Exclusive Test Report: HOW GOOD ARE STEREO RECORDS?

ELECTRONICS ILLUSTRATED

25c NOVEMBER

Watch TV Anywhere with NEW TRANSISTOR-BATTERY PORTABLES

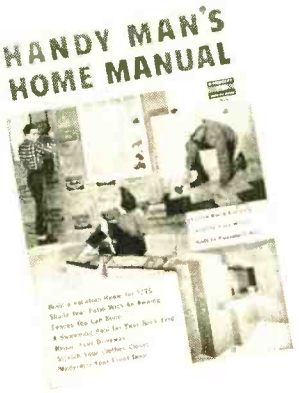
All About:

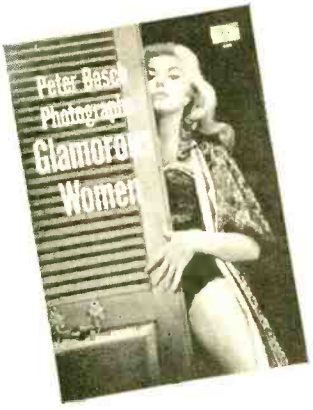
Short Wave Receiver Kits • Rebuilt TV Picture Tubes

MECHANIX ILLUSTRATED

By the Publishers of

FAWCETT HOW-TO BOOKS





HANDY MAN'S HOME MANUAL • Block flooring, insulation, built-ins, fences, swimming pool, etc. (No. 426)

Peter Basch Photographs GLAMOROUS WOMEN • Fashion, theater, foreign pin-ups, 200 photos. (No. 425)

Electronics Illustrated HI-FI HANDBOOK • Preamps, cartridges, changers, tuners, AM, FM, stereo. (No. 424)

HOME IMPROVEMENTS You Can Do • Build kitchens, basement playroom, garage, closet, built-ins. (No. 423)

GOOD PHOTOGRAPHY • Beauty portraits, animals, closeups, nudes, fog photos, jazz impressions. (No. 422)

STOCK BUYING GUIDE • Investment clubs, mutual funds, retirement, penny stocks, debentures. (No. 421) Also available in hard cover edition at $2.50 per copy.

ATTIC AND BASEMENT IDEAS • Proper planning, stairways, panel walls, ceilings, flooring, etc. (No. 420)

FRED RUSSELL'S CAR CARE • Power steering, carburetors, radiators, tires, batteries, brakes. (No. 419)

LUCIAN CARY ON GUNS • Streamlined firepower, preserve shooting, air guns, rifles, equipment. (No. 418)

RUSSIA and THE BIG RED LIE • Exposes hoax of Soviet supremacy; missiles, air power, space. (No. 417)

Electronics Illustrated HAM RADIO HANDBOOK • Mobile rigs, transmitters, receivers, codes, etc. (No. 416) Also available in hard cover edition at $2.50 per copy.

PRIZE WINNING PHOTOGRAPHY • Nudes, portraits, children, news, glamour, sport, animals, action. (No. 415)

PLYWOOD PROJECTS You Can Build • Headboards, desk, cabinets, tables, racks, bookcase, divider. (No. 414)

How To Build and Race HOT RODS • Go Karts, dragsters, sports rods, soup T-Bird & Chev V-8, etc. (No. 413) Also available in hard cover edition at $2.50 per copy.

PHOTOGRAPHING GLAMOUR • Gowland, Ornitz, Meyer, Yulsman, Jerger and many others. (No. 412)

WATER SKIING HANDBOOK • Fundamentals, equipment, driving boats, motors, jumping, shows. (No. 411)

PHOTOGRAPHY HANDBOOK • Underwater nudes, camera tricks, offbeat glamour, montages. (No. 410)

TV REPAIR AND MAINTENANCE • Receivers, tubes, sockets, sound, antennas, trouble shooting. (No. 409)

NEW GOLF SECRETS OF THE PROS • Hogan, Venturi, Snead, Middlecoff, Casper, Ford, etc. (No. 408)

HOW TO BUILD • Outdoor barbecues, patios, terraces, swimming pools, walls, fences, paths, steps. (No. 407)

BOATING HANDBOOK • Piloting, sail racing, hull and engine care, build a dock, outboards. (No. 406)

CANDID PHOTOGRAPHY • Nudes, glamour, children, humor, animals, camera news, salon section. (No. 405)

To order direct, send 75c per copy for regular edition or $2.50 per copy for De Luxe edition to: FAWCETT BOOKS, Dept. EI-11, Greenwich, Conn. Add 10c per copy mailing charge for all books. Specify title and number. Canadian orders cannot be accepted.

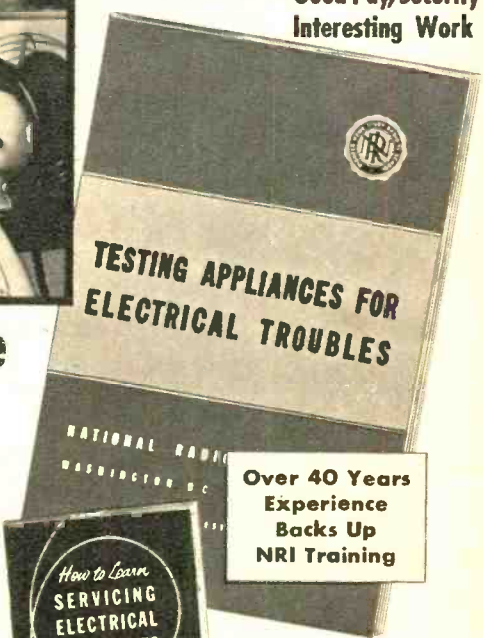
A FAWCETT HOW-TO BOOK 75¢

AT YOUR LOCAL NEWSSTAND, LEADING DRUG STORE, SUPER MARKET, HARDWARE STORE AND BUILDING SUPPLY DEALER

Make More Money Soon Fixing Electric Appliances

Actual Lesson FREE

Fast Growing Field Offers Good Pay, Security Interesting Work



Over 40 Years Experience Backs Up NRI Training

Learn at Home in Spare Time

Earn more money. Enjoy doing important, interesting work. Learn Electrical Appliance Servicing. This is a field of increasing opportunity. Today every wired home has many electrical appliances and millions and millions of new appliances are made and sold each year. Find out more about this great, growing field. Find out how NRI can train you, at home and in spare time to be an Appliance Service Technician. See how you can start soon to make extra money servicing appliances.

Add to Your Income Soon After Enrollment

Opportunities Increasing for Service Technicians

NRI Training is practical, thorough. You get easy-to-understand lessons, *and* NRI supplies parts to build professional type Multi-Use Tester. Use it to get practical experience. Soon, you can add to your income by servicing appliances. Build a profitable *sideline* for your spare time—qualify for a good job—develop a business and be your own boss. As an Appliance Service Technician, your opportunities are broad—your services wanted, gladly paid for, highly regarded in your community.

Appliances are necessary to comfortable, convenient living. Owners pay well to keep them in repair. The field is amazingly big. In addition to major appliances such as electric ranges, air conditioners, refrigerators, there are over 40,000,000 electric irons, 5,000,000 electric blankets, 15,000,000 coffee makers, plus more millions of vacuum cleaners, fans, toasters, mixers, etc.

Find Out What Appliance Repair Offers You

Learn and Earn With Tester Diploma When You Finish

Locate appliance troubles easily with Portable Appliance Tester you build. You use it to learn and do actual electric appliance repair jobs. For only $3.00 with enrollment and $6 per month, get training including Tester—a small price to pay for increased earnings. Mail coupon for Sample Lesson and Book—your first step toward more interesting work, bigger earnings. **NATIONAL RADIO INSTITUTE, Dept. KM9, Washington 16, D. C.**

Mail Coupon FOR LESSON AND BOOK FREE

National Radio Institute
Dept. KM9, Washington 16, D. C.

Please send me Electric Appliance Servicing Lesson and Book FREE. (I understand no salesman will call.)

Name_____ Age_____

Address_____

City_____ Zone____ State_____

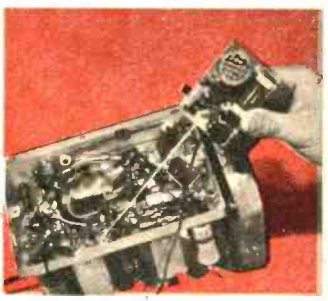
ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

ELECTRONICS ILLUSTRATED

NOVEMBER, 1959 Vol. 2, No. 11

A FAWCETT PUBLICATION

CONTENTS



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

EDITORIAL AND ADVERTISING OFFICES: 67 West 44th Street, New York 36, N. Y.

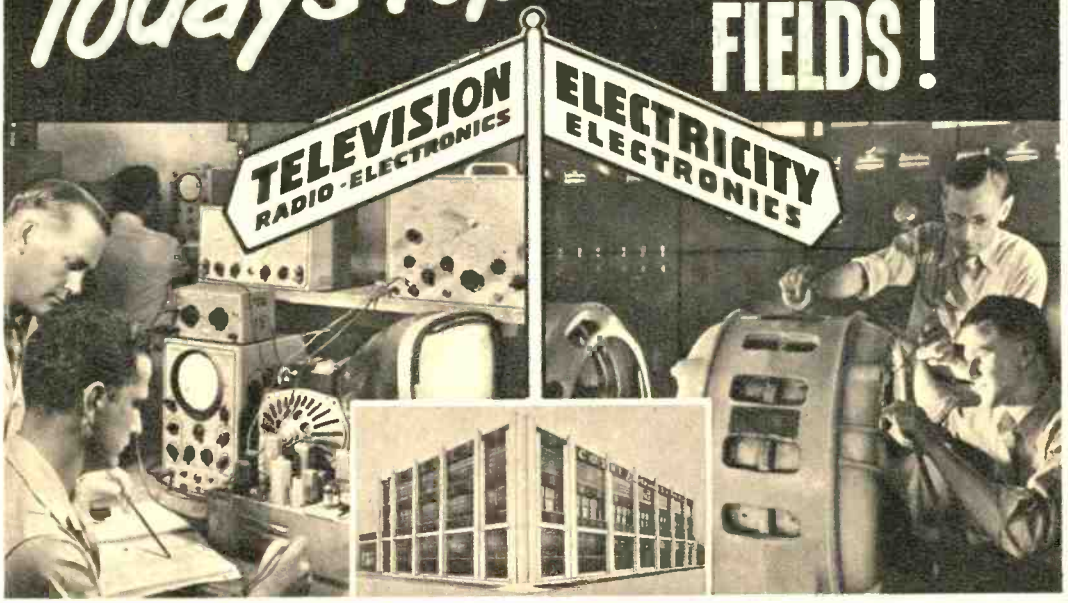
ADDRESS ALL MAIL: Subscriptions, change of address, Form 3579 to Circulation Dept., Fawcett Bldg., Greenwich, Conn.; and all editorial and advertising to Fawcett Publications, Inc., 67 W. 44th St., New York 36, N. Y.

Second-class postage paid at Greenwich, Conn., and at additional mailing offices.

Subscription price $3.00 per year in the U. S. and possessions and Canada. All other countries $6.00 per year. Foreign subscriptions and sales should be remitted by International Money Order in U. S. funds payable at Greenwich, Conn.

Printed in U.S.A.

Train in New Coyne Shop-Labs for Today's Top OPPORTUNITY FIELDS!



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

This modern fire-proof building which is occupied entirely by Coyne, houses the NEW COYNE SHOP-LABS.

Instructor explaining operation and testing of a large Motor Generator.

TELEVISION-RADIO ELECTRONICS

Here at COYNE you're trained for Testing, Trouble-Shooting and Servicing on AM and FM Radio, Auto Radio, Television, Color TV, 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—over a quarter of a million dollars worth—plus necessary technical training right here in the *NEW* COYNE *Shop-Labs.*

Training in Refrigeration and Electric Appliances can be included.

Training offered to VETERANS and NON-VETS alike

START NOW—PAY LATER

Enroll now, pay most of tuition after Graduation. Part time employment help for students. Lifetime employment service to Graduates. Starting dates, every six weeks.

B. W. COOKE, JR., President **COYNE ELECTRICAL SCHOOL** FOUNDED 1899

CHARTERED AS AN EDUCATIONAL INSTITUTION NOT FOR PROFIT
1501 W. Congress Parkway, CHICAGO, Dept. 89-8C
ELECTRICITY • RADIO • TELEVISION • REFRIGERATION • ELECTRONICS

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

Send Coupon or Write for

FREE BOOK

"GUIDE to CAREERS"

Whether you prefer Electricity—Television—Radio or Combined Electronics Training this book describes all training offered.

Information comes by mail and no salesman will call.

To get Free Book and information, mail this Coupon in envelope or Paste on Postal Card, or write to address below.

COYNE ELECTRICAL SCHOOL, Dept. 89-8C
1501 W. Congress Pkwy., Chicago 7, Ill.

At no obligation to me send FREE book "Guide to Careers" and details of all the training you offer. However, I am especially interested in:

☐ ELECTRICITY ☐ TELEVISION ☐ BOTH FIELDS

Name_____

Address_____

City_____ State_____

(I understand no Salesman will call.)

A Message From the Editor

WELL here we are in the middle of the hi-fi season. Chicago and New York have had their hi-fi shows, there is one now going on in Kansas City and very soon there will be one in Los Angeles. Stereo once again is stealing the show. For this reason the stereo record report in this issue merits your special attention. The information we gathered during our heartbreaking destruction of good records for this exclusive laboratory test report should increase your enjoyment of stereo records and help save those which you treasure most. We would like to take this opportunity to thank the Glaser-Steers, Garrard, Miracord, Heath and Webcor companies for submitting their record changers and the Shure, Electro-Voice, General Electric, Argonne, Pickering, Fairchild, Dynaco and Ronette companies for lending their stereo cartridges. Our thanks also to the various record companies who sent us records for these tests, especially London whose new recording of Petrushka we so mercilessly played to destruction.

Worthy of note in these back-to-school days is a new approach to public school education that could offer significant economies in overall school budgets while increasing quality of education. In this proposal by an executive of General Electric, a system of about four educational TV stations would serve all schools within a radius of 30 to 40 miles. These stations could be built for less than the average cost of one new classroom per district or about $28,000. The operating cost per student would break down to about $8.42 annually. This is less than 2% of the average $493 percent cost of education per student annually. The TV stations would permit an average of ⅓ of the school day to be taught by television in each of the grades, 1 through 12. Educational television has in the past been proposed as the only way that a vast number of students of all ages can be reached by the best teachers effectively, and this may be one step in this direction.

Many listeners to the shortwave bands may not know that an organization in Great Britain runs a contest strictly for them. This contest is being held on November 21 and 22 this year by the Radio Society of Great Britain. Actually there are two contests run simultaneously, one for radio amateurs, the other for shortwave listeners. These are separate and distinct and there are prizes awarded for the top entries in each. For additional information write to the Con-

Groove breakup was visible halfway through tests.

test Committee, Radio Society of Great Britain, New Ruskin House, Little Russell Street, London, W.C. 1, England. Indicate the name of the contest you are interested in clearly at the top left hand corner of the envelope, and Good Luck!

Your editor visited the New York City Coliseum when the Russian Exhibition was in progress. I was accompanied on this trip by Mr. Lloyd Mallan author of Fawcett book, "Russia and the Big Red Lie," who spent two months travelling throughout Russia visiting top research labs, satellite tracking stations, etc. His comments comparing what the Russians displayed at the Coliseum with what he actually saw in their country were so enlightening that we are bringing them to you in an interview right off the tape recorder.

In our continuing tests with the new Class D Citizens Radio band, we recently erected a large ground plane antenna on the roof of our building and installed quarter-wave whip antennas on our cars. All of our tests to date indicate that the reception and distance covered depends to a great degree on the antennas used. If you plan to get the most out of your new two-way radio, read the article in this issue on antennas for this band. Incidentally, a recent notice from the FCC reports that of 100 violation notices sent out to licensees of Class D stations, Section 19.61 (c) of FCC Rules and Regulations was violated in 61 instances. This section requires that you be brief and to the point while on the air. Forty-four violators were would-be hams using this band for long distance rag chewing. There were also 57 instances of off-frequency operation. This band was given to us for a specific purpose—it can be taken away for excessive violations. The FCC will continue to monitor Citizens Radio frequencies. Let's keep this band!

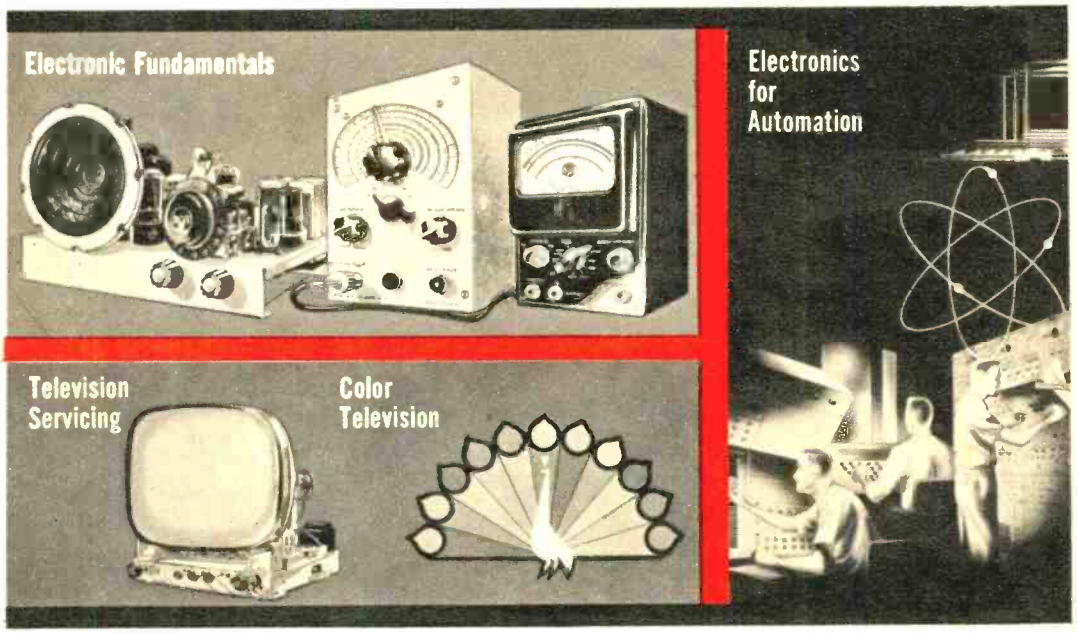
Charles Tuffer

LET RCA TRAIN YOU IN ELECTRONICS

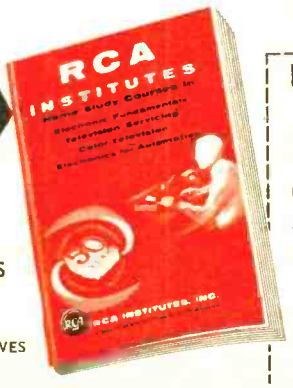
RCA Institutes celebrates Fifty Years of Electronic Training by introducing its newest Home Study Course . . .

ELECTRONICS FOR AUTOMATION

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



Send for our 64 page Home Study Catalog FREE!



FOR RESIDENT SCHOOL COURSES SEE AD ON OPPOSITE PAGE

ANOTHER WAY RCA SERVES EDUCATION THROUGH ELECTRONICS

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

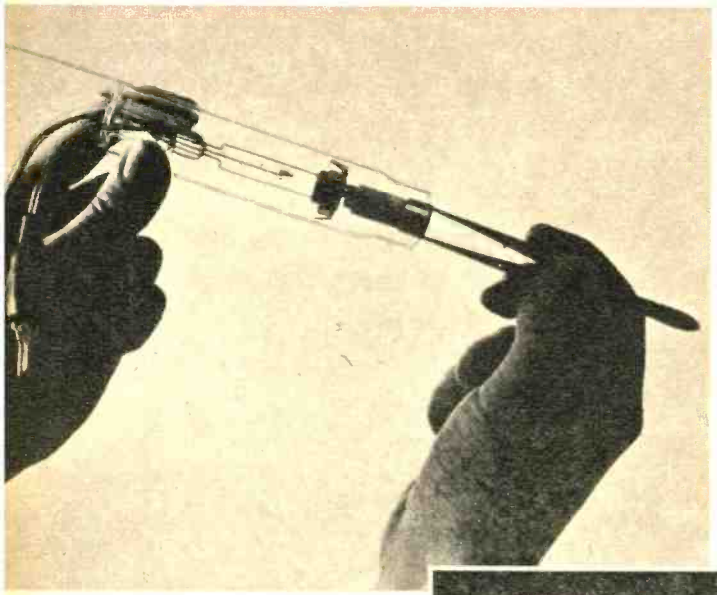
RCA INSTITUTES, Inc. Home Study School, Dept. EI-119
A Service of Radio Corporation of America
350 West Fourth Street, New York 14, N. Y.

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

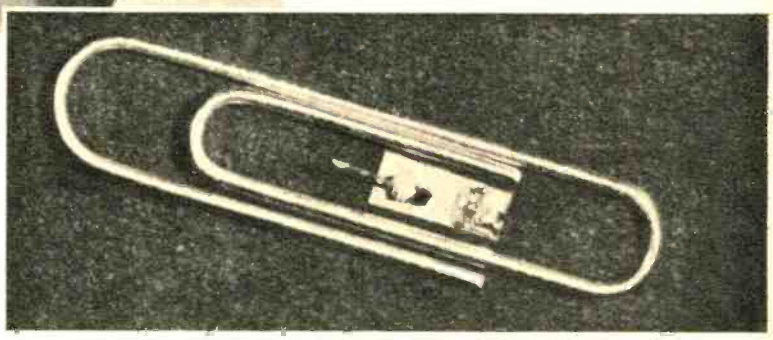
Name .....
Please print
Address .....
City ..... Zone ..... State .....
Korean Vets! Enter Discharge Date .....

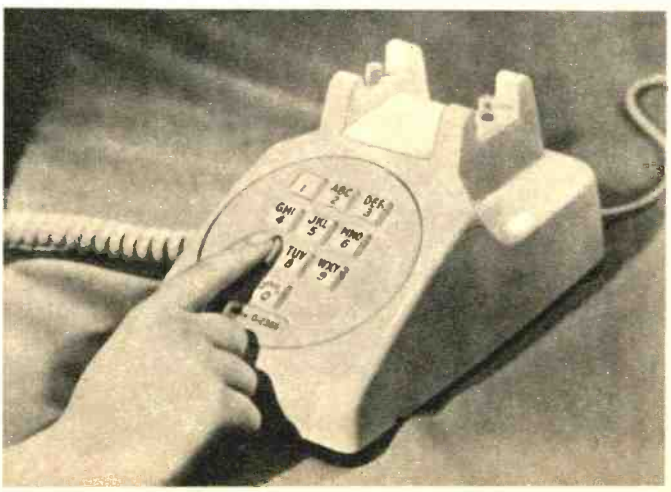
CANADIANS — Take advantage of these same RCA courses at no additional cost. No postage, no customs, no delay. Send coupon to: RCA Victor Company, Ltd., 5001 Cote de Liesse Rd., Montreal 9, Quebec
To save time, paste coupon on postcard.

Electronics in the News



In all the hubbub about tubes vs. transistors one idea has been up to now avoided, why not combine the two? Now, some Westinghouse scientists have used the semiconductor silicon carbide to emit electrons when it breaks down under high voltage in a vacuum tube (above). In the meantime, G-E has introduced the transistor-like tunnel diode shown at right. It is easy to make, and works at VHF frequencies.





Speed-conscious Americans have triumphed again as Bell Laboratories manufactures the pushbutton telephone. Designed for attractiveness and ease in calling, model at right shows the final arrangement of the buttons as decided by human-factor tests. A switching system, called "translator," has been developed to adapt existing central telephone offices to this new method.

the Best News in electronic kits for 1960

world's easiest-to-build kits

SAVE UP TO 50%

BEST...by Design!

BUILD THE BEST

Y-774 Deluxe 40-Watt Stereo Amplifier (with Center Channel) **$79.50**
only $5 down

R-100 Amateur Communications Receiver (Hi-gain, with built-in Q-Multiplier) **$104.50**
only $5 down

Y-713 Citizen's Band Transceiver **$39.95**
only $2 down

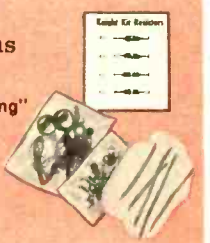
with the exclusive ***knight-kit***

MONEY-BACK GUARANTEE

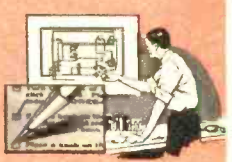
KNIGHT-KITS are an exclusive product of Allied Radio. Every KNIGHT-KIT meets or exceeds published specifications, or we refund your money in full.

BUY ANY KNIGHT-KIT! BUILD IT! IT MUST PERFORM EXACTLY AS CLAIMED
– OR WE REFUND YOUR MONEY!

only *knight-kits* have "CONVENIENCE ENGINEERING" for easiest building...no previous electronic experience needed



Exclusive in Knights-Kits, "convenience engineering" means special attention to every detail: resistors are carded and numbered for easy selection...all parts and hardware are packaged in clear plastic bags for easy identification...wire is precut, stripped, tinned and color-coded to save time... special printed circuitry is used to eliminate complex wiring...all parts are top premium quality...you get everything—even the solder! Finally, Knight-Kit instructions are clear as crystal; step-by-step procedure and wall-sized picture diagrams make assembly a marvel of simplicity. Your final reward is proud enjoyment of the superior performance designed into your Knight-Kit.



SEE THEM HERE

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

FREE send for the value-packed

1960 ALLIED CATALOG

Write for the 1960 ALLIED Catalog featuring the complete KNIGHT-KIT line—see the big news in electronic kits—get this leading Buying Gulde for everything in Electronics. Send for your FREE copy.

ALLIED RADIO CORP., Dept. 164-L9
100 N. Western Ave., Chicago 80, Ill.

☐ Send FREE 1960 ALLIED Catalog

Name_____

Address_____

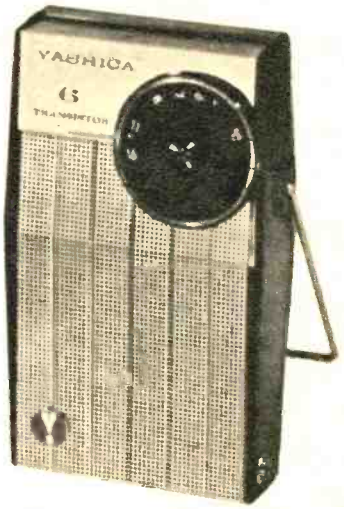
City_____ Zone____ State_____

Pioneers in the development of the world's finest electronic kits

our 39th year

THE WORLD'S LARGEST ELECTRONIC SUPPLY HOUSE

. . . News



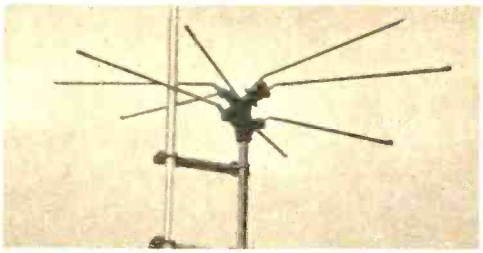
Yashica, a name long associated with cameras, is now appearing on transistor radios. The new Yashica YT-100 portable employs a superhet six-transistor printed circuit with a frequency range covering the complete AM broadcast band. Measuring 2¾"x4⅝"x1⅜", it has a high-impact case. $39.95/with earphone, battery and leather case.

—o—

A new line of cartridges has been announced by General Electric. Called the VR-22 series, two stereo units are available; the VR-225, with a .5 mil diamond stylus for professional turntable systems and the VR-227, with a .7 mil stylus for record changer and turntable use. The VR-225 is said to have a 20-20,000 cycle frequency response within 3 db and a tracking force of 2-4 grams. The VR-227 is claimed to have a frequency response of 20-17,000 cycles, and a tracking force of 5-7 grams. The cost of the VR-225 is $27.95 and $24.95 for the VR-227.

Electronics Illustrated

. . .News



JFD Electronics Corp. announces a new series of FM antennas for primary, secondary and fringe areas. The Stereo Cone design consisting of 8 multi-element dipoles is packaged in two forms: the "Attach-It" for existing TV Antenna installations and also as a complete kit with all accessories. JFD is also producing a special FM Folded Dipole and Reflector Kit, and a Stereo Fringe FM antenna featuring a 6-element Satellite dipole Yagi System. Prices are $15.95 for the AFM 100 Stereo Cone Kit for new installations; $13.95 for the AFM 150 Stereo Cone "Attach-It," $14.95 for the AFM 200 Stereo Folded Dipole Kit; and $23.50 for the AFM 300 FM Yagi.

A Shield remote speaker with a built-in volume control has been made available by Olson Radio Warehouse. Volume control will not affect other speakers connected to sound source. Model CA-121 has a walnut casing in a high gloss finish with contrasting plastic grille. Its 4" PM speaker rated at 3 watts can be used with any phonograph, radio, TV or intercom. One of the 8"x5¾"x 4⅛" speakers is priced at $5.19—3 for $15. Olson Radio Warehouse, 260 S. Forge Street, Akron, Ohio.

AT LAST!

RADIO-TV and ELECTRONICS TRAINING

....AT A PRICE YOU CAN AFFORD!

*21 INCH
Receiver Kit included

COMPLETE **COLOR** INSTRUCTION INCLUDED

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

Think of it — a complete training program including over 120 lessons, Fourteen 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 Many More Shops This Year

This 37 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, a great many such shops are NOW IN BUSINESS AND PROSPERING. We are helping and training ambitious men to become future owners and operators of these shops in all areas.

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

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

RTS APPROVED SERVICE SHOP

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

We supply and finance your equipment

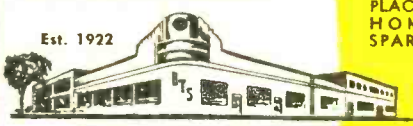
When you are ready and qualified to operate one of our RTS-Approved TV Repair Shops ***WE WILL SUPPLY AND FINANCE EVERY BIT OF EQUIPMENT YOU NEED TO GET STARTED*** plus an inventory of parts and supplies. In other words *we will stake you* . . . **AN OFFER NEVER MADE BEFORE BY ANY TRAINING ORGANIZATION.**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

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

you build these and other units

*tubes excluded

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



ACT NOW!

ASSOCIATION OF HOME STUDY SCHOOLS

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

ALL THESE FREE!

CUT OUT AND MAIL — *TODAY!*

RADIO-TELEVISION TRAINING SCHOOL
5100 S. Vermont Avenue, Dept. EI-119,
Los Angeles 37, California

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

☐ Radio-Television ☐ Industrial Electronics (Automation)

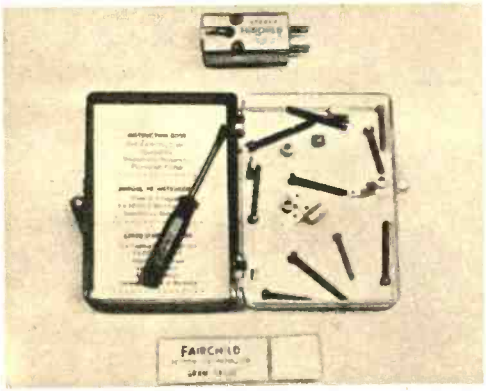
Name _____ Age _____
please print

Address _____

City & State _____

300

. . . News



Have you ever had to search for the correct size tools while you're trying to install a hi-fi cartridge? Fairchild Recording Equipment Corp. has solved this annoying problem by including a kit complete with all the tools necessary to install their new SM-1 monophonic and stereo cartridge. A stylus gauge, and directions in English, French and Spanish are also included. The complete kit, with cartridge of course, is priced at $34.95 from Fairchild at 10-40 45th Avenue, Long Island City, New York.

—o—

The Vandel Alarm, a centralized sound surveillance system designed by Bogen-Presto, detects the presence of any intruder unbeknown to him. Loudspeakers operating as microphones are placed in the building. When the noise level of an area rises, an alarm is sounded in the watchman's station signalling trouble may be brewing. The operator can turn off the alarm and listen for suspicious sounds picked up by the loudspeaker-mike.

—o—

IBM recently presented an IBM digital electronic computer experimental kit to the Electronics Institute in Detroit. This model, to be used in the Institute's recently incorporated computer phase of the Electronic Engineering course, is an example of a laboratory instrument used in the design of basic circuits for a large IBM computer.

BECOME A RADIO TECHNICIAN For Only $22.95

BUILD 16 RADIO CIRCUITS AT HOME

All Guaranteed to Work!

Progressive Radio "Edu-Kit"®

Reg. U.S. Pat. Off.

PRACTICAL HOME RADIO COURSE only **$22.95**

NOW INCLUDES

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

★ No Knowledge of Radio Necessary
★ No Additional Parts or Tools Needed

Unconditional Money-Back Guarantee

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

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

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

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

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

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester and the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 16 Receiver, Transmitter, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for Television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $22.95. The Signal Tracer alone is worth more than the price of the entire Kit.

THE KIT FOR EVERYONE

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

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

PROGRESSIVE TEACHING METHOD

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

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

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

THE "EDU-KIT" IS COMPLETE

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

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

FREE EXTRAS

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

SERVICING LESSONS

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

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

FROM OUR MAIL BAG

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

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

PRINTED CIRCUITRY

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

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

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

☐ Send "Edu-Kit" Postpaid. I enclose full payment of $22.95.
☐ Send "Edu-Kit" C.O.D. I will pay $22.95 plus postage.
☐ Rush me FREE descriptive literature concerning "Edu-Kit."

Name .....

Address .....

.....

PROGRESSIVE "EDU-KITS" INC.
Progressive Building, Dept. 517AE, 1184-86 Broadway, Hewlett, N. Y.

A. A. Ghirardi
Electronic's best-known instructor

FIX ANY TV or

These 2 great Ghirardi books bring you COMPLETE TRAINING FOR MODERN RADIO-TV SERVICING!

Let these two famous Ghirardi training books teach you to handle all types of AM, FM and TV service jobs by approved *professional* methods! Almost 1500 pages and over 800 clear pictures and diagrams explain EVERY troubleshooting and repair operation as clearly as A-B-C. No needless mathematics. No involved theory. You get practical training of the type that teaches you to do the best work in the shortest time. Sold separately—or you save $1.25 by buying both books. Use coupon or order from Rinehart & Co., Inc., Dept. PR-119, 232 Madison Ave., New York 16, N. Y.

1 RADIO & TV CIRCUITRY AND OPERATION

Complete training in modern circuits and how to service them

You can repair ANY radio, television or other electronic equipment lots easier, faster and better when you really understand circuits and know just how and why each one works. That's exactly the kind of training you get in Ghirardi's 869-page Radio & TV CIRCUITRY AND OPERATION handbook! Gives a complete understanding of modern circuits. Shows what troubles to look for, and how to eliminate useless testing in servicing them. Throughout, it brings you the above-average training that takes the guesswork out of troubleshooting and fits you for the best paid service jobs. 417 illustrations. Price $6.75 but see money-saving offer!

Circle No. 1 in coupon to order

Save $1.25

Get both of these famous Ghirardi books at a saving of $1.25 under the regular price. Check MONEY-SAVING OFFER in coupon!

2 RADIO & TV TROUBLE-SHOOTING AND REPAIR

Complete training in modern service methods

Ghirardi's Radio & TV TROUBLESHOOTING AND REPAIR is a complete 822-page guide to professional service methods. For beginners, this giant book with its 417 clear illustrations is an easily understood course in locating troubles fast and fixing them right. For experienced men, it is ideal for developing better methods and finding fast answers to puzzling problems. Covers troubleshooting by all methods including both "static" and "dynamic" signal tracing types. Step-by-step charts demonstrate exactly how to proceed. A big television section is a down-to-earth guide to all phases of TV troubleshooting and service. Price $7.50. See money-saving offer!

Circle No. 2 in coupon to order

3 LEARN ALL ABOUT INSTRUMENTS!

Save time—avoid buying instruments you don't really need!

It pays to think twice before you buy new instruments —without first determining whether you really need them —or just how and where you'll actually use them!

