Street, New York 36, N. Y.



Naval officers make an inspection tour, via closed circuit TV, of Lockheed's P2V Neptune. Engineer with pocket-size TV camera and microphone inside plane at right, provides a look at the extensive electronic installations for inspectors seated before TV monitors outside.

Electronic Earmuffs, which create artificial quiet by adding more noise, have been developed by Army and RCA engineers. A miniature microphone in the special earpiece creates a noise, just as loud as the external one but opposite in phase. When the two sound waves meet in the earcup they use up most of their energy fighting each other, thus reducing a loud roar to a whisper. The earmuffs could be used to muffle combat noise, as well as having commercial applications for factories and mills.

A fully transistorized portable color TV system which uses 75 watts less power than the sealed-beam headlights of an automobile, is in the experimental labs of RCA. The system is designed for closed circuit use in industry, defense, education and research, where compactness, portability and operating economy are essential.

An index to manuals of radio and TV schematic diagrams and tube layouts, listed according to make of set and year is now available to readers of *EI* from Supreme Publications, 1760 Balsam Road, Highland Park, Illinois, for only 5c in stamps. Usual price is 25c.

**AT  
LAST!**

# RADIO-TV and ELECTRONICS TRAINING

**.... AT A PRICE  
YOU CAN AFFORD!**



**\*21 INCH**  
Receiver Kit included

Yes, this great course costs far less than any training of its kind given by other major schools! Radio-Television Training School will train you for a good job in Television or Industrial Electronics — **AT HOME IN YOUR SPARE TIME.**

Think of it — a complete training program including over 120 lessons, Eleven Big Radio-Television Kits, Complete Color-TV Instruction, Unlimited Consultation Service... **ALL at a really big saving to you.** How can we do this? Write to us today... and find out!

And what's more — you can (if you wish)  
**OPEN YOUR OWN RTS-APPROVED AND  
FINANCED RADIO-TV SERVICE SHOP**

**We Want 100 More Shops This Year**  
This 35 year old training organization — called RTS, that's Radio-Television Training School — wants to establish a string of Radio-TV Repair Shops in principal cities throughout the U. S. So far, 36 such shops are NOW IN BUSINESS AND PROSPERING. We are signing contracts with ambitious men to become future owners and operators of these shops in all areas.

**FOR UNSKILLED  
INEXPERIENCED MEN ONLY —  
WE TRAIN YOU OUR WAY!**

We must insist that the men we sign up be trained in Radio-TV Repair, Merchandising and Sales by our training methods—because **WE KNOW** the requirements of the industry. Therefore, we will TRAIN YOU... we will show you how to earn EXTRA CASH, during the first month or two of your training period. **YOU KEEP YOUR PRESENT JOB. TRAINING TAKES PLACE IN YOUR OWN HOME, IN YOUR SPARE TIME!**

**RTS**  
APPROVED  
SERVICE  
SHOPS

Get your free book on the  
**FAMOUS RTS BUSINESS PLAN**  
find out how you can open  
**A REPAIR SHOP OF YOUR OWN**

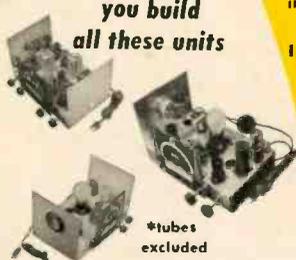
We supply and finance your equipment

When you are ready and qualified to operate one of our RTS-Approved TV Repair Shops **WE WILL SUPPLY AND FINANCE EVERY BIT OF EQUIPMENT YOU NEED TO GET STARTED** plus an inventory of parts and supplies. In other words we will stake you... **AN OFFER NEVER MADE BEFORE BY ANY TRAINING ORGANIZATION.** Under the RTS Business Plan you receive:

1. An electric sign for the shop front.
2. Complete laboratory of test equipment.
3. Letterheads, calling cards, repair tickets, etc.
4. Basic inventory of tubes, parts, supplies.
5. Complete advertising and promotional material.
6. Plans for shop arrangement.
7. Instructions on how to go into business.
8. Continuous consultation and help.
9. The right to use RTS Seal of Approval, and the RTS Grid.
10. The right to use the Famous Trade Mark.

**COMPLETE  
COLOR  
INSTRUCTION  
INCLUDED**

you build  
all these units



\*tubes  
excluded

## RADIO-TELEVISION TRAINING SCHOOL

5100 S. VERMONT AVENUE  
LOS ANGELES 37, CALIFORNIA

Est. 1922



**ACT  
NOW!**

**CUT OUT AND MAIL — TODAY!**

### RADIO-TELEVISION TRAINING SCHOOL

5100 S. Vermont Avenue, Dept. EI-118  
Los Angeles 37, California

SEND ME FREE — all of these big opportunity books — "Good Jobs in TV-Electronics," "A Repair Shop of Your Own" and "Sample Lesson." I am interested in:

- Radio-Television       Industrial Electronics  
(Automation)

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

City & State \_\_\_\_\_

300



RTS' Membership in The Association of Home Study Schools is your assurance of Reliability, Integrity, and Quality of Training.

**ALL  
THESE  
FREE!**



Your New Job Is Waiting in

# TV-ELECTRONICS

## TRAIN BY PRACTICING AT HOME

Over 100,000 jobs are open for trained men in TV-Electronics. By 1961, demand for technicians will increase by 209%, according to Labor Dept. Earn up to \$150 a week and more repairing radios and TV sets. Open a repair shop. Or get into Automation, Communications, Broadcasting, Radar.



**BUILD THIS  
21" TV SET**

**YOU GET 20 KITS** of parts and tools to build a 21-inch TV set (with new 110° picture tube.) You also assemble a Tube Checker (a CTI "first.") With this instrument you can make service calls, earn cash as you train. Lessons on Color TV, Hi-Fi. Mail coupon!



## MAIL TODAY • TWO FREE BOOKS

Commercial Trades Institute • Dept. T-112  
1400 Greenleaf Ave., Chicago 26, Ill.  
Please send valuable free catalog, You and Television, and Lesson Samples.



Name \_\_\_\_\_ Age \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



## college graduates get ahead faster!

... have higher income ... advance more rapidly. Grasp your chance for a better life. Share rewards awaiting college men. Important firms visit campus regularly to employ Tri-State College graduates. Start any quarter. Approved for Vets.

### Bachelor of Science Degree in 27 months

Electrical Engineering with either an Electronics or Power major. Also Mechanical, Civil, Chemical, Aeronautical Engineering. In 36 months a B. S. in Business Administration (General Business, Accounting, Motor Transport Management Majors). Superior students faster. More professional class hours. Small classes. Enrollment limited. Beautiful campus. Well-equipped labs. Prep courses. Mature students. Modest costs. Enter January, March, June, September. Mail coupon now to Jean McCarthy, Director of Admissions, for Catalog, View Book and book "Your Career in Engineering and Commerce."



## TRI-STATE COLLEGE

48118 College Avenue, Angola, Indiana

Please send me your catalog with full information on Radio Engineering and other courses. I am especially interested in courses checked:

- Electrical Engineering (Radio, TV, Electronics option)  
 Electrical Engineering (Power option)  Chemical  
 Civil  Mechanical  General Business  
 Accounting  Motor Transport Management  Drafting

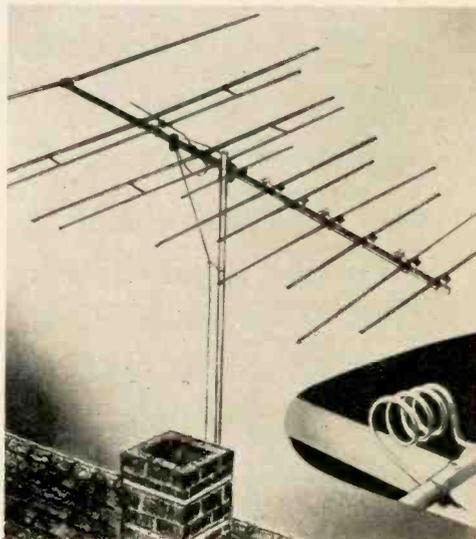
Name .....

Street Address .....

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



Insomniacs take heart—electronics has come to the rescue with the Sleepatron. Developed by Gardiner Electronics Co., the device simulates the sound of falling rain and completely shuts out extraneous noises. Its aluminum box contains 4 flashlight batteries and 7 transistors, and is entirely portable. \$125.



The Sky Blazer, Channel Master's Model 334, an all-channel VHF antenna with impedance compensating inductance coils provides a uniform, flat response pattern on all channels. Special elements give an extra gain boost on channels 7-13. List price \$21.53.

Light bill savings and fewer-bulb replacements are aims of a Bendix G-15 computer used in an effort to put longer, more uniform life into light bulbs.

# see what's new in electronic kits... see the outstanding 1959 **knight®-kits**

AN ALLIED RADIO PRODUCT



featured in **ALLIED'S**  
1959 CATALOG

*free!* send for it



There's a **knight-kit** for every need

- LOWEST COST • EASIEST TO BUILD
- LATEST DESIGN • FINEST QUALITY

*Do-It-Yourself: SAVE UP TO 50%*

SEE TYPICAL **knight-kit** VALUES LIKE THESE



**knight-kit Stereo Adapter Control Kit**  
Y-778 \$9<sup>95</sup>



**knight-kit Stereo Deluxe Preamp Kit**  
Y-776 \$62<sup>50</sup>



**knight-kit "Space Spanner" 2-Band Receiver Kit**  
Y-259 \$18<sup>95</sup>



**knight-kit Amateur Cbm-communications Receiver Kit**  
Y-726 \$104<sup>50</sup>



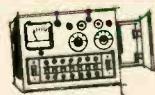
**knight-kit Dual 30-Watt Stereo Hi-Fi Amplifier Kit**  
Y-777 \$84<sup>50</sup> (less case)



**knight-kit 12-Watt Hi-Fi Amplifier Kit**  
Y-784 \$19<sup>95</sup> (less case)



**knight-kit "Ranger III" AC-DC Radio Kit**  
Y-736 \$16<sup>95</sup>



**knight-kit "400" Tube Checker Kit**  
Y-707 \$19<sup>95</sup>



**knight-kit "Span-Master" 4-Band Receiver Kit**  
Y-258 \$24<sup>95</sup>



**knight-kit "Ranger" Clock-Radio Kit**  
Y-737 \$24<sup>95</sup>



**knight-kit "Ranger" Radio-Intercom Kit**  
Y-739 \$27<sup>50</sup>



**knight-kit 12-in-1 Electronic Lab Kit**  
Y-272 \$14<sup>95</sup>

**Plus** DOZENS OF OTHER BEST BUY **knight-kits**

**EASY TERMS AVAILABLE**  
on orders of \$20 or more, only 10% down

### HI-FI KITS

- 18-Watt Amplifier
- 25-Watt Basic Amplifier
- 30-Watt Amplifier
- FM-AM Tuner
- FM Tuner
- Hi-Fi Preamplifier
- 2-Way Speaker Systems
- 3-Way Speaker Systems

### HOBBY KITS

- Printed Circuit Radio

### "Ocean-Hopper" Radio

- 5-Transistor Portable
- 2-Transistor Pocket Radio
- Transistor Lab Kit
- 1-Transistor Radio
- 2-Way Intercom
- Wireless Broadcaster
- Photoelectronic System
- Electronic Photoflash
- Crystal Set

### INSTRUMENT KITS

- 5" Oscilloscopes
- VTVM
- Tube Testers
- VOM's
- RF Signal Generator
- Signal Tracer
- Audio Generator
- Sweep Generator
- R/C Sub Boxes
- Capacitor Checker

### R/C Tester

- Transistor Checker
- Flyback Checker
- Battery Eliminator
- Voltage Calibrator

### AMATEUR KITS

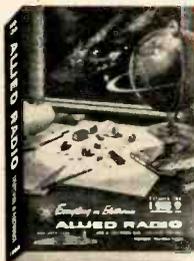
- 50-Watt Transmitter
- Self-Powered VFO
- 100 kc Crystal Calibrator
- RF "Z" Bridge
- Code Practice Oscillator

**FREE**

**452-PAGE 1959 ALLIED CATALOG**

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

**WRITE FOR YOUR FREE COPY TODAY!**



**ALLIED RADIO**

ALLIED RADIO CORP., Dept. 133-L8  
100 N. Western Ave., Chicago 80, Ill.

Send FREE 1959 ALLIED 452-Page Catalog

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# INVENTORS

Learn how to protect your invention. The U. S. patent laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable.

Unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor," containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form, will be promptly forwarded to you without obligation upon request.

## CLARENCE A. O'BRIEN & HARVEY JACOBSON

Registered Patent Attorneys

810-K DISTRICT NATIONAL BUILDING  
WASHINGTON 5, D. C.



Two stereo hi-fi amplifiers are now available from General Electric; the MS-4000 40-watt model with two integrated 20-watt channels at \$169.95, and the MS-2000 28-watt model, pictured, with two integrated 14-watt channels at \$129.95. Each has two power amplifiers and two preamp control units on a single chassis. The balance control on both allows the listener to adjust the sound volume from both speakers for the stereo perspective he wishes. Other controls for volume, bass, treble and contour are integrated dual types for simultaneous adjustment of both stereo channels.

A spectacular stereo demonstration by RCA will take place October 21 with a radio and color TV simulcast of the George Gobel show. The music and special effects will demonstrate the dramatic aspects of stereo, which home listeners can receive by placing an AM radio about 8 feet to the right of the TV set.

Five kits for converting present hi-fi equipment to stereo have come from RCA Victor. Model CK-2, consisting of a complete stereophonic record changer including cartridge, at \$49.95, also permits playing of stereo discs monaurally. Model SA-2 has a single speaker and a second amplifier unit in a mahogany table cabinet, for \$54.95. When combined with model CK-2 this completes conversion to stereo with separate amplifiers and speakers for each of the two channels. Model SH-3 has a second amplifier and a 3-speaker sound system in a console cabinet for \$79.95. SK-2 is a modification parts kit with the RCA Victor stereo cartridge, at \$19.95. Model AK-1 is an AC-DC dual channel amplifier, \$29.95.

## FAST WAY TO TOP PAY

Train Yourself To Level Of  
**ENGINEERING TECHNICIAN**  
with Radio College of Canada

Nowhere is there a greater need for skilled men than in the fabulously expanding field of electronics. And, it's easy to get started fast toward the high-paying jobs that are open in radar, microwave, television, aviation electronics. Enrol now in R.C.C.'s ELECTRONIC COMMUNICATIONS course . . . home study, day or night. No previous experience needed.

Radio College, now in its 30th successful year, has the facilities and the staff to give you the know-how it takes. Hundreds of graduates now employed in dozens of firms and Government agencies—some earning as much as \$10,000 a year within 2 years of graduating.

Act now . . . don't delay your future in electronics another day. Write stating age, education.

## RADIO COLLEGE OF CANADA

write to

86 Bathurst St.,  
Toronto, Canada

or

P.O. Box 164,  
North Wales, Pa., U.S.A.

# NO OTHER TUBE TESTER MADE- AT ANY PRICE - can MATCH the VALUE of the CENTURY FAST-CHECK



## 20,000 SERVICEMEN CAN'T BE WRONG!

See for yourself—AT NO RISK—why over 20,000 servicemen selected the FAST-CHECK above all other tube testers—regardless of price. With the FAST-CHECK you will make every call pay extra dividends by merely showing your customer the actual condition and life expectancy of the tube. The extra tubes you will sell each day will pay for the FAST-CHECK in a very short time.

Just 2 settings on the  
**FAST-CHECK TUBE TESTER**  
tests over 650 tube types completely,  
accurately — **AND IN SECONDS!**

- **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.

- **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 650 tube types is conveniently located inside FAST-CHECK cover. New tube listings are easily added without costly roll chart replacement.

Dimensions: Width: 14 1/4" Height: 11 1/4" Depth: 4 3/4"

Special compartment accommodates line cord and Picture Tube Test Adapter

### 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. This feature eliminates the need of carrying extra instruments and makes the FC-2 truly an all-around tube tester.

**FAST-CHECK'S** low price is made possible because you are buying direct from the manufacturer.

Model FC-2 — housed in rugged oak carrying case complete with CRT adapter...

Guaranteed for One Full Year

only **\$69.50** Net

## COMPARE FAST-CHECK WITH OTHER TESTERS RANGING FROM \$40 TO \$200

### RANGE OF OPERATION

- ✓ Checks quality of over 650 tube types, which cover more than 99% of all tubes in use today, including the newest series-string TV tubes, auto 12 plate-volt tubes, OZ4s, 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

- Checks each section of multi-section tubes and if only one section is defective the tube will read "Bad" on the meter scale
- Less than 10 seconds required to test any tube
- 41 long lasting phosphor-bronze tube sockets accommodate all present and future tube types... cannot become obsolete
- 7-pin and 9-pin straighteners mounted on panel
- Large D'Arsonval type meter is extremely sensitive yet rugged — fully protected against accidental burn-out
- Special scale on meter for low current tubes
- New tube listings furnished periodically at no cost
- Compensation for line voltage variation.

Other testers may have some of the above features... but only the **FAST-CHECK** has them all!

## SHIPPED ON APPROVAL FOR 10 DAY FREE TRIAL

Try the FC-2 before you buy it! No obligation to buy.

### PAY IN SMALL MONTHLY PAYMENTS

Easy to buy if you're satisfied. Pay at net cash price... no financing charges.

**NO MONEY REQUIRED WITH ORDER...**

## CENTURY ELECTRONICS CO., Inc., 111 ROOSEVELT AVENUE Dept. 411, Mineola, N. Y.

Rush the FAST-CHECK for a 10 day trial period. If not completely satisfied I will return the instrument within 10 days without further obligation. If fully satisfied I agree to pay the down payment within 10 days and the monthly installments as shown. No financing charges are to be added.

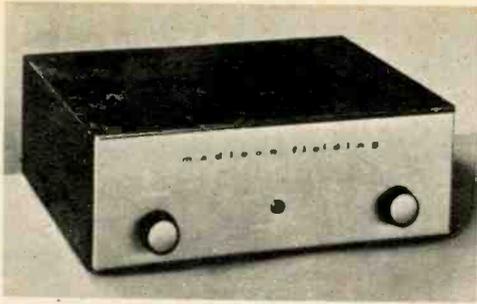
MODEL FC-2 . . . \$69.50 — Pay \$14.50 within 10 days.  
Balance \$11.00 monthly for 5 months.

Name .....

Address .....

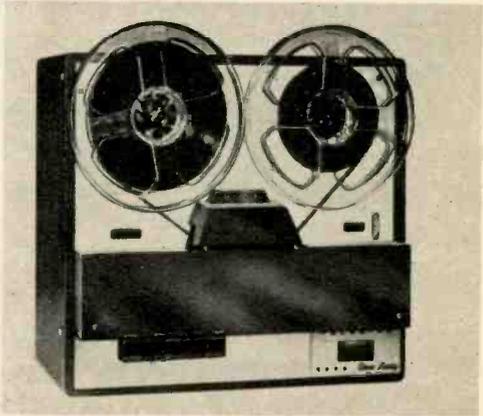
City ..... State .....

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



Home audiences will be able to receive the new stereophonic FM broadcasts with Madison-Fielding's Multiplex Converter Model MX-100. Manufactured under license from Murray Crosby, the unit need only be plugged into the Multiplex output on most FM tuners, to achieve stereo. The "Dimension" control enables the user to choose the degree of aural separation desired, regardless of speaker placement. Completely self-powered, the converter connects to FM tuners and amplifiers by means of standard phono-tip cables. Retail price, \$49.95.

The Telectro Tape Transport, Series 900, from Telectrosonic Corp., can record and play back stereo at 3 speeds: 1 7/8 ips, 3 3/4 ips and 7 1/2 ips. The deck is equipped with a 4-track head that accommodates 2 and 4 channel stereo as well as dual track monaural tapes. A unique braking system and re-wind method prevent tape spill or breakage. Prices from \$89.95 to \$114.95.



# Stereo THAT MEETS THE REAL TEST!



- ✓ SOUND REALISM
- ✓ REALISTIC PRICES



### SA-25 STEREO PRE-AMP PLUS ONE 25 WATT AMP

Here is the finest dual channel pre-amp and amp on one precisely engineered and designed chassis. When the SA-25 is attached to your present power amplifier it reproduces two separate channels of sound for STEREO from tape, records, and AM-FM. One easy, inexpensive step brings you the realistic, breathtaking magic of STEREO—with Arkay's SA-25.

Wired and tested ..... \$89.95  
 SAVE! Easy-to-build-kit ..... \$59.95



### SP-6 STEREO CONTROL CENTER

The SP-6 is a completely self powered sensitive dual pre-amp with dual inputs and outputs. Engineered to fit your requirements today, as well as tomorrow, the SP-6 provides unparalleled flexibility. Output of both amps is individually adjusted by one control, reverse position, hi lo filters, etc.

Wired and tested ..... \$62.95  
 SAVE! Easy-to-build-kit ..... \$39.95

Prices less cover—for panel mounting



### SPA-55 STEREO AMP

Priced for everyone's budget, here at last is a STEREO amp which is a must for every STEREO fan! Housing two identical 27 1/2 watt distortion-free amplifiers the SPA-55 is unsurpassed in quality and performance. This unit may be used as a STEREO amp, a bi-amp, and as a 55 watt Monaural unit.

Wired and tested ..... \$79.95  
 SAVE! Easy-to-build-kit .... \$64.95

### SPA-35

Same quality and performance as the SPA-55 35 watts.

Wired and Tested ..... \$62.95  
 SAVE! Easy-to-build-kit .... \$49.95



### ST-11 AM-FM STEREO TUNER

Here, for the first time, is an AM-FM STEREO Tuner within the reach of every adiphile. Unmatched by units costing twice the price, the ST-11 is two distinct receivers in one, featuring 4ur for 20 db quieting, Variable AFC, Single front panel switch controls AM, FM or STEREO selection.

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

**FREE!** At your dealer or write for complete catalogues of Stereo & Monaural HI-FI, Radio & TV, Kits & Wired

All prices 5% higher West of Mississippi

**arkay**

120 CEDAR STREET NEW YORK 6 6

Foremost Manufacturer of Kits In the World

RADIO KITS, INC., Dept. EI-11  
 120 Cedar St.  
 New York 6, N. Y.

Gentlemen:  
 Please send me your FREE 16 pg illustrated catalogue without cost of obligation.

NAME .....

ADDRESS .....

CITY ..... STATE .....

# BUILD 125 COMPUTERS AT HOME WITH GENIAC® <sup>ONLY</sup> \$19<sup>95</sup>

With the 1958 model GENIAC®, the original electric brain construction kit including seven books and pamphlets, over 400 parts and component rack, and parts tray, and all materials for experimental computer lab plus DESIGN-O-Mat®.

## A COMPLETE COURSE IN COMPUTER FUNDAMENTALS

The GENIAC Kit by itself is the equivalent of a complete course in computer fundamentals, in use by thousands of colleges, schools and industrial training labs and private individuals. Includes everything necessary for building an astonishing variety of computers that reason, calculate, solve codes and puzzles, forecast the weather, compose music, etc. Included in every set are seven books described below, which introduce you step-by-step to the wonder and variety of computer fundamentals and the special problems involved in designing and building your own experimental computers—the way so many of our customers have.

## ANYONE CAN BUILD IT!

You can build any one of these 125 exciting electric brain machines in just a few hours by following the clear cut step by step directions given in these thrilling books. No soldering required . . . no wiring beyond your skill. But GENIAC is a genuine electric brain machine—not a toy. The only logic and reasoning machine kit in the world that not only adds and subtracts but presents the basic ideas of cybernetics, boolean algebra, symbolic logic automation etc. So simple to construct that a twelve year old can build what will fascinate a Ph.D. In use by thousands of schools, colleges etc. and with the special low circuitry you can build machines that compose music, forecast the weather, which have just recently been added.

## TEXT PREPARED BY MIT SPECIALIST

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

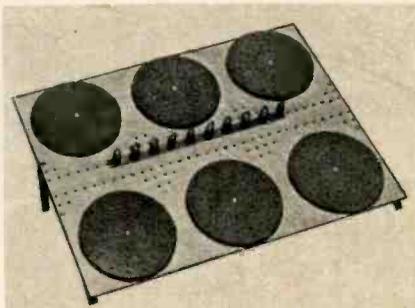
The complete design of the kit and the manual as well as the special book DESIGN-O-Mat® was created by Oliver Garfield, author of "Minds and Machines," editor of the "Gifted Child Magazine" and the "Review of Technical Publications."

## KIT IS COMPLETE

The 1958 GENIAC comes complete with the following books and manuals and over 400 components.

- 1) A sixty-four page book "Simple Electric Brains and How to Make Them."
- 2) Beginners Manual—which outlines for people with no previous experience how to create electric circuits.
- 3) "A Symbolic Analysis of Relay and Switching Circuits" By Dr. Claude Shannon provides the basis for new and exciting experimental work by the kit owner who has finished book No. 1.
- 4) DESIGN-O-Mat® Introduces the user to over 50 new circuits that he can build with GENIAC and outlines the practical principle of circuit design.
- 5) GENIAC STUDY GUIDE equivalent to a complete course in computer fundamentals, this guides the user to more advanced literature.
- 6) A Machine to Compose Music shows in an actual circuit what other GENIAC owners have been able to do on their own in designing new devices.
- 7) A Machine to Forecast the Weather—again a new adventure in scientific thinking created by one of our users who was trained on his GENIAC KIT.

Plus all the components necessary for the building of over 125 machines and as many others as you can design yourself.



OVER 20,000 SOLD

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

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

## COMMENTS BY CUSTOMERS

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

## Oliver Garfield Co., Inc. Dept. EI-118, 108 East 16th St., N. Y. 3, N. Y.

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

I have enclosed \$19.95 (plus 80c shipping in U. S., \$1.50 west of Miss., \$2.00 foreign), 3% New York City Sales Tax for N. Y. City Residents.

Send GENIAC C.O.D. I will pay postman the extra C.O.D. charge.

Name .....

Address .....

The experts say...  
in HI-FI and TEST  
INSTRUMENTS your best  
buy is

**EICO**

**EICO** 33-00 Northern Blvd., L. I. C. 1, N. Y. EI-11

Show me HOW TO SAVE 50% on 63 models of top-quality equipment (in box I have checked here.)

HI-FI  TEST INSTRUMENTS  HAM GEAR  
Send FREE literature & name of neighborhood EICO dealer.

Name.....

Address.....

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

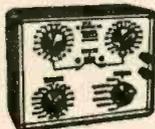
Add 5% in the West.



**New!**  
Miniaturized  
MULTI-SIGNAL  
TRACER #145A  
KIT \$19.95  
WIRED \$28.95



**New!**  
1000 OHMS/VOLT  
V-O-M #536  
KIT \$12.90  
WIRED \$14.90



**New!**  
Series/Parallel  
R-C COMBINATION  
BOX #1140  
KIT \$13.95  
WIRED \$19.95  
1350 Combinations!



VACUUM TUBE  
VOLTMETER #221  
KIT \$25.95  
WIRED \$39.95



5" PUSH-PULL  
SCOPE #425  
KIT \$44.95  
WIRED \$79.95  
Lowest-priced  
professional Scope



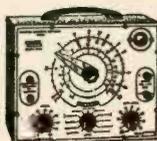
6V & 12V BATTERY  
ELIMINATOR  
& CHARGER #1050  
KIT \$29.85  
WIRED \$38.95  
Extra-filtered for  
transistor equip't.  
#1060 KIT \$38.95 WIRED \$47.95



PEAK-TO-PEAK  
VTVM #232  
& UNI-PROBE  
(pat. pend.)  
KIT \$29.95  
WIRED \$49.95



TUBE TESTER #625  
KIT \$34.95  
WIRED \$49.95



R-C BRIDGE & R-C-L  
COMPARATOR #950B  
KIT \$19.95  
WIRED \$29.95

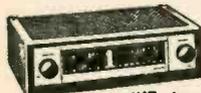
**IN TEST INSTRUMENTS  
IN HI-FI... STEREO and MONAURAL**



**New!**  
STEREO DUAL  
AMPLIFIER-PREAMPLIFIER HF81  
including cover:  
KIT \$69.95. WIRED \$109.95  
STEREO DUAL PREAMPLIFIER HF85  
KIT \$39.95, WIRED \$64.95



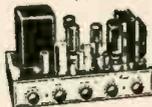
MASTER CONTROL  
PREAMPLIFIER HF65A:  
KIT \$29.95 WIRED \$44.95  
with power supply HF65:  
KIT 33.95 WIRED \$49.95 Superb  
new design . . . new "low sil-  
houette" look.



FM TUNER  
HF790  
KIT, less cover \$39.95\*  
WIRED, less cover \$65.95\*  
COVER. \$3.95 \*FET incl.  
"Drift absolutely absent; audio  
quality excellent."  
— Electronics Illustrated



60-WATT  
ULTRA LINEAR  
POWER AMPLIFIER HF60  
with ACRO TO-330 Output Xfmr  
KIT \$72.95 WIRED \$99.95 "excellent  
buy" — Marshall, AUDIOCRAFT.



50-WATT  
ULTRA-LINEAR  
INTEGRATED  
AMPLIFIER HF52  
KIT \$69.95 WIRED \$109.95  
"Excellent value"—Hirsch-Houck Labs.



20-WATT  
ULTRA-LINEAR  
WILLIAMSON-TYPE  
INTEGRATED AMPLIFIER HF20  
KIT \$49.95 WIRED \$79.95  
"Well-engineered"  
— Stocklin, RADIO TV NEWS



12-WATT  
WILLIAMSON-TYPE  
INTEGRATED AMPLIFIER HF12  
KIT \$34.95 WIRED \$57.95  
"Packs a wallop" — POPULAR  
ELECTRONICS



2-WAY  
SPEAKER  
SYSTEM HFS1  
complete with  
factory-built cabinet:  
\$39.95



STANDARD SPEAKER  
SYSTEM HFS2:  
Completely factory-built  
\$139.95 "Unusual  
suitability for stereo  
. . . eminently musical"  
— Holt, HIGH FIDELITY

Copyright 1958 by Electronic Instr. Co., Inc.

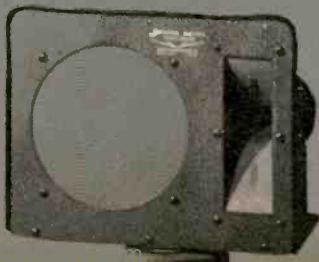
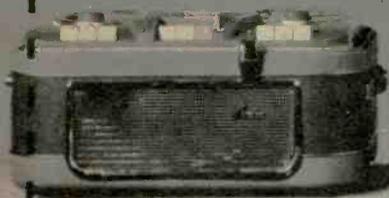
**IN STOCK!**

Compare, take them home—right "off the shelf"—from 1900 neighborhood EICO dealers. Over 1 MILLION EICO instruments in use throughout the world.

## Electronics Illustrated's Stereo Report

CAN a loudspeaker in a living room recreate for you the experience of attending a live concert? Up until STEREO made its appearance the answer to this question was a qualified yes. Good monaural hi-fi equipment does an amazingly accurate job of reproducing the sounds of an orchestra on records or tape or FM broadcasts. But, the sounds are coming out of that box in the corner or one end of the room and you know it. STEREO changes all this. Now, by using special records or tapes and some added components the sound seems to live around you. You play a STEREO record of a jazz group and from the two speaker systems spaced a small distance apart in front of you out march the five or six musicians, taking their places across the room and playing right at you. The trumpeter blows a hot solo and your head swivels to face him. This is STEREO!

This 27 page section has been especially prepared to tell you how *you* may get and enjoy STEREO from records and off the air. 



# Stereo Survey

By Norman Eisenberg

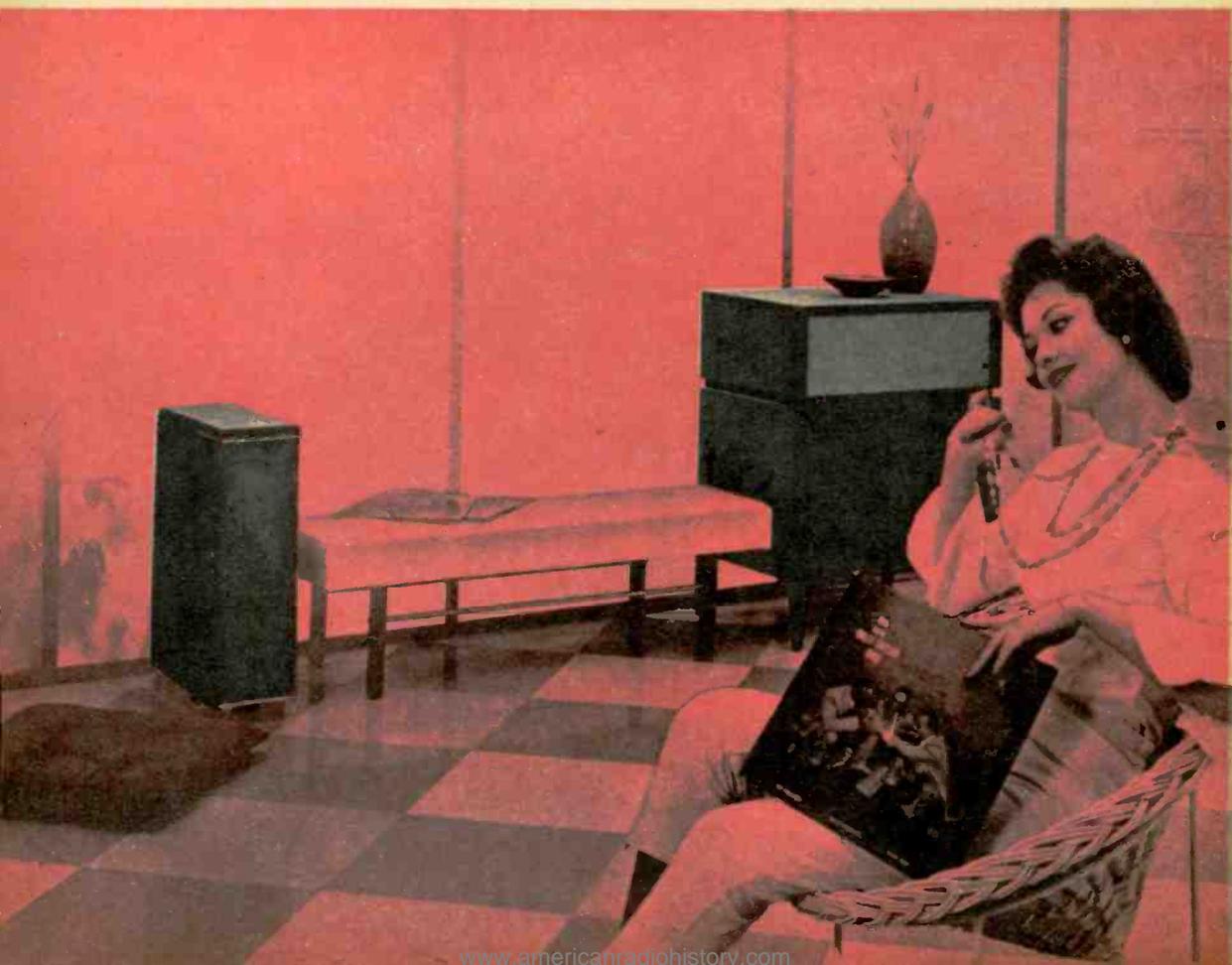
**You can convert to stereo or buy an all new stereo system—either way, here is what you will need.**

**S**TEREO, because of its realism and naturalness, promises to convert more people to quality audio in the home than monaural hi-fi ever did. As a matter of fact, stereo has become synonymous with hi-fi.

If you are interested in stereo hi-fi you will need some special equipment. But before you buy, you would probably like answers to the following questions: How does stereo equipment differ from monaural equipment? Should I buy stereo now, or wait? Should I buy stereo at all? Is the stereo component actually better for two channel listening than two monaural units? What's the purpose of all the new controls?

The rest of this article answers these questions.

**Two full-range speaker systems are not needed for stereo, says Electro-Voice. The second speaker can be like their Stereon, a small mid- and high-range unit.**

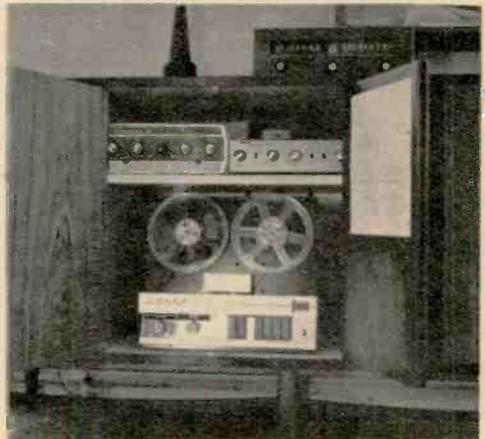




The above is not a typical stereo setup. The author is shown with but a portion of the components he tested for this article.



Stereo components need not take up much room. At the right is shown a complete stereo preamp-amplifier and record player which replace only twenty books on a shelf. Two speakers are elsewhere.



The complete tuner and tape system shown below right, uses two dissimilar preamps and amplifiers which may be balanced by using a stereo adapter like the one just above the author's hand in the top photo.



H. H. Scott Type 330C



Fisher Model 101-R



Harman Kardon TP-200



Lafayette KT-500



Heathkit PT-1

**Stereo tuners with individual AM and FM. Two stations can be tuned in simultaneously.**

### Stereo Tuners

A stereo AM-FM tuner is, essentially, two tuners in one. AM and FM sections are built on the same chassis and use the same power supply, but they function independently. With such a tuner you can listen to AM only, FM only, or both at once. The both-at-once function permits tuning in stereo AM-FM broadcasts. Available in some areas, those broadcasts provide stereo of sorts.

The "of sorts" qualifies the set-up, of course. Listeners to broadcast stereo point out that the channel separation is nothing like what is available from good tapes and discs played at home. This appears to be true, using a stereo tuner or using an FM-only tuner and a self-contained AM receiver. Obviously, the tuner itself, good as it is, cannot furnish more than is sent to it by the broadcasters. And even the best AM lacks the wide-range, interference-free characteristics of average FM.

