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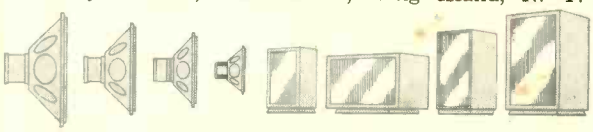

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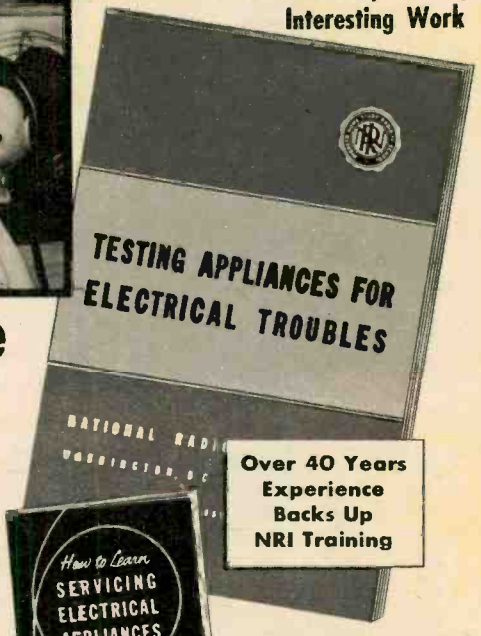

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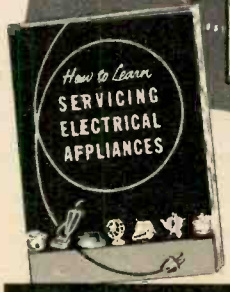

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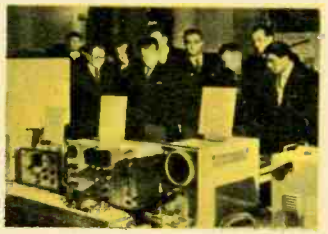
ELECTRONICS ILLUSTRATED

A Fawcett Publication

Vol. 1 No. 4

Oct. 1958



EI Exclusive

Hi-Fi Hi-Lite

Special Project

Contents

Cover photo of Ford Thunderbird by Simon Nathan.

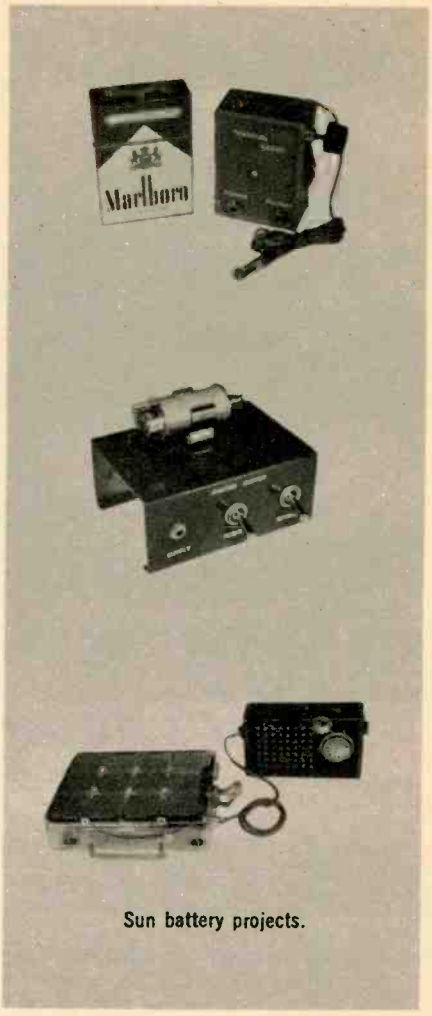
ELECTRONICS ILLUSTRATED is published monthly by Fawcett Publications, Inc., Fawcett Place, Greenwich, Conn. W. H. Fawcett, Jr., President; Gordon Fawcett, Secretary and Treasurer; Roger Fawcett, General Manager; Roscoe K. Fawcett, Circulation Director. Editorial and Advertising offices: 67 West 44th Street, New York 36, N. Y. Entered as second class matter at the Post Office at Greenwich, Conn. under the Act of March 3, 1879 with additional entry at Louisville, Ky. Price 25¢ a copy. Subscription price, 12 issues for $3.00 in U. S. and Possessions and Canada.

A Message From the Editor

It's no news to us by now that the Russians have made great progress in electronics and other branches of science since the end of World War 2. However, during this period of soul searching for us, it is a good idea to learn, as much as we can, more specific details about their electronic devices and techniques. Let's separate their propaganda from their actual accomplishments in order to determine whether we really can learn much from them.

All this by way of explaining why we are publishing "Inside Russian Electronics" in this issue. One very obvious lesson that can be drawn from this interview is that our TV sets, test equipment and other electronic devices may not be best simply because we made them. In designing and building things there is always more than one way and there are undoubtedly times when we have not taken the best way. We have closed our minds to the possibility that advances are being made in Russia and some European countries for too long. It's time we assume that we can learn from them as they have so well learned from us in the past and are learning now.

Although blimps are known to be obsolete for efficient air travel they have a way of popping up now and again to do a specific job better than any other type of airship. They have now been invested by the Navy with a tremendous amount of specialized electronic equipment and have in effect been turned into floating electronic platforms for the detection of enemy submarines and for other duties as part of our early warning continental defense system. ELECTRONICS ILLUSTRATED in the person of Don Hoefler was lucky enough to go along on a Naval Reserve blimp recently to hunt for the old steamship Savannah, sunk off Fire Island. The success of this mission is now a matter of record, but Don tells you how it felt to be up under that gas bag and how the discovery was made. Don, who has been bitten by the "lighter than air" bug and wouldn't rest until he had gotten me aboard, was a flight communications officer on Pan American's trans-Atlantic Clippers. As a staff engineer he worked with Major Edwin Armstrong, inventor of FM, in his Alpine, New Jersey, laboratories. Don is also the author of our "ABC's of Electronics" series and is leaning heavily



Sun battery projects.

EI's editor, Hoefler and blimp pilot Hanley.

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on his experience as an instructor in the U.S. Navy Air Transport Service Electronics Technicians School. He has just finished two Fawcett "How-To" books: "Hi-Fi Manual" and "All About Hi-Fi Tape Recording".

We handed Robin Lanier, well-known hi-fi author, a special assignment: to present to our readers an evaluation of all of the stereo hi-fi pickups now available. These are the little cartridges that have been especially designed to play back the new stereo records now available. Robin is well known for his articles on stereo hi-fi in the Sunday edition of the N.Y. Times. Not all of the pickups he reports on were available at the time of writing for him to take home and test on his own equipment. Those which were not were demonstrated for him by the manufacturers.

Next month we are featuring stereo hi-fi. There'll be a special round-up article on all stereo equipment other than phono pickups. The emphasis will be on what you can buy to convert your present system to stereo—or how to start from scratch. We also will have for you all the information on the new multiplex broadcasting method of FM stereo.

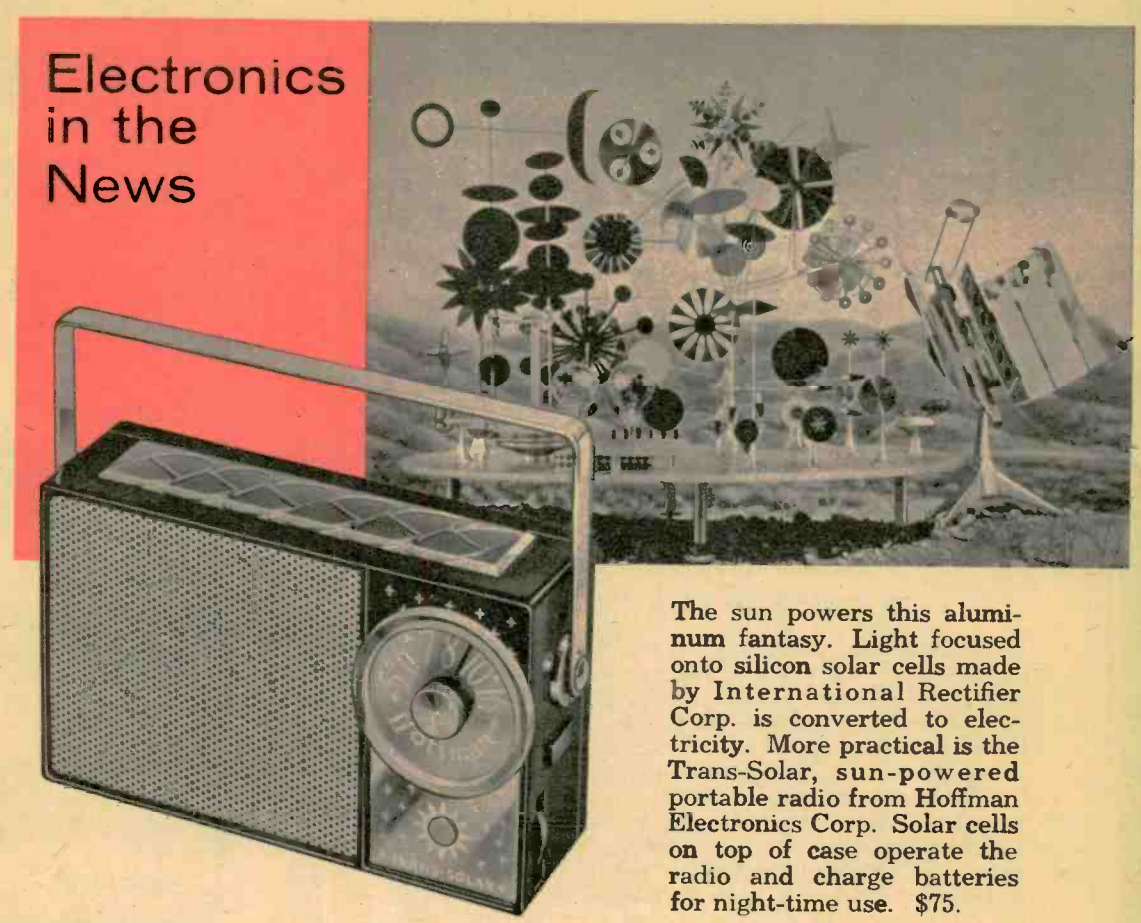
If you think that our "Stereo on a Shoestring" article in this issue presents a rather ingenious solution to low-cost stereo, wait till next month. There, you will find an article on adding one tube to this amplifier for the operation of two loudspeakers. We're certainly not entering into competition with high quality hi-fi equipment in these two articles. Rather, we're hoping to get you excited about stereo and whet your appetite.

