HOW TO MAKE: Telephone Recording Beeper
5-Transistor Portable Radio • Child's Radiophone
Prowler-proof Electronic Light Switch for Your Home

1959 stereo components

HAM RADIO • HI-FI • SHORT WAVE LISTENING • HOME EXPERIMENTS • MODEL MISSILES
FIRST ALL-NEW, LOW-PRICED, SHORTWAVE RECEIVER
IN OVER TEN YEARS!!!

NEW NATIONAL NC-60 Special . . . covers .54 to 31 mcs in 4 bands with full electrical bandspread on all frequencies. Features exceptional sensitivity with separate tuning coils for each band. Separate general coverage and bandspread tuning capacitors. Front panel phone-jack. Standard broadcast, civil defense, WWV, marine, aircraft, amateur and worldwide 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.

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 you hear. Send 50¢ to NATIONAL COMPANY, INC., Malden 48, Mass.

National
NATIONAL COMPANY, INC., MALDEN 48, MASS.

www.americanradiohistory.com
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 electrical 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 and 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. KMB, Washington 16, D.C.

MAILING THIS COUPON MAY START YOU TO SUCCESS
LEONIZATION AND BOOK FREE

NATIONAL RADIO INSTITUTE, Dept. KMB, Washington 16, D.C.

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

Name
Address
City
State
Zone

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL
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
El Assembles a Stereo Preamplifier Kit ....................................... 48
Shelves For Your Hi-Fi .......................................................... 52
For Sterephiles 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

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 Kay .................................................. Assistant Production Editor
John F. Webster ........................................... Advertising Manager

Ralph Daigh ............................................ Editorial Director
James Boynton ........................................... Advertising Director
Al Allard .................................................. Art Director
Ralph Mathison ........................................ 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; Rossco 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 25c 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.

Electronics Illustrated
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.

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.

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.

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

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.

COYNE
ELECTRICAL SCHOOL
A TECHNICAL TRADE INSTITUTE OPERATED NOT FOR PROFIT
500 S. Paulina Street, Chicago, Dept. 88-8C
ELECTRICITY ★ RADIO ★ TELEVISION ★ REFRIGERATION ★ ELECTRONICS

November, 1958

www.americanradiohistory.com
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.
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.

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

November, 1958
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.

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

SEND COUPON TODAY!

Milwaukee School of Engineering
Dept. Ef 1158, 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 El. 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.

Electronics Illustrated
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.


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):

<table>
<thead>
<tr>
<th>RADIO</th>
<th>BUSINESS</th>
<th>ELECTRICAL</th>
<th>LEADERSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>TELEVISION</td>
<td>☐ Cost Accounting ☐</td>
<td>☐ Electrical Engineering ☐</td>
<td>☐ Industrial Foremanship ☐</td>
</tr>
<tr>
<td>ELECTRONICS</td>
<td>☐ Managing a Small Business ☐</td>
<td>☐ Elec. Engr. Technician ☐</td>
<td>☐ Industrial Supervision ☐</td>
</tr>
<tr>
<td>☐ General Electronics Tech.</td>
<td>☐ Purchasing Agent ☐</td>
<td>☐ Elec. Light and Power ☐</td>
<td>☐ Personnel—Labor Relations ☐</td>
</tr>
<tr>
<td>☐ Industrial Electronics</td>
<td>☐ ☐</td>
<td>☐ Practical Electrician ☐</td>
<td>☐ ☐</td>
</tr>
<tr>
<td>☐ Practical Radio-TV Eng’r’g</td>
<td>☐ Electrical Drafting ☐</td>
<td>☐ ☐</td>
<td>☐ ☐</td>
</tr>
<tr>
<td>☐ Practical Telephony</td>
<td>☐ ☐</td>
<td>☐ ☐</td>
<td>☐ ☐</td>
</tr>
<tr>
<td>☐ Radio-TV Servicing</td>
<td>☐ ☐</td>
<td>☐ ☐</td>
<td>☐ ☐</td>
</tr>
<tr>
<td>☐ ☐</td>
<td>☐ ☐</td>
<td>☐ ☐</td>
<td>☐ ☐</td>
</tr>
</tbody>
</table>

How to Succeed in
ELECTRONICS
RADIO and TV

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 Canadian residents send coupon to International Correspondence Schools, Canadian, Ltd., Montreal, Canada.

Accredited Member, National Home Study Council

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

November, 1958
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. E1-118
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

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

November, 1958

www.americanradiohistory.com
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.

*Electronics Illustrated*
Get into TELEVISION RADIO-ELECTRONICS

LEARN ALL 8 PHASES OF THE INDUSTRY
BY SHOP METHOD

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

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 earnings. 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 19 big kits of equipment!

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 Shop. Labs and Electronic Equipment Studios. Here you work with latest Electronic equipment—professionally installed in 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.

NATIONAL SCHOOLS

LOS ANGELES 37, CALIF.

NATIONAL SCHOOLS

TECHNICAL TRADE TRAINING SINCE 1905

LOS ANGELES 37, CALIFORNIA

GET FAST SERVICE—MAIL NOW TO
NATIONAL SCHOOLS, DEPT. RA-108
4000 S. FIGUEROA ST., LOS ANGELES 37, CALIF.