What with FM multiplexing coming in as a superior broadcast stereo medium (see story on page 44 of this issue), one may well speculate on how important a stereo AM-FM tuner is at all. The simple answer is that this type of unit—whether you use it on stereo or not—still furnishes you with two basic program sources, and if you feel you need them, then the stereo tuner is no less valid than the nonstereo AM-FM tuner.

At this writing, there are less than a dozen different makes of stereo tuners. As with any carefully designed AM tuner, the AM half of the stereo unit pulls in AM broadcasts with clarity and apparently wide response. However, in some circuit designs, AM sensitivity tends to be lowered if wideband response is sought; this fact often calls for a healthy length of outside antenna.

All of which means that the stereo AM-FM tuner is a two-in-one affair that

will allow you to tune in the limited AM-FM type stereo broadcast with extra convenience. The important question when judging one, is how good is it as an FM tuner, and as an AM tuner.

Proven performers include the \$199.95 Scott 330-C; the Madison Fielding 330 at \$149.95; the Lafayette KT-500, a kit for \$74.50, or the LT-50, the same unit wired and tested for \$114.50. More recent models worthy of serious consideration are the \$229.50 Fisher 101-R and the Harman Kardon TP-200 which at \$189.95 includes a built-in stereo preamp. A new stereo tuner kit by Heath, the PT-1 for \$89.95 is worth noting and Knight (Allied Radio) promises one soon. The lowest priced model is the ST-11, a kit by Arkay, at about \$50 it offers an interesting, if minimal, circuit.

### Stereo Amplifiers

The stereo tuner may not be the answer to everyone's crying need, but the stereo amplifier is virtually a must for

correct, convenient, and ultimately satisfying stereo operation. Many listeners (the author included) have concluded by now that using two monaural amplifiers for stereo discs or tapes (yes, and broadcasts too) omits a lot.

For one thing, there is the matter of stereo balance. Level controls on each channel are, of course, needed, but they're not enough; a master control for regulating overall level is handy, as is a control that can be used to favor one channel over the other. Differences in the two speaker systems as well as differences in the acoustical characteristics of various parts of the same room can be settled with a balance control.

There are other areas for variation in stereo. Differences in recording techniques as well as in listening tastes being what they are, a convenient means of reversing the relative positions in the room of channels 1 and 2, i.e., changing one channel from the left speaker to the right one and vice versa, is a definite

**Combined stereo preamp-amplifiers. These can all be used in a conventional monaural system.**



Eico HF 81



Bell Pacemaker Model 2221



Pilot SM-244



Sargent-Rayment Model SR-17-17



Harman Kardon Model A-250



H. H. Scott Type 299

advantage. A switch on the control panel saves you the job of changing the connections to your loudspeakers. Yet another chore is eliminated by a phase reversal switch. When connecting two speakers to stereo outputs, you have a fifty-fifty chance of connecting them in phase, so that they work together instead of against each other. A phase reversal switch enables you to correct the mistakes from the amplifier control panel instead of crawling behind the speakers again.

Aside from control convenience there are other points on which the stereo amplifier scores over two separate monaural amplifiers. Connecting the output from a stereo magnetic phono pickup

to two distinct chassis increases the likelihood of a hum loop, or even a shock hazard. Then too, stereo amplifiers can do tricks. The better stereo preamps have provision for blending part of channel 1 and 2, without interfering with them, and combining the mixture for a third channel—for monaural listening in another room, or for 3-channel stereo. Also, some stereo amplifiers have provision for operating their power output sections in "cascade"; a dual 10-watt unit, for example, can be switched for use as a monaural 20-watt amplifier. This is of value to the owner who has not yet bought a second speaker.

We have been using the term ampli-

Typical stereo preamp control units with such unfamiliar controls as "balance" and "phase".



H. H. Scott Type-130



Eico HF-85



Leak Point One Stereo



Arkay SA25



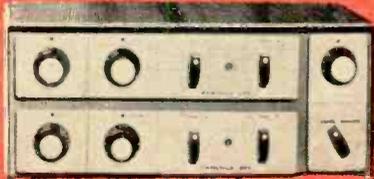
Madison Fielding Series 340



Knight Model KN-700



Lafayette remote stereo control



Fairchild stereo converter with preamps



Dynakit stereo control DSC-1 with preamps

If two individual preamps are used it is convenient to use an "adapter" to balance them.

fier in its most general sense, implying all the while, of course, preamplifier and power amplifier. In terms of specific models available, the greater number produced to date are "integrated amplifiers" (also described as "all-in-one" or "single-chassis" or "complete" or "control" amplifiers). In such a unit the preamp and its controls as well as the power amplifier (for both channels) are all on the same chassis.

Alternately, the separate preamp-power amplifier approach is represented by a number of top-quality stereo preamp-only units which may be connected to two separate power amplifiers or two power amplifiers on one chassis. Yet another variation, unique to stereo, is the unit that contains a stereo preamp with one built-on power amplifier. This type needs an additional power amplifier for stereo.

*All-in-one Stereo Amplifiers.* Many of the first crop of lower-priced stereo all-in-one amplifiers, produced apparently in response to a big demand for low cost equipment that would enable people to play the new stereo discs immediately, provide most of the extras mentioned earlier, but omit some of the staples associated with hi-fi amplifiers. It is perhaps too early in the game to

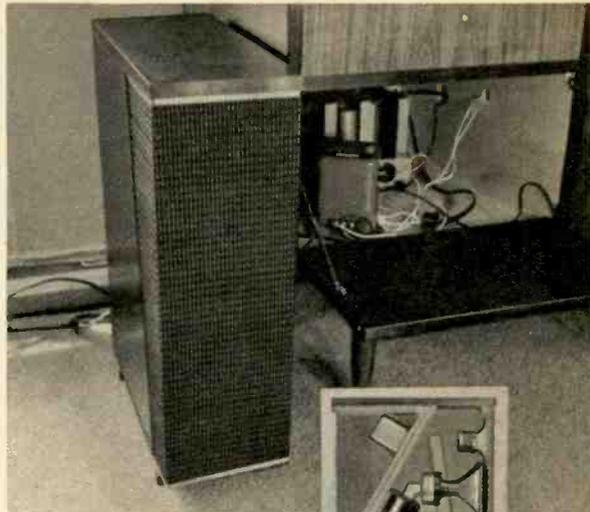
generalize; changes in design, specifications, and price are going on even as this is being written.

Many of the all-in-one units do not furnish, for example, separate treble and bass controls on each channel. The use of a common or "tandem" control is, to be sure, convenient; it is also, obviously, an economy. But it assumes you will never want to compensate one channel a little differently than the other. As things stand now, there is good reason for using separate controls on each channel—because of dissimilarity of speaker characteristics. There is something quite frustrating about trying, for example, to bring up the treble on channel 1 only to find it causes channel 2 to become screechy.

Among the all-in-one stereo amplifiers, a few offer more controls and facilities than others. The Madison Fielding 320, for example, and the Scott 299 both provide separate tone controls on each channel. Additionally, the 320 features a novel channel balancing system and a very logical panel layout. The 299, on the other hand, includes channel and phase reversal, rumble and scratch filters, and phono pickup selectors. Less features are offered by such amplifiers as the Harman Kardon "Epic" A-250



Jensen DS-100 speaker system has two woofers pointed down two mid- and high-range units that can be rotated toward the listener.



Electro-Voice Stereon speaker system contains only mid- and high-frequency horns, supplies directive range of hi-fi sound.



and the Pilot SM-244, both of which provide for channel reversal, but use tone controls common to both channels. The Pilot's tone controls are calibrated for phono equalization; obviously once you set them for a particular playback curve they no longer function fully to compensate for speaker characteristics or room acoustics.

In another vein, the buyer should check to see that the mechanical layout is not so tight that the amplifier will eventually heat up excessively and cause premature breakdown. The Sargent-Rayment SR-17-17, for example, an integrated stereo amplifier with controls and 17 watts output on each channel, stands 5½ inches high. This unit shows evidence of careful conservative design, with plenty of room for its parts.

**Stereo Preamplifiers.** It is in the area of the separate preamp and power amplifiers that one finds an all-out, no-holds-barred approach to stereo. As might be expected, one finds higher prices too, but the extra cost buys you all the imaginable conveniences and extras of stereo control.

The roster of stereo preamps is impressive and appears to be growing weekly. The Pilot SP-215 at \$189.50,

the \$169.95 Scott 130, the Altec Lansing 445A at \$189 and the Fisher 400C at \$169.50 were among the first of the stereo preamp leaders. More recent is the model 340 by Madison Fielding. Each of these provides full stereo facilities and each has unique features for individual appeal; the Scott with its thorough flexibility and third-channel provisions; the Pilot with its two front-panel meters for monitoring stereo recordings; the Altec Lansing with its extensive use of low-noise transistors; the Madison Fielding with its third-channel provision and two-channel mixing facilities for home recording; the Fisher with its simplified push-button control arrangement. The most expensive stereo preamp is the \$239.50 Fairchild 248; this consists, basically, of two monaural preamps and a stereo adaptor packaged as one big unit. A low priced stereo preamp, aside from kits, is the Grommes 208. At \$124.50 it offers most but not all of the features found in the others. The Leak stereo preamp appears to be well designed and solidly built but is usable only with Leak power preamplifiers.

Among kits, Eico, Arkay, Heath, Al-  
 [Continued on page 96]

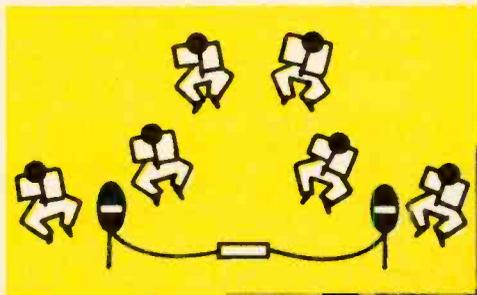
# Stereo Records: An Appraisal

**How good is the sound on the new stereo records?  
Much depends on the recording session techniques.**

**S**TEREO recording, like a new tool, works fine if it is used properly. From a purely mechanical point of view, the problem of packing two or more audio channels into a single record groove has been solved. But the acoustics of stereo recording are still largely unexplored and record makers must learn how to use them to best advantage.

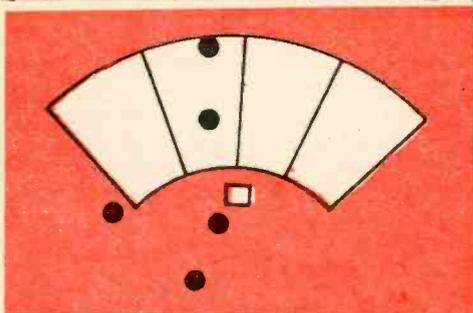
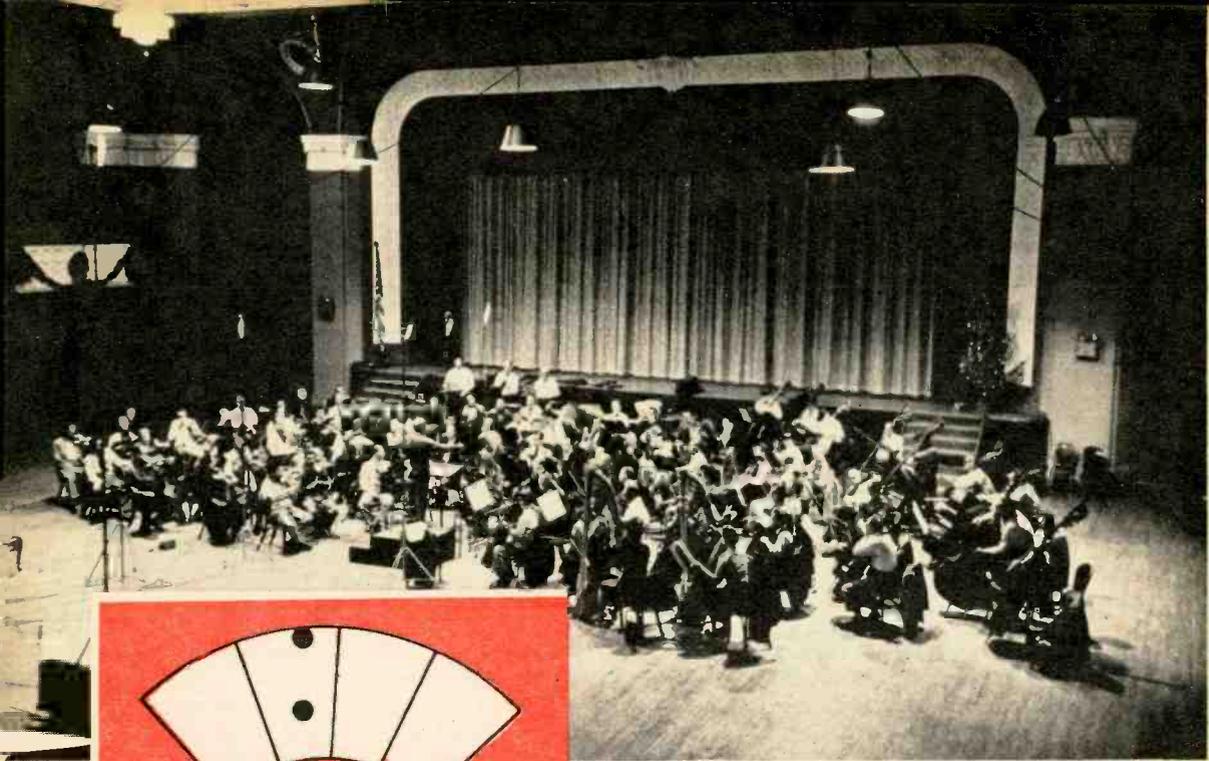
At present, recording engineers are experimenting with various microphone setups and the results vary all the way from superb to just plain awful. Eventually, standards will be adopted for stereo recording, but before this is done it will be necessary to reconcile different ideas on just what makes good stereo sound.

The usual way of making stereo recordings is to space out two microphones in front of the orchestra, one on the left side, the



Lateral (A-B) mike placement "lines up" musicians, separates instruments. Suitable for recording small groups, it's used below with jazz unit of Columbia's "Seven Lively Arts."





Symphonic recording often strives for three-dimensional tonal perspective in depth. Here Columbia has placed mikes behind conductor and through rows of Philadelphia Orchestra all the way to percussion section at rear.

other on the right. This is called "A-B" recording, since the two microphones are usually designated by those letters.

The spacing of the microphones is critical and no general rules have been formulated as yet. The size of the orchestra, the type and instrumental texture of the music, and the acoustics of the recording studio or auditorium figure strongly. If the mikes are too close, the stereo effect is diminished and the various instruments are not clearly localized in space. If the distance between the microphones is too great, the left-right directionality is exaggerated and, instead of giving the feeling of solid sound spreading evenly between the two speakers, the music jumps back and forth between the speakers like a ping-pong ball, with nothing in the middle.

The "hole in the middle" tends to rob the sound of the sonority and "body" that we might rightfully expect as one of the advantages of stereo.

Some record companies have recently found ways to plug up that sonic "hole

in the middle" between the two stereo speakers. They put a third microphone, called a "fill mike" midway between the spaced-out "A" and "B" microphones in front of the orchestra. The output from this centrally located mike is then fed as a weak addition into both stereo channels.

Some recording companies seem to sidestep musical fidelity and concentrate on achieving acoustic sensation. Left/right separation is exaggerated for its dramatic effect.

Sidney Frey, president of Audio Fidelity Records, makes no bones about it: "It's going to take more than just music—even good music beautifully reproduced—to sell stereo. The old ping-pong ball and the choo-choo demonstration record—'Listen, you'll hear it crash along from one side of the room to the other'—are going to clinch more stereo sales than the best symphonic recordings.

"Why? The customer is paying for two amplifiers and two speakers—not to

mention a special cartridge and needle. He wants to be able to hear what these two channels can do.

Goddard Liberson, president of Columbia Records, came out clearly on the side of "truthful" music: "We pay an orchestra to play together," he said, "and we won't let our engineers pull it apart."

As a basic rule in buying stereo recordings, remember that the best stereo sounds very much like the best monaural, except that it has more depth and spaciousness. Don't be taken in by dramatic effects of the ping-pong technique.

Some critics of current stereo discs point out that A-B mike placement, even with the fill mike, emphasizes directionality at the expense of depth. They consider this musically incorrect. It is not necessary, they say, to localize the instruments because nobody really cares

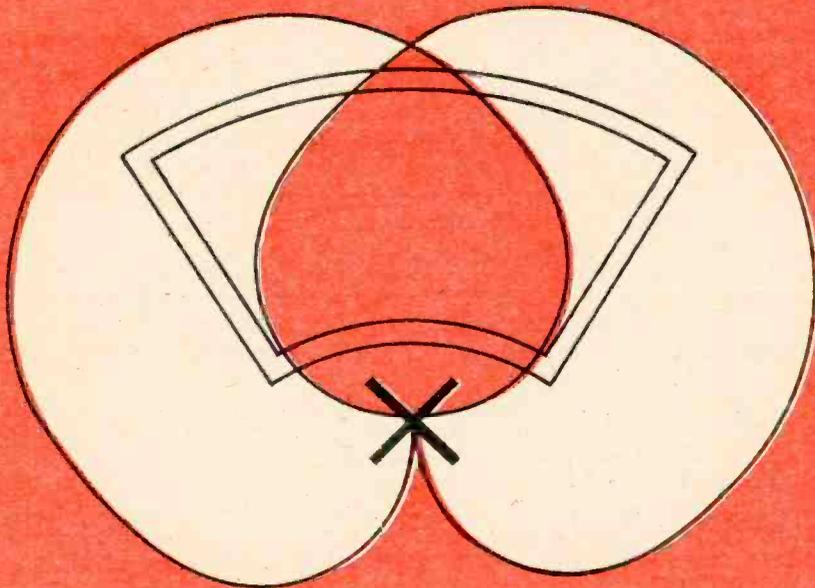
just where the players sit. What should exist is a three-dimensional sense of tonal perspective that puts the woodwinds behind the strings, the brass behind the winds, and percussion behind the brass.

These ideas have prompted some European companies to experiment with so-called M/S stereo system in which microphones and speakers are oriented in depth rather than from side to side. But here the shoe is on the other foot because depth is gained at the expense of directionality and we still do not have full dimensional sound.

A compromise solution is a stereo technique now favored by several other European recording companies, notably E.M.I., which appears as Angel and Capitol in the American market. In this system, two microphones (called the

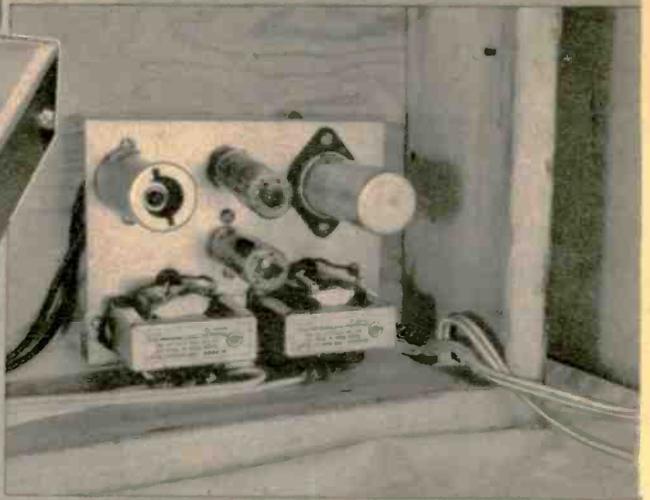
[Continued on page 94]

**New M-49 stereo mike (Internal view at right) is actually two mikes in one. Set above center of orchestra, heart-shaped pickup pattern of each element is aimed at different far corner of symphonic group, achieving compromise between depth and directionality. Shaded area is where patterns overlap.**





The stereo player described last month is seen above. The two-channel amplifier added now and shown at right will work with any phono having a crystal pickup.



## Stereo on a Shoestring-2

By Ernest Wayland

**Convert the simple stereo amplifier described last month from headphone to loudspeaker operation.**

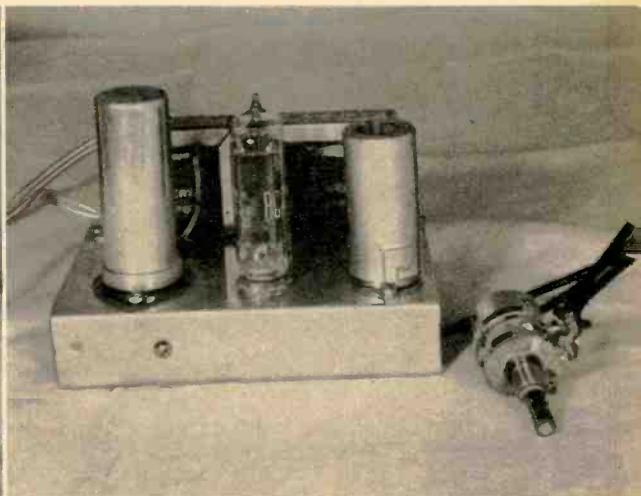
**L**AST month we described a two-channel stereo amplifier and record player to use with headphones. In this article the amplifier is expanded for operating two loudspeakers, the basic player mechanism remaining unchanged. All that needs to be added are two power output circuits and two speakers. The instructions given here are detailed enough so the amplifier may be built to use with an existing phono without referring to the previous article.

The stereo power amplifier is designed for operation with the Electro-Voice Model 66 stereo cartridge and two inexpensive speaker systems. The stereo speaker designed for *EI*'s first issue (May, 1958) worked out extremely well as one of the two speaker channels. Any of the small full-range systems will serve equally well in the other channel.

The new stereo loudspeaker amplifier is built on the same chassis used for the headphone version presented in our October issue. None of the expensive components are scrapped and additional parts should run about \$10.

The original dual triode circuit serves as the voltage amplifier to drive the new output stages. The output transformers fit comfortably on the chassis side by side if you followed the original layout.

Start the conversion by removing the 750 ohm resistor (R10). The ventilation holes which were drilled directly above it now



The additional parts visible on top of the amplifier chassis are two output transformers at left and the 50C5 output tubes, center. Right photo shows the dual control R11 and R12. On the chassis left to right are C3, V2, and V1.

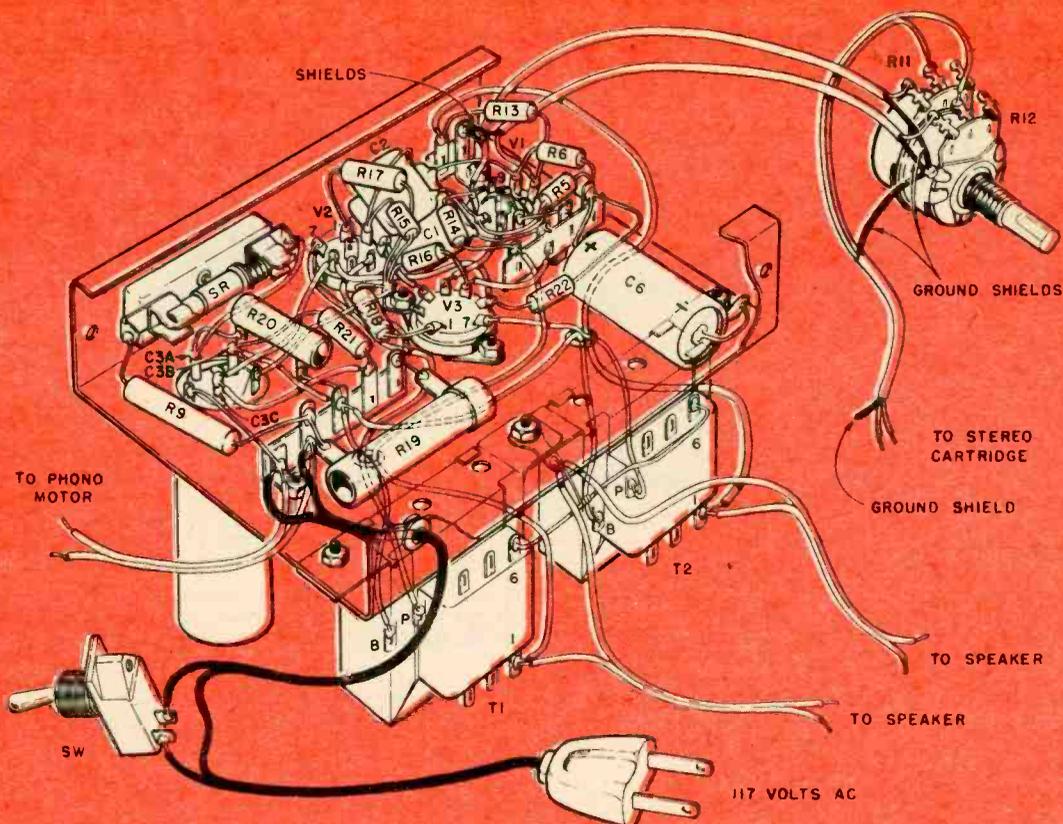
serve for transformer mounting. Notice that only three bolts are used, the middle bolt holds one tab of each transformer and a ground lug.

Before mounting the transformers, the tube socket holes are drilled and positioned on the chassis as shown. Two extra chassis holes are drilled on the plate lead side of the transformers to accommodate the B plate and feedback leads. It is good construction practice to insulate each chassis feed hole with a rubber grommet.

In addition to the removal of the filament dropping resistor, certain other wiring changes must be made and several components added. The filament of the 12AT7 is now wired in series with the 50C5's and the new 75 ohm 10 watt dropping resistor serves as a filament ballast. It's important that the filament ground return be made at the 12AT7 end of the series string as shown in the schematic.

Power supply redesign was necessary both to reduce the hum level of the amplifier for use with speakers having a good bass response and to supply the extra current for the output tubes. The wattage ratings specified for the new power supply resistors were determined experimentally. All of them will heat up during use but they are operating within their ratings. The original triple-section can type capacitor and an additional 20 mfd. tubular are used for filtering. The 3-section pi-filter network keeps the hum down to the point where it is inaudible more than two feet away from the speaker cabinets.

The input stage of each channel was redesigned for best possible performance with the remainder of the circuit. The 4.7 megohm feedback loop and grid return resistors were all removed, as were the headphone leads and jack. The two 5.6 megohm feedback resistors are critical and 5 or 10% tolerance components should be used. These resistors serve a triple function; (1) They are the cartridge load resistors; (2) The



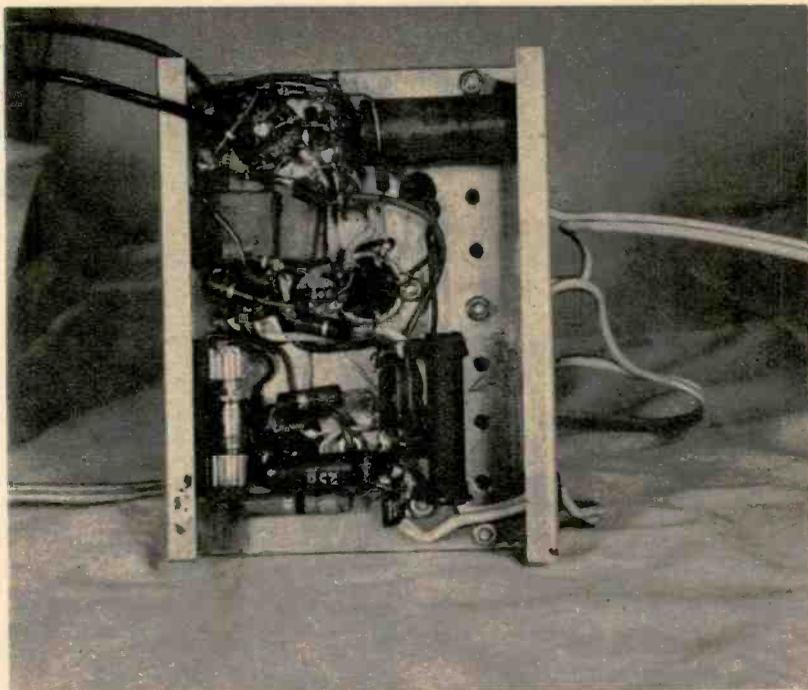
This guide will enable you to mount and wire in the new parts or to build the amplifier completely.

12AT7 grid bias resistors; and (3) provide the negative feedback from the secondary winding of the output transformer.

Make sure that the feedback loop is connected correctly. Note that on each transformer, one side of the secondary winding is ground and the other is connected to the feedback loop. If the phasing of the hookup is incorrect, one or both channels may squeal. In that case reverse the connections to the transformer secondary so that the lug that previously was grounded is now the feedback point. In the author's model, lug No. 6 on both transformers is grounded and lug 1 is the feedback connection. The speaker leads connect to the same terminals. Note that one side of both speaker lines is connected to the

chassis. Since the amplifier is AC-DC operated and may have a hot chassis, it is important to polarize the line plug to prevent chance of shock. See *EI* article "Play It Safe" (July, 1958) for the proper precautions.

A number of features available on the more expensive commercial stereo amplifiers have been omitted in this stripped down model. A volume control was considered necessary (it wasn't with the headphone model) and a 3 megohm unit was wired as shown in the schematic. The unconventional hookup used achieves a type of loudness compensation. That is, as the volume is turned down, bass boost is applied to achieve pleasant listening at low volume levels. The control itself may be two separate controls, ganged.



Underside view of the modified amplifier. Filter condenser C6, seen at upper right, and filament dropping resistor R19 lower right, are both new components.

Both the schematic and parts list indicate old and new parts. On the schematic, all additional components are designated by figures printed in heavy type.

PARTS LIST

Old Parts

- R5, R6—100,000 ohm, 1/2 w.
- R9—33 ohm, 1 w.
- C1, C2—1 mfd., 200 v.
- C3A, B, C—3-section electrolytic, all 40 mfd., 150 v.
- V1—12AX7 or 12AT7

Nine pin miniature tube socket

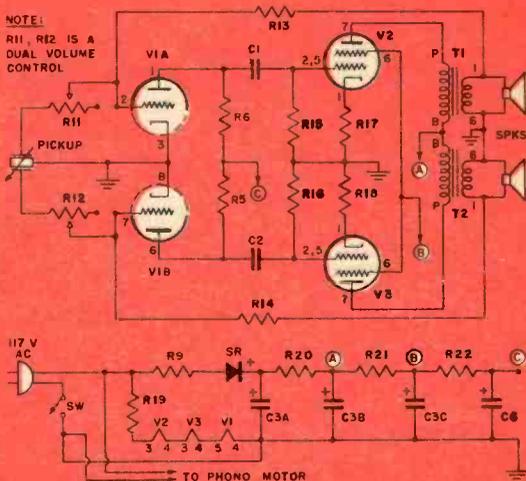
Aluminum chassis—1"x4"x5"

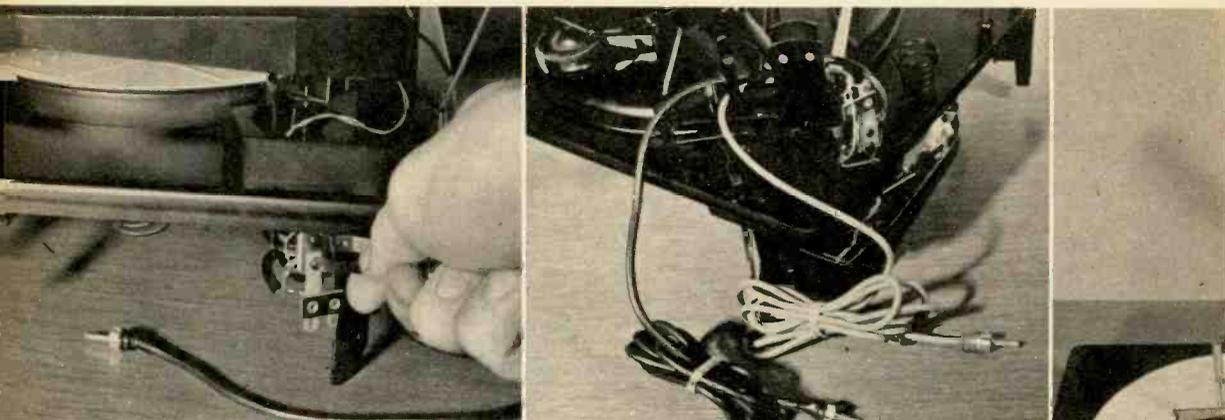
Switch—single pole single throw

SR—Silicon diode rectifier (Audio Devices A750)

New Parts

- R11, R12—3 megohm dual potentiometer
- R13, R14—5.6 megohm, 1/2 w.
- R15, R16—470,000 ohm, 1/2 w.
- R17, R18—150 ohm, 1 w.
- R19—75 ohm, 10 w.
- R20—250 ohm, 5 w.
- R21—1500 ohm, 2 w.
- R22—4700 ohm, 1/2 w.
- C6—20 mfd., 150 v.
- V2, V3—50C5 tubes
- 2—seven pin miniature tube sockets
- T1, T2—Output transformers (Stancor A-3849)





First mount a two-terminal strip (one lug grounded) below the changer deck near where pickup leads emerge. Then solder inner conductor of a second audio cord to the insulated lug and its shield to the ground lug. A #30 lead from pickup's third terminal is twisted through arm onto insulated lug. Materials shown here come in conversion kits for the Glaser Steers changer.

# Convert Your Record Player to Stereo

By Sid Norinsky

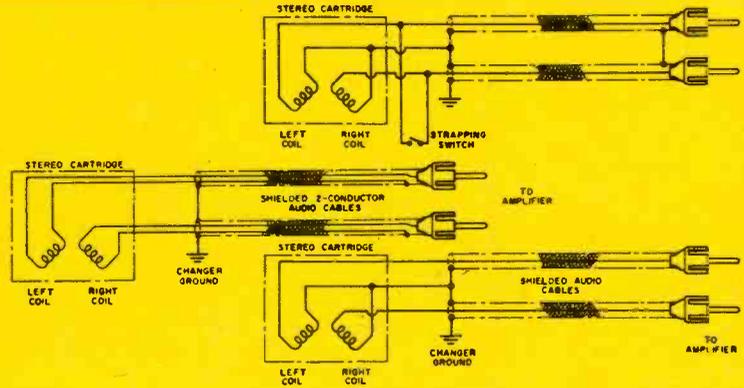
**I**F YOU are converting an existing monaural system to stereo, your present record playing equipment can continue to serve you by means of a few simple modifications. These consist in the main of rewiring the tone arm for a stereo cartridge. Your record player, manual or automatic, should meet certain standards, however, if it is to deliver clean stereo sound. Later we'll describe a simple test you'll be able to run to determine its suitability.

Assuming for now that your record changer is suitable, you can go ahead and convert in about half an hour. Most manufacturers of record players and changers make conversion kits available. Some are shown here. Complete instructions accompany these kits.

If you use a three terminal stereo pickup you will use a three wire setup; for a four terminal pickup you may use either three or four wires. Three-wire stereo operation is satisfactory where the cartridge feeds a one-chassis stereo preamplifier. The common amplifier ground for both channels makes its susceptibility to hum pickup about the same as it is for ordinary monaural reproduction.

A four-wire hookup is the best approach where separate-chassis amplifiers are to be used. In the four wire connection, hum-inducing ground currents circulate only in the shields of the audio cords, and do not contribute to cartridge output by circulating in a common third wire.

For a four-wire hookup, double-conductor audio cable is required, and a four-lug (all insulated) terminal strip. One of the



If the stereo pickup cartridge you use has three prongs, the prong marked R is connected to the inner lead of one audio cord, that marked L to the inner lead of the other cord and the third prong goes to the ground shields. A 4-prong cartridge is wired as shown in center. On top is rumble test setup.

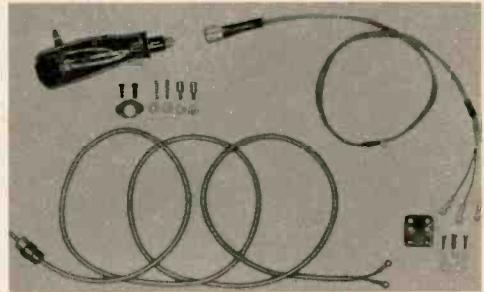
inner conductors in each cable is soldered to the shield at the phono plug end, where the cord plugs into the amplifier. Only the shields are soldered to a ground lug connected to the metal frame of the record changer.

Now comes the question that really takes precedence over the relatively easy matter of the conversion itself. Is your record changer suitable for stereo?

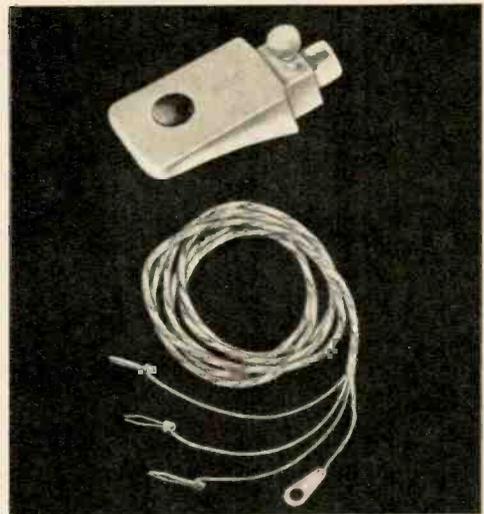
The first step in finding out is to obtain a stereo cartridge. You'll need it to carry out the simple test described below. Install the cartridge in your present record changer, make the stereo conversion, and plug the audio cables into your stereo amplifier-speaker system. You'll also need an LP "silent-groove" test record, which contains unmodulated grooves. Theoretically such grooves should produce perfect silence out of your loudspeakers. Components Corporation, D&R, Cook, and others offer such test records.

The basis of the record changer test is to determine how much rumble the turntable produces. Excessive rumble is due to worn motor bearings or cheap motor construction. Rumble is a serious cause of distortion with stereo records, because it contains a vertical motion component to which the stereo cartridge responds, just as it responds to the vertical components of the 45x45 groove modulations.

[Continued on page 100]



This kit converts Garrard players to stereo.



Audax tone arms may be converted to stereo by using kit consisting of new cable and shell.



The Bogen Multiplex receiver is currently being used in commercial background music. It includes a single-frequency FM tuner and multiplex adaptor.