"Use the Sun For Power" is the first of a series on how to take advantage of the new low-cost sun batteries now available to operate low-powered radios, toys, and items for the home. We will continue this series in every issue, because we think the ideas we have for using sun batteries will result in ingenious and highly practical items for your use.

Now that we're monthly, be sure to look for us every month on your newsstands.

Charles Tuttle

Electronics in the News



The sun powers this aluminum fantasy. Light focused onto silicon solar cells made by International Rectifier Corp. is converted to electricity. More practical is the Trans-Solar, sun-powered portable radio from Hoffman Electronics Corp. Solar cells on top of case operate the radio and charge batteries for night-time use. $75.

Customers become cameramen at San Francisco's Channel Inn. The panoramic DuMont TV camera on the roof can be swiveled to any direction by remote control units run by customers at the bar.

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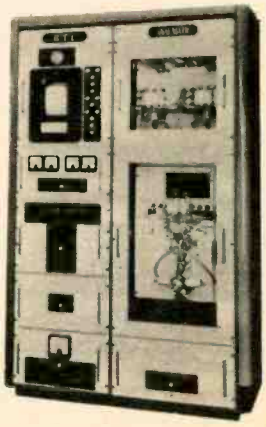
Add RCA's stereophonic tape recorder cartridge to the expanding market of stereo equipment. Housed in a plastic magazine 7″ long, 5″ wide and ½″ thick, the cartridge, which is recorded at 3¾″ per second, contains enough tape for one hour of stereophonic or two hours of monaural music, recorded at home. It slips onto the tape recorder player as easily as a record, no need to thread the tape by hand or rewind. Cartridges are $4.95 to $8.95.

—o—



Complete automation has reached the chemical laboratory to free scientists from routine analytic work. Needing no human assistance at all, the Analmatic system measures, mixes, heats, tests, records test results and even cleans up after itself, thoroughly washing all vessels used. Developed by Baird and Tatlock of Great Britain, the Analmatic is available through the Chicago Apparatus Co. in the U. S.

—o—

A combination tuner-amplifier incorporating an AM-FM tuner with a 15 watt amplifier has been released by Bell Sound Systems, Inc. An electronic tuning bar on the Model 2521 provides an accurate indication of tuning to a distortion-free signal by means of a broken bar of light that comes together as the signal gets stronger. The tuner also has automatic frequency control on FM which locks into a signal from either side of the scale. The built-in preamplifier provides equalization for various phono pickups and tape heads. A multiplex output on the rear chassis is provided to receive "All-FM" Stereo broadcasts. Price is $149.95 net.

—o—

A trade-in plan encouraging hi-fi listeners to buy and enjoy monaural equipment now, and switch to stereo later if they wish, has been put into operation by Shure Brothers, Inc. Anyone buying Shure's "Dynetic" tone arms and cartridges will be able to exchange them for Shure's stereo units with an allowance of 75% of the purchase price of the monaural unit.

—o—

A hi-fi sales manager turned teacher, part time, and over two dozen youngsters eagerly attend "classes" on Saturday afternoons. It sounds unusual, but there's nothing ordinary about "Exploring Electronics," a course given weekly at Boston's Museum of Science. Marvin Grossman, sales manager at H. H. Scott Co. and an electrical engineer, initiated the idea of presenting electronics to junior high school students in a way that would capture their imaginations and encourage further work in high school. Since theory alone would not suffice for this age group, students first discuss a principle and then try it out by building something. Their first project was a simple four-part crystal set, next a vacuum tube amplifier. Several local industries have donated parts and publishers give printed matter.

—o—

GE's new glass housing for transistors which meets industry-set specifications costs one-tenth of what is now spent on metal cases and cuts production costs.

A "Music Minder" which will turn off a phono hi-fi system after the last record has been played, has been introduced by C.B.C. Electronics Co., Inc. Operation is completely electrical, the device is merely plugged in. $11.95 list.

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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.

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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.

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- PRINTED CIRCUITRY

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

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

FROM OUR MAIL BAG

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

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

UNCONDITIONAL MONEY-BACK GUARANTEE

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

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

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

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

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PROGRESSIVE "EDU-KITS" INC.
1186 Broadway, Dept. 504AE, Hewlett, N. Y.

The sun's free and inexhaustible energy is used in the "Solaris," Zenith's eyeglass-type hearing aid. Silicon cells on temple bar operate hearing aid even on overcast days; when light is insufficient, a tiny, nickel-cadmium rechargeable storage battery cuts in automatically.

—o—

A "do-it-yourself" home study course for learning all about transistors and how to use them is now being made available by CBS Hytron. The ten lessons feature simplified basic theory with practical experiments and servicing techniques for transistor amplifier, oscillator, and rectifier circuits. Write to CBS-Hytron Advertising Service, Parker St., Newburyport, Mass., for free descriptive folder.

—o—

Man, with the aid of electronics *can* do something about the weather, indoors at least. In Montreal's 21-story Queen Elizabeth Hotel a giant electronic brain, designed by Minneapolis-Honeywell, has taken over the vast air-conditioning task. At a single, central location temperatures of all rooms are recorded automatically. With only one engineer needed to push buttons, temperatures are set and adjusted, fans started and stopped, trouble spotted by built-in alarms and corrected at once. With the Supervisory-Data-Center, the operator has a complete picture of conditions throughout the building and is in complete control of the entire system.

BIG NEWS!

A RONDINE TURNTABLE IN KIT FORM

only $39.95

Also see the all-new, improved factory-assembled Rondines at your dealer!

A revolutionary breakthrough in the industry! A stereo turntable kit with traditionally superior Rek-O-Kut performance! It's engineered to give Rek-O-Kut's famous silent operation, **eliminating** all traces of record changer rumble in stereo disc playback.

The kit contains the same exclusive, precision-machined turntable and bearing-well used on all Rondine models. Assembles easily and quickly to the deck plate. The motor installs on a specially-made mounting plate. A minimum number of working parts go together accurately, in 30 minutes or less . . . reflecting the simplicity and trouble-free operation of Rek-O-Kut design. This new Rondine offers you superb quality . . . unmatched performance, the kind you need for better monaural reproduction . . . the **kind you must have for stereo!**

ADVANCED FEATURES OF NEW RONDINE K-33 STEREO TURNTABLE!

- Single-speed (33⅓) Crown-Spindle Belt Drive. Custom-made endless-woven fabric belt with thickness held to ± .001. Adjustment for belt tension.
- Assembly time: about 30 minutes with simple tools.
- Noise level: 47db. (NARTB standards.)*
- Motor: 4-pole induction, designed and built to Rek-O-Kut specifications.
- Built-in strobe disc: for checking speed.
- Turntable: Heavy Cast Aluminum, lathe-turned. Tapered for easy disc handling.

*National Association of Radio and Television Broadcasters specifications.

PERFECT TURNTABLE MATE . . . AUDAX TONEARM
the only stereo tonearm in kit form!

Assembles in just 15 minutes . . . no mechanical skill needed! A professional tonearm precision-engineered to highest broadcast standards. You save over 50% simply because you assemble it yourself. Ingeniously simple for foolproof operation, dependable performance. Takes all stereo cartridges. 12" arm—KT-12—$15.50. 16" arm—KT-16—$18.50.

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HIGH FIDELITY TURNTABLES • TURNTABLE ARMS

Engineered for the Studio • Designed for the Home

INSTITUTE OF HIGH FIDELITY MANUFACTURERS INC.

Rek-O-Kut Co., Inc., Dept. EI 10, 38-19 108th St., Corona 68, N.Y.

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RK27

Television as a teaching technique was demonstrated at the annual meeting of the U.S. Chamber of Commerce, using General Precision Laboratory, Inc. equipment. A simulated classroom and TV studios were set up enabling the audience to see closed circuit telecasting used in teaching.

—o—

The new "Debonaire" lowboy speaker systems and enclosure, available from University Loudspeaker, Inc., in three different versions, can be easily adapted to traditional or modern decor by a simple resetting of the legs, and through a choice of woods. The enclosure is available separately for $63 to $69 or may be bought with one of two three-way systems already installed.

—o—

U.S. color TV went behind the iron curtain for closed-circuit demonstrations at the Polish International Trade Fair. RCA Victor equipment was used.

—o—

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, Eleven Big Radio-Television Kits, Complete Color-TV Instruction, Unlimited Consultation Service . . . *ALL at a really big saving to you.* How can we do this? Write to us today . . . and find out!

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

We Want 100 More Shops for 1957

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

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

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

RTS APPROVED SERVICE 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.
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you build all these units

*tubes excluded

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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)

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Address _____

City & State _____

300

From RCA comes the transistorized "Wireless Wizard," an electronic remote control unit that operates all the controls on a color TV set from anywhere in the room. One is available for black-and-white TV also.

—o—

The 7-piece De-Soldering Kit, #270 from Ungar Electric Tools, Inc., is designed for fast, easy and safe removal of parts mounted on printed circuit boards. Among the special features are a tip which simultaneously melts solder and straightens bent tube tabs or other leads bent against the board and tips which melt solder on all tube tabs and center pin in one operation.

—o—

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

20,000 SERVICEMEN CAN'T BE WRONG!

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

Just 2 settings on the FAST-CHECK TUBE TESTER

tests over 650 tube types completely, accurately — *AND IN SECONDS!*

- **POSITIVELY CANNOT BECOME OBSOLETE** Circuitry is engineered to accommodate all future tube types as they come out. New tube listings are furnished periodically at no cost.
- **NO TIME CONSUMING MULTIPLE SWITCHING** Only two settings are required instead of banks of switches on conventional testers.
- **NO ANNOYING ROLL CHART CHECKING** Tube chart listing over 650 tube types is conveniently located inside FAST-CHECK cover. New tube listings are easily added without costly roll chart replacement.

Dimensions: Width: 14⅝" Height: 11¼" Depth: 4⅜"

Special compartment accommodates line cord and Picture Tube Test Adapter

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

Guaranteed for One Full Year

Picture Tube Test Adapter Included With Fast-Check

Enables you to check all picture tubes (including the new short-neck 110 degree type) for cathode emission, shorts and life expectancy . . . also to rejuvenate weak picture tubes. This feature eliminates the need of carrying extra instruments and makes the FC-2 truly an all-around tube tester.