NAME
ADDRESS
CITY
STATE
ZONE
AGE
VETERANS
( ) Check if interested only in Resident School training at Los Angeles.

NATIONAL SCHOOLS

LOS ANGELES 37, CALIF.

November, 1958

11

www.americanradiohistory.com
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 2 1/2" 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!

* * * * * 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: ____

November, 1958

13
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.

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

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.

MAIL TODAY

Please mail immediately this free booklet without obligation

VETERAN APPROVED

BAILEY TECHNICAL SCHOOLS

1625a S. Grand • St. Louis 4, Mo.

www.americanradiohistory.com
BUILD 16 RADIO CIRCUITS AT HOME
with the New Deluxe 1959
PROGRESSIVE RADIO "EDU-KIT®

The "EDU-Kit" offers an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of and studying standard instruction manuals, textbooks, reference books, and equipment. You will learn the latest technical theory, construction, practice and servicing, including the latest developments of Printed Circuit Cards.

You will learn the principles of radio, wave theory, practice trouble-shooting and repairing. This is a complete radio course in every detail. You will also study the latest developments in electronics and the use of Printed Circuit Cards. The "EDU-Kit" is designed to train Radio & Electronics Technicians, making use of and studying standard instruction manuals, textbooks, reference books, and equipment. You will learn the latest technical theory, construction, practice and servicing, using the Progressive Course in Printed Circuit Cards. The "EDU-Kit" offers an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of and studying standard instruction manuals, textbooks, reference books, and equipment. You will learn the latest technical theory, construction, practice and servicing, using the Progressive Course in Printed Circuit Cards.

You will learn the principles of radio, wave theory, practice trouble-shooting and repairing. This is a complete radio course in every detail. You will also study the latest developments in electronics and the use of Printed Circuit Cards. The "EDU-Kit" is designed to train Radio & Electronics Technicians, making use of and studying standard instruction manuals, textbooks, reference books, and equipment. You will learn the latest technical theory, construction, practice and servicing, using the Progressive Course in Printed Circuit Cards. The "EDU-Kit" offers an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of and studying standard instruction manuals, textbooks, reference books, and equipment. You will learn the latest technical theory, construction, practice and servicing, using the Progressive Course in Printed Circuit Cards. The "EDU-Kit" is designed to train Radio & Electronics Technicians, making use of and studying standard instruction manuals, textbooks, reference books, and equipment. You will learn the latest technical theory, construction, practice and servicing, using the Progressive Course in Printed Circuit Cards. The "EDU-Kit" offers an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of and studying standard instruction manuals, textbooks, reference books, and equipment. You will learn the latest technical theory, construction, practice and servicing, using the Progressive Course in Printed Circuit Cards. The "EDU-Kit" is designed to train Radio & Electronics Technicians, making use of and studying standard instruction manuals, textbooks, reference books, and equipment. You will learn the latest technical theory, construction, practice and servicing, using the Progressive Course in Printed Circuit Cards.
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."

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 you test it 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 Electromagnetism
- 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.

November, 1958

STUDY 10 DAYS FREE!

Dept. PR-118, RINEHART & CO., INC.
732 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.

www.americanradiohistory.com
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 teststock 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 25¢
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 Lock-
heed'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 ap-
lications for factories and mills.

A fully transistorized portable color
TV system which uses 75 watts less
power than the sealed-beam headlight-
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 compact-
ness, 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
5¢ in stamps. Usual price is 25¢.

Electronics Illustrated
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!

ACT NOW!

CUT OUT AND MAIL — TODAY!

RADIO-TELEVISION TRAINING SCHOOL
5100 S. VERNONT AVENUE
LOS ANGELES 37, CALIFORNIA

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

☐ Radio-Television
☐ Industrial Electronics
(Automation)

Name ____________________________ Age ______

Address __________________________

City & State _______________________

30c
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, III.

Please send valuable free catalog, You and Television, and Lesson Samples.

Name ____________________________ Age ______

Address __________________________

City __________________ Zone _______ State _______

College graduates get ahead faster!

Bachelor of Science Degree in 27 months


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 _______

20

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**

**free!** send for it

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

<table>
<thead>
<tr>
<th>Kit Type</th>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stereo Adapter Control Kit</td>
<td>Y-778</td>
<td>$9.95</td>
</tr>
<tr>
<td>Deluxe Preamplifier Kit</td>
<td>Y-776</td>
<td>$62.50</td>
</tr>
<tr>
<td>&quot;Space Spanner&quot; 2-Band Receiver Kit</td>
<td>Y-259</td>
<td>$18.95</td>
</tr>
<tr>
<td>Dual 30-Watt Hi-Fi Amplifier Kit</td>
<td>Y-777</td>
<td>$18.45</td>
</tr>
<tr>
<td>Hi-Fi Amplifier Kit</td>
<td>Y-784</td>
<td>$19.55</td>
</tr>
<tr>
<td>&quot;Ranger III&quot; AC-DC Radio Kit</td>
<td>Y-736</td>
<td>$16.95</td>
</tr>
<tr>
<td>&quot;Ranger&quot; Clock-Radio Kit</td>
<td>Y-737</td>
<td>$24.95</td>
</tr>
<tr>
<td>Radio-Intercom Kit</td>
<td>Y-739</td>
<td>$27.50</td>
</tr>
<tr>
<td>&quot;Span-Master&quot; 4-Band Receiver Kit</td>
<td>Y-258</td>
<td>$24.15</td>
</tr>
</tbody>
</table>

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

**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

**ALLIED RADIO**

**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!

_November, 1958_
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.