BASIC ELECTRONIC TEST INSTRUMENTS discusses and explains over 60 modern instrument types and the advantage and limitations of each. Shows how to choose the instruments you really need; how to understand instrument readings and put them to practical use; how to work with fewer instruments, and how to put old instruments to new uses. Includes details on every type of instrument in ordinary service or communications use including V-O-M's; V-T voltmeters; capacitor checkers; oscilloscopes; special-purpose bridges; R-F oscillators; signal generators; audio oscillators; signal tracers and over 50 more. 254 pages, 171 illus. Price $4.95.

Circle No. 3 in coupon to order

4 REPAIR ANY ELECTRIC MOTOR!

. . . handle any job from minor repairs to complete rewinding

It pays to train for something different! ELECTRIC MOTOR REPAIR is a complete guide that helps you cash in on this vast, rapidly growing field. Shows how to handle all repair jobs (including complete rewinding) on practically ANY AC or DC motor or generator in common use. Special duo-spiral binding brings text and related how-to-do-it diagrams side by side so that you learn fast, easily and right. Every job is explained so clearly you can hardly fail to understand it. Over 100,000 copies in use in motor repair shops, schools and for home study. 560 pages. Over 900 how-to-do-it pictures. Price only $6.95 for the complete training.

To order, circle No. 4 in coupon

5 SHORT CUTS TO TV REPAIRS!

Eliminate Useless Testing—Fix TV Receivers Twice as Fast!

Just turn the dials of these handy, pocket-size Ghirardi & Middleton PIX-O-FIX TV Trouble Finder Guides. When the picture in the PIX-O-FIX window matches the screen image on the television set you're repairing . . . presto! . . . you've got your clue.

PIX-O-FIX shows the causes of the trouble, indicates the receiver section where it has probably happened, then gives repair instructions. PIX-O-FIX No. 1 identifies 24 common troubles and gives 192 causes and 253 remedies for them. No. 2 covers 24 more advanced troubles. Together, they are an easy guide to quick "picture analysis" servicing of any TV set . . . AND THE PRICE IS ONLY $2.00 for both.

To order, circle No. 5 in coupon

RADIO EVER MADE!

The only how-to-do-it handbook of its kind still in print!

DON'T THROW OLD RADIOS AWAY!

Here's the data you need to fix them in a jiffy!

Just look up that troublesome old radio you want to fix. Four times out of five, this giant, 3½-pound, 744-page Ghirardi RADIO TROUBLESHOOTER'S HANDBOOK tells what is causing the trouble . . . shows how to fix it. Cuts service time in half. Eliminates useless testing. Even beginners can easily fix old sets which might otherwise be thrown away.

Gives trouble symptoms and their remedies for over 4,800 specific models of old home, auto radios and record changers made between 1925 and 1942 . . . Airline, Apex, Arvin, Atwater Kent, Belmont, Bosch, Brunswick, Clarion, Crosley, Emerson, Fada, G-E, Kolster, Majestic, Motorola, Philco, Pilot, RCA, Silvertone, Sparton, Stromberg and dozens more. Has hundreds of pages of old tube and component data, service short cuts, etc. Price $6.95.

Circle No. 6 in coupon to order

The most important training of all!

HOW TO GET STARTED IN ELECTRONICS

Now you'll really understand circuits—components—equipment!

Learn basic electricity thoroughly—then everything else in electronics, radio, TV, communications, hi-fi etc. comes 10 times as easy—because they're all based on the same fundamental electrical principles.

This big 396-page BASIC ELECTRICITY manual covers the entire field . . . from circuits and currents to electromagnetism . . . from tubes to transistors and all the rest. More than 300 pictures make everything doubly clear. Set-up diagrams explain procedures. Basic electrical problems are explained. Also includes a complete, easy-to-understand 61-page INTRODUCTION TO ELECTRONICS. Backed with this great training, every detail of electrical-electronic operation will be far clearer to you than ever before! Price only $6.50.

Circle No. 7 in coupon to order

PASS FCC LICENSE EXAMS . . . easier . . . faster!

Train for communication's good paying commercial jobs!

Get one of radio's best paying jobs—as a commercial operator aboard ship, in aviation, in broadcasting or telecasting—wherever an FCC license is a "must!" LICENSE MANUAL FOR RADIO OPERATORS by J. R. Johnson is a quick, easily understood guide to help you breeze through FCC exams. Covers ALL EIGHT exam elements. Reviews almost 2200 typical questions. Covers everything from fundamentals to navigation and related subjects. Remember . . . only 1st or 2nd class radio-phone license holders can do any work that affects the broadcasting of a transmitter! This is just one of many job opportunities open to you! Price only $5.00.

Circle No. 8 in coupon to order

GET MORE WORK OUT OF YOUR OSCILLOSCOPE!

Learn all about the handiest service instrument of all!

Here, in a big, revised 2nd edition, is THE book that really shows you how to get more work out of your oscilloscope.

Clearly as A-B-C MODERN OSCILLOSCOPES AND THEIR USES gets right down to "brass tacks" in telling you exactly when, where and how. You learn to locate either AM or FM radio or television troubles in a jiffy. Even tough realignment jobs are made easy. Every detail is clearly explained—from making connections to adjusting circuit components and setting the oscilloscope controls. And you learn to analyze patterns fast and RIGHT!

Includes latest data on quantitative measurements (the slickest method of diagnosing many color TV troubles and aligning sets properly); using 'scopes in industrial electronics, teaching . . . even in atomic energy work. Over 400 helpful pictures include dozens of pattern photos. Price $6.50.

Circle No. 9 in coupon to order

REPAIR OIL BURNERS

Solve oil heat problems of all kinds

Save money by repairing, adjusting or even redesigning your own oil burner installation. Earn good pay doing this work for others! This 400-page DOMESTIC OIL BURNERS AND OIL HEAT handbook trains you for fast, accurate work on all systems in common use. Has over 300 pictures and diagrams. Teaches all about puzzling oil burner controls. Shows how to make heat loss surveys and design economical systems. Includes details on firing rates; chimneys & drafts; piping; wiring; and dozens of other subjects. Book has famous duo-spiral binding that puts both pictures and related text side by side for easy use on the job. Price $6.95.

Circle No. 10 in coupon to order

TRY ANY BOOK 10 DAYS FREE!

Dept. PR-119, RINEHART & CO., INC.

232 Madison Ave., New York 16, N. Y.

Send books indicated for free examination. (Circle the numbers of those you want.) In 10 days I will remit price indicated plus postage or return books postpaid and owe nothing. (SAVE! Send cash with order and we pay postage. Same 10-day return privilege with money promptly refunded.)

☐ Check here for **MONEY-SAVING COMBINATION OFFER**

on books Nos. 1 and 2. Make your radio-TV service training library complete! Send both big books at only $13 for the two plus postage. (Regular price $14.25—you save $1.25) Payable at rate of $4 plus postage after 10 days and $3 a month for three months until $13 has been paid.

CIRCLE NUMBERS OF THE BOOKS YOU WANT

1 2 3
4 5 6
7 8 9 10

Name .....

Address .....

City, Zone, State .....

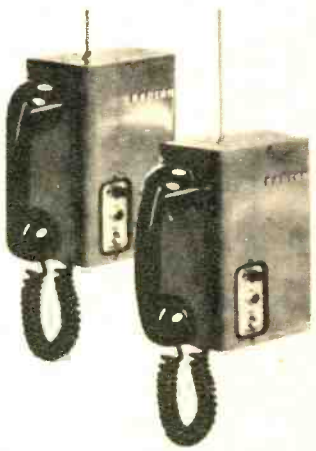
OUTSIDE U.S.A.

Add 50c to price of each book. Combination offer $14. Cash with order. Same 10-day return privilege.

. . . News

Lafayette Radio has announced their new 8-inch full range duaxial speaker. Consisting of an 8-inch woofer and 2-inch tweeter integrally mounted on dual axes it employs a new coaxial design using an elliptical baffle and an eccentric tweeter mounting. The model SK-128 will operate from any amplifier with an output of 1 watt or more. Speaker is supplied complete with brilliance control and is priced at $19.50 from Lafayette, 165-08 Liberty Ave., Jamaica, New York.

—o—



Two new 2-way Citizens band transceivers have been designed by Radson Engineering Corporation, Macon, Illinois. The base unit, model RT-70, is for use on 115 volt AC ($149.95), and the field unit, model RT-75, is powered by a 6 or 12 volt DC source ($159.95). Each unit has a "push-to-call" button which buzzes the other party and comes complete with a whip antenna. Push-to-talk button is in the hand set. Accessories are available.

Learn Electronics

PREPARE FOR YOUR F. C. C. LICENSE—YOUR TICKET TO A BETTER JOB AND HIGHER PAY!

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.

WHICH LICENSE FOR WHICH JOB?

The THIRD CLASS radiotelephone license is of value primarily in that it qualifies you to take the second class examination. The scope of authority covered by a third class license is extremely limited.

The SECOND CLASS radiotelephone license qualifies you to install, maintain and operate most all radiotelephone equipment except commercial broadcast station equipment.

The FIRST CLASS radiotelephone license qualifies you to install, maintain and operate every type of radiotelephone equipment (except amateur) including all radio and television stations in the United States, its territories and possessions. This is the highest class of radiotelephone license available.

GRANTHAM TRAINING PREPARES YOU

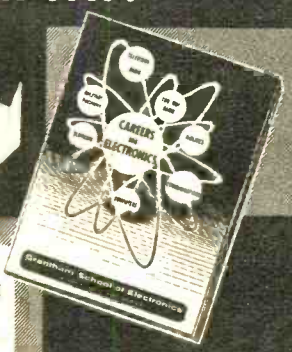
The Grantham Communications Electronics Course prepares you for a *FIRST CLASS* F.C.C. license, and it does this by TEACHING you electronics. Each point is covered simply and in detail, with emphasis on making the subject easy to understand. The organization of the subject matter is such that you progress, step-by-step, to your specific objective—a first class F.C.C. license.

CORRESPONDENCE OR RESIDENCE CLASSES

Grantham training is available by correspondence or in resident classes. Either way (residence or correspondence), we train you quickly and well—no previous training required. Even a beginner may qualify for his first class license in a relatively short time.

FOUR COMPLETE SCHOOLS: *To better serve our many students throughout the entire country, Grantham School of Electronics maintains four complete Divisions—located in Hollywood, Calif., Seattle, Wash., Kansas City, Mo., and Washington, D.C. All Divisions of Grantham School of Electronics offer the same rapid courses in F.C.C. license preparation, either by home study or in resident classes.*

This booklet **FREE!**



This free booklet gives details of our training and explains what an F.C.C. license can do for your future.

Upgrade Your Income with a First Class

F. C. C. LICENSE

HERE'S PROOF...

that Grantham students prepare for F.C.C. examinations in a minimum of time. Here is a list of a few of our recent graduates, the class of license they got, and how long it took them:

	License	Weeks
Donald E. Mason, 2659 Centinella, Santa Monica, Calif.	1st	12
Everett T. Bozard, 411 N. Wash. St., Alexandria, Va.	1st	12
Henry M. Best, 1003 Vermont St., Fremont, N. C.	1st	11
Harold V. Jones, P.O. Box 705, Alamogordo, N. M.	1st	13
Michael F. Aperio, 916 Townsend St., Chester, Pa.	1st	12
Earl A. Stewart, 3918 Modesto Dr., San Bernardino, Calif.	1st	14
Donald L. Leeburg, Box 1075, Anchorage, Alaska	1st	12
J. Milton Condit, 1312 N. 78th Street, Seattle, Wash.	1st	8
John R. Bahrs, 72 Hazelton St., Ridgefield Park, N. J.	1st	12
Richard Baden, 4226-37th St., N.W., Washington, D.C.	1st	12
James F. Stewart, 2618½ Prospect Ave., La Crescenta, Calif.	1st	12
Norman R. Cook, 130 Olive Street, Neodeska, Kans.	1st	12

GRANTHAM SCHOOL OF ELECTRONICS

HOLLYWOOD CALIF.	1505 N. Western Ave. Hollywood, Calif.	(HO 7-7727)
SEATTLE WASH.	408 Marion Street Seattle, Wash.	(MA 2-7227)
KANSAS CITY MO.	3123 Gillham Road Kansas City, Mo.	(JE 1-4320)
WASHINGTON D. C.	821 - 19th Street, N. W. Washington, D. C.	(ST 3-3614)

MAIL COUPON TO SCHOOL NEAREST YOU

(Mail in envelope or paste on postal card)

To: **GRANTHAM SCHOOL OF ELECTRONICS**

1505 N. Western Hollywood • 408 Marion Seattle • 3123 Gillham Rd. Kansas City • 821-19th, NW Washington

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 98-S

. . . News

The same RCA tape cartridge that is now available containing pre-recorded music, has been introduced in a blank form that allows for home recording. Each unit can take two hours of monaural or one hour of stereo play. Instructions for using tape come with each cartridge. In addition, the cartridge has an automatic safeguard switch which prevents accidental erasure.

Accredited by the National Home Study Council

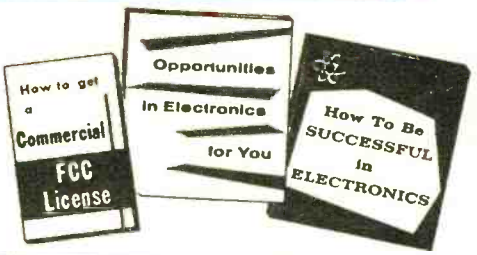
good training doesn't cost . . . it pays!

How To Get an FCC License (Commercial)

Get Your FCC License Quickly

We Guarantee to train you until you receive Your FCC License

Get all 3 FREE



We guarantee

to train you until you receive

Your FCC License

—or your money back

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

Our Trainees Get Good Jobs

"Investment in training really pays off"

"I am now employed by the Western Electric Company as an electronic tester. My status as a student of Cleveland Institute was an important factor in my being employed. Knowledge gained through the course has proved amazingly helpful and affords me a feeling of complete confidence."

T. E. Spence, Greensboro, N. C.

Get this handy Pocket Electronics Data Guide *Free*

Puts all the commonly used conversion factors, formulas, tables, and color codes at your fingertips. Yours absolutely free if you mail the coupon in 30 days. No further obligation!

TO GET THIS FREE GIFT, MAIL COUPON Within 30 Days!

Cleveland Institute of Electronics

4900 Euclid Ave., Desk EI-14 Cleveland 3, Ohio

Cleveland Institute of Electronics

4900 Euclid Ave., Desk EI-14, Cleveland 3, Ohio

Please send Free Booklets prepared to help me get ahead in Electronics and a free copy of your "Pocket Electronics Data Guide." I have had training or experience in Electronics as indicated below:

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

In what kind of work are you now engaged?_____

In what branch of Electronics are you interested?_____

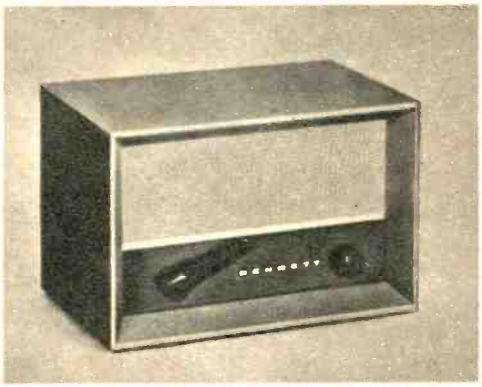
Name_____ Age_____

Address_____

City_____ Zone____ State_____

EI-14

. . . News



A carrier current intercom, designed to plug into any wall socket supplying 110 volts current has been announced by Bennett Laboratories. The unit employs an automatic squelch control which eliminates noise while the intercom is idle. The monitor switch, a special feature, allows one intercom to be set for "constant talk" thus making it perfect for baby sitting. This wireless unit is priced at $44.75 for one. Further specs available from Bennett Laboratories, Emeryville, California.

—o—

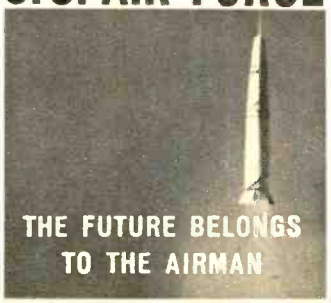
Thermoelectricity will eventually be everywhere (see September 1959 *EI*). Even hundreds of fathoms below the surface of the oceans. RCA is now planning to employ thermoelectric principles to cool our submarines. Because there is no need of compressors, motors or other moving parts, the equipment can be made more rugged, compact and more flexible than conventional air conditioners and will be easier to maintain, say RCA scientists.

—o—

"Death rays," and everything from countermissiles through antigravity in conjunction with defense against missile attack will be studied by Technical Operations, Burlington, Mass. The Defense Department has given the firm a $127,600 grant for this purpose.

FORMER SERVICEMEN: MAKE YOUR SKILLS PAY OFF WHERE THE AGE OF SPACE IS REAL

AS A SPECIALIST IN THE U.S. AIR FORCE



With the new Age of Space, more and more men are finding that their previous military training can really pay off in the U.S. Air Force. If *you* have a skill the Air Force needs, you, too, can step into an important job. You'll work with the latest equipment, learn the newest techniques of your specialty – and look to a future that's guaranteed. Find out if there is a place for you, where the Age of Space is *real*. See your local Air Force Recruiter, or mail the coupon.

PASTE ON POSTAL CARD AND MAIL TO:

Prior Service Information, Dept. ME-911
Box 7608, Washington 4, D. C.

Please send me more information on the Air Force Prior Service Program.

Name_____

Address_____ Age_____

City_____ Zone___ State_____

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

EI Exclusive

how good are

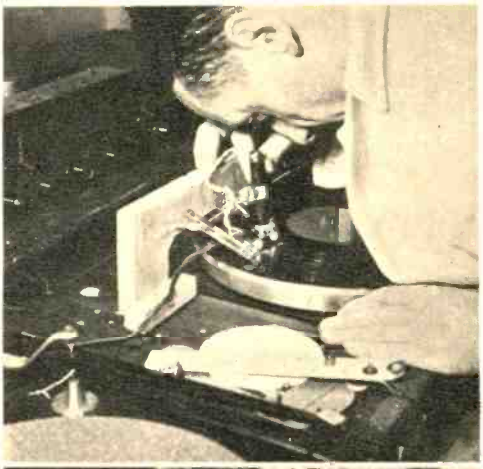
Stereo Records?

If you want your records to last, here's what to do, as determined in our actual lab tests.

ELECTRONICS ILLUSTRATED has just finished nearly six weeks devoted to torturing the life out of stereo records under every conceivable condition of pickup installation, stylus force, and record care, to find out once and for all if the stereo disk is the born-today, dead-tomorrow weakling some have claimed it to be.

The heartening result: by following the principles outlined in this article the user can make his stereo records last, in usable

Battery of record changers, each with different pick-up, played small number of grooves on each record hundreds of times. Records were inspected often and condition noted.



Microscope was mounted on wood bracket for ease of examining record grooves. Pilot lamps illuminate area.

Careful checks were made on various styli through microscopic examination. All were diamond, displayed little wear.

A cartridge is installed in tone arm of changer. Group of pickups (on the table) was chosen from available types.

Gauge measures stylus force. Incorrect adjustment was found to produce excessive record wear.

form, for as long as he will conceivably want to hear them. "In usable form" requires a careful definition, which will be supplied in a few moments. Playing life, with long-life rules reasonably applied, will be in the range of 200 to 400 playings, probably many more than most record users will require of any record. By exercising special care, you can extend this several times over!

Here is a quick summary of the main long-life rules for stereo disks:

(1) Use a high-compliance, low-mass pickup—no other rule is more important.

(2) Set the stylus force correctly, using an accurate gauge, and check it from time to time. This rule is far more important than it was with monophonic pickups. Some of the inexpensive gauges available are wildly inaccurate.

(3) Cleanliness is *equal* to godliness, when it comes to making stereo records live. Keep a record really clean and you keep it going for an astounding number of plays.

(4) The stereo pickup must be installed with great care, to insure long record life.

How The Tests Were Made

The tests were made with the battery of Glaser-Steers GS-77 changers seen in the photographs. A solenoid was attached to each changer so the change cycle could be tripped with the pickup at any point on the record. The solenoids received 15-volt DC current through the relay systems seen in back of the changers. The relays were energized when the spring wires projecting back from the pickup arms met the upright

Rapid location of specific passages on record was aided by ruler pivoted on turntable post.

Portions of discs were dubbed on Bell tape recorder for comparison and permanent record.

contact bars. The contact bars could be set to meet the wires when the pickup was at any point on the record.

By setting the index screw on the changer for the desired beginning spot, and the relay contacts for the desired ending spot, any part of a record, no matter how short, could be played automatically and repeatedly. In the tests, record bands not exceeding about 35 seconds playing time were used, in order to bring the total time within reasonable dimensions, and to put worn and unworn bands side by side on the record, for help in evaluating record wear.

What Is Wear

This brings us to the sticky question: what is record wear and when is a record "worn"? Investigation of top professional opinion on this subject lets you down through a net of intangibles. The head engineer of one of the largest recording companies said: "The decision on when a record is worn is just as subjective as that on when a tire is worn. You can keep going quite a while on a badly worn tire. The same applies to a record."

Not only the listener's personal standards, but also the refinement of the playing equipment affects the decision materially. Further, there are many kinds of record wear. Some of the most important are:

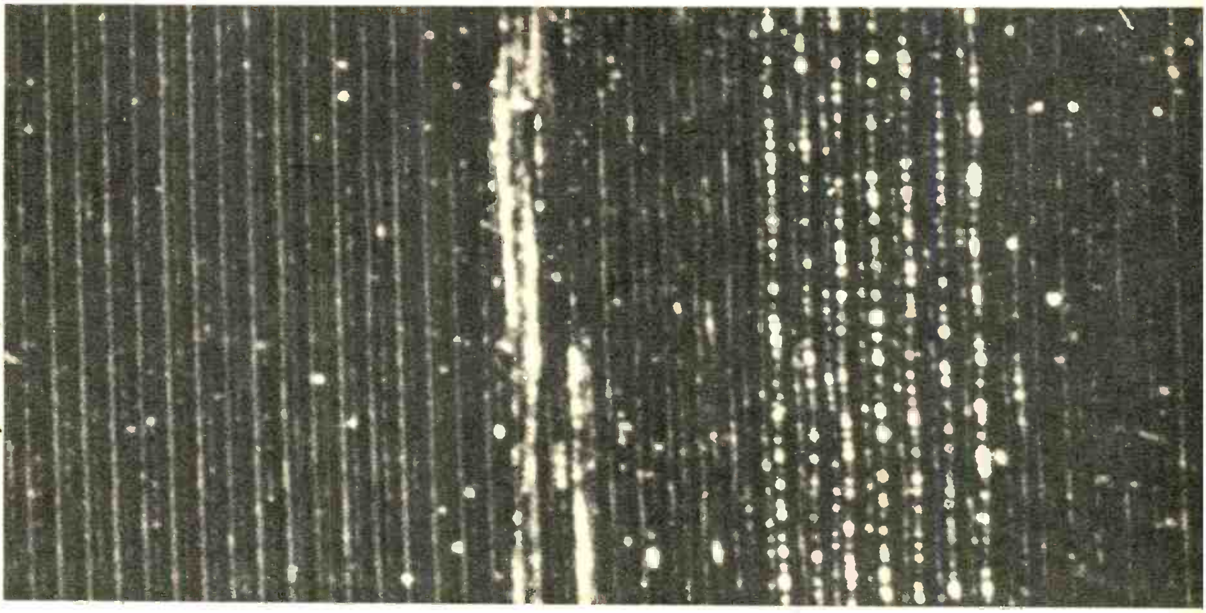
(1) The extreme top highs above, say, 7500 cps will be worn off; but on a great deal of playing equipment (and with perhaps a majority of adult ears) this will be more or less unapparent.

(2) The general noise level inevitably goes up with wear.

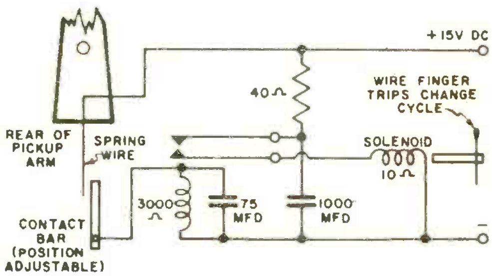
(3) The groove wall at points of heavy modulation may break down, causing mistracking with its shatter or buzz.

(4) Heavily modulated passages develop "modulation noise" which is a function of level. The result is a fuzz "in back of the music," which in its beginnings may be very subtle, a slight "veil" apparent only on careful comparison with *the same passage* on an unworn record. Many listeners are unaware of this effect until it is pointed out.

(5) Loud bursts can be carried through from one groove to the next, an amusing effect in some cases but one putting an effective end to the record's useful life.



Photomicrograph of record. Narrow white streaks near center were caused by pickup landing and bouncing. Right, 8 worn grooves.



Tripping mechanism designed to cause tone arm to play one band on record repeatedly.

(6) Very complex high level passages may develop intermodulation distortion, by deformation of the record under influence of the heavy lower frequencies.

(7) Soft passages, particularly solos, wear hardly at all; a quiet violin passage may go on practically forever.

No one has come up with a way of putting any of these effects into numbers. In the present tests, the seriousness of wear was evaluated in three main ways.

First, the existence of low-level wear was determined by A-B comparison between the worn passage and the identical passage on an unworn copy of the record. Two Pickering Gyropoise turntables, with identical pickups, were set up for all A-B comparisons.

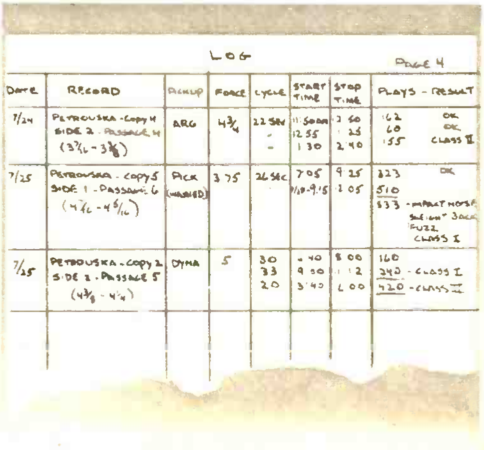
Second, worn records were compared with each other, to determine which was the worse worn.

Third, wear ratings were assigned, based on group evaluation, in three broad classes: Class I, wear perceptible, but not at all bothersome; Class II, wear strongly evident, but record still playable if the music is badly wanted; Class III, record destroyed—unplayable.

Admittedly these are imprecise and

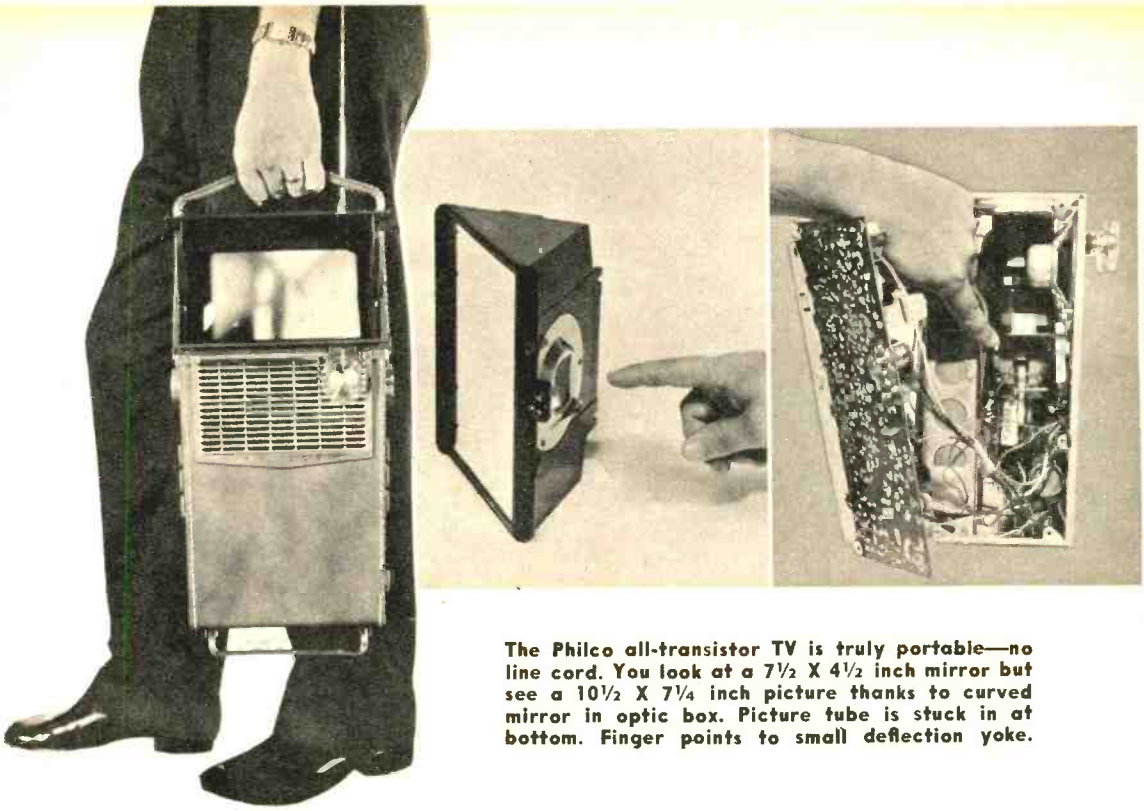
[*Continued on page* 96]

Sample portion of log which was kept to provide an account of test and conclusions.



LOG — PAGE 4

DATE	RECORD	PICKUP	FORCE	CYCLE	START TIME	STOP TIME	PLAYS - RESULT
7/24	PETROUSKA - COPY 4 SIDE 2 - PASSAGE 4 (3 7/16 - 3 5/8)	ARG	4 3/4	22 SEC - -	11:50 AM 12 55 1 30	12 50 1 25 2 40	162 OK 60 OK 155 CLASS II
7/25	PETROUSKA - COPY 5 SIDE 1 - PASSAGE 6 (4 7/16 - 4 5/16)	PICK (WASHED)	3 75	26 SEC	7 05 7/10-9:15	9 25 2 05	323 OK 510 833 - IMPACT NOISE, SLIGHT BACK FUZZ CLASS I
7/25	PETROUSKA - COPY 2 SIDE 2 - PASSAGE 5 (4 3/8 - 4 1/4)	DYNA	5	30 33 20	- 40 9 50 3 40	8 00 1 12 6 00	160 240 - CLASS I 420 - CLASS II



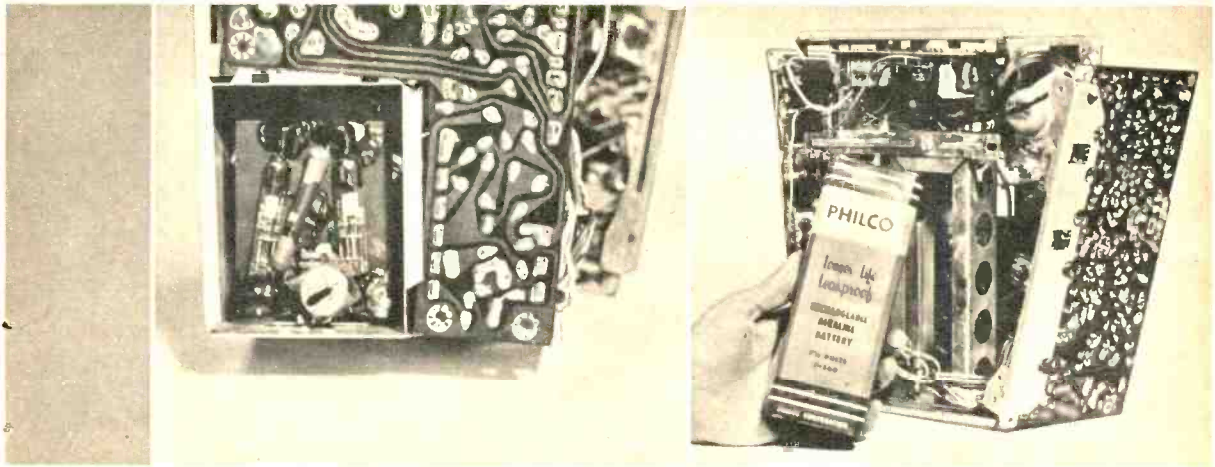
The Philco all-transistor TV is truly portable—no line cord. You look at a 7½ X 4½ inch mirror but see a 10½ X 7¼ inch picture thanks to curved mirror in optic box. Picture tube is stuck in at bottom. Finger points to small deflection yoke.

Transistor TV Portables

One is on the market now with more to come. *EI* checked the Philco and reports on its innards.

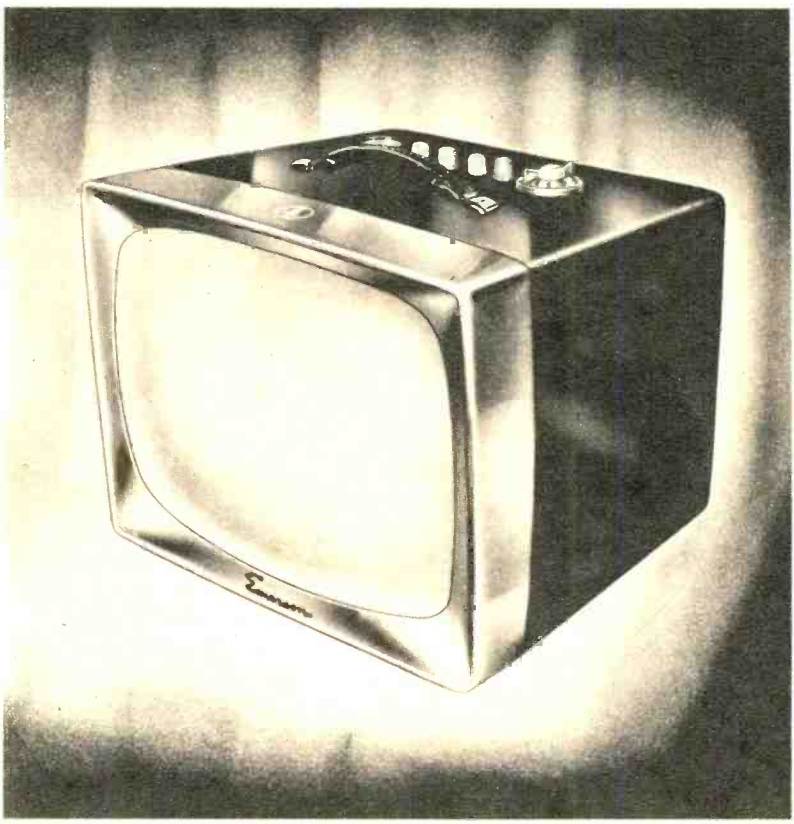
IN the midst of persistent rumors that the Japanese had an all-transistor TV set which they were going to market in this country and after *RCA* and *G-E* displayed laboratory models three and one year ago respectively, *Philco* beat everyone in the world to the punch and produced the first transistor portable TV set for the market. This 15-pound, 21 transistor job sells for about $250 and is oil-can size.

What size picture does it have on its mirrored screen? Well, it all depends on how you look at it. As a matter of fact, the distance from which you view the picture will determine the size picture you see. From the optimum viewing distance, about four and one-half feet from the face of the set, you see eighty square inches of picture, approximately the same size as the picture you get from a conventional 14-inch picture tube. This picture is magnified seven times from its original size on the receiver's postage-stamp-size cathode ray tube. You view a larger picture because you look at the apparent image through first a 45 degree and then a concave mirror. This mirror system has the same advantage as the old-time projection TV receivers which were popular over ten years ago when direct view tubes were limited to about ten inch size. The projection system gives you the effect of viewing a much larger picture, however, and herein lies [*Continued on page* 92]



Close to 90% of components are on printed wiring boards but high voltage cage is separate. Two rectifiers are used, these and CRT are the only tube types in entire set. The special battery pack consists of five alkaline rechargeable units good for 80 hours. Recharger is built into receiver.

The Emerson 17 inch direct view transistor TV looks like conventional "portable," will be available in 1960. This uses a rechargeable battery.



Compact Simpson scope has 5-inch tube for general purpose work. Horizontal and vertical lines (grid) over face of tube aid in calibration, measuring signal voltage.

Milt Kiver on Oscilloscopes-1

They are easier to operate than they look, and there is almost no limitation on their usefulness.