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

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

RANGE OF OPERATION

- ✓ Checks quality of over 650 tube types, which cover more than 99% of all tubes in use today, including the newest series-string TV tubes, auto 12 plate-volt tubes, OZ4s, magic eye tubes, gas regulators, special purpose hi-fi tubes and even foreign tubes.
- ✓ Checks for inter-element shorts and leakage.
- ✓ Checks for gas content.
- ✓ Checks for life-expectancy.

IMPORTANT FEATURES

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

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

SHIPPED ON APPROVAL FOR 10 DAY FREE TRIAL

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

PAY IN SMALL MONTHLY PAYMENTS

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

NO MONEY REQUIRED WITH ORDER . . .

CENTURY ELECTRONICS CO., Inc., 111 ROOSEVELT AVENUE Dept. 410, Mineola, N. Y.

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

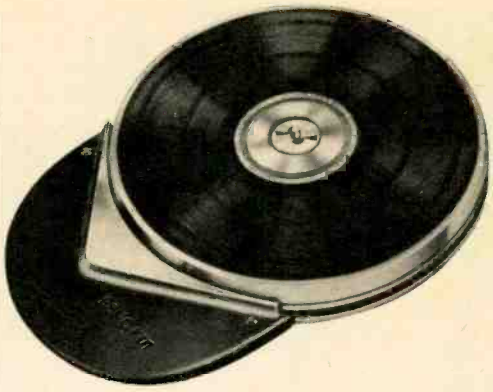
MODEL FC-2 . . . $69.50 — Pay $14.50 within 10 days.
Balance $11.00 monthly for 5 months.

Name.....

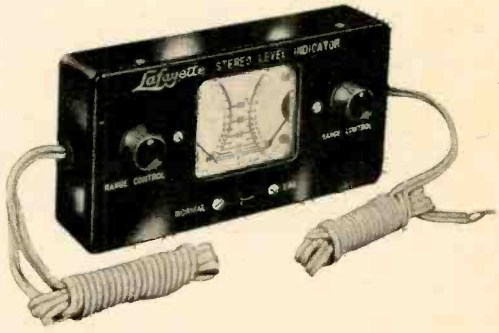
Address.....

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

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



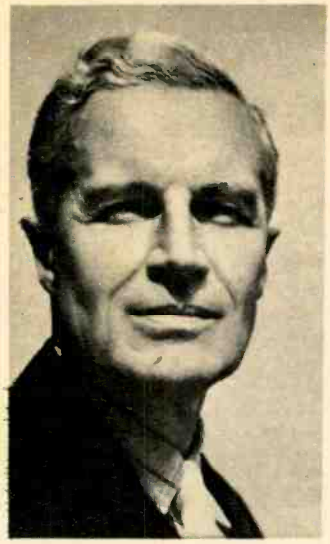
Rek-O-Kut is offering a single speed (33⅓ RPM) turntable kit to sell for $39.95. It may be assembled by anyone in approximately 30 minutes with simple tools. The motor is a 4-pole induction type that drives a special endless fabric belt with a thickness held to micrometer tolerances. To permit noise level control, the belt has adjustable tension. The turntable itself is solid cast aluminum and has a strobe disc.



A new dual audio output level indicator is available from Lafayette Radio. The Model TM-40 stereo balance indicator has separate, continuous controls in each channel and a switch to permit calibrating one meter against the other. Blocking capacitors are internally installed to prevent meter damage by DC. The meters peak at average values and are ideal for maintaining control of recording levels on tape recorders or output level on stereo tuners, or for comparing levels in any 2 audio channels. $8.95 list.

I'd like to give this to my fellow men...

while I am still able to help!



I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my summer home, my Cadillacs, my Winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things; of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life, is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows". It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own". It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest $15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

VICTOR B. MASON
1512 Jarvis Ave., Suite M-120-L
CHICAGO 26, ILLINOIS

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see the outstanding 1959 knight®-kits

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Do-It-Yourself: SAVE UP TO 50%

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knight-kit Stereo Adapter Control Kit
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knight-kit "Space Spanner" 2-Band Receiver Kit
Y-259 $18.95

knight-kit Amateur Communications Receiver Kit
Y-726 $104.50

knight-kit Dual 30-Watt Stereo Hi-Fi Amplifier Kit
Y-777 $84.50

knight-kit 12-Watt Hi-Fi Amplifier Kit
Y-784 $19.95

knight-kit "Ranger III" AC-DC Radio Kit
Y-736 $16.95

knight-kit "400" Tube Checker Kit
Y-707 $19.95

knight-kit "Span-Master" 4-Band Receiver Kit
Y-258 $24.95

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Y-737 $24.95

knight-kit "Ranger" Radio-Intercom Kit
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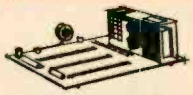

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Y-272 $14.95

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

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- 25-Watt Basic Amplifier
- 30-Watt Amplifier
- FM-AM Tuner
- FM Tuner
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HOBBY KITS
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- 5-Transistor Portable
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- Photoelectronic System
- Electronic Photoflash
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- Audio Generator
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- Flyback Checker
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AMATEUR KITS
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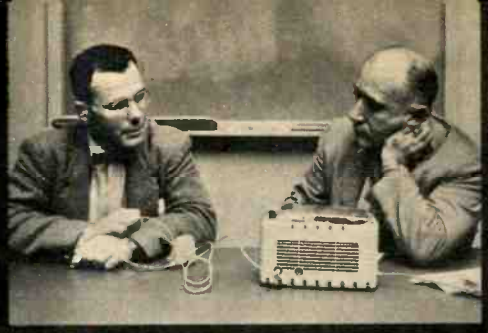


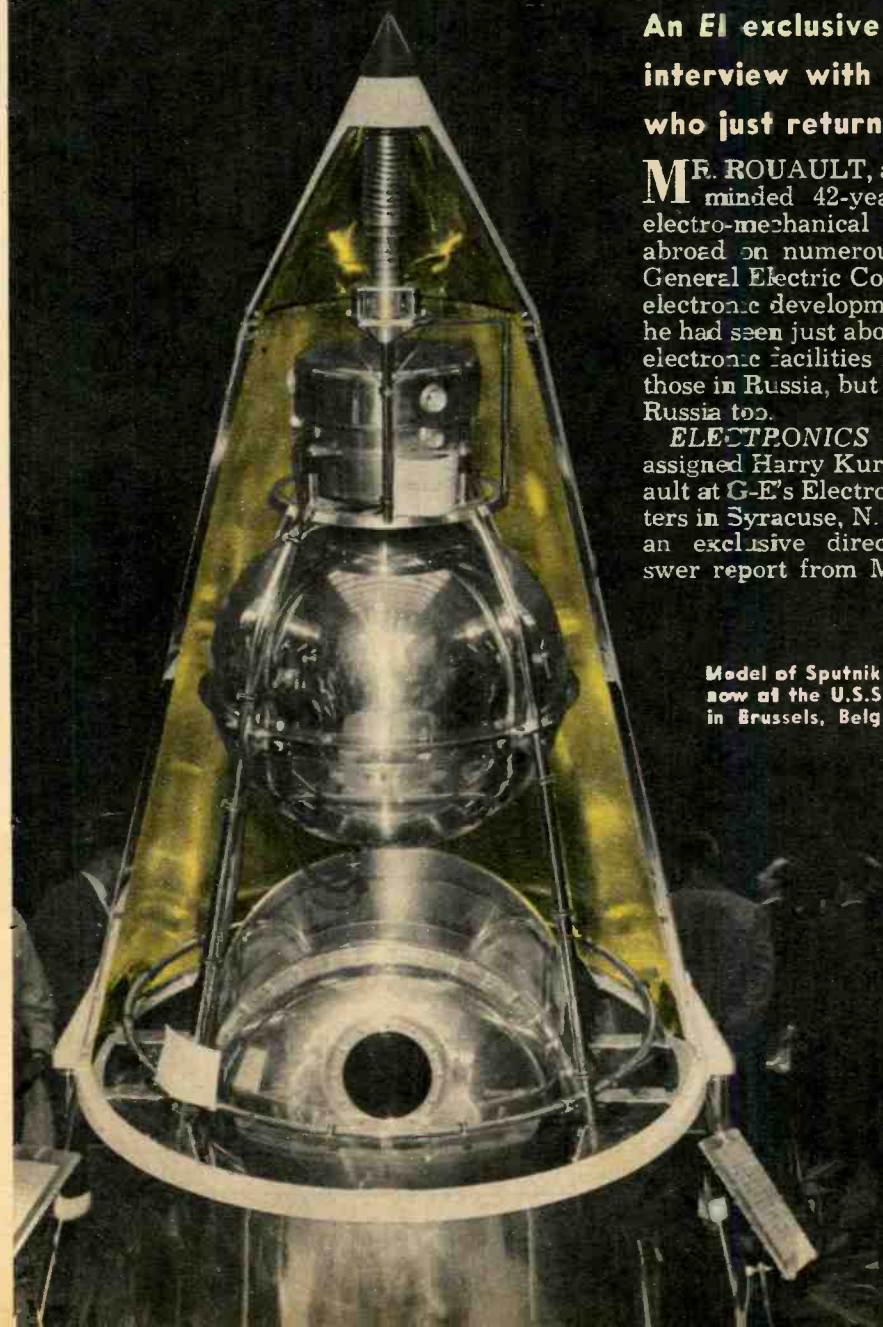
EI author Harry Kursh (right) interviews G-E engineer Charles Rouault with tape recorder.

INSIDE RUSSIAN ELECTRONICS

An *EI* exclusive tape recorded interview with a G-E engineer who just returned from Russia.

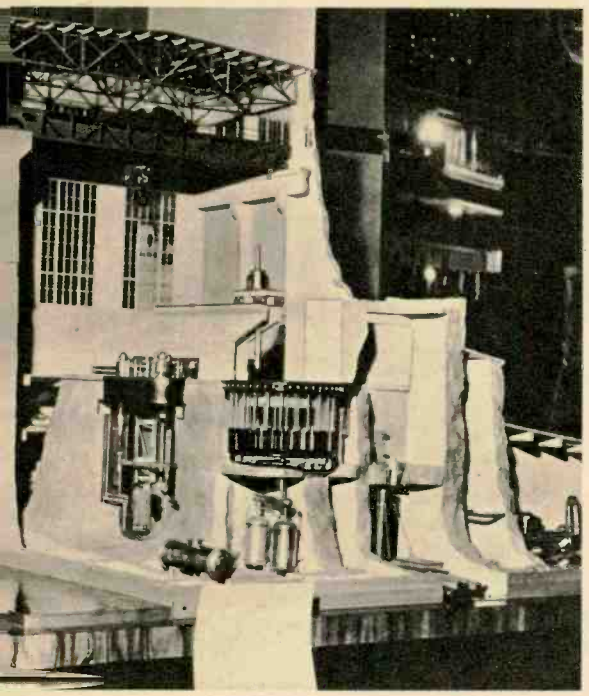
MR. ROUAULT, a genial but serious-minded 42-year-old specialist in electro-mechanical devices, has been abroad on numerous missions for the General Electric Co., inspecting foreign electronic developments. Until recently he had seen just about all the important electronic facilities in the world except those in Russia, but now, he has been to Russia too.