Electronics Illustrated
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
  Circuity 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.

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...

Dimensions: Width: 14½" Height: 11¼" Depth: 4¾"
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 on all-around tube tester.

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

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, O24s, magic eye tubes, gas regulators, special purpose high-tube 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 meter 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 DarSavon type meter is extremely sensitive yet rugged...fully protected against accidental burn-out. Actual 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!

GUARANTEED FOR ONE FULL YEAR $69.50 ONLY

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

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

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.

Name 
Address 
City 
State 
F.O.S., Mineola, N.Y.

November, 1958
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: 1½ ips, 3½ ips and 7½ 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 NA-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 NA-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

ST-11 AM-FM STEREO TUNER
Here, for the first time, is an AM-FM STEREO Tuner within the reach of every audiophile. Unmatched by units costing twice the price. the ST-11 is two distinct receivers in one, featuring 40 for for 20 db quieting. Variable APC. Single front panel switch controls AM, FM or STEREO selection.
Wired and tested $74.50
SAVE! Easy-to-build-kit $49.95

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 17½ 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 $99.95
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

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

Radio Kits, Inc., Dept. E1-11
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

Arkay
120 Cedar Street
New York 6
BUILD 125 COMPUTERS AT HOME WITH GENIAC®

ONLY $19.95

With the 1958 model GENIAC®, the original electric brain construction kit including seven books and pamphlets, over 400 parts and component rack, owner's manual 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 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 PhD. 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, for 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 "Automaton 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:
2) Beginners Manual—written 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) A SYMBOLIC GUIDE endemic to a complete course in computer fundamentals, this guide the user to more advanced literature.
6) A Machine to Compute Music shown 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—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.

November, 1958

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 tests 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 Genius 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 ones that come in daily attached to new circuits that have been created by the owners of GENIAC. 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 analytical and ideal units after my pet projects in cybernetics to a weather forecaster. I find that your GENIAC Kit may be used in their construction. I enclose the circuits and their explanation."

Oliver Garfield Co., Inc.
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), 35% 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

City

State

Zip

Please type or print clearly.

www.americanradiohistory.com
The experts say...

in HI-FI and TEST INSTRUMENTS your best buy is EICO®

**New!**
Miniaturized MULTI-SIGNAL TRACER #148A
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!

**NEW!**
VACUUM TUBE VOLTMETER #221
KIT $25.95
WIRED $39.95

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

**NEW!**
6V & 12V BATTERY ELIMINATOR & CHARGER #1050
KIT $29.95
WIRED $36.95
Extra-filtered for transistor equipment

**NEW!**
Series/Parallel R-C COMBINATION BOX: #1060
KIT $38.95
WIRED $47.95

**NEW!**
STEREO DUAL AMPLIFIER-PREAMPLIFIER HF81
including cover:
KIT $69.95
WIRED $109.95

**NEW!**
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 silhouette" look.

**NEW!**
FM TUNER HFT90
KIT, less cover $39.95
WIRED, less cover $65.95
COVER, $3.95 "FET incl. "Drift absolutely absent; audio quality excellent."
— Electronics Illustrated

**NEW!**
60-WATT ULTRA LINEAR POWER AMPLIFIER HF60
with ACRO TO-330 Output Xfmr
KIT $72.95
WIRED $98.95 "excellent buy" — Marshall, AUDIOCRAFT.

**NEW!**
50-WATT ULTRA LINEAR INTEGRATED AMPLIFIER HF52
KIT $66.95
WIRED $109.95
"Excellent value"—Hirsch-Houck Labs.

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

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

**NEW!**
TUBE TESTER #625
KIT $34.95
WIRED $49.95

**NEW!**
PEAK-TO-PEAK VTVM #232 & UNI-PROBE
(pet. pend.)
KIT $29.95
WIRED $49.95

**NEW!**
R-C BRIDGE & R-C-L COMPARATOR #950B
KIT $19.95
WIRED $28.95

IN TEST INSTRUMENTS

IN HI-FI...STEREO and MONAURAL

**NEW!**
IN TEST INSTRUMENTS

IN HI-FI...STEREO and MONAURAL

**NEW!**
60-WATT WILLIAMSON-TYPE INTEGRATED AMPLIFIER HF12
KIT $34.95
WIRED $57.95
"Packs a wallop" — POPULAR ELECTRONICS

**NEW!**
50-WATT ULTRA LINEAR INTEGRATED AMPLIFIER HF52
KIT $66.95
WIRED $109.95
"Excellent value"—Hirsch-Houck Labs.

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

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

**NEW!**
TUBE TESTER #625
KIT $34.95
WIRED $49.95

**NEW!**
PEAK-TO-PEAK VTVM #232 & UNI-PROBE
(pet. pend.)
KIT $29.95
WIRED $49.95

**NEW!**
R-C BRIDGE & R-C-L COMPARATOR #950B
KIT $19.95
WIRED $28.95

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.

www.americanradiohistory.com
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, 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.
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.
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 for use with separate power amplifiers 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-
If two individual preamps are used it is convenient to use an "adapter" to balance them.

der 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.