THE oscilloscope is one of the most important test instruments the technician has. Unfortunately, it is also the one that is understood the least, so that many who have oscilloscopes seldom use them.

Actually, the oscilloscope should be no more difficult to adjust than a television receiver since both possess many features in common. On the front panel of the oscilloscope you will find positioning controls which move the pattern up or down and to the right or left, focusing controls which bring the beam to sharp focus, gain controls which increase the height or width of the pattern and an intensity control comparable in its action to the

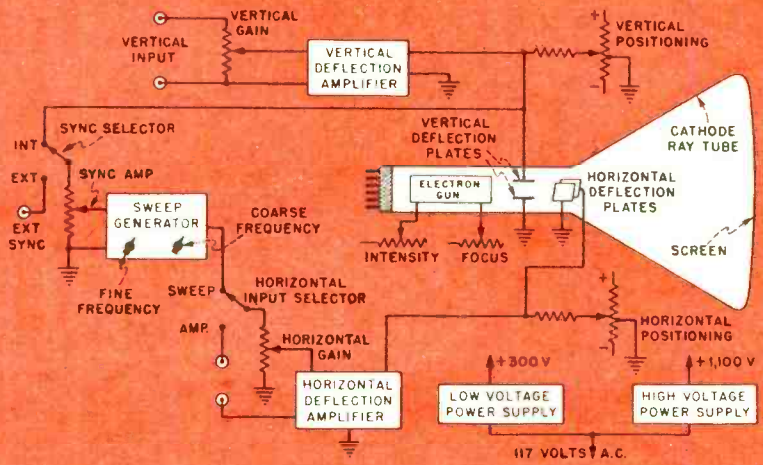
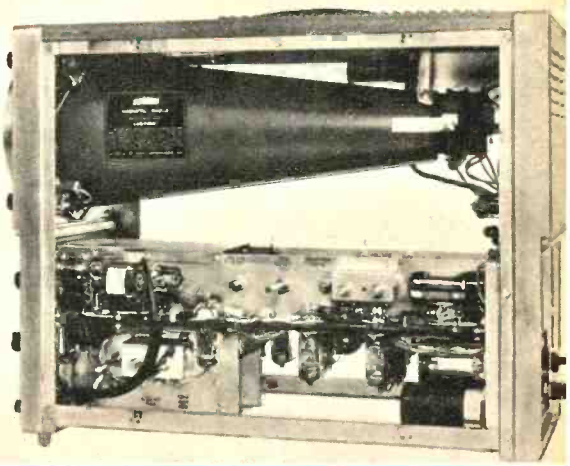
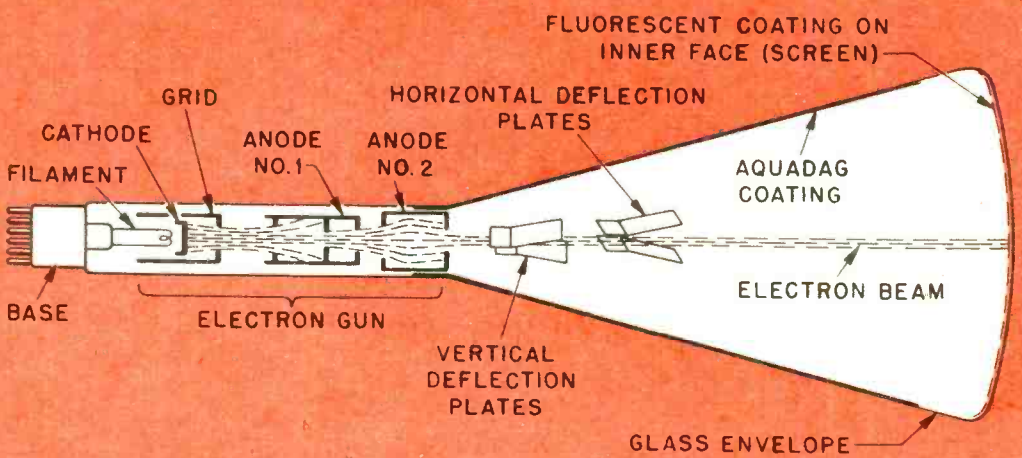


Fig. 1. Block diagram showing major sections of a general service oscilloscope.

The magnetic shield around the cathode ray tube in this DuMont keeps beam sharp.

Fig. 2. C. R. tube's electron beam generating and deflecting elements are below.





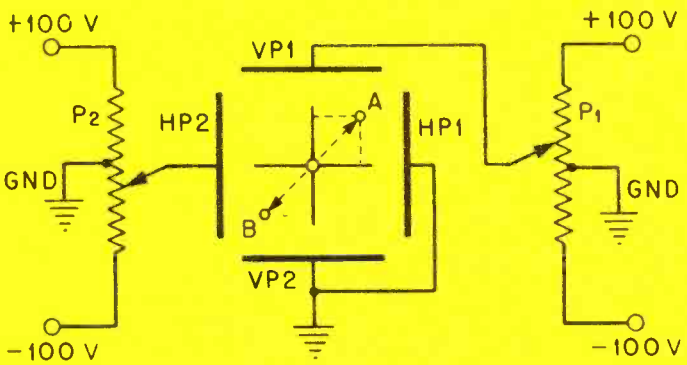


Fig. 3. Two sets of deflection plates, one horizontal and the other vertical, bend the electron beam in a cathode ray tube as shown in this diagram.

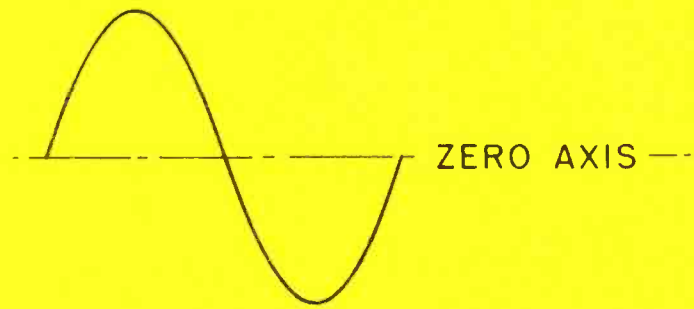


Fig. 4. This is a perfect sine wave pattern as it may appear on the face of a cathode-ray oscilloscope tube. The distance of each point above axis corresponds to its voltage.

brightness control on a television receiver. There are additional controls which have no counterpart in television receivers, but their adjustment is not difficult and can be mastered easily by anyone who can use a VOM or VTVM.

The chief function of an oscilloscope is to enable you to *see* what is occurring in an electronic circuit. It will show you the form of the voltage which is present or the shape of the current flowing through the wires. The oscilloscope will also enable you to measure the peak amplitude of any current or any voltage.

Accurate frequency measurements are another feature of an oscilloscope when this is combined with an auxiliary signal generator. Finally, when used in conjunction with a sweep generator, an oscilloscope will enable you to visually adjust a tuned circuit. This is particularly valuable since you can see the effect of each adjustment and ascertain when the precise alignment point has been reached. In a radio set, it is possible to properly adjust the RF and IF coils by using only a signal generator and a VOM or VTVM. In a television receiver, this approach is not nearly as accurate because of the wide bandpass of the circuitry. It is here

that an oscilloscope simplifies the alignment procedure considerably and enables you to achieve a high degree of accuracy. The same is true in FM receivers, although to a somewhat lesser extent.

A block diagram of a cathode-ray oscilloscope is given in Fig. 1. The principal components are the cathode-ray tube, a sawtooth sweep generator, vertical and horizontal deflection amplifiers and suitable controls, switches, and input terminals for the proper operation of the unit.

The heart of the oscilloscope is the cathode-ray tube (see Fig. 2). This is similar to the picture tube in a television receiver except that the beam is deflected electrostatically by plates, rather than electromagnetically by a coil mounted on the neck of the tube. The scanning beam starts at a cathode capable of emitting a relatively large number of electrons. These electrons are forced to pass through a cylindrical control grid which is completely closed at one end except for a minute circular opening which permits only a small beam of electrons to pass through. The grid serves the same function here as in any conventional electron tube; that is, it controls the number of electrons which leave the cathode. Thus, by varying the potential on this grid, we can control the intensity of the beam.

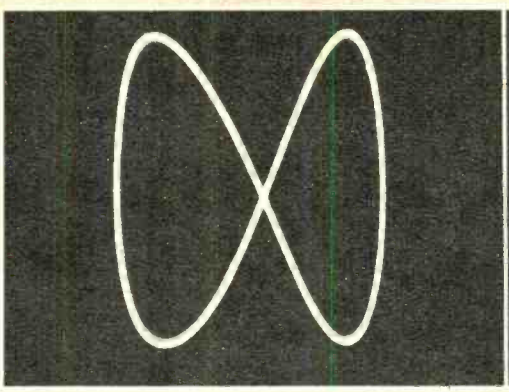
Further beam concentration occurs in several additional cylinders which follow the control grid. These cylinders, known as anodes (i.e., Nos. 1, 2, etc.) have positive voltages which not only attract the beam forward but also vary its diameter. The extent of the latter action is determined by the relative voltages between the anodes and by varying these voltages, we can alter the beam focus at the screen. The control which does this is known as the "Focusing Control."

Once the electron beam has been formed, it is accelerated down the length of the tube by high positive voltages on the forwardmost anode and also on a special coating which is deposited around the inner side of the cathode tube bulb. This coating, known as an "aquadag" coating, consists chiefly of graphite. It not only helps accelerate the electron beam to the fluorescent screen but also shields the beam electrostatically and provides a return path for the electrons after they have served their purpose at the screen.

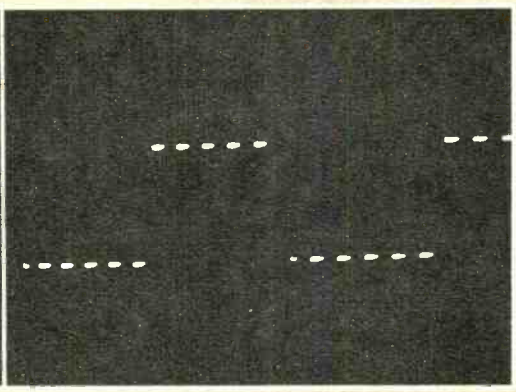
The end goal of the electron beam is to strike a fluorescent screen which is deposited over the front end of the tube.

[*Continued on page* 94]

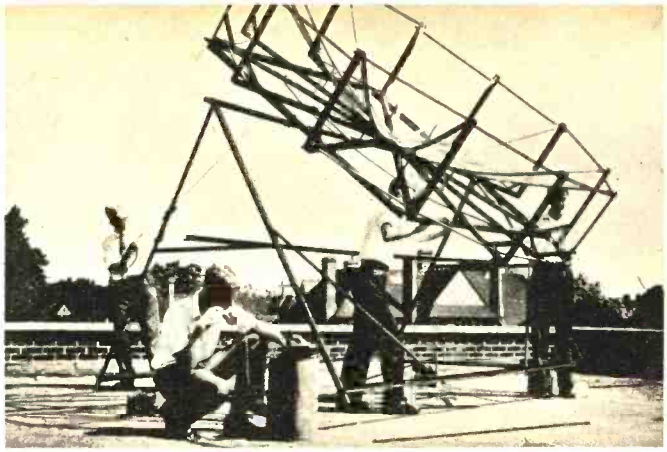
Courtesy DuMont Laboratories



Example of a Lissajous figure on scope tube.



Square wave pattern with grid modulation.



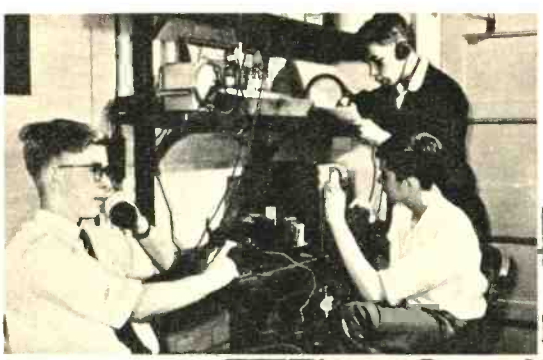
It took a year to construct, but all agree it was worth the trouble. Here the boys rotate the antenna by hand and rope, while phone contact is maintained with room downstairs.

Highschool Boys Build a . . . . .

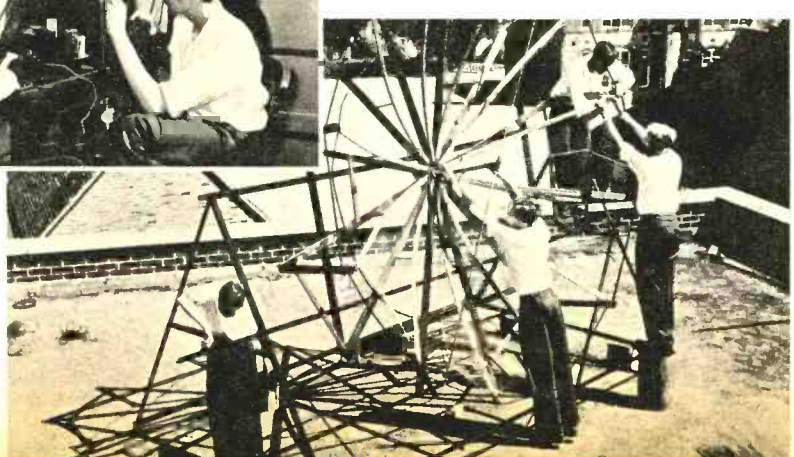
Homemade Radio Telescope

A FLOCK of schoolboys at the Dartford Grammar School near London, England, has been stealing some thunder from professional radio astronomers at the huge Jodrell Bank radio telescope. They have built their own private radio telescope, and it only cost them £15 ($40)! This isn't an adolescent joke, for as you can see, their 12-foot-wide dish antenna has become a permanent fixture on the school's roof. Like its big Jodrell Bank brother, it can be aimed (manually) at any point in the sky.

The youths already have pulled in signals from the Milky Way, our sun, and the constellation Sagittarius. Led by 16-year-old Doug Miller (who has been an electronics buff since age 13), the boys ripped apart a donated TV set to obtain parts for receiver.



Master control room at left was once a cloak room. It now houses a receiver built from donated and salvaged parts, as well as a small oscilloscope. Below is a view of the dish under construction. The metal frame that supports netting is covered with plastic. The net reflects radio signals from space to antenna at focal point of dish.



Antennas For Citizens Radio

By Len Buckwalter
Associate Editor

To get the most range out of Class D 2-way radio you need the best antenna—here's what's available.

ALL the antennas pictured here are departures from the basic type—the half-wave dipole. For Class D Citizens Radio, a dipole consists of a wire, approximately 17 feet long, fed at the center with coaxial cable. For mobile use this length is inconvenient; for fixed stations, improvement is possible.

The *vertical whip* is one answer to the problem of carrying 17

This is a full size ¼-wave graund plane antenna, the madel GP-1 made by Hy-gain and sold for about $30. Author is using an indicator for tune-up.

Tele-beam ¼-wave ground plane has loading coils in its elements.

feet of antenna atop a car. It is cut to a quarter-wave, or half the length of the dipole. When mounted, the body of the car itself is electrically equivalent to the missing quarter wave.

The 8½ feet of whip may also be reduced. It takes the form of the 2 or 3 foot *clip-on antenna* that mounts easily on the car's rain gutter. A loading coil is used to achieve this extremely short length. Its effect is to *electrically* lengthen the whip to 8½ feet, but permits it to remain *physically* short. This is a compromise. Full transmitter power is absorbed by the coil and whip, but the radiation is less than with the full 8½-foot whip. Of course, a shortened whip with no loading coil is virtually useless.

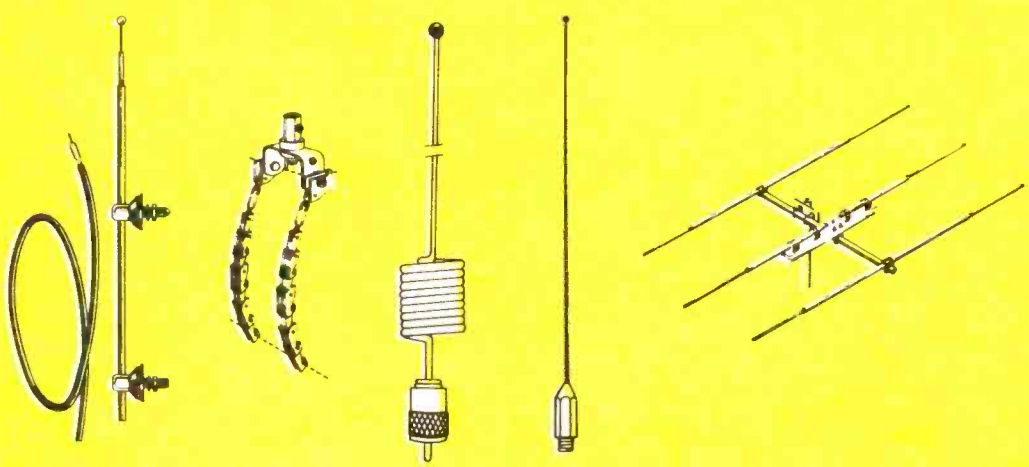
A popular fixed station antenna is the *ground plane*. An 8½-foot radiator is mounted vertically. Several radials are attached to the base and slant down and away from it. The radials establish a good electrical ground for the radiator, usually located atop a building. The ground plane, shown on page 41, may be shortened with loading coils, in the interest of saving space.

The *beam* is among the high gain antennas, and the most elaborate. A reflector and director are spaced on either side of the 17-foot dipole. Power is radiated in just one direction (toward the director). Essentially, the multiplication of power is caused by beaming the energy into a narrow arc. The beam is not customarily used for working mobile stations since the cars may be located on the "dead side." But, it yields the greatest range between two fixed stations.

Installation

In mounting a mobile antenna, bumper and clip-on mounts can solve one problem—marring the body of the car with drill holes. The cowl mount, replacing the original broadcast antenna, is another resort. If drilling holes is not a factor, the traditional whip loca-

[*Continued on page* 95]

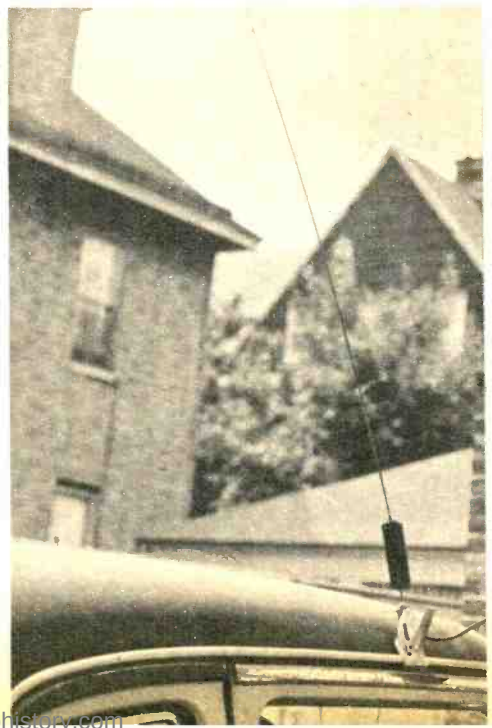


The various antennas shown here are all for the Citizens band on 27 mc. At left is side cowl mount for autos and co-ax cable, next to it is a chain mount for automobile bumpers to hold a spring type whip. Third from the left is a coil loaded whip, 40 inches long, for portable use, and next to it is a single rod ⅛-wavelength long. All by Antenna Specialists. Last is a 3-element beam by Mosley.

Small loaded whip antenna shown on this receiver is sold by Globe Electronics for under $6. This unit can also be modified for use on auto. It is telescopic type.

The Tele-beam "Magic Wand" automobile fender-mounting antenna shown below is a loaded whip which replaces broadcast whip, is used for both sets.

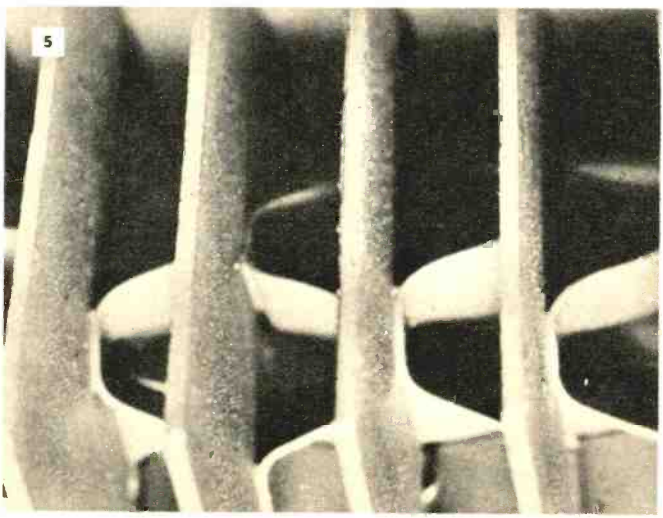
The Heath clip-on base loaded whip shown here can be placed on rain gutter of any car and is removable. The car acts as ground.

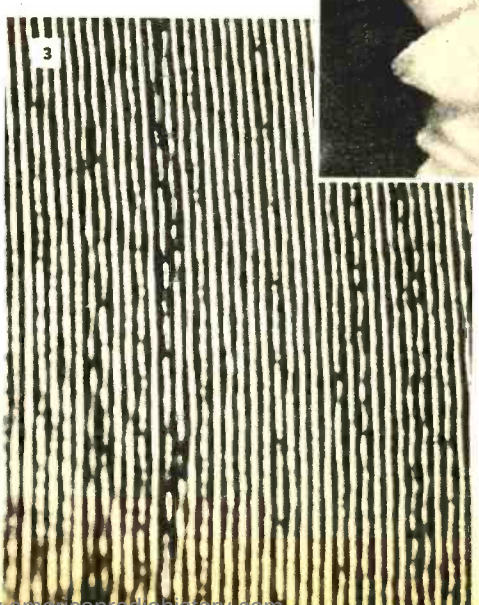


Electronic Photoquiz

By John A. Comstock

Identify the five "familiar" items pictured here. They are likely to be found on, or near the electronic hobbyist's bench. Correct answers are on page 100.





EI report on the

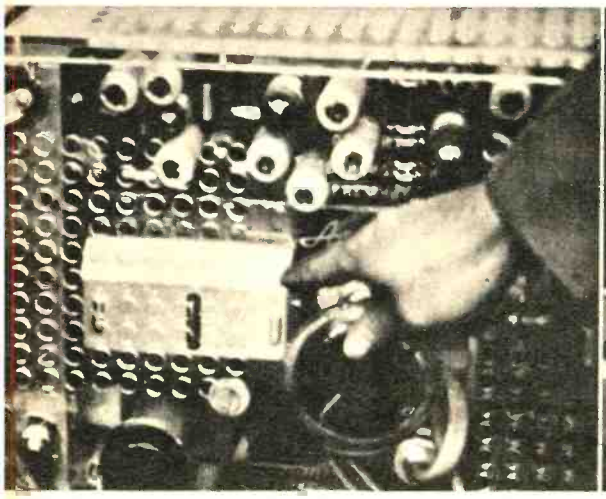
Russian New York Fair

ANYONE who exhibits at a State Fair puts his best foot forward. It was common sense to expect, then, that the Russians would show the best of their electronic equipment, home conveniences, cars, etc., at their Fair in New York City this past Summer. We expected to see the best of what they had, that is, NOT the best they could handmake for special exhibition purposes. We are not stating definitely that this is in fact what they did, rather, we will let this interview speak for itself.

Lloyd Mallan, widely read and respected analyst of missile and space research, and *EI* Editor Charles Tepfer walked through the Coliseum in New York City, took pictures of the electronic equipment models, talked with the Russian guides and science advisers and recorded their comments on a miniature Dictet tape recorder. Lloyd had just returned from a two-month, 14,000 mile tour through European and Siberian Russia. During this trip he had visited private homes, lived in hotels, gone to department and special stores, observatories, research labs, and universities. Here we present Lloyd's comments and answers to *EI* Editor Tepfer's questions, not as an electronics expert but as a careful and astute observer.

21-inch Russian TV set resembled latest models available from capitalistic U.S. but, American visitor to USSR did not see a set over 14-inch size there.

Notice the tuner in this plastic-cased TV set, it looks exactly like U.S. Standard Coil unit.



Russians claimed this TV set worked off auto battery, had transistors—but wouldn't open it.

Ques. *Lloyd, I count twenty-four distinct TV models on display here. Did you see these TV sets during your trip to Russia?*

Ans. No, except that model on the end of the counter, the one that's sort of squared-off, it looks similar to the general style in use.

Ques. *Here. See this portable . . . ?*

Ans. . . . but I *never* saw a portable TV receiver in the Soviet Union. Not in 14,000 miles of traveling there.

Ques. *Not even in any of the big department stores in Moscow?*

Ans. Never. Nor even in any of the luxury hotels or anywhere else.

Ques. *Now here's a unique receiver. About a 21-inch screen, I'd say. See, you can fold it back into the table, like a sewing machine. There's an inlaid chess board on top. Did you ever notice anything like this in Russia?*

Ans. No, I never saw it before. This is the first time, right here in the New York Coliseum, but this may be an advance model for 1960.

Ques. *This TV receiver is designed to work off a car battery—it doesn't seem much heavier than the Philco all-transistor battery portable we tested recently. Lloyd, did you ever see this model in Russia?*

Ans. I never found a TV set in any of the many Intourist cars I rode in. Actually I can't recall their even having radios and Intourist is the official greeter and guide for almost all foreign travelers in the Soviet Union. You'd think they would want to make an impression on foreigners—if they had anything like this.

Ques. *There's a model of a completely automatic airport nearby. I'd like your opinion of it.*

Ans. Fine. I'm quite familiar with Russian airports. All of my travel there, except locally, was by air.

Ques. *Here it is. How many airports like this did you land at or take off from?*

Ans. Not one.

Ques. *Not one? How about Moscow?*

Ans. I repeat. Not one. Vnukovo Airport at Moscow is probably the Soviet Union's most important commercial airport. In fact, it's *the* international airport. The only kind of radar I noticed there was ILS (Instrument Landing System) radar. It's the only kind of radar I ever saw at any airport in the Soviet Union. There were no height-finder radar antennas—not even at air defense centers.

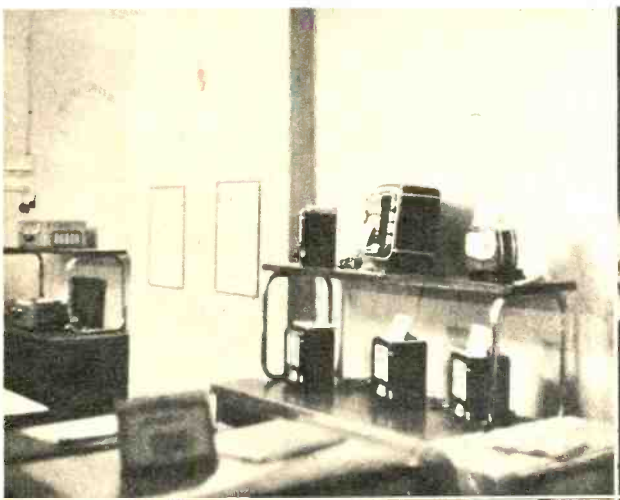
Ques. *You saw air defense installations?*

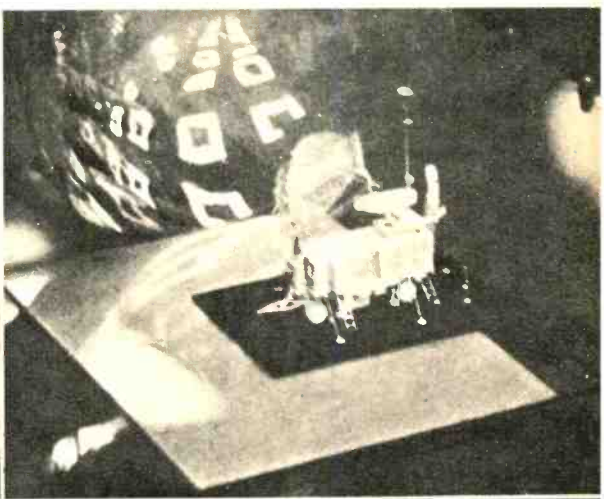
Ans. At least five of them.

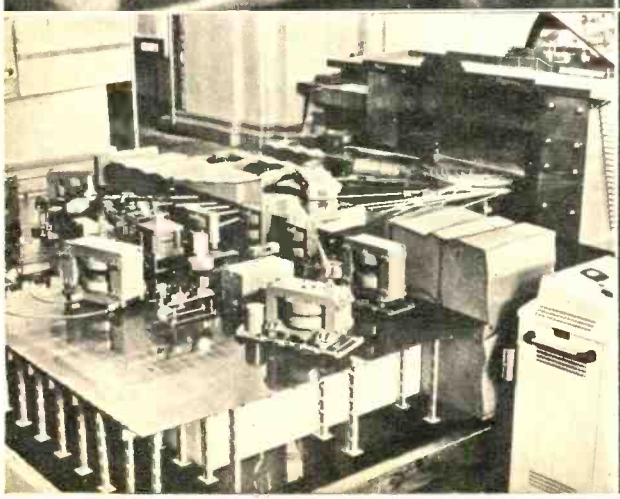
Ques. *How did you see these air defense locations? You mean, you flew over them?*

Ans. No, I saw them closeup. I even landed at two of them—the big air defense center at Yerevan, in Soviet Armenia, and another big one at Kharkov. Not one of the five had a height-finding radar, such as is shown here in this model. In fact, this little model looks as if it was copied exactly from pictures of American height finders.

Ques. *Here's some interesting looking electronic devices for nuclear research. Here they have what appears to* [*Continued on page* 89]



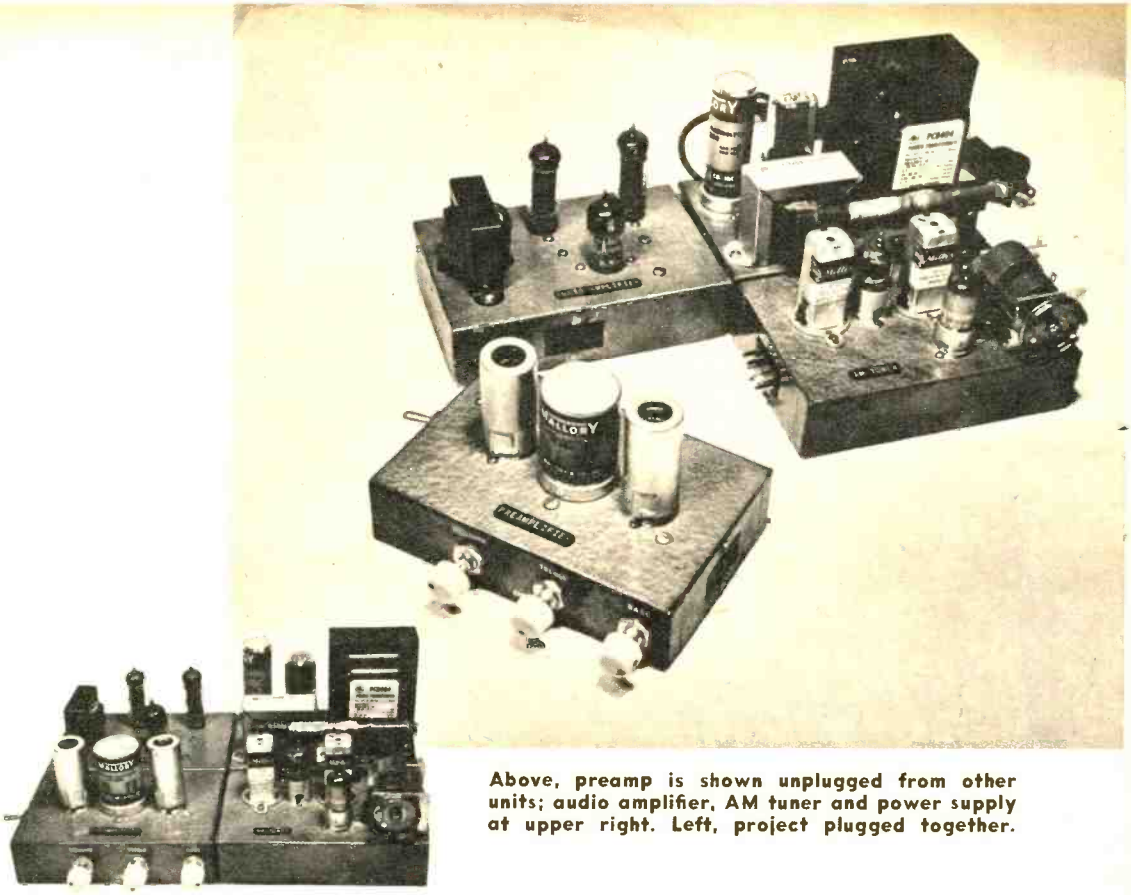




Upper left: Mallan photo in Moscow's GUM department store showed few radio styles.

Height finder radar shown in N. Y. with model airport was not seen at Red skyports.

U.S. experts claim that Russian giant synchrophasotron (model at left) cannot work.



Above, preamp is shown unplugged from other units; audio amplifier, AM tuner and power supply at upper right. Left, project plugged together.

the E I

Build-it Course-3

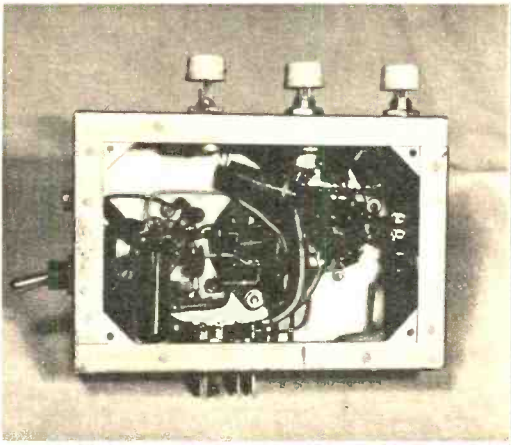
Add a preamplifier to the plug-in projects already described. It controls tone, volume and equalization.

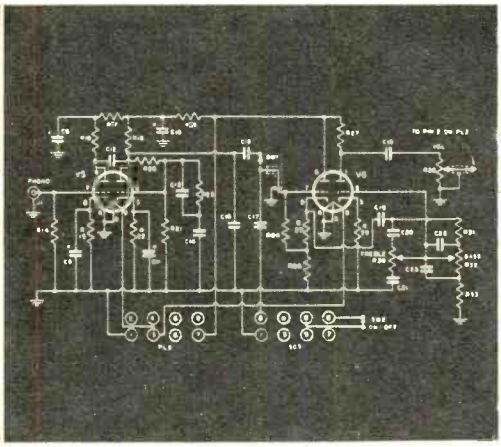
TO DATE, a basic power supply and amplifier have been described in this series of plug-in units that form the building blocks of a working unit. The preamplifier is introduced here.

In present usage, the preamplifier has come to mean more than just a tube that brings signals up to the proper strength for feeding the main amplifier. Preamps also have *equalization* and *tone* controls. In more elaborate equipment, they provide a control center where most-often used knobs are mounted on one convenient panel.

First a look at equalization—and why it's important. When a recording is cut, two undesirable effects occur. Strong bass notes cause the stylus to cut inordinately wide grooves. High tones, on the other hand, produce an opposite effect. Groove modulation is weak, and quite often lost in the noise on the record surface.