ELECTRONICS ILLUSTRATED assigned Harry Kursh to visit Mr. Rouault at G-E's Electronic Park headquarters in Syracuse, N. Y. What follows is an exclusive direct question-and-answer report from Mr. Rouault.

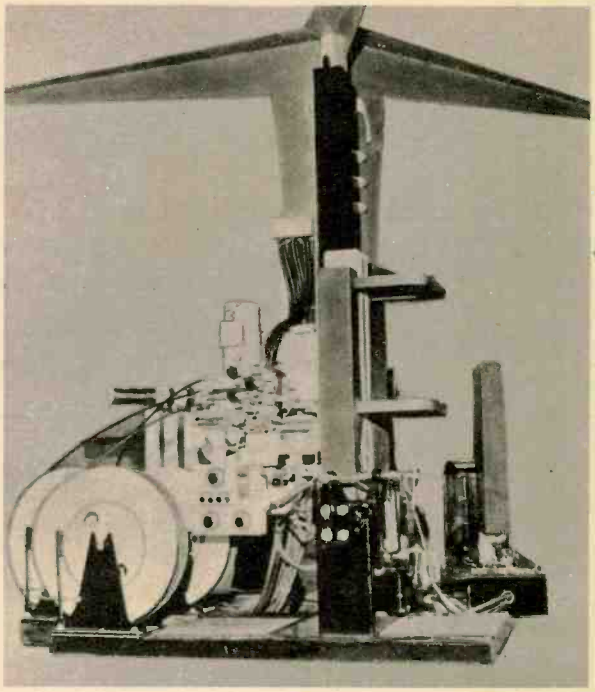


Model of Sputnik 2, the Soviet satellite, now at the U.S.S.R. building at the Fair in Brussels, Belgium. Note transmitter.

Cutaway view of Russian nuclear experimental station. Electronic control panels are at left.



This is an automatic welding machine which performs operations via a preset program.



Ques. *Was this your first visit to Russia, Mr. Rouault?*

Ans. Yes.

Ques. *What was the main purpose of your mission?*

Ans. To attend meetings of the Popov Society in Moscow, at the invitation of the Society.

Ques. *Were you alone?*

Ans. No. There were four of us. The other three were: Axel G. Jensen, of the Bell Telephone Laboratories; John N. Dyer, of Airborne Instruments Laboratory, Inc.; and Robert F. Schulz, of Sylvania's Microwave Division. However I am only talking for myself.

Ques. *What is the Popov Society?*

Ans. It is the Russian equivalent of the IRE (Institute of Radio Engineers)—named in honor of Alexander Popov, a Russian who had conducted experiments in wireless telegraphy quite a number of years before Marconi.

Ques. *How long were you in Russia?*

Ans. Two weeks.

Ques. *Were you permitted to visit many electronic installations?*

Ans. Yes, as many as we could get to.

Ques. *Did they choose the places for you to visit?*

Ans. Essentially, yes. But many of the visits were arranged pretty much on the spur of the moment. They were remarkably cooperative.

Ques. *Were any restrictions imposed upon you?*

Ans. None whatsoever. We were permitted to take pictures anywhere and everywhere, inside and outside electronic plants.

Ques. *What sort of electronic facilities did you get to visit?*

Ans. We saw selenium rectifier and resistor plants in Moscow, a tube and transistor plant in Leningrad and we visited their famed Radio Town in Zilinograskaya, just north of Moscow. We also saw a cyclotron and synchrophasitron at Dubne, the radio astronomy station at Pulkovo and the Moscow Physics Institute.

Ques. *Did you see any television broadcasting facilities?*

Ans. Yes. In Moscow and Leningrad.

Ques. *What single fact of your visit has left you with the most indelible impression?*

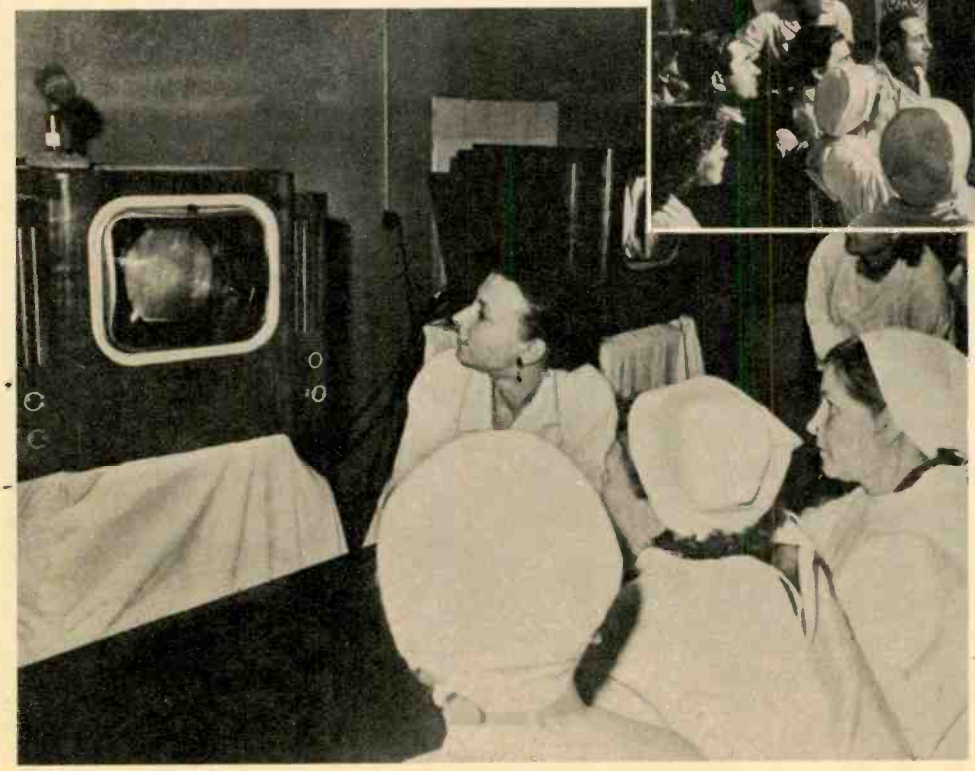
Ans. The fact that they have made a very large amount of progress in fields which we had not expected to be anything but propaganda gestures.

Ques. *For instance?*

Ans. Well, they have lots of home TV sets, something like 3,000,000, mainly around the major cities; their programs are pretty good; their technical facilities are excellent.

Ques. *Their TV broadcasting studios, too?*

Ans. Yes. Their studios compare well with those I have seen in New York. The TV studios in Moscow occupy a large city block. Studio facilities are located in a group of old buildings which obviously were not originally designed for the purpose. But it was apparent that ultimately these would be quite elaborate and somewhat similar, for instance, to the Television Cities in Hollywood.



Medical workers outside an operating room watch on a small-screen color TV set. Larger monochrome sets (right) are also used.

Ques. *How many channels in Moscow?*
Ans. Two, which are 8 megacycles wide as compared to our 6 megacycle channels.

Ques. *What sort of transmitters are they using?*
Ans. One has a 12½ kilowatts output power and consists of an original RCA transmitter brought to Russia in the 1930's and now completely rebuilt by them. The other transmitter has 7½ kilowatts power and is completely Russian designed and built.

Ques. *What are their TV studio cameras like?*
Ans. Each of the large studios had four or five cameras, and in one studio the cameras were all using image iconoscopes, while in the other studio the cameras were using image orthicons. The director of the station stated that they preferred the iconoscope for studio use because of its better signal-to-noise ratio but, as far as we could see, the pictures from the image orthicon cameras were every bit as good as those obtained from similar cameras over here. Both the gradation and the signal-to-noise ratio were very satisfactory.

Ques. *Do they have coaxial hookups?*
Ans. We were told that only one coaxial cable link exists in Russia, namely, a 150-kilometer link connecting the Moscow station with a satellite station in Kalinin.

Ques. *What do they use for remotes?*
Ans. They were using microwave relay installations using conventional dishes and operating at about 2500 megacycles. We were also shown a complete truck-mounted mobile television relay installation.

Ques. *What did you learn regarding their home TV sets?*
Ans. We saw black-and-white and color sets in 17 and 21 inches, with cabinets of wood, plastic and metal. We were told that they were going to start producing portables also, and by 1959 they expect to start producing a total of 10,000,000 TV sets annually. Their home TV sets appear to be well designed and compare favorably

These Russian youngsters are on duty at the receiver of their youth club's hom station.

Exhibit in Russia of electronic equipment. Instrument third from left is a sleep inducer.

with American sets. Perhaps their performance and circuitry is less subject to variation than some of ours because we have designed ours to meet competition and they have not trimmed theirs.

Ques. *Do you mean their TV sets are not as compact as ours?*

Ans. That's right. Their sets are more ruggedly built.

Ques. *Are you referring to the components in the set?*

Ans. Yes.

Ques. *Are the Russians impressed at all by the amount of miniaturization and compactness we are getting into our electronic devices?*

Ans. They are slightly negative, to put it mildly. They believe we are trying to do too much in too small a space. They are not enthusiastic about our printed circuits because they say these are too difficult to maintain and because it poses a problem in automation. I did not get the impression that they'd care to emulate the amount of miniaturization we are trying to do in this country.

Ques. *What is your opinion of their attitude toward miniaturization?*

Ans. I'd say they're trying to keep their feet on the ground.

Ques. *Did you see much automation in their plants?*

Ans. No. But they talk about it as much as we do.

Ques. *Did you see much of their research facilities?*

Ans. Only the ones in the Moscow Physics Institutes, and these seemed, on the whole, to be pretty good. They were doing work on semiconductors and signal propagation. Their techniques and attitudes seemed to be roughly the same as you'd see elsewhere.