# All About FM Multiplex

By Len Buckwalter

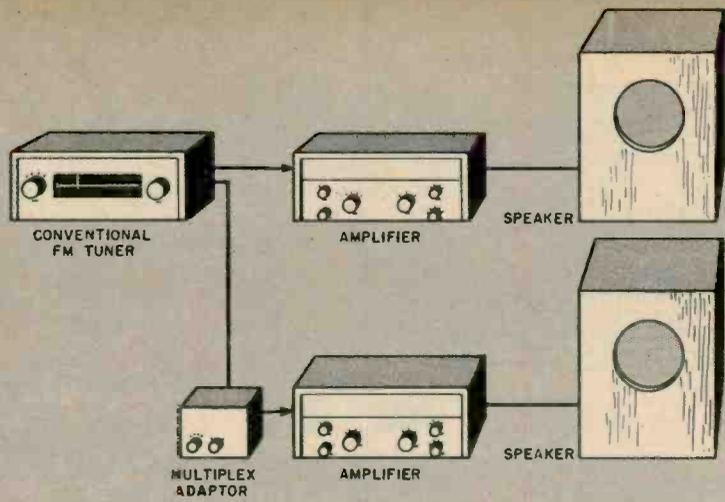
Associate Editor

**The newest source of stereo sound, 2-channel FM, uses your present tuner with a plug-in adaptor.**

**J**UST three years ago, in 1955, the Federal Communications Commission quietly triggered a chain of events now reverberating throughout the broadcast industry. Multiplex, a completely new concept in FM radio, is providing the answer to the problem of transmitting stereophonic sound to the home. Within a surprisingly short time this new medium will bring the audio enthusiast the depth and realism of stereo with a minimum of expense and equipment. Multiplex is now rising to the status of the stereo disc and tape recorder, with an extra bonus or two.

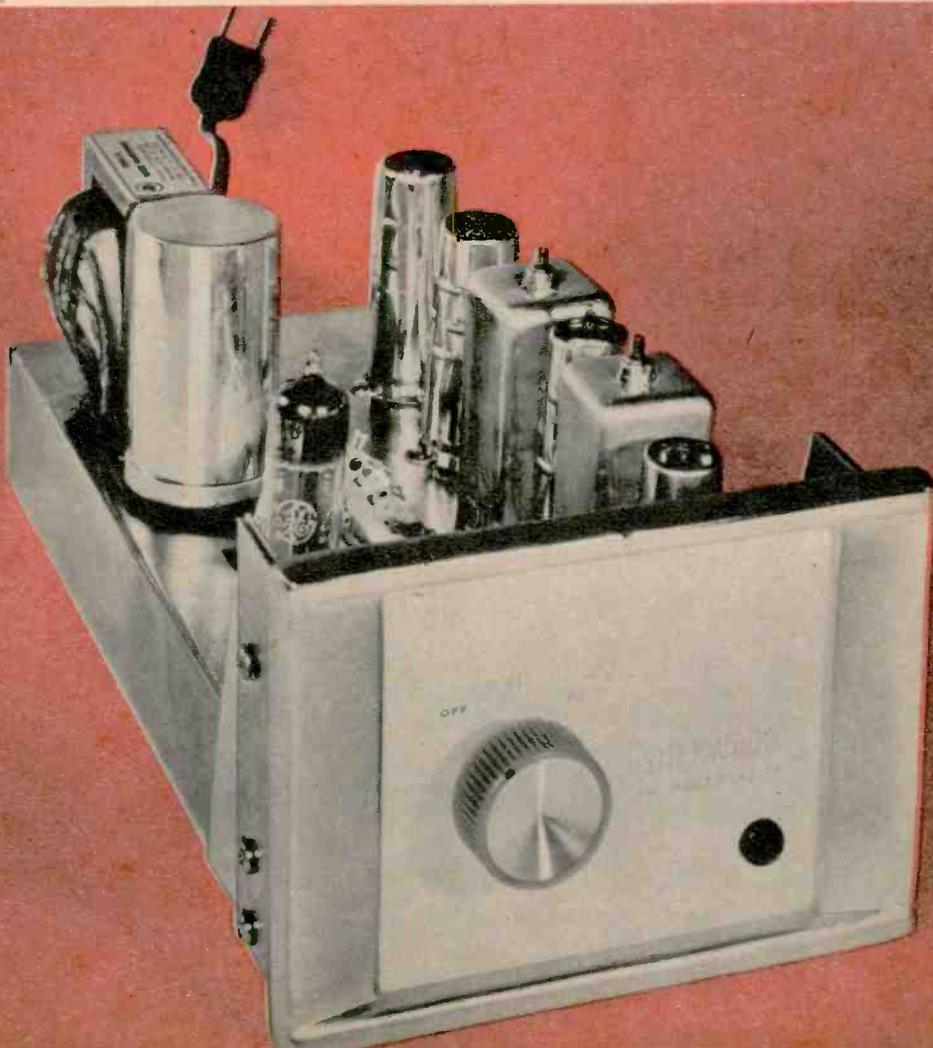
The April broadcasters' convention in Los Angeles devoted considerable emphasis to multiplex. Engineering papers and demonstrations proved conclusively that it is now ready for general use. The initial doubts expressed by many were dispelled when several Los Angeles stations transmitted high quality sound on the new system. As the number of FM stations acquiring these facilities increases, a fresh look at the origin and future of multiplex appears to be in order.

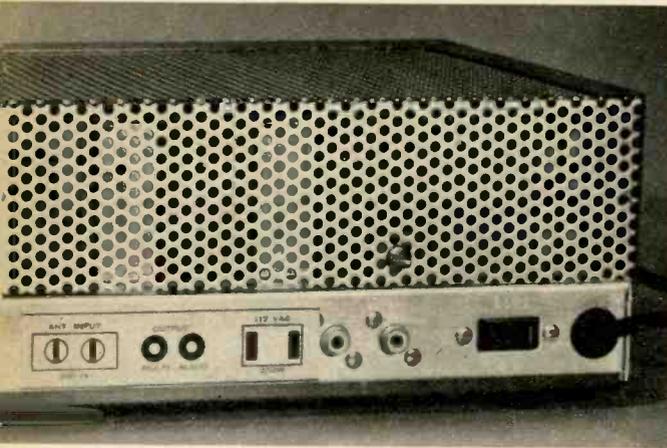
The birth of multiplex was sparked by a problem . . . a dilemma pervading all branches of radio today, namely a shortage of frequencies. There are simply too many services competing for



A typical set-up, in the home, for receiving multiplex programs. The FM tuner feeds amplifier in the usual way, while multiplex adaptor operates only on the sub-channel.

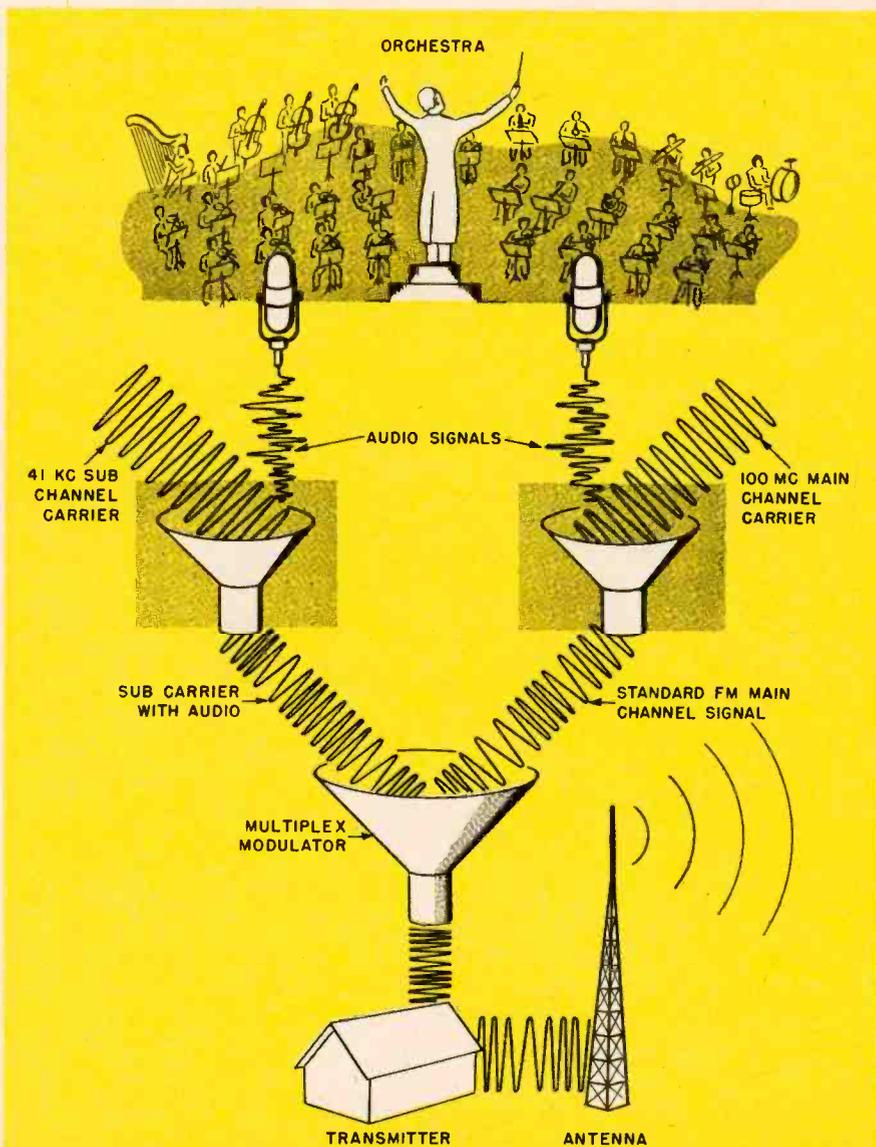
A prototype of the Sherwood multiplex adaptor with selectable sub-channels (41 and 67 kc). FM tuners are designed with room for an adaptor on the same chassis.





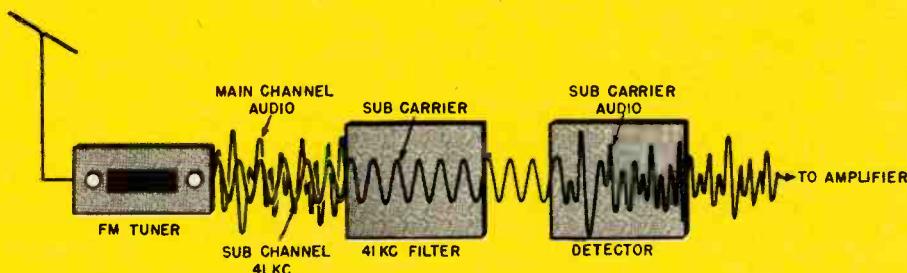
Multiplex jack is provided on the rear apron of most present day FM tuners (left jack of the pair at center). The adaptor picks off sub-channel signal at this point.

Creating the multiplex signal is mostly a process of superimposing one frequency upon another so they may be separated later on without undesirable "crosstalk."



MULTIPLEXED  
FM SIGNAL

The multiplex adaptor is represented by the 2 blocks following the FM tuner. Its 41 kc filter will not accept the main channel audio which is fed conventionally to its amplifier and speaker for one half of stereo presentation.



too few allocations. For example, mobile radio now "splits" channels, TV ventures into the UHF region, and ham operators turn toward single side band. Each of these approaches serves to exploit the limited radio spectrum since the growth of communications during the post-war period has been phenomenal.

Multiplex, the word literally meaning "to interweave many" fits perfectly into this crowded pattern.

If it were possible for FM stations to send out two separate programs on their single assigned frequency, the complete FM band could effectively be doubled in width. You would then hear twenty stations where only ten existed before. Not only would the original band remain the same, but each program would be a separate entity causing no interference to another. This is the electronic miracle of multiplex—a contribution pioneered by Major Edwin H. Armstrong and only recently updated to commercial reality.

The key to understanding how multiplex works is a rudimentary grasp of FM. The customary FM transmitter produces a carrier wave changing in step with the audio program source. The music and voice frequencies from 15 to 15,000 CPS are recovered from the carrier at the home receiver. In multiplex, the second program is interwoven within this framework.

First, a carrier is supplied for it; one

that does not interfere with the normal channel. This new frequency is generated at 41,000 CPS. It is an *ultrasonic* tone appearing on the main carrier much in the same manner as the lower tones of voice or music, with one important difference—it cannot be heard. Even if the human ear could perceive such a tone, the FM receiver would de-emphasize it anyway. In the parlance of multiplex, a "sub-channel" has been created that is completely compatible with existing systems. At this moment you may be listening to an FM station unaware of sub-channel transmission.

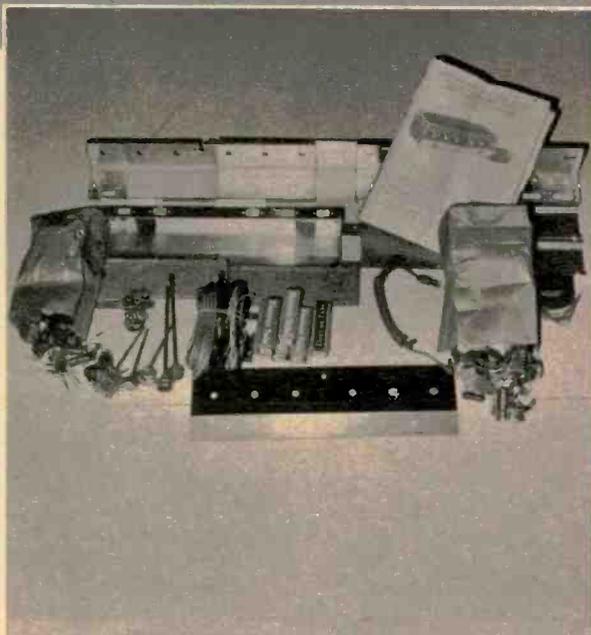
It is upon the new carrier that the second program, perhaps the second channel of a stereophonic broadcast, is impressed. The audio tones are not heard in the home receiver since they occur only as small frequency changes of the 41,000 CPS. They can be recovered only by a special receiver or adaptor added to the set.

Next in the multiplex chain is the receiver. It is actually two receivers in one, to detect the main and sub-channels. The first portion is quite similar to a conventional FM set. At the detector stage appear the main and sub-channel with audio and ultrasonic tone. Here a separation occurs; main channel audio goes to an amplifier and speaker, the sub-channel goes to the *multiplex adaptor*.

This adaptor, due to a filtering  
[Continued on page 90]

*EI* assembles a  
**Stereo Preamplifier Kit**

The Heath 3-chassis SP-2 preamp has many advanced features. We built it for this special report.



Both preamps are adjusted at the front panel by concentric knobs that may be adjusted individually, or work in unison.

The major parts furnished with kit are shown here. Construction time by the author, about 23 hours. Cost of kit \$56.95.

**T**HE introduction of the single groove stereophonic disc caused an uproar of activity among the high fidelity component manufacturers. New stereo models of everything from cartridges to speakers were rushed from the drawing board to the production line in an effort to be "firstest with the latest." And often the performance and features of the new stop-gap stereo products reflected the haste in design.

Amidst this stereo uproar, what are the hi-fi kit manufacturers doing? Do kit stereo units measure up to the factory wired products? That's the big question **ELECTRONICS ILLUSTRATED** set out to answer for you.

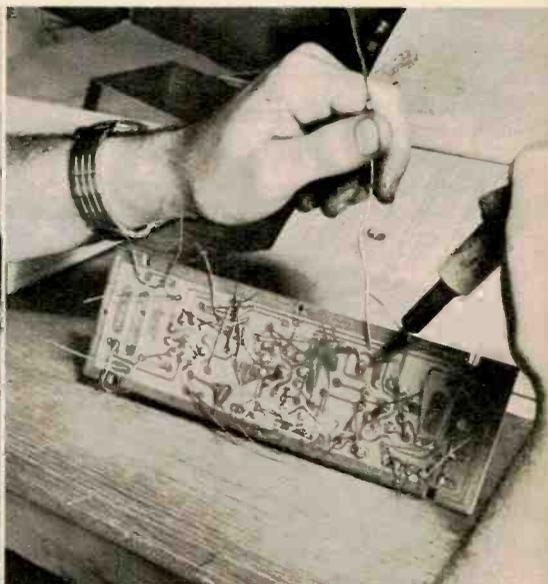
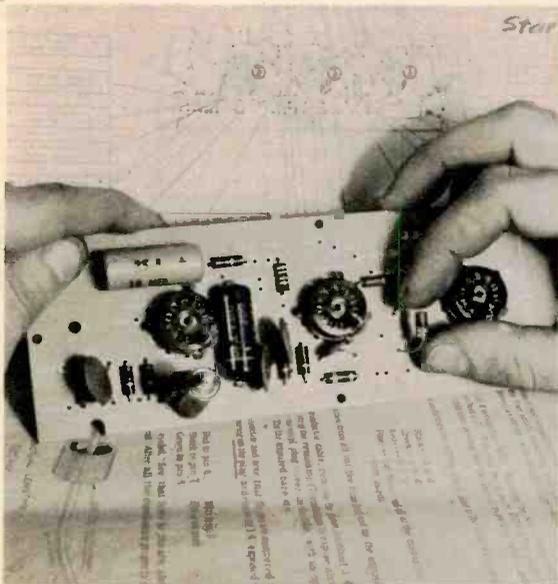
We checked with a number of manufacturers and came up with a pre-production sample of the Heath stereo-preamp kit SP-2. Unpacking the stereo kit is a startling experience. Heath seems to be playing double-or-nothing with the components. Bags of resistors, boxes of switches and bunches of wire overflow out of the carton.

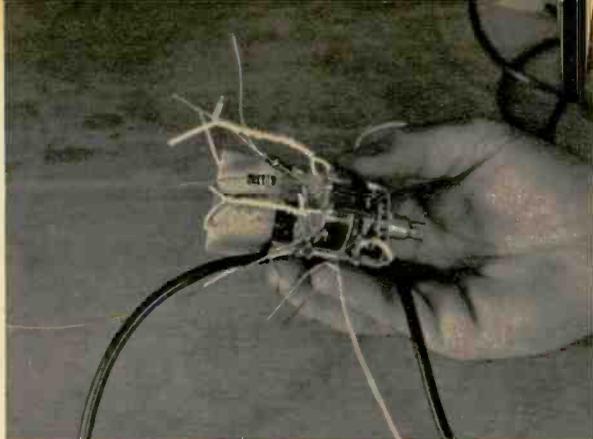
The 27 separate controls (6 switches, 21 potentiometers), 41 capacitors and 60 resistors are justified by the two *complete* preamps with special stereo switching and a built-in power supply that make up the SP-20.

The construction manual is a model of clarity, all 72 pages of it. In the usual comprehensive Heath manner, distortion and response curves are given for all functions, outputs and controls. Two pages are devoted to soldering instructions and old hands at the kit construction game may want to skip them. Don't—those two pages are as valuable a primer of soldering technique as you can find anywhere.

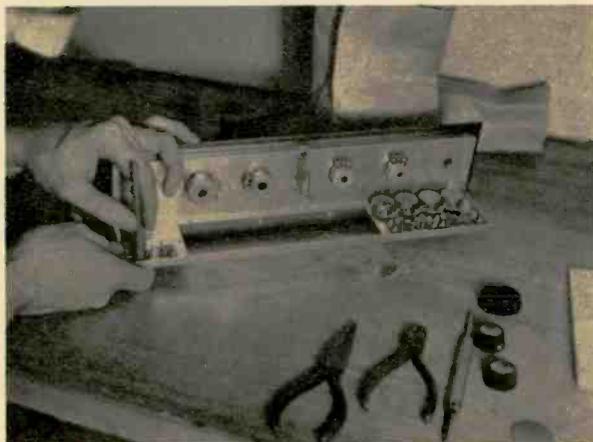
**Total construction time is reduced considerably through use of printed circuit boards. Lower left shows resistor inserted into holes before soldering.**

**At the underside of printed board, lower right, component wires are soldered to the foil. Iron is applied quickly since excess heat causes foil to peel.**



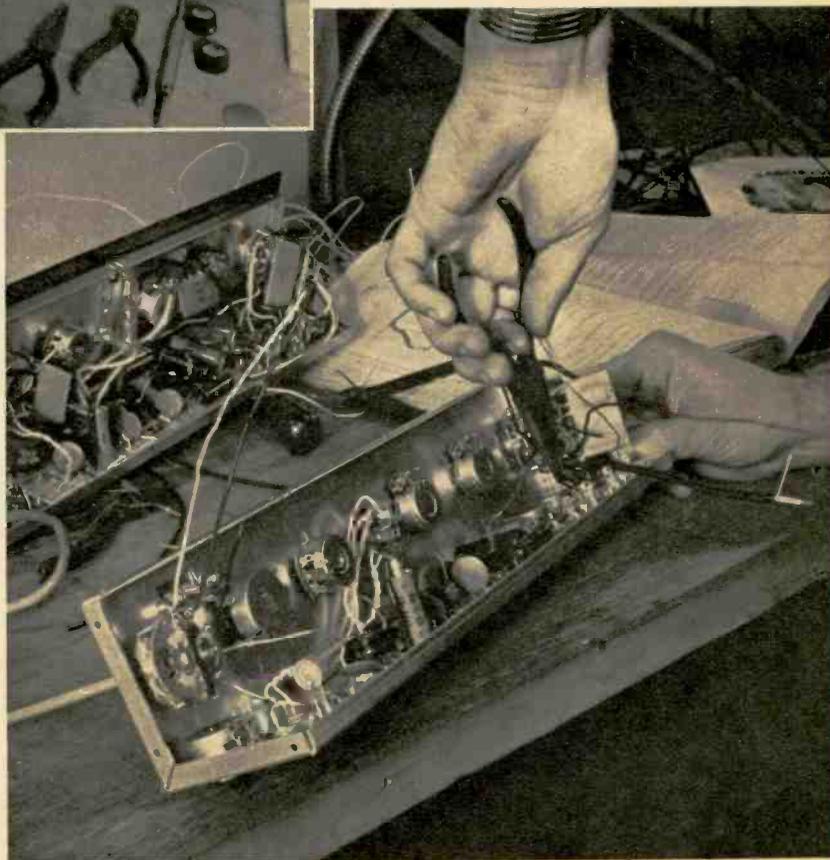


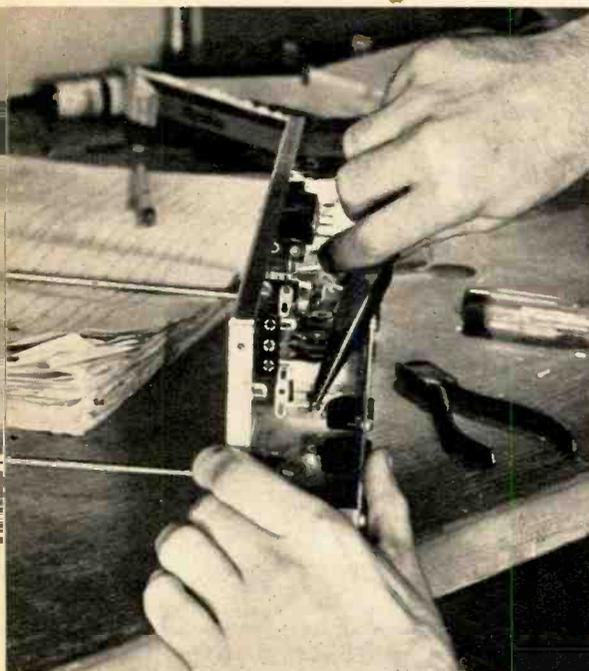
To avoid wiring in tight corners of the chassis, components are soldered on function switches before mounting.



During early stages of construction, controls and tube sockets are mounted on rear of front panel and chassis.

The second preamp, seen in front of the first, nears completion. The two units have almost identical circuits.



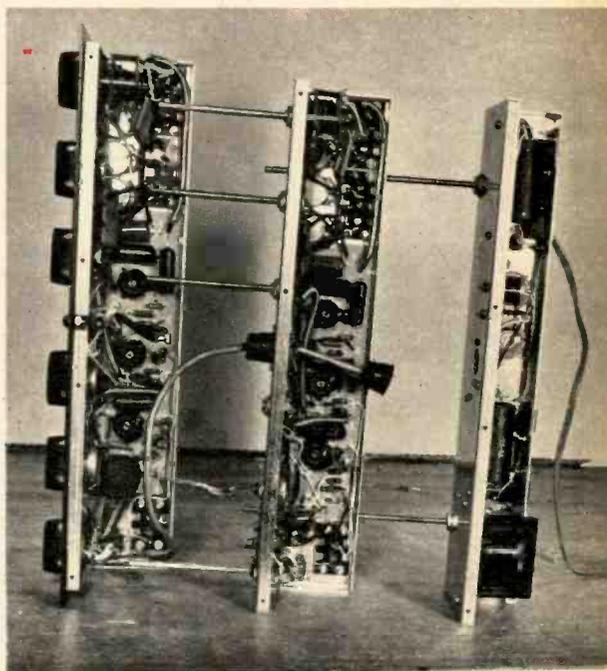


The power supply is the final section to be wired. It is assembled on a separate chassis.

Heath makes the point that the best way to solder printed wiring boards is "touch and go." It was found best to have a small blob of solder on the tip of the iron when applying it to any printed board connection. This insures rapid heat transfer. The iron, by the way, should be one of the high heat pencil types. The closeness of the connections on the printed circuit board make a small tip necessary.

Exercise extra care when soldering any lug or terminal with three or more wires connected to it. These multi-wire solder points are a favorite spot for rosin joints to crop up.

The construction book your reviewer used was still in page proof form and, not surprisingly, errors and misprints were found. These have been referred back to Heath for correction and will not appear in your copy of the manual. Construction is divided into several steps. There are five or six connections to be made in small corners but in general only minor wiring difficulties were experienced.



The two preamps and power supply. All the long shafts terminate in front panel knobs.

The two preamp sections are similar, but not identical, in construction and wiring. The printed circuit boards, however, do have the same component layout and it would probably save time and minimize error to assemble the components on both boards simultaneously.

Wiring time for the first preamp section ran about 10 hours, the second preamp—8 hours. The two hour difference was due both to the experience gained on the first unit and the slightly simpler hookup of the second.

The third unit to be wired deserves special mention. Heath calls it a Remote Stereo-Balance Control. It's a neatly packaged control at the end of a twenty-foot cable that plugs into the rear of the preamp. Its use is optional, but if desired, your stereo channels can now be balanced from almost anywhere in your listening room. This feature, to the best of your reviewer's knowledge, is exclusive with Heath.

The fourth and last unit to be wired is the power supply that serves both

[Continued on page 92]

# Shelves for Your Hi-Fi

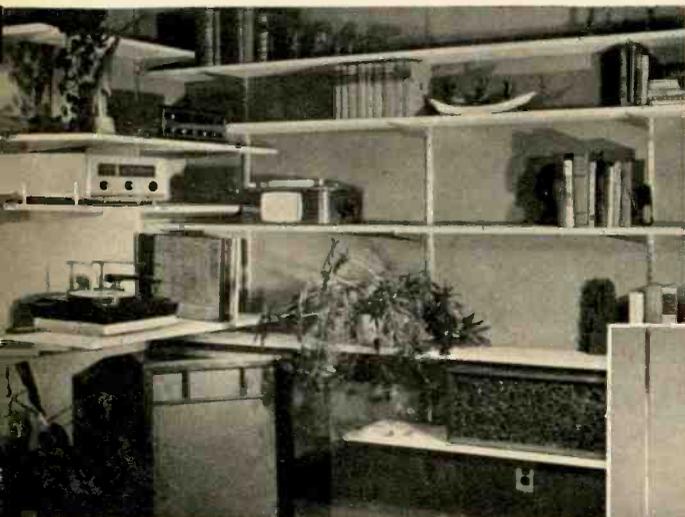
**Good sound and good styling are not incompatible. Here's a hi-fi setup pleasing to both eye and ear.**

**V**ERY small amounts of time and money are all you need for building a practical place for hi-fi components, which will also be an attractive addition to any room.

The shelves pictured here began with metal standards and brackets, available at any hardware store. These aluminum finish standards cost 20 cents a foot, 10-inch brackets 50 cents each. Other finishes are available at higher prices. Brackets come in varying sizes from 8 to 18 inches. For components it's best to use the narrowest possible consistent with the dimensions of the unit, since wider brackets have a greater moment of force and a greater tendency to break.

The first step in hanging your shelves is to locate the studs in your wall. On an outside wall they should be exactly 16 inches apart; up to 20 inches apart on an inside wall. A stud finder is recommended for this job. This is a compass needle which swings around to point to metal and will indicate where the nails, and thus the stud, are located. The standards are then fastened to the wall by screwing them into the studs, next the brackets are fastened to the standards, as pictured.

For the shelves themselves common pine, costing about 20 cents a square foot is a good economical choice, if you can find pieces without too many knots. Select lumber runs about twice that. Stain or finish the boards to blend with your room and enjoy good looks along with good listening. —●—



Components are installed on the finished shelves with heavier units at the bottom.

Where heavy loads are to be supported standards should be no more than one stud apart. For lighter loads a two-stud separation will do. You can be sure the standards will hang straight if you fasten the top screws in first. With standards secure you can install the brackets (below right) at any level you desire. These can be easily altered at a later date if you wish to change the arrangement or even add more shelves.



# For Stereophiles Only

**A**NYONE going in for stereo in a really big way of course wants to know everything there is to know about it. And, just as naturally, the manufacturers of stereo equipment are most anxious to oblige, by providing information on stereo in general, and their equipment in particular. Listed here is the literature available to you, our readers, at little or no cost. For your convenience we have divided this descriptive material into two categories: booklets about stereo in general, how it works and how it can work best for you; and catalogs describing specific equipment available from individual manufacturers.

## BOOKLETS

### STEREO FACT BULLETIN

4 page booklet explaining the fundamental principles of stereo sound reproduction. No charge.  
*Allied Radio Corp., Dep't. EI*  
180 N. Western Ave., Chicago 80, Ill.

### UNDERSTANDING HIGH FIDELITY— STEREO EDITION

A detailed, thorough explanation of stereophonic sound, complete with diagrams. 25 cents.  
*David Bogen Company, Dep't. EI*  
P. O. Box 500, Paramus, N. J.

### HOW TO CHOOSE & PLACE STEREO EQUIPMENT FOR THE HOME

An illustrated brochure of stereo set-ups to suit individual rooms, plus general rules on arranging stereo equipment. 50 cents.  
*Electro-Voice, Inc., Dep't. EI*  
Buchanan, Mich.

### STEREO—THE EASY WAY. BOOKLET K

A simplified explanation of the basic facts of stereophonic sound. No charge.  
*Fairchild Recording Equipment Co., Dep't. EI*  
10-40 45th Ave., Long Island City 1, N. Y.

### HOW TO ASSEMBLE A STEREO SYSTEM

8 page booklet on how to convert a monaural system to stereo, and how to set up a complete stereo system with the company's equipment. No charge.  
*H. H. Scott, Dep't. EI*  
111 Powdermill Road, Maynard, Mass.

### IT TAKES TWO TO STEREO

12 page illustrated brochure describing how stereo records are recorded and reproduced, and how to convert a monaural system. No charge.  
*Pickering and Company, Dep't. SB*  
Sunnyside Boulevard, Plainview, N. Y.

### STEREO FIDELITY FOR YOUR HOME

A booklet about the fundamentals of stereo, and how to achieve stereo hi-fidelity. No charge.  
*Pilot Radio Corp., Dep't. EI*  
37-06 26th St., Long Island City 1, N. Y.

## CATALOGS

### STEREO EQUIPMENT FROM AMPEX

Individual brochures, illustrated in color, on all stereo components available.  
*Ampex Audio Inc., Dep't. EI*  
1020 Kifer Road, Sunnyvale, Calif.

### CERAMIC STEREO CARTRIDGES

Technical data sheets, including diagrams, describing available cartridges.  
*Astatic Corp., Dep't. EI*  
Conneaut, Ohio

### BELL HAS IT

Illustrated booklet describing available stereo equipment.  
*Bell Sound Systems, Inc., Dep't. EI*  
Columbus 7, Ohio

### STEREO EQUIPMENT

Illustrated flyers on the Gyro/Jewel stereo cartridge and the Gyro/Balance arm.  
*Electro-Sonic Labs, Inc., Dep't. EI*  
35-54 36th St., Long Island City 6, N. Y.

### THE FISHER STEREOPHONIC—1959

Brochure of equipment, illustrated in color.  
*Fisher Radio Corp., Dep't. EI*  
21-21 44th Drive, Long Island City 1, N. Y.

### STEREO FROM HARMAN-KARDON

Descriptive material on stereo tuners, amplifiers and multiplex adaptors.  
*Harman-Kardon, Dep't. EI*  
520 Main St., Westbury, N. Y.

[Continued on page 109]



# Hi-Fi Clinic

Send in your questions on hi-fi. The clinic will answer any query on how to repair, how to install, or how to listen.

## Pickup Distortion

*My hi-fi system does not reproduce music at the upper end of the scale clearly. On records where the brass section is prominent, a "tinny" sound is produced along with the normal tones. It sounds similar to listening to a radio that is tuned slightly off the station. Also, I notice that adjustment of the treble control influences this sound to a large degree. Please advise me on this matter.*

*W. Krapcho, Chatham, N. J.*

Although almost any component in your system might be the cause, the most common source is the cartridge or stylus. First, be certain that the stylus is centered properly in the cartridge. Also check for wear and correct pressure.



## Eliminating Hum

*I have tried to put an extension cord on the microphone used with my tape recorder. When the plug is inserted into the jack on the recorder, a loud hum is heard. Could you tell me the reason for this?*

*Richard Armenteros, Downey, Calif.*

Hum of this kind is usually caused by an improper or open shield on the microphone cable, especially for high impedance types such as crystal. Check if the shield on the microphone cable joins the shield of the extension cord.

Long leads on crystal microphones are susceptible to hum pickup and high frequency loss. However, for runs of up to 20 or 30 feet, no particular difficulty should be encountered if good shielding is used.



## Transistor Schematics

*I have a portable tape recorder and would like to use a small, simple transistor amplifier with it. It should be able to operate a 2½-inch speaker. Can you supply a diagram for it?*

*Mike Lambert, Arlington Heights, Ill.*

At present, ELECTRONICS ILLUSTRATED does not maintain a diagram service. However, construction articles on transistorized amplifiers will appear in future issues. Booklets on transistor application are available from Raytheon, Sylvania, RCA, GE, Motorola, and other large producers with a number of schematics that would fulfill your immediate requirements.

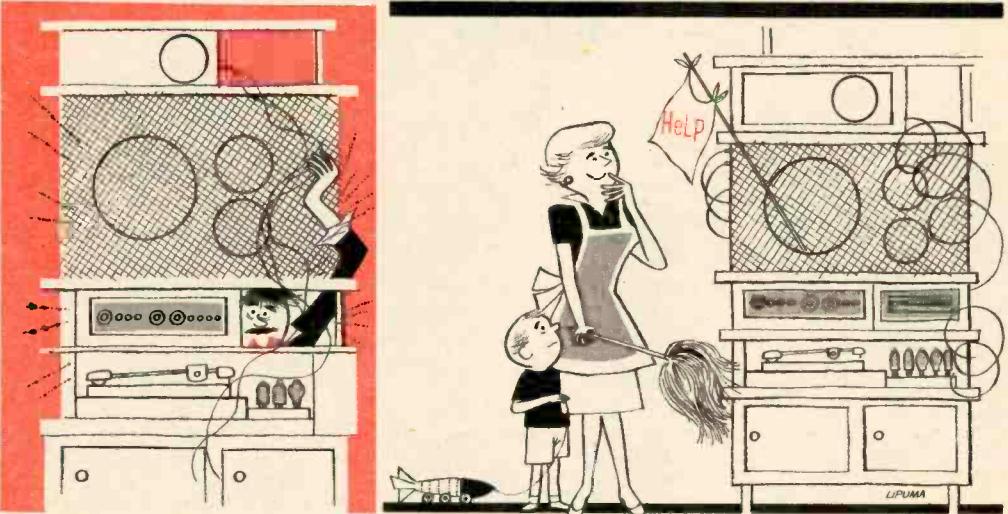
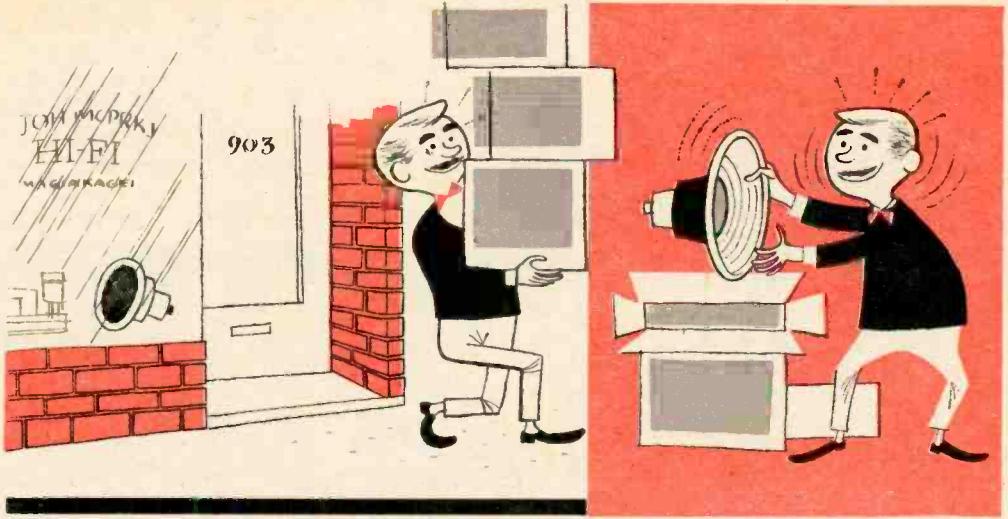


## Feedback

*I recently set up my hi-fi rig after moving to a new location and something very odd is occurring with the new arrangement. I can't turn the volume control of the amplifier beyond a certain point without the speaker sort of "roaring" at me. This only happens when I'm playing the phonograph, not the tuner. What's your guess as to what's wrong?*

*Tom Bell, Atlanta, Ga.*

What you're experiencing is probably a bad case of acoustic feedback from your phono cartridge to the speaker. Vibrations from the speaker cabinet in this set-up are transmitted directly back to the stylus. Either the speaker is physically too close to the turntable, or your turntable is mounted on something that is resonating to the louder passages reproduced by the speaker. The cure is to reposition your speaker and turntable so the same acoustic path no longer exists.