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.

STEREO 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
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]
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.

LAST 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.
- VI—12AX7 or 12AT7

Nine pin miniature tube socket
Aluminum chassis—1" x 4" x 5"
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—50CS tubes

2—seven pin miniature tube sockets

T1, T2—Output transformers (Stancor A-3849)

---

**NOTE:**
R11, R12 IS A DUAL VOLUME CONTROL

---

November, 1958
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

If 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]
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.

JUST 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."
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 deemphasize 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 subchannel 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.
THE 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 multiwire 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.

November, 1958

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.

Very 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.

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.

Components are installed on the finished shelves with heavier units at the bottom.
ANYONE 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., Dept. 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, Dept. 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., Dept. 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., Dept. 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, Dept. EI
111 Powdormill 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, Dept. 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., Dept. EI
37-06 26th St., Long Island City 1, N. Y.

CATALOGS

STEREO EQUIPMENT FROM AMPLEX
Individual brochures, illustrated in color, on all stereo components available.
Ampex Audio Inc., Dept. EI
1020 Kifer Road, Sunnyvale, Calif.

CERAMIC STEREO CARTRIDGES
Technical data sheets, including diagrams, describing available cartridges.
Astatic Corp., Dept. EI
Conneaut, Ohio

BELL HAS IT
Illustrated booklet describing available stereo equipment.
Bell Sound Systems, Inc., Dept. EI
Columbus 7, Ohio

STEREO EQUIPMENT
Illustrated flyers on the Gyro/Jewel stereo cartridge and the Gyro/Balance arm.
Electro-Sonic Labs, Inc., Dept. EI
35-54 36th St., Long Island City 6, N. Y.

THE FISHER STEREOPHONIC—1959
Brochure of equipment, illustrated in color.
Fisher Radio Corp., Dept. 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, Dept. 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.

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 2 1/2-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—

The 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 torroid-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 explorers, 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-Abie 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.
INFORMATION IS SENT TO EARTH BY PULSES ON 108.03 MC RADIO WAVE

30" TOROID SHAPED MOON ORBITING INSTRUMENT PACKAGE

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 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

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.
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 satellite 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*
IN 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.
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]
Fix Your TV Set

By Lawrence Herrick

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

One 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.

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 HEIGHT: vertical output or osc.

INSUFFICIENT WIDTH: horizontal output, damper, low voltage rectifier, horizontal oscillator.

HORIZONTAL LINE, NO RASTER: vertical output, vertical 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.
SMALL PICTURE, INSUFFICIENT HEIGHT AND WIDTH; Low voltage sect., 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.

November, 1958
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.

WITH 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.

Esco 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.

*November, 1958*
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 rud-[Continued on page 106]
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.

SMALL, 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.
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-265).
- Sun Battery—4 volt Solar Battery (Lafayette No. F-380).
- Chassis—Aluminum, approx. 3½"x4½"x2".
- Battery holder—For (2) Size "C" Cells.
- Large fuse clip—for motor mounting (Union type 31-60A).

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 oversize gear or pulley.

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.

Develop 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.

According 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.
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 tubo-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 ¾" 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 ¾" spacers. Make the neon-winker peep hole in the front apron of the chassis quite small—say ¼"—to keep it subdued and unobtru-

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

**PARTS LIST**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI—8 mfd. 200 v miniature electrolytic</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C2—1 mfd. 200 v paper</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NE-21—Neon lamp</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>PC—Photocell, cadmium sulfide, Hupp</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Powermaster CDS-10</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>R1—130,000 ohm 1/2 w</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>R2—25,000 ohm linear taper potentiometer</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>RY1—Thermal time delay relay, Amperite 115NO40</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>RY2—SPDT, 10,000 ohm coil</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Potter &amp; Brumfield</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>LBS-10,000</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SO—AC chassis receptacle</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SR—Selenium rectifier, 45 ma. 120 v</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SW—DPDT switch</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Chassis—7&quot;x7&quot;x2&quot; black ripple, Bud C8.789</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bakelite—Perforated sheet 7½&quot;x6½&quot;</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Octal socket, bakelite</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Line cord, plug, solder lugs, hardware</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

*November 1958*
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.

My 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 screwdriver 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.

THE 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!

<table>
<thead>
<tr>
<th>CHRISTMAS SUBSCRIPTION RATES:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First 1 year gift</strong></td>
</tr>
<tr>
<td>(regular rate $3.00 per year)</td>
</tr>
<tr>
<td><strong>Second 1 year gift</strong></td>
</tr>
<tr>
<td><strong>Each add’l 1 year gift</strong></td>
</tr>
</tbody>
</table>

In U. S., Possessions and Canada

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

Fawcett Place, Greenwich, Conn.