Ques. *In other words, if you did not hear Russian you might think you were in any typical American research lab?*

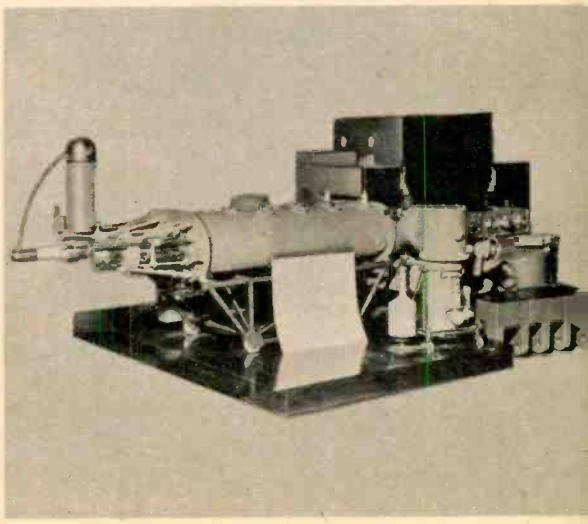
Ans. No, no. The appearance is quite different. They don't pay much attention to lighting and surroundings as we do. But all the instruments would be quite familiar. They seem to be quite well equipped with instruments and research facilities.

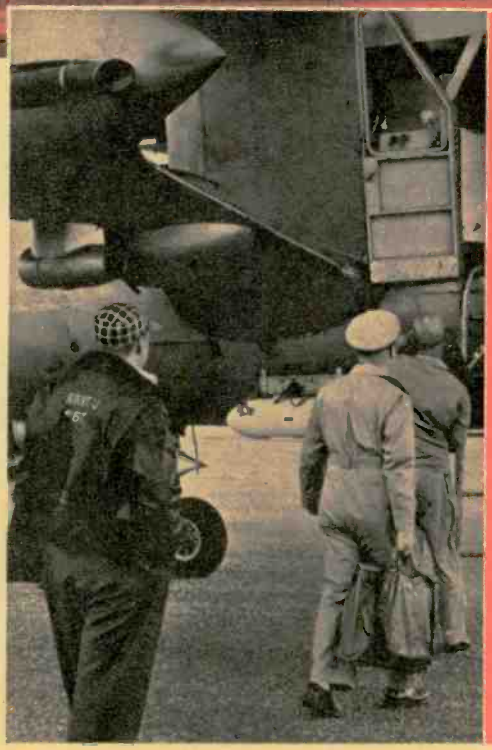
Ques. *Did you notice any particular electronics lab and research instruments which might have been a revelation to you?*

Ans. No, not in electronics. But in the field [*Continued on page* 88]

Many Russian women hold responsible positions in electronics. This is a satellite tracker.

This is a model of a Soviet cyclotron used for atom smashing tests in advanced research.





The hunt for the S.S. Savannah, first steam ship to cross the Atlantic, was led from this "K" type airship.

Author and crew board blimp which will seek the remains of a ship lost 137 years ago near N. Y.

We Hunted Buried Treasure From the Air

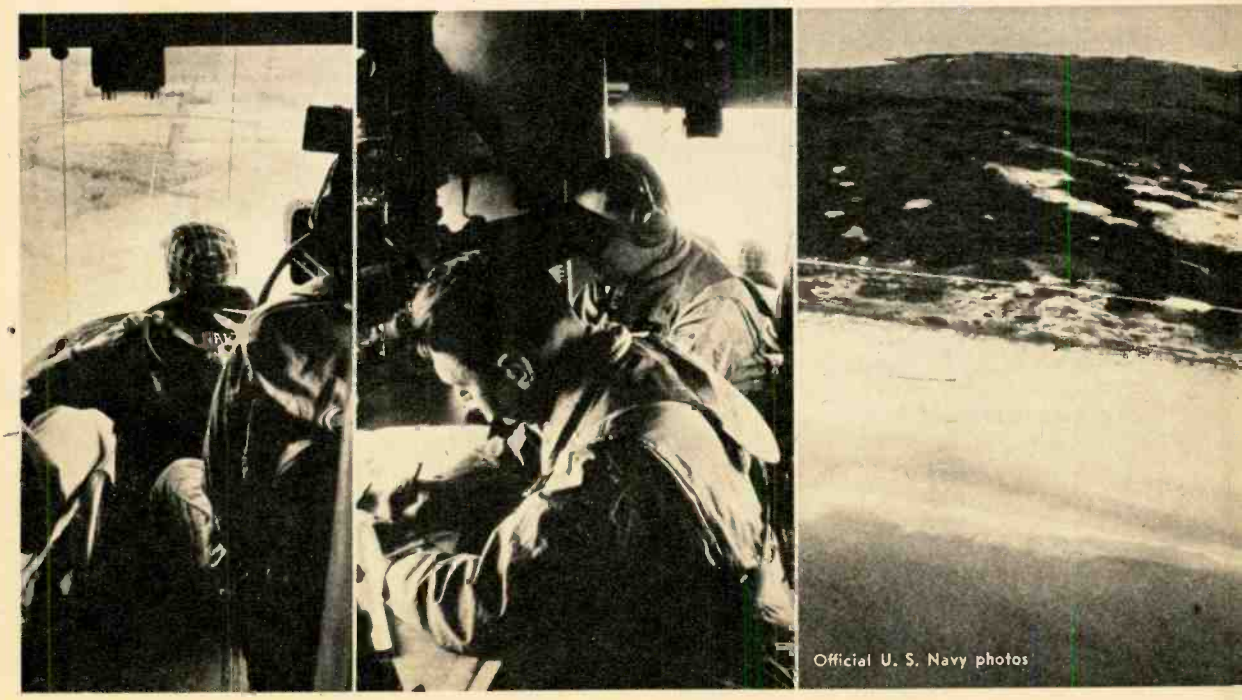
By Donald Hoefler

An outdated blimp, modernized with electronics, searches for a sunken ship over a century old.

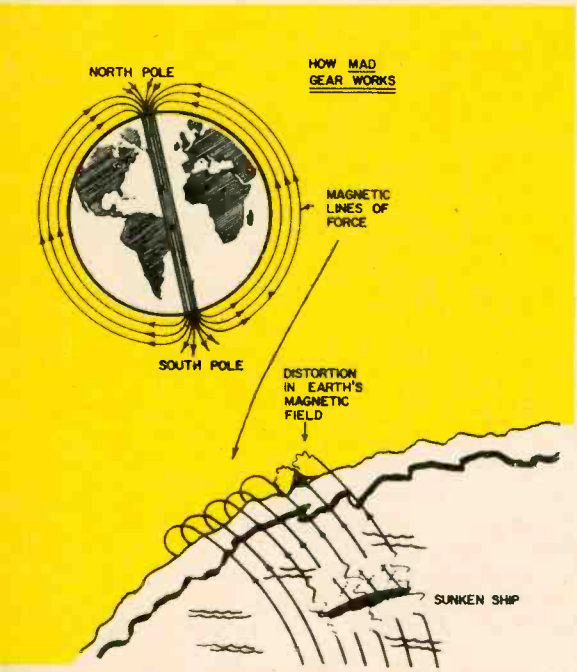
WHEN the Navy announced early this year that they would try to locate the hulk of a ship which sank well over a century ago, that they'd do it not from the water but from the air, and that the search vehicle would be a blimp, the whole scheme seemed fantastic. But when they added that the means of locating the objective would be a new secret piece of electronic gear, suddenly it became obvious that this was a story which *EI* readers would want and should have.

To find out the connection between electronics, a sunken ship and a motorized gas bag, I contacted Captain James W. Condit, Commanding Officer at the Naval Air Reserve Training Unit,

The search is on. Members of the Naval Air Reserve Training Unit leave New Jersey and head their airship out to sea. The course is plotted by Airship Commander Hanley, Flight Engineer Nadler observes the radar screen, center. Off Fire Island, right, is the spot thought to be the resting place of the S.S. Savannah. The hulk of another ship is seen half buried on the beach.



Official U. S. Navy photos



Earth is a huge magnet. Magnetic materials distort lines of force and activate MAD gear.

Any object on the ocean's surface will appear as a white pip on this Surface Radar Scope.

Lakehurst, New Jersey. Captain Condit began by updating my thinking on the airship. He pointed out that the blimp is the one weapon with a 100 percent anti-submarine record, and our Navy has it exclusively. This is most important, because submarine launched missiles today pose the greatest outside threat this country faces.

With this reassurance under my belt, I got back to the question at hand: why and how is a Navy blimp going to look for an ancient maritime wreck? The assignment this time was to go out and locate a ship which had been covered with tons of water—and probably tons of sand too—for 137 years. The object of the search is the *S.S. Savannah,* a little scow, unimportant save for one brief moment of glory in her very short life.

She was a small wooden ship, with a full set of sails and a pair of paddle wheels at her sides. These paddle wheels were driven by a steam engine, the very first to propel a ship across the Atlantic. She made her historic voyage in 1819, and in 1821 was devoured by the same sea she had once proudly conquered.

The name *Savannah* will again go down in the history books, however, for it will also grace the world's first nuclear powered merchant ship, now under construction. It occurred to members of the Merchant Marine Institute that it would be appropriate to adorn the new *Savannah* with some part of the old one. And the Navy was called in as the logical group to find it.

Blimps already carried the needed equipment, but since the operational airship squadrons are far too busy with anti-submarine and aircraft-early-warning duty to carry out such a mission, prospects at first didn't look too promising. Permission was finally obtained, however, for the Naval Air Reserve Training Unit at Lakehurst to take on the job, with a training blimp to be manned by "Weekend Warriors." Although not then a member of the Naval Air Reserve, I was fortunate enough to be invited to participate in one of the *Savannah* searches.

The electronic tool we were to use in the search is magnetic airborne detec-

tion—MAD gear to Navy men—which makes the blimp a deadlier foe of the submarine than ever. Details of this equipment are still highly classified, but some idea of the way it operates can be had by likening it to the Geiger counter. Unlike radar or sonar, the system is entirely passive, radiating no signal of its own.

The theory of MAD gear is based on the fact that this planet itself is a huge magnet, with lines of force moving from the south magnetic pole to the north magnetic pole along the surface of the earth, and from north to south through the center. The surface lines are of course curved to follow the earth's contour, but most of the time within a small area they can be regarded as straight.

Most of the time, that is, but not all. For whenever any part of the earth's field comes into the vicinity of a magnetic material, the field is *distorted*. And the purpose of MAD gear is to detect that distortion. It is originally calibrated so that the normal magnetic lines of force produce no output. But when the field becomes misshapen by the presence of magnetic materials, the output is no longer balanced and a signal is produced.