# Shooting For The Moon

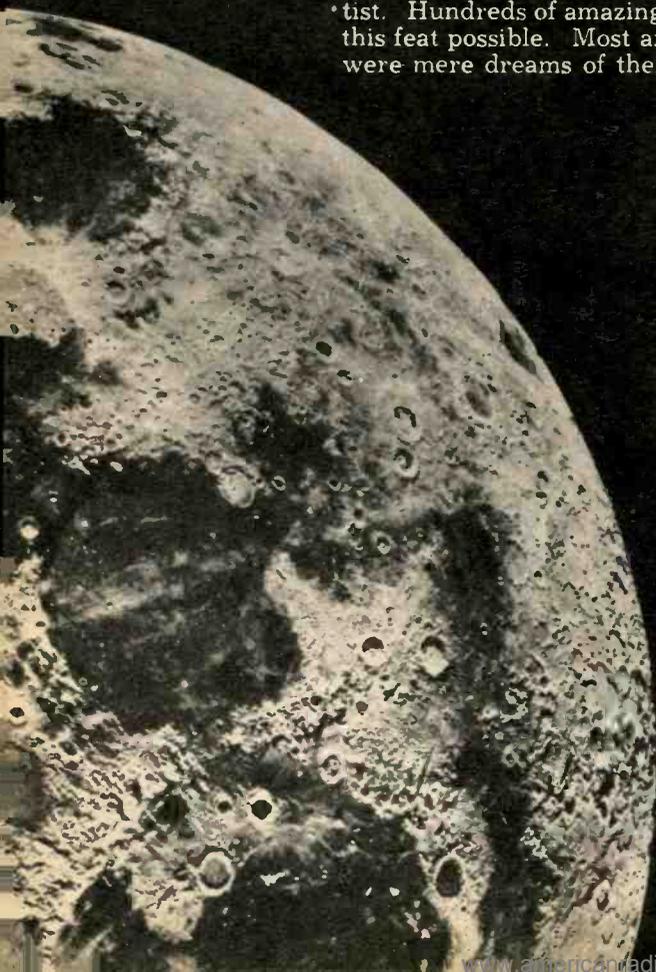
By John L. Springer

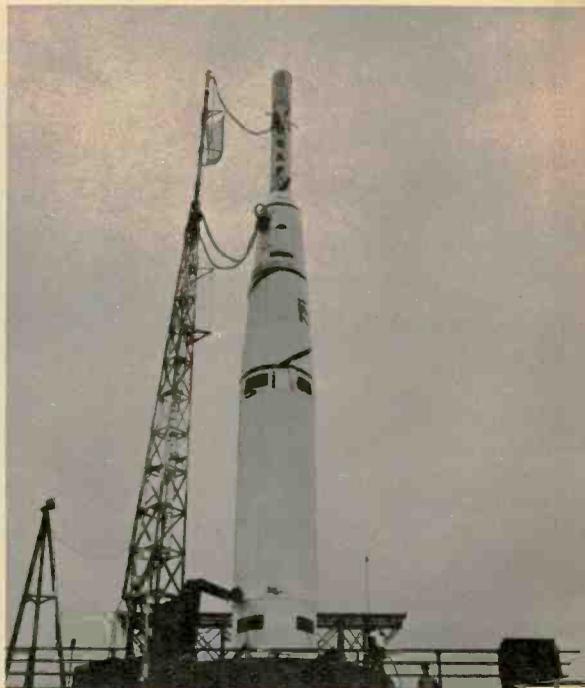
**America's lunar probes gather data essential for space travel, and here is how it's done—**

**T**HE big four-stage Thor-Able I blasts off from its flame-filled launching pad at Cape Canaveral. Almost hesitantly at first it rises, a stream of flame and smoke spewing from its tail. It pierces the sky with growing fury at speeds up to 20,000 miles per hour. Minutes later it is through the clouds and beyond sight.

Now we wait. Two days and 14½ hours after the tense moment on the launching platform, the rocket's teardrop-shaped instrument package reaches its destination, the moon's gravitational field—the first step of our amazing conquest of a body in outer space.

Unlike Columbus and other adventurers, modern-day explorers are not human, but electronic marvels of breathtaking daring and ingenuity. For "shooting the moon," like man's earlier successes in rocketry and satellites, would be impossible without the knowledge and practical application of the electronics scientist. Hundreds of amazing electronic devices are needed to make this feat possible. Most are in the top secret category and many were mere dreams of their designers only months ago.

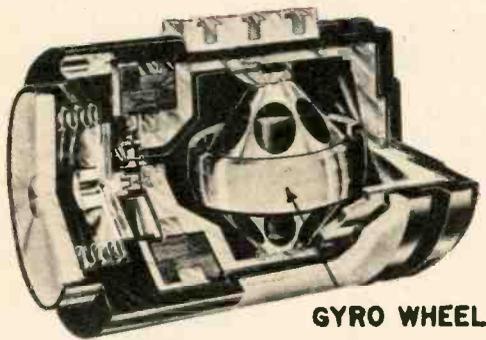
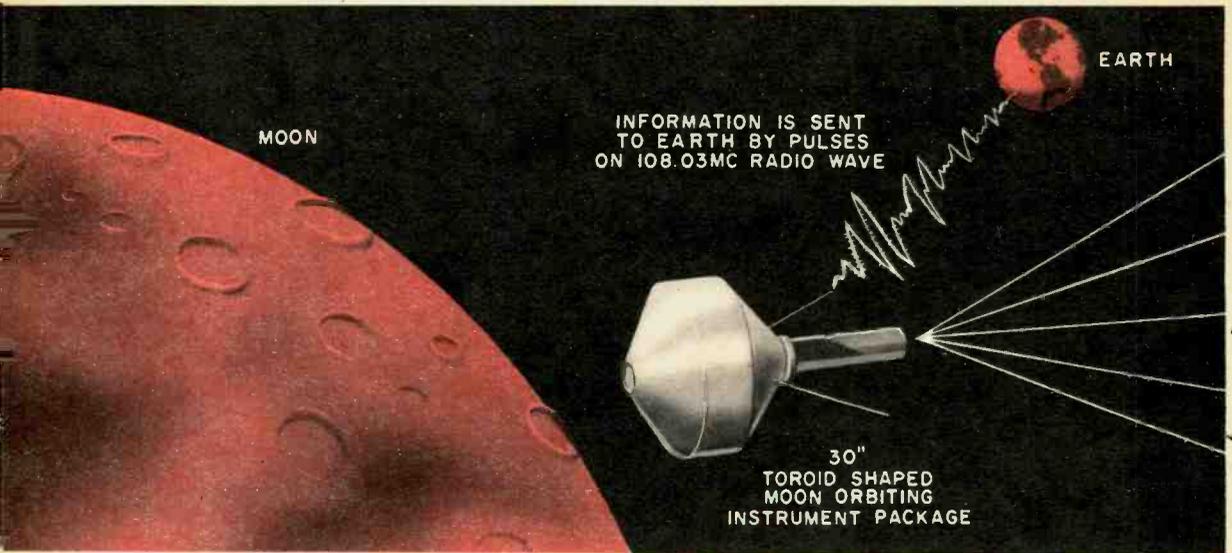




**Thor-Able I, the Air Force's lunar probe, stands ready (right) to deliver its 85 lb. instrument package to moon's vicinity. At left, 60 feet of spider web-like antenna for automatic telemetry tracking, towers over man on 7-story tall base.**

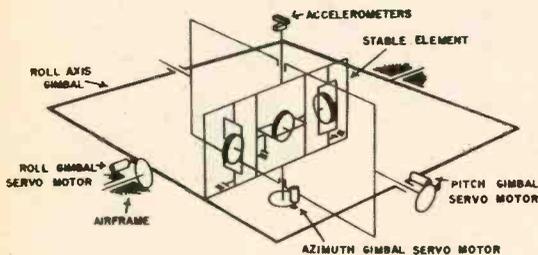
**Complex telemetry racks for rocket firing, guidance and data gathering get serviced and modified almost constantly to avoid hitches when the chips are down.**





**GYRO WHEEL**

Honeywell



Aviation Week

Heart of inertial guidance is spinning gyro, a stable reference regardless of conditions and in all planes, as shown in diagram. Gyro pictured in cutaway is only 2.7", 1/2 lb. System using gyro, computer, accelerometers, helps rocket remember starting point, destination.

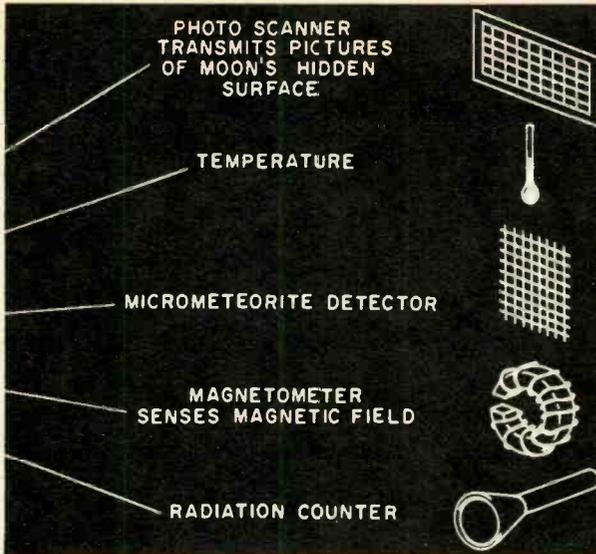
The lunar probe vehicle itself stands 88 feet high. The first stage, the standard USAF Thor, weighs over 100,000 pounds and delivers an initial thrust of 150,000 pounds. The "Able" addition adds eight spin rockets.

The earth, being itself a body in space orbiting around the sun and spinning on its own axis, is a rather unstable platform for shooting the moon, but the only platform we have. Sending the moon rocket off in the right direction is of the utmost importance, just as important as keeping it on course in outer space. Therefore the moon rocket requires two guidance systems—one to direct it out of the earth's atmosphere and gravitational pull, and one to guide it across outer space.

The first is an inertial guidance system like that of our ICBMs. Using this system the rocket directs its own course. The second guidance control method involves navigating the rocket electronically from the earth.

The inertial guidance system, once a highly hush-hush item, employs some of the most complex instrument packages that have yet come out of the the electronics lab. It is an electro-electronic-mechanical arrangement designed with the utmost precision.

Inertial guidance, as applied to rockets and missiles, is invulnerable to enemy jamming, independent of ground



Telemetering the moon shot enables earth-bound scientists to receive and interpret new and important data that will eventually permit interplanetary travel by humans. Conditions in outer space and the moon's gravitational field such as temperature, cosmic radiation, magnetic fields are encoded into one radio signal which is transmitted back to earth at 108.03 mc. Widely scattered receiving stations record the signal, then decipher it by measuring frequency, spacing and length of pulses much as a detector in your television set separates audio and visual signals, horizontal and vertical pulses, etc. A separate transmitter for each of the satellite's telemetering instruments is therefore not required.

facilities and does not emit radiation which can be detected by an enemy. It is designed to operate in all temperatures, through shock and vibration.

Such a system employs accelerometers that instantly sense and measure any change of direction or speed and warn the remainder of the system when the rocket veers off course even slightly. But the heart of every known inertial guidance system is the gyro. The gyro maintains a stable platform for the accelerometers while an electronic computer calculates positions in 1,000th of a second and immediately signals other mechanisms that must make certain adjustments to keep the rocket on course.

The second guidance control for the moon-bound rocket involves the use of radio. Telemetering equipment in the rocket beeps its data into space and these radio signals are picked up here on earth, fed into a control center computer which calculates the rocket's exact speed and relationship to the moon. Signals are then transmitted from earth to direct the rocket.

On the way toward the moon's gravitational field, the rocket's most urgent job is the measuring and recording of cosmic rays in outer space beyond the orbits of present earth satellites. The first United States and Russian satellites found that intense radiation about 500 miles up literally choked the Geiger

counters sent along to check it.

Other devices in the rocket's 30 pound moon-orbiting instrument package are designed to measure temperatures, solar rays, gases, the impact of micrometeorites and the strength of magnetic fields in interplanetary space. Most of the instruments are geared to run on batteries recharged by the sun and the data gathered will be broadcast back to earth at 108.03 mc. The toroid-shaped moon satellite resembles a 30-inch angular mushroom.

Widely scattered stations have been set up to track the lunar probes. They are located at: USAF Missile Test Center in Florida; Millstone Mountain, New Hampshire, operated by MIT's Lincoln Laboratories; Manchester, England, site of the world's largest radio telescope; Singapore on the Malay Peninsula; and Hilo, Hawaii. Information gathered at these locations is recorded on magnetic tape and relayed to the Air Research and Development data reduction center in Inglewood, Calif.

Scientists have always wondered what's on the side of the moon that always faces away from the earth and has never been seen by man. The moon's hidden side, roughly 40 percent of its total surface, may be explored by a TV-like scanning device using infrared light. When the strange vehicle con-

[Continued on page 104]

*how to build a safe rocket—part 4*

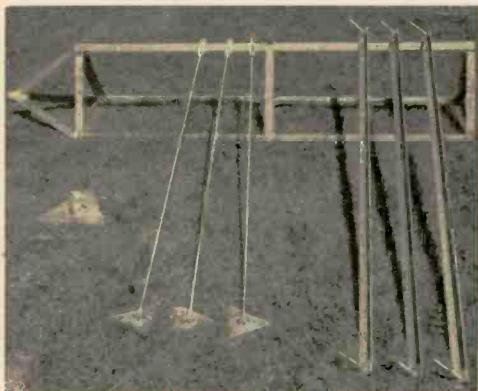
# A Launching Pad

**By Lt. Col. C. M. Parkin, Jr.**

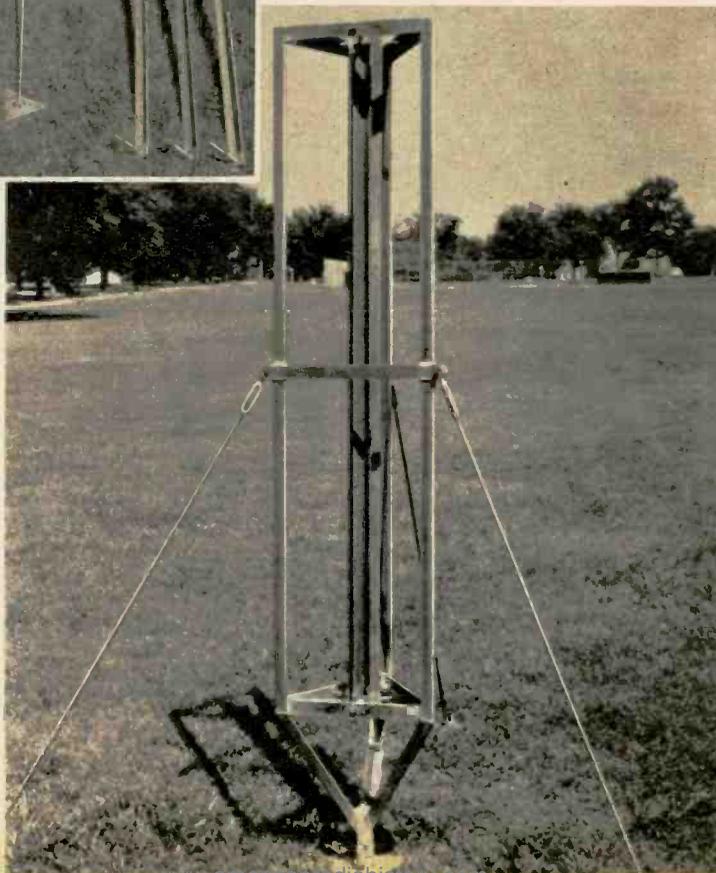
Corps of Engineers, U.S. Army  
Chairman of the Advisory Committee for Missile & Rocket Amateurs  
National Capital Section, American Rocket Society

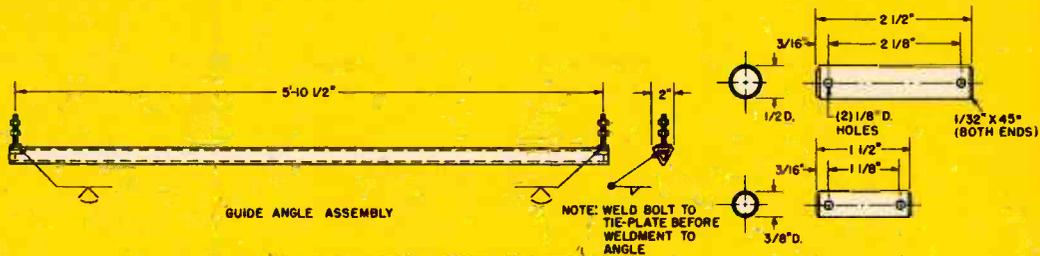
**I**N THE July issue we discussed the safety rules and plans for a safe model rocket, in September it was how to fuel your model rocket, in the October issue it was how to test your rocket, and now we shall discuss the launching pad for your rocket.

If you haven't already, it is imperative that you now look up the rules and laws of your community regarding the firing of rockets and **OBEY THEM**. Check with the Chief of Police, the Fire Marshal, the local Civil Aeronautical Authority and the

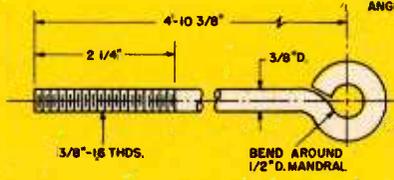


**At left are major parts of the launching pad. Below, the pad is erected, ready to receive rocket. Local officials, civic or military, should be consulted before the actual firing of rocket. On facing page are detailed plans for building launcher.**

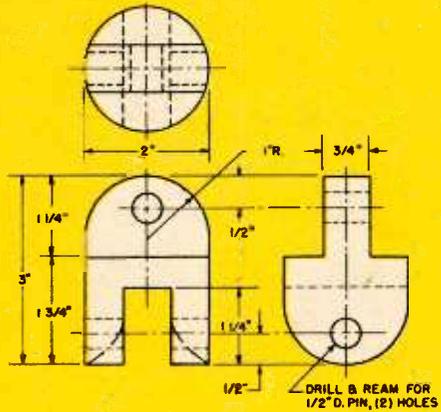




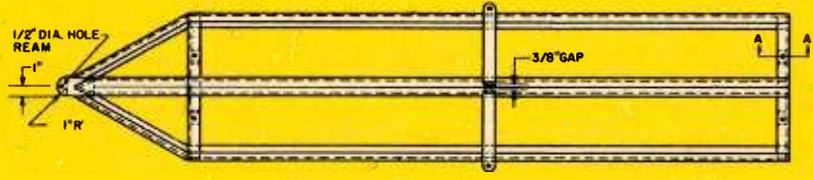
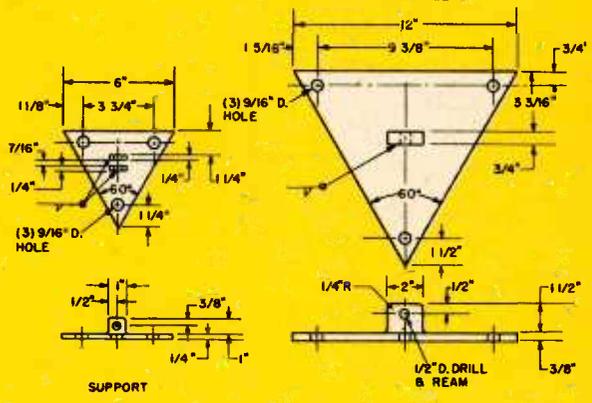
GUIDE ANGLE ASSEMBLY



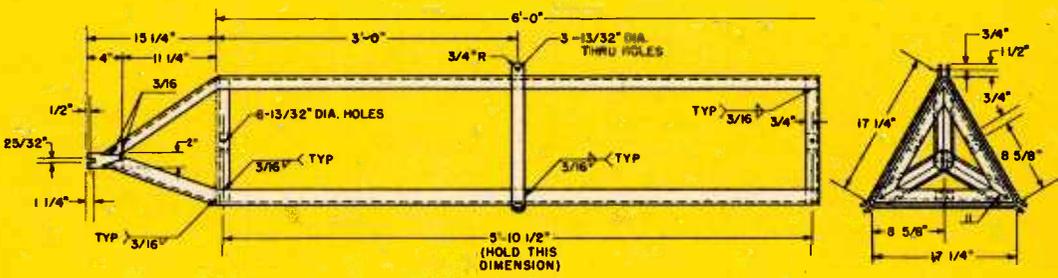
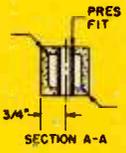
SUPPORT ADJUSTING ROD STEEL



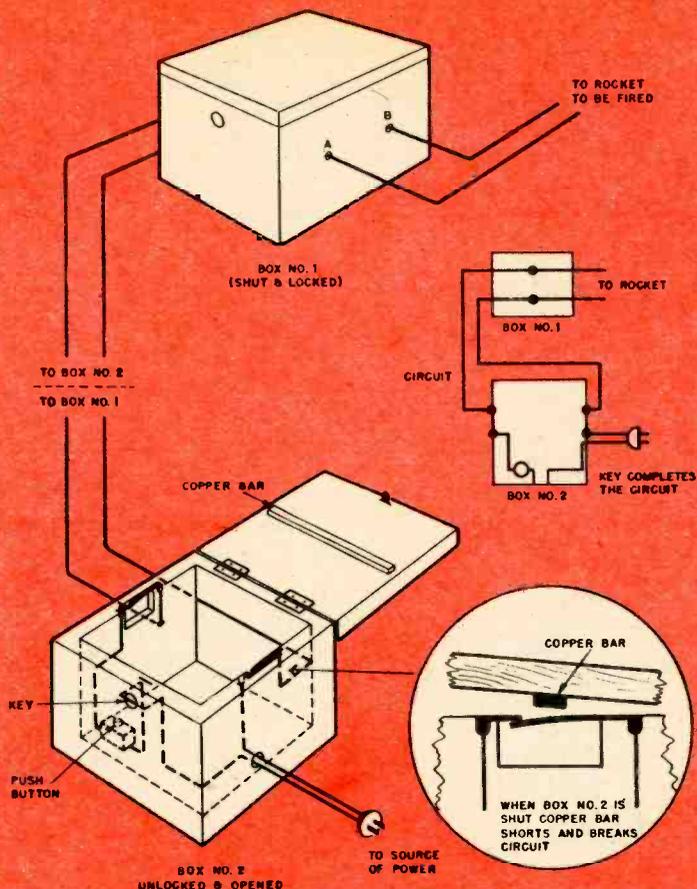
CLEVIS ALUM. ALLOY



BASE



The Firing Circuit shown here is the most important piece of safety equipment and must be built according to diagram and instructions.



agency that your local authorities have asked to coordinate the local amateur rocket clubs, groups or societies.

Nine times out of ten you will find that once you have checked in with the authorities mentioned above that the answer is NO, you can't fire your rocket in this community or surrounding area.

The question that confronts you now is what to do. Let us stop for a minute or two and look at this problem from a few different angles. Depending on your ability and knowledge, your rocket, once launched, might travel as high as 2000 feet and that far again from your launcher. Remember, 2000 feet is four times as high as the Washington Monument. Then again, your rocket might explode and burn on the launcher or explode just after launching.

But let us assume that your rocket leaves the launcher with a great deal of thrust. What control do you have over

the rocket? Why, none. What direction will it travel? You hope in the direction that it was pointed but you can't be sure. What will happen if the rocket is still burning when it lands? Depending upon the remaining thrust the rocket will scoot about on the ground obeying Newton's second law of motion. Where will it land? Even the experts couldn't tell you. What happens if your rocket lands in a hay stack or in a large vacant lot overgrown with grass that is now dry? A blazing inferno is the answer.

We advise that you:

1. Join a recognized and qualified rocket club.
2. Have representatives of all qualified clubs in the same area get together.
3. Write to the Department of Defense, Washington, D. C., and request a copy of directive DOD 5410.9.

[Continued on page 110]

Your set's model and serial number are on rear cover. Tube layout sheet is inside cabinet.



# Fix Your TV Set

By Lawrence Herrick

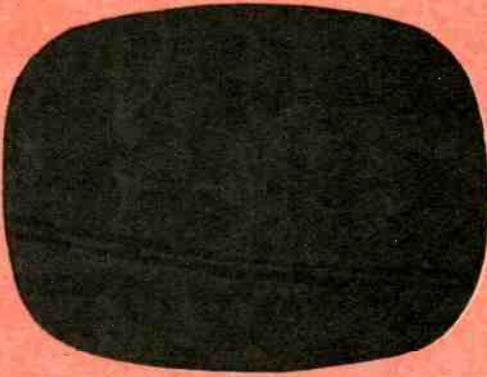
**Find faulty TV tubes with the EI Picture Chart—  
a key to localizing most of your TV set trouble.**

**O**NE of the first rules for rapid repair of any electronic equipment is to localize the trouble. This procedure is simplified in the case of TV receivers since most of the time the symptom will appear on the picture tube. Then, with the aid of the chart accompanying this article, the defective tube may be located and replaced.

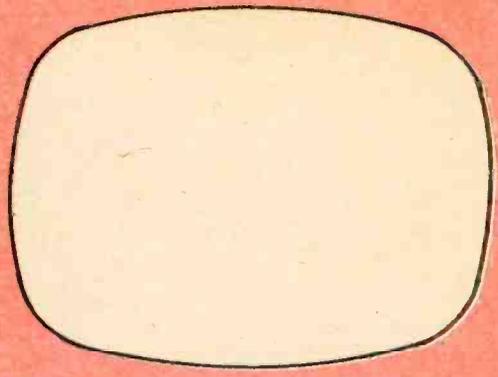
Some symptoms are perfectly obvious—for instance, a loss of height, width, or both; dark screen, etc. Other symptoms are more subtle and can best be detected when a test pattern is on the screen. If the symptoms fall into this category, that is, if an inspection of the picture doesn't permit you to determine just what is wrong, postpone operations until you have a little spare time some morning to check reception with a test pattern coming in.

Tubes are listed in the chart according to function, not tube type. Before you can make the substitutions indicated in the chart, you must know which tubes in your set are performing the functions listed in the chart. To determine the function of any tube in your receiver, do the following;

[Continued on page 102]



**DARK SCREEN, NO SOUND;** low voltage rectifier. If series set, any open filament. If sound OK, hi-v. rect., damper, horiz. output, oscillator.



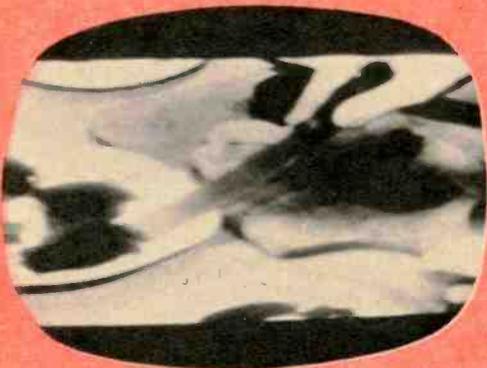
**NO PICTURE, NO SOUND, RASTER OK;** RF amp., HF osc., mixer, video IF, amp., or detector. If sound normal, check video amp., video detector.



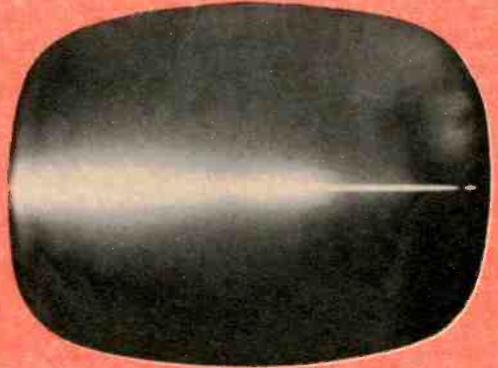
**WEAK PICTURE WITH SNOW;** RF amp., AGC. If picture is weak with no snow, check HF oscillator, mixer, video IF, video detector, video amp.



**INSUFFICIENT WIDTH;** horizontal output, damper, low voltage rectifier, horizontal oscillator.



**INSUFFICIENT HEIGHT;** vertical output or osc.



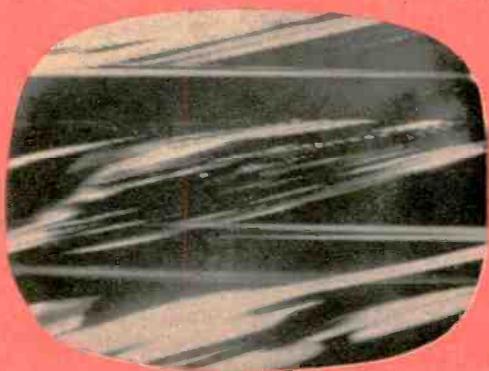
**HORIZONTAL LINE, NO RASTER;** vertical output, vertical oscillator.



**SMALL PICTURE, INSUFFICIENT HEIGHT AND WIDTH;** Low voltage rect., damper, horiz. output.



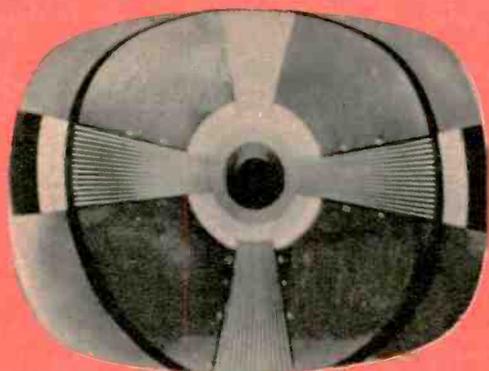
**LOSS OF VERTICAL SYNCH;** vertical oscillator.



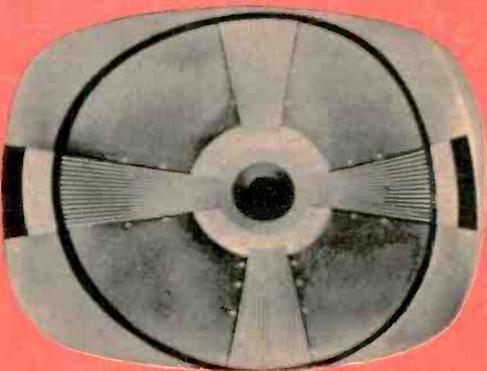
**LOSS OF HORIZONTAL SYNCH;** horiz. osc., AFC.



**HORIZONTAL PULLING;** RF amp., video IF amp., video detector, video amp., horizontal osc., AFC, synch separator, synch amp.



**VERTICAL NON-LINEARITY, TOP WEDGE SHORTENED;** vertical output, vertical oscillator.



**HORIZONTAL NON-LINEARITY, RIGHT WEDGE SHORTENED;** horizontal output, damper, or horizontal oscillator.

*we try for a*

# Radio Controlled Model Airplane Record

**By William Winter**

**Dawn-to-dusk in the air is the ambitious goal of these R/C modelers, but their problems are many.**

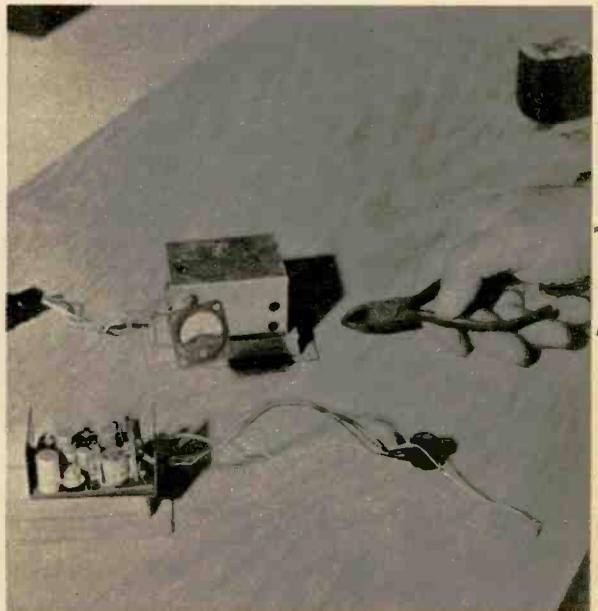
**W**ITH radio control of model planes, boats, cars and even decoy ducks a routine matter, the hobbyist wants new worlds to conquer. Miniature boats and airplanes have been guided across the Catalina and English Channels. A six-foot long plane remained aloft for 5½ hours—a model glider more than seven. But here's the story of a really king-sized project—a dawn-to-dusk flight of a model airplane!

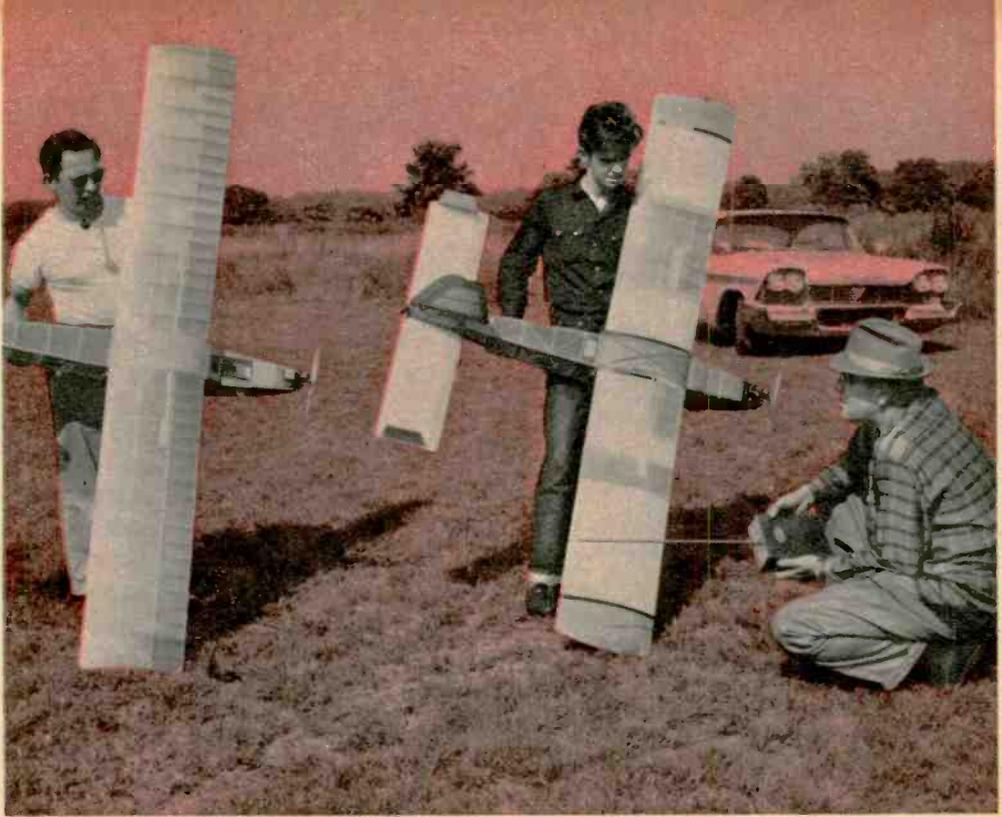
Federation Aeronautique Internationale, with headquarters in Paris, has strict rules governing record flight attempts. The model plane must take off from the ground and may not exceed a gross weight of 11 lbs.

Electronic equipment must be light and reliable and a power plant with the lowest rate of fuel consumption is essential. Trying to strike a practical weight balance between the electronic gear, engine and fuel, then trying to build a plane around them is

Shown alongside familiar dry batteries, two VO-500s (left) and four LRO5s (center foreground) were excellent in-plane power packs.

Essco receiver (at rear with tiny meter) is operated by on-off carrier. All-transistorized CG (cover removed) uses modulated tone.

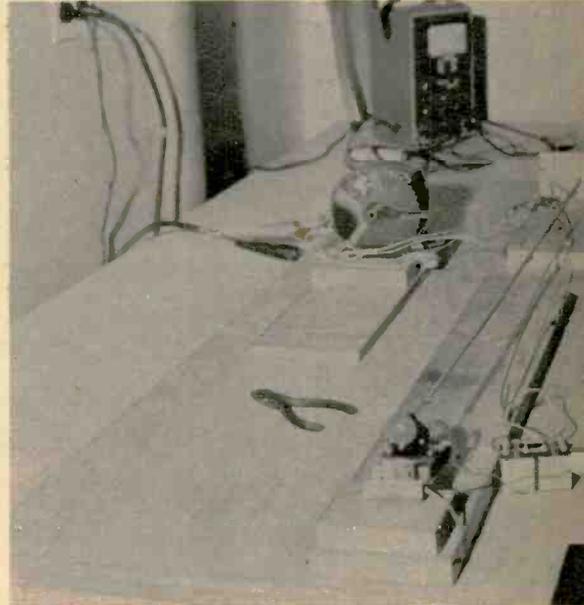
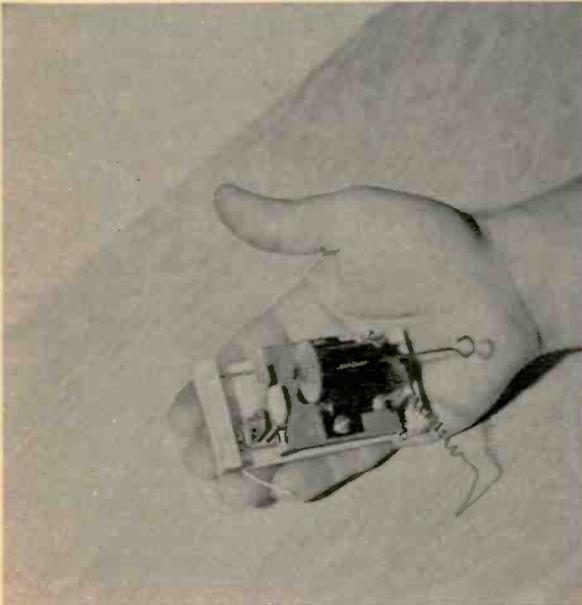




**Author (with R/C transmitter, right) inspects two 13-hour capability test models in field.**

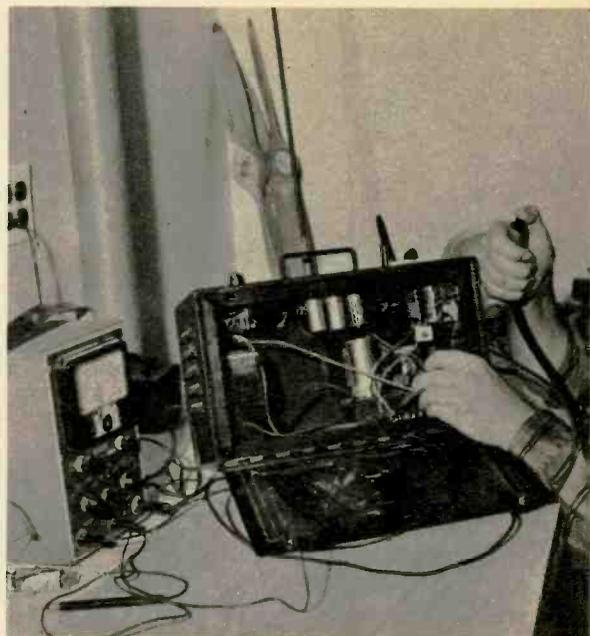
**This small motor is mounted on wire runners and winds rubber escapements. It is turned on and off by varying tension in escapement.**

**Tests run continuously. Below, keying disc on slow speed motor at rear triggers rubber escapement which is hooked to winding motor.**





**Bramco tone xmtr works CG rcvr. Keying lead with phone jack allows placement on car roof.**



**In carrier wave operation, Essco with 2v wet cell and built-in charger, vibrator was used.**

nothing short of a designing nightmare.