Special Gift Rates

<table>
<thead>
<tr>
<th></th>
<th>First 1 year gift</th>
<th>Second 1 year gift</th>
<th>Each add'l 1 year gift</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$2.50</td>
<td>$2.50</td>
<td>$2.00</td>
</tr>
</tbody>
</table>

(Restricted Rate $3.00 per year)

Please enter gift subscriptions to ELECTRONICS ILLUSTRATED for:

<table>
<thead>
<tr>
<th>Name</th>
<th>Street</th>
<th>City</th>
<th>Zone</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

My Gift Card(s) Should Read

From —

- Remittance enclosed
- Bill me

My Name:

<table>
<thead>
<tr>
<th>Street</th>
<th>City</th>
<th>Zone</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

www.americanradiohistory.com
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:

<table>
<thead>
<tr>
<th>Rises</th>
<th>Drops</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>300</td>
<td>70</td>
</tr>
</tbody>
</table>

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]
Knight 5-Transistor Portable

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

FROM kit to complete radio in an evening! That's the story of a new 5-transistor portable radio than 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]
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 control 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, TELEMETRYING, 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.

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

---

November, 1958

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 degrees 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.)

VETERANS:

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

CAPITOL RADIO ENGINEERING INSTITUTE

ECFD 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

FIELD OF TRAINING

Greatest Interests

Name ____________________________________________ Age ______

Street ____________________________________________

City _______ Zone _______ State __________

CHECK: [] Home Study [ ] Residence School [ ] Korean Veteran

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

---

FREE

www.americanradiohistory.com
Superior's New Model 77
VACUUM TUBE VOLTMETER
WITH NEW 6" FULL-VIEW METER

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

Model 77 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 12A17 as D.C. amplifier and two 9906’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 microammeter is isolated from the measuring circuit by a balanced push-pull amplifier.

Model 77 uses selected 19° zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

Specifications:
- D.C. Volts — 0 to 3/15/75/150/300/750/1,500 volts at 1 megohms input resistance.
- A.C. Volts (RMS) — 0 to 3/15/75/150/300/750/1,500 volts.
- A.C. Volts (Peak to Peak) — 0 to 46/130/340/500/750/1,500/3,000 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 = 0.006 watt at 6 megohms.
- Center Meter — For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/150/750 volts at 11 megohms input resistance.

Model 77 comes complete with operating instructions, probe and leads. Use it on the bench — use it on call. 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 $42.50.

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

Superior's New Model 79
SUPER-METER
WITH NEW 6" FULL-VIEW METER

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

The Model 79 represents 20 years of continuous experience in the design and production of SUPER-METERS, an exclusive SICO development. In 1938 Superior Instruments Co. designed its first SUPER-METER, Model 1100. In 1948 it followed with Model 1350 and in succeeding years with models 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, but in addition includes those services required by 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.

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 required by 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.

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

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 1,000 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 call. Only $38.50.

EXAMINE BEFORE YOU BUY!
USE APPROVAL FORM ON NEXT PAGE

Electronics Illustrated

www.americanradiohistory.com
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, Fluorescents, 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
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.

Superior’s New Model 82
A truly do-it-yourself type
TUBE TESTER
TEST ANY TUBE IN 10 SECONDS FLAT!

FEATURES:
• Tests over 600 tube types.
• Tests Q.E.D. and other gas-filled tubes.
• Simplifies new 4" meter with sealed air-damping chamber resulting in accurate vibration-less 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.

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

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 boast 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 $36.50

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.0.1., N. Y. C.

Model 77
Total Price $12.50 $12.50 within 10 days. Balance $6.00 monthly for 5 months.

Model 79
Total Price $38.50 $38.50 within 10 days. Balance $6.00 monthly for 5 months.

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

Model 82
Total Price $38.50 $38.50 within 10 days. Balance $6.00 monthly for 5 months.

November, 1958

www.americanradiohistory.com
Knight 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 I₁. Flowing out of A, however, is I₂ amounting to 14 amperes. This is a difference between I₁ and I₂ 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 I₁, which must therefore equal 5 amperes and flow in the direction B to A. Let's check that out.

If I₁ is in fact flowing into A from B, then point A becomes the confluence, like two rivers flowing together, of I₁ and I₂, 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 I₂, also equal to 14 amperes. Thus we see one justification for Kirchhoff's Second Law. But what about the other unknown, the I₂ branch?

We know now that I₁ is 5 amperes, flowing from B to A. And we know that flowing into B is I₂, 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 I₂. 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.
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.

Choose Your Graduate Specialist Schooling From 107 Courses Like These

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

November, 1958
**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.

*Electronics Illustrated*
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 has occupied this entire building. Coyne's modern resident training of men for Television, Radio, Electronics and Electricity has produced thousands of successful graduates.

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 cover, 3 vol. set, 416 pp., $4.95
$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 amazed at how easy it is to learn from these courses.

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

$165, soft cover, 5 vol. set, $10.00
$165-H, cloth bound, 5 vols. in one binding, $11.50

BASIC ELECTRONICS—Vol. 1, diodes and power supplies; vol. 2 and 3, amplifiers and oscillators; vol. 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 house 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., EL-11
116 West 14 St., New York 11, N. Y.