Until the day comes that a submarine can be built entirely of non-magnetic materials, no sub will remain undetected if there is a blimp carrying MAD

[*Continued on page* 96]

Is it the Savannah? Crewman listens intently for a signal bounced back from a sunken ship.

Recording mechanism on MAD (magnetic airborne detection) gear indicates a contact.

Following contact a smoke bomb is tossed into the water. Author (bottom) awaits the signal.

At bottom, colored smoke streams over ocean's surface, where ship may be buried.

Stereo on a Shoestring

By Ernest Wayland

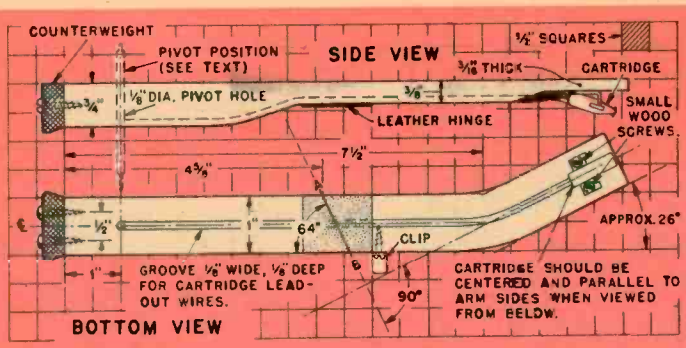
Introduce yourself to the world of stereo sound with this two channel phono—for fifteen dollars.

THE most exciting news for the hi-fi music listener since the introduction of the LP record is the development of the stereo disc. Stereo records now available take you from the blaring brass band of the bullfight ring to the whirling three-quarter time of the Strauss waltz . . . and the stereo bandwagon is just beginning to roll. By the time you read this, the record bins will be chock full of music for every taste—all designed for "two-ear" listening.

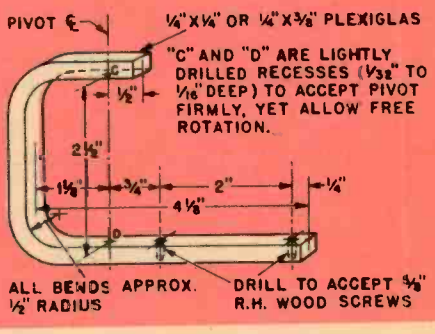
The big question is—How much? What do the stereo records and a playback machine cost? The good news is that you don't need the wealth of Midas to set yourself up with three dimensional hi-fi. The present list price of the stereophonic records averages only about a dollar higher than the standard LP.

How about the playback equipment? Go about it the right way, and you can match the stereo records in cost, with a complete

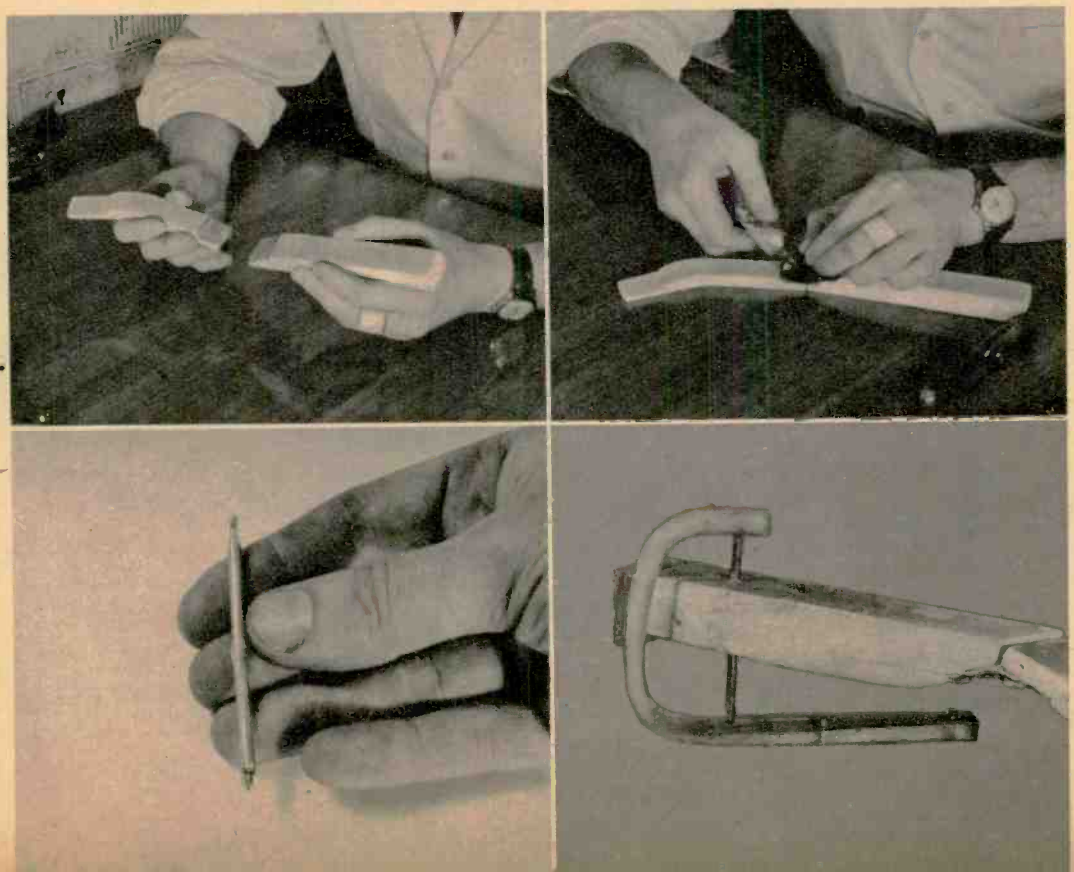
The two stereo channels are fed separately to each of the hearing aid type headphones. The two knobs seen at lower left are optional volume controls.
Photo by Grayson Tewksbury

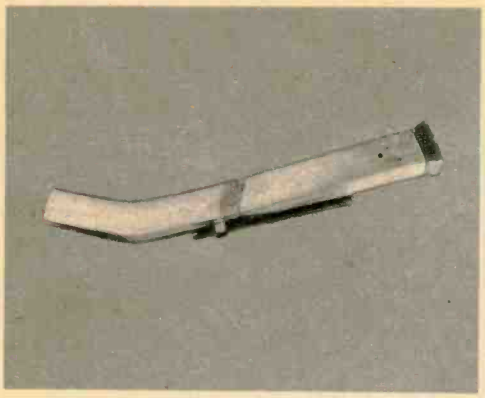


The wood tone arm may be constructed from the dimensions given above. As a convenience, the drawing can be enlarged three times, by photostat or graph paper, to provide a full scale plan. A detail of the pivot bracket is at right. The Plexiglas, softened by immersion in boiling water, is bent into the desired shape.

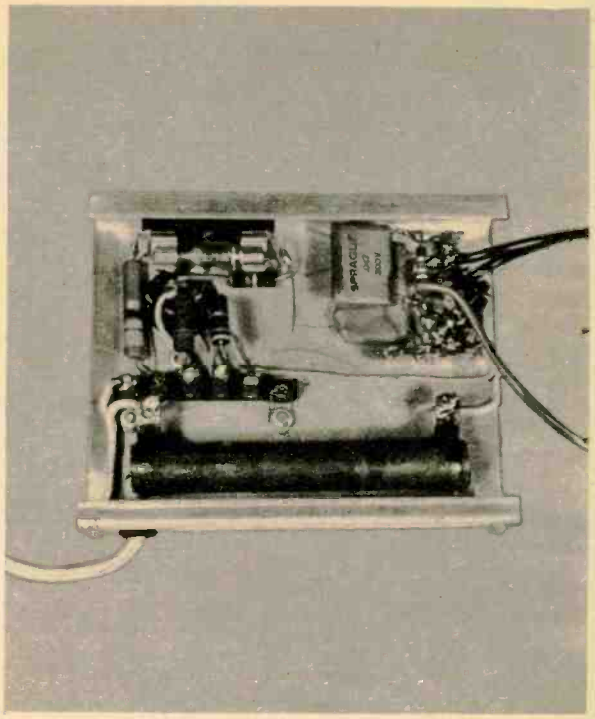


The two upper photos show the arm cut, recessed, and joined by the flexible hinge. This hinge is made from rubber-impregnated fabric or thin leather. At lower left are two ball point refills that serve as pivot. Lower right, mounting of pivot with tone arm and bracket.

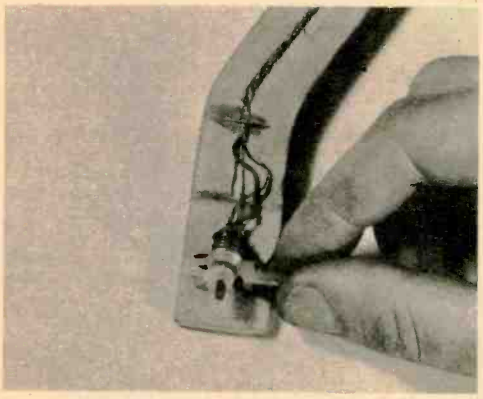




Top view of arm. Counterweight to the right is a chunk of lead filed to shape. The thin brass rod is for adjusting stylus pressure.



Underside of chassis. Next month, when modification for driving 2 speakers is described, R10 (bottom) is removed for the new parts.



The Electro-Voice stereo cartridge, at left, is mounted in its holder. The 2-wire shielded cable carries the signals to the amplifier.