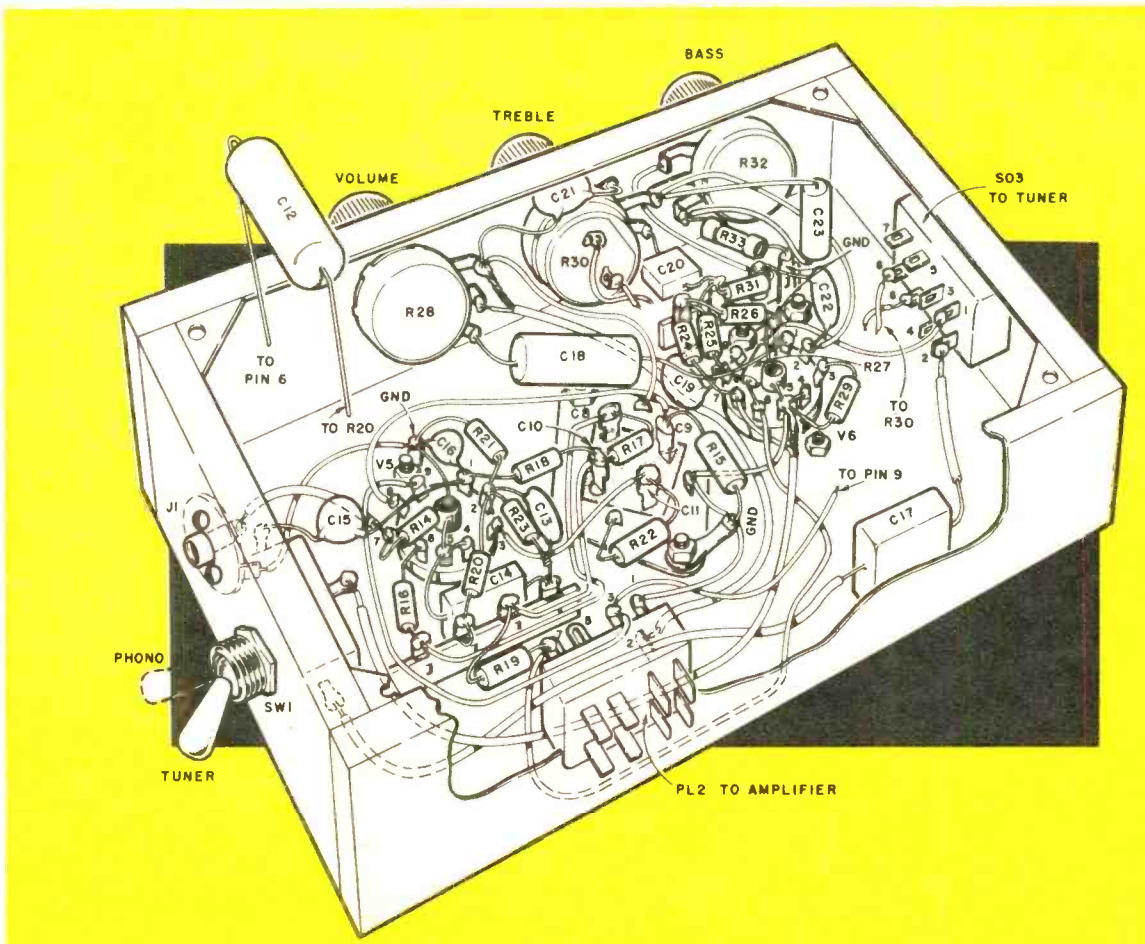
In an effort to counter this, bass tones are reduced and treble tones boosted before being fed to the cutting head. Although the two original problems have been corrected, what happens when





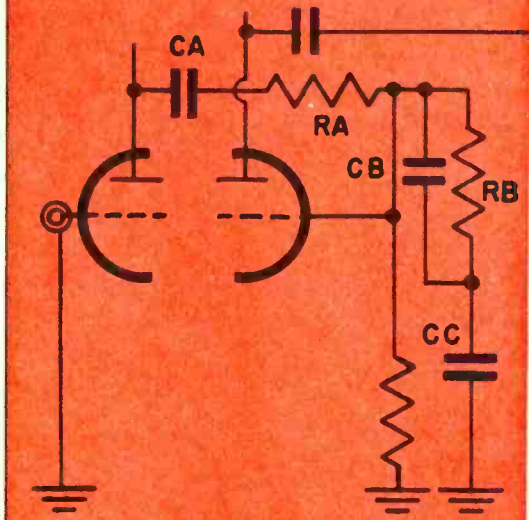
Underside view of preamplifier, completely wired. Schematic is at right. SW2, the AC power switch seen at lower right, is actually attached at rear of volume control R28 (at upper right).

C12, below, is removed for clarity. Center lugs on Bass and Treble controls are soldered together.



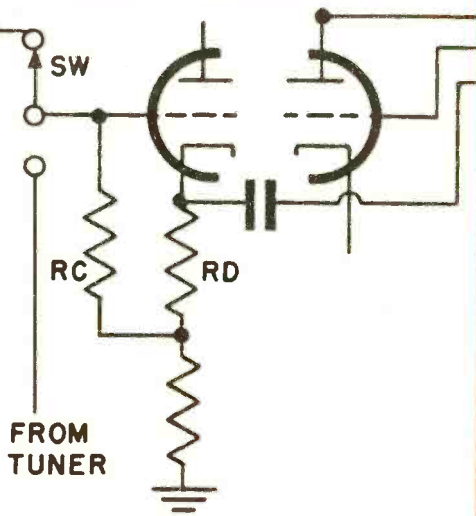
HOW THE PREAMPLIFIER WORKS

EQUALIZATION



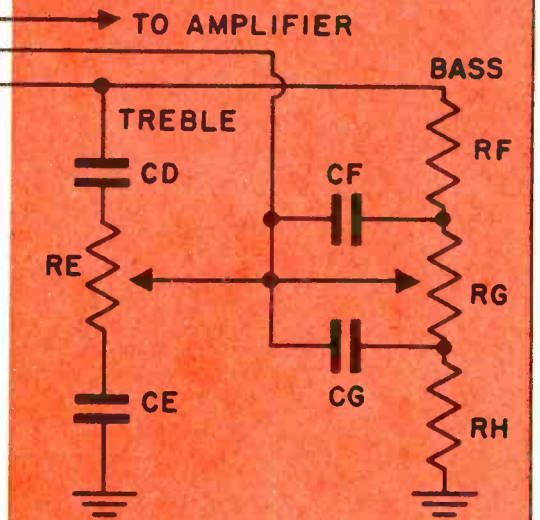
First stage boosts low-level signal from magnetic phono cartridge. Equalization, boosting bass and reducing treble, takes place in the resistor-capacitor network. Signals pass through DC blocking capacitor CA, then load resistor RA. They encounter the series combination RB-CC. As frequency increases, it finds an easier path to ground through CC. This is due to the decreasing reactance of capacitor CC at the higher frequencies. The lows reach the tube grid since they would find a difficult path to ground through CC. Further shunting of the highs occurs through capacitor CB. Net result is bass boost, treble roll-off.

CATHODE FOLLOWER

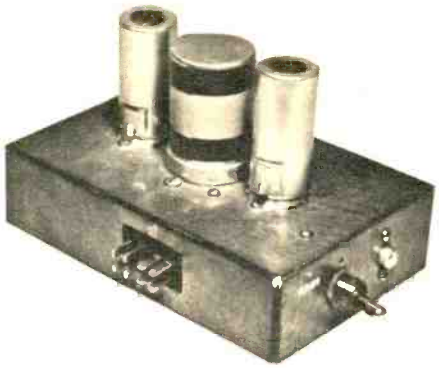


Phono signals enter the selector switch SW. Tuner signals need not be equalized since this is done at the radio station. Cathode follower is an impedance transforming device. High impedance of the previous stage is reduced to a low value and signals are fed to tone controls from top of cathode resistor RD. RC is grid resistor. Purpose of low impedance at this point in the circuit is to prevent interaction with input. The second half of the tube is an amplifier. It boosts signals that have passed through the tone controls. The plate of the tube feeds the main power amplifier. See upper right. Signal level is approximately 2 volts.

TONE CONTROLS



Potentiometer RE affects treble response, RG controls Bass. Signals containing both highs and lows appear at the top of the network. High tones enter CD-RE-CE. CD has low reactance to highs and they appear across RE. Arm of RE receives desired amount of highs, depending on its position. When moved up, maximum voltage is fed to tube grid. Low tones encounter high reactance at CD and appear across the bass leg at right. The arm of RG selects desired amount of bass voltage. Basically, each section of the tone control is an AC voltage divider, capable of discriminating between high and low frequencies.



Plug PL2 is at rear of preamp, selector switch SW1 and phono jack along the side.

the recording is played back in the home? It will sound deficient in bass, with far too much emphasis in the treble range. Here is where the preamp's equalization circuit operates. It boosts the bass and reduces treble. This is simply a reverse process when compared to the equalization used by the recording engineer.

The preamplifier illustrated here utilizes RIAA (Record Industry Association of America) equalization. This was adopted by the industry several years ago as a standard. Previously, most companies equalized differently, necessitating a preamp that could compensate for each one; NAB, AES, etc.

This preamplifier is designed for a magnetic cartridge on the phono input. One important consideration is the input resistor. Various cartridges work into different loads. Resistor R14 is shown as a 27,000 ohm unit, but the manufacturer's literature should be consulted for the optimum value of a particular type.

A selector switch permits the use of a tuner input. Tuner signals are not low-level and therefore may by-pass the first stage of amplification. They are fed directly into the tone control circuit.

Tone controls are an important adjunct to the playback system. They permit the listener to balance the sound according to individual preference. Variations in room acoustics, and speaker systems may be compensated for by tone controls.

The equalizer and tone control circuits are basically the same. The equalizer's response is fixed, however, since it must conform to a specific curve (RIAA). It is in the tone control section where continuously variable potentiometers allow for variation in the system's response. The heart of both circuits is a simple resistor-capacitor

[*Continued on page* 112]

PARTS LIST

(Part numbers continue from last month's project)
R14—27,000 ohm resistor (resistors ½ watt unless noted)
R15, R22, R25—2200 ohm resistor
R16—100,000 ohm resistor
R17, R18—33,000 ohm resistor
R19—15,000 ohm resistor 1 watt
R20—470,000 ohm resistor
R21—680,000 ohm resistor
R23—24,000 ohm resistor
R24—510,000 ohm resistor
R26, R27, R31—200,000 ohm resistor
R28—500,000 ohm potentiometer, audio taper
R29—5100 ohm resistor
R30, R32—1 megohm potentiometer audio taper (R30 with AC switch)
R33—22,000 ohm resistor
C8—15 mfd capacitor 450 volt
C9, C11—20 mfd capacitor 25 volt
C10—20 mfd 450 volt (C8 through C11 is 4-section electrolytic, Mallory FP 426)
C12—.1 mfd paper capacitor 600 volt
C13—.0033 mfd paper or disc capacitor 600 volt
C14, C15, C17, C23—.01 mfd paper or disc capacitor 600 volt
C16—180 mmfd ceramic of mica capacitor 500 volt
C18—.05 mfd paper or disc capacitor 400 volt
C19—.02 mfd paper or disc capacitor 200 volt
C20—470 mmfd mica capacitor 200 volt
C21—.005 mfd mica capacitor 200 volt
C22—.001 mfd paper capacitor 200 volt
J1—Phono jack
V5, V6—12AU7 tube
PL2—8-pin chassis mount plug (Cinch-Jones P308AB)
SO3—8-pin chassis mount socket (Cinch-Jones S308AB)
SW1—SPDT toggle switch
Misc.—Two 9-pin tube sockets with shield bases and center posts, aluminum chassis 4"x6"x1½" (Premier ACH 436), knobs, tube shields, 4-lug terminal strip with one ground lug, 4-lug terminal strip.

Front view of preamp, with controls along its front panel. Shields are on both tubes.

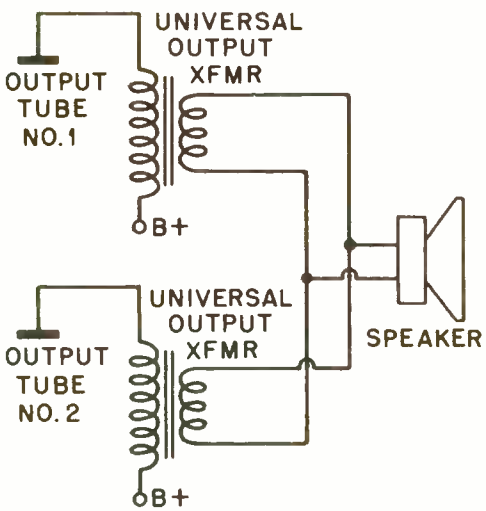
The Electronic Brain

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

Two Amplifiers Feed One Speaker

How can I connect a single speaker to two different receivers, both receiving the same program but on two different frequencies? This would help to reduce the effects of fading on one frequency since the fading pattern would be different for the two frequencies.

J. A. Russell, San Diego, Calif.



This idea has much merit and will reduce the effects of fading substantially, particularly when the two stations broadcast on frequencies that are well separated in the spectrum.

The diagram above shows the best way to do this. The two output transformers should be of the "universal" type with a number of taps on the primary of each one to enable you to establish the best impedance match between the particular output tubes you have in each radio and the speaker to be operated. It goes without saying, of course, that the individual receiver gains should be adjusted so that they are as nearly alike as possible. The system would work best with two identical receivers, if this is possible in your case.

When the circuit is finished, the transformers should be phased properly to prevent cancellation of signals. This is best done by listening; if the output is weak, reverse the wires on the secondary of *either* of the two output transformers.

TV Interference Filter

Our local television station operating on Channel 10 blocks our reception of other more distant stations on Channels 8, 9, 11, and 12. Can I remedy this difficulty?

Dave Currie, London, Ontario

We would interpret the word "blocks" as used in your question to mean that the signal strength of this television station is so great in your location that its influence extends into the tuning range of the other channels you mention. If this interpretation is correct, you can cure your trouble by installing transmission-line rejection filters at the terminals of your present antenna feeders. These traps must tune very sharply to Channel 10; that is, from 192-198 mc.

The most convenient way to do this is to cut a length of twinlead somewhat longer than a quarter-wave at the rejection frequency. For Channel 10, connect a two-foot length of twinlead directly to the antenna terminals of the receiver; then, using a pair of diagonal cutters, remove ½ inch of the twinlead at a time while watching the picture. As you approach a quarter wavelength (about 1¼ feet), the signal should begin to show evidence of weakening. Continue to do this until you get the "snowiest" picture; this is maximum attenuation, obtained by what is referred to as an open, quarter-wave rejection line. Naturally, you want to attenuate Channel 10 only when receiving other channels so that the rejection filter should be removed when receiving this channel.

Shorted Tuning Capacitor

All I can get are crackling noises below a certain spot on the dial of my communications receiver. The noise begins at the same spot on every one of the four bands as I tune the variable capacitor; when the noises begin the signal disappears. What causes this?

Stan Zawrothy, Barth, New York

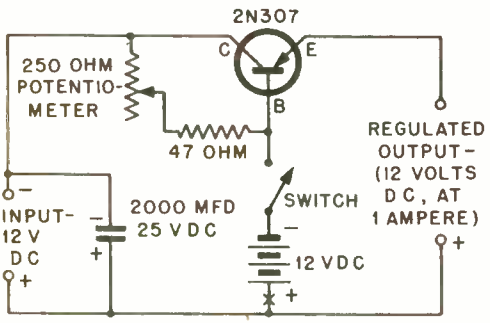
Your trouble is probably being caused by short-circuiting between rotor and stator plates on one or more of the main tuning variable capacitor sections. This would account for both symptoms you mention: crackling noise as the plates make intermittent shorting contact and lack of signals in this area of the dial.

It will be necessary for you to inspect the tuning capacitors *very* carefully to determine where the plates touch. It is usually possible to bend one or more plates ever so slightly to remove the short-circuit permanently.

Voltage Regulator

I would appreciate a circuit of a voltage regulator that would operate on 12 volts DC. Please make it as simple as possible.

John A. Sampson, Bronx, N. Y.



We shall be happy to provide you with the circuit you wish. Since you mention only the voltage regulator, we shall go on the assumption that you already have a 12 volt DC source.

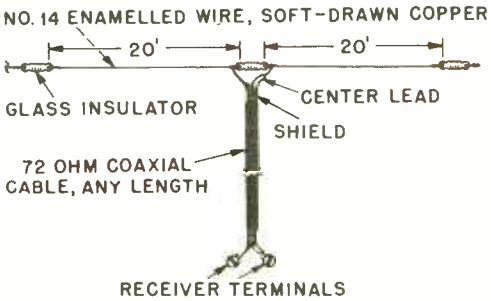
Regulation is provided by a power transistor of the inexpensive variety—a 2N307. It employs a 12 volt battery of the standard type as a reference voltage source. Since this battery current is balanced out during operation, it should last several years, or for its shelf life.

The regulator should be adjusted as follows: Insert a milliammeter in series with the battery (temporarily) and adjust the 250 ohm potentiometer for zero current with the power supply loaded as it will be during normal operation. Remove the milliammeter and replace it with a short jumper. The balance should be checked occasionally in the same way. Be sure to include a switch as shown to open the battery circuit when the power supply is idle. This switch may be ganged with the one used to turn the power supply on and off.

Receiver Antenna

What kind of an antenna would you recommend for use with a Hallicrafter SX-100 receiver? I have about 40 feet of straight-run available.

E. F. Martin, San Diego, Calif.



A simple, yet satisfactory antenna for a communications or short-wave receiver such as yours is a long wire. Its length may run from thirty to a hundred feet. Keep it as high as possible and clear of metal surfaces that might reduce its efficiency.

An improvement over the single wire is the doublet shown in the diagram above. The coaxial cable lead-in is shielded and therefore reduces the amount of noise pickup from man-made sources found near the ground and low levels; motors, power lines, etc. The shield of the cable should go to the ground terminal on the receiver and also to a building ground—a cold water pipe, for example.

This antenna will be bi-directional and most sensitive broadside to the horizontal wire.

Unique wireless system sends six different messages to a transistorized receiver. Used by UN, others.

Six Channels In A Loop

By Steven Hahn

THE United Nations, Geneva, Chile, the Summit, disarmament, cultural exchanges, medical meetings—our daily headlines spell out a steady stream of international conferences. The easier it is for people to travel intercontinental distances via air, the more and more they are getting together to exchange ideas.

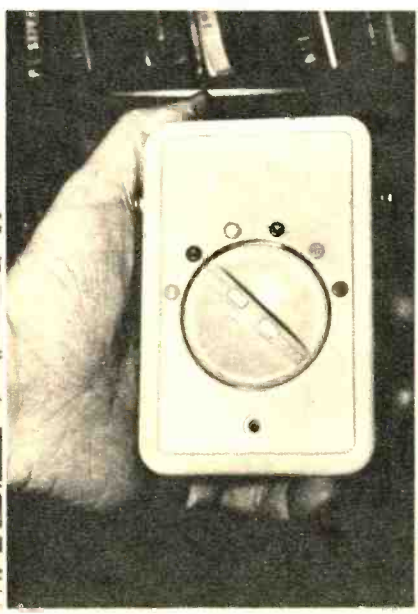
But it is very difficult to have a useful exchange if the participants cannot understand each other. Indeed, the very success or failure of an international conference may well depend on the translation of a speaker's remarks into the varied native languages of the participants. Also, to keep a conference alive and interesting, these translations should be simultaneous. In other words, the translation must follow right along with the speaker and end not more than a few seconds after the applause begins.

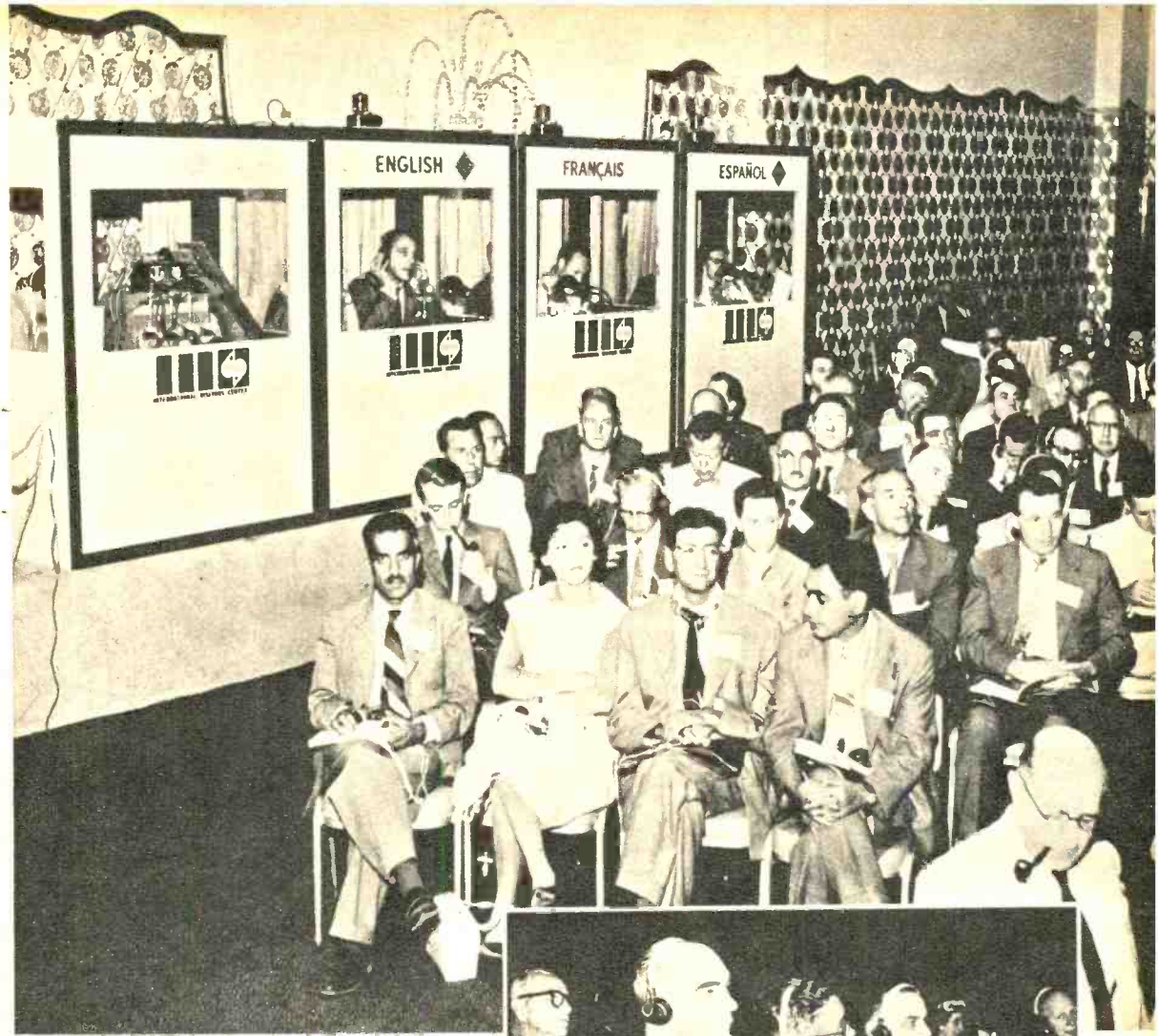
Electronics companies the world over have tried to find the most convenient, unobtrusive means of relaying these translations. Their problems are many. Sometimes five or six different languages must be made available to the listeners. Conferences don't always take place in the same [*Continued on page* 93]

Lightweight receiver can be worn around neck, permits freedom of movement. Tiny unit has special "theft" circuit.

Selector switch has six positions, each representing a different translation on a harmonic of 22.5 kc, basic frequency.

There are 3 transistors in receiver package, but only two are actually used in receiver section. Note ferrite antenna.





Expert interpreters, isolated in soundproof booths, provide simultaneous translations for all the delegates.

Not all delegates require translation. Those who understand language of speaker need not listen over headset.

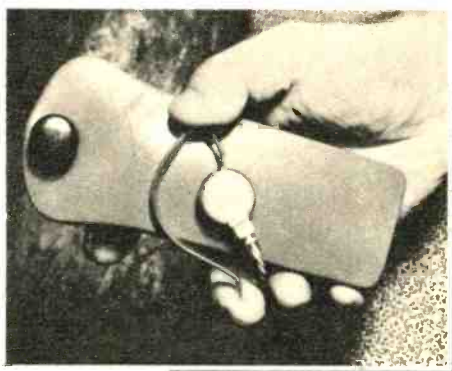
At right, author checks out transmitter setup that can be dismantled, moved from one meeting to another.

A Wireless Earphone

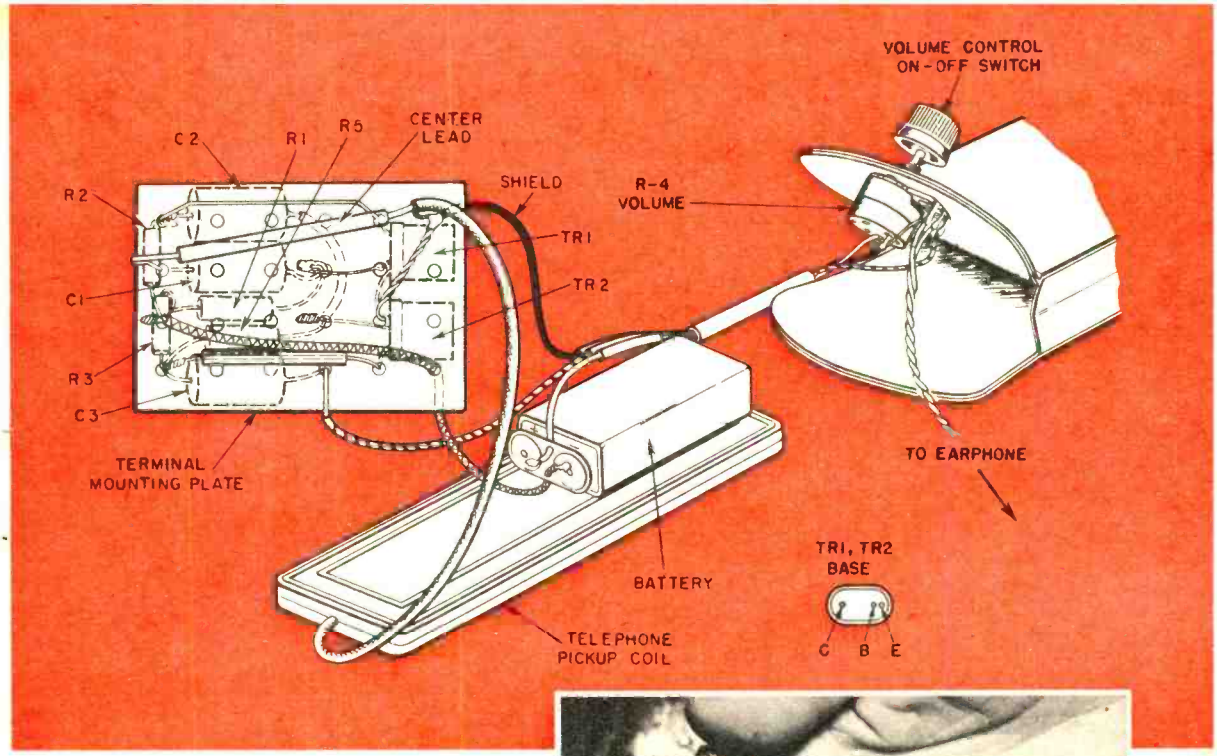
By Steven Hahn

This pocket receiver can be used with a hi-fi set or TV for private listening or for indoor paging.

WIRELESS transmission of sound by means of audio induction is a simple, foolproof method. In this type of system, a standard audio amplifier feeds a loop of wire strung around the area in which the receiver is to be located. The receiver simply consists of a high gain audio amplifier whose antenna is a small coil. Thus, this circuit can be likened to a large audio transformer whose primary is the outside loop and whose secondary is the small detection loop in the receiver. A system of this kind has



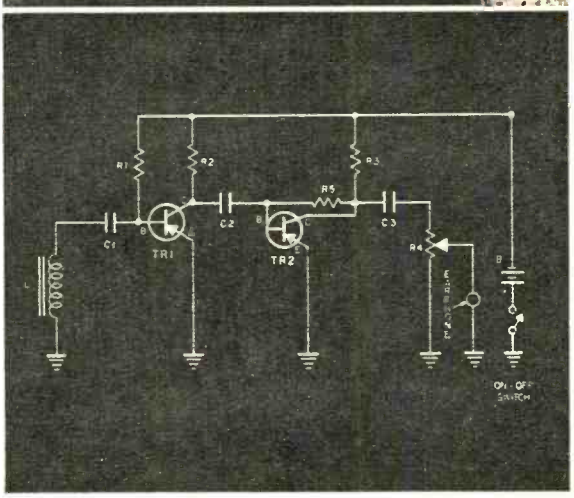
The complete receiver is shown at left and in use below. Volume knob is on eyeglass case.

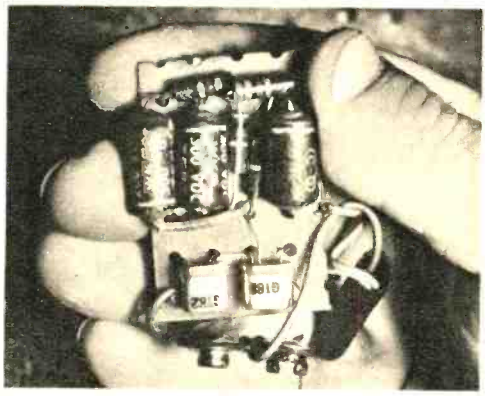


The circuit board has been lifted off the pickup coil and flipped in the wiring guide above for clarity's sake.

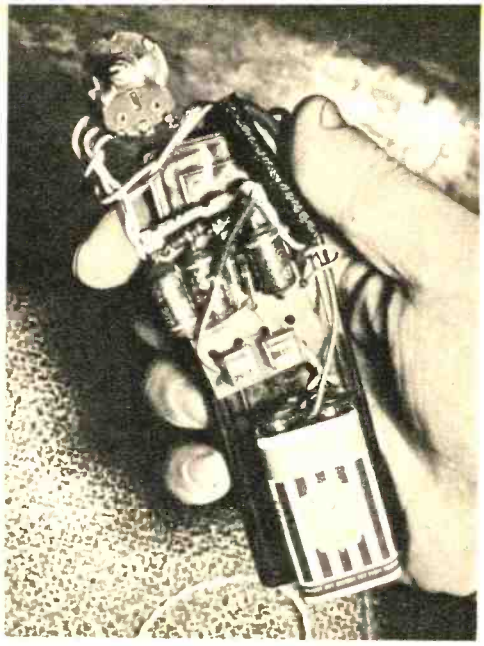
Use spaghetti tubing as shown over the connection points on board. Pick-up coil is sold at parts suppliers.

Circuit diagram of receiver indicates simplicity of this two-stage high gain audio amplifier. Cost is about $15.

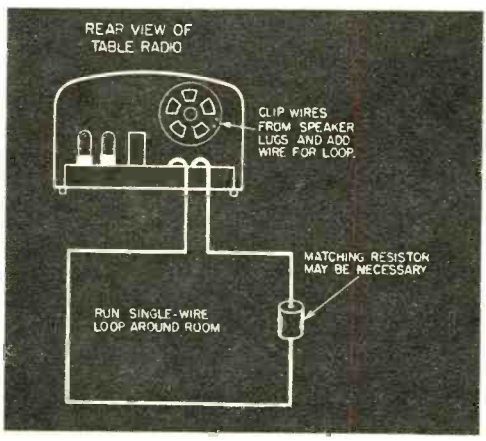




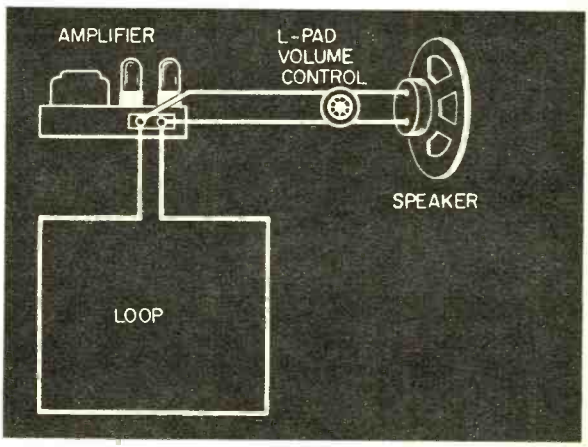
Note tight placement of parts on the circuit board. Actually the parts can be arranged in any manner since placement is not critical.



The complete receiver before insertion in the eyeglass case. Circuit board and battery are held to pickup coil with rubber bands or glue.



Two methods of rigging transmission coil are shown above and at right. Resistor is used to help match impedance of loop to radio.

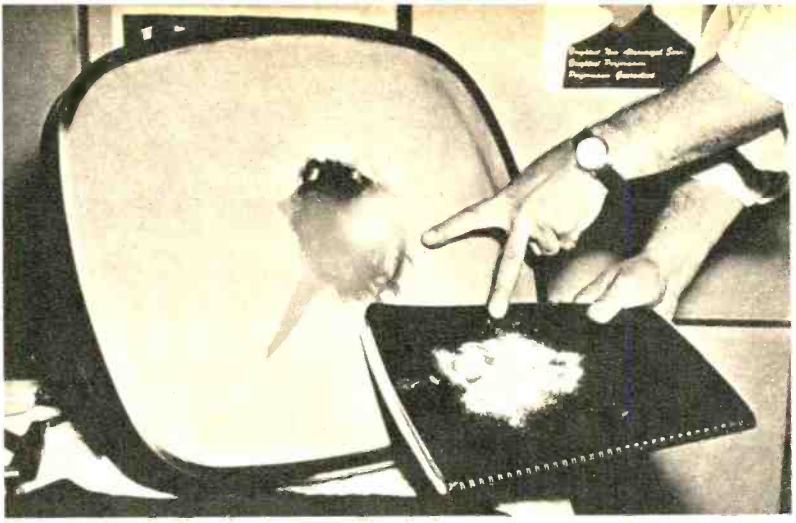


many advantages: it is extremely dependable and very economical to build. In addition, since only audio power is radiated, it does not fall under the jurisdiction of the Federal Communications Commission and any amount of power can be fed into the radiating loop. With a fairly sensitive receiver, the efficiency of such a system is remarkable and less than three watts of audio power are required to cover every thousand square feet. Thus, utilizing a 15-watt audio amplifier, an area of 100 feet by 50 feet can be handled. All that need be observed is that the impedance of the transmitting

[*Continued on page 89*]

PARTS LIST

L—Telephone pickup coil
C1, C2, C3—.1 mfd paper or ceramic disc 200 volt capacitor
R1, R5—1 megohm, ¼ watt resistor
R2—5600 ohm, ¼ watt resistor
R3—6800 ohm, ¼ watt resistor
R4—5000 ohm miniature volume control with switch and knob
TR1, TR2—GT 82 transistor
B—9-volt battery (Eveready 216)
Misc.—Battery clip, 5000 ohm magnetic earphone, phenolic board 1½"x2", large eyeglass case



Photos courtesy
La Salle Tube Mfg. Co.

Phosphors and aluminum sometime flake or peel off inside tube when air is let in to remove old electron gun. Best rebuilts have new inside surfaces.

Vacuum seal of dud is broken by hot wire which cuts glass evenly and slowly so that new neck can be welded on later. Glass envelopes do not implode during delicate process.

Neck of tube is carefully cleaned with acid baths, then rinsed to remove any trace of the acid. Old gun and base of tube have been taken out, thrown away.

all about

Rebuilt TV Picture Tubes

By E. M. Delman

Wonder how good rebuilt video tubes really are? How they fix the "dud"? Here's the inside story.

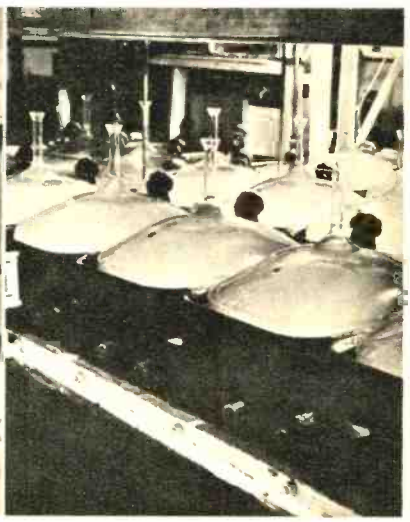
CHANCES are three-to-one the next time you replace the picture tube in your TV set, the glass envelope will have seen service in someone else's set at least once—and perhaps two, three, or four times!

Using the glass envelopes of burned-out picture tubes over and over again makes a lot of sense. After all, it's what's *inside*

New electron guns, which "paint" picture on tube's face, are inspected at RCA's plant in Marion, Ind. There is no difference between guns in new, rebuilt tubes.

Here electron gun is ready to be inserted into neck of TV tube. Additional glass tubing to replace that part cut off when seal was broken, has been welded on.