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 monostereo 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 preamp 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.
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

PASTE ON POSTCARD AND MAIL TO:
Prior Service Information, Dept. El-53
Box 7608, Washington 4, D.C.
Please send me more information on the Air Force Prior Service Program.
Name ________________________________ Age ________________________________
Address ___________________________________________________________________
City ___________________________ Zone _______ State _______________________

November, 1958
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 recording where it is desirable for each mike 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 full mike, may be preferable for symphonic recordings where much more depth is 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 comes as a whole other dimension to the average ear. In the home, on the other hand, it is quite possible to get the whole package, as it were, by using the proper equipment and technique.

As new physical dimensions of sound are added by stereo reproduction, our emotional response to it is also improved. The presence of natural space in stereo recordings can be truly appreciated.

All this is a part of the bigger picture of stereo "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, though: even in the midst of the hi-fi excitement and rush of new models and lenses, there is still a place for the old-fashioned "feel" of the old records to be enjoyed.

Stereo has come to stay, and its place in our lives will be determined by our willingness to accept it and adapt to it.
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 ±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.

**Whatever your hobby there is a HEATHKIT for you!**

- **TEST**
  - Model V-7A VTVM, $24.50

- **HI-FI**

- **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 COMPANY** BENTON HARBOR 39, MICH.
a subsidiary of Daystrom, Inc. I'm interested in the following type of equipment: □ TEST, □ HI-FI, □ HAM GEAR, □ MARINE.

name
address
city & state

November, 1958
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. El-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 obliga-
tion 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 Fair-
child 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 con-
trol 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 func-
tion, but only with certain Bogen am-
plifiers.

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 sys-
tems using separate monaural preamps
and power amplifiers, or using two iden-
tical 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
c 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 ampli-
fiers 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 dupli-
cated, 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,
How To Get an FCC License (Commercial) Accredited by the National Home Study Council

good training doesn’t cost ... if pays!

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 $3 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., Cleveland 3, Ohio

November, 1958
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 DICONARY OF PHYSICS AND
ELECTRONICS explains more than
12,000 laws, relationships, equations, basic principles, instruments, apparatus and techniques. Everything from alphabetic, band
and cyberspace to Wankel, Fem and Zwillitzeion.

Save time. Avoid costly errors.
Unique system of cross referencing helps you locate the
information you want instantly. Bold-face word "signals" refer
you to related articles.

You’ll turn to this giant 1000-
pag2 volume dozens of times a
day - to recheck your work, to
clarify technical articles or enig-matize 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 address.
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.

16 Books in One
Electronics Litilads
Mechanics Optics
Units and Dimensions
General Principles
Nuclear Physics
Mathematical Physics
Quantum Mechanics
Mathematical Physics
Electrical Engineering

See the Stars, Moon, Planets Close Up!
3" ASTRONOMICAL
REFLECTING TELESCOPE

60 to 160 Power — An Unusual Buy!

FAMOUS MT. PALOMAR TYPE!
Astrograph — 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. Galilean Equatorial mount
with lock on both axes. Aluminized with overcoated 3" diameter
magnapoint f/16 mirror. Telescope comes equipped with a 30x 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 copy: Valuable STAR CHART
and 272 page "Astronomy Book" — $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. Blends
into the room decor. No special wiring needed. Can be
hooked to a motor in opposite directions. Metal collector brushes
pick up the static electricity, done in the Leyden Jar type
condenser until discharged by the jumping spark. Count-
less trunks and experiments. 91 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 ppspd.

Send Check or M.O. Money-Back Guarantee.

COLOR TV TUBESCOPE
Ruves time. effort in alignment of color dot pattern.

Stock No. 50,159-EB — 22 power — $24.50 ppspd.

Send Check or M.O. — Money-Back Guarantee.

WRITE FOR FREE CATALOG "EB"!
Complete line of Astronomical Telescope Parts and Assembled Tele-
sopes. Satellite Crystal for two huge projection of time grain, surplus optical instruments, parts and accessories. Telescopes, micro-
scopes, binoculars, etc. Send for "EB" catalog!

GUARANTEED 100% 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 directed.
Consequently, goes the explanation,
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
company. 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
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.

Electronics Illustrated
BIG NEWS!

A RONDINE TURNTABLE IN KIT FORM

only $39.95

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

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 specialty-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!
- 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.E1 22, 38-19 108th St., Corona 68, N.Y.
Please send me your new 1958 Catalogs.

NAME

ADDRESS

CITY * ZONE STATE

November, 1958

www.americanradiohistory.com
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.
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

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 megohms. Checks capacity from .01 to 1 mfd.
Model 204P (illustrated) $55.90
Cathode Ray Tube Adaptor available $4.50

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-
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

TESTMASTER, INC.
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.

MAIL THIS COUPON TODAY! NO OBLIGATION TO BUY—YOU MUST BE SATISFIED!

Name
Address
City Zone State
All prices net, F.O.B. N. Y. C.
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, the new tube is 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!