Six months of testing, automatic keying devices triggering trial equipment on a 24-hour basis, setting up and then changing the positions of system components, dozens of flying sessions, and lots of worry were what faced the builders of this radio controlled 13-hour capability "test" airplane.

Selecting fuel and engine was the first step. After three months of engine testing, P.G.F. Chinn, British authority on miniature engines, came up with a .09 Diesel engine that burned about three ounces of fuel per hour. At this rate the fuel tank would have to hold about 48 ounces to sustain a dawn-to-dusk flight. So heavy a fuel tank would have to be placed at the plane's center of gravity to achieve proper balance. But such a move puts the fuel too far from the engine. The answer: Pressure fuel feed using a float chamber to supply fuel to the engine on demand.

Engine requirements met, the next knotty problem was making some provision for bringing the model down from excessively high altitudes which inevitably would be reached many times

during a long flight. Engine-throttle control was not practical because varying throttle adjustments on such a small engine might lead to engine failure. Elevator control was undesirable because of speed build-ups in dives which might overload the structure or cause engine stoppage due to over-revving. Violent aerobatics due to "spinning down" the machine were taboo for the same reasons.

The answer was the "spoiler"—a small appendage extending vertically from the upper surface of the wing. This tends to reduce lift and permits a shallow dive. For steering, rudder-only control is adequate.

These simple controls required a compound actuator to be worked by a simple single-channel receiver. Limited to products readily obtainable in any hobby shop, the designers used a compound type escapement to mechanically power the rudder and spoiler. (Bonner and Babcock motor servos subsequently were used in two test ships.) The compound escapement is rubber-strand driven. One long pulse gives one rudder  
[Continued on page 106]

*another EI sun-powered project*

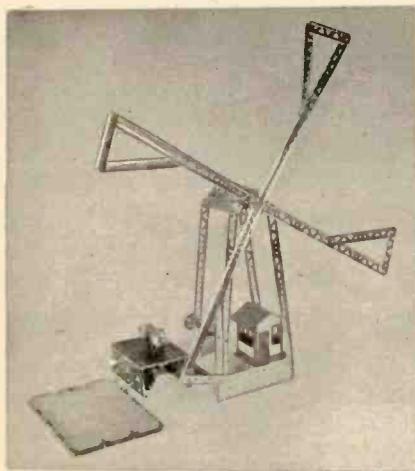
# Fun With a Sun-Powered Motor

By Lou Garner

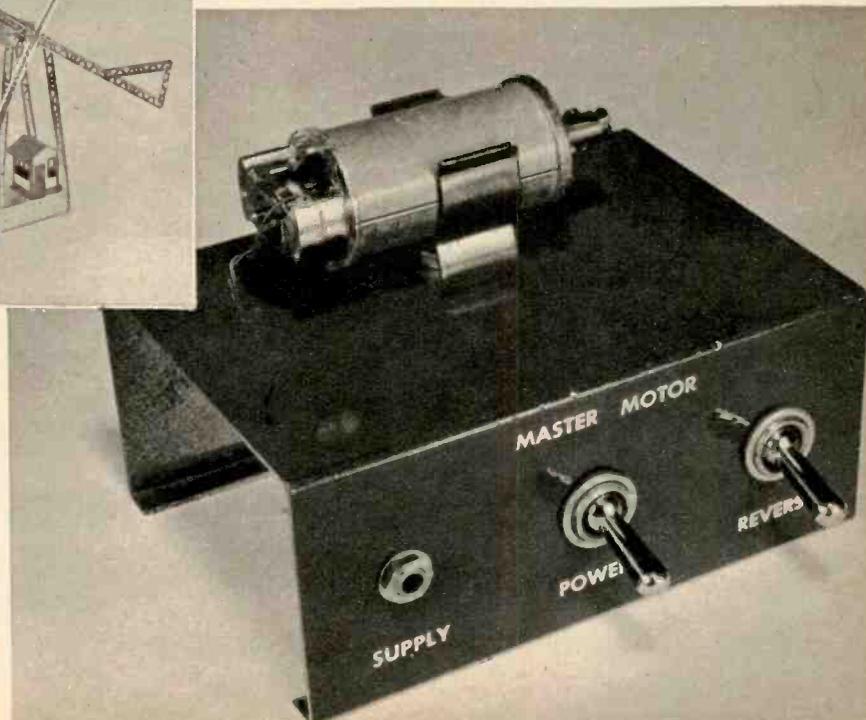
**A miniature power plant to operate toys, models, or window displays, is recharged by solar energy.**

**S**MALL, low-power battery-operated motors have dozens of useful applications. You can use them to operate scale models, toys, small fans and stirrers, and in similar projects around the home. Industry uses them in small instruments and to operate scientific and educational displays. Department stores and merchants use them to operate eye-catching store window and showroom displays.

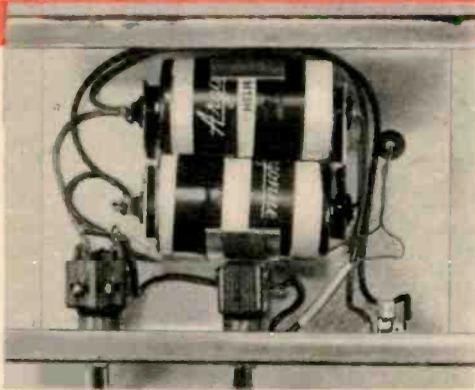
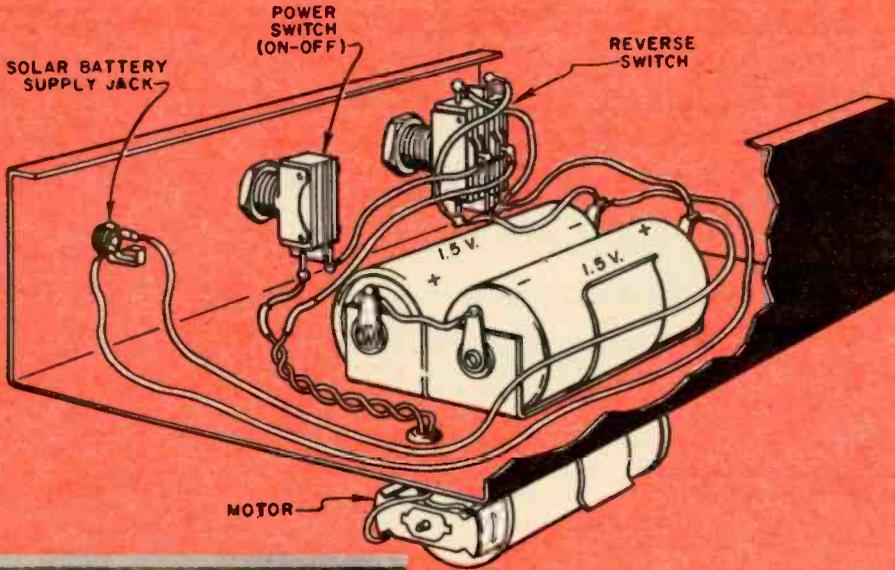
An important limitation on the use of these motors is their relatively high cost of operation. While these motors, in general, are powered by standard flashlight cells, their current require-



At left the motor assembly powers a toy windmill. The large flat plate is the Sun Battery that recharges the cells in the unit. Seen below are motor and chassis. The motor may be conveniently mounted by snapping it into a 60 ampere fuse clip.



November, 1958



Underchassis view of the 3 volt assembly. Add two more cells in series for 6 volt operation.

The motor shaft is shown being wound with electrical tape to fit oversized gear or pulley.



Follow the wiring guide above. However, the exact placement of the parts is not critical.

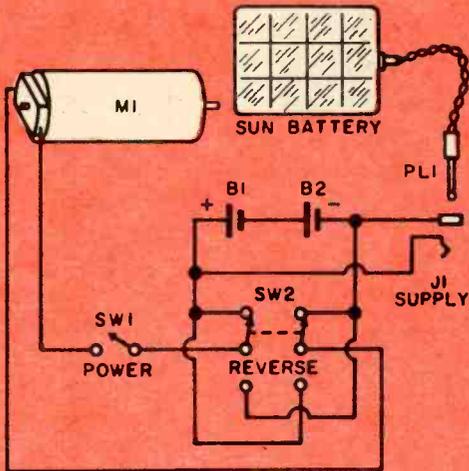
#### PARTS LIST

- SW1—SPST Toggle switch.
- SW2—DPDT Toggle switch.
- J1—Miniature jack.
- PL1—Plug, to fit J1.
- B1, B2—1½ volt rechargeable flashlight cells (Lafayette No. BA-10).
- M1—Low drain battery motor (Lafayette No. F-285).
- Sun Battery—6 volt Solar Battery (Lafayette No. F-380).
- Chassis—Aluminum, approx. 3¼" x 4½" x 2".
- Battery holder—For (2) Size "C" cells.
- Large fuse clip—for motor mounting (Union type 31-60A).

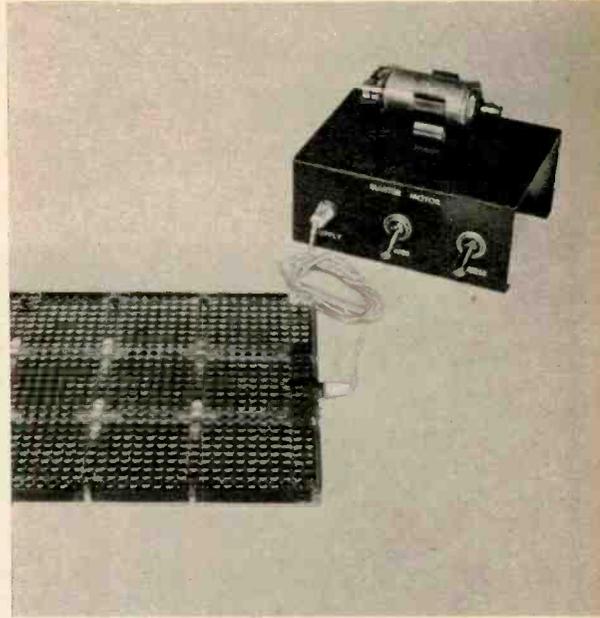
ments are such that a typical cell lasts a comparatively short time.

However, with the recent introduction of a high-efficiency motor and the commercial availability of a high-output Sun Battery and moderately priced rechargeable flashlight cells, you can now put together a useful motor assembly which derives its ultimate power from the Sun . . . an unlimited source of "free" energy.

The very small motor specified in the PARTS LIST will operate with from 3.0 to 6.0 volts. The higher the operating voltage applied to the unit, the greater the torque the motor can de-



After charging cells, Sun Battery may be disconnected. Motor uses energy stored in cells.



Don't put the glass-topped Sun Battery too near a light bulb. Excess heat will damage it.

velop and the higher its no-load speed. If you intend to use the completed assembly for light-duty applications only, you can plan on a three-volt power supply (as was used in the model).

For a three-volt power source, use a single dual-battery holder, wiring the two sections in series. To use the motor to operate a model, toy, or display, you'll need to mount a small pulley or gear adaptor on this shaft. If you have difficulty finding a pulley or gear which matches the motor's shaft *exactly*, obtain a unit with a slightly larger hole and bush out the motor's shaft to provide a snug fit, applying one or more layers of Scotch electrical tape. Stretch tape slightly as you apply to insure good adhesion and a smooth, round surface.

The Sun Battery used to recharge the motor's built-in batteries is supplied with a flexible connection cord equipped with two subminiature plugs. One of these fits the battery's own "output" jack. The other should be replaced with a plug to match the motor assembly's power SUPPLY jack (J1). Be sure to observe correct polarity, checking the Sun Battery's output with a voltmeter if necessary.

To use the motor, simply couple it to the toy, display, or other item you wish to operate, using an appropriate drive belt or gear train. In general, the use of small pulleys and a drive belt is preferred, for this arrangement permits a certain amount of "slippage" and makes it easier for the motor to start under load. A small rubber band makes an excellent drive belt if only light loads are to be driven by the motor.

To recharge the built-in battery power supply (B1, B2), insert the Sun Battery's output plug (PL1) into Supply jack (J1). Full sunlight is best, but an acceptable charging rate may be maintained if the unit is exposed to a fairly strong artificial light.

The Sun Battery is a multi-cell unit having a nominal output rating of six volts, and, therefore, can be used to recharge up to four cells in series. Don't worry about damaging your rechargeable cells if you've used a three-volt (two cell) power pack, however, as a greater load is placed on the Sun Battery, its output voltage drops. In actual practice, its no-load (open circuit) output voltage may reach as high as seven volts in full sunlight. ●



**The unit, placed under lamp base near window, responds to the amount of light outdoors. It is insensitive to auto headlights or lightning.**

**On the rear panel from left to right; on-off switch, R2 sensitivity control, 1-inch photocell window, and AC receptacle for lamp plug.**



# The Skywatcher

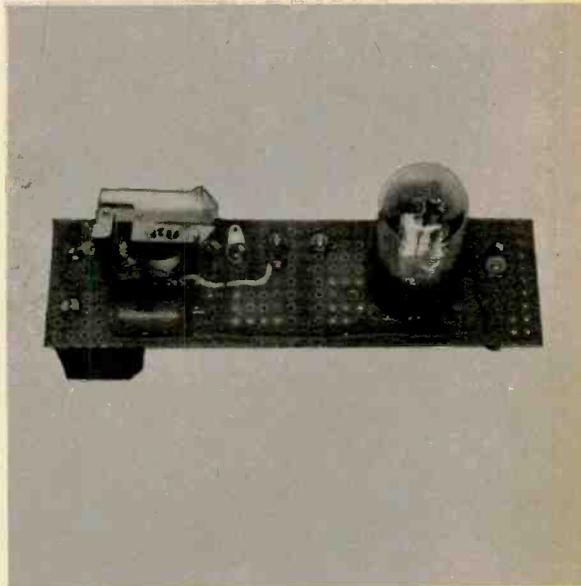
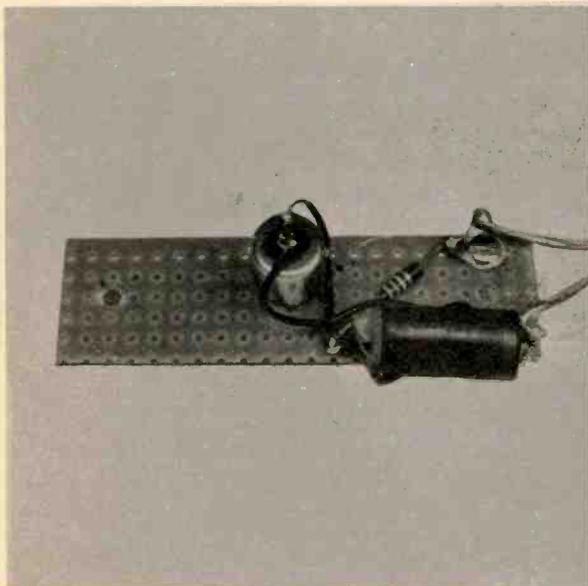
By Harvey Pollack

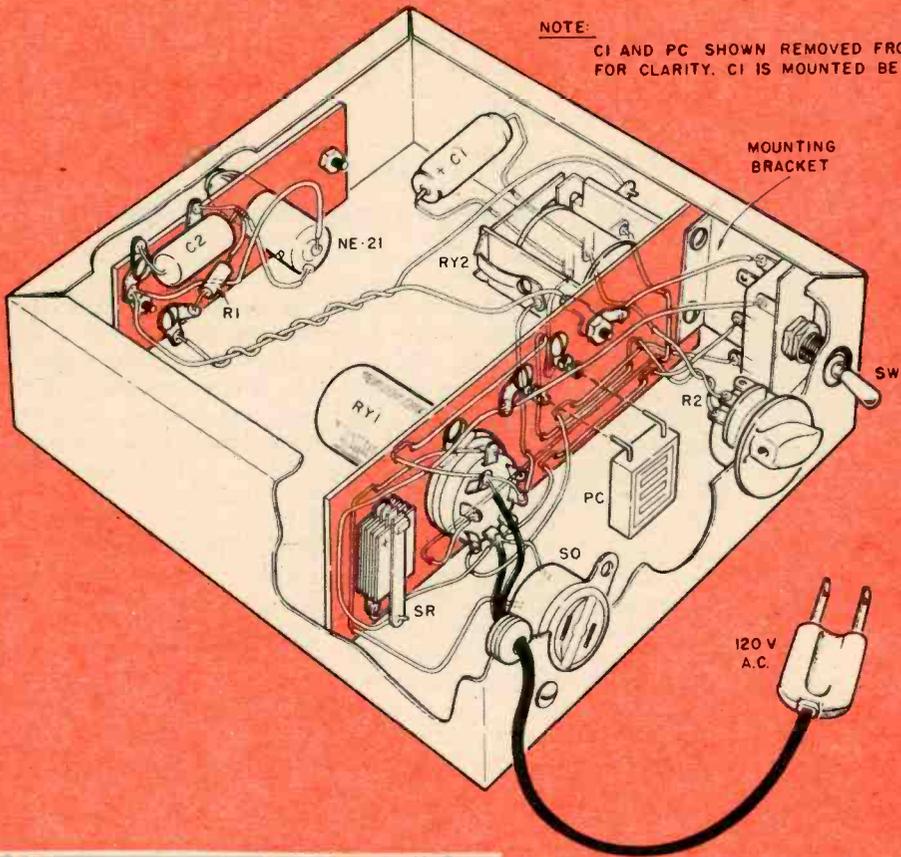
**Build this effective countermeasure against home burglary. It automatically turns on lamp at night.**

**A**CCORDING to some recent newspaper surveys, the best measure against home burglarizing is to leave a lamp or other light on at night. Of course, if you are going away for an interval greater than a day or two, this poses some problems. Apart from the fact that electricity costs money, a lamp that burns continuously is a dead give-away to a criminal that happens to be "casing" the neighborhood. This is like hanging a sign that says "Nobody Home" in your window!

Comparatively little in the way of time, effort and money is involved in building the SKYWATCHER, an electronically controlled lamp base that will turn on one or more lamps with the coming of night. At daybreak, regardless of the weather or the density of the clouds, it will extinguish the lights until the next evening. But that's not all! The SKYWATCHER has been designed with other unique and uncanny "abilities." For example, suppose you go out during the afternoon and return after nightfall; you will find the lamp glowing brightly when you return so there will be no fumbling for light switches or pull-cords. You leave the lamp on for the evening and, when you

**Below left is the neon-winker sub-chassis. The leads are soldered directly on the base of the bulb at center. C2 may be seen with R1 above it. Below right is RY2 with C1 below it. At other end of board is thermal relay RY1.**

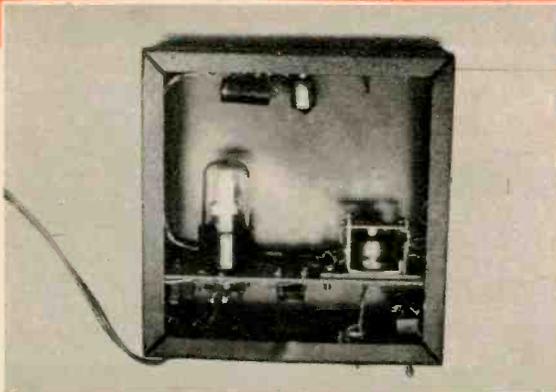




**NOTE:**  
 C1 AND PC SHOWN REMOVED FROM CHASSIS  
 FOR CLARITY. C1 IS MOUNTED BELOW RY2.

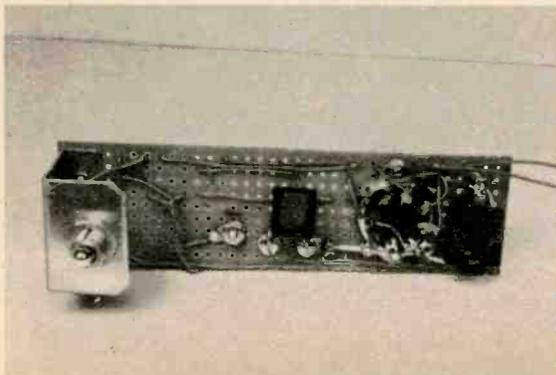
MOUNTING  
 BRACKET

120 V  
 A.C.



The two sub-assemblies, in guide above, are wired before mounting in chassis. To avoid any shock hazard don't connect any of the wires to the metal chassis.

Bottom view of unit. Appearing like a tube, RY1 is visible at left. RY2 is on the same board to the right. Complete unit costs about 70¢ a year to operate.



Underside view of the larger sub-chassis shows, from left to right, toggle switch with bracket, photocell (center), octal socket for RY1, and selenium rectifier.

*Electronics Illustrated*

are ready to retire, you turn off the switch. The lamp does not extinguish immediately, but remains lit for a sufficiently long period of time to enable you to reach the bedroom without hurrying or stumbling into things in the dark. The arrival of daylight triggers a little winking neon bulb into action so that you are reminded to turn the SKY-WATCHER on again to ready it for the next night. Once the switch is moved to ON, the neon light goes out and, to all intents and purposes, everything about the lamp is off.

Construction should be started by cutting a piece of perforated bakelite measuring 6½"x1½" from a larger sheet. This serves as the sub-chassis that supports most of the electrical components.

A 1-inch round hole cut with a tube-socket punch acts as the window in the rear apron of the base through which sky light can reach the photocell located about 1 inch behind the hole. To avoid unsightly screw heads on the sides of the base, a short bracket cut from scrap aluminum is used to hold the sub-chassis firmly in place by drilling it with a ½" hole so it will fit over the shank of the toggle switch. The parts are quite

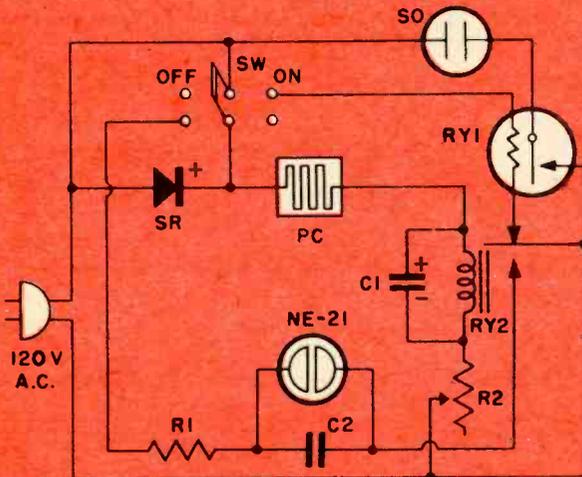
light in weight so that the toggle switch can do double duty—as a switch and as a bracket retainer. The bracket is folded so that it holds the sub-chassis about 1¾" back from the rear apron. The photocell is held to the bakelite sheet by two solder lugs that may be bent outward to permit the transparent face to lie about 1" back of the hole and directly in line with it.

The time-delay relay looks like an octal tube and is held by an octal socket. The hole for the socket is most easily cut by a slow-speed 1" drill. However, you can cut it by first drilling with a ½" drill and then reaming or filing it to its final 1" diameter.

A second small piece of perforated bakelite is utilized to support the neon-winker, its capacitor, and its resistor. Drill a ⅜" hole in its exact center and slowly, ream it out until the NE-21 glass bulb just slips through and is held by friction. After assembly, the perforated sheet is held away from the front apron by two decorative-head screws passed through a couple of ⅜" spacers. Make the neon-winker peep hole in the front apron of the chassis quite small—say ¼"—to keep it subdued and unobtrusive.

[Continued on page 107]

Schematic and parts list. Photocell resistance: dark-1 megohm, in bright light-under 100,000 ohms.



#### PARTS LIST

- C1—8 mfd. 200 v miniature electrolytic
- C2—1 mfd. 200 v paper
- NE-21—Neon lamp
- PC—Photocell, cadmium sulfide, Hupp Powermaster CDS-10
- R1—330,000 ohm ½ w
- R2—25,000 ohm linear taper potentiometer
- RY1—Thermal time delay relay, Amperite 115N060
- RY2—SPDT, 10,000 ohm coil Potter & Brumfield LB-5 10,000
- SO—AC chassis receptacle
- SR—Selenium rectifier, 65 ma. 120 v
- SW—DPDT switch
- Chassis—7"×7"×2" black ripple, Bud CB-789
- Bakelite—Perforated sheet 7½"×6¾"
- Octal socket, bakelite
- Line cord, plug, solder lugs, hardware

# Revive Your Speedlight

By Marshall C. Anderson

**With a simple conversion you can renew the life of a Speedlight—and no additional parts are needed.**

**M**Y EARLY vintage speedlight had been powered by a pair of rechargeable wet cell batteries. The batteries were long-since worn-out and gone. In addition, one of the two large condensers in the power pack was shorted out and useless. Repairs and replacements would have been expensive, yet it seemed a shame to relegate it to the junk pile while there were still useful parts in it.

I solved the battery problem by converting the light to AC operation and the condenser problem by simply removing the blown-out condenser from the circuit. Result—a speedlight

**Since conversion, this unit has given 2 years of perfect service. A battery charger replaces the wet cells, and a shorted condenser has been removed.**



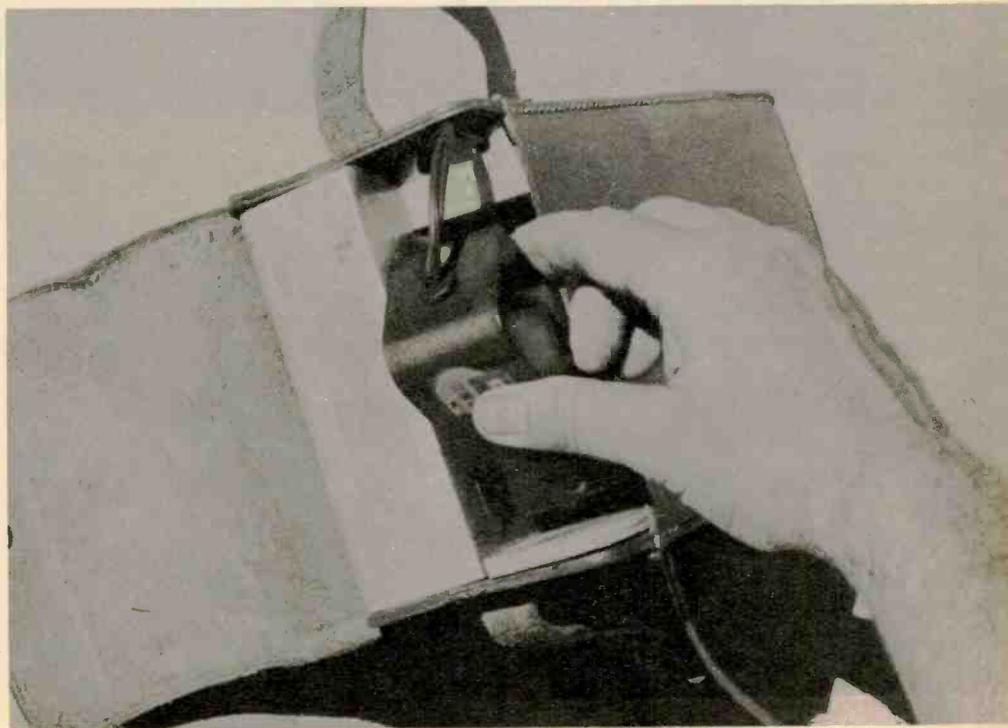
The original wet cell batteries, no longer rechargeable, are removed and discarded.



The battery charger wires are connected to the leads that originally went to the wet cells.



The charger and AC cord fit easily into the space formerly occupied by the batteries. Re-cycling time of Speedlight using the charger is slightly longer than with batteries.

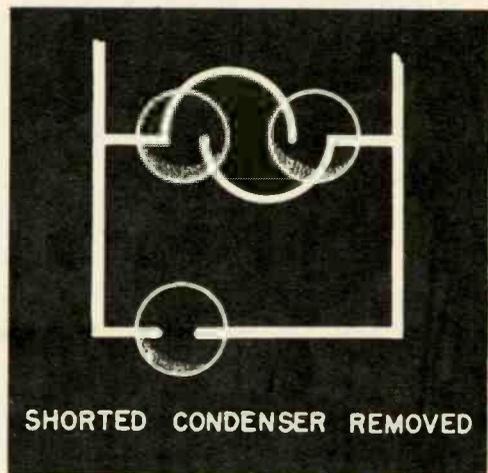
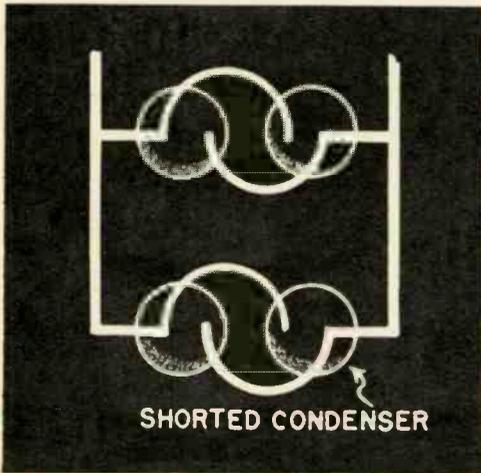




Bad condenser is replaced with a light wooden box (center right) to support the other parts.



Relay points are cleaned with very fine grade of emery cloth. See text for adjusting process.



"Bridging" the circuit. Text explains how to compensate for reduced light output that results.

that has served for over two years without missing a beat. Cost for repairs—zero.

A word of caution is in order before you open the case of any speedlight. The high voltage power supplies of these sets produce anywhere from 1200 to 3000 volts. Before working on a speedlight, let the set stand overnight. This will permit the condensers to lose most of their charge. If the light is in use, fire the lamp to discharge the circuit, then continue to push the firing button several times to bleed off as much charge as possible. Then let the set stand overnight before opening the case to work on it. When the case is opened, immediately short out the condensers several times by using a screw-

driver with insulated handle and shorting between terminals of condensers.

A speedlight powered by rechargeable wet cells can very easily be converted to AC operation by using the original battery charger as a power supply. The conversion costs nothing and can save a speedlight for which you no longer wish to buy batteries. Usually the chargers are dry rectifiers. Your light will not re-cycle as fast with the AC power supply as it did on fully-charged batteries since the capacity of the battery charger is small. On the speedlight shown, recycle time on AC operation using the old battery charger is 45 seconds.

[Continued on page 108]

# The ABC's of Electronics-5

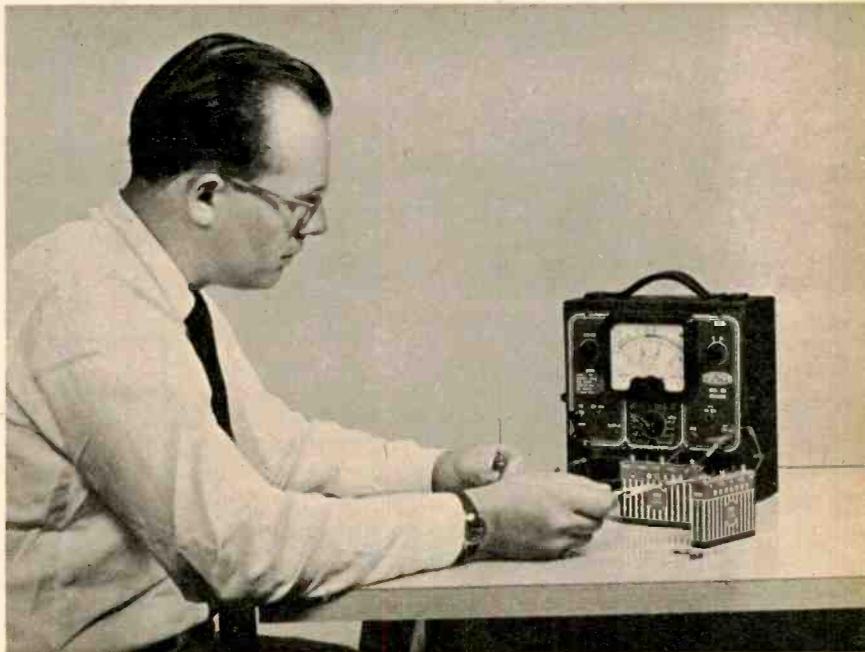
By Don Hoefler

**Part five in this series describes Kirchhoff's Laws, used to solve problems where Ohm's Law falls short.**

**T**HE relationships between voltage, current and resistance defined in Ohm's Law enable us to determine circuit conditions in many types of complex series-parallel arrangements. But, just when we think all is smooth sailing, we run into a criss-cross arrangement, or a circuit having more than one source of electromotive force. We find to our dismay that Ohm's Law just doesn't give us enough to work with. At this point we must turn to other techniques. Among them is the application of Kirchhoff's Laws.

This subject isn't nearly so sticky as you might gather, judging from the short shrift it usually gets in elementary textbooks. Every electronic technician, whether hobbyist or professional, should have this accomplishment under his belt, but very few do. So, if you'd like to elevate yourself a cut or two above the

**The various forms of Kirchhoff's Laws, as they appear in these problems, may easily be demonstrated with the aid of resistors, batteries, and multimeter.**





“...and here’s EI’s gift to you.”

Christmas is a time when we all get ties we don’t want, handkerchiefs we don’t need and shirts we wouldn’t be seen in.

But here’s a chance to give someone... perhaps even *yourself*... a gift that will really be appreciated—a year’s subscription to **ELECTRONICS ILLUSTRATED**.

If you (or your dad, friend, brother, etc.) are keen on Hi-Fi, do-it-yourself projects, short wave listening, radio control, ham radio or any other aspects of the wonderful field of electronics, you’ll be glad to receive **ELECTRONICS ILLUSTRATED** each month.

**And now, for the first time,  
you can get or give EI  
at money-saving gift subscription rates!**

All you have to do is fill out and mail the special **CHRISTMAS GIFT ORDER CARD**. So do it now!



**ELECTRONICS  
ILLUSTRATED**

**CHRISTMAS  
SUBSCRIPTION RATES:**

First 1 year gift . . . . . \$2.50  
(regular rate \$3.00 per year)  
Second 1 year gift . . . . . \$2.50  
Each add’l 1 year gift . . . . . \$2.00

*In U. S., Possessions and Canada*

**ELECTRONICS ILLUSTRATED**  
Fawcett Building, Greenwich, Conn.

Electronics Illustrated  
**ELECTRONICS  
ILLUSTRATED**

Fawcett Place, Greenwich, Conn.



**Special Gift Rates**

- First 1 year gift . . . . . \$2.50  
(Regular Rate \$3.00 per year)
- Second 1 year gift . . . . . \$2.50
- Each add'l 1 year gift . . . . . \$2.00

*Please enter gift subscriptions to  
ELECTRONICS ILLUSTRATED for:*

Name.....

Street.....

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

---

Name.....

Street.....

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

---

Name.....

Street.....

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

---

My Gift Card(s) Should Read  
From —

---

Remittance enclosed       Bill me

My Name.....

Street.....

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

---

If You **Also** Want ELECTRONICS ILLUSTRATED Sent To You, Check Here

**FIRST CLASS**  
PERMIT NO. 80  
Greenwich, Conn.

**BUSINESS REPLY CARD**  
No Postage Stamp Necessary if Mailed in the United States

**POSTAGE WILL BE PAID BY**

# **ELECTRONICS ILLUSTRATED**

**FAWCETT PLACE  
GREENWICH, CONN.**



average, come along as we delve into some most interesting concepts in the electronic art.

One way of putting the First Law, which seems to convey the concept as well as any, is as follows:

*All of the voltage drops occurring within a continuous circuit are exactly equal to all of the voltage rises.*

This doesn't mean that each source voltage necessarily has an equivalent drop somewhere in the circuit, but rather that the sum total of all the sources equals the sum total of all the drops. As a practical example, look at Fig. 1.

Between end points A and B there is a battery supplying 100 volts. Since the negative terminal of the battery is the source of excess electrons, the electron current is said to flow from A to B, and there is a voltage rise between these two circuit points of 100 volts.

Now the 10 amperes of electron current in continuing from point B to point C must pass through an 8 ohm resistor. This will cause a difference of potential between these two points, which by Ohm's Law,  $E = I \times R = 10 \times 8 = 80$  volts. The resistor is, of course, not a

source of voltage. On the contrary, it is a loss device. There is therefore said to be a voltage drop of 80 volts between B and C.