Tubes at Sylvania plant are put on conveyors where they are re-phosphored. As bulb moves down line, phosphors settle uniformly. Screens are heat-dried.



STEPS IN REBUILDING

1. "Dud" glass inspected for chips, breaks.
2. Neck is cut, vacuum seal broken.
3. Shortened neck is returned to original length by welding on 4-inch glass tube.
4. Phosphor screen is washed in series of acid baths and rinses.
5. New phosphor screen is deposited on tube face.
6. Plastic is sprayed inside tube to bind new aluminum coating to glass.
7. Screen is aluminized by vaporizing piece of aluminum inside bulb under temporary vacuum.
8. Tube is baked to remove plastic, leaving aluminum.
9. New electron gun is mounted in neck.
10. Tube is evacuated and sealed in vacuum at temperatures up to 900°F. to help drive off gases inside glass envelope.
11. Base is added; leads and pins soldered.
12. Tube is "aged" under normal operating conditions for about one hour.
13. Tube is mounted in test panel and subjected to about 20 checks for shorts, quality of cathode, etc. If tube fails any test, it is returned to first step.
14. Face plate is buffed with polishing rouge.

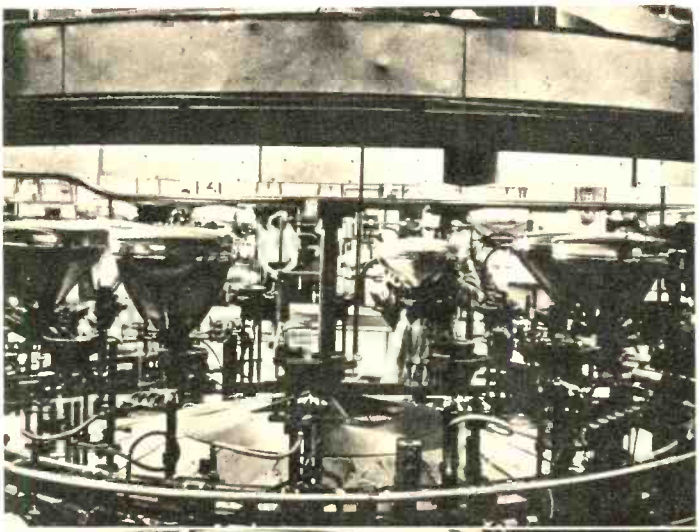
the "bottle" that you're buying. In picture tubes, only the insides, the electron gun and phosphor screen, wear out. As long as the glass envelope isn't broken or the tube face isn't badly scratched, it can be used again.

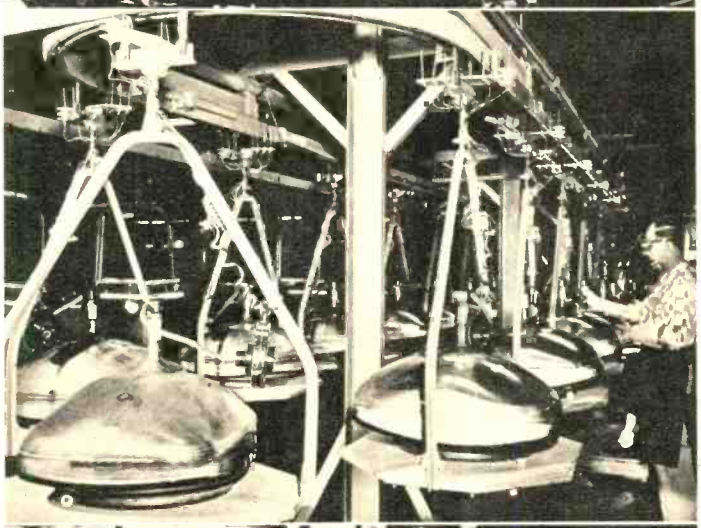
Picture tube rebuilding goes back practically to the advent of commercial television. The first rebuilder set up his little shop in 1949. Since the glass envelope is the most expensive part of the tube, he reasoned that the electron guns and phosphor screens could be replaced cheaply enough in burned-out tubes (called "duds") to sell the rebuilt units considerably below the price of new picture tubes. In addition, the Federal excise tax on new tubes apparently did not apply.

Some of the new picture tube manufacturers tried to make it hot for the rebuilders by stirring up the Federal Trade Commission. Eventually, the government applied the excise tax to rebuilts. However, that has not kept over 100 rebuilders from doing a land-office business selling replacement tubes from 20-40 percent less than all-new ones. The time finally came when major

[*Continued on page* 108]

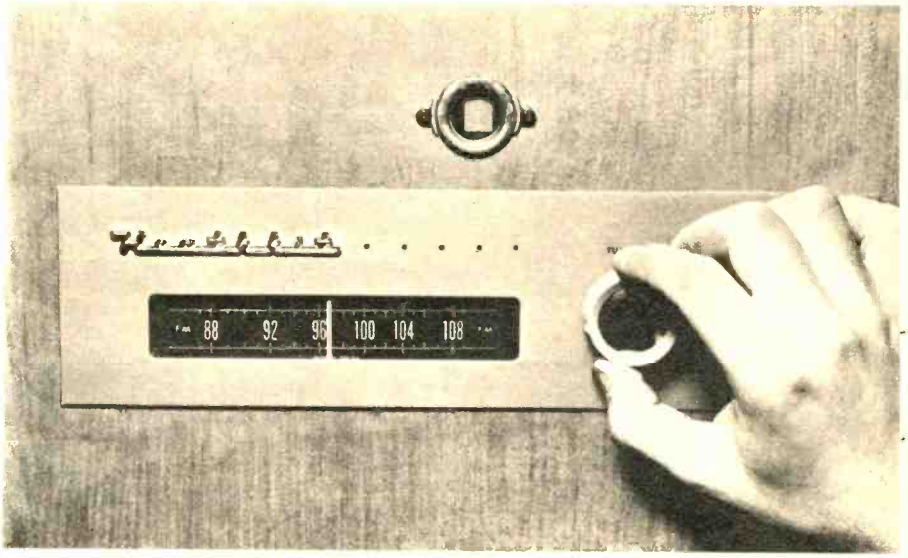
"Merry-go-round" machine seals electron gun on RCA factory rebuilt "Monogram" tube line. Series of gas burners melt glass in neck of bulb temporarily, securing gun in correct position.





Rebuilt tubes pass through machine that performs an emission and gas check at the end of Sylvania's tube production line at Seneca Falls, N. Y. Rebuilt tubes receive as many, if not more tests than new ones.

Before being packed and shipped to dealers and TV servicemen, rebuilt tubes have their faceplates carefully buffed with rouge to insure a smooth viewing surface.



Since many compact FM tuners will not have room for the eye, it may be mounted on an external panel. Diagrams on next page show how eye reacts.

Add a Tuning Eye to Your FM Set

By Paul Hertzberg

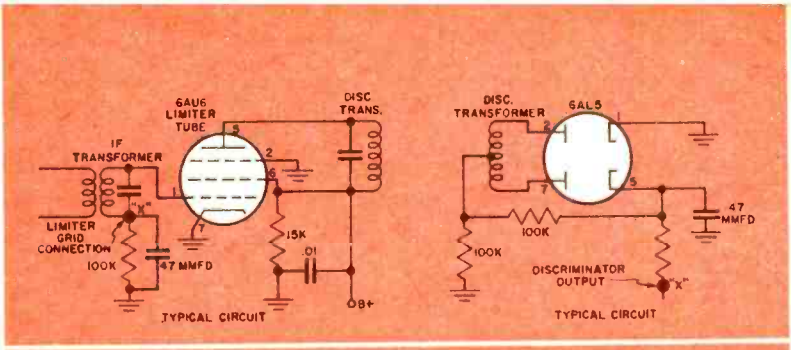
Precise visual tuning of FM stations is possible with an electron-ray tube. Here's how to install one.

IF you are constantly turning the knob of your FM receiver trying to tune in the station clearly, installing a tuning indicator is certain to solve the problem. Adjusting the tuning dial is critical, since the proper adjustment is not the one that gives maximum speaker output.

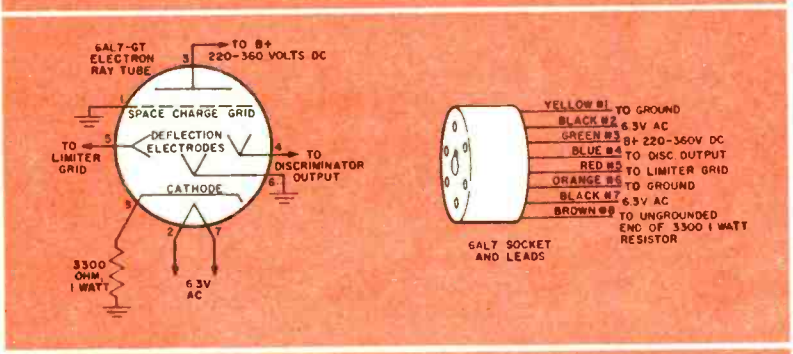
An indicator tube, 6AL7, has been designed to show visually the effects of tuning in a signal. The FM receiver's limiter grid voltage and discriminator output voltage control the illuminated portions of this special tube. The accompanying patterns show what happens when a station is not tuned in at all, when the station is tuned to its low or high frequency edge, and properly tuned.

The tuning indicator can be mounted in the tuner cabinet or on a front panel near the chassis. The socket leads enable you to place the tube up to 22″ from the connections in the receiver.

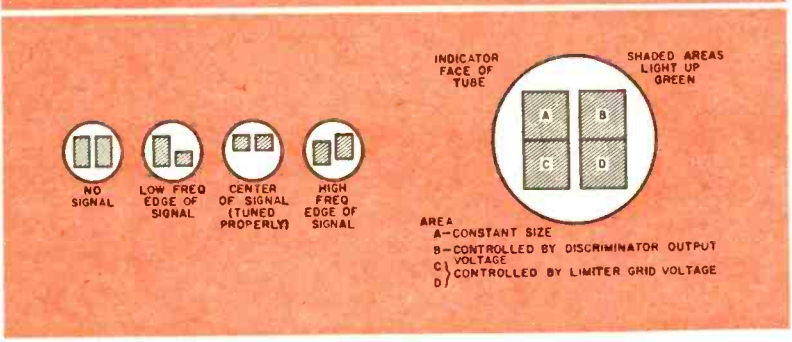
A typical limiter and discriminator circuit are shown with the points indicated where the two main connections are to be made. Filament voltage is easily obtained by wiring in parallel with another tube's filament. [*Continued on page* 112]



Limiter-discriminator in FM set. Note "X" points.

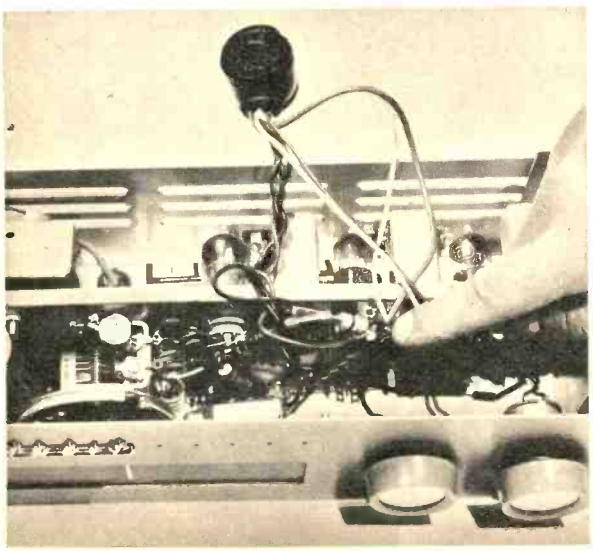


Eye tube schematic and its color coded connections.

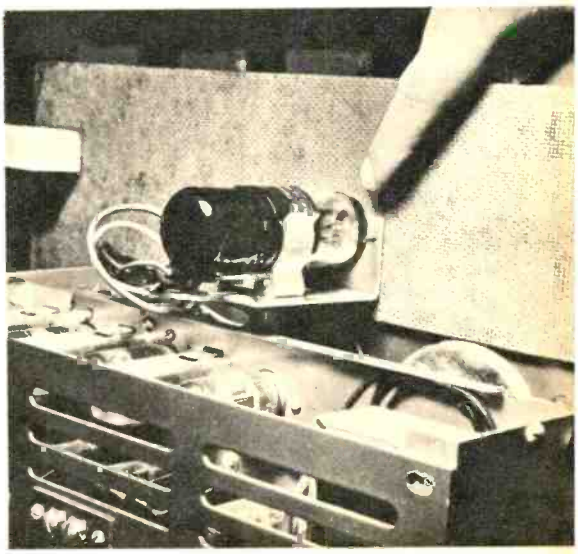


Various patterns on face of eye as FM dial is tuned.

A 3,300 ohm resistor, added to circuit, goes to ground of FM set and pin 8 of eye tube.



After wiring is done, 6AL7 tube is plugged into its octal socket and snapped into the clamp.



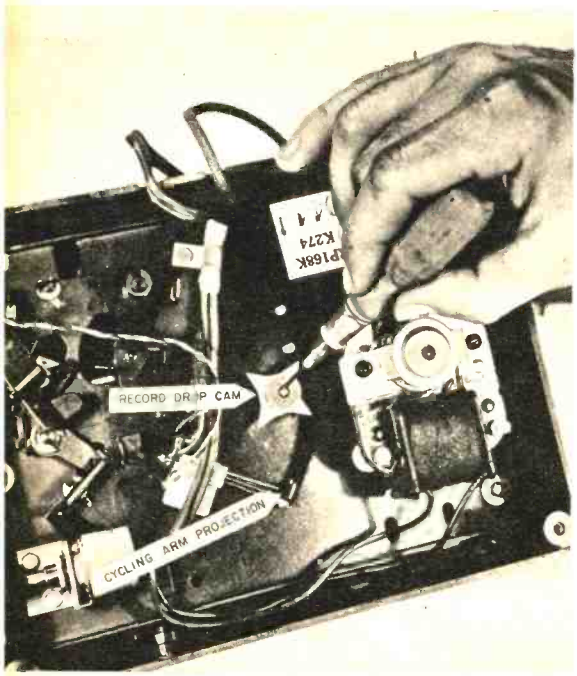
Tape arm down to protect cartridge while working on changer. Piece of sponge between arm and deck will protect stylus from damage.

How to

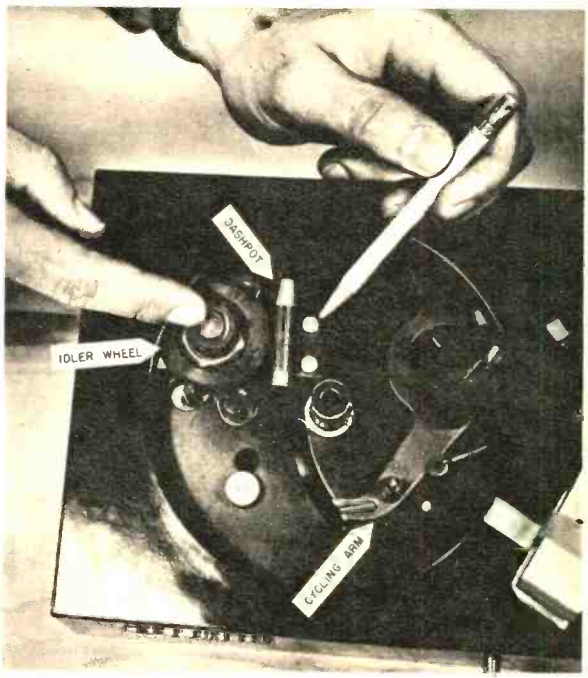
Fix Your 45 RPM Phono

By Joe W. Rocke

HAS your 45 rpm record changer been relegated to a back shelf because it will no longer change records automatically? Chances are that all it needs is a tune-up. The mechanism in the '45 is sturdy and dependable; an ideal combination in an automatic changer for the small fry. Follow these hints for many more hours of trouble-free listening.



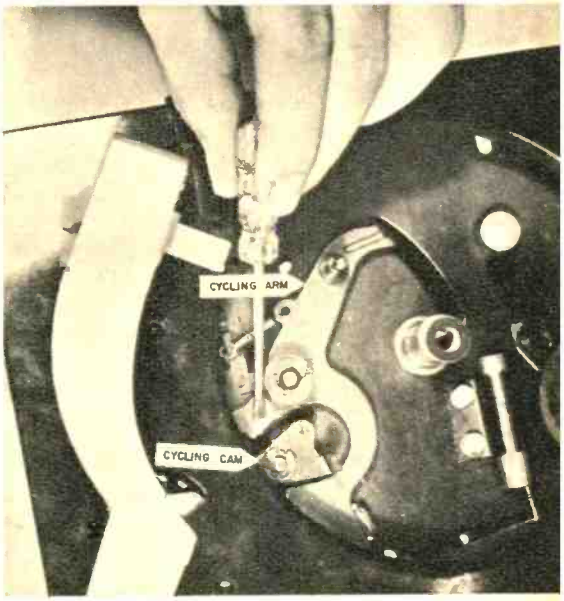
Turntable removal. First scribe mark on cam so it may be re-installed in same position. Loosen set screws then pry off circlips on turntable shaft. Pull turntable straight off.



Worn idler wheel causes turntable slippage. To replace it, dashpot must be removed (mark position). Circlip on idler is slipped off with screwdriver. Swing idler to right and pull off.

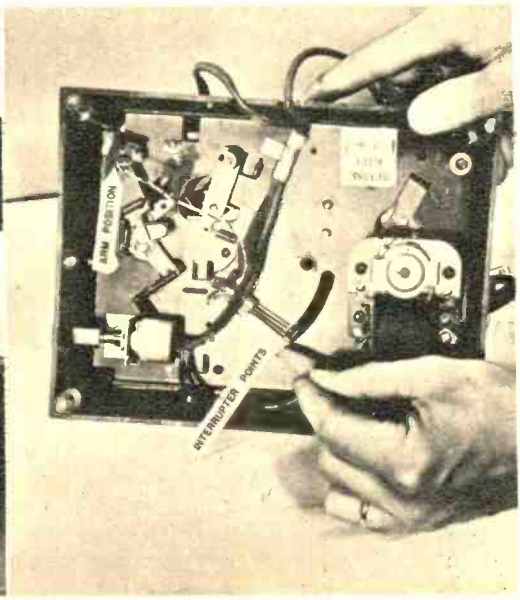
Apply small amount of light grease to grooved track on underside of turntable. Wipe inside rim of turntable and remove glaze with fine sandpaper. Apply light oil on turntable shaft.

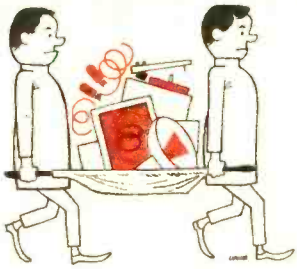
If turntable fails to cycle, check for excess friction at point shown and apply tiny smear of grease. Check all levers for free movement, oil their pivots lightly with a toothpick.



Tone arm height is adjusted so arm clears stack of records. Another hole, further forward (not visible) is for the needle setdown position. Adjustments are trial and error.

If audio output seems weak or scratchy, clean points with extra-fine sandpaper. Make sure they close completely. A weak spring on the cycling arm may tend to let them remain open.





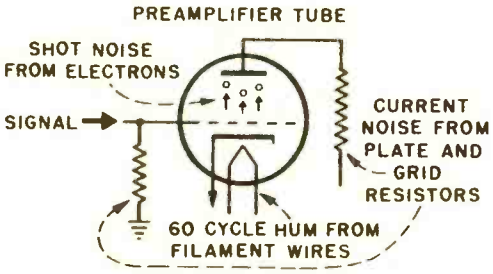
Hi-Fi Clinic

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

Hum and Noise

Whenever I increase the Bass control on my hi-fi set, there is a noticeable hum in the speaker. When the Treble control is advanced there is a hissing or frying sound. Is there a remedy for this?

Gene Morrison, New York, N. Y.



First we'll assume that your trouble was not present when the amplifier was new, thus ruling out poor design. Most noise or hum is traceable to the preamplifier, where signals are low level.

Try replacing the tube with one of the low-noise types now available. Be sure the ground between preamplifier and amplifier is secure. Adjust the hum balance control (if there is one) for minimum hum. Replace the preamplifier plate and grid resistor with low-noise types. Check if the tube shield is properly in place. Reverse the AC plug in the wall outlet.

Only the more expensive equipment fulfills the stringent design requirements for reducing hum and noise to very low levels. However, it is rare that tone controls are used at the extreme ends of their travel where the difficulties become annoying. Some of the causes are shown in the diagram. Shot noise occurs when electrons arrive at the plate. Current noise is produced from the movement of electrons through resistors and other elements in the circuit. Thermal agitation (not shown) produces minute noise since electrons do not move evenly through a conductor.

Hum may be amplified through cathode to heater leakage, or picked up from strong AC fields near the preamplifier. A poorly filtered power supply also contributes to hum.

Using An Old Speaker

I have an old speaker with a five-wire cable coming from it. I would like to know how I may use this speaker in conjunction with a radio that has two speaker leads.

Guy Fischetti, Bronxville, N. Y.

If three of the wires go to a transformer mounted on the speaker frame, and two emerge from the dust cover at the rear of the speaker, your job would be difficult. The speaker has a field coil that must be energized. All newer speakers utilize permanent magnets of the Alnico type.

The radio must be specifically designed to feed the proper amount of current to the field coil. Another difficult (and expensive) alternative is building a small power supply external to the radio.

Harmonics

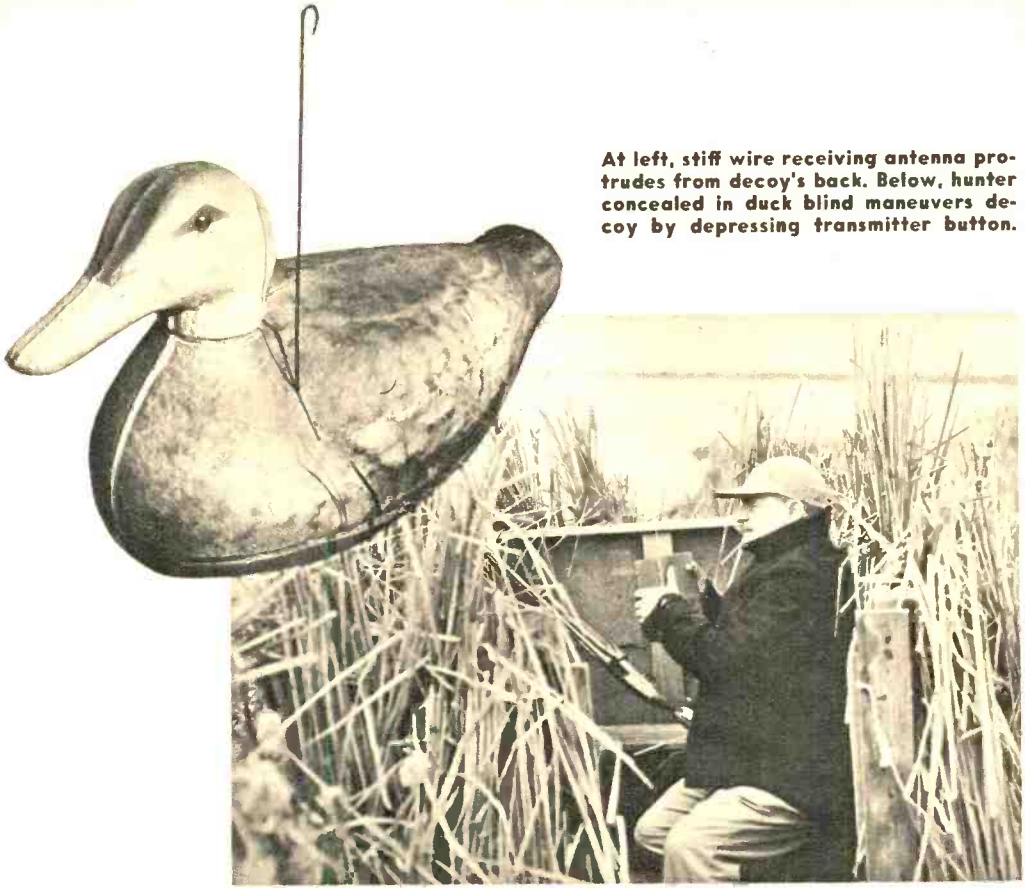
Would you please explain to me what harmonics are?

Denis Williamson, New York, N. Y.

Harmonics are tones whose frequencies are mathematically related to a single, lower-pitched tone (which is referred to as the fundamental tone or frequency).

For instance, if 1,000 cps is taken as the fundamental tone, its second harmonic will be a tone of 2,000 cps and its

[*Continued on page* 95]



At left, stiff wire receiving antenna protrudes from decoy's back. Below, hunter concealed in duck blind maneuvers decoy by depressing transmitter button.

R/C Duck Decoy

By Paul Hertzberg

Entice the real duck into range with this decoy —maneuverable around the lake by radio control.

INSTEAD of just bobbing aimlessly on the water, this "duck" can be directed anywhere on the lake. Decoys can be purchased at almost any sporting goods store for a few dollars. In order to install the equipment inside the decoy it is necessary to remove the top section shown in the photos. This is done with a razor, knife or similar instrument in order to make a clean cut. The bottom of the decoy is cut out, and a flat piece of pine fitted in place. It is absolutely necessary to waterproof this piece with several coats of clear dope or shellac. This wood base helps to stabilize the duck and provide a solid mount for the motors and other equipment.

The propeller drive motor shown is a K and O No. 2 mounted on a small block to give the proper propeller angle. It is fastened with small wood screws. Power is supplied to the motor by

a two-cell rechargeable wet battery. This type battery is sold at local hobby stores for about $2.50.

The rudder servo motor is a Berkley Wonder Motor attached to a 324:1 gear reduction box.

As long as the transmitter is keyed and the receiver picking up the signal, the servo motor will run. The motor turns the rudder through its straight-right-straight-left cycle. The rudder remains in any position until the transmitter is keyed again, continuing the cycle from wherever it stopped.

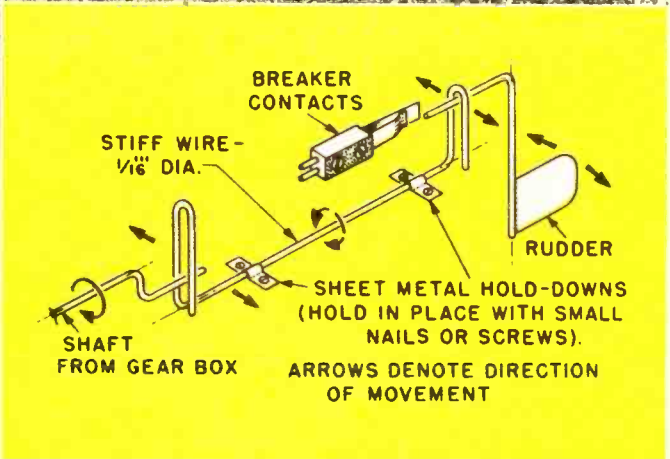
The duck can be stopped in the water by shutting off the drive motor. This is done by utilizing a set of breaker points actuated by the rudder mechanism. In the full right rudder position the points open, cutting the power to the drive motor. This system eliminates the purchase of an expensive motor control escapement.

A small, light-weight receiver such as the Gyro DX22 is ideal. The receiver and transmitter are operated on the 27.255 mc model control frequency. The receiver uses one small 22½ volt hearing aid battery and one 1½ volt size C battery. A thin piece of piano wire about 18″ long serves as an antenna and is almost invisible when the duck is more than a few feet from the shore. To add the finishing touch to the duck, paint it with colored dope to match the ducks on the pond. Check with your local authorities—in some states this electronic means of outwitting the ducks is illegal!

Various equipment suitable for in-

The back of the decoy duck is removable to permit installation and access to equipment.

Linkage translates rotation of gears to rudder action. Breaker stops motor at right rudder.



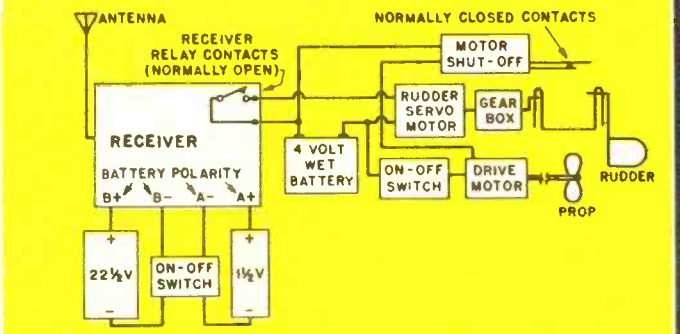
stallation in the decoy is available from:

Gyro, 325 Canal St., New York, N. Y.
Lafayette Radio, 165-08 Liberty Ave., Jamaica, N. Y.
Babcock, Van Nuys, Calif.
Polks. 314 Fifth Ave., New York, N. Y.

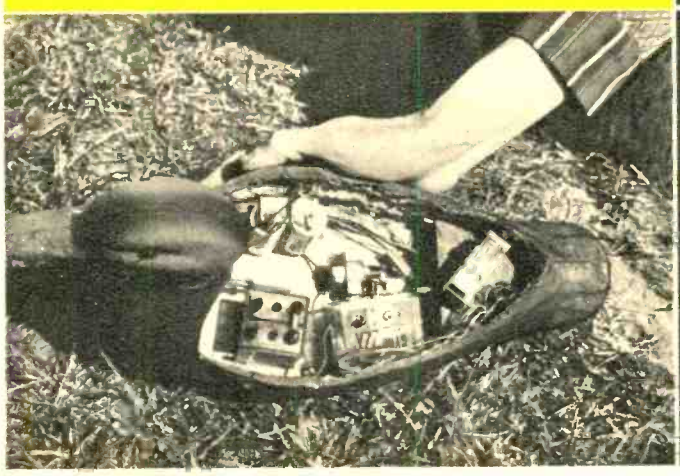
The transmitting equipment must be licensed by the FCC. No theory or code test is required to secure this ticket, which falls into the category of Citizens Radio. Complete details on rules and regulations are covered in Part 19 of the FCC's rules and regulations. This is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Include ten cents with your order.

The license form itself, if not packed with the equipment, is available from the FCC, Washington 25, D. C. Ask for form 505.

Equipment is visible within the body of the decoy. Finger points to 4 volt rechargeable battery for rudder servo and drive motors.



Block diagram of complete system using factory-built components. See text for parts.



Receiver is along lower right edge, in plastic box. Rudder servo motor is just above it.

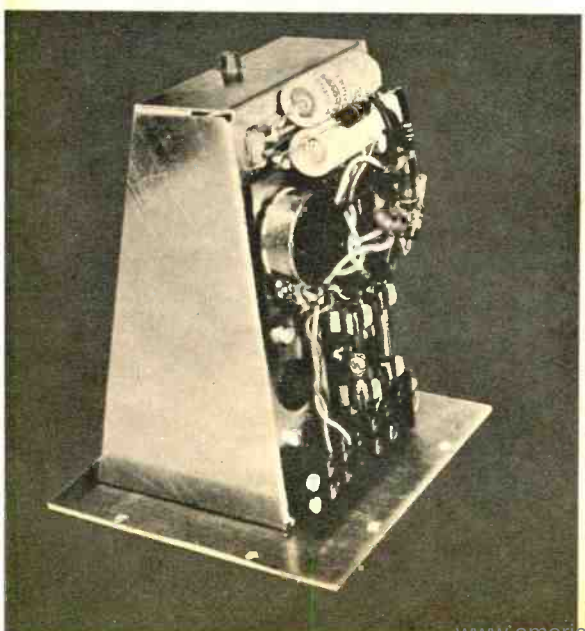
Mounted atop pipe, unit responds to beam from car headlights. It is unaffected by daylight.

Driveway Light Control

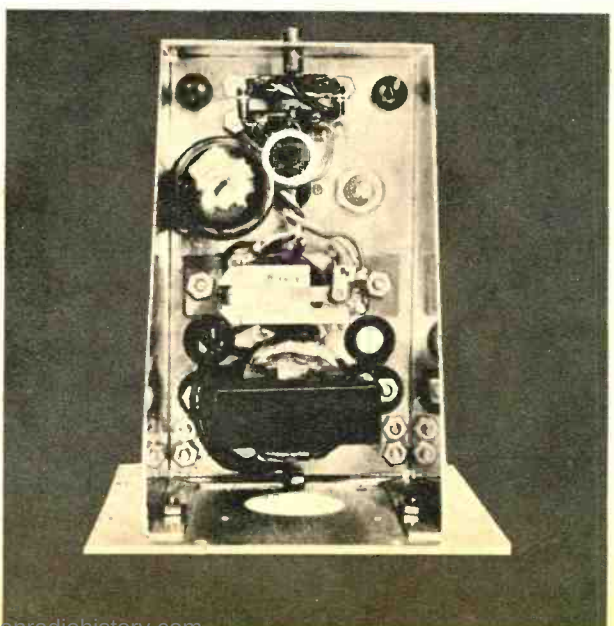
By Wayne Chou

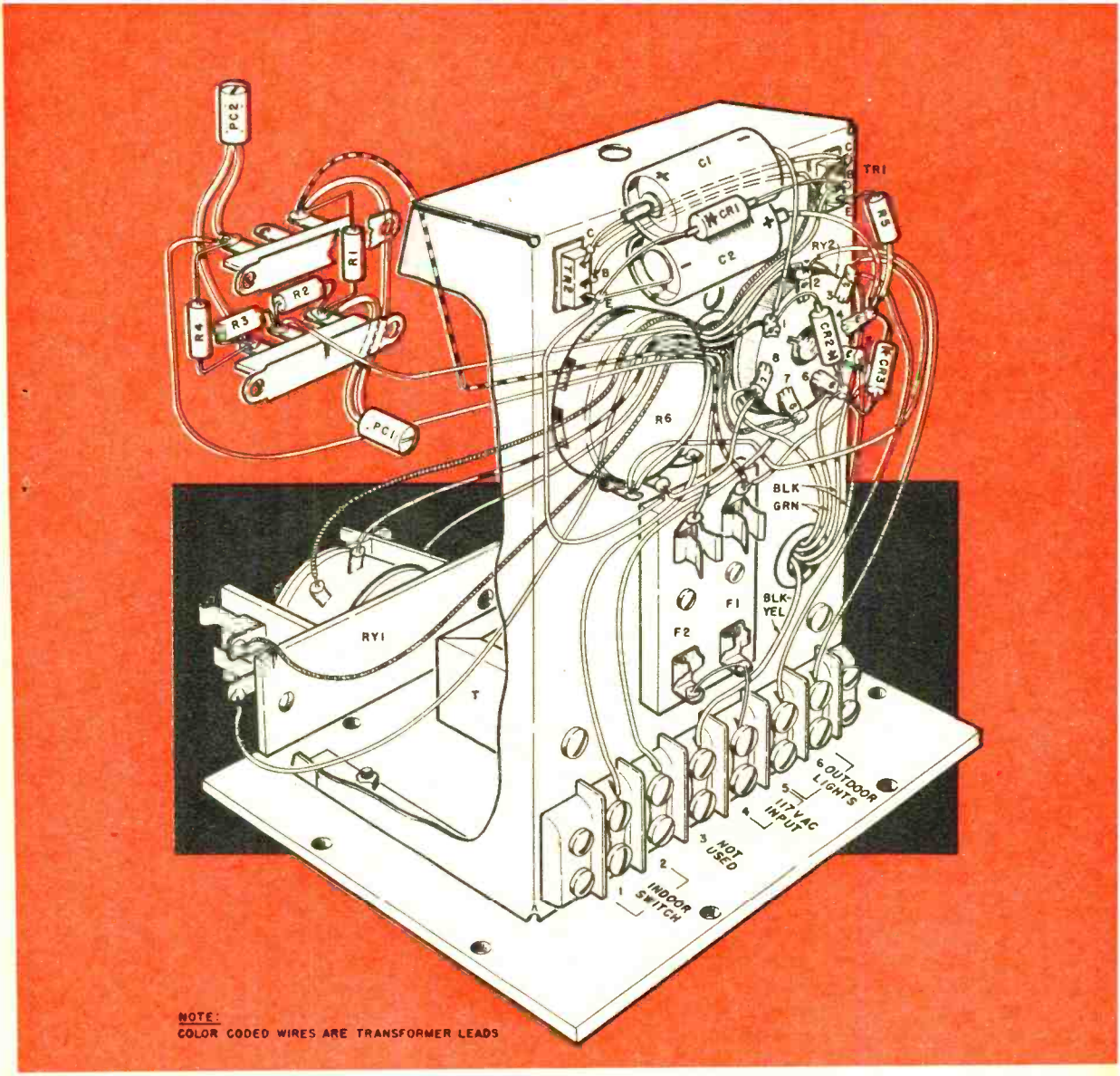
Pull in driveway, open garage, then walk to house—with outdoor illumination automatically controlled.