OE2 5KB 5686 6836 6837 6857 6977 7027 7037 7067 7136 7147 7236 7247 7347 7376 7387 7427 7437 7487 7497 7527 7537 7547 7557 7567 7587 7597 7637 7647 7687 7697 7737 7747 7787 7797 7837 7847 7887 7897 7937 7947 7987 7997 8037 8047 8087 8097 8137 8147 8187 8197 8237 8247 8287 8297 8337 8347 8387 8397 8437 8447 8487 8497 8537 8547 8587 8597 8637 8647 8687 8697 8737 8747 8787 8797 8837 8847 8887 8897 8937 8947 8987 8997 9037 9047 9087 9097 9137 9147 9187 9197 9237 9247 9287 9297 9337 9347 9387 9397 9437 9447 9487 9497 9537 9547 9587 9597 9637 9647 9687 9697 9737 9747 9787 9797 9837 9847 9887 9897 9937 9947 9987 9997 10037 10047 10087 10097

FREE TUBE WITH ANY ORDER OVER $100

Guarantee: We guarantee to replace free for one (1) year any tube purchased from us which fails to function efficiently. Any tube purchased in actual operating conditions will be replaced immediately for any defective merchandise. Made promptly in the factory, these tubes are the tube manufacturers tube and are so warranted.

Guarantee for Equipment: We guarantee to replace free for one (1) year any equipment purchased from us which fails to function efficiently in actual operating conditions. Any equipment purchased in actual operating conditions will be replaced immediately for any defective merchandise. Made promptly in the factory, this equipment is the equipment manufacturer's equipment and is so warranted.

Free Postage in U.S.A. and Territories. Free postage on orders over $5.00. 25c handling charge on orders under $5.00. 25c deposit required on C.O.D.'s. Please send approximate postage or freight on Canadian and foreign orders. Subject to prior sale.

WE HAVE OVER 1000 USED TV SETS

All TV's in our huge warehouse. Buy one or more of these working TV's to sell or use as your own second set. All sets are in GOOD WORKING condition. Your Choice—Console or Table Model.

10”...$23.00 19”...$45.00
24”...$50.00 25”...$58.00
25”...$60.00 28”...$64.00
28”...$76.00 32”...$84.00

When ordering TV's, state whether console or table model is desired. Also, preference on make of set. All TV's sent rail express F.O.B. Newark. On any quantity, Wire or Call today!

FREE POSTAGE in U.S.A. and Territories. Free postage on orders over $5.00. 25c handling charge on orders under $5.00. 25c deposit required on C.O.D.'s. Please send approximate postage or freight on Canadian and foreign orders. Subject to prior sale.

FREE POSTAGE in U.S.A. and Territories. Free postage on orders over $5.00. 25c handling charge on orders under $5.00. 25c 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

November, 1958

EEE 9-15 6TH ST., HARRISON, N. J.
continued from page 59

Shooting for the Moon

With the scanner entering 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.
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.

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 48 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 cost $28, but take 60 recharging. 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.

---

November, 1958
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.

UNITED STATES commemoration containing 13 different stamps. White, 513-M Avenue 30, New York.

225 STAMPS FOR ONLY $1.

ECONOMICAL VS-3c APPROX, Verichrome, Dorel, Box Englewood, N. J.


100 OLD UNITED States by 1935, $1.00. Roush Chestnut, Mansfield, Ohio.

TRADE YOUR duplicates for provols. (Foreign Only) for detailed information, 10c. (1)


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.  

Electronics Illustrated
For Stereophiles Only

Continued from page 53

THE INTEGRAND STORY
Description of the Stereo Servo Speaker System.
Integrand Corp., Dept. El
c/o Brand Products, Inc.
11 Lorimer St., Brooklyn 6, N. Y.

BULLETIN JH-1
An illustrated brochure on stereo systems
Jensen Manufacturing Co., Dept. El
6601 S. Laramie Ave., Chicago 38, Ill.

STEREO FROM MADISON FIELDING
Descriptive material on available equipment.
Madison Fielding, Dept. El
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., Dept. EL
9101 King St., Franklin Park, Ill.

STEREO EQUIPMENT
Illustrated catalog of new stereo hi-fi equipment,
especially designed by the noted industrial de-
signer, George Nelson.
Rek-O-Kut Company, Dept. El
38-19 108th St., Corona 58, N. Y.

STEREO CARTRIDGES
Flyers describing new stereo cartridges.
Ronette Sales Corp., Dept. El
190 Earle Ave., Lynbrook, N. Y.

STEREO REPRODUCERS
Colorful, illustrated brochure on stereo tuners
and amplifiers.
Sargent-Rayment Co., Dept. El
4926 E. 12th St., Oakland 1, Calif.

STEREO PROFESSIONAL DYNETIC
Illustrated flyer and technical data sheet on this
new stereo cartridge.
Shure Brothers, Dept. El
322 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., Dept. El
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, Dept. El
10 E. 52nd St., New York 22, N. Y.
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.
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 are of 30° permits accurate readings. Accuracy within 3/4 of full scale. Currently available in 18 popular ranges. Immediate delivery.

Send Check, M.O. or Cash: shipped prepaid: Money Back Guarantee.