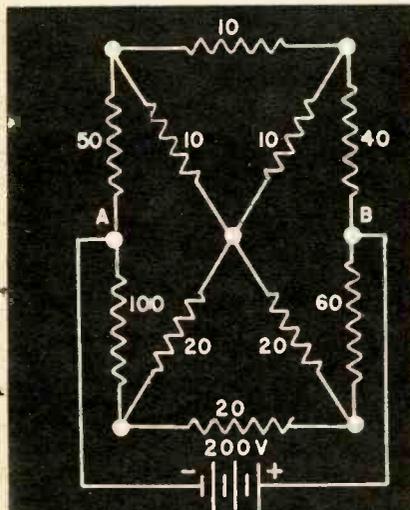
Let's go on. From C to D we encounter another loss, this time equal to  $10 \times 15 = 150$  volts. Hence, there is a 150 volt drop between these two points. Then between D and E we have the second battery, connected in the same direction as the first, to provide another voltage rise of 200 volts. Finally, from E to A there is another drop of  $10 \times 7 = 70$  volts.

Now let's add up all of the rises and drops:

Rises	Drops
100	80
200	150
	70
300 volts	300 volts

The sums are in fact equal, just as the First Law promised. Another way of stating this Law is based on the thought that the voltage drops are actually subtracting from the voltage rises. If this is true, then each of the drops would be preceded by a minus sign. Then in this example the sum of the rises is 300 volts and the sum of the drops is -300 volts.

[Continued on page 88]



Find the resistance between Points A and B using Kirchoff's Laws. See solution next month.

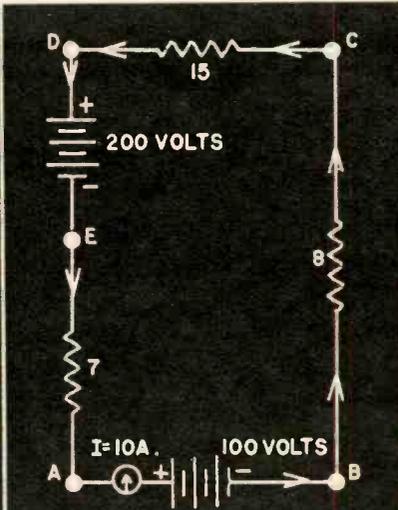


Fig. 1. Voltage conditions in this simple series circuit illustrate Kirchoff's First Law.

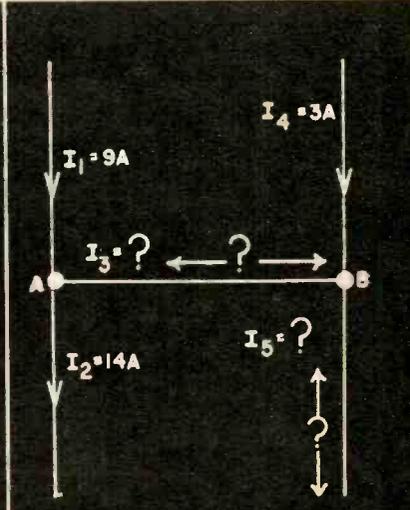


Fig. 2. Current conditions in this circuit illustrate an example of Kirchoff's 2nd Law.

# Knight 5-Transistor Portable

**A beginner builds this receiver kit for his first project—and here are some reactions.**

**F**ROM kit to complete radio in an evening! That's the story of a new 5-transistor portable radio that can be assembled by anyone who recognizes the business end of a pair of long-nose, side-cutting pliers.

You don't even have to know how to solder to build this one. Complete instructions in the art come with the kit, along with a few special notes on "Tinning the Iron," and "Printed Circuit Board Soldering."

The set shown on these pages was put together in just four and a half hours by a novice who didn't know a transistor from a transmitter, or a capacitor from a cake pan. The step-by-step instruction book that comes with the Knight 83Y766 by Allied Radio Corporation spells out the smallest detail.

"Study the pictorial diagrams," says the booklet, which then goes on to refer each operation to one of the ten illustrations. *[Continued on page 88]*

**First check components against parts list. Card (left) simplifies resistor location.**

**Circuit board cuts assembly time and error. Here, oscillator coil is soldered in place.**

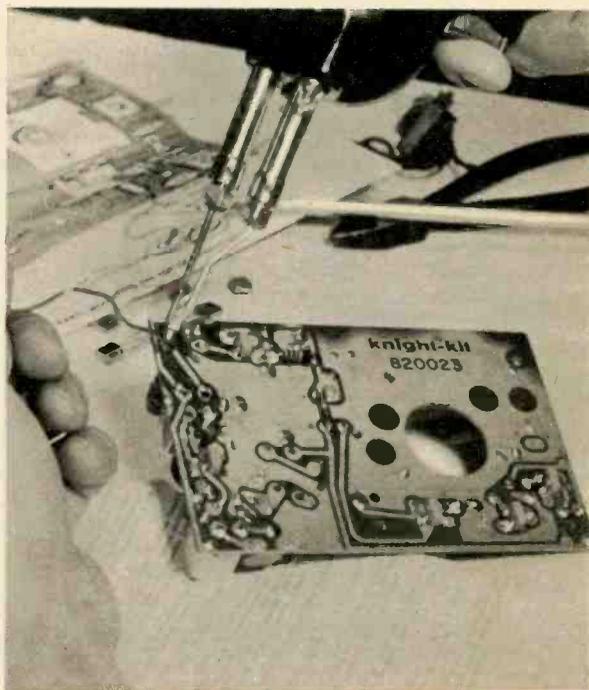
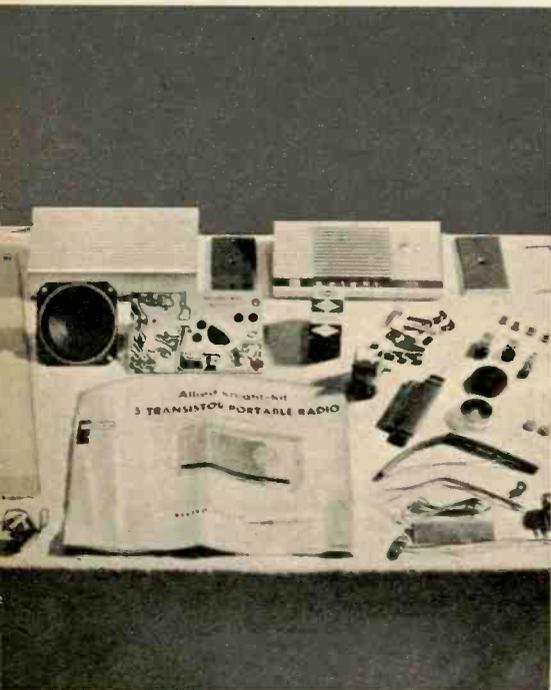




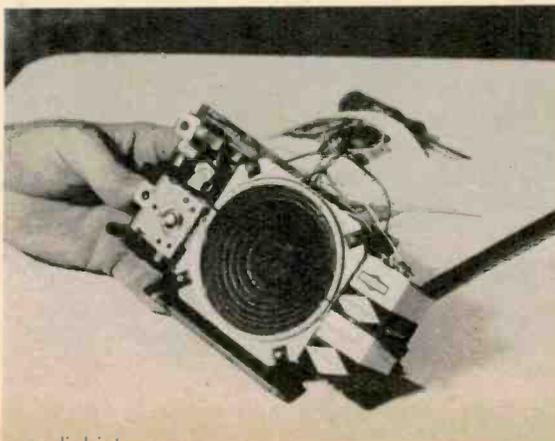
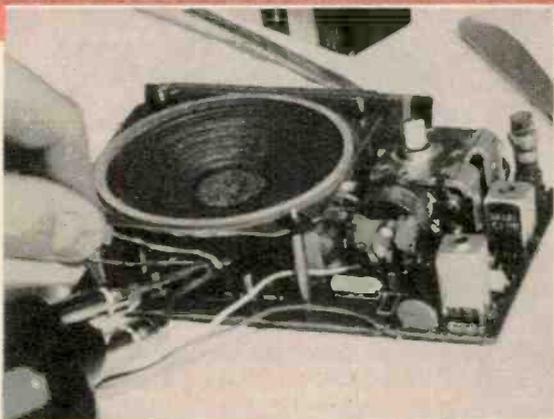
Photo by Mike Bonvino

On the left side of the complete receiver is a pull-out handle and earphone jack. The earphone for private listening can be purchased for \$3.17.

To assist in the mounting of parts, code letters are stamped right on the circuit board. Component wires are inserted in holes, bent, and soldered.

Driven by push-pull transistors, the 3½" speaker is capable of full room volume. 200 hours of playing time is claimed for a single 9-volt battery.

November, 1958



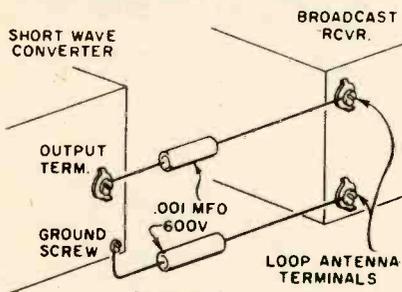
# The Electronic Brain

All questions of an electronic nature will be answered by the Brain. If the question is of general interest, it may be printed in a future column.

## Connecting a Short-Wave Converter

Most short-wave converters have single wire output. My broadcast receiver has two antenna terminals, one on each side of the loop. What is the best way to connect the converter to my receiver?

Robert Bussey, Arlington, Texas

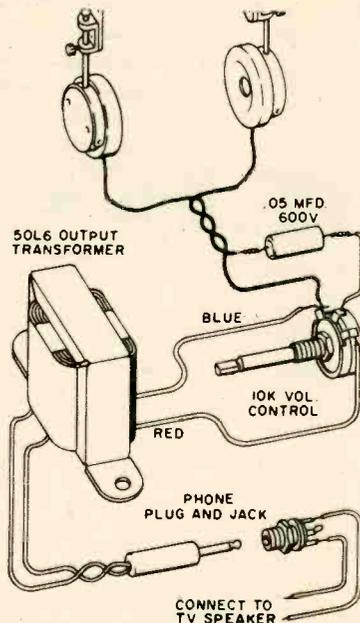


Connect the converter output terminal to either antenna terminal on the receiver loop through a .001 capacitor as shown. Repeat this procedure—again through a .001 mfd capacitor—connecting the second loop terminal to any screw on the converter case or chassis. Test the reception by listening carefully to a short-wave station that is likely to remain on the air for some time. Then, reverse the leads at the loop terminals and compare the volume and noise with the previous test. Make your final connections those which provide the best results. You can do no damage if you work with capacitors of the size suggested.

## Headphones For TV Set

Can you give me a circuit which will permit me to connect a set of headphones to my television receiver so that a person who is hard-of-hearing will be able to listen at the same time as the rest of the family listens to the loudspeaker? I would like to include a volume con-

trol to be used with the headphones.  
Harry Goynes, McAllen, Texas



Since the headphone signal will have to be quite loud to satisfy one who is hard-of-hearing, a matching transformer has been included to do the job right. When purchasing the transformer, order an output type designed to match a 50L6 tube to the voice coil of an 8 ohm speaker. This is suggested because you will find such transformers readily available and quite low in cost.

If you don't already have the headphones, purchase a pair having an impedance from 3000 to 5000 ohms, the higher the better. Then, using a 10,000 ohm audio taper potentiometer, connect the circuit as shown. It would be wise to bring the connections from the loudspeaker out to a standard phone jack mounted on the television cabinet. ●

# This book is a Gold Mine Send for it immediately!



**REVEALS HOW YOU CAN GAIN QUICKER SUCCESS  
OR TURN YOUR HOBBY INTO A WELL-PAID CAREER  
IN RADIO . . . TELEVISION . . . ELECTRONICS**

*Whether you're an amateur . . . a hobbyist . . . or already in electronics . . . let us show you how to have a bright career in*  
**Electronics—Television—Broadcasting—Guided Missiles—Aeronautical Electronics  
 Radar—Automation—Instrumentation—Computers  
 Servomechanisms—Astronautics—Communications—Manufacturing—Telemetering**

## TURN YOUR HOBBY INTO A HIGH-PAYING CAREER!

Today thousands of electronics hobbyists have an opportunity to turn their hobbies into profits. It's the "Age of Electronics!" Trained men are in crucial demand! You may be "outside" the electronics industries now, working on a job you enjoy far less than experimenting, building, transmitting, receiving; working for less money than is being paid to electronics engineering technicians. But your "true love" is electronics. Why not awaken to your opportunities—now?

## ELECTRONICS HAS GOOD PAYING JOBS FOR TRAINED MEN!

And only trained men can fill them. You can get your share, if you take time now to gain that indispensable technical knowledge.

CREI offers you advanced, professional home study training in Electronic Engineering Technology including **SERVOMECHANISMS; COMPUTERS; RADAR; AUTOMATION; AERONAUTICAL ELECTRONICS; BROADCASTING; COMMUNICATIONS** and **MANUFACTURING**, and the **ELECTRONIC PRINCIPLES ASSOCIATED WITH GUIDED MISSILES, TELEMETERING, ASTRONAUTICS, AND INSTRUMENTATION.**

## YOU NEED ADVANCED TRAINING

Sure you have some experience. But the fellows with only partial technical knowledge move slowly, or stand still while you—the man with advanced technical training—plunge ahead in the golden world of electronics opportunities.

## ACQUIRE NECESSARY TRAINING AT HOME

Use spare-time hobby hours for CREI Home Study as thousands of successful technicians have done since 1927. Get concentrated training in minimum time, then step into a good job and enjoy good pay in the mushrooming electronics industry. CREI courses are being studied *today* on the DEW Line in the Antarctic—in Alamogordo and in Munich—by electronics experts in guided missile development and by telemetering technicians on the missile ranges.

## CREI TRAINS YOU IN MINIMUM TIME AT HOME

Thousands of men before you have benefited quickly from CREI Home Study training. Thousands of CREI graduates are now employed in industry here and abroad. Here is what they say: "You can quote me as saying that it was the smartest money I ever invested in my life, and it has repaid me several hundred times in earnings, not to mention the confidence and security that accompanied mastery of radio and electronics, thanks to CREI" — Joseph Zelle/W8FAZ; Radio Engineer, WERE, Cleveland, Ohio.

## VETERANS:

If eligible for training under the new G. I. Bill of Rights, check the coupon for full information.

## FAMOUS FOR MORE THAN 31 YEARS

CREI is known and respected throughout the Electronic world. Since 1927 we have trained thousands in the military, industry and government. "ASK ANY ENGINEER."

## CREI ALSO OFFERS RESIDENCE TRAINING IN WASHINGTON, D. C.

at the same high technical level. Day and evening classes start at regular intervals. Qualified residence school graduates earn degree as "Associate in Applied Science." You can qualify for CREI home study training if you have had electronic education, or experience in electronics—and realize the need of a high level technical knowledge to make good in the better electronic jobs. (Electronics experience is not required for admission to CREI Residence School.)

# TAKE A MINUTE TO MAIL THIS COUPON FOR FREE BOOKLET!

## CAPITOL RADIO ENGINEERING INSTITUTE

ECPD Accredited Technical Institute Curricula—Founded 1927  
 Dept. 1711-E 3224 Sixteenth St., N.W., Washington 10, D. C.

Please send me your course outline and FREE illustrated Booklet, "Your Future in the New World of Electronics" . . . describing opportunities and CREI Home Study courses in Practical Electronic Engineering Technology.

CHECK  Radar, Servo and Computer Engineering Technology  
 Electronic Engineering Technology  
 Broadcast (AM, FM, TV) Engineering Technology  
 Television Engineering Technology  
 Aeronautical Engineering Technology Z<sub>1</sub>

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

Street .....

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

CHECK:  Home Study  Residence School  Korean Veteran

To help us answer your request intelligently, please give the following information:

EMPLOYED BY .....

TYPE OF PRESENT WORK .....

EDUCATION: YEARS HIGH SCHOOL .....

OTHER .....

ELECTRONICS EXPERIENCE .....

## Superior's New Model 77

# VACUUM TUBE VOLTMETER WITH NEW 6" FULL-VIEW METER

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



### AS A DC VOLTMETER:

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

### AS AN ELECTRONIC OHMMETER:

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

### AS AN AC VOLTMETER:

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

- ✓ Model 77 completely wired and calibrated with accessories (including probe, test leads and portable carrying case) sells for only \$42.50.
- ✓ Model 77 employs a sensitive six inch meter. Extra large meter scale enables us to print all calibrations in large easy-to-read type.
- ✓ Model 77 uses new improved SICO printed circuitry.
- ✓ Model 77 employs a 12AU7 as D.C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability.
- ✓ Model 77 uses a selenium-rectifier power supply resulting in less heat and thus reducing possibility of damage or value changes of delicate components.
- ✓ Model 77 meter is virtually burn-out proof. The sensitive 400 microampere meter is isolated from the measuring circuit by a balanced push-pull amplifier.
- ✓ Model 77 uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

### Specifications

• DC VOLTS — 0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance.  
• AC VOLTS (RMS) — 0 to 3/15/75/150/300/750/1,500 volts. • AC VOLTS (Peak to Peak) — 0 to 8/40/200/400/800/2,000 volts. • ELECTRONIC OHMMETER — 0 to 1,000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms. • DECIBELS: —10 db to +18 db +10 db to +38 db +30 db to +58 db. All based on 0 db = .006 watts (6 mw) into a 500 ohm line (1.73v). • ZERO CENTER METER — For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

Model 77 comes complete with operating instructions, probe and leads. Use it on the bench—use it on calls. A streamlined carrying case, included at no extra charge, accommodates the tester, instruction book, probe and leads. Operates on 110-120 volt 60 cycle. Only

**\$42<sup>50</sup>**

# The Most Versatile All-Purpose Multi-Range Tester Ever Designed!

## Superior's New Model 79

# SUPER-METER

WITH NEW 6" FULL-VIEW METER

*A Combination VOLT-OHM MILLIAMMETER.  
Plus CAPACITY, REACTANCE, INDUCTANCE AND DECIBEL MEASUREMENTS.  
Also Tests SELENIUM AND SILICON RECTIFIERS, SILICON AND GERMANIUM DIODES.*



Model 79 completely wired and calibrated with test leads and portable carrying case sells for only \$38.50. Positively no extras to buy.

but in addition includes those services which are "musts" for properly servicing the ever-increasing number of new components used in all phases of today's electronic production. For example with the Model 79 SUPER-METER you can measure the quality of selenium and silicon rectifiers and all types of diodes—components which have come into common use only within the past five years, and because this latest SUPER-METER necessarily required extra meter scale. SICO used its new full-view 6-inch meter.

The Model 79 represents 20 years of continuous experience in the design and production of SUPER-METERS, an exclusive SICO development. In 1938 Superior Instruments Co. designed its first SUPER-METER, Model 1150. In 1940 it followed with Model 1250 and in succeeding years with others including Models 670 and 670-A. All were basically V.O.M.'s with extra services provided to meet changing requirements.

Now, Model 79, the latest SUPER-METER includes not only every circuit improvement perfected in 20 years of specialization.

• D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500.  
• A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000. • D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes. • RESISTANCE: 0 to 1,000/100,000 Ohms. 0 to 10 Megohms. • CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. • REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms. • INDUCTANCE: .15 to 7 Henries. 7 to 7,000 Henries. • DECIBELS: —6 to +18, +14 to +38, +34 to +58.

The following components are all tested for QUALITY at appropriate test potentials. Two separate BAD-GOOD scales on the meter are used for direct readings.

• All Electrolytic Condensers from 1 Mfd. to 1000 Mfd. • All Selenium Rectifiers. • All Germanium Diodes. • All Silicon Rectifiers. • All Silicon Diodes.

Model 79 comes complete with operating instructions and test leads. Use it on the bench—use it on calls. Only

**\$38<sup>50</sup>**

**EXAMINE BEFORE YOU BUY!**  
**USE APPROVAL FORM ON NEXT PAGE**

# Superior's New Model 70 UTILITY TESTER®

## FOR REPAIRING ALL ELECTRICAL APPLIANCES MOTORS ★ AUTOMOBILES ★ TV TUBES



**As an electrical trouble shooter  
the Model 70:**

- Will test Toasters, Irons, Broilers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorecents, Switches, Thermostats, etc.
- Will test all TV tubes for open filaments, inter-element shorts, burned out tubes, etc. (Will not test TV tubes for quality. An emission type tester such as the model E2 described below, is required to test tubes for quality.)
- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakage, 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—practically 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 test all TV tubes; also simple procedure for determining which specific tube (or tubes) is causing the trouble.

• How to trace trouble in the electrical circuits and parts in automobiles and trucks. **Only**

**Model 70 comes complete with 64 page book and test leads.**

**\$15<sup>85</sup>**

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



# TUBE TESTER

**TEST ANY TUBE IN 10 SECONDS FLAT!**

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

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

**FEATURES:**

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

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

**Model 82 comes complete, housed in portable, hand-rubbed oak cabinet with removable cover. Only**

**\$36<sup>50</sup>**

# 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 DISTRIBUTING CO., INC.**

Dept. D-528 3849 Tenth Ave., New York 34, N. Y.

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

Name .....  
Address .....  
City ..... Zone ..... State .....

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

- Model 77 ..... Total Price \$42.50  
\$12.50 within 10 days. Balance \$30.00  
monthly for 5 months.
- Model 79 ..... Total Price \$38.50  
\$8.50 within 10 days. Balance \$30.00  
monthly for 5 months.
- Model 70 ..... Total Price \$15.85  
\$3.85 within 10 days. Balance \$12.00  
monthly for 3 months.
- Model 82 ..... Total Price \$36.50  
\$6.50 within 10 days. Balance \$30.00  
monthly for 5 months.

## Knigh 5-Transistor Portable

Continued from page 83

A light-weight soldering gun was found helpful in assembling the set as shown in the accompanying photographs. The parts are, of course, tiny and the gun made it easy to apply the drop or two of rosin core solder needed to firmly fix the plainly numbered parts to the correspondingly numbered positions on the circuit board.

"I've never seen anything so easy in my life," said Jack as he turned on the switch of the finished radio. "The instructions are simpler than those on a ready-mix cake box."

Characteristic of all transistor sets, there is no warm-up period before pleasant tones drift from the surprisingly large 3½" speaker enclosed in the finished radio's compact little cabinet.

"For anyone who hasn't fooled with electronics before, I'd say this was a good place to start," Jack said. "The set will certainly be handy when the World Series rolls 'round again."

We did note, however, one possible source of difficulty. The mounting of the tuning condenser on the circuit board is not a very rigid arrangement. A slight detuning and a loss in volume occurred when the case was first put on. It seems that when the case is tightened down, the board is warped just enough to cause pressure on the tuning condenser. This was corrected when the case was repositioned, but there is a possibility of it happening again.

The complete kit, ready for assembly, with nothing more required than pliers, screwdriver, and soldering iron, sells for \$29.95.

## The ABC's of Electronics-5

Continued from page 81

In this case all of the voltage drops may be considered as cancelling out all of the voltage rises. In mathematical terms, the sum of +300 and -300 is zero. For this reason, Kirchhoff's First Law is sometimes stated as: *The algebraic sum of all the voltage rises and*

*drops occurring within a complete circuit is zero, which is just another way of saying the same thing.*

Kirchhoff's Second Law also states the same general concept, but in terms of current rather than voltage:

*The amount of current entering any junction point in a circuit is equal to the amount of current leaving it.*

Fig. 2 is only part of a circuit, as much as is shown having several branches to form an "H." The currents in each of the branches are DC, flowing in one direction only, but in two of the branches the directions are unknown. The amount of current in each of these branches must be determined as well.

Starting with the upper left-hand section, it is seen that flowing into point A is a current of 9 amperes, due to  $I_1$ . Flowing out of A, however, is  $I_2$  amounting to 14 amperes. This is a difference between  $I_2$  and  $I_1$  of 5 amperes. Where does it come from?

In this case the only place it possibly can come from is the branch between A and B. It seems reasonable to assume then that this branch makes up for the deficiency by virtue of  $I_3$ , which must therefore equal 5 amperes and flow in the direction B to A. Let's check that out.

If  $I_3$  is in fact flowing into A from B, then point A becomes the confluence, like two rivers flowing together, of  $I_1$  and  $I_3$ , which combine at this point to make a total value of  $9 + 5$ , or 14 amperes. Then, flowing out of A into the lower left branch is  $I_2$ , also equal to 14 amperes. Thus we see one justification for Kirchhoff's Second Law. But what about the other unknown, the  $I_5$  branch?

We know now that  $I_3$  is 5 amperes, flowing from B to A. And we know that flowing into B is  $I_1$ , in the amount of 3 amperes. At this point then, to the best of our knowledge, the current out of point B is 5 amperes and the current flowing in is 3 amperes, a discrepancy of 2 amperes. But this cannot be. The difference *must* be made up by  $I_5$ . In the lower right leg there must be 2 amperes of current, and it must be flowing upward into B. Hence, we can determine from Kirchhoff's Second Law, not only the value of an unknown current, but also the direction in which it is flowing. —●—

# Announcing the United States Army's Graduate Specialist Program 1958 ~ 1959

**The Purpose:** This program is offered to provide qualified high school graduates with the technical schooling which will enable them to join the Army's key group of specialists, its select team of experts in every field from electronics to rocketry and guided missiles.

**The Program:** This plan offers young men their choice of 107 technical training courses—young women, their choice of 26. These courses are conducted at special Army schools which utilize the most modern technical facilities and equipment available. All instructors are experts in their fields. Completion of schooling qualifies young men and women as skilled specialists—ready to begin careers in their chosen specialties.

**The Qualifications:** To qualify as a Graduate Specialist, you must pass certain qualification and aptitude tests and be a high school graduate. However, you may apply while you are still in your senior year and, if qualified, enter the program after graduation. It is advisable to apply early, since quotas for each course are limited and qualified applicants are selected on a first-come-first-served basis.

**The Procedure:** To apply for the Graduate Specialist Program, visit your local Army Recruiting

Station. Your Army Recruiter will give you an enlistment screening test. After passing this initial qualification test, you will be interviewed by the Recruiter who is an experienced counselor. He will discuss your academic background and interests with you. Based on your own abilities and desires, he will help you select a first choice course and two alternates. If quotas for your first choice course are filled, you may still become a Graduate Specialist in one of your selected alternates. Your Army Recruiter will then forward your application for processing. You will later receive a formal letter notifying you that a place in a course of your choice is waiting for you. Not until after high school graduation and shortly before your course begins will you actually enlist, and then only for three years. Before enlistment, you will take two final tests, the Armed Forces Qualification Test and the Army Qualification Battery. After making qualifying scores in these tests relating to your particular chosen field, you are ready to enlist as an Army Graduate Specialist.

**The Benefits:** Through this unique program, today's Army offers qualified high school graduates an outstanding educational opportunity—a tremendous headstart toward a successful specialist's career—as well as the chance to join the Army's select group of key personnel.

*Get choice, not chance,  
in  
Today's Army*

## Choose Your Graduate Specialist Schooling From 107 Courses Like These

Guided Missile Electrical Equipment Repair	Construction Drafting
Radar Repair	Construction Surveying
Microwave Radio Equipment Repair	Motion Picture Photography
Aircraft Components Repair	Neuropsychiatric Procedures
Engineer Equipment and Maintenance	Dental Laboratory
Atomic Weapons Electronics	Medical Laboratory Procedures
	Photographic Laboratory Operation

## FM Multiplex

Continued from page 47

process, will only accept 41,000 CPS. A special detector removes the audio and introduces it to a low-pass filter. This final stage prevents higher interfering frequencies from passing through. The output of the adaptor may then be fed to an amplifier and speaker.

It is possible to use many present day FM receivers for sub-channel reception with the addition of an adaptor. Most recent tuners have a jack marked "Multiplex" into which the future adaptor can be plugged. If there is no such provision, this output may be added by tapping off the proper stage in the receiver (at the detector before de-emphasis). Most high-quality FM tuners with proper alignment and bandwidth should present no problem when used with the adaptor.

Due to the rapidly increasing interest in stereophonic sound, several manufacturers are designing multiplex adaptors for home receivers to sell for approximately fifty dollars. The most popular sub-channel frequencies among the broadcasters appear to be 41 kc and 67 kc. This is a carefully chosen combination which may be used in a two sub-channel operation simultaneously.

WGHF in Connecticut successfully broadcast stereophonically using one main and one sub-channel. The second sub-channel was, at the same time, carrying background music to commercial locations. Fidelity was reported to be excellent with no "crosstalk" between signals. WBAI in New York has announced imminent entry into the field of stereo with multiplex once the adaptors are available.

Upwards of fifty FM stations around the country are now multiplexing primarily for commercial background music to restaurants, stores, etc. As the use of adaptors increases, no doubt many stations will provide stereo broadcasts for the home. The AM-FM type of stereo broadcasting now utilized by some stations is subject to several limitations on the AM side; including fading, static, and limited frequency response. Multiplex is essentially an FM-FM system

with all the attendant advantages.

"Compatibility" has keynoted the development of the stereo disc. This concept prevents equipment from becoming obsolete each time a new system develops. Such is the case with multiplex since it does not interfere with existing programs. However, it is evident that a person listening to a stereo program without a multiplex adaptor would receive only one side of the orchestra. To alleviate this "incompatibility" the Crosby "Sum and Difference" technique has evolved.

In this system the *sum* of the two studio microphone voltages feeds the main channel and is received on a conventional FM tuner. The *difference* voltage is transmitted over the sub-channel. It is then a function of the multiplex receiving adaptor to use the difference voltage to split up the signals and feed them to separate amplifiers. KGLA-FM in Los Angeles has recently completed a series of successful tests using the Crosby system.

Several other uses of multiplex are looming into view. They are worth mentioning here since they offer a means of insuring the economic well-being of the 530 FM stations now on the air. With the competition of TV for the listener's time, FM is trudging an arduous road to financial stability. Commercial multiplex applications include business information services via facsimile and radio call systems for vehicles. In the developmental stage for multiplex is "slow-scan" television, a series of still pictures transmitted in a far narrower band than required for pictures in motion. Chain stores could use this device for promotion and it would allow banks to compare signatures between two remote points. Indirectly these uses could insure our continued enjoyment of FM broadcasting.

Stereo sound on multiplex will be a sensible addition to a hi-fi system. If the equipment can already reproduce stereo tape or disc, the adaptor is the only additional item necessary. If not, a simple amplifier and speaker can be added to use with the sub-channel. Not only will multiplex bring excellent stereo listening, but will provide an invaluable means of auditioning discs and tape over the air before purchases are made



*Prepare now*  
**IN SPARE TIME**  
**AT HOME**  
*for great opportunity*  
*field of...*

# TELEVISION

**The future is YOURS in**  
**TELEVISION—RADIO—COLOR-TV!**

A fabulous field—good pay—fascinating work—a prosperous future! Good jobs or independence in your own business!

**Modern Training by Coyne**  
**RIGHT IN YOUR OWN HOME**

Coyne brings you the first truly lower cost, MODERN—QUALITY Television Home Training; training designed to meet Coyne standards. Not an old RADIO Course with Television "tacked on." Here is MODERN TELEVISION TRAINING including RADIO, UHF and COLOR TV. No previous experience needed. Personal guidance by Coyne Staff.

**The Institution Behind this Training**

Famous for over a half a Century, COYNE occupies this entire building. Coyne's modern, resident training of men for Television, Radio, Electronics and Electricity has produced thousands of successful graduates.



B. W. COOKE, Jr., President



FOUNDED 1899

**COYNE**  
**ELECTRICAL SCHOOL**

**A TECHNICAL TRADE INSTITUTE CHARTERED**  
**NOT FOR PROFIT**

**500 S. Paulina Street, Chicago 12, Dept. 88-H8**

**MAIL COUPON NOW FOR-DETAILS FREE**

**LEARN TO**

**EARN IN SPARE TIME AT HOME**

COYNE offers a most practical, Home Television Training. Easy to follow step-by-step instructions, fully illustrated with 2150 photos and diagrams. Practical Job Guides to show you how to do actual servicing jobs—make money early in course. Keep your present job while training.

*Low Cost—Easy Terms*

We save you money because we don't send you—AND CHARGE FOR—a long list of parts or "put together kits," which you may not want or do not need. With Coyne Television Home Training you pay only for your training, no costly extras.

Let us show you that this is not only the newest, most up-to-the-minute Training in Television—but also it costs you much less than other leading home training courses. Send coupon today for details including Easy Payment Plan.

**SEND COUPON FOR**  
**FREE BOOK**

and full details, including Easy Payment Plan. No obligation, no salesman will call.



**COYNE Television**  
**Home Training Division**  
 500 S. Paulina St., Chicago 12, Ill.  
 Dept. 88-H8

Send Free Book and details on Television Home Training. This does not obligate me in any way.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

(It is understood no salesman will call.)

*It's easy to learn all about*  
**DIGITAL COMPUTERS • TELEVISION**  
**ELECTRICITY • ELECTRONICS**  
**THE RIDER 'PICTURE-BOOK' WAY**

Rider 'picture-book' training courses are your easiest, quickest, most economical way to learn all about electronics and launch a successful career in this growing field. Fundamentals are presented idea-by-idea permitting you to build your knowledge step-by-step. Specially conceived, easily understood illustrations support the text, and make each subject crystal-clear. These four Rider 'picture-book' courses are your springboard to a career in electronics.

**BASICS OF DIGITAL COMPUTERS** by John S. Murphy  
*Catapults you into exciting digital computer field*

If you have a knowledge of the fundamentals of electronics, you can master the basics of digital computers and understand the details of any specific digital computer with this new 3 volume 'picture-book' course. Written by an expert in the computer field, text matter has been tested and proven in the training of computer field engineers and technicians. More than 350 illustrations support the text. Volume 1 covers the background of computers; Volume 2: the components and units; Volume 3: operation of the computer.

#196, soft covers, 3 vol. set, 416 pp., \$6.95  
 #196-H, cloth bound, 3 vols. in one binding, \$7.95

**BASIC TELEVISION** by Dr. Alexander Schure  
*Newcomer or old 'pro' you can learn all about television*

You can learn the complete basic principles and practices of black and white television easily, quickly and understandably with this new 5-volume 'picture-book' course. Leading editors and teachers have declared this to be the clearest presentation of the basic fundamentals, operation and circuitry of black and white television ever published. Everything from the transmitter to the picture on the receiver screen is explained with utmost clarity. More than 700 understandable, exciting illustrations.

#198, Soft cover, 5 vol. set, \$10.00  
 #198-H, cloth bound, 5 vols. in one binding, \$11.50

**BASIC ELECTRICITY — BASIC ELECTRONICS**  
 by Van Valkenburgh, Nooger, Neville, Inc.

This is the fabulous "Common Core" training program so successfully used by the U.S. Navy to teach over 25,000 Navy students the basics of electricity and electronics. Now this material is available for civilian training. Over 1700 big "show-how" drawings make every subject crystal clear—regardless of previous education. You will be astounded at how easy it is to learn from these courses.

**BASIC ELECTRICITY**—Vols. 1 and 2 cover DC components and circuits, vols. 3 and 4 cover AC components and circuits; vol. 5 covers AC and DC motors and machinery.

#169, soft cover, 5 vol. set, \$10.00  
 #169-H, cloth bound, 5 vols. in one binding, \$11.50

**BASIC ELECTRONICS**—Vol. 1, diodes and power supplies; vols. 2 and 3, amplifiers and oscillators, vols. 4 and 5, transmitters and receivers.

#170, soft cover, 5 vol. set, \$10.00  
 #170-H, cloth bound, 5 vols. in one binding, \$11.50

Send today for these exciting new training courses—you risk nothing! Examine them in your own home for ten full days. If, at the end of that time you are not completely satisfied, simply return the books for full refund of purchase price. Order these books today. If your dealer doesn't have these books, order direct.

**10 day unconditional money back guarantee**



**John F. Rider Publisher, Inc., EI-11**  
**116 West 14 St., New York 11, N. Y.**

I enclose \$..... Please send  
 (check catalog numbers of courses desired)  
 196..... 196-H..... 198..... 198-H..... 169.....  
 169-H..... 170..... 170-H.....

Name .....

Address .....

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

**Stereo Preamplifier Kit**

*Continued from page 51*

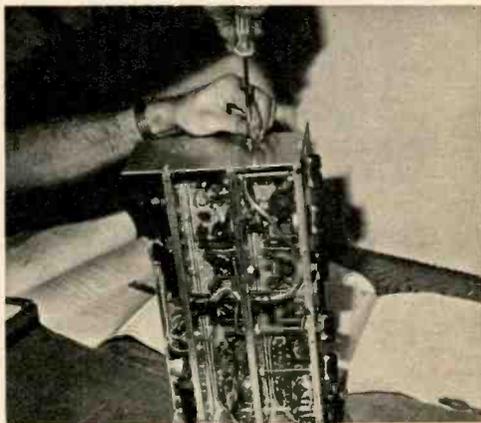
preamps. Separate hum balance controls are provided for each channel to insure optimum adjustment. Wiring time for the last section and final mechanical assembly of the three chassis ate up another 5 hours.

Each channel of loudness and level controls can be adjusted individually and then locked together by simply pushing in the inner knob.

The other necessary stereo features such as independent treble and bass controls for each channel and mono-stereo switching are included. The two independent input selector switches and a 4-position channel switch will enable any program source to be fed to either amplifier without the necessity of unplugging leads. The input sensitivity of the channels is very high (2 mv. input provides 25 volts out) and any low output monaural or stereo phono cartridge will drive the accompanying power amplifier (s) to full output.

The specifications of the Heath pre-amp are very good and our tests revealed no significant deviations from them. We would not suggest the SP-2 as a first project. It would be far wiser to build one of the power amplifiers and judge from your experience with it whether you want to tackle the SP-2.