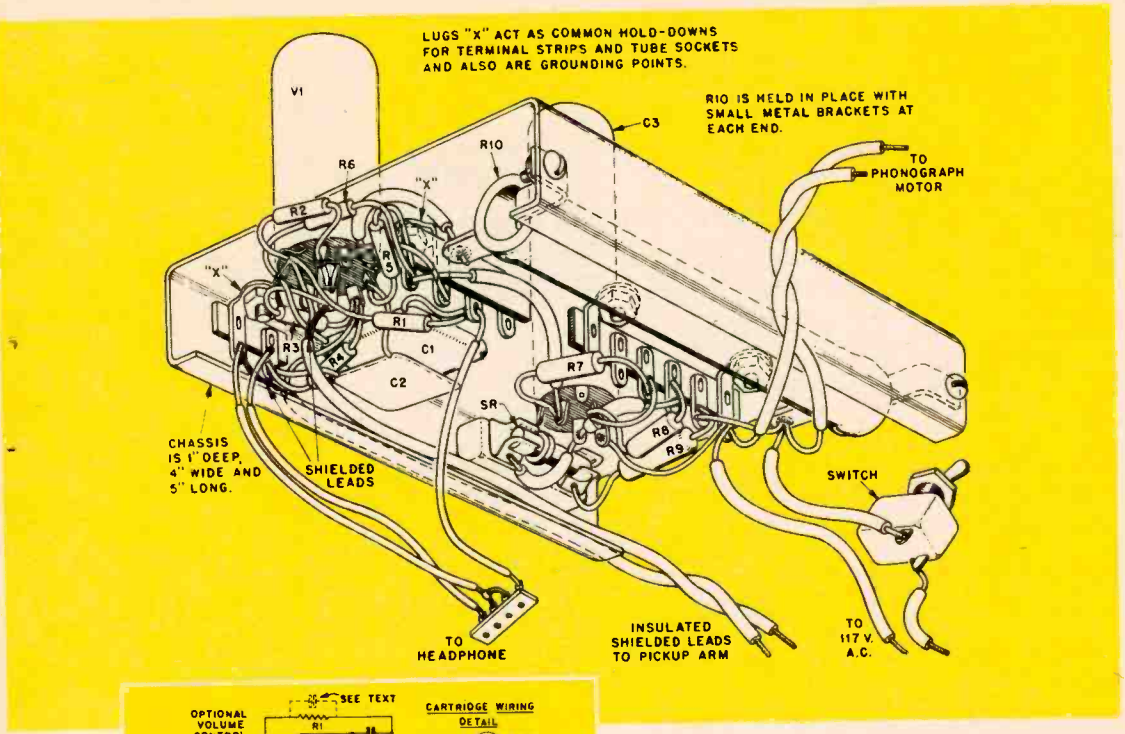
setup for approximately fifteen dollars.

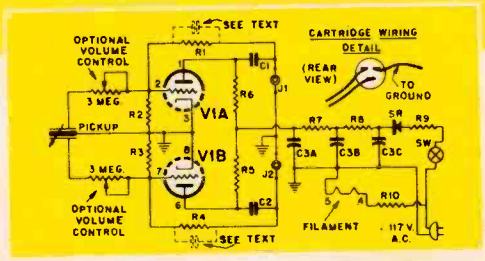
Here's how it's done. The heart of the EI player is the new Electro-Voice $3.50 stereo cartridge, Model 66 3-speed turnover Power-Point. The Power-Point stylus rides along the stereo record groove and produces two separate signals. They are forwarded through a two-channel amplifier to the two elements of the stereo headphones and then to your ears.

The pickup arm shown is a special home-made job. It need not be, of course. Any standard commercial arm could be used. Because of its low natural resonance, wood was chosen as arm material. The arm is jigsawed to shape from a length of ¾" pine board as per the drawing. A rasp file, plane, and several grades of sandpaper are used to bring the arm to its final dimensions and provide a finished appearance. The arm is then cut in two at hinge line A-B.

Before installing the hinge, construct the pivot assembly. The vertical pivot (on which the arm swings horizontally) is made of two used-up metal ball-point pen refills. Before starting work on the refills it's a good idea to soak them in carbon tetrachloride or other solvent to remove any remaining ink.

One refill is cut to a length of 2½" as measured from the end with the ball point. The ballbearing assembly of the other refill is removed with a pair of long-nose pliers and inserted in the open end of the first refill. You will end up with a little rod with a ballbearing tip





SR, in the wiring guide above, is a new type silicon rectifier that clips in like a fuse.

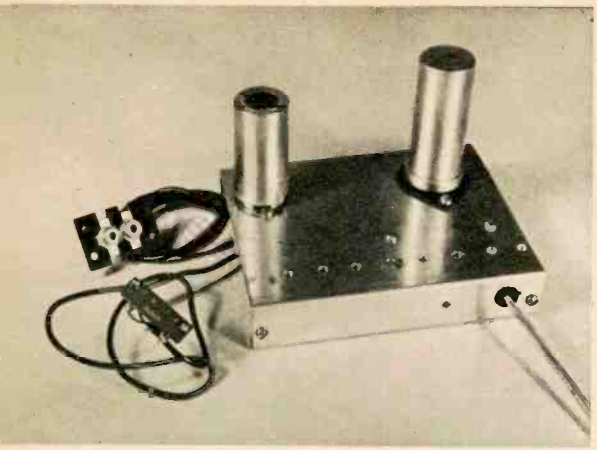
The circuit, left, is AC-DC type. Precautions in the text must be observed to avoid shock.

on each end for perfect pivot points.

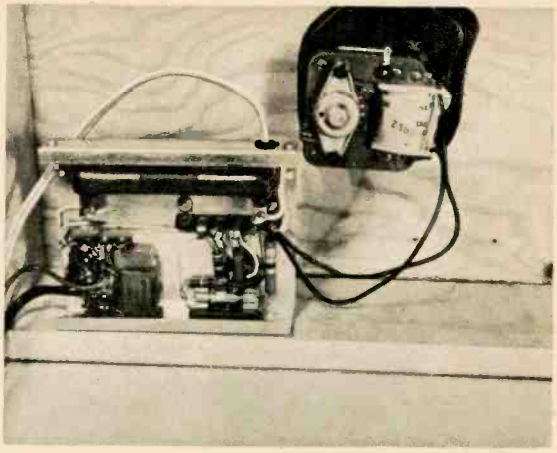
The next step is to drill a hole through the rear of the arm to receive the pivot. The pivot mounting is the only critical point in the arm construction. The pivot hole must be drilled exactly between the two sides and perpendicular to the arm's longitudinal axis. The size drill used will depend upon the diameter of the barrel of the ballpoint refill. The pivot is press fit into place and, once the arm is set up permanently, a small collar of tape or a spot of Duco cement can be applied to hold it in place.

The hinge that joins the two arm sections is made of rubber-impregnated fabric such as used in rubber overshoes. A tire patch or thin leather strip would probably serve as well. A good grade of glue should be used to attach the hinge to the underside of the arm. If needed, staples can be used to reinforce the glue. After the sections of the arm are joined, the hinge should work smoothly with practically no horizontal play at the hinge point.

The pivot bracket in the author's model is constructed of a ¼"x⅜"x7" piece of Plexiglas. It can be bent to the desired shape after immersion in boiling water for several minutes. A piece of aluminum stock could be used instead with equally good results. In either case, two small "dimples" are punched or ground at points C and D which serve as bearing hollows. It's important, when the arm is mounted, that C be exactly over D for proper arm balance. The



Top of chassis shows V1, left, and C3, right. Input jacks, left of V1, from arm, are optional.



Amplifier chassis is located in wooden base. Motor, above, draws AC through 2 black leads.

PARTS LIST

R1,R4—2.2 megohm, ½ w.
R2,R3—4.7 megohm, ½ w.
R5,R6—100,000 ohm, ½ w.
R7,R8—4700 ohm 1 w.
R9—33 ohm, 1 w.
R10—750 ohm, 40 w.
Volume controls—(optional) two 3 megohm potentiometers
C1,C2—.1 mfd., 200 v.
C3A,B,C—3-section electrolytic, all 40 mfd., 150 v.
V1—12AX7 or 12AT7
Nine pin miniature tube socket
Aluminum chassis—1"x4"x5"
Switch—single pole, single throw
SR—Silicon diode rectifier (Audio Devices A750 or equiv.)
2' two-conductor shielded, AC line cord and plug
J1,J2—4 terminal jack to match headphone plug
Headphones—High impedance crystal (Lafayette MS-433)
2 ball-point pen refills
7" piece of Plexiglas

bracket should be bent so the ball-point pivot assembly, when installed, rotates freely but is not loose. This adjustment is relatively easy to make.

A counterweight is installed on the rear of the arm. A chunk of lead scrap filed to shape and secured with wood screws was used on the author's model. The counterweight should be heavy enough to balance out the hinged portion of the arm and cartridge.

A sliding ¼" brass or iron rod serves as the stylus pressure adjustment and is sensitive enough to adjust in 0.25 gram steps. The rod fits into a clip broken from a 3AG type fuse holder screwed to the side of the tone arm.

The Power-Point cartridge holder (E-V PT3) can be mounted with small nuts and bolts or ¼" wood screws. In either case, make sure it's firmly seated at the correct tracking angle. The two-wire shielded cable connected to the turnover assembly should be the thinnest and most flexible available. It is carefully run so as not to impede the motion of the arm. It can be held in place with glue or thin wire staples. The pickup arm rest is a 2" wood screw or dowel set in the base at the appropriate point.

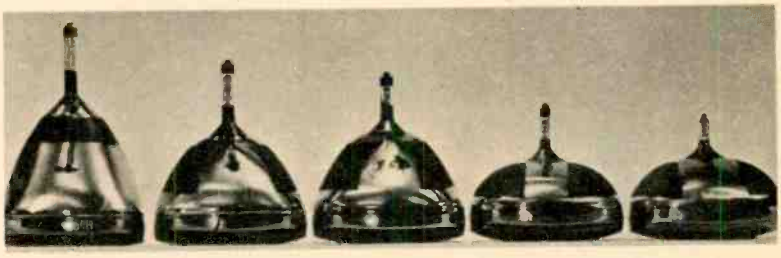
You are offered three modes of operation of the stereo player. The least expensive and simplest technique is to drive the headphones directly from the cartridge. The disadvantages of this system are that the E-V cartridge doesn't see its proper load resistance (the frequency response of the system suffers as a result) and the playback may not be loud enough for your particular taste.

Both these problems are solved by the second approach. A one-tube, two-channel amplifier is used to feed the headphones. A dual triode tube is used with each triode identically wired, but operating independently.

[*Continued on page* 90]

The New Look in TV

THESE futuristic TV sets represent the latest advancements in separate screen television. The "Predicta" series from Philco Corporation offers some startling innovations. Both chassis and picture tubes have been re-engineered to operate as separate units. Swivelling screens figure prominently. One model allows the viewer to pick up the 21-inch screen and place it anywhere in the room. Prices range from $190 to $425.



Development of picture tubes since 1950 is shown from left to right. Today's tube has flat instead of cylindrical cathode, shorter lens system.

One of Philco's "Predicta" series, this set has swivel screen, hidden telescopic aerial.

New Italian TV sets also feature the separate, revolving screen. Available in U. S. for $300.

Stereo pickups included in home test are (left to right) Elac, Electrovoice, Ronette, CBS-Hytron, Shure, Fairchild, ESL, Sonotone. Top, Pickering in arm.