Nelson Hall Co., 210 S. Clinton, Dept. SLS-45, Chicago 6

FREE Illustrated Instruction book shows you how to get correct answers instantly without pencil and paper. (You get 10" rule and instruction book for only 98c postpaid. Satisfaction guaranteed or refund.)

Satisfaction Guaranteed or Refund!!


Locksmithing Making and Key

Today's Home Building and Remodeling

A Fawcett Publication

At your Favorite Newsstand—50¢

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.

"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: Oregan 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 ____________

November, 1958
FREE Lafayette 1959 CATALOG
260 GIANT-SIZED PAGES!

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 & MONOAURAL REPRODUCTION

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 monoaural 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

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

Send FREE CATALOG 590

Name ____________________________
Address ____________________________
City ____________________________ PASTE ON POSTCARD
Zone ____________________________ State ____________________________
"Lucky Guys...Good Pay, Good Fun"

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.

Mail Postage-Free Card For SAMPLE LESSON and 64 Page Catalog FREE SEE INSIDE

Learn RADIO By Practicing

People look up to a great and are moved your spare time, you Fast Growing

NATIONAL RADIO INSTITUTE
Washington 16, D.C.

BUSINESS REPLY CARD
Postage will be paid by
No Postage stamp necessary if mailed in the United States

FIRST CLASS
(see 3461A & B)
Washington, D.C.

www.americanradiohistory.com
the stereo space problem is solved...

with the ELECTRO-VOICE STEREON

matching Electro-Voice and all other high quality systems

Now, for the first time, you don't need two full-range speakers to enjoy the added third dimension of stereophonic sound...thanks to a new application by Electro-Voice engineers of a basic principle of acoustics. As early as 1934 it was 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 quality 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 STEREON, an uncompromised second channel loudspeaker to match even the largest bass producer...a compact, functional furniture piece allowing greatest placement flexibility for optimum stereo.

The STEREON is designed to complement any full-range speaker by reproducing only those frequencies required for stereo, thus eliminating your need for a second expensive bulky enclosure.

HERE'S WHAT HAPPENS:

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

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

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

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

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

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

ELECTRO-VOICE, Inc.
Buchanan, Michigan

STEREO'S STANDARD

STEREON III—3-way system for use with high efficiency systems.

- Uses MT30 mid-bass coaxial assembly and T35 VHF driver, built into integral 200 cps taper horn. Integral crossover network limits overall input to signals above 300 cps.
- Order driver only: 35 VHF (T35); 135 VHF (T335).
- Uses high quality, full-range speakers in both channels.
- STEREON begins with the E-V totally compatible STEREON Cartridge—already the accepted standard.

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

XX3 STEREON CONTROL FILTER—For use with Electro-Voice STEREONS. Uses matching transformer and crossover network components. All signal of 1st channel above 300 cps feeds STEREON; all signal below 300 cps from this channel is combined with full range output from second channel to utilize full bass reproduction capabilities of a single full range system. Input impedance from both amplifiers 8 ohms, output impedance 16 ohms nominal. Size: 5%" high, 4%" wide, 5%" deep. Shipping weight: 8 lbs. Net ........................................ $30.00

STEREONs FOR CAR--Stereo loudspeaker of high compactness, designed to match systems using regular flat horn tweeters. Uses MT30B and T35B driver components. Shipping weight: 12 lbs. Net ........................................ $180.00

STEREON 1B—Identical to STEREON III, for use with normal efficiency systems. Uses MT30C and T35C driver components. Shipping weight: 33 lbs. Net ........................................ $99.50

STEREO II—Use STEREON II, 3-way system for use with low efficiency systems.

- Uses MT19 mid-bass coaxial assembly and T15 VHF driver, built into integral 200 cps taper horn. Integral crossover network limits overall input to signals above 300 cps.
- Order driver only: 15 VHF (T15); 20 VHF (T20).
- Uses high quality, full-range speakers in both channels.

STEREO III—3-way system for use with low efficiency systems.

- Uses MT30 mid-bass coaxial assembly and T35 VHF driver, built into integral 200 cps taper horn. Integral crossover network limits overall input to signals above 300 cps.
- Order driver only: 35 VHF (T35); 135 VHF (T335).
- Uses high quality, full-range speakers in both channels.

STEREON 1C—Identical to STEREON III, for use with normal efficiency systems. Uses MT30D and T35D driver components. Shipping weight: 33 lbs. Net ........................................ $99.50

STEREO II—Use STEREON II, 3-way system for use with low efficiency systems.

- Uses MT19 mid-bass coaxial assembly and T15 VHF driver, built into integral 200 cps taper horn. Integral crossover network limits overall input to signals above 300 cps.
- Order driver only: 15 VHF (T15); 20 VHF (T20).
- Uses high quality, full-range speakers in both channels.

STEREON 1D—Identical to STEREON III, for use with normal efficiency systems. Uses MT30E and T35E driver components. Shipping weight: 33 lbs. Net ........................................ $99.50

STEREO V—5-way system for use with all low efficiency systems.

- Uses MT50 mid-bass coaxial assembly and T50 VHF driver, built into integral 200 cps taper horn. Integral crossover network limits overall input to signals above 300 cps.
- Order driver only: 50 VHF (T50).
- Uses high quality, full-range speakers in both channels.