One side of chassis wiring and parts. PC2 photocell protrudes from chassis lip at top.



Other side of chassis. White circle near top shows rear view of PC1, the control photocell.



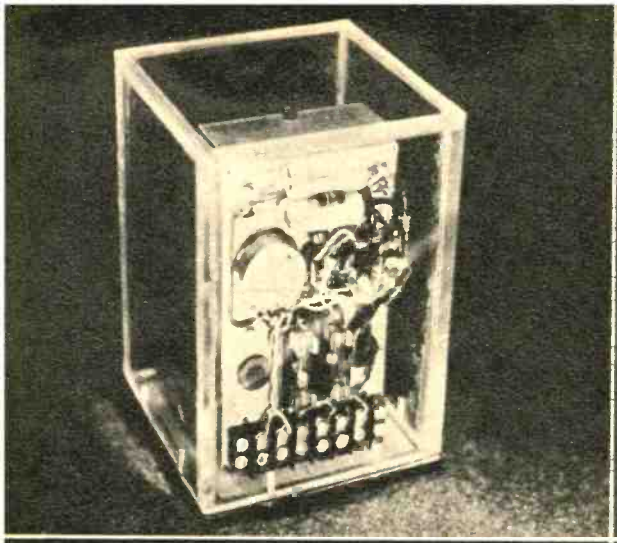


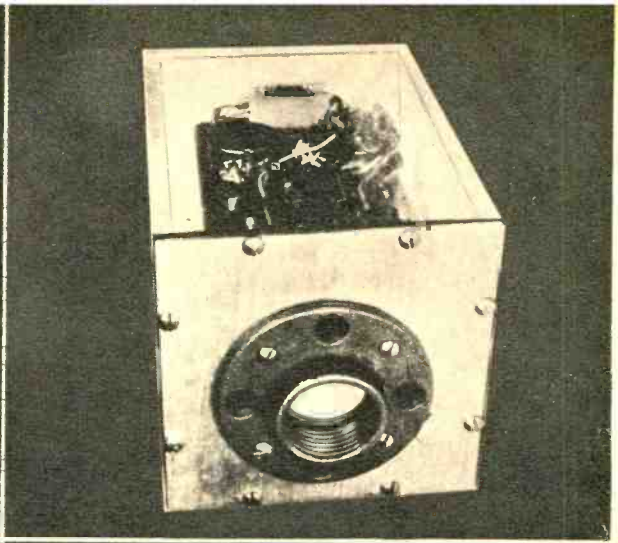
For reasons of clarity, assembly at upper left has been drawn away from chassis. See photos on previous page for actual location of PC1, PC2.

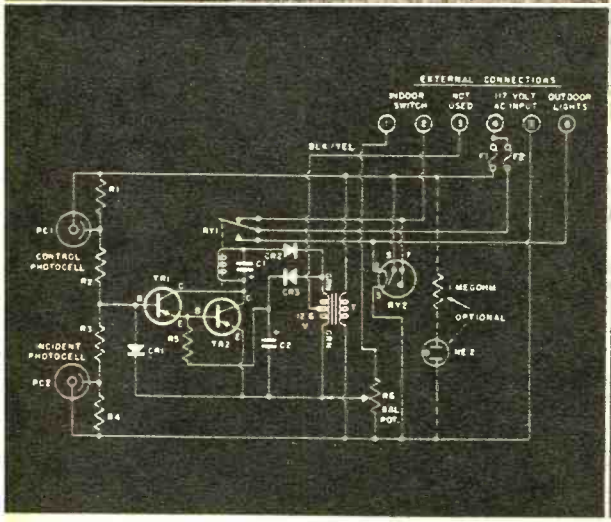
HOW many times have you come home late at night, especially during the icy winter months, and wished it was still light enough to walk to your house without fear? The unit described here solves this problem by automatically turning on an outdoor light as your car enters the driveway.

The light remains on for three minutes to enable you to walk to the house. An indoor switch permits the reverse situation to occur. Flip it on and you may walk out to the garage, your pathway lit for three minutes. An over-ride feature allows the outdoor light to remain on for any length of time.

Two photocells were incorporated into the design of the unit. One is activated by the car headlights, while the other prevents operation during the day when sunlight falls on the control cell.







Upper left shows Plexiglas cover used to weatherproof the unit. Its edges are sanded smooth and glued with plastic cement.

Above, underside view shows bottom plate with pipe flange. Plexiglas is tapped to receive 6-32 screws which fasten plate.

In schematic, dotted lines at right show optional neon bulb, useful as a pilot light for indicating the presence of AC power.

Note in the wiring guide that they are mounted at right angles to each other.

Follow the illustrations for construction information. Plexiglas was used to encase the unit. It must be carefully assembled for weatherproofing. Other alternatives are food containers, fish bowls and the like, but the material must be transparent and as distortion free as possible.

After the circuit is wired, checks are made to verify its proper operation. Short the indoor switch terminals and pins 5 and 7 at RY2. Then connect the 117 volt AC terminals to house current. Rotate the balance potentiometer R6 in either direction and note if relay RY1 closes. If it does not, check for 18 volts DC across the relay coil. Failure of the relay to operate with this voltage usually indicates that its spring tension is too tight. Bend the spring to remedy

[*Continued on page* 104]

PARTS LIST

R1,R4—100,000 ohm ½ watt resistor
R2,R3,R5—47,000 ohm ½ watt resistor
R6—100,000 ohm potentiometer ½ watt
C1,C2—10 mfd 25 volt electrolytic capacitor
RY1—SPDT relay 2500 ohm coil (Potter & Brumfield LB5 2500 ohm)
RY2—Thermostatic time delay relay (Amperite 115N0180)
T—Power transformer 117 volts AC to 12.6 volts AC (Stancor P-8130)
CR1,CR2,CR3—1N48 or 1N34 diode
TR1,TR2—2N43 transistor
PC1,PC2—Cadmium selenide photocell (Clairex CL-3)
F1—⅓ ampere fuse type 3AG
F2—5 ampere fuse type 3AG
Misc.—Fuse block for two type 3AG fuses, transistor sockets, 6-terminal barrier strip, weatherproof transparent case four 4¼"x6" pieces, one 4½"x6" piece for top (all ¼" Plexiglas if desired). Aluminum chassis base 3"x5½" with 4½"x4½" plate for pipe mount.

"A radio station in a lawn mower," people tease. Actually it is K9JAW's Gonset "Communicator" in a roll-back top Isetta.

Here's Homer, K9DYP, in clothes closet hamshack. By judicious use of shelves, he has been able to cram just about everything he needs into this "hole in the wall." Now running out of QSL card display area, he has made contacts clear around the world without benefit of kw transmitter.

Your Hamshack Can Go Anywhere!

By Carole F. Hoover, K9AMD

Wherever they live, wherever they go, amateur radio ops somehow find a way to get on the air.

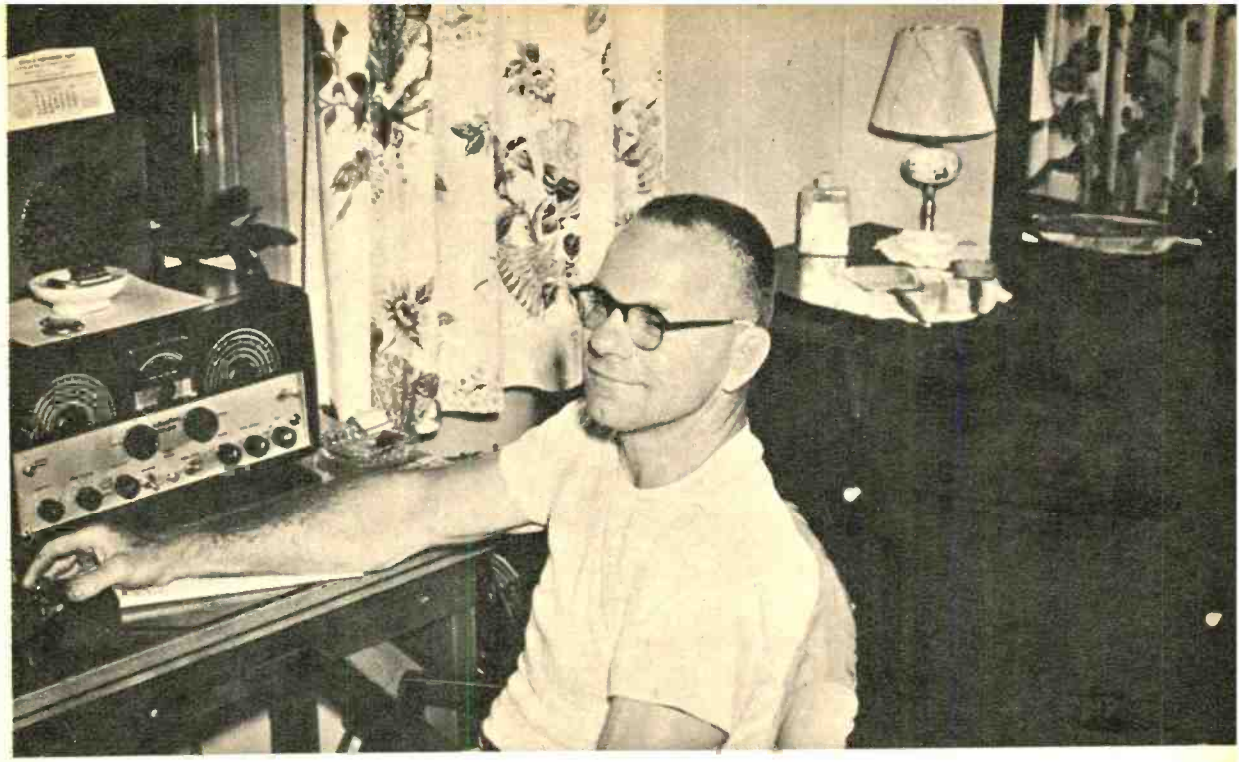
WHERE to put the equipment? Now this can be a delicate matter when there are wives and landlords with which to contend. But every ham knows if you give him an inch, he'll soon have a "shack," whether it's in the attic, alongside the furnace, on land, sea or above the clouds.

Fortunate, but few, are the amateurs who enjoy the ideal situation—a spacious, air conditioned radio room or workshop where they can accumulate receivers, transmitters, and the precious spare parts known to most outsiders as "junk." Many more are stuck with a dark corner or stuffy slot in an otherwise uninhabited part of the house. One such ham, who was quick to meet

Left: Each shelf in "console" arrangement of YL Bobbie Pattie, K9GOL, was designed with a specific piece (or two) of gear in mind. Custom-built shelves are usually most satisfactory. Dick Pattie, W9VWJ (right), operates from table in corner of family living room. "I prefer calling my CQ's from a big, stuffed chair," he says.

Gene Markos, K9JFE, operates from the basement laundry room, but he has to stay on CW until the noisy washing machine has done its chores. Then he can switch to phone. XYL, Nita, is K9JFD; uses same rig.

Spacious basement workshop is ideal for the ham who puts together his own gear, once the dampness problem has been licked. Wires may be strung at will without disturbing others.



While the XYL sleeps, Bill Jenkins, W9WHL, happily works electronic "bug" from writing desk situated in bedroom. His wife has become almost immune to the sounds of hamming at bedtime.

the no-elbow-room challenge, operates from a tiny clothes closet.

"It's crowded, but I make contacts from New Zealand to Africa," laughs Homer Hucker, K9DYP. "Now I'm even considering the problem of squeezing a kilowatt transmitter in there!"

By taking advantage of shelf space, Homer tunes his receiver at chair level, dips the final of his transmitter on the second shelf, and stacks the rest of his gear up to the ceiling. He usually leaves the door open for ventilation, but when his wife has a bridge party, the only tell-tale sign that Homer is hamming is a thin, white stream of cigarette smoke curling up from the crack at the bottom of the door. [*Continued on page* 104]

WHERE TO PUT YOUR HAMSHACK

LOCATION	PLUS FACTORS	MINUS FACTORS
Basement	storage space; privacy	dampness; rubber runners desirable near equipment
Kitchen	convenient for hamming XYL	cooking grease gums gear; shock hazard on wet counters and tables
Living room	comfortable	disturbs others in family; difficult to stow gear; string wire neatly
Bedroom	comfortable	same as living room
Attic	ease of antenna installation; ideal after you lug up gear	generally requires air conditioning in warmer months
Garage	will not disturb others	possible heating and dampness problems; shock hazards
Auto	no TVI; you can ask directions of local hams when on long trip	special antenna problems on lower frequencies; capacity of car's electrical system important
Boat	no TVI; rig is available for possible distress use	dampness and spray; capacity of electrical system important
Airplane	high antenna	airborne gear must be portable or else approved by FAA

the new art of

Electronic Music

Serious composers and audio engineers join forces in effort to create lasting works of musical art.

A NEW art form, generally called "electronic music," has come into being and has captured the imagination of serious composers as well as electronics experimenters all over the world.

Here in the United States, creating electronic works and studying compositional possibilities of sounds manipulated by electronic devices is centered in a studio located at Columbia University. This studio is now in the process of greatly expanding its facilities with the aid of a Rockefeller Foundation Grant given jointly to Columbia and Princeton Universities. The new electronic music center is administered by four composers: Otto

With an array of complex equipment in background, Professor Luening listens as electronically manipulated sounds are mixed with those of flute.

Photos by Flatow

1. Composer Ussachevsky (with score) and Peter Mauzey, engineer, listen for unwanted distortion on final tape. 2. Composer adjusts long tape loop which stretches from tape recorder all the way across studio and back. Loop in motion will repeat sound pattern while composer shapes sound with filters, speed variations, etc. 3. Composer Luening checks and times one passage of composition. Convenience of being able to hear each step of work in progress is big advantage of composing with tape. 4. Percussive sounds, such as those from Oriental gongs and temple blocks, make valuable raw material which can be modified and mutated by electronic means to produce new, interesting timbres. 5. "Conductor" can reach controls from one location.

Luening and Vladimir Ussachevsky of Columbia and Roger Sessions and Milton Babbitt of Princeton. The engineer in charge is Peter Mauzey of the Electrical Engineering Department at Columbia.

The accompanying photos show how composers have functioned in the original small, but nicely diversified Columbia studio. Organization of any electronic music studio depends on the kind of sound material with which the composers prefer to work. In Germany composers use only electronic instruments to generate their sounds. In France they rely mainly on the electronic modification of existing sounds, including conventional musical instruments. In the United States, the original Columbia studio has not restricted itself to any single class of sound sources, using whatever sound manipulation techniques were available. The compositions produced in this studio became known as "tape music."

It is popularly thought that in order

BFO, signal generator and electronic switch are used to create regular rhythmic patterns of pure tones. At right, author's "Composition for Tape Recorder" rests on desk in front of recorders, mixers, etc. Five recorders, two mikes, eight oscillators may be mixed at once.

to live up to the designation "music," a combination of sounds must be pleasing, expressive, or intelligible to the listener. To create an electronic musical composition, five basic steps are necessary to achieve the most comprehensive results. First, one must decide on the electronic or non-electronic origin of the sounds, which are then recorded. Next the sounds are usually modified. Thirdly, the various sounds are mixed. Then these combinations of sounds are arranged in a pre-determined sequence on several reels. Finally, the material on these reels is combined to produce the final composition.

The equipment used at Columbia to accomplish these varied functions was set up by Peter Mauzey. To supplement sounds from conventional musical instruments and recordings of those instruments, several electronic sound sources, such as sinusoidal oscillators and square-wave generators, are used. These sounds can be modified by filters, equalizers, modulation, and judicious tape editing, while mixing devices can blend as many as eight inputs to produce a single output. The tape recorders are all Ampex professional units.

The recording of original sounds on tape represents only the first step. The composer must then take the original sound, modify and combine it to produce new timbres and to create new rhythmic patterns. Original sounds seldom are retained in the final composition, but are altered, one by one, cut and spliced in a planned sequence by the composer.

There are many ways in which sounds or segments of sounds can be prolonged, but one of the most interesting is the tape loop. A loop can be made of a tape recording of any sound; it can be made as large as the size of the room allows. The loops can provide a repeated sound of short duration, or an uninterrupted sound.

Composers of electronic music use a variety of filters not normally found in recording studios. Equalizers and band-pass filters are useful, but octave filters, such as third-of-an-octave filters with individual attenuation on each channel are more versatile.

Filters provide a means of carefully controlling changes in frequency content. Composers know that changes of timbre have a subtle psychological effect, and a group of individually controlled filters allows the composer to shape gradually a sound spectrum into

[*Continued on page* 109]

Here is a line-up of budget-priced communications receivers designed in simple to assemble kit form, any one of which will add to your short-wave enjoyment. Both Knight-kits shown sell for under $20, while the new Philmore 4-band receiver is under $40.

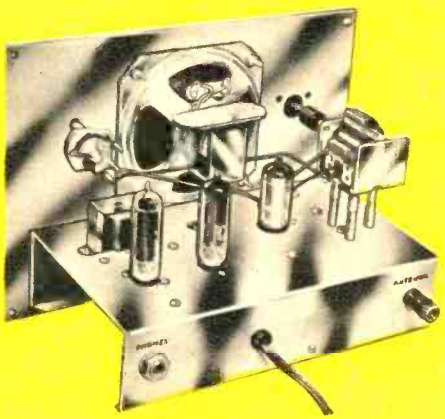
Kits for the Short-wave Listener

So you want to listen to shortwave, but you don't think you can afford a receiver. Look at these!

"SURE there's adventure on the airways! That shortwave's great stuff. I'd sure like to tune in the world and listen to all that exotic programming. I might even want to collect QSL cards as a hobby and eavesdrop on the amateur bands as well. But I'll tell you something: I'm not ready to plunk down $100 or $200 for a receiver!"

Well, you don't have to. There are plenty of inexpensive short-wave receivers on the market and there are always the kits. Know how much they cost? As low as $15.95!

The Knight-kit "Ocean Hopper" receiver sells for that price. For about $3 more you can get a set of five plug-in coils that will bring in frequencies from 155 kc to 35 mc, including the standard broadcast band. In addition to the main tuning dial there is an all-important bandspread tuning feature. Bandspread tuning is almost essential in a short-wave receiver for ease and accuracy in separating overlapping stations. Also on the front panel of this receiver is an antenna trimmer to provide sharp reception. No speaker in this model, so you'll have to listen via headphones.



At top is the Heathkit model AR-3 4-band receiver which sells for $29.95 without the cabinet. Its tube complement numbers five, with beam power output. Amateur bands are marked off on the slide rule dial face. Below is the Lafayette 3-tube "Explor-Air" kit that can be bought for only $18.50, less case. It has features found in more expensive receivers, such as bandspread tuning.

Another budget-priced Knight-kit short-wave receiver is the "Space Spanner" which carries a price tag of only $18.95, including case. Again there is bandspread tuning. In addition to local broadcast signals, you can pull in short-wave between 6.5 and 17 mc. These frequencies include the 20 and 40 meter amateur bands, police, aircraft and marine stations, and broadcast stations overseas. There's a built-in 4″ speaker in addition to headphone connectors, while a speaker cut-out switch lets you select private listening or both speaker and headset.

If you've never built a kit, chances are you're wondering about the level of electronic knowledge required. You can set your mind at ease on this score. Most kits can be assembled by a beginner in a matter of hours, and all you need is a soldering iron and a screw driver.

Kit manufacturers, along with their design engineers, take great pains to clearly mark and identify parts and prepare foolproof, step-by-step, instruction booklets. If you follow the instructions, checking off each step as you complete it, you'll have no difficulty. You don't even have to know how to read a schematic diagram since the instruction booklets include wiring diagrams that actually *picture* the various components and connections.

Typical of the easy-to-follow instructions are those issued with the new Philmore communications receiver kit Model CR-5AC. Here is a lot of radio

for $39.95 (less cabinet). There are four bands covering all frequencies up to 30 mc, including the standard broadcast band. The amateur and novice ham might take serious notice of this kit since it covers the 10, 15, 20, 40 and 80 meter bands as well as the 11 meter Citizens Band.

Some of the more sophisticated features of Philmore's 5-tube superhet receiver are electrical bandspread tuning on each band, a horizontal tuning dial 11 inches long, flywheel tuning and a built-in S-meter that can be used for precise tuning in addition to a signal-strength meter. There is also a built-in BFO with adjustable tone control, a big help when listening to CW signals. Additional features are a noise limiter, AVC switch, standby position for use with transmitting equipment, an input jack for an external Q-multiplier, and an auxiliary power socket. A built-in speaker rounds out the picture. The chassis is designed either for rack mounting or insertion into a heavy-gauge steel bookshelf type cabinet. The cabinet sells for $7.95.

Heathkit's AR-3 receiver is $29.95 less cabinet, which costs another $4.95. Frequency coverage is 550 kc to 30 mc in four bands which are marked off on a slide-rule dial. RF and AF controls, bandswitch, bandspread, standby switches are additional features, as is the antenna trimmer. There is also a noise limiter, and a Q-multiplier can easily be added.

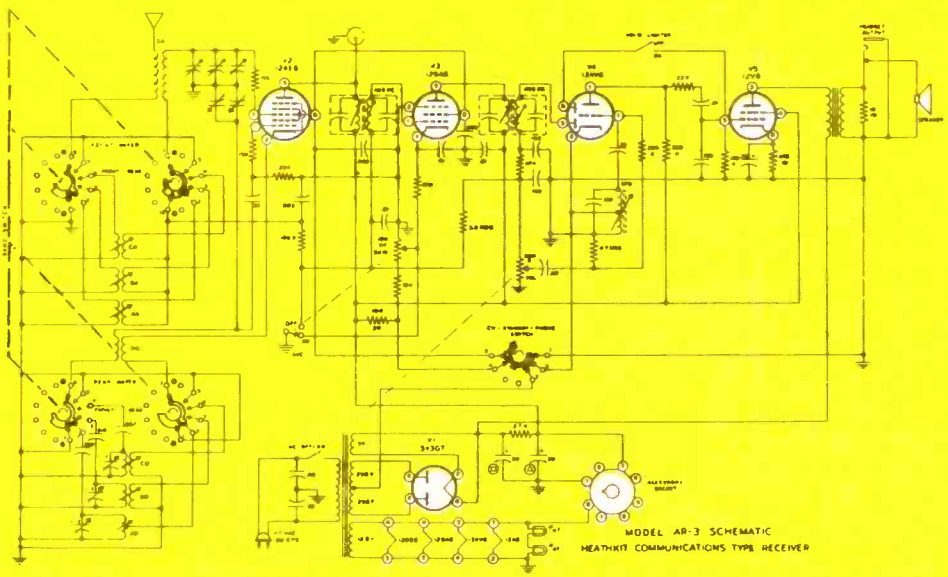
Lafayette's entry into the low-priced short-wave receiver kit market is the "Explor-Air," which also covers 550 kc to 30 mc in four bands. It sells for $18.50 with a wooden-based cabinet costing an additional $2.75. Bandspread, bandswitch and antenna tuning are all on the front panel.

Of course, the better your antenna the better your reception on any receiver. However, for the receivers described above, no special antennas are required. Generally speaking, a standard long wire assembly will bring in some pretty exciting listening.

Keep the antenna wire high for best results. Its length should run about thirty to a hundred feet. Keep it clear of steel structures, which reduce signals considerably.

Glass insulators are available for preventing the antenna from grounding out against the tree or pole it is tied to.

Schematic diagrams of most kits are similar to this one of Heath's, detail drawings are furnished.



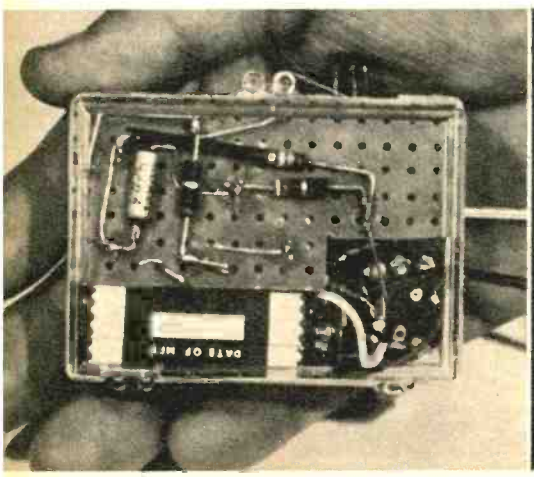
Stiff wire probe is touched to input and output stages of table model broadcast set.

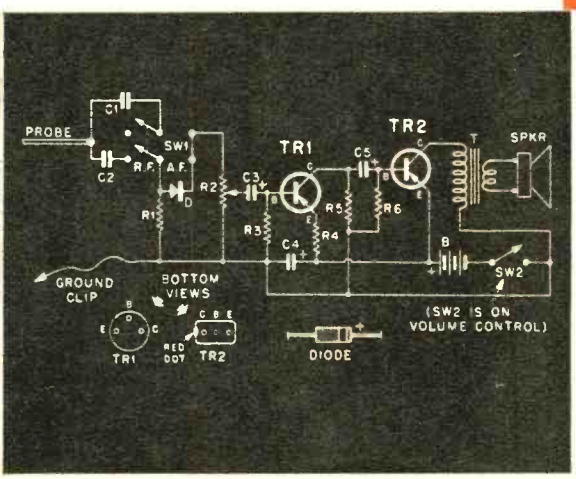
Radio-TV Troublefinder

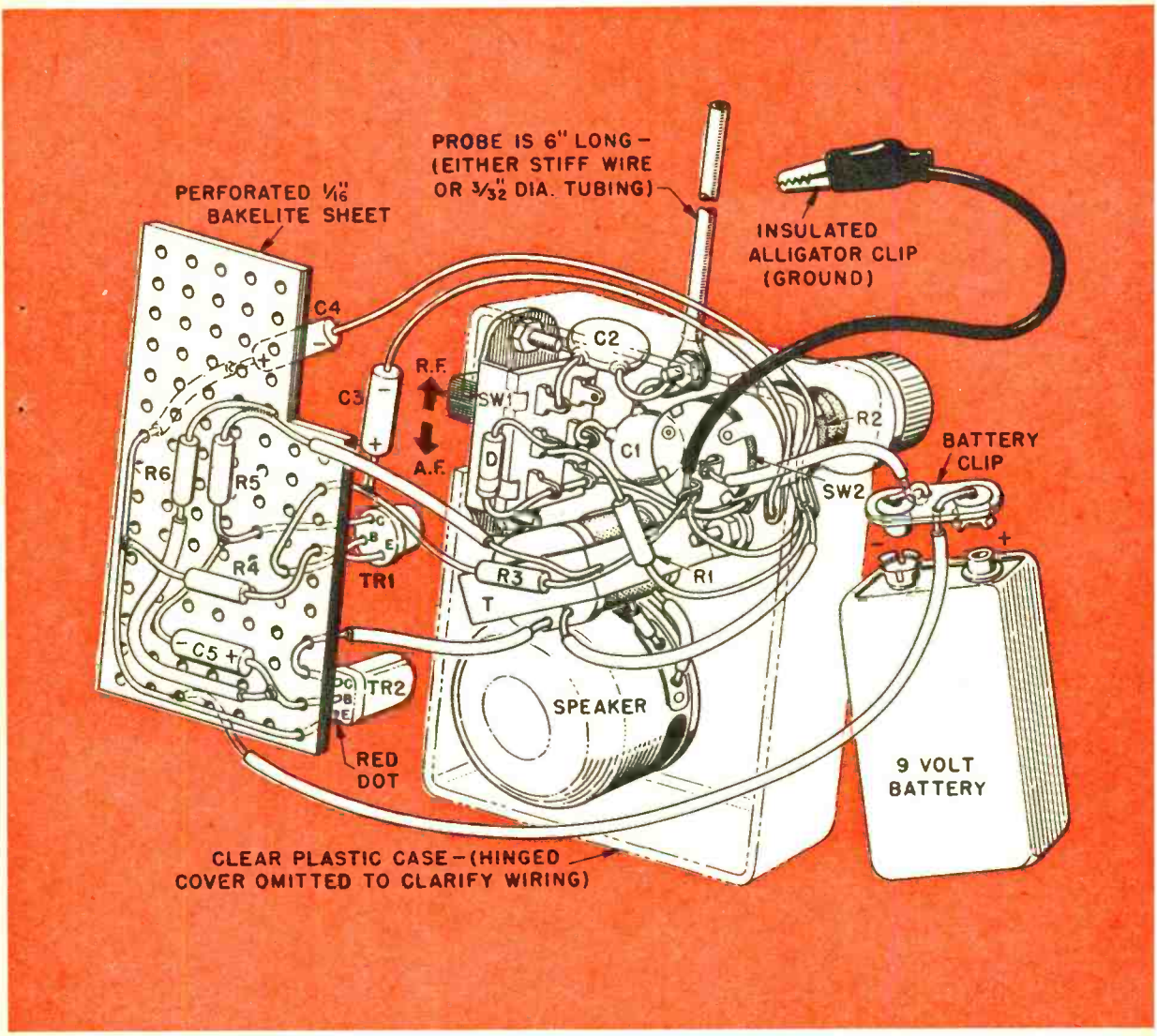
By Paul Hertzberg

This compact signal tracer, with built-in speaker, will help locate faulty audio or radio stages.

Perforated board is cut to fit case; leads on parts are threaded through holes. Leave room for battery, at lower edge. At right is schematic.





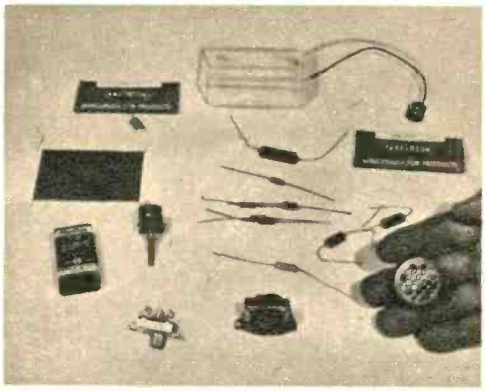


In the wiring guide, the perforated board has been displaced to the left to clarify the connections. Transistor bases are also shown in schematic.

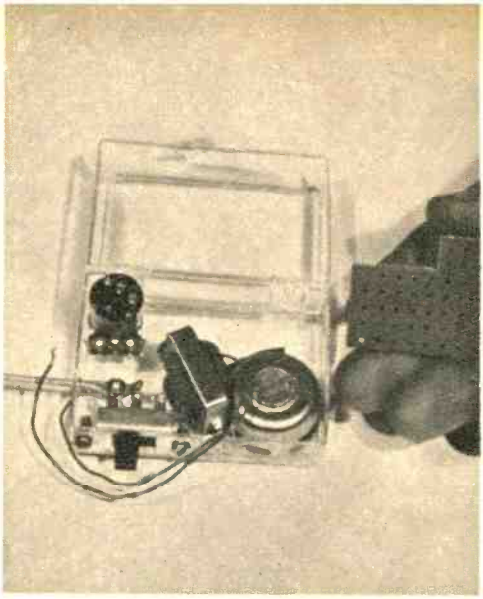
ONE of the most effective instruments for the radio-TV serviceman is the signal tracer. This instrument is used to follow a known signal through a piece of equipment.

This transistorized tracer may easily be built pocket size. It is designed to check auto, home or portable broadcast receivers and audio amplifiers. Many circuits in TV sets may also be checked.

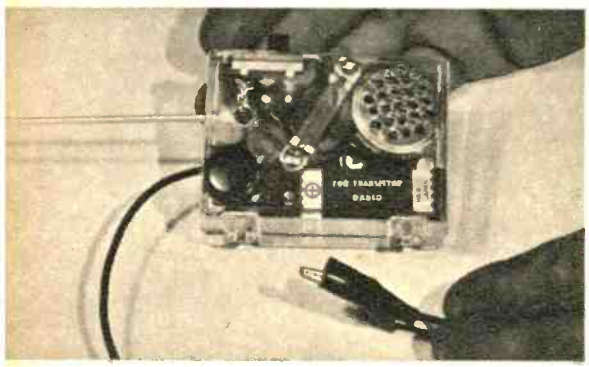
The tracer is composed of a diode detector coupled to a two stage audio amplifier. A 100 mmfd capacitor couples the incoming signal to the diode in the RF switch position. When the switch is in the AF position the diode is shorted out and a .05 mfd capacitor couples the audio signal to the volume control



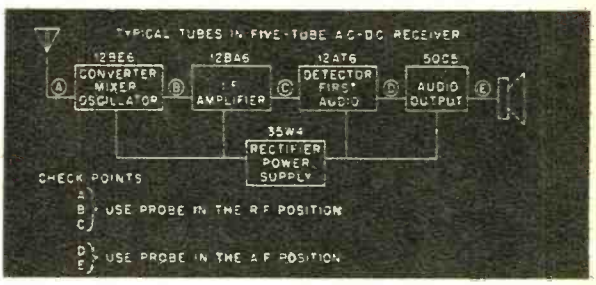
Total cost of the parts, shown here prior to assembly, runs about $7. Hand holds speaker.



First stage of construction is mounting the larger parts to plastic box, then wiring board.



Note holes for speaker at upper right. Alligator clip goes to ground of set under test.



Check points shown are usually tube grids on the input side, tube plates on output side.

and amplifier circuits. The output of the amplifier is heard over a miniature PM speaker.

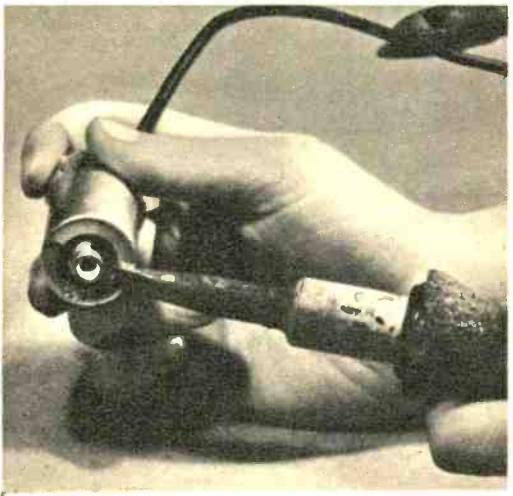
Wiring is not critical and all the parts can be housed in a small plastic box. Mechanical construction starts by cutting a slot and drilling holes for the slide switch SW1. Mount the output transformer using two small nuts and bolts and locate the speaker between the transformer and a corner of the box to hold it in place. The volume control is mounted through a hole in the box and fastened with a lockwasher and nut. The test probe is fastened to the box with a nut, bolt and solder lug. Then mount and solder in place parts C1, C2, C3, C4, R1, R3 and the diode 1N295. A small piece of perforated board will serve as a chassis. Transistor leads are pushed up through holes in the board and parts R4, R5, R6 and C5 are connected as shown.