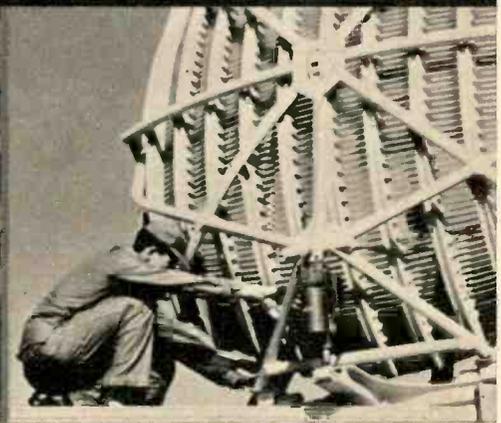
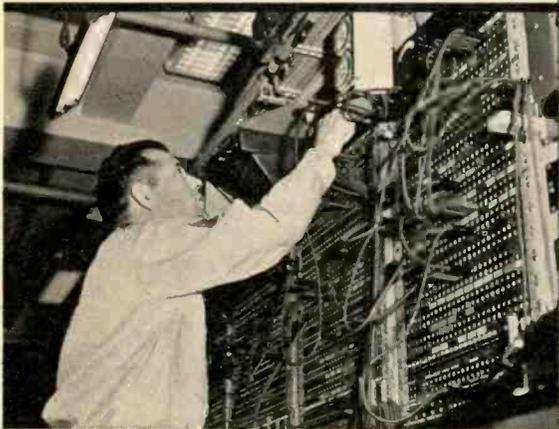
For our efforts we ended up with a cut finger and a first class complete stereo preamplifier control unit. —



**The completed kit is firmly bolted together.**

**FORMER SERVICEMEN**

**IF YOU  
HAVE A  
TECHNICAL  
SPECIALTY**



**There's an important job and a guaranteed future for you...in the U.S. Air Force**

• There is no more important job than being an Air Force specialist. For  
• he is not only a fine technician, but also a man of responsibility. On his  
• shoulders rests the vital assignment of maintaining and operating the  
• increasingly complex equipment that makes his Service the world's  
• most efficient striking force. But with this responsibility, he also knows  
• great pride...and a future that's *guaranteed*. As a technician, you, too,  
• can have this same satisfaction and assurance—in the U.S. Air Force.  
• See your Air Force Recruiter, or mail the coupon.

• **The Future Belongs to the Airman**



**Today and  
Tomorrow,  
you're better off  
in the  
U. S. AIR FORCE**

**PASTE ON POSTCARD AND MAIL TO:**

Prior Service Information, Dept. E1-53  
Box 7608, Washington 4, D.C.

Please send me more information on the Air Force Prior Service Program.

Name \_\_\_\_\_

Address \_\_\_\_\_ Age \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# TUBES "TAB" TESTED GUARANTEED

New, Surplus & Used Our 14th Year in Business

0A2	.80	9L7	1.00	6BQ6	2.00	7Q7	.79
0B2	.72	2C22	20/\$1	6BQ7	.99	12AT6	.59
0B3	.82	7193	20/\$1	6C4	.49	12AT7	.79
0C3	.82	1N34A	2/\$1	6CB6	.69	12AU7	.69
0D3	.80	CK722	.99	6CD6	1.49	12AV6	.59
0Z4	.50	3U4	.59	6H6	.59	12A6	.59
1AK2	.98	6V4	.89	6J5	.59	12AX4	.79
1B3	.78	5Y3	.59	6J6	.59	12AX7	.79
1L4	.82	8A84	.59	6K8	.59	12BH7	.69
1R4	.88	6A7	.79	6K7	.79	12BY7	.89
1R5	.78	6A77	.97	6L6	1.19	12SA7	.69
1S4	.78	6AM4	.89	6S4	.59	12SK7	.69
1S5	.68	6AM6	.95	6S47	.79	12SN7	.69
1T4	.69	6AU6	.59	6SH7	.69	12T6	.69
1U5	.59	6AL5	.59	6S17	.69	14A7	.69
1X2	.66	6AQ5	.66	6SK7	.69	18B6	1.69
2D21	.68	6AS5	.75	6SL7	.69	28B6	1.29
2X2	2/\$1	6AT6	.49	6SN7	2/\$1	25Z6	.79
2V3	2/\$1	6AU4	.89	6SQ7	.59	35C5	.59
3A5	.69	6AUG	.59	6T4	1.19	35L6	.59
954	10/\$1	6AX4	.79	6T8	.98	35W4	.59
955	3/\$1	6BA6	.59	6U8	.89	35Z5	.55
957	4/\$1	6BC5	.59	6V6	.59	50A5	.69
1619	5/\$1	6BE5	.59	6W6	.79	50B5	.69
1625	3/\$1	6BF5	.79	6X4	.39	50C5	.69
1626	5/\$1	6BG6	1.49	7A8	.79	50L6	.69
1629	4/\$1	6BK5	.89	7C5	.79	75	1.00
807	1.15	6BL7	.99	7F7	.79	76	5/\$1
808	.89	6BN6	.89	7F8	.79	77	5/\$1
5B1	\$3.98			7N7	.79	10Y	3/\$1

## "TAB" —for—KITS! —from—"TAB"

Each "TAB" Kit Contains the Finest Selection of Top Quality Components in the Most Popular Values and Sizes

- |                              |                                |
|------------------------------|--------------------------------|
| Kit 35 Precision Resistors   | Kit 40 Insulators              |
| Kit 5 Submin tubes           | Kit 35 Power Resistors         |
| Kit 75 Resist ins 1/2, 1, 2W | Kit 75 Mica Condensers         |
| Kit 150 Carbon Resistors     | Kit 5 Crystal Diodes           |
| Kit 5 Glass Strip Mica       | Kit 250 ft. Hook Up Wire Astd. |
| Kit 12 Electrolytic Cond's   | Kit 100 Fuses, asstd.          |
| Kit 15 Volume Controls       | Kit 100 Ceramic Condensers     |
| Kit 65 Tubular Condensers    | Kit 50 Coil Forms              |
| Kit 36 Tube Sockets          | Kit 8 Xtal OSC blanks          |
| Kit 500 Lugs & Eyelets       | Kit 4/ FT243 xtal holders      |
| Kit 10 Bathtub Oil Cond's    | Kit 65 Inductors & Coils       |
| Kit 5 lbs. Suprply Package   | Kit 5 Microswitches            |
| Kit 10 Transmit Mica Cond's  | Kit 10 Wheat Lamps             |
| Kit 3 Phone patch xfms       | Kit 3 Transistor Xfms          |

Order Ten Kits Each one of the Above **99c**  
We Ship Eleven!! KITS ONLY

SEND 25¢ TODAY FOR NEW BONUS CATALOG

"TAB" FINEST HI-FI RECORDING TAPE each  
7" Reel—1200 Ft. Per Reel **\$1.45** Lets  
Sold on Money Back Guarantee

Highest quality HI-FI Precision Coated. Add 15¢ each P.P.  
"ERIN" MFR & PROCESS, quality controlled, constant output  
Noise FREE Plastic Tape. Freq. 7 1/2 IPS, 40-15KC Oxide-Wind-  
In.

New 1st Quality "MYLAR" 2400 FT. Reel  
"ERIN" GLOSS & PROCESS RECORDING TAPE \$4.49 @ 3/512

### NEW "TABTRON" SELENIUM RECTIFIERS

Full Wave Bridge. Dated—One Year Guarantee  
18VAC/14VDC—1 Amp. \$1.40; 2A \$2.00; 3A \$2.90; 4A \$3.50;  
6A \$3.95; 10A \$5.85; 12A \$7.20; 36VAC/28VDC—1 Amp.  
\$2.80; 2A \$3.60; 3A \$4.10; 4A \$6.40; 6A \$7.70; 10A \$11.35;  
12A \$14.25.

Infrared Receiver Assembly USN/US-AM-R1400, Direct Viewing  
Telescope Unit. Charges invisible infrared energy into a visible  
image on an inbuilt screen includes infrared filter & radioactive  
charging system. Navy cost \$216 includes inst., case & data.  
Special \$21.

### NEW TRANSISTORIZED "TABPAK"

D.C. Power Supply!!! Kit or Assembled. Filtered. Small in size!  
Quiet! Light Wgt.! Input 12 to 14VDC. (Low Idle Current.)  
Output 450 & tap @ 250 VDC at up to 150 ma/65 watts.  
Built TR39CB \$35. Kit TR39CK \$35.

### TPSK2—KIT FOR DC POWER FOR TRANSISTORS!!

Transistor! Filtered Power Supply Kit used to power transistor  
circuits, amplifiers, etc. Delivers 12VDC at 2 AMPB filtered less  
than 0.5% ripple or 28VDC at 1A. TPSK2 Kit \$18. TPS2W  
assembled & wired \$24. Add 60¢ Postage!

### NEW RADIO & T. V. RECTIFIERS Guarantee

35MA 40¢ @ .6 for \$2; 65MA 45¢ @ .5 for \$2; 75MA 49¢ @ .5  
for \$2; 100MA 59¢ @ .6 for \$3; 150MA 70¢ @ .8 for \$5;  
250MA 79¢ @ .6 for \$4; 300MA 88¢ @ .5 for \$4; 400MA \$1.10 @ .8  
for \$7; 400MA \$1.10 @ .5 for \$5; 500MA \$1.35 @ .4  
for \$5. Order \$10. Postpaid 48 States!  
NEW SILICON 500MA/100°C/280VAC/400 P.I.V. Hmt/Sealed  
\$1.50 @ .5/\$6.50.

INFRARED SNOOPERSCOPE See in Dark Tube  
Selected G.T.D. Image Converter Tube, Hi-sensitivity  
simplified design 2" dia. Willemite screen—Hi-Res-  
olution. Tube & Data \$5 @ .2 for \$9

SNOOPERSCOPE POWER SUPPLY KIT  
Model PS2001K—4500 VDC/35MA Supply using dual  
double ekt. Less chassis & grill \$13.95

BATTERY CHARGER KIT 2 to 4 Amps. CHARGES 2-4-6 &  
12 VOLT BATTERIES. KIT BCK-1 \$11; Built BCW-1 \$12.75

"TAB" TERMS: Money Back Gtd. \$2 min.  
order F.O.B. N.Y.C. Add shpg. charges  
or for C.O.D. 25% Dep. Prices shown  
are subject to change.

111-XF Liberty St., N. Y. 6, N. Y., Rector 2-6245

## Stereo Records: An Appraisal

Continued from page 37

M-49) are hung directly above each other, not spread out in front of the orchestra. But the microphones are directional in their sensitivity patterns and "look" at the orchestra at different angles, along diagonal lines. Since both mikes are on the same vertical axis, as if they were both hung from the ceiling on the same string, this setup is known as "coaxial miking."

Facing diagonally across the orchestra into the two far corners, the coaxial microphones achieve a 50-50 compromise between depth and directionality.

There is no inevitable conflict between A-B stereo and coaxial stereo. Some engineers believe that A-B stereo is the ideal recording method for small jazz groups where it is desirable for each player to be pinpointed for his solo. In these small groups musicians usually are lined up next to each other in a lateral spread which does not exceed the length of the average living room wall. In other words, A-B stereo is fine where the original dimensions of the group are about the same as the speaker spacing in the home. On the other hand, coaxial stereo, or the A-B technique with a fill mike, may be preferable for symphonic recordings where depth is more significant than spread and where the original dimensions of the concert stage have to be reduced for home playback.

Even the touchiest critics of the new stereo discs agree that the "third dimension" in stereophonic sound gives the music an entirely different "feel" from what is heard on conventional phonographs.

As new physical dimensions of sound are added by stereo reproduction, our emotional response to the music also seems somehow enlarged.

All this is a part of the stereophonic "payoff." But it presupposes stereo at its best—true in spatial representation, free from distortion, and without compromise on any of the customary hi-fi standards.

One thing is certain even now: hi-fi is a continuing adventure and a new phase of this adventure has just begun with the advent of the stereo disc.

easy to build  
do it yourself



**COMBINES BEAUTY, STYLE AND QUALITY**  
**"bookshelf" 12 watt amplifier kit**

Build this high quality amplifier in a few hours of your spare time and enjoy true high fidelity performance for years to come. Provides full range frequency response from 20 to 20,000 CPS within  $\pm 1$  db, and has less than 1% harmonic distortion at full 12 watt output over the entire range (20—20,000 CPS). Miniature tubes are used throughout the advanced circuitry, including EL84 output tubes in a push-pull tapped-screen output circuit. The special design output transformer has taps for 4, 8 and 16 ohm speakers. The model EA-2 has its own built-in preamplifier with provision for three separate inputs, mag phono, crystal phono and tuner. Features RIAA equalization, separate bass and treble tone controls, and a special hum-balance control. Complete with instructions for easy assembly.



MODEL EA-2  
**\$27<sup>95</sup>**



**Whatever your hobby there is a HEATHKIT for you!**



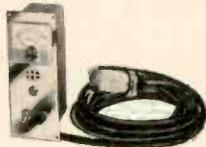
**TEST**  
Model V-7A  
VTVM, \$24.50



**HI-FI**  
Model SS-2 "Basic Range"  
Speaker System, \$39.95.



**HAM**  
Model DX-20  
CW Transmitter, \$35.95



**MARINE**  
Model FD-1 Fuel  
Vapor Detector, \$35.95

**Send for FREE catalog**

listing nearly  
100 high quality  
dependable  
Heathkits for you  
to choose from.



**HEATH**

pioneer in  
"do-it-yourself"  
electronics

**COMPANY BENTON HARBOR 39, MICH.**

**D** a subsidiary of Daystrom, Inc.

I'm interested in the following type of equipment:  
 TEST,  HI-FI,  HAM GEAR,  MARINE.

name \_\_\_\_\_  
address \_\_\_\_\_  
city & state \_\_\_\_\_

**WRITE FOR  
YOUR FREE COPY  
OF THE NEW  
H. H. SCOTT STEREO  
HI FI GUIDE . . .**



**H. H. Scott Inc.  
111 Powdermill Road  
Maynard, Mass.  
Dept. EI-11**

Please rush me a free copy of your new Hi Fi Guide featuring the full line of new Stereo Components.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

**IF IT'S EXTRA MONEY  
YOU NEED—**

**Start A Spare Time Business  
With a 3¢ Postal Card As  
Your Only Investment**

Hundreds of men and women of all ages are earning extra money as part time subscription sales representatives for **ELECTRONICS ILLUSTRATED** and other leading publications. You need no experience to earn steady profits and you keep a cash commission on every sale. You operate in your own community by phone or personal calls. You will be authorized to sell new and renewal subscriptions along with special offers made by the publishers. To get started immediately—send us your name (on a 3¢ postal card) requesting free supplies and selling materials. You're under no obligation and you'll be your own boss.

**Write to: Electronics Illustrated Subscription Dept. DE  
Fawcett Bldg., Greenwich, Conn.**

**Stereo Survey**

*Continued from page 34*

lied and Lafayette have all put forth attractively priced units.

Stereo adaptors have been offered to the monaural hi-fi owner as a kind of link between what he now has and a second monaural amplifier he might buy. Some adaptors—such as the Fairchild and the Dynakit—literally make a stereo unit out of two monaural units, physically as well as electrically.

The stereo adaptors do add some of the extras found on complete stereo control panels but they are not universal devices. Most are designed for use with specific models of monaural amplifiers. Thus, the Dynakit stereo control, \$12.95, is a handy gadget, if you're using two Dynakit monaural preamps. The \$13.50 Bogen STA-1 performs a similar function, but only with certain Bogen amplifiers.

The Scott model 135 "Stereo-Daptor" costs more—about \$25.00—but has wider use. In addition to most Scott amplifiers, it may be connected into systems using separate monaural preamps and power amplifiers, or using two identical all-in-one amplifiers that have tape monitoring facilities.

Units such as these are "passive" in that they contain no tubes. A new "Stereo Remote Control" by Lafayette Radio, available in kit form for \$29.50, uses two tubes and provides for a third channel, which can be adjusted to eliminate the sometimes annoying "ping-pong" effect between two stereo speakers. What's more, it may be used remotely up to 50 feet from the amplifiers under its control.

**Speakers for Stereo**

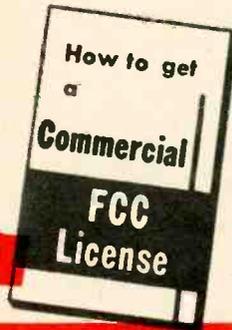
If speaker systems for monaural hi-fi were the subject of much discussion, the disagreement is compounded in stereo. The all-out approach, in which your present speaker system simply is duplicated, is generally the safest, but it can be the costliest. And in some cases, duplication is not a good idea. Two corner horn systems, for example, have been found not too satisfactory on stereo. As a means of avoiding costly, and sometimes incorrect, duplication,



Accredited by the National Home Study Council

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

# How To Get an

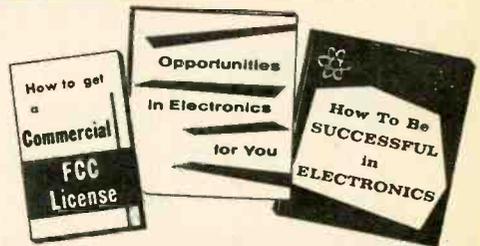


Get Your FCC License Quickly

We Guarantee to train you until you receive Your FCC License

## Get all 3 FREE

We guarantee to train you until you receive Your FCC license



If you fail to pass your commercial License exam after completing our course, we guarantee to continue your training, without additional cost of any kind, until you successfully obtain your Commercial license.

**Cleveland Institute training results in job offers like these:**

### Radio Operator

Capital Airlines (Ohio) is looking for a radio operator. A touch typing speed of 40 wpm is necessary. Must have at least a restricted operator's permit, but a radio-telephone 2nd or 1st class license is desirable.

### 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 E1-2 Cleveland 3, Ohio

### Cleveland Institute of Radio Electronics

Desk E1-2 4900 Euclid Ave., 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:

- |   |   |
|---|---|
| <input type="checkbox"/> Military           | <input type="checkbox"/> Broadcasting       |
| <input type="checkbox"/> Radio-TV Servicing | <input type="checkbox"/> Home Experimenting |
| <input type="checkbox"/> Manufacturing      | <input type="checkbox"/> Telephone Company  |
| <input type="checkbox"/> Amateur Radio      | <input type="checkbox"/> Other _____        |

In what kind of work are you now engaged?

In what branch of Electronics are you interested?

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

E1-2

**Every essential term in physics  
and electronics-12,000 of them  
—now in one giant dictionary!**

Send today for a free  
examination copy of this  
1000-page reference work

THE INTERNATIONAL  
DICTIONARY OF PHYSICS AND  
ELECTRONICS explains more than  
12,000 laws, relationships, equa-  
tions, basic principles, instruments,  
apparatus and techniques. Every-  
thing from alphasoft, band and  
cybotaxls to Wronksian, ylem and  
Zwitteron.

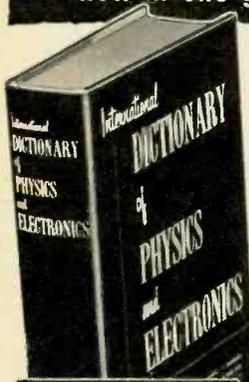
**Save time. Avoid costly  
errors!**

Unique system of cross refer-  
encing helps you locate the in-  
formation you want instantly. Bold-face "word signals" refer  
you to related articles.

You'll turn to this giant 1000-  
page volume dozens of times a  
day—to recheck your work, to  
clarify technical articles or engi-  
neering data, to increase your  
own knowledge and understanding.  
This helpful volume can pay for  
itself in just one avoided error!

**Send No Money**

Just tear out this ad, and mail  
today with your name and ad-  
dress. Examine book free. If you  
don't find it to be one of the  
most valuable books you have  
ever owned, simply return it and  
owe nothing. Otherwise send \$7.50  
plus small shipping cost in 10  
days and \$5 a month for 3 months.  
D. Van Nostrand Co., Inc. Dept.  
1511, 120 Alexander St., Prince-  
ton, N. J. (Established 1848)



**16 Books in One**

- Electronics
- Liquids
- Meteorology
- Solids
- Mechanics
- Acoustics
- Gases
- Optics
- Units and Dimensions
- General Principles
- Thermodynamics
- Nuclear Physics
- Mathematical Physics
- Quantum Mechanics
- Electricity
- Relativity

**See the Stars, Moon, Planets Close Up!**

**3" ASTRONOMICAL  
REFLECTING TELESCOPE**

**60 to 160 Power—An Unusual Buy!**

FAMOUS MT. PALOMAR TYPE!

Assembled—ready to use! You'll see the  
Rings of Saturn, the fascinating planet  
Mars, huge craters on the Moon, Star

Clusters, Moons of Jupiter in detail. Galaxiel Equatorial mount  
with lock on both axes. Aluminized with overcoated 3" diameter  
highspeed f/10 mirror. Telescope comes equipped with a 60X eyepiece  
and a mounted Barlow Lens, giving you 60 to 160 power. An Optical  
Finder Telescope, always so essential, is also included. Sturdy hard-  
wood, portable tripod.

Free with scope: Valuable STAR CHART  
and 272 page "Astronomy Book."

Stock No. 85,050-EB .....\$29.95 Postpaid  
Send check or M.O.—money back guarantee.

**NEW! STATIC ELECTRICITY GENERATOR**

See a thrilling spark display as you set off a miniature  
bolt of lightning. Absolutely safe and harmless. Stands  
14" high. Turn the handle and two 9" plastic discs rotate  
in opposite directions. Metal collector brushes pick up  
the static electricity, store it in the Leyden jar type  
condenser until discharged by the jumping spark. Count-  
less tricks and experiments. 24 page instruction booklet  
included.

Stock No. 70,070-EB .....\$10.95 Postpaid  
Send Check or M.O. Money-Back Guarantee.

**SPECIAL! SPECIAL!**

**INFRARED 1P25A IMAGE TUBE**

Stock No. 70,127-EB .....\$9.95 pstpd.  
Send Check or M.O. Money-Back Guarantee.

**COLOR TV TUBESCOPE**

Saves time, effort in alignment of color dot pattern.  
Stock No. 50,139-EB .....\$24.50 pstpd.  
Send Check or M.O. Money-Back Guarantee.

**WRITE FOR FREE CATALOG "EB"!**

Complete Line of Astronomical Telescope Parts and Assembled Tele-  
scopes, Satellitescopes. Also huge selection of lenses, prisms, war  
surplus optical instruments, parts and accessories. Telescopes, micro-  
scopes, binoculars, etc. Request Catalog "EB!"

ORDER BY STOCK NUMBER. SEND CHECK OR MONEY ORDER. SATISFACTION GUARANTEED!  
**EDMUND SCIENTIFIC CO., BARRINGTON, N. J.**

one manufacturer is offering stereo add-  
on speaker systems in which the driver  
elements used are similar to those in  
the same company's larger systems. The  
add-on unit is smaller, lower-priced,  
and can be spotted along the wall. Ob-  
viously, in such an approach something  
has to give; in the case of the Electro-  
Voice "Stereon" the thing that gave was  
the bass end. These units are designed  
specifically to reproduce sound above  
200 or 300 cps, on the theory that bass  
below these frequencies is not direc-  
tional. Consequently, goes the explan-  
ation, all the bass—from both channels  
—can be fed to one speaker (the origi-  
nal full range speaker) and stereo will  
still be possible.

Whether such an arrangement will  
prove ultimately satisfying is something  
each listener should decide for himself.  
Certainly it represents a space-saving  
and money-saving compromise. On the  
other hand, it seems that the stereo add-  
on speakers are best used with mating  
full-range units made by the same com-  
pany. A Stereon, matched with a full  
range, low-efficiency speaker system,  
did provide directionality, if not as  
much depth as that obtained from two  
full-range speaker systems. Admittedly,  
this is a subjective judgment and open  
to debate. Less open to debate is the  
loss in signal strength that was apparent  
in the full-range speaker when hooked  
up, as per instructions, to the Stereon  
and its accompanying filter network. A  
good amplifier, with plenty of reserve  
power, should be able to overcome this  
loss.

As things stand now, two matched  
non-corner speaker systems provide the  
best stereo results, with the quality of  
the overall sound depending largely on  
the quality of the individual speakers.  
Any two separate speakers will furnish  
stereo; whether that stereo is truly hi-fi  
and natural-sounding is another matter.

Matching speaker systems can be  
chosen from the bookshelf type units,  
using small resonators or the acoustic  
suspension principle, through the small,  
floor-standing models, to big consoles.  
After a point, in speaker selection, ob-  
jective discussion leaves off and per-  
sonal taste rules. What may sound  
thrillingly heady to one man may sound  
head-achy to another.

# BIG NEWS!



## A RONDINE TURNTABLE IN KIT FORM

only \$39<sup>95</sup>

Also see the all-new, improved  
factory-assembled Rondines at your dealer!

### REK-O-KUT

HIGH FIDELITY TURNTABLES • TURNTABLE ARMS

Engineered for the Studio • Designed for the Home



November, 1958

A revolutionary breakthrough in the industry! A stereo turntable kit with traditionally superior Rek-O-Kut performance! It's engineered to give Rek-O-Kut's famous silent operation, eliminating all traces of record changer rumble in stereo disc playback.

The kit contains the same exclusive, precision-machined turntable and bearing-well used on all Rondine models. Assembles easily and quickly to the deck plate. The motor installs on a specially-made mounting plate.

A minimum number of working parts go together accurately, in 30 minutes or less... reflecting the simplicity and trouble-free operation of Rek-O-Kut design. This new Rondine offers you superb quality...unmatched performance, the kind you need for better monaural reproduction...the kind you must have for stereo!

#### ADVANCED FEATURES OF NEW RONDINE K-33 STEREO TURNTABLE!

- Single-speed (33 $\frac{1}{3}$ ) Crown-Spindle Belt Drive. Custom-made endless-woven fabric belt with thickness held to  $\pm .001$ . Adjustment for belt tension.
- Assembly time: about 30 minutes with simple tools.
- Noise level: 47db.
- Motor: 4-pole induction, designed and built to Rek-O-Kut specifications.
- Built-in strobe disc: for checking speed.
- Turntable: Heavy Cast Aluminum, lathe-turned. Tapered for easy disc handling.

#### PERFECT TURNTABLE MATE...AUDAX TONEARM the only stereo tonearm in kit form!



Assembles in just 15 minutes...no mechanical skill needed! A professional tonearm precision-engineered to highest broadcast standards. You save over 50% simply because you assemble it yourself. Ingeniously simple for foolproof operation, dependable performance. Takes all stereo cartridges. 12" arm—KT-12—\$15.50. 16" arm—KT-16—\$18.50.

REK-O-Kut Co., Inc., Dept. E111, 38-19 108th St., Corona 68, N.Y.

Please send me your new 1958 Catalogs.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

RK27

# FREE

GIANT NEW  
1959 B-A

# CATALOG

A COMPLETE BUYING GUIDE FOR EVERYTHING IN

**RADIO TV**

**ELECTRONICS**

**BA 1959**  
ANNUAL CATALOG 591

SINCE 1927

**BURSTEIN-APPLEBEE CO.**

Dept. E1, 1012 McGee St., Kansas City 6, Mo.

Send Free 1959 B-A Catalog No. 591.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

SEND FOR IT TODAY

**180 KING-SIZED PAGES**

**EVERYTHING IN RADIO TV AND ELECTRONICS**

**100'S OF NEW ITEMS LISTED HERE FOR 1st TIME**

**21 PAGES OF BARGAINS NOT IN ANY OTHER CATALOG**

**LEARN**

**RADAR MICROWAVES**

**COMPUTERS**

**TRANSMITTERS**

**CODE • TV • RADIO**

**Phila. Wireless Technical Institute**

1533 Pine St. Philadelphia 2, Penna.

A Non-Profit Corp. Founded in 1908

Write for Free Catalog to Dept. E1 118

## Convert Your Record Player

Continued from page 43

The voltage outputs of the left and the right channel coils of a stereo cartridge may be represented by diagonal lines, the resultants of vertical and lateral (horizontal) components. These coils are so set up that the horizontal component of each is in phase with the other and in the same direction. That means that their electrical polarities are identical. The vertical components, however, are in opposite directions, indicating that their polarities are out of phase. Thus, for example, a sideways movement would produce equal and identical lateral voltage components. But a vertical thrust of the stylus would produce vertical components in each channel of equal voltage, but opposite in polarity.

Therefore, if we were to tie both outputs together with a strapping switch the lateral components of both channel outputs would add, but the vertical components would cancel. Since the vertical rumble motion is the villain in stereo, the object of our test is to compare it to the lateral output to see if it is appreciably disturbing.

To make the test, connect the strapping switch as shown in the diagram, making the soldering connections at the record player end of the audio cables.

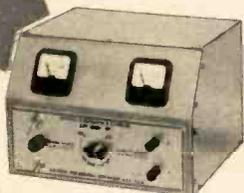
Now, with the volume control of your amplifier turned up to a comfortable listening level, play the "silent groove" test record and listen to the rumble output. Next, close the strapping switch so that you hear the lateral components only. If the output with the switch closed is noticeably less, the vertical rumble is considerable. On the other hand, if the difference is small your record changer will do the job for stereo.



# Shipped on... approval

**SEND NO MONEY —  
NO C.O.D.**

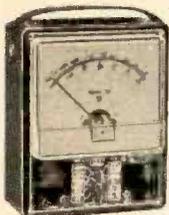
Try them for 10 days at no risk!  
Examine first, and then only if completely  
satisfied, pay lowest prices for  
highest quality units, in easy  
monthly installments.



### MODEL 905 BATTERY ELIMINATOR and CHARGER

Continuously variable voltage output. Automatic overload relay self-resetting. Either 6 or 12 volt operation. Heavy duty rectifier. Continuous operation 6V. at 10A. or 12V. at 6A. Intermittent operation 6V. at 20A. or 12V. at 12A.

Model 905 (Wired) ..... \$37.50



### VOLOMETER, Model 104.

This 20,000 Ohms per volt instrument is the lowest priced, domestic made, unit of its kind in today's market. Uses large 4½" D'Arsonval, 50 mi-



### MODEL 204 P TUBE-BATTERY-OHM CAPACITY TESTER

An Emission Tube Tester, with a completely flexible switching arrangement. Test all tubes. Checks batteries under rated load on "reject-good" scale. Uses 25W line voltage control. Checks condenser leakage to 1 meg. Checks resistance up to 4 megs. Checks capacity from .01 to 1 mfd.

Model 204P (illustrated) ..... \$55.90  
Cathode Ray Tube Adaptor available ..... \$ 4.50

croampere meter, accurate to 2%. Housed in polished, high impact, bakelite case . . . uses a durable, etched aluminum panel. 3 AC Current Ranges. Checks resistance accurately in 3 ranges to 20 megohms. 5 DC and AC Ranges to 3000 volts. 5 DB Ranges. Model 104 (wired) \$26.95 Net

**MAIL THIS  
COUPON  
TODAY! NO  
OBLIGATION  
TO BUY— YOU  
MUST BE  
SATISFIED!**

## TESTMASTER, INC.

Dept.  El 11-8

192 Mercer Street, New York 12, N. Y.

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

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

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

MODEL 905  
Total Price \$37.50  
\$11.50 within 10 days.  
Balance \$6.50 for 4 mos.

MODEL 204 P  
Total Price \$55.90  
\$15.90 within 10 days.  
Balance \$8.00 for 5 mos.

MODEL 104  
Total Price \$26.95  
\$6.95 within 10 days.  
Balance \$5.00 for 4 mos.

# SHOOT TV TROUBLE FAST

## With H. G. Cisin's Copyrighted RAPID "TV TROUBLE SHOOTING METHOD"

Without experience or knowledge, this guaranteed new method of servicing TV sets enables you to **DIAGNOSE** TV troubles as rapidly as an expert. **NO THEORY—NO MATH**—you can locate all faults in record-breaking time regardless of make or model. "TV TROUBLE SHOOTING METHOD" is the most valuable aid to TV servicing ever written. Be a TV Trouble Diagnostician. Increase your present earnings. Open your own Profitable Business or get a high-paying skilled job.

### It's all in this book . . . Nothing more to Pay—Nothing else to Buy

Alphabetically listed are 85 picture troubles, over 58 raster and 17 sound troubles. By this unique copyrighted method you know **EXACTLY WHERE** the trouble is; plus step-by-step instructions, including 69 RAPID CHECKS, help to find faulty part.

**13 IMPORTANT PRELIMINARY CHECKS NEED NO INSTRUMENTS!** Of the 69 Rapid Checks, **OVER 65 ALSO REQUIRE NO INSTRUMENTS!** Rapid checks include emergency checks for distorted pictures, defective tubes including PIX tube, plus 57 others. **ALL EXPLAINED IN SIMPLE LANGUAGE. PERFORMED WITHOUT INSTRUMENTS. MANY CHECKS USE THE PICTURE TUBE AS A GUIDE.**

H. G. Cisin, the author, is the inventor of the AC/DC midset radio. He licenses RCA, AT&T, etc. He has also trained thousands of technicians now owning their own prosperous TV service organizations or holding highly paid TV positions. His years of experience are embodied in this remarkable new book.

Guaranteed Money Back in 5 Days if Not Satisfied!

**ABSOLUTELY FREE** with each order: Your choice of Cisin's newest books: **BASIC ELECTRICITY—Vol. 1** or **TV-RADIO TUBE SUBSTITUTION GUIDE**. These sell for 50c ea. **ACT NOW—get 2 books postpaid at cost of only one!**

**\$1** Postpaid

### RUSH COUPON NOW!

H. G. CISIN, Consulting Engineer—Dept. E1-3

Amegansett, N. Y.

Enclosed find \$1. Rush Trouble Shooting Method and free book marked above (if not marked Basic Elec. will be sent).

Send all 3 books. Enclosed find \$1.50.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

## LIBERTY MAIL ORDER T. V. PICTURE TUBES

AMERICA'S BEST . . . AMERICA'S LOWEST  
PRICE GUARANTEED FOR ONE (1) FULL YEAR

LICENSED BY . . . RCA . . . DUMONT . . .

10BP4	\$7.50	17AVP4	\$13.50	20HP4	\$15.00	21EP4	\$14.50
12LP4A	8.75	17BP4	10.95	20MP4	14.00	21F/KP4	15.75
14B/CP4	9.50	17CP4	16.50	21AP4	19.95	21MP4	19.95
16AP4	14.95	17GP4	15.50	21AL/		21YP4	15.50
16DP4	13.50	17H/LP4	13.50	ATP4	19.95	21WP4	14.75
16GP4	15.95	17QP4	11.50	21AMP4	18.95	21ZP4	15.00
16K/LP4	10.50	17TP4	16.50	21AU/		24CP4	26.00
16R/WP4	10.50	19AP4	17.75	AVP4	19.95	24DP4	28.00
16T/ZP4	10.50	20CP4	13.50				

FOR ALUMINIZED TUBES ADD \$4.00

Prices are subject to change without notice. Write for price on non listed tubes. All prices F.O.B. Wallingford, Conn. Prices include dud. Send \$5.00 deposit when old tube dud is not returned. Deposit refundable at time of return of dud. Dud must be returned prepaid. We ship anywhere. Domestic, foreign, export.

TERMS: 25% with Order—Balance C.O.D.

## LIBERTY TUBE CO.

DEPT. E1, HALL AVE., COR. CHERRY ST.  
WALLINGFORD, CONN. COLONY 9-8038

## Fix Your TV Set

Continued from page 65

Inspect a diagram showing the locations of the tubes in your set. Such a diagram is often pasted into the cabinet; it is also included in the service data for your set, available from the set manufacturer.

Find the tube in the tube location diagram that has the function you are concerned with. Say your picture shows a loss of width. The chart informs you that a defective horizontal output tube can cause this. Look for the tube designated **HORIZONTAL OUTPUT** in your tube location diagram. Using it as a map, locate the tube you are looking for.

Remove the tube (turning the power off first), replace it with a new one of the same type number and check receiver operation. If the original symptoms have disappeared, leave the new tube permanently in the socket.

Some of the terms used in the chart call for some clarification.

**RASTER** refers to the white light on the screen when there is no picture.

**LOSS OF VERTICAL SYNCH** refers to a condition where picture roll or jumpy movement in the vertical direction occurs from time to time.

**LOSS OF HORIZONTAL SYNCH** refers to the impossibility of synchronizing the picture horizontally.

**HORIZONTAL PULLING** refers to a condition where portions of the picture pull out sideways from time to time.

**HORIZONTAL NON-LINEARITY** is a condition where the picture is distorted in the horizontal direction. Horizontal non-linearity is revealed in the test pattern when the horizontal wedges are not equal in width.

**VERTICAL NON-LINEARITY** is a condition where the picture is distorted in the vertical direction. Vertical non-linearity is evident in the test pattern when the vertical wedges are not equal in length.

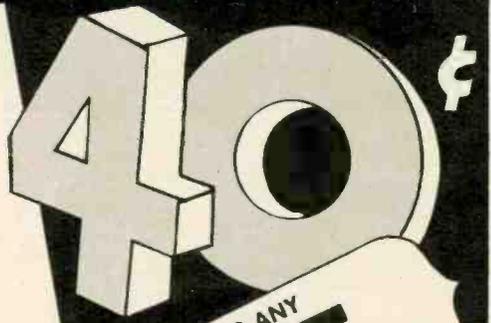
Next month we'll talk about the tuner, a common source of trouble in your TV set. There'll be hints on how to perform channel alignment without removing the chassis from the cabinet, and other measures to keep it in good operating condition.

# VIDEO ELECTRIC COMPANY says: DOWN WITH RISING COSTS OF ELECTRON TUBES OVER ONE MILLION USED TUBES TO SELECT FROM at only

Each and every tube is tested by our supplier under actual operating conditions in Radio, FM, Hi-Fi, Industrial equipment and Television Chassis or Intricate Testing Equipment for Mutual Conductance and Life Test.

BELOW IS A PARTIAL LIST OF OVER THREE HUNDRED POPULAR TYPES! WRITE FOR FREE COMPLETE LIST AND ORDER BLANK!