[*Continued on page 89*]

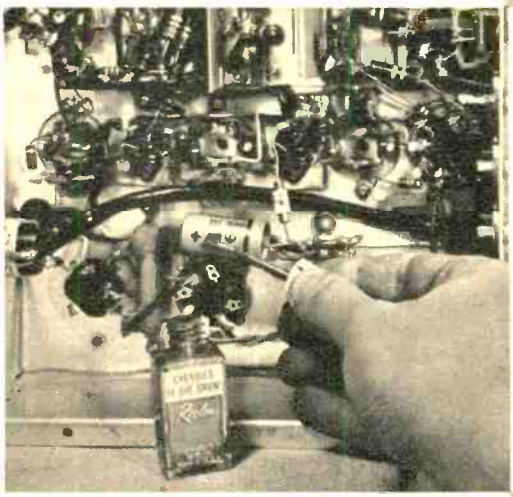
PARTS LIST

C1—.05 mfd disc ceramic capacitor
C2—100 mmfd disc ceramic capacitor
C3,C5—2 mfd 12 volt miniature electrolytic capacitor
C4—10 mfd 12 volt miniature electrolytic capacitor
R1—100,000 ohm resistor (all resistors ½ watt)
R2—25,000 ohm potentiometer
R3,R6—270,000 ohm resistor
R4—82 ohm resistor
R5—4,700 ohm resistor
SW1—DPDT slide switch
SW2—SPST switch (mounted on volume control R2)
B—9 volt battery (Burgess P6 or equiv.)
T—Output transformer with speaker (Lafayette SK-96)
TR1—CK768 transistor
TR2—CK722 transistor
D—Crystal diode 1N295
Misc.—Battery clip, plastic box 1"x2"x3", perforated board, alligator clip, stiff wire for probe

Try These

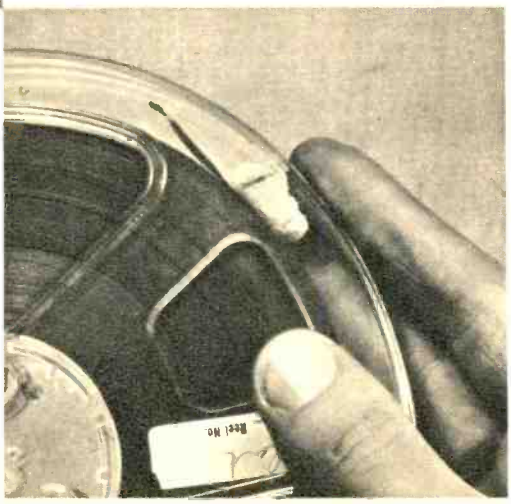


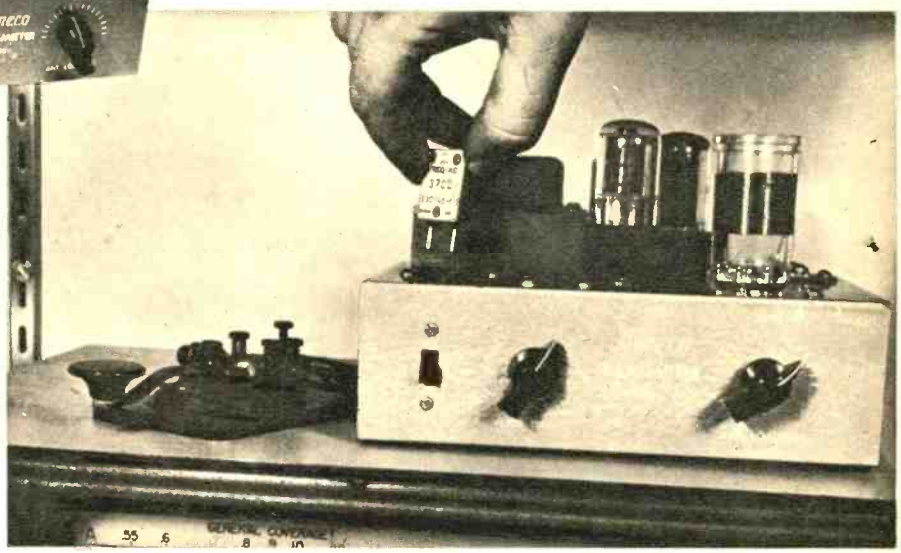
Extension Jack
A neat extension jack for use with phono plugs can be made from tube shield and jack.



Nail Polish Marker
Milady's nail polish is fine for marking test points, leads, tested or questionable parts.

Secure Tape End
A small piece of foam rubber pressed between reel prevents loose tape from slipping out.





Complete kit appears at left. Plug-in coil, wound for 80 meters, is along right edge with 6V6 tube next to it. Below, crystal is plugged into 8-pin socket that also serves as the key jack. Controls on panel are, AC on-off at left, plate tuning, antenna loading.

E I assembles the

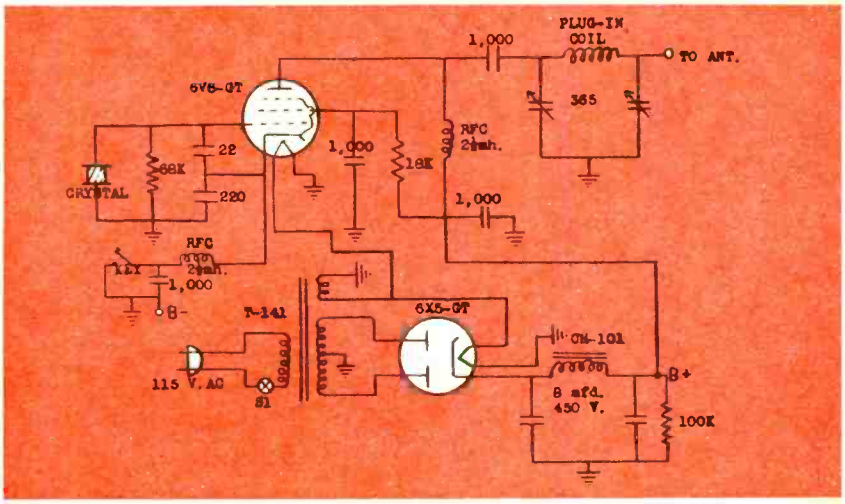
AMECO AC-1T Ham Transmitter

Primarily a first transmitter for the Novice, this CW rig provides 15 watts on the 80 or 40 meter band.

THE AC-1T is a transmitter reduced to the simplest form. One tube performs the job of oscillator and amplifier. A full-wave rectifier in the power supply completes the tube line-up.

All basic parts are included in the kit except key and crystal. The single coil form supplied may be wound for 80 or 40 meter operation. An additional form is available for fifty cents. The transmitter's performance will fall off if coils are wound for bands higher in frequency than 80 or 40 meters. Another practice not recommended is using 80 meter crystals to attain 40 meter output. Frequency doubling, in this case, reduces the rig's efficiency considerably.

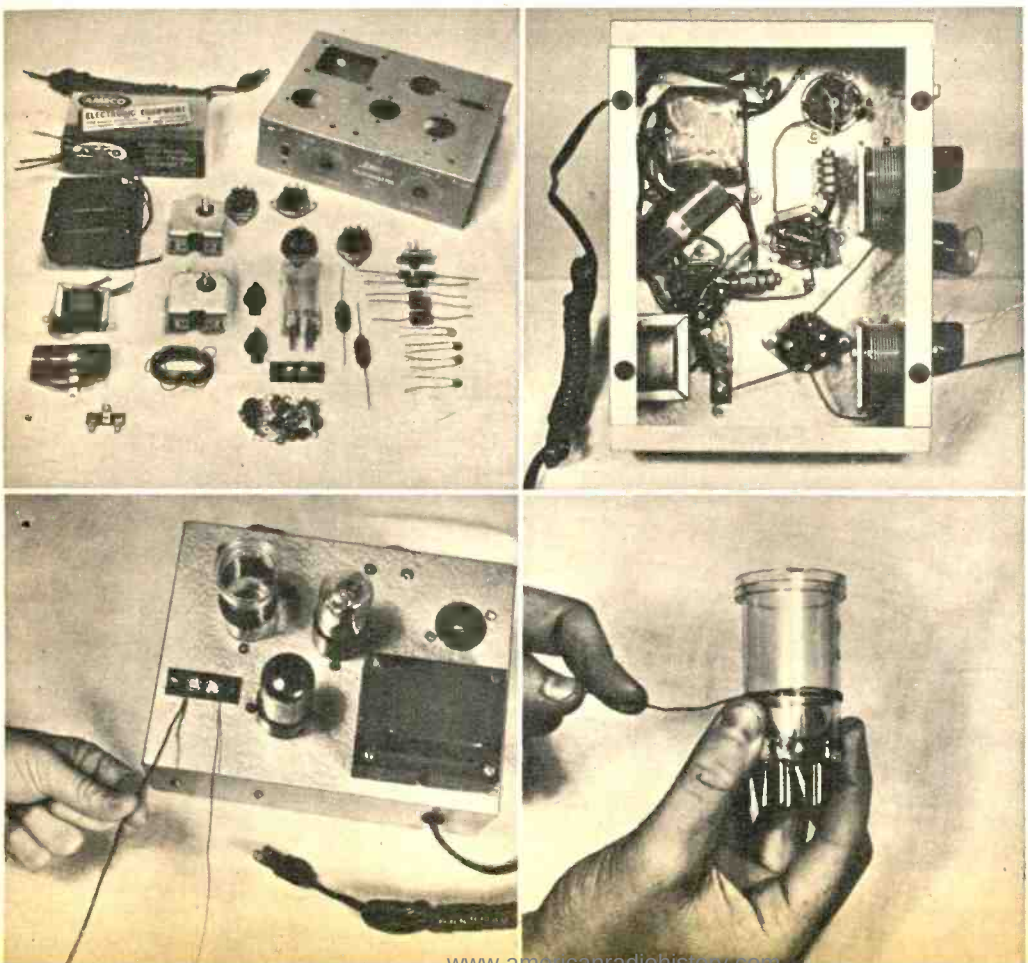
The unit can be built in three or four hours. Care must be taken in assembling the coil. Wind the turns tightly and keep them close-wound, that is, touching each other. The two coil leads are soldered to pins on the coil-form base. When too much heat is applied, the pins will melt the plastic in which they are imbedded. If this happens, prop up the pin and [*Continued on page* 111]



Schematic shows circuit simplicity. Oscillator is 6V6, which feeds antenna through a pi-network.

Layout of parts supplied with kit, available from Ameco, 1203 Bryant Ave., N. Y. 59, N. Y. (price is $18.70). Underside view of wired unit shows tuning capacitors along right edge.

At lower left, hand holds antenna wire. The other lead, connected to terminal strip, goes to a cold-water pipe ground. Other photo shows coil form being wound for 80 meters.



A Wireless Earphone

Continued from page 58

loop roughly matches the impedance of the audio amplifier output transformer tap.

The receiver actually consists of a two-stage low noise, transistorized audio amplifier mounted on a perforated phenolic board 1½ by 2 inches. Almost any type of earphone will work with this receiver as long as it is of the magnetic variety having a DC resistance of 5,000 ohms or less.

Any audio amplifier can be used to power the transmitting loop. The following table for various sizes of wire is given to facilitate proper matching.

Wire Size vs Impedance

AWG	Ohms per 1,000-ft length
16	3.8
14	2.7
12	1.9
10	1.2
8	0.75

To avoid grounding the system, the loop should use insulated wire even though the voltages in it are too low to cause shock or fire. The table indicates that, using a No. 16 wire, 1,000 feet will be required to obtain a resistance of 3.8 ohms. If the circumference of your room is considerably less than 1,000 feet and a good impedance match to the output of your amplifier cannot be obtained even when the thinnest practical wire is used, a 4 to 10 ohm resistor with a wattage rating equal to the wattage of the audio amplifier may be inserted in series with the loop for proper matching. If the audio amplifier which is used also drives a speaker, a separate volume control for the speaker may be desired. This can easily be done by wiring a standard L-pad into the speaker circuit.

With this receiver the volume will vary very little, if at all, as you move around in the transmitting area. As soon as you step outside of the loop the volume will drop off quite rapidly. Ordinarily, excellent results are obtained if the loop is strung around the floor or ceiling. When reception is desired over two or three floors of a building, two separate loops can be strung and fed from the same amplifier, observing impedance matching of course.

Russian New York Fair

Continued from page 47

be a particle-counter. Beside it is a standard oscilloscope. Their exhibition guides are supposed to be specialists, so this one ought to be a physicist.

Ques. (directed at Russian Guide) *We've been looking over your equipment here and don't notice any tubes that display numbers. Do you have them in the USSR?*

Guide (puzzled) Tubes and numbers?

Ques. *Do you have tubes that actually flash a number—we call them nixie tubes?*

Guide I understand very well what you mean. No we do not have them. Oh, in the Soviet Union we have such counters, but we cannot . . . we may not show here *everything* we have.

Ques. *Thank you very much.*

Guide Such counters are too special for the people's interest.

Radio-TV Trouble Finder

Continued from page 84

To use the tracer for checking a receiver, be sure the set is turned on and tuned to a strong local station. Turn on the tracer to full volume and attach the ground lead to the receiver chassis. Switch to the RF position. Start by touching the probe to the antenna loop terminals. A strong station will be heard from the tracer speaker. Move the probe from the input of one stage to its output and then to the next stage. If the signal is lost from one point to the next, you have found the defective area. Further checks with a voltmeter or ohmmeter should reveal the defective components.

The tracer can be used to find defective stages in hi-fi amplifiers by applying a tuner or phono signal to the amplifier input and tracing the audio signal toward the output transformer circuit and speaker. For this test the switch must be in the AF position.

SHIPPED ON APPROVAL

NEW

CRT TESTER-REACTIVATOR Model CRT-2

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

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

Model CRT-2 $57.50 Net

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

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

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

TEST

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

REPAIR

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

REACTIVATE

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

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

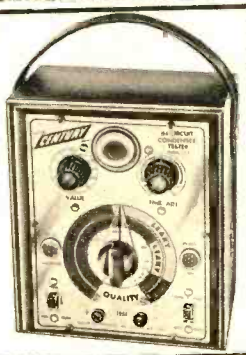
ADDITIONAL FEATURES

• Employs the time proven dynamic cathode emission test principle • Large 4½" meter with heavily damped movement for smooth action, accuracy and long life • Provides separate shorts test for each element in the picture tube • Filament continuity is shown on a separate glow indicator • An easy to read instruction manual contains all the latest testing information on old and new type picture tubes • Housed in handsome hand-rubbed oak carrying case with special compartment for MULTI-HEAD and line cord.

* patent pending

IN-CIRCUIT CONDENSER TESTER Model CT-1

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



in-circuit checks:

- Quality of over 80% of all condensers even with circuit shunt resistance . . . (This includes leakage, shorts, opens, intermittents)
- Value of all condensers from 200 mmfd. to .5 mfd.
- Quality of all electrolytic condensers (the ability to hold a charge)
- Transformer, socket and wiring leakage capacity

out-of-circuit checks:

- Quality of 100% of all condensers . . . (This includes leakage, shorts, opens and intermittents)
- Value of all condensers from 50 mmfd. to .5 mfd.
- Quality of all electrolytic condensers (the ability to hold a charge)
- High resistance leakage up to 300 megohms
- New or unknown condensers . . . transformer, socket, component and wiring leakage capacity

OUTSTANDING FEATURES

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

Model CT-1 $34.50 Net

TERMS: $9.50 within 10 days. Balance $5 monthly for 5 months.

EASY TO BUY IF SATISFIED – *see order form on facing page*

FOR 10 DAY *FREE* TRIAL

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

NOW a Battery Operated Peak-to-Peak VACUUM TUBE VOLT METER Model VT-1

WITH LARGE EASY-TO-READ 6" METER —

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

No extra probes to buy! The versatile MULTI-PROBE does the work of 4 probes

❶ DC Probe ❷ AC-Ohms Probe ❸ Lo-Cap Probe ❹ RF Probe

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

Housed in hammertone steel-case — complete with MULTI-PROBE

FUNCTIONS

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

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

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

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

OUTSTANDING FEATURES

• Completely portable — self powered with long life batteries — permits use everywhere • New advanced pentode amplifier circuit assures amazingly low battery drain • Large 6" 100-microampere meter, many times more sensitive than meters used in most V.T.V.M.'s • Laboratory accuracy performance — 2% of full scale on DC, 5% of full scale on AC • Simplified multi-color easy-to-read 4-scale meter • No heat operation assures rigid stability and accuracy • Immune to power line fluctuations • Amplifier rectifier circuit with frequency compensated attenator — a feature found only in costly laboratory instruments • Meter completely isolated — practically burn-out proof • Hand-crafted circuitry eliminates the service headaches of printed circuitry • 1% resistors used for permanent accuracy • Separate RF ground return for low-loss RF measurement • Microphone type co-axial connector • Matching cover protects instrument face — snaps on and off instantly.

SPECIFICATIONS

• DC Volts — 0 to 1.5/6/30/150/300/600/1500 volts
• AC Volts (RMS and Peak-to-Peak) — 0 to 3/12/60/300/1200 volts
• Ohms — 0 to a billion ohms, 10 ohms center scale — Rx1/10/100/1K/10K/100K/1M
• RF — Peak reading demodulator supplied for use on all DC ranges
• Zero Center — available on all DC volt ranges with zero at mid-scale
• Decibels — from —10 Db to +10/22/36/50/62 based on the 0db unit: 0Db-1MW in 600 ohms
• Impedance — 11 megohms DC, 1 megohm AC, 10 megohms Lo-Cap
• Input Capacity — 130 mmfd. RMS, 250 mmfd. Peak-to-Peak, 25 mmfd. Lo-Cap

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

FAST-CHECK TUBE TESTER Model FC-2

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

Over 20,000 servicemen are now using the FAST-CHECK in their every day work and are cutting servicing time way down, eliminating unprofitable call-backs and increasing their dollar earnings by selling more tubes with very little effort. See for yourself at no risk why so many servicemen chose the FAST-CHECK above all other tube testers.

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

RANGE OF OPERATION

- Checks quality of over 700 tubes types, employing the time proven dynamic cathode emission test. This covers more than 99% of all tubes in use today, including the newest series-string TV tubes, auto 12 plate-volt tubes, 0Z4s, magic eye tubes, gas regulators, special purpose hi-fi tubes and even foreign tubes.
- Checks for inter-element shorts and leakage.
- Checks for gas content.
- Checks for life-expectancy.

SPECIFICATIONS

• No time consuming multiple switching . . . only two settings are required instead of banks of switches on conventional testers • No annoying roll chart checking . . . tube chart listing over 700 tube types is located inside cover. New listings are added without costly roll chart replacement • Checks each section of multi-section tubes and if only one section is defective the tube will read "Bad" on the meter scale • 41 phosphor bronze beryllium tube sockets never need replacement • 7-pin and 9-pin straighteners mounted on panel • Large 4½" D'Arsonval type meter is the most sensitive available, yet rugged — fully protected against accidental burn-out • Special scale on meter for low current tubes • Compensation for line voltage variation • 12 filament positions • Separate gas and short jewel indicators • Line isolated — no shock hazards • Long lasting etched aluminum panel.

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

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

CONVENIENT TIME PAYMENT PLAN — NO FINANCING CHARGES

ALL CENTURY INSTRUMENTS ARE GUARANTEED FOR ONE FULL YEAR

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

CENTURY ELECTRONICS CO., INC.

CHECK INSTRUMENTS DESIRED

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

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

111 Roosevelt Avenue, Dept. 411, Mineola, New York

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

Name .....
Please print clearly

Address .....

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

Transistor Portable TV's

Continued from page 34

its big fault, you must view the picture head-on. If you stand even slightly to either side of center, you do not see the full picture.

The total power consumed by this set is four and one-half watts as contrasted with the power taken by the average home TV set, about two hundred watts. This power is drawn from a specially developed battery pack, consisting of alkaline rechargeable batteries, which sells for about $5.25. Its power cycle permits four full hours of operation before a 16-hour recharge, which is accomplished simply by connecting the set to a household AC outlet. A special charge function switch is built into the set for convenient overnight recharging. According to *Philco*, this special battery may be recharged as many as twenty times, giving it an operating life of eighty hours or more.

One of the problems in designing a transistor TV set, and this is one of the problems that has held back many other manufacturers, is to get a transistor which can operate reliably at the high frequencies used in television. Such transistors are presently available but they're super expensive. *Philco's* answer is to use seven MADT (for micro alloy diffused transistor) type transistors which they developed and produce. These transistors are capable of VHF service and, as a matter of fact, have been used in military equipment heretofore. Three are used in the tuner, four are in the video IF.

In order to test this receiver under the worst and most favorable conditions, we took the receiver on a New York Central commuter train out of Grand Central Station, New York City, north about forty-five miles. This set, working off its own single-rod telescoping antenna, pulled in stations from the Empire State tower, while running under electric lines in a steel railroad coach right out to the limit. Its sensitivity is greater than that of most AC operated portable TV sets. There was a good picture and good sound reception for all of the low channel stations and most of the higher channels. In driving around a suburban town about thirty miles from New York City, we received a fairly good picture in the car. In a side-by-side comparison with a conventional AC operated portable receiver in a home in a suburban area, 45 miles from New York City, the *Philco* job pulled in stations clearer and sharper. In New York City reception under all kinds of conditions was excellent.

Although *Philco* entered the market with a transistor portable TV set first, it will not have the market to itself for very long. The *Emerson Radio and Phonograph Corporation* has just announced a 17-inch direct view tube transistor TV receiver to sell for approximately $250. It too will operate on rechargeable batteries which can be recharged up to forty times. The total computed cost to operate this set on the *Emerson* battery pack will be only three cents per operating hour. This set has twenty-five transistors and will probably be introduced very late this year but is expected to go on sale the beginning of next year.

Outwardly the *Emerson* receiver does not appear to be at all different from a conventional AC operated 17-inch portable. This, of course, is to be expected since it uses the same type of direct view tube and the size of the set, after all, is regulated by the size of the TV picture tube.

What are the Japanese doing? Well, one thing is definite, they will not let the Americans have the market all to themselves. Original Japanese research in tunnel diodes and other transistor techniques have produced transistors which operate stably on high frequencies. One Japanese television broadcasting company has already built and demonstrated an all-transistor, battery operated portable, however, it is not interested in going into production on such a commodity. The well-known manufacturers of Japanese radios and televisions like Toshiba and Sony definitely intend to have a TV set on the market in the United States in the next year if they can. And when they do, watch for the $250 price to tumble.

Six Channels In A Loop

Continued from page 55

place and the location may be a large convention hall or a small meeting room. The General Assembly of the United Nations, for instance, has a permanently wired arrangement. But what about their countless committee rooms? What about that International Conference on Geriatrics scheduled to meet for only three days in a hotel ballroom?

A new transistorized wireless communication system ideal for such conferences has been introduced by a large West German electronics firm, the Siemens Co. It is marketed in this country by the International Visitors Center in New York. In this system, each conference delegate receives a transistorized receiver from which he can select one of six languages.

The transmitters are housed in four wooden cases, interconnected by cables and easily dismantled for portability. The carrier frequencies are:

Channel 1	67.5 kc
Channel 2	90.0 kc
Channel 3	112.5 kc
Channel 4	135.0 kc
Channel 5	180.0 kc
Channel 6	225.0 kc

All carriers are developed in one of two identical master oscillators. Should one oscillator fail, plate voltage may be transferred to the other unit by the flick of a switch, thus insuring continuous operation. The master oscillator is crystal controlled and operates at a basic frequency of 22.5 kc. RF drive for the transmitters' frequencies is obtained by utilizing harmonics of the basic crystal oscillator. Simple arithmetic reveals that the above listed frequencies are all harmonics of the basic frequency.

Each transmitter has a seven-position selector switch for continuously monitoring critical voltages and currents in the circuit, which include those of the audio amplifier, RF amplifier and modulator cathodes. In addition, a five-step attenuator is used to control RF output. The outputs of all six transmitters (as high as eight watts), are coupled in series and fed to an antenna tuning panel. Now we come to the most unusual feature of the system: the antenna.

The typical antenna is simply some number 16 insulated wire strung as a loop around the conference hall or meeting room. The signal on the inside of the loop, as measured by a field strength meter, remains virtually the same at any point. But outside the loop, the signal falls off by the square, thereby meeting federal radiation laws.

Receivers are only three inches in their largest dimension and are powered by a single 1.5 volt nickel cadmium battery good for more than 50 hours of continuous operation. Additionally, the batteries are easily rechargeable.

There are three transistors in the six channel receiver. One serves as a detector and initial audio amplifier; the second drives standard magnetic 300 ohm earphones. The third has a most unusual function, which you'll learn about in the next paragraph. The six channels, with their 22.5 kc separation, are free from crosstalk. In addition, the high "Q" ferrite antenna provides increased selectivity. The receiver may be worn about the neck, thereby allowing complete freedom of movement. When the earphone is disconnected, the battery is electrically isolated from the receiver, thus conserving power.

Now about that third transistor: Sometimes conference delegates are forgetful. Sometimes they have so many important things on their minds, and the receivers are so small and lightweight, that they forget to leave them behind when they leave. This third transistor, for lack of a better name, operates in a "theft protection" circuit. It acts as an unmodulated oscillator at 392 kc. In temporary setups where many receivers are distributed, a loop is strung around each exit. The signal in the loop is detected by a special tuned radio frequency (TRF) receiver. If someone inadvertently leaves the room without returning his receiver, the 392 kc signal emitted by the oscillator triggers an alarm circuit in the TRF receiver. This circuit is in operation even though the earphone has been disconnected.

Continued from page 39

When the beam strikes this screen, light is emitted. The ability of some materials to produce light in this fashion is known as fluorescence. The intensity of the spot on the screen depends on two factors—the speed of the electrons in the beam and the number of electrons that strike the screen at a given point per unit of time.

Now, if this is all that the cathode-ray tube contained, then the beam would always strike the fluorescent screen at one spot, in the center. In order to have the beam move up and down and back and forth across the screen, two sets of plates straddle the path of the beam between the point where it leaves the electron gun and where it strikes the fluorescent coating. The two sets of plates are positioned perpendicular to each other, so that each will swing the beam in a different direction.

In order to see what happens when voltages are applied to both sets of plates, consider Fig. 3. One plate of each set is so connected that it can receive either a positive or a negative voltage from a voltage divider.

One vertical deflection plate is connected to potentiometer P1 while its mate connects to ground. For the horizontal deflection pair, one plate connects to P2 while its partner also goes to ground.

Initially, let us assume that the arm of each potentiometer is at the point marked ground. In this position, neither set of plates has any voltage difference across it. Under these conditions, the beam will pass through the plates, unaffected, and strike the screen in its central region. Now consider the vertical plates VP1 and VP2. If the arm of P1 is moved above the ground point, a positive voltage will be applied to plate VP1 and the electron beam will be attracted upward; therefore, the beam will strike the screen at a point above center. If we also apply a negative voltage to horizontal plate HP2 from P2, the same electron beam, while it is being attracted upward by plate VP1 will also be repelled to the right by HP2, finally coming to rest at point A on the screen.

To move the electron beam to point B on the screen as indicated in Fig. 3, a negative voltage should be applied to VP1 and a positive voltage to HP2. This means moving the arm of P1 below the ground point and moving the arm of P2 above the ground point. If potentiometers P1 and P2 are moved back and forth across the zero point at the same time and at the same rate, what you will see on the screen is a solid line extending from point A to point B. This is the screen trace. By applying a variety of different voltages to both sets of plates, we can obtain an infinite number of patterns on the screen.

It has been assumed that in the absence of any voltages on either set of deflection plates, the electron beams from the gun would strike the fluorescent screen precisely at its center. Due to slight imperfections which generally arise in manufacture, it is more probable that the beam will strike the screen some point off center. In order to center the beam, vertical and horizontal positioning controls are provided. All these controls do is apply a small positive or negative voltage to each of the deflection plates to bring the beam to the desired point on the screen.

In order to obtain significant deflection of the beam, horizontally and vertically, it is necessary to apply fairly large voltages to the deflection plates. Such voltages are seldom available directly from the electronic circuits where the oscilloscope is to be used, and it is customary to build into the oscilloscope special horizontal and vertical deflection amplifiers. These amplifiers raise the input voltages to the necessary level and then apply them to the deflection plates.

In addition to a deflection amplifier, the horizontal system also contains a sweep generator. This is a circuit which develops sawtooth waves. A sawtooth wave will move the beam horizontally from left to right at a uniform rate of speed. When the beam reaches the extreme right-hand side of the screen, it is quickly brought back to the left-hand side and then the slower left-to-right motion is resumed. A sawtooth wave is

employed because it provides the beam with a uniform left-to-right motion. This horizontal movement usually represents the time axis.

For example, consider the sine wave shown in Fig. 4. This wave is to be reproduced on the face of an oscilloscope screen. It starts from zero, increases until it comes to a positive peak, gradually decreases when it comes to zero, reverses itself until it comes to a negative peak, then gradually moves back to zero.

However, these variations do not all occur at the same time; rather, they occur in sequence, one after the other. Hence, when we apply this voltage to an oscilloscope, we must not only have the beam move up and down, but also horizontally to show that one part of the wave occurs before another.

To produce the up-and-down motion, the sine voltage is applied to the vertical deflection system. At the same time, a sawtooth voltage, is applied to the horizontal deflection system. The result is the sine-wave pattern. Failure to provide this sawtooth voltage will produce a vertical line. Here the beam is moving up and down all right, but it has no horizontal spread.

In most of the applications where the oscilloscope is employed, this same type of time base or steady horizontal motion from left-to-right is required. That is why the sweep generator is built into the instrument.

A second control associated with the sweep generator is the one labeled "Sync Amp." Its purpose is to take a small portion of the input voltage being applied to the vertical system and use it to synchronize the sweep generator so that the sawtooth voltage moves in step with the applied signal. It locks the sweep generator in with the frequency of the applied signal (or a multiple of it) in order to produce a stationary pattern on the screen. If such synchronization were not employed, the pattern would drift across the screen and be in constant motion. This would make it difficult for the user to observe and also difficult to use in the event he wished to measure the amplitude of the applied signal.

Next month we'll consider each of the oscilloscope's controls in detail.

Antennas For Citizens Radio

Continued from page 43

tion is on the rear trunk deck. Here, the whip encounters the least metallic obstruction.

One trick, used by hams, is to remove a back-up light and install the antenna base there. When the car is sold, the light and lens are re-installed. In mobile installations always ground the tailpipe to the body and tighten all bolts to eliminate interference and noise caused by loose body parts.

Fixed station antennas may be installed with the same techniques used in TV antenna work. The large ground plane shown in the photo was mounted on a 5-foot TV mast, secured with vent mounts on a 4-inch pipe. Use guy wires if mast sections rise over ten feet.

The leadin wire called for in virtually all current Citizens Radio gear is 52 ohm coaxial cable. Various TV standoffs may be used to bring it from the antenna to the transmitter. Unlike twinlead (300 ohm) the jacket on the cable may touch metal without signal loss.

Selecting an antenna is apparently a compromise between physical size and range. The clip-on is inexpensive, easy to install, but most limited in range. Tests at *EI* have shown that a clip-on mounted on a car gave good results over two miles of obstructed terrain. The fixed location transmitter used a short whip atop a 200-foot building.

If maximum range is needed, a full ground plane (as high as possible) should be used for the fixed station with an 8½-foot whip for mobile use.

Hi-Fi Clinic

Continued from page 66

third harmonic will occur at 3,000 cps. The fundamental tone is considered the first harmonic.

All natural sounds contain at least a few harmonics, and it is differences between the relative strengths and distribution of these harmonics which make two instruments sound different even though both may be sounding the same fundamental pitch.

Stereo Record Test

Continued from page 33

subjective ratings. But by using a representative group of listeners, we believe that we came more directly at the actual impact of wear on the record user than any rating number could, even if it were possible to produce one.

Admittedly, too, extremely finicky listeners might find our categories a bit too generous to the records. The evaluating equipment used was top high fidelity, with pickups and amplifiers in the best class and wide-range speakers. Everything considered, we believe that our tests were definitely on the "tough" side, as far as most listeners are concerned.

Another vital point is that *records recover*. A record played once and then put away for a day or a week will last better than one played over and over continuously, as they were in these tests. This recovery ability has to do with cold flow of the record material and its "memory" for its original shape; pushed out of shape, the groove tends to come back almost to normal in a few hours or a day. The effect was demonstrated several times in the course of the tests when a record was evaluated immediately after the run, and then again some time later.

Another important point: serious noise was produced by multiple playings at the point where the descending stylus hit the record. This "impact noise," of course, does not apply to normal use in which the stylus is put down on the outside edge of the record.

The basic test material was supplied by a number of copies of Stravinsky's "Petrushka," London CS-6009. This is a magnificent recording, with plenty of soft passages and sudden fortissimos.

A representative group of the most widely distributed pickup cartridges was evaluated in a number of tests. The most significant: with every condition as alike as possible, all set at 5 grams stylus force, the pickups were played 400 times each on separate records but on the same passage.

Least wear was produced by the Shure, with the Pickering very close behind. The wear with these two at 400 playings was definite but moderate, so they were pushed to 800. At this point, the records were still "playable," although approaching Class III.

Other pickups with outstandingly low wear were the Miratwin and the Electro-Voice 21MD. Most destructive was an imported ceramic. The ceramics as a group were somewhat more destructive than the magnetics.

A rule of thumb long applied has been: the louder a pickup "talks" in direct noise, the worse its effect on a record. This was confirmed, generally speaking. The "worst" pickup talked so loudly it could be cued, even in pianissimo passages, with the amplifier turned off. The best units were inaudible until the listening ear was practically wrapped around them.

Watch That Stylus Force!

Neither were there any big surprises in the results of varying the stylus force: just a hair-raising confirmation of the fact that this is far more critical on stereo records than it was on monophonic. A test was run with four of the pickups, ranging from "best" to "worst," set at 7½ grams rather than the standard 5 grams. The following table gives results, compared with the 5-gram test:

Number of Plays for Roughly Equal Class II Wear

Pickup	5 *grams*	7½ *grams*	
"Worst"	110	20	(Horribly wrecked at 65 plays)
"Medium"	300	90	
"Best"	550	200	

Early in the tests, a measuring error started the "best" pickup on a section of groove at *10 grams* stylus force. A routine listening check at *5 plays* revealed a groove murdered into mutilated death. The surface was pure Grade 3 sandpaper; the highs were all gone. Thereafter, measuring techniques were revised and force was checked at beginning, several times in the middle, and at the end of each test.

[*Continued on page* 100]

Model 77—VACUUM TUBE VOLTMETER . . . Total Price $42.50 — Terms: $12.50 after 10 day trial, then $6.00 monthly for 5 months.

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 12AU7 as D.C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability.
- Model 77 uses a selenium-rectified power supply resulting in less heat and thus reducing possibility of damage or value changes of delicate components.
- Model 77 meter is virtually burn-out proof. The sensitive 400 microampere meter is isolated from the measuring circuit by a balanced push-pull amplifier.
- Model 77 uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

Specifications

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

AS A DC VOLTMETER:

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

AS AN ELECTRONIC OHMMETER:

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

AS AN AC VOLTMETER:

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

Comes complete with operating instructions, probe, leads, and streamlined carrying case. Operates on 110-120 volt 60 cycle. Only . . . **$42.50**

Superior's New Model TV-50A GENOMETER

7 Signal Generators in One!

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

Model TV-50A GENOMETER . . . Total Price $47.50—Terms: $11.50 after 10 day trial, then $6.00 monthly for 6 months.

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

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

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

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

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

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

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

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

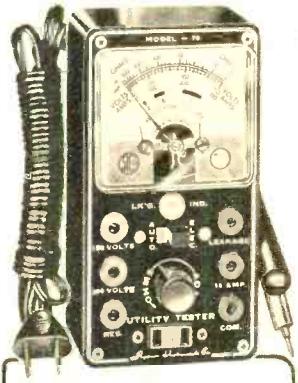
The Model TV-50A comes absolutely complete with shielded leads and operating instructions. Only **$47.50**

EXAMINE BEFORE YOU BUY!

USE APPROVAL FORM ON NEXT PAGE

Superior's New Model 70 UTILITY TESTER®

FOR REPAIRING ALL ELECTRICAL APPLIANCES and AUTOMOBILE CIRCUITS



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

As an electrical trouble shooter the Model 70:

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

As an Automotive Tester the Model 70 will test:

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

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

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

Model 70 comes complete with 64 page book and test leads

Only $15.85

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

TUBE TESTER

TEST ANY TUBE IN 10 SECONDS FLAT!

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

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

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

FEATURES:

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

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

Model 82A comes housed in handsome, portable Saddle-Stitched Texon case

(Picture Tube Adapter available for $5.50 additional)

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, INC.
Dept. D-674, 3849 Tenth Ave., New York 34, N. Y.

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

Name .....

Address .....

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

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

- ☐ Model 77 ..... Total Price $42.50 $12.50 within 10 days. Balance $6.00 monthly for 5 months.
- ☐ Model TV-50A ..... Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model 70 ..... Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model 82A ..... Total Price $36.50 $6.50 within 10 days. Balance $6.00 monthly for 5 months.
- ☐ Include Model 82A Picture Tube Adapter at $5.50

Stereo Record Test

Continued from page 96

In another of the several stylus force tests, the best and worst pickups were run on the same passage on different records, at gradually increasing stylus force. The results:

Number of Plays for Roughly Equal Class II Wear

Stylus Force	Best Pickup	Worst Pickup
3 grams	850 (still good)	Won't track
4.75 grams	—	300
6 grams	550	60 (wrecked at 75)
8 grams	310	15 (wrecked at 30)

The "best" pickup at the 8 gram force did produce a curious "flattening" of the music, partly the reduction of highs, but very little increase in noise.

To make sure you are getting the stylus force set right, measure just off the edge of the turntable, with the stylus tip *at the level of the top of the turntable.* Move the gauge and the pickup with it up and down several times gently to be sure the vertical pivot in the arm is not sticking and giving a false reading. As you move, the inertia of the arm will naturally increase the reading; the opposite happens on the way down. Take an average reading, or the one with the gauge held steady at the turntable level, once you are convinced the arm is free.

Keep 'Em Clean and They'll Go Forever

The foregoing tests, and many variations, were made with records kept in jackets when not in use, but with no special effort to clean the surfaces. So a test was run with a "good" pickup, at 3.75 grams, on two records: one left out on a table face up for four days, the other washed in a detergent just before playing, and kept covered during the test. The results:

Washed record—833 plays—wear noticeable on careful listening, but sound still excellent.

Dirty record—135 plays—roughly the same wear; a fuzzier sound.

Excited by these results we then ran a test with every conceivable condition at optimum. The best pickup (Shure M3D), at 3.75 grams, was played on a record washed before each run in detergent. A Discharger was put on the pickup to keep the surface ionized. The changer was covered. The passage chosen had both soft and extremely loud music.

The tremendous result: the passage was played *1150 times* and except for the "impact noise," it still sounds marvelous.

To wash your records, use a good-grade *detergent* (never soap or any other gooey stuff, no matter how enthusiastically advertised) in *lukewarm* water. (Hot water will destroy a record.) Use a short rod through the center hole, and fill a pan with the water and detergent to about 4 inches depth. You can then hold the record vertically and revolve it in the water without getting the label wet. Slosh the water through the grooves with a soft cloth. Then rinse in lukewarm water and dry very gently with a lint-free cloth.

The principal makes of record on the market were compared with each other and with the London record. There were differences, but they were insignificant compared to the effects of pickup design, stylus force, and cleanliness.

Throughout the test, the condition of each stylus was carefully watched with a microscope giving 100 and 200 times magnification. All styli were diamonds. No significant wear occurred on any stylus. This is to be expected, because the actual total playing time with any stylus was very small. For instance, in the 1150-times test described, the stylus was on the record for only 18 seconds during each play, for a total of 345 minutes or about 12 to 15 LP sides.

Answers to Electronic Photoquiz

1. Open can of soldering paste.
2. Drill shavings from plastic coil form.
3. Record grooves.
4. Splatter of hot solder.
5. Selenium rectifier.

STUDY AT HOME
for a career in ELECTRONICS

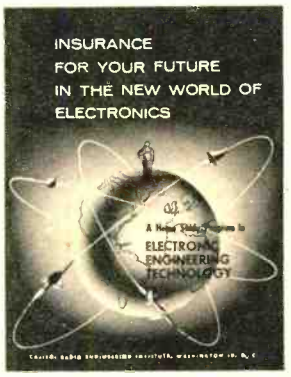
CREI prepares you quickly for success . . . in Electronic Engineering Technology, including Automation, Instrumentation, Industrial Electronics, Aeronautical Electronics, Guided Missiles, Radar, Servomechanisms, Computers, Astronautics, Telemetering, Communications, Manufacturing.

BENEFITS FELT RIGHT AWAY Almost immediately, you feel the benefits of CREI study. Your employer, when informed of your step toward advancement (only at your request), is certain to take new interest in you and in your future. What you learn in CREI Home Study can start helping you do a better job immediately.

CREI HOME STUDY . . . QUICK WAY TO GET THERE Since 1927, CREI has given thousands of ambitious young men the technical knowledge that leads to more money and security. CREI can help you, too—if you really want to be helped. CREI lessons are prepared by experts in easy-to-understand form. There is a course of instruction geared to the field in which you want to specialize. Study at your convenience, at your rate of speed.

INDUSTRY RECOGNIZES CREI EDUCATION CREI courses are prepared with an eye to the needs and demands of industry, so your CREI diploma can open many doors for you. Countless CREI graduates now enjoy important, good-paying positions with America's most important companies. Many famous organizations have arranged CREI technical education for their personnel. To name a few: All America Cables and Radio, Inc.; Canadian Broadcasting Corporation; Columbia Broadcasting System; Gates Radio Company; Federal Electric Corp.; The Martin Company; U. S. Information Agency (Voice of America); Canadair Limited; Trans-Canada Air Lines; United Air Lines.

PAYS FOR ITSELF QUICKLY Your very first raise could repay your investment in CREI education, and leave you a profit the very first year. Increases in pay thereafter are pure profit, and you'll be prepared for many more promotions and pay raises. If you have had a high school education, and experience in electronics—and realize the need of a high-level technical knowledge to make good in the better electronic jobs—you can qualify for CREI home study. (Electronics experience is not required for admission to CREI Residence School.) CREI also offers residence courses in Washington, D. C. at the same high technical level. Day and evening classes start at regular intervals. Qualified residence school graduates earn degree of "Associate in Applied Science." Check coupon, or write Capitol Radio Engineering Institute, Dept. 1711F, 3224 16th St., N.W., Wash. 10, D. C.



Get This New Fact-Packed 54-Page Book—Free!

Brand New Course: Automation and Industrial Electronics Engineering Technology
Covers all electronic phases of automation. Special emphasis on theory, functioning, and applications of servomechanisms and computers. Also noteworthy: Lessons on machine control, instrumentation, data-processing, and telemetry.

TAKE A MINUTE TO MAIL THIS COUPON FOR FREE 54-PAGE BOOK

CAPITOL RADIO ENGINEERING INSTITUTE
ECPD Accredited Technical Institute Curricula—Founded 1927
Dept. 1711F 3224 Sixteenth St., N.W., Washington 10, D. C.

Please send me your course outline and FREE illustrated 54-page book, "Insurance for Your Future in the New World of Electronics" . . . describing opportunities and CREI Home Study courses in Practical Electronics Engineering Technology

CHECK FIELD OF GREATEST INTEREST
- ☐ Radar, Servo and Computer Engineering Technology
- ☐ Electronic Engineering Technology
- ☐ Communications Engineering Technology
- ☐ Television Engineering Technology
- ☐ Aeronautical Electronic Engineering Technology

L2

☐ Automation and Industrial Electronics Engineering Technology

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

Street .....

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

CHECK: ☐ Home Study ☐ Residence School ☐ Korean Veteran

To obtain fast, immediate service and to avoid delay, it is necessary that the following information be filled in:

EMPLOYED BY .....

TYPE OF PRESENT WORK .....

EDUCATION: YEARS HIGH SCHOOL .....

OTHER .....

ELECTRONICS EXPERIENCE .....

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

TELEVISION

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

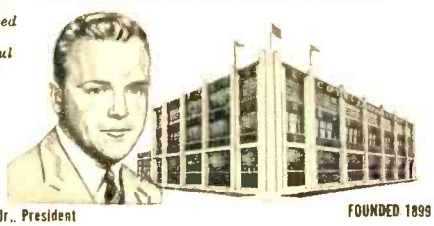
A fabulous field—good pay—fascinating work—a prosperous future! Good jobs **or** independence in your own business!

Modern Training by Coyne RIGHT IN YOUR OWN HOME

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

The Institution Behind this Training

Famous for over a half century. COYNE occupies this entire building which is the new home of COYNE. COYNE'S modern resident training of men for Television, Radio, Electronics and Electricity has produced thousands of successful graduates.



B. W. COOKE, Jr., President

FOUNDED 1899

COYNE ELECTRICAL SCHOOL

CHARTERED AS AN EDUCATIONAL INSTITUTION NOT FOR PROFIT

1501 W. Congress Parkway, Chicago 7, Dept. 89-H8

MAIL COUPON NOW FOR DETAILS FREE

LEARN TO

EARN IN SPARE TIME AT HOME

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

Low Cost—Easy Terms

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

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

SEND COUPON OR WRITE TO ADDRESS BELOW FOR FREE BOOK

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

COYNE Television
Home Training Division
Dept. 89-H8 —New Coyne Building
1501 W. Congress Parkway, Chicago 7, Illinois

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 salesmen will call.)

Driveway Light Control

Continued from page 72

this. In the average lighted room it should be possible to adjust the balance pot so the relay is just on the verge of closing. The unit is at its most sensitive point, and the shadow of the hand over the top photocell should cause the relay to close. If the relay closes when the shadow is over the control photocell, reverse either the primary or secondary leads of transformer T, but not both. Remove the temporary shorts from the indoor switch terminals and RY2 and the unit is ready for installation.

The unit is mounted at headlight level in the driveway. The author's model utilizes a 1-inch pipe and an electrician was consulted to bring the AC wiring from the house to the unit. Wire the switch, lights and power line according to the diagrams.

At night, park your car with the headlights on at the point where the unit is to trigger. Adjust the balance pot until the relay just triggers and check the adjustment by turning the headlights on and off. Be sure to wait for the completion of the cycle before any changes in adjustment are made. Replace cover and check the manual switch by opening momentarily. Cycle should repeat.

Hamshack Goes Anywhere

Continued from page 75

Should the ham, or his collection of equipment be too large for a clothes closet, he shouldn't be discouraged. Many wives and mothers gladly consent to an out-of-sight basement spot. There the ham of the house can string wires, strew equipment, hang "picturesque" calendars, QSL cards, and scatter tools to his heart's content. Indeed, many a water meter reader and gas man has viewed such a scene.

Besides offering ample storage space and privacy, the coolness of a basement is perfect during summer "dog days," but there are a couple of disadvantages. Excess moisture in the air will quickly corrode and rust metal components if

[*Continued on page* 108]

FREE

350 BIG PAGES OF BARGAINS LIKE THIS

WRITE TODAY FOR **FREE**

12 MONTHS SUBSCRIPTION TO BARGAIN BULLETINS

Page-after-page, month-after-month. Exclusive bargains in HI-FI and LP RECORDS plus 1001 other items. To be "in-the-know" you must be on Radio Shack's mailing list. Just check the coupon below and mail it today!

SEND 35c FOR A COMPLETE GUIDE TO ELECTRIC PARTS BUYING

300 pages, 8½ x 11, illustrated handbook. Articles, engineering data plus buying guide. Over 40,000 items.

------ FILL IN -- CLIP -- MAIL TODAY ------

RADIO SHACK CORPORATION, Dept. 11P
730 COMMONWEALTH AVENUE, BOSTON 17, MASS.

Please send me

- ☐ Bargain Bulletins for 1 year FREE!
- ☐ 1960 Guide to Electronic Buying at 35c
- ☐ REALISTIC 40-W AMPLIFIER Order #90LX023 at $79.50*
- ☐ FREE Brochure on REALISTIC Line

☐ Check ☐ Money Order ☐ C.O.D. *Shipped by express only

NAME_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

RADIO SHACK CORPORATION

167 WASHINGTON STREET, BOSTON 8, MASS.
730 COMMONWEALTH AVENUE, BOSTON 17, MASS.
230-234 CROWN STREET, NEW HAVEN 10, CONN.

NEW REALISTIC 40-W STEREO OUTPERFORMS $140 AMPLIFIERS

$8 DOWN
$7 MONTHLY

$79.50 INCLUDING CABINET

$50 TO $90 LESS THAN COMPARABLE QUALITY UNITS

REALISTIC STEREOLYNE-40 AMPLIFIER Only REALISTIC could bring you this sensational value! Our buyers shopped the entire market. Our engineers made comparison test after test. All agree the REALISTIC-40 delivers more watts per dollar than any other stereo amplifier on the market today! Note that it's not a kit . . . the REALISTIC-40 is completely wired, and this amazing low price includes the cabinet . . . there's nothing else to buy! Read the specs. You'll agree it's one more reason why REALISTIC is America's best buy in HI-FI!

SPECIFICATIONS and FEATURES: Two 20-watt stereo channels or 40-watts monaural; 80-watts total peak audio output. Frequency Response: 20-20,000 cps ±1 db. Feedback: 20 db Less than 1% total R.M.S. harmonic distortion at 400 cps; hum level: -59 db on phono and tape head inputs; -79 db on tuner input at 20 watts output. Controls: individual bass and treble controls for each channel; balance control and phasing switch; single volume control adjusts both channels simultaneously; separate loudness switch; AC accessory outlet. Inputs: Tuner, Stereo Phono, Stereo Tape Head. Outputs: 4 /8 /16 ohms and Tape Recorder. 117 VAC, 50 /60 cycles. Size: 12" W x 4⅛" H x 9⅛" D. Custom-styled gold, maroon and white metal cabinet.

REALISTIC... *America's BEST BUY in HI-FI!*

AMPLIFIERS | TUNERS | TURNTABLES AND TONE ARMS | ELECTROSTAT-3 TWEETER | SPEAKERS AND SPEAKER SYSTEMS

send for a FREE Brochure on the complete REALISTIC Line

Lafayette Superior Quality Hi-Fi Kits

50 WATT INTEGRATED STEREO AMPLIFIER

KT-250 IN KIT FORM 64.50

LA-250 COMPLETELY WIRED 89.50

● RESPONSE 17-21,000 CPS ± 1 DB (at normal listening level) ● UNIQUE "BLEND" CONTROL ● PREMIUM EL86 OUTPUT TUBES ● 50 WATTS MONAURAL—25 WATTS EACH STEREO CHANNEL ● CLUTCH-OPERATED VOLUME CONTROL ● SEPARATE BASS & TREBLE CONTROLS

A completely new stereo high fidelity amplifier with a high quality of reproduction, remarkable versatility and new distinctive styling. Full range of controls include a unique "blend" control for continuously variable channel separation—from full monaural to full stereo, 4-position Selector, Mode, Loudness and Phasing switches plus outputs for 4, 8 or 16 ohm speakers. Harmonic distortion less than 0.25%, IM distortion less than 1%. Hum and Noise 74 db below full output. Assembly is simple—no special skills or tools required. Complete with deluxe cabinet and legs, all parts, tubes and detailed instruction manual. Shpg. wt., 26 lbs.

KT-250 Stereo Amplifier Kit .....6.45 down.....Net **64.50**

LA-250 Stereo Amplifier, wired & tested—8.95 down Net **89.50**

PROFESSIONAL STEREO CONTROL CENTER

KT-600 IN KIT FORM 79.50

LA-600 COMPLETELY WIRED 134.50

● RESPONSE 5-40,000 CPS ± 1 DB ● UNIQUE STEREO & MONAURAL CONTROL FEATURES ● PRECISE "NULL" BALANCING SYSTEM ● CONCENTRIC INPUT LEVEL CONTROLS

A truly professional stereo preamplifier and master audio control center—solves every stereo/monaural control problem. Features unique Bridge Control for variable cross-channel feed for elimination of exaggerated channel separation effects—plus cantrolled 3rd channel output. Has all-concentric controls—including clutch-operated Volume Balance control. Provides complete and advanced facilities for accepting, controlling and providing undistorted gain for any and all program sources. Sensitivity 2.2 mv for 1 volt out (low level inputs). Dual low impedance "plate follower" outputs 1500 ohms. Response 5-40,000 cps ± 1 db. Less than .03% IM distortion. Less than .1% harmonic distortion. Hum and noise 80 db below 2 volts (high level inputs). Uses 7 new 7025 low-noise dual triodes. Size: 14" x 4½" x 10⅝". Shpg. wt., 16 lbs. Complete with all parts, tubes, deluxe cabinet and detailed instruction manual.

KT-600 Stereo Preamplifier Kit—7.95 Down .....Net **79.50**

LA-600 Stereo Preamplifier, wired and tested—13.45 Down Net **134.50**

Outstanding Design—Incomparable Performance

STEREO/MONAURAL POWER AMPLIFIER KIT

KT-310 IN KIT FORM 47.50

LA-310 COMPLETELY WIRED 72.50

● 36 WATT STEREO AMPLIFIER—18 WATTS EACH CHANNEL ● EMPLOYS 4 PREMIUM-TYPE 7189 TUBES ● 2 PRINTED CIRCUIT BOARDS FOR SIMPLIFIED WIRING ● RESPONSE BETTER THAN 35-30,000 CPS ± ½ DB AT 18 WATTS ● LESS THAN 1% HARMONIC OR IM DISTORTION

A superb basic stereo amplifier in easy-to-build kit form. Unit may be used with a stereo preamplifier to provide two 18 watt stereo channels or, at the flick of a switch, as a fine 36 watt monaural amplifier. Controls include 2 input volume controls, Channel Reverse switch and Monaural-Stereo switch. Dual outputs for 4, 8, 16 or 32 ohm speakers. Input sensitivity .45 volts per channel for full output. Tubes are 2-6AN8, 4-7189, GZ-34 rectifier. Size 10-9/16" d x 5¼" h x 13¼" w. Complete kit with cage, all parts, tubes and detailed instruction manual. Shpg. wt., 22 lbs.

KT-310 Stereo Power Amplifier Kit—4.75 Down ....Net **47.50**

LA-310 Stereo Power Amplifier, wired and tested— 7.25 Down Net **72.50**

FM-AM STEREO TUNER KIT

KT-500 IN KIT FORM 74.50

LT-50 COMPLETELY WIRED 124.50

● 11 Tubes (4 dual-purpose) + Tuning Eye + Selenium rectifier provide 17 tube performance ● Multiplex Output for new Stereo FM ● Armstrong Circuit with Dual Limiters and Foster-Seeley Discriminator ● Extreme Sensitivity and Wide Frequency Response.

A precision engineered, highly stable tuner—perfect for life-like stereo FM-AM broadcast reception, FM reception and/or AM reception. Features separate tuning and volume controls for AM and FM. Magic eye on AM and FM, plus automatic frequency control on FM for accurate tuning—stations are "locked" in. Other deluxe features include cathode follower outputs and 5-position Function Selector. Efficient, broadband circuitry on AM with built-in antenna. FM section features include 2 microvolts sensitivity for 30 db quieting, frequency response 20-20,000 cps ± ½ db and full 200 KC bandwidth. Two printed circuit boards make wiring simple—even for such a complex unit. Complete kit includes all parts, deluxe cabinet and detailed instruction manual. Size is 13¾" W x 10⅝" D x 4½" H. Shpg. wt., 22 lbs.

KT-500 FM-AM Stereo Tuner Kit—7.45 Down .....Net **74.50**

LT-50 Same as above, wired & tested—12.45 Down Net **124.50**

Lafayette Radio 165-08 Liberty Ave. JAMAICA, N. Y. AXtel 1-7000

NEW YORK, N. Y.	BOSTON, MASS.	BRONX, N. Y.	NEWARK, N. J.	PLAINFIELD, N. J.
100 6th Ave.	110 Federal St.	542 E. Fordham Rd.	24 Central Ave.	139 W. 2nd St.
WOrth 6-5300	HUbbard 2-7850	FOrdham 7-8813	MArket 2-1661	PLainfield 6-4718

LAFAYETTE'S
1960 CATALOG
308 GIANT SIZED PAGES
Our 39th Year

The Complete Catalog Featuring
"The Best Buys In The Business"

FOR THE NEWEST AND FINEST IN STEREOPHONIC HI-FI EQUIPMENT AND SYSTEMS

- TAPE RECORDERS
- PUBLIC ADDRESS SYSTEMS
- AMATEUR EQUIPMENT
- INDUSTRIAL SUPPLIES
- MINIATURE COMPONENTS
- RADIO & TV TUBES AND PARTS
- EXCLUSIVE LAFAYETTE TRANSISTOR & HI-FI KITS

Send for Lafayette's FREE 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.

CONTAINS HUNDREDS OF EXCLUSIVE LAFAYETTE ITEMS NOT AVAILABLE IN ANY OTHER CATALOG OR FROM ANY OTHER SOURCE — SEND FOR YOUR COPY NOW!

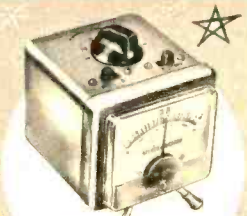
A "must" for the economy-minded hi-fi enthusiast, experimenter, hobbyist, engineer, technician, student, serviceman and dealer.

FREE

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.

EASY PAY TERMS Available on orders over $20
Only 10% down—Up to 18 months to pay



TM-66 STEREO AUDIO ANALYST
11.95

KT-135 4-BAND RECEIVER KIT (Less Cabinet)
18.50

PK-330 4 SPEED CHANGER WITH BRAND NEW GE VR-22 (.7 MIL) DIAMOND STEREO CARTRIDGE
42.50

PA-56 TRANSISTORIZED POWER MEGAPHONE
29.50

PK-331 33⅓ RPM HYSTERESIS TURNTABLE
47.50

PROFESSIONAL COMMUNICATIONS RECEIVER
KT-200 KIT 64.50
HE-10 WIRED 79.95

RW-60 20,000 OHM PER VOLT MULTITESTER
13.50

SK-128 ULTRA-LINEAR 8" DUAXIAL SPEAKER
19.50

Lafayette Radio
"Everything in Electronics"

FREE
308 GIANT SIZED PAGES

CUT OUT AND PASTE ON POST CARD

LAFAYETTE RADIO, Dept. EIK-9
P.O. Box 222, Jamaica 31, N. Y.
SEND FOR THE WORLD'S LEADING ELECTRONICS, RADIO, T.V., INDUSTRIAL, AND HI-FI GUIDE

☐ Send FREE LAFAYETTE Catalog 600

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

Hamshack Goes Anywhere

Continued from page 104

left exposed. This can generally be overcome by one or two applications of a sealing-type paint on walls and floor. A dehumidifier will generally solve the problem completely.

Another less obvious disadvantage of basement radio work is the danger of severe shock to a ham who must stand on the damp floor to repair or adjust equipment. Insulating rubber or plastic runner strips placed in front of work bench and equipment is a simple but worthwhile safety measure.

Amateur radio is by no means restricted to four walls. In fact, hundreds operate entirely from autos where they have installed receivers, transmitters and antenna systems. A complete station made up of compact units may be sandwiched beneath the dash panel. Another trick is to use the trunk compartment for bulky equipment with remote controls installed close to the driver.

Ham stations are on the wing, too. Contacts can be made with operators in a small aircraft out for a Sunday spin through the clouds, or with a jet bomber streaking toward Greenland working a kilowatt mobile aeronautical!

Dropping down to lake or sea level, one finds a growing number of launches, liners, houseboats and yachts with hams at their helm. While a special FCC license is required for limited operation on marine frequencies, many sea-faring CQ'ers are heard on the higher ham band frequencies.

No matter what the situation, every amateur agrees "Where there's a will, there's a way." Maybe that's why hamshacks are everywhere.

Rebuilt TV Picture Tubes

Continued from page 60

tube manufacturers admitted that rebuilding is here to stay by going into the business themselves. Some of the important tube manufacturers actually rebuild in the same plants where their new picture tubes are made—and send them through the same rigid tests.

The rebuilding process is not much different from making new tubes, and local rebuilders can compete with the giant companies. For instance, La Salle Tube Manufacturing Co., one of the first rebuilders to open shop, services the Chicago area. Its trucks pick up duds and distribute rebuilt tubes within a 500 mile radius of its plant. Visitors to La Salle's plant see workers, aided by several conveyors and automatic devices, turning out thousands of rebuilt tubes each month. The tubes are mainly used in home TV receivers, but some are for closed-circuit TV systems or cathode-ray oscilloscopes.

Although no two rebuilders follow exactly the same procedure, the steps taken at La Salle (see p. 60) are typical of quality workmanship.

The rise of tube rebuilding has allowed fraudulent operators to emerge. One type of fly-by-nighter has been selling "fake" rebuilts. Instead of going to the trouble of cutting open the bottle and replacing the screen and electron gun, they have been "hot-shotting" the original worn-out electron gun. This means giving the gun a heavy electrical shot, which temporarily revives it.

No reputable dealer will knowingly sell a hot-shotted tube because it would never last the one-year warranty period. To make sure that you don't receive a hot-shotted tube, insist on seeing the warranty statement that goes with all new or rebuilt tubes. If any picture tube you buy doesn't last one year from date of purchase or installation, don't hesitate to take it back for a substitute.

Many companies insist that their rebuilt tubes are just as good as all-new tubes. Some say that rebuilts are even better because during the tube's initial use, any moisture trapped in the glass has probably leaked out, molecule by molecule, resulting in "seasoned" glass envelopes that contain no moisture to damage the new elements.

Electronic Music

Continued from page 78

precisely the musical color he wants.

Many challenges to the composer arise in the handling of distortion and

ELECTRONICS ILLUSTRATED Classified Ads

Your advertisement can reach this mail-buying audience for only 35¢ per word . . . payable in advance (Check or M.O. please) . . . minimum 10 words. Closing dates are the 20th of 3rd preceding month i.e. copy for the February issue must be in our office by November 20th. Mail to ELECTRONICS ILLUSTRATED, 67 West 44th St., New York 36, N. Y. Word count: Zone number free. Figure one word: Name of state (New Jersey), name of city (New York); sets of characters as in key (14-D); also abbreviations as 35MM, 8x10, D.C., A.C.

SAVE MONEY • ORDER BY MAIL

• • • FOR SALE

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

GOVERNMENT SELLS: Surplus Electronics; Test Equipment; Oscilloscopes; Transceivers; Jeeps; Boats; Aircrafts; Misc.—Send for U. S. Depot Directory & Procedure $1.00. "Government Surplus Sales," Box 425-EL, Nanuet, N. Y.

BARGAIN PARTS Kit M101—Fabulous assortment—10 lbs., 50 items, $50 value for $3.00 (Add postage). MDC, 944 W. Tioga Street, Phila. 40, Pa.

BARGAINS—BARGAINS. Catalog 10¢. T-K Enterprises, 4526 So. 46 Ave., Omaha 7, Nebr.

• • • BUSINESS OPPORTUNITIES

GROW MUSHROOMS. Cellar, shed and outdoors. Spare, full time, year round. We pay $4.50 lb. dried. We have 29,000 customers. Free Book. Mushrooms, Dept. 315, 2954 Admiral Way, Seattle, Wash.

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

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

• • • HI-FI

PHONOGRAPH RECORDS cheap, postpaid. Catalogue. Paramount, Box 2026-K, Pine Castle, Florida.

HI-FI CONVERTER. Console sound from your radio, television, tape recorder, phonograph, with new speaker and enclosure kit. Free folder. Windhaven Radio, Box 16L-74, Baroda, Michigan.

• • • EMPLOYMENT OPPORTUNITIES

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

• • • TAPE RECORDERS

TAPE RECORDERS, recording tape, Bell tape decks, Hi-Fi equipment, Norelco speakers. We Will Not Be Undersold! Send for our discount catalog and see why! Commissioned Electronics, 1776 Columbia Road, Washington, D. C.

RENT STEREO Tapes—over 800 different —all major labels — free catalog. Stereo-Parti, 1608-J Centinela Ave., Inglewood 3, California.

SCOTCH RECORDING tape at "Profit Sharing" prices—send for catalog—you'll be glad you did!—Tapeco, Dept.-J, P. O. Box 4353, Inglewood 3, California.

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

HI-FI, RECORDERS. Free Wholesale Catalogue. Carston, 125-G East 88, N. Y. C. 28.

• • • RADIO & TV

DIAGRAMS FOR radios, phonos, recorders, $1.00; television $2.00. Airmailed. Give make, model. Electronics Services, Box 1706-El, Coral Gables, Fla.

POCKET T-V with picture. Send stamped envelope for info. Ekeradio, 650 N. Fair Oaks, Pasadena, California.

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

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

WORLD'S SMALLEST Radio $1.00 and a stamped addressed envelope to Ekeradio, 650 N. Fair Oaks, Pasadena, Calif.

NEW! "10 TESTED Crystal Set Plans"—25¢, with Transistor experiments, catalog. Laboratories, 1131-K Valota, Redwood City, California.

STOP T.V. commercials, Control volume and Off-On Switch from your chair. Complete plans $1.00. Kittymack, Box 34E, Monclova, O.

• • • ELECTRICAL SUPPLIES & EQUIPMENT

AMAZE YOUR friends with simple to build binary device that will indicate their age. Plans and instructions 50¢. Kit $7.95, Wired and tested $9.95. D & C Electronics, P O Box 824, Rome, N. Y.

• • • INVENTIONS & INVENTORS

FOUND! YOUR "open sesame" to selective manufacturers interested in acquiring available inventions. Write: Willard Bott, 2106 Customhouse Sta., San Francisco 26, Calif.

• • • MISCELLANEOUS

HAVE FUN: comic postcards. 25 different $1.00. Bradleys Variety, P. O. Box 281, McGregor, Iowa.

CHEMICALS AND Apparatus Catalog 25¢. Nu-Age Laboratories, Box 232, Bellmore, N. Y.

• • • DETECTIVES

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

• • • MUSIC

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

every effort is made to turn unavoidable distortion into musically acceptable sounds. All the various processes of timbre-modification must become an integral part of the general plan of the composition. Mixing often requires considerable experimentation to achieve proper balance of unusual sound materials and to avoid undesirable masking. Synchronization is another difficulty if precision is required in the final composition. Synchronous motors are a must, and starting and stopping the recorders often requires more than one pair of hands.

What is the future of electronic music or of tape music as it has been called in the United States? First of all, it will never replace the more conventional methods of musical composition. However, inasmuch as it permits composers to do things which are impossible to accomplish with conventional instruments, it offers a new field of exploration which is not likely to be soon exhausted. Movies, television, and radio have begun to make use of this new music, and it also has been heard in the concert hall. A new bond between composer and engineer appears to be in the making.

Ameco AC-1T Ham Transmitter

Continued from page 87

the plastic will solidify it into its original position.

No meter is used in the circuit but tune-up may be done with a small pilot lamp. If the builder has a DC milliammeter, it is inserted in series with a key lead. The plate tuning capacitor is rotated for a dip in current and the antenna loading capacitor brings the current up to its rated value. As customary with pi-network outputs of this type, the final step is to dip the plate current.

A 65-foot antenna of the single-wire type was strung up to check the rig's on-the-air performance. Five contacts on the 80 meter CW band were logged, each yielding a report of good signal strength and quality. *EI* rates AC-1T for $18.70 as an easily-assembled unit for the beginner and a Good Buy.

Build-It Course

Continued from page 51

network. Apply a frequency to a capacitor and it opposes it with capacitive reactance. But, as the signal goes up in frequency, the opposition decreases. In the higher treble ranges, the capacitor is virtually a short circuit. The low-frequency bass notes encounter great resistance—an open circuit.

It is the varying degree of opposition between highs and lows that enables the equalizer, or tone control, to yield the desired response curve.

The design of this preamplifier is basic. It is a workable unit capable of good performance in conjunction with the other plug-in projects in this series. An important consideration in its construction is avoiding hum. Be certain that all grounds are secure and well-soldered. Try a ground lead between chassis, at various points, if hum level in the completed unit is objectionable.

Next month an AM tuner will be added to this series.

Add A Tuning Eye

Continued from page 63

Refer to a schematic drawing of your set for a point to obtain B+ from 220-360 volts DC. This is most readily available at the large filter capacitors in the power supply section.

An Amphenol Magic Eye assembly contains a hood-type escutcheon made of plastic, a metal support bracket and socket with leads. The only additional part required is a 3,300 ohm, 1 watt resistor.

A special procedure must be followed with a tuner that has a ratio detector such as the Heathkit. Pins 1, 5 and 6 are connected to ground and the output from the ratio detector is connected to pin 4 of the 6AL7. The negative end of the 10 mfd 50 volt capacitor is suitable. Target areas A, C and D will not change size during tuning. Area B will vary and should be tuned for smallest size.

The Amphenol kit cost $1.50 and the 6AL7 tube $3.

You Practice Kits NRI

People *look up to* a Technician, more t New Electronic proc ing the job opportu Television-Electroni Right in your own h time, you can gain k skills needed to get vast industry. You le get NRI kits develo give actual practice As part of your NRI get all parts includi build the 17" Televisi use vacuum tube at left, use it to lear tronic circuits, ma ments. All equipmen

FOR GOOD PAY TO START AND

Learn Radio–TELEVISIO

AT HOME IN Y

Broadcasting offers satisfying careers. Hundreds of Radio and Television stations on the air offer interesting jobs for Operators and Technicians. Police, Aviation, Two-Way Communications are expanding. Men with Radio-TV training are in demand.

A solid, proven field of opportunity for good pay is servicing the millions of Radio and TV sets now in use. Government, military, guided missile manufacturers, industry . . . all need Technicians. Color-TV, Hi-Fi are increasing the opportunities.

Start Soon to Earn $10—$1 a Week Extra in Spare Tim

Many NRI students find it easy and profitable to fix sets f friends and neighbors starting a few months after enrollin Use the Tester built with parts NRI furnishes to locate a correct Radio-TV receiver troubles. Picking up $10, $15 a more a week gives substantial extra spending money. Ma who start in spare time soon build full time Radio-Televisi sales and service businesses, enjoy prestige, respect and sati faction in this fast growing industry.

Benefit by NRI Experience—Oldes Largest Home Study Radio-TV Scho

NRI's more than 40 years experience training men for succe —the outstanding record and reputation of this school—ben fits you in many ways. NRI methods are tested, proven. Su cessful graduates are everywhere, in small towns and b cities. Here is an investment that pays big profits soon. Ea week, invest only a few hours spare time in yourself—pr paring to be a Radio-TV-Electronics Technician. Invest training to get ahead. NRI can provide the training you nee

NRI Is The Tested Way to Better Pa

Technical know-how brings better pay, fast advancemer Radio-TV-Electronic opportunities are great, and are increa ing. NRI has devoted over 40 years to developing simplifie practical training methods. Mailing the card at right can one of the most important acts of your life. Do it now. Reaso able tuition, on low monthly payments available. Let us se you an actual Lesson and 64 page Catalog—BOTH FREE. Address: NATIONAL RADIO INSTITUTE, Dept. 9MK, Washington 16, D. C.

J. E. Smi Founde

National Radio Institute

Washington 16, D. C. Est. 1914

NOW THERE'S A NATIONAL SHORTWAVE RECEIVER FOR ANY BUDGET

NC-60 SPECIAL

BURTON BROWNE / New York

For the armchair adventurer to travel the world without leaving his living room. National's new NC-60 Special is the first all new, low priced shortwave receiver in over 10 years. Features continuous coverage of AM broadcast, amateur and world-wide shortwave bands with full electrical bandspread on all frequencies: 540-1600 kc to 31 mc in four bands. Giant, easy-to-read dial with standard broadcast, civil defense, WWV, marine, aircraft, amateur and foreign shortwave frequencies clearly marked.

Suggested list: $59.95* Only **$5.99** down

FOR BOATSMEN—FOR SHORT WAVE LISTENERS—FOR HAMS

NC-66

SAVE $36.39! National's famed NC-66, portable short-wave/ham receiver! Features 5 bands including marine and aircraft direction finding beacons, standard AM, 160-5 meter amateur, and world-wide shortwave bands . . . AC/DC or battery pack. NC-66 at regular price: $129.95; RDF-66 direction finder at regular price: $39.95; Eveready "Magnet Torch lite" including cells: $2.49; and Marine Electronics Handbook: $3.95. Total value: $176.34

NOW only **$13.99** down

Special cash price: $139.95*—a saving of $36.39

NC-66 alone ($129.95) now only $99.95* full price

NC-188

National's NC-188—new general coverage receiver—a truly great value. Designed for Short Wave Listeners and for new Hams, it covers AM broadcast and all popular SWL and amateur bands. Continuous coverage; 540 kc to 40 mc in 4 bands, plus all the latest engineering features.

NOW only **$13.99** down

cash price: $139.95*

*Slightly higher west of the Rockies and outside U. S. A.

NATIONAL NC

RADIO CO., INC. MELROSE 76, MASS.

A wholly owned subsidiary of National Co., Inc.

THIS SPECIAL OFFER IS SUBJECT TO WITHDRAWAL AT ANY TIME, WITHOUT NOTICE.