0A2	5X8	6BH6	6SF5	7Z4	198G6
0E4	5Y3GT	6BJ6	6SF7	12A8	19J6
1A7GT	5Y4G	6BK5	6SJ7	12AQ5	19T8
1B3GT	6A7	6BK7	6SK7	12AT6	24A
1H4G	6A8	6BL7GT	6SL7GT	12AT7	25AV5
1H5GT	6AB4	6BN6	6SN7GT	12AU6	25BQ6
1L4	6AC7	6B06GT	6SQ7	12AV7	25DN6
1L6	6AF4	6BQ7	6S57	12AV6	25L6GT
1N5GT	6AG5	6BZ6	6T4	12AV7	25W4GT
1Q5GT	6AG7	6CZ7	6U8	12AX7	25Z5
1R5	6AH4GT	6C4	6V6	12AX7	25Z6
1S5	6AH6	6C5	6W4GT	12A7	35A5
1T4	6AK5	6C6	6W6GT	12B4	35B8
1U4	6AL7	6CB6	6X4	12BA6	35C5
1U5	6AM8	6CD6G	6X5	12BA7	35L6GT
1V2	6AN8	6CF6	6X8	12B6	35W4
1X2	6AQ5	6CG7	6Y6G	12BF7	35Y4
2A3	6AQ6	6CH6	7A4/XXL	12B7	35Z5GT
2A7A	6AQ7GT	6CM7	7A5	12C5	37
3BC5	6AR5	6CN7	7A6	12CA5	39/44
3BN6	6AS5	6C87	7A7	12K7	42
3BZ6	6AT6	6C87	7A8	12L6	43
3CB6	6AT8	6C87	7B4	12Q7	45
3CF6	6AU4GT	6D6E	7B5	12SA7	50A5
3C66	6AU5GT	6D6E	7B8	12S67	50B5
3LF4	6AU6	6F6	7C4	12S7	50C5
3Q4	6AUB	6H6	7C5	12SK7	50L6GT
3S4	6AV5GT	6J4	7C6	12SN7GT	50X6
3V4	6AW8	6J5	7C7	12SQ7	56
4B27	6AX4GT	6K7	7E6	12V6GT	57
5A58	6AX5GT	6K7	7E7	12W6GT	58
5AT8	6B8	6K8	7F7	12X4	71A
5AV8	6BA6	6L7	7F8	12Z3	75
5AW4	6BC5	6N7	7H7	14A7 12B7	76
5BK7	6BC8	6Q7	7N7	1486	77
5J6	6BD6	6S4	7Q7	1407	78
5T8	6BE6	6S8GT	7X7/XXFM	19	80
5U4G	6BF5	6SA7	7Y4	19AU4GT	84 6Z4
5U8	6BF6	6SC7			117Z3
5V6GT	6BG6G				117Z6



each FOR ANY  
**TUBE**



**\$37.00**  
PER HUNDRED

GUARANTEE: WE GUARANTEE TO REPLACE FREE FOR ONE (1) YEAR ANY TUBE PURCHASED FROM US WHICH FAILS TO FUNCTION EFFICIENTLY UNDER ACTUAL OPERATING CONDITIONS. REFUNDS WILL BE MADE PROMPTLY FOR ANY DEFECTIVE MERCHANDISE. NEW TUBES THE TUBES ADVERTISED HEREIN ARE NOT NECESSARILY NEW TUBES BUT MAY BE ELECTRICALLY PERFECT FACTORY SECONDS OR USED TUBES AND ARE SO MARKED.

### WE HAVE OVER 1000 USED TV SETS

At All Times In Our Huge Warehouse, Buy one or more of these WORKING TVs to sell or use as your own second set! All sets in GOOD WORKING condition! Your Choice—Console or Table Model.

10"	\$23.00	19"	\$58.00
12"	\$28.00	20"	\$64.00
14"	\$33.00	21"	\$72.00
16"	\$40.00		
17"	\$46.00	24"	\$99.00

When ordering TVs, state whether table model or console is desired. Also, preference on make of set. All TVs sent railway express F.O.B. Newark. On any quantity, WIRE or CALL today!

<b>FREE</b>	<b>FREE</b>
RCA "Cheater" Cord Given with Any Tube Order of \$7.00 or More!!	Bonus Antenna Given with Any TV Set Order!!

SEND for our **FREE** complete **TUBE & PARTS LIST** and order blank.

# VIDEO ELECTRIC COMPANY

### FREE POSTAGE

in U.S.A. and Territories on orders over \$5.00. 25c handling charge on orders under \$5.00. 25% deposit required on C.O.D.'s. Please send approximate postage or freight on Canadian and foreign orders. Subject to prior sale.

Phone  
HUMboldt 4-9848

**ELECTRIC COMPANY**  
9-15 6TH ST., HARRISON, N. J.

# Grommes Little Genie HIGH FIDELITY KITS

• LAYER BUILT • COLOR GUIDE

*"So simple . . . it's like magic"*



20PG8-K

Before you build another kit, see this new method of kit assembly. Each kit complete with all parts and instructions.

- 20PG8-K 20 Watt Amplifier with built-in pre-amplifier and all controls. Net \$9.50
- LJ-6K 10 Watt Amplifier (Little Jewel). Has built-in preamplifier and record compensator on phono channel. Net 24.95
- 207A-K Hi-Fi Preamplifier (Self-Powered). Feedback circuit with 10 controls. Net 44.50
- 250-K 60 Watt Basic Hi-Fi Amplifier. For use with a preamplifier (such as 207A-K). Net 70.50

Grommes—Div. of Precision Electronics, Inc.  
Dept. EL-11, 9101 King St., Franklin Park, Ill.

Name of Dealer \_\_\_\_\_  
 Send complete Kit details.       Kit  
 Check or M.O. enclosed       C.O.D. \$5 enclosed  
 Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

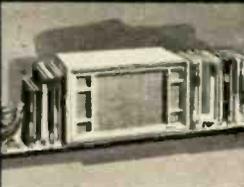
To everyone considering a small-space wide-range speaker system . . . monaural or stereo

## ACTUAL TESTS PROVE UNIVERSITY RRL \* Ultra Linear Response Systems SUPERIOR

to competitive high compliance systems

# AT \$40-\$85 SAVINGS (User net)

\*RRL—Radiation Resistance Loading



With University RRL ultra linear response systems you get 75% less bass distortion, wider frequency response, lower power requirements and no "damping factor" problems. Write for proof . . . actual comparative measurements under identical conditions of University Model S-10 RRL system and widely publicized competitive brands X and Y. RRL systems use a specially designed acoustic coupler to load the new University high compliance woofer, enabling it to radiate tremendous bass energy with only small cone excursions. This achieves greater linearity and virtually eliminates distortion. Tweeter response, carefully matched to woofer's acoustic output, is smooth and flat to beyond 20,000 cps. Result: better bass, cleaner treble, smoother response than any competitive small-space, high compliance units based on totally sealed enclosures using "air spring" capacitance loading.

For the full story of these tests plus complete specs of the RRL ultra linear response systems and money-saving kits, write Desk E-5, University Loudspeakers, Inc., 80 So. Kensico Ave., White Plains, N. Y.

LISTEN

*University sounds better*



## Shooting for the Moon

Continued from page 59

taining the scanner enters the moon's gravitational field at about 20,000 miles from the moon's surface, it is shot into orbit around the moon; creating a moon for the moon, so to speak. This is accomplished by sending out a radio signal from earth (Hilo, Hawaii) which triggers the fourth stage rocket.

The moon's distance from the earth varies between 221,000 and 252,000 miles and proper conditions for launching the moon-bound rocket occur only on four consecutive days each month.

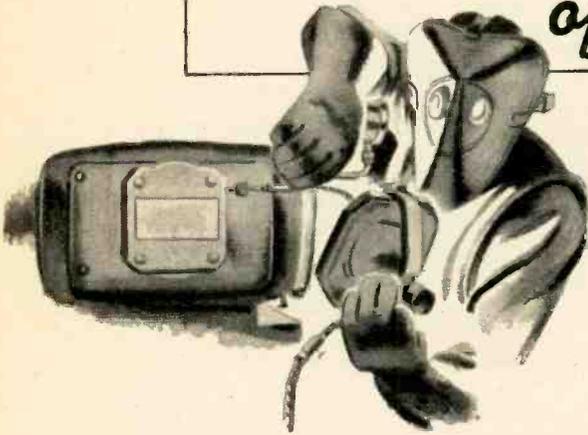
Landing a rocket with equipment intact on the moon is an Army project and involves additional problems. The moon's gravity must be offset and braking the space vehicle by means of reverse thrust rockets is one possibility. Radar focused on the moon and radio signals from the rocket are fed into a computer on earth which tells immediately the distance still to be traveled, the rocket's exact speed and the moon's gravitational pull. At the precise split-second, a signal radioed from earth starts the rocket's reverse engines.

On the lunar surface, batteries of telemetry instruments developed by the Navy begin to broadcast their discoveries. We soon know how hot the moon gets when the sun strikes it through a sky without atmosphere, and how quickly it cools off at night. Intensity of cosmic rays and other vital information if man intends to travel in space and on other planets can also be gathered by electronic telemetry equipment.

The possibility exists that a hydrogen bomb will be exploded on the moon to observe the reaction where there is no atmosphere, but scientists fear such an explosion might contaminate the moon to a degree that further exploration of its surface would not be practicable.

Probably a dozen or more unmanned trips will be made to the moon before we send out a man with a 50-50 chance of returning safely. Before the first earthling sets foot on the moon's surface we will know thousands of new facts about it, facts made known to us by the electronic instruments enclosed in the early moon shots.

# The Secret of an Atom



## Does It Conceal The Purposes Of Our Lives?

**WERE THE ANCIENTS RIGHT?** Does the whirling heart of an atom contain the secret of the universe? If everything from a grain of sand to the mighty stars—including man—is composed of atoms, do these particles contain the *infinite intelligence* which ordained and directs all things? Shall man at last find within them his true purpose in the scheme of things?

Before the powerful cyclotron that now smashes atoms to expose their hidden interior—even before the telescope and microscope—*men of nature* in the ancient world disclosed secrets of her phenomena, *the mysteries of life and death*. These teachings have become the foundations of thought which have raised men to *heights of achievement and happiness*.

## LET THIS FREE BOOK EXPLAIN

The Rosicrucians, a world-wide fraternity of thinking men and women—but not a religious organization—have helped preserve *the wisdom* of these age-old sages. In these teachings have been found the solution to many of the perplexing, haunting problems that confront millions of bewildered people today. These *truths of nature*—

easy to comprehend—free of fanaticism, or fantasies, *are offered to you, too.*

Send today for your *free* copy of the book, "The Mastery of Life" which will explain how you may receive for study and use, this centuries-old but ever modern information. Use the coupon or send your request to Scribe A.D.Y.

Scribe A.D.Y.  
The Rosicrucians (AMORC)  
San Jose, California, U.S.A.

Please send me your free book, "The Mastery of Life," which I shall read as directed. I understand there is no obligation.

Name \_\_\_\_\_

Address \_\_\_\_\_



**The ROSICRUCIANS (AMORC) San Jose, Calif.**

## Model Airplane Record

Continued from page 68

der position; two pulses the opposite position.

To operate the auxiliary control (spoilers in this case) a fast or "quick blip" signal triggers the second escapement, located in the wing. A Citizenship self-neutralizing type, it is so mounted that in one neutral position the spoilers are extended, in the other, retracted. Each quick blip changes the auxiliary escapement from one neutral to the other without affecting the rudder control.

Numerous dry runs of radio and battery supply were made by E. J. Lorenz, radio designer for this project, and Norman Rosenstock. They prepared motor-driven printed-circuit keying discs for continuous tests by laminating micarta "bumps" to a flat, circular plate to obtain the number and length of pulses desired. A transistorized CG single channel receiver operated for 480 hours before failure of an electrolytic condenser.

Weeks of tests on the Essco twin- (dual purpose) tube receiver told us it could be operated for 16 hours continuously, keyed electronically 66 times a minute on one Yardney LR05 battery for filament and one 30-volt hearing aid battery for plate. The CG receiver operated for 43 hours keyed twice a minute on six-second pulses using two Voltabloc V500s.

Ordinary dry batteries would certainly prove unsatisfactory for an all-day flight where plane design had to meet international weight and size limitations. Also, their changing voltages would undoubtedly affect receiver sensitivity adjustments.

Various modern batteries of the nickel-cadmium, zinc-nickel, and mercury types do a good job for their weights and sizes. Four Yardney LR05 batteries will run radio, a servo and auxiliary escapement for more than 12 hours, with the number of control impulses sent to the plane varying from 8-15 per minute. Four Voltabloc V500s do the same job and two in parallel will operate a Bonner multi-servo for better than 6,000 pulses.

Initially expensive, these batteries save money in the long run. The four Yardney cells costs \$28, but take 60 rechargings. For ordinary model flying they would give at least 60 flights per charge, provided charging procedures were carefully followed. Voltabloc batteries can be left on charge for 90 days without harm and none require rest periods.

In early tests, a 250 watt transmitter for traffic lights emitting 27.255 mc almost killed the project and it was necessary to travel to distant, little-used airports away from the powerful carrier of the lights. These emissions would actuate a carrier-wave receiver (like the Essco) and spiral the plane into the ground. On a tone-modulated receiver like the CG, the lights' carrier would block the model's receiver and the plane would fly away. It did twice, but the changing note of the traffic carrier triggered the spoiler escapement, causing the plane to descend.

After 60 test flights, the rubber-wound escapement was a decided weak link. Two rubber motors of 36" length were geared in series to provide the required turns. These were not enough. A Victory (Mighty Midget) electric motor was designed into an automatic winding device. Faltering rubber tension would start the motor. When tension again built up, the motor would stop.

At this writing, tests of simpler servos to wind the rubber are underway. At first, all motor-driven servos with single channel operation resulted in high battery drain when starting.

Transmitter? No problem, providing at least one spare is available. Large, replaceable battery packs, vibrator supply or a car battery and vibrator will run a transmitter designed to operate either a tone- or carrier-wave single channel receiver.

If a dawn-to-dusk model flight is ever achieved, the designs described here will be the ones to do it. But much depends on the unpredictable—the human error factor, weather and radio interference. For the modeler such a flight has all the elements—suspense, adventure, frustration—of putting a satellite into orbit. —●—

## The Skywatcher

Continued from page 75

sive. Connections are made to the NE-21 lamp by soldering directly to its brass sleeve and bottom-button contact.

Most of the wiring should be completed before the final installation of the bakelite sheets in the chassis. Leave 3-inch wire leads projecting from the sub-chassis for later connection to the AC receptacle, the sensitivity control (R2), and the toggle switch (SW). The wires that connect the sub-chassis to the neon-winker must be longer, of course, to reach from the back to the front of the chassis.

Before applying power, an ohmmeter should be used to detect short-circuits or other low resistance paths that might indicate an error. Also check to be sure that neither leg of the incoming AC is touching the chassis.

Set R2 at about half-rotation and, with switch SW in either position, apply power. As the photocell is alternately shielded and exposed to light of medium intensity, the sensitive relay (RY2) should open and close positively. Starting from a "cold" condition, cover the photocell with SW set ON, plug any lamp into the receptacle and wait for the thermal relay (RY1) to turn on the lamp. Now expose the photocell so that the sensitive relay pulls in and wait for the lamp to extinguish. The neon-winker should not flash for either of these settings. Now throw SW to its OFF position with the photocell still exposed to the light and the sensitive relay still latched; the neon tube should now flash on-and-off to inform you that the SKYWATCHER is off and not readied for the next evening. Moving SW back on ON should stop the flashing.

Absolutely no trouble was experienced in getting this model to perform according to the original design. However, neon lamps have somewhat different performance from one to the next. If the winker does not light at all when the photocell is illuminated, try paralleling R1 with a second 330,000 ohm resistor. If this does not correct the trouble, try reducing R1 to about 200,000 ohms with the paralleling resistor in place. ●

if you think  
that all brands of  
recording tape are alike...

wait  
till  
you  
try

**irish**  
BRAND



**ferro-sheen**

Available wherever quality tape is sold.  
ORRadio Industries, Inc., Opelika, Alabama  
Export: Morhan Exporting Corp., New York, N.Y.  
Canada: Atlas Radio Corp., Ltd., Toronto, Ontario

## Revive Your Speedlight

Continued from page 78

Let's consider next an inexpensive repair for a shorted condenser. A blown condenser can sometimes be identified by its appearance. The case of a shorted condenser will be burned or overheated. Speedlight condenser units may consist of one or two large condensers, or of several smaller ones connected in parallel. If the speedlight uses a single condenser and this shorts out, of course, nothing can be done but replace it or discard the set. If two or more condensers are used, you can put the set back in operation by removing the bad condenser and wiring around it.

After the light output of your speedlight has been reduced by removing a bad condenser from the circuit, it will be necessary to establish a new guide number. You can do this easily by setting up your camera and light a measured ten feet from the subject and shooting a series of test exposures. Vary the lens aperture one stop each time. A card with the *F* stop written on it can be included in the picture for identification. Use your usual film and development procedure. After developing, choose the correct exposure from your series and multiply the *F* stop used by ten to arrive at the new guide number. The guide number on the speedlight shown is 80 with Verichrome, after conversion.

Relay points are another source of trouble on units using a relay. The points are dressed with a very fine grade of emery to remove pitting or burning. Remove only enough metal to smooth and polish the contact points. After dressing the relay points, synchronization with the camera shutter should be checked. This is done by removing the back from the camera and holding the light behind the opening. Use a sheet of tissue paper in front of the lens to cut down the light so it won't blind you. Fire the speedlight by tripping the camera shutter. Looking into the lens, you should see a full circle of light, indicating that the shutter is wide open when the light fires. If it is out of synchronization, turn the relay adjusting screw slightly and recheck until light fires in sync. ●

MENS For Embroidery Or  
y direct from manufacturer  
and For Free catalog. Merrit  
19th St., Dept. 778, New

O \$35 weekly addressing en-  
car instructions reveal how.  
x 6568, Cleveland 1, Ohio.  
NEY mailing. Samples free.  
SE 65th, Portland, Ore.

ER COUNTERS,  
SURE FINDERS

or hid  
metal  
tors,  
eratur  
2545  
O SILL



**ELECTRONICS  
ILLUSTRATED**

Corporation  
wood, Calif.

PROFITS! Exciting Treasure  
Locator Literature Free.  
ansas, Michison Kany.

TING, M  
EOGRAPH

ADDRESS  
Frank

ESS CAR  
ples. Pi

TING OUTFITS

DU  
ill  
als  
R  
d  
isc  
BE  
CI  
NE  
OO  
E  
FO  
set  
O  
DO  
at  
NE  
Tr  
MF

Here's a great new medium for  
classified advertisers.  
**ELECTRONICS ILLUSTRATED**  
is now accepting classified ads—  
opening a wide new market  
for any product or service of  
interest to men. Get all the  
details now. Write to  
Classified Department,  
**ELECTRONICS ILLUSTRATED,**  
67 West 44th Street,  
New York 36, N. Y.,  
for full information.

ABLE USA! (1) Scarce gen-  
stamp picturing first USA,  
1917! (2) Big collection 30 all-  
States; ancient 19th cen-  
\$1 stamp, etc. (3) Collec-  
Commemoratives. (4) Col-  
Big 64-page Bargain Cata-  
all US Postage Issues; other  
! Send 10¢ for mailing ex-  
isco, 4166 Transit Bldg., Bos-

WORLDWIDE Stamp Assort-  
provals. Send Dime for han-  
mp, St. Catharines 620, On-

ISH Colony Stamps. Ap-  
close 10¢ for handling. Ni-  
M. Catharines 673, Ontario.

UNITED STATES commemo-  
tion containing 33 differ-  
provals. White, 516-M Avenue  
lyn 30, New York.

225 STAMPS FOR Only 10¢!  
moth value includes Airm-  
raits; stamps from strange  
cataloguing up to 25c each  
provals. Mystic Stamp Com-  
den 30, N. Y.

WOW! 110 ALL Different G-  
Zeppelins, Semi-postals, Ai-  
values, etc. Giant Catalog, b-  
fut  
A89

tes i  
Co,  
Col

ive Green

Free with approv-

amp Co., Ferrysburg 5, M.

STAMP FINDER, World Ma-  
yclopedia of stamp issu-  
Goliath

Hundred

pany, H

n Catalog

ands of

B. N.

albums,

with be

provals. Jamestown Stamp, O-

umeston, N. Y.

at

O

ta

NG

ye

VI

RA

up 10¢. U. S. Approvals. K

Brooklyn 23, N. Y.

ECONOMICAL 1/2-3¢ APPROV-

varieties, Dresel, Box 12

Englewood, N. J.

OLD SCARCE U. S. Second

proval. Slight imperfec-

prices. Herfelder, Clintonhill

ark 8, N. J.

100 OLD UNITED States be

and 1935, \$1.00. Roush

Chestnut, Mansfield, Ohio.

TRADE YOUR duplicates tow-

provals. (Foreign Only.) Co-

tailed information, 10c. (R)

Variety Stamps, Box 98-T, Ne-

lands 61, Mass.

## For Stereophiles Only

Continued from page 53

### THE INTEGRAND STORY

Description of the Stereo Servo Speaker System.  
*Integrand Corp., Dep't. EI*  
*c/o Brand Products, Inc.*  
*11 Lorimer St., Brooklyn 6, N. Y.*

### BULLETIN JH-1

An illustrated brochure on stereo systems  
*Jensen Manufacturing Co., Dep't. EI*  
*6601 S. Laramie Ave., Chicago 38, Ill.*

### STEREO FROM MADISON FIELDING

Descriptive material on available equipment.  
*Madison Fielding, Dep't. EI*  
*c/o Brand Products, Inc.*  
*11 Lorimer St., Brooklyn 6, N. Y.*

### PRECISION ELECTRONICS PRESENTS STEREO

Individual brochures, with illustrations, of stereo equipment available.  
*Precision Electronics, Inc., Dep't. EI*  
*9101 King St., Franklin Park, Ill.*

### STEREO EQUIPMENT

Illustrated catalog of new stereo hi-fi equipment, especially designed by the noted industrial designer, George Nelson.  
*Rek-O-Kut Company, Dep't. EI*  
*38-19 108th St., Corona 68, N. Y.*

### STEREO CARTRIDGES

Flyers describing new stereo cartridges.  
*Ronette Sales Corp., Dep't. EI*  
*190 Earle Ave., Lynbrook, N. Y.*

### STEREO REPRODUCERS

Colorful, illustrated brochure on stereo tuners and amplifiers.  
*Surgent-Raymont Co., Dep't. EI*  
*4926 E. 12th St., Oakland 1, Calif.*

### STEREO PROFESSIONAL DYNETIC

Illustrated flyer and technical data sheet on this new stereo cartridge.  
*Shure Brothers, Dep't. EI*  
*222 Hartrey Ave., Evanston, Ill.*

### 8T CARTRIDGE

Catalog sheet describing and picturing a new ceramic cartridge.  
*Sonotone Corp., Elmsford, N. Y.*

### STEREODOT

An illustrated brochure explaining the workings of this special stereo speaker.  
*Stephens Trusonic, Inc., Dep't. EI*  
*8538 Warner Drive, Culver City, Calif.*

### THE STORY BEHIND TANDBERG STEREO

A booklet describing stereo tape recording and playback equipment with details on how the components are made.  
*Tandberg of America, Dep't. EI*  
*10 E. 52nd St., New York 22, N. Y.*

MODEL M-40 for 30-50 MC \$99.50 • • • • • MODEL M-160 for 152-175 MC \$99.50

example, for highest selectivity. Also featured are: built in 4" speaker, tuned RF stage, excellent sensitivity, built in squelch, adjustable from the front panel, and well illuminated slide rule dial, for easy and accurate tuning.

Housed in attractive cabinets, only 4 1/2" x 6 1/2" x 8 3/4", the receivers are readily installed, and the chassis are easily removed from the cabinets for ease of service.

Ideal for monitoring the communications of all users of the 30-50 and 152-174 MC bands — police and fire departments, utilities, trucking and railroads, conservation departments, and other governmental, municipal, and industrial radio systems, the M-40 and M-160 are invaluable, of course, where two or more channels must be monitored.

These two fine receivers offer features ordinarily to be found only in much higher priced equipment—double conversion, for



amazingly low cost!

**FIRST  
MOBILE  
FM receivers  
TUNABLE**  
across the entire  
**EMERGENCY  
communications band**

Model M-40	Model M-160
30-50 MC	152-174 MC
2 uv or less	4 uv or less
±40 kc at 20 db	±40 kc at 20 db
1 uv (adjustable) 1 uv (adjustable)	1 uv (adjustable) 1 uv (adjustable)
.8 W	.8 W

monitoradio

Division of I.D.E.A., Inc.

7400 Pendleton Pike • Indianapolis 26, Indiana

## A Launching Pad

Continued from page 62

4. Have one or two adults prepare a plan for launching. This plan should include all possible data about the rockets to be launched. Attached to this plan should be a schedule of launchings. All of this should be part of a letter to the local military authorities requesting permission to use the military ranges near your locality.

5. Before submitting the letter have one or two adults call on the Commanding General of the Post or Commanding Admiral of the Station in question and seek his advice.

Local communities can help in building an effective core of trained scientists by building static test stands. The officials of Fairfax County, Virginia, have announced that Fairfax County will build a static test stand to be used by all High Schools of the county. This stand will be staffed with qualified help and the amateurs will be given an opportunity to first test their rockets many times before a live launching.

### The Launcher

The launcher described in this article will take rockets of varying sizes, with and without fins.

The Firing Circuit is of utmost importance because it is here that a real factor of safety should be built into the design. Many clubs and groups have been interviewed by your author and I have yet to meet a group that does not consider the firing circuit the one piece of equipment that is all important from a safety point of view.

The firing circuit consists of two small red boxes with double lead wires between them. One box is located in the block house for the static stand or in the block house for the launcher. Both of these red boxes are so designed that a key is necessary to open the lock and the key cannot be extracted when the box is open. To extract the key, the boxes must be shut and locked.

To connect your rocket for testing and launching, it is essential that you proceed as follows:

1. The two red boxes are connected with double lead wires, the length to

be determined by the type of block house that has been constructed and other safety factors.

2. Box No. 1 is then taken to the site where the rocket is to be tested.

3. The one and only key is then inserted in the lock of Box No. 1 and the box is opened.

4. The two rocket lead wires are then inserted and extended through the holes A and B of Box No. 1 and connected to the two terminals within the Box No. 1.

5. Box No. 1 is then shut, locked and key withdrawn.

6. You then proceed to Box No. 2 in the block house.

7. The key is inserted in Box No. 2 and the box is then opened. You will notice on the circuit diagram that when the key is inserted into Box No. 2 and the key is turned, the key then helps to complete the circuit. Also, as you open the lid on Box No. 2, notice the copper rod across the bottom of the lid. Thus, when the box is shut, the copper rod shorts out the double leads from Box No. 1 and breaks the circuit in two places between Box No. 1 and Box No. 2.

8. In order to fire, insert the male plug into a source of power.

9. The circuit is now armed and ready to fire.

10. To fire, push down on the push button.

If the rocket fires or if the rocket leaves the launcher, that part of the test or shoot has been a success. You now proceed as follows:

11. Disconnect the plug from the source of power.

12. Shut Box No. 2, lock the box and withdraw the key.

13. Proceed now to Box No. 1 and unlock the box and disconnect the rocket leads.

14. Shut and lock Box No. 1.

You are now ready for the next test or launching.

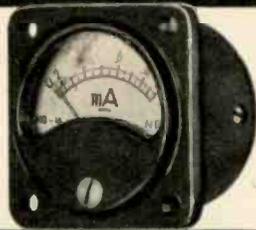
In case of a misfire, first press the push button again and this time hold it down for five seconds. If the rocket fails to fire, then follow instruction 11 and 12 above and wait 30 minutes before you proceed with caution and protective clothing to Box No. 1. There should be a protective wall between you, Box No. 1 and the rocket. —

# new 1 INCH Miniature Panel Meters

## PRICE LIST

D. C. MICROAMMETERS	0-300	-5.95	0-500	-7.75	
D. C. MILLIAMMETERS	0-1	-4.95	0-100	-4.95	
	0-5	-4.95	0-200	-4.95	
	0-10	-4.95	0-300	-4.95	
	0-50	-4.95	0-500	-4.95	
D. C. VOLTMETERS	1000 Ohms per volt	0-3	-4.95	0-50	-4.95
	0-10	-4.95	0-150	-4.95	
A. C. VOLTMETERS	RECTIFIER TYPE—				
	1000 Ohms per volt	0-15	-5.25	0-150	-5.25
	0-300	-5.25			

Features the smallest and lightest self shielded moving coil meter commercially available; no calibration necessary. Designed to save space in compact equipment. These Alco 1-inch meters are in step with the trend to miniaturization. Unique case design allows optional mounting as a round or rectangular meter. Requires only a 1-inch hole for mounting. Minimum scale arc of 90° permits accurate readings. Accuracy within 3% of full scale. Currently available in 18 popular ranges. Immediate delivery.



ACTUAL  
SIZE 1 INCH

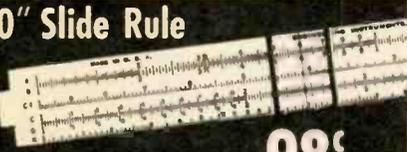
Send Check, M.O. or Cash; shipped prepaid. Money Back Guarantee.



## ALCO ELECTRONICS

MFG. LAWRENCE  
CO. MASS.

## 10" Slide Rule



ONLY **98¢** postpaid

ANYONE WHO UNDERSTANDS SIMPLE 7TH GRADE ARITHMETIC CAN USE THIS STANDARD SLIDE RULE

Be modern—use this quick easy way of figuring. For business men, students, carpenters, machinists, salesmen, printers and engravers, office workers, farmers, merchants, time keepers, plumbers, electricians—everyone who does figuring can save time and labor with this slide rule.

**FREE** Illustrated instruction book shows you how to get correct answers instantly without pencil and paper. (You get BOTH slide rule and instruction book for only 98¢ postpaid. Satisfaction guaranteed or refund.)

Nelson-Hall Co., 210 S. Clinton, Dept. 5L5-45, Chicago 6

## SIGN PAINTING

Home-Study Course—Only \$5.95

Teaches you commercial sign painting and sign building as it is being done TODAY in leading shops all over the country. Complete practical course for self-instruction. Shows latest methods of truck lettering, office doors, wood letters, reflecting signs, sprayed signs, gold leaf, silk screen process, up-to-date alphabets, money-making business information, etc.

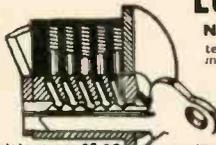
**SATISFACTION GUARANTEED OR REFUND!** Contains all the instruction of a high-priced correspondence course. Full price, only \$5.95, postpaid. Or C.O.D. plus postage. No risk—order today. Satisfaction or money back! Order: "Sign Painting Course," NELSON-HALL CO., 210 S. Clinton St., Dept. 3L5-45, Chicago 6, Ill.



## Locksmithing AND KEY MAKING

Now Made Easy! Practical up-to-date course

teaches you how to pick locks, decode, make master keys, repair, install, service, etc. New self-instruction lessons for every handyman, home-owner, carpenter, mechanic, service station operator, fix-it shop, hardware dealer, gunsmith. 53 easy illustrated lessons. Full price only \$5.95



Complete course \$5.95 postpaid; or C.O.D. plus postage. Satisfaction or refund guaranteed. Nelson-Hall Co., 210 S. Clinton St., Dept. 3L5-45, Chicago 6, Ill.

## HELP

yourself to better service from your postal service by including postal zone numbers on all correspondence.

Don't forget to include your own postal zone number in your own return address.

Postal zoning helps your post office give you better service.



# TODAY'S HOME

## BUILDING AND REMODELING

A Fawcett Publication

At Your Favorite Newsstand—50¢

## "BUCK STRETCHER" HI-FI VALUES!



Expand the buying power of your Hi-Fi dollar at Sun Radio with substantial savings on new and fully guaranteed name brand Hi-Fi components!

Dept. D8,  
**SUN Radio & Electronics Co., Inc.**  
650 6th Ave., New York 11, N. Y.  
Phone: ORegon 5-8600

*I am interested in your special price quotations and your Hi-Fi package specials! Please send data at once.*

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# FREE Lafayette 1959 CATALOG

## 260 GIANT-SIZED PAGES!



*"Everything  
in  
Electronics"*

CONTAINS HUNDREDS OF EXCLUSIVE LAFAYETTE ITEMS NOT AVAILABLE IN ANY OTHER CATALOG OR FROM ANY OTHER SOURCE — SEND FOR YOUR COPY NOW!

A "must" for the economy-minded hi-fi enthusiast, experimenter, hobbyist, engineer, technician, student, serviceman and dealer.

### The Complete Catalog Featuring "The Best Buys In The Business"

Send for Lafayette's 1959 Catalog—the most complete, up-to-the-minute electronic supply catalog crammed full of everything in electronics at our customary down-to-earth money-saving prices.

**LEADERS IN HI-FI**—The most complete selection and largest stocks of hi-fi components and systems—available for immediate delivery at the lowest possible prices. Save even more on Lafayette endorsed "best-buy" complete systems.

#### FOR THE NEWEST AND FINEST IN STEREOPHONIC HI-FI EQUIPMENT AND SYSTEMS

- TAPE RECORDERS
- PUBLIC ADDRESS SYSTEMS
- AMATEUR EQUIPMENT
- INDUSTRIAL SUPPLIES
- MICROSCOPES & TELESCOPES
- RADIO AND TV TUBES & PARTS
- EXCLUSIVE LAFAYETTE TRANSISTOR AND HI-FI KITS

#### EASY PAY TERMS

Only 10% down—Up to 18 months to pay

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

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



LAFAYETTE  
LA-90



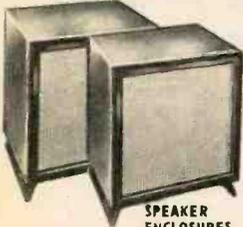
GARRARD  
RC 121/11



NEW GE GC-7  
STEREO COMPATIBLE  
CARTRIDGE WITH  
DIAMOND STYLUS



SK-58 SK-58



SPEAKER  
ENCLOSURES

Reg. Catalog Price  
~~200.57~~

ONLY **167.50**

SAVE 33.07!

16.75 DOWN ● 12.00 MONTHLY

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

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

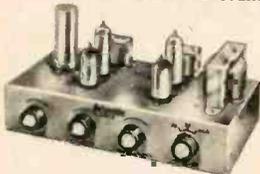
HF-375 Same, but with 2-Lafayette CAB-16 mahogany or walnut or CAB-17 blonde speaker enclosures (specify which).  
Net **222.50**

#### STEREO FM/AM-PHONO SYSTEM

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

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

#### NEW! LAFAYETTE STEREO AMPLIFIER KIT



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

ONLY **17.95**

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

KT-126 — Complete Kit, with tubes.....Net **18.95**

*Lafayette Radio* P. O. BOX 511  
Dept. EIK JAMAICA 31, N. Y.

Send FREE CATALOG 590

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

Zone \_\_\_\_\_ State \_\_\_\_\_

**CUT OUT  
AND  
PASTE ON  
POSTCARD**

**"Lucky Guys...T  
Good Pay, Good Fu**



**RADIO-TV SERVICING NEEDS MORE TRAINED MEN. GOOD OPPORTUNITIES FOR SPARE TIME EARNINGS, FULL TIME CAREER JOBS OR A BUSINESS OF YOUR OWN.**

**NRI SENDS VALUABLE KITS. YOU LEARN-BY-DOING. YOU BUILD RADIO-TELEVISION CIRCUITS, GET PRACTICAL EXPERIENCE WHILE LEARNING.**

LEARNING THIS WAY IS FUN. LOOK, MARY, THIS VACUUM TUBE VOLTMETER I BUILT HELPED ME FIX MR. JONES' SET.

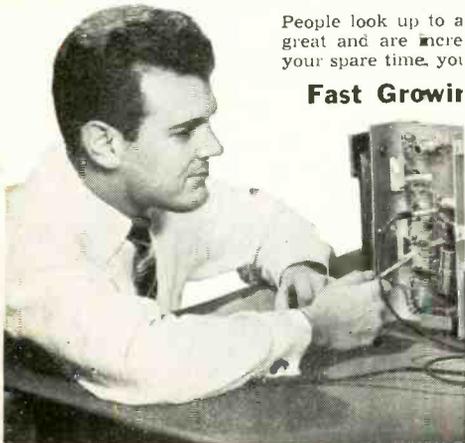
YES, YOU'VE REALLY LEARNED FAST.



**Learn RADIO.  
By Practicing**

People look up to a great and are incre your spare time, you

**Fast Growir**



**NRI Trained These Men**



"I am Chief Engineer of Station KGCU. I also have my own spare time business servicing high frequency communications systems."

R. BARNETT  
Bismarck, N. D.



"I am doing well in spare time TV and Radio Servicing. Sometimes have several TV jobs waiting. Paid for instruments out of earnings."

G. F. SEAMAN  
New York, N. Y.



"We have an appliance store with our Radio and TV Servicing. During my Army service, NRI training helped get me a top rated job."

W. M. WEIDNER,  
Fairfax, S. D.

**Mail Postage-Free Card For  
SAMPLE LESSON  
and 64 Page Catalog**

**FREE**

**SEE INSIDE**



**NATIONAL RADIO INSTITUTE**

**Washington 16, D. C.**

**BUSINESS REPLY CARD**

No Postage Stamp Necessary If Mailed in The United States

**POSTAGE WILL BE PAID BY**

**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 STEREO**

matching Electro-Voice and *cl!* 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 verified 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 2 1/2 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 STEREO, 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 STEREO 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 STEREO 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 STEREO ... to give you full dimensional stereo ... inexpensively, compactly.

Stereo—the Electro-Voice STEREO 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 STEREO... FOR SUPERLATIVE STEREO NOW...**

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



**Electro-Voice**® **ELECTRO-VOICE, Inc.**  
 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**

STEREO 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  $\pm 2$  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, 17 1/2" deep, 7 1/2" wide. Shipping weight: 37 lbs. Net ..... \$129.50  
 STEREO IA—Identical to Stereo III, for use with normal efficiency

systems. Uses MT30B and T35B driver components. Shipping weight: 33 lbs. Net ..... \$99.50

XX3 STEREO CONTROL FILTER—For use with Electro-Voice Stereons. Uses matching transformer and crossover network components. All signal of 1st channel above 300 cps feeds Stereo; 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: 5 1/2" high, 4 3/4" wide, 5 1/4" deep. Shipping weight: 8 lbs. Net ..... \$30.00

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