All About Stereo Hi-Fi Pickups

By R. S. Lanier

Stereo records sound only as good as the phono pickup used—here are results of listening tests.

I LISTENED to eleven stereo pickups, all that were available at the last moments before this issue went to press. The overall report is this (details on individual pickups in a moment): the tough problems of designing a stereo pickup have, by and large, been handled well.

It had better be done well, because the stereo disc, marching in with all banners flying, will fall on its face unless we have pickups available that maintain the high quality of reproduction we have become accustomed to. *Stereophonic reproduction is not a substitute for high fidelity.* After the first excitement of hearing stereo effects has subsided, you are going to look for

low distortion, freedom from peaks, and balanced highs and lows, just as much as you did with monaural reproduction. Listening fatigue creeps in with distortion in stereo, just as it does in monaural equipment.

To get the same quality of performance in a stereo pickup that we were getting in the best monaural pickups is a plenty tough design problem. The stereo stylus has to move more "hardware" when it vibrates, because there are two electrical generators instead of one. Put more mass in the vibrating system, and the peaks and resonances come down the scale to where they cause nasty sound and high record wear. Besides the mass, the "compliance" of the stylus system is vital. Compliance measures how free the stylus is to move—in a stereo pickup, from side to side and up and down.

Mass and compliance together determine an overall quantity, the "mechanical impedance," which is a measure of how much effort it takes for the record groove to make the stylus move. The lower the mechanical impedance, the better a pickup behaves.

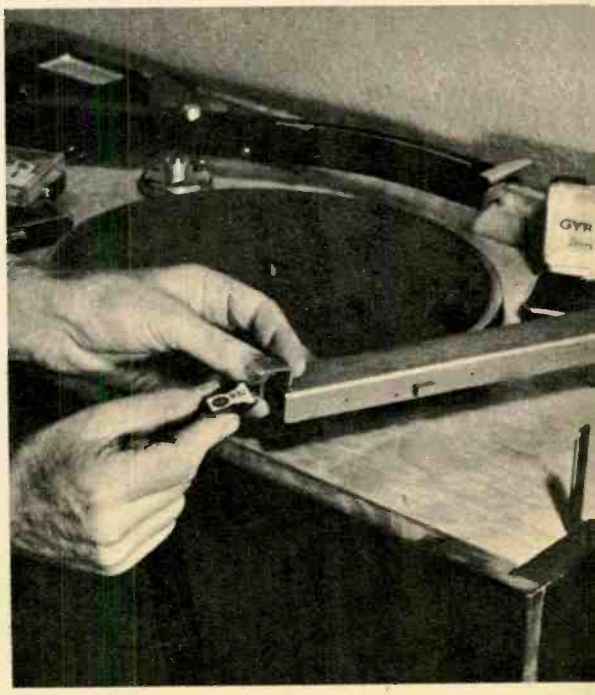
A stereo pickup needs lower mechanical impedance than a monaural for equivalent quality because the stereo groove is more complex and delicate; because the stylus is sharper, 0.7 mil against 1.0 mil radius; and because the up-and-down groove motions have a tendency to "jump" the stylus.

Another quality a stereo pickup must have is "separation." When the right-hand track on the groove is pushing the stylus, we want the sound to be much stronger from the right-hand speaker than from the left-hand one. And vice versa. The exact degree of difference needed is not certain, but 15 to 20 db of "separation," as a minimum, is considered desirable. Without separation, there is no stereophony.

How To Use A Stereo Pickup

You have to learn some new tricks when you bring a stereo pickup home. The sensitivity of the pickup to vertical motion means that the whole motor

The author's home testing setup includes turntable and two arms, by Fairchild and Pickering.



Shure pickup is slipped into arm for instant comparison with other unit via preamp switch.

The two identical speakers used for the tests were positioned as shown for the best stereo.

The author examines closely the Ronette cartridge used in tests. This has crystal elements.

board must be well insulated from vibration coming through the cabinet. A heavy footfall in the room will send a loud *wurrump* through the speaker if the shake reaches the turntable. Acoustic feedback, that snake-chasing-tail process in which bass from the loudspeakers shakes the turntable, which sends a bass signal to the speakers, which shakes the turntable, etc., etc., is more apt to plague you with stereo, unless your motor board is on soft springs that absorb vibration.

You must balance the two channels carefully with the particular pickup you are going to use. (The balance varies slightly from pickup to pickup.) To balance, put on a *monaural* recording of a soloist or speaker, and adjust the balance control until the single instrument or voice seems to come from exactly midway between the two loudspeakers.

You must adjust the downward stylus force ("needle pressure") on a stereo pickup most carefully. Some authorities say 4 to 5 grams is the maximum allowable stylus force on a stereo record; others put it lower. Of course, you must have enough stylus force to make the pickup "track" the loudest passages on a record. The lower the mechanical impedance, the less force it takes to make a pickup track, so the minimum stylus force is a good rough measure of pickup quality.

How They Sound

Now for the report on the pickups I heard. I listened with the same recordings, the same amplifiers, and the same speakers, set up the same way in the same living room. This is an "initial impression" report because there has been no time to "live" with a pickup, nor give any of them an endurance test. In most cases, too, the units tried were first-run off the production line, or even handmade models. For these reasons, mark this one up as preliminary.

Every pickup in the group put out reasonably clean, well-balanced sound, that would be thoroughly acceptable in nearly any home installation. All had enough "separation" to bring out stereo

effects, although no doubt the amount of separation varies substantially from one unit to another. (I did not attempt to *measure* this or any other characteristic—this was purely a *listening* test.)

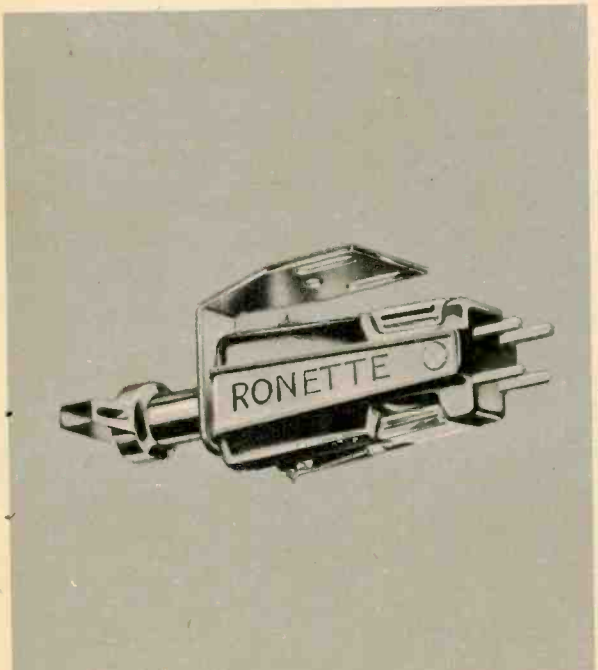
I like the fine smoothness and lack of strongly marked peaks in the following particularly (in alphabetical order): Elac (Audiogersh), Electrosonic, Fairchild, Pickering, Ronette, and Shure. All of them tracked well at 2 to 4 grams. If I have to pick the top two—they were all so close I might change my mind at next hearing—they would be the Shure and Electrosonic.

Of the six listed, the Electrosonic and Fairchild are moving coil, and Elac and Shure are moving magnet, the Pickering is variable reluctance, and the Ronette is a crystal pickup. Among the magnetics, the Elac has the highest output, which is an advantage in keeping hum down when the pickup must be near a source of hum such as a power transformer. The lowest output is from the Electrosonic. Compact input transformers, supplied by the maker, were used to raise the output. With some preamplifiers, these might not be necessary.

Among the magnetics, the Elac, Pickering and Shure have the stylus bar backed up in such a way that dropping the pickup, or otherwise imparting too strong an upward push to the stylus, will not result in damage—the stylus assembly can move only so far in the vertical direction. This looks like a good idea for the stereo pickup.

I heard another moving coil magnetic pickup, the Grado, in the laboratory of the maker, since a single hand-made model was the only one in existence when this article was written. Direct comparisons with the other pickups, under standard home conditions, could therefore not be made. In the laboratory setup, the Grado stereo unit sounded exceptionally clean and smooth, possibly the best stereo reproduction I have heard. It remains to be seen how the actual production models will compare with the other pickups. I want to emphasize again that, in any case, the

[*Continued on page* 92]



This new Ronette three-speed crystal turnover cartridge was not yet available at test time.

Note the ceramic elements on both sides of the needle shaft in closeup of CBS-Hytron unit.

Photos by F. Gerritsen from P.I.P.

Rescue Dog Uses Radio

Finding a child is dog's play to animals trained in the use of a specially adapted two-way radio.

AT the First Dutch School for Dogs in Amsterdam, canines are trained for rescue work with walkie-talkies. The dogs are equipped with a radio-installation consisting of a small loudspeaker behind the ear, a small throat microphone, a pliable antenna fastened to the back and three small cases. Dogs trained to use this equipment could be a great aid in searching for lost persons, and other rescue work. These pictures show Aruk, a radio-trained police dog, go after and find a lost child —

Aruk, a police dog trained to use a walky-talky, gets scent of lost child's clothes, begins search. Radio set is fastened so as not to hinder movement.

Aruk finds child's toys and growls. This is picked up by throat mike, sent out to master.

Aruk then finds shoes, but waits for master to arrive and make positive identification.

Through loudspeaker behind his ear, Aruk receives radioed instructions from his master.

Dog barks only when child is found. Sound is heard over radio by master and mother.

Radio direction finding techniques enable dog's master to locate dog and child.

The vast New Jersey Turnpike depends on electronics for policing, emergency road service, maintenance, toll collection, administrative activities.

Radar gear transmits signal which bounces off passing car with changed wavelength.

Speed of passing car, recorded on this graph, determines change in radar wavelength.

Electronics Controls the Turnpike

A 118 mile highway becomes as easy to control as a short street, thanks to electronics equipment.

A MILLION calls per year are transmitted along the 118 mile New Jersey Turnpike, via a radio communications system consisting of 120 2-way radio equipped mobile vehicles, 23 2-way radio equipped interchange stations, 7 2-way radio equipped maintenance district stations, 65 radio dial telephone stations and 5 teletype stations. This complex installation combines a very high frequency radio system operating in the 150-160 megacycle band and a microwave point to point relay system operating in the 2000 megacycle band.

Due to the Turnpike's length, plus the fact that high frequency radio impulses travel on a straight line, the system employs automatic repeater stations. Messages are transmitted by "line of sight" impulses from a series of radio towers, which receive messages and then automatically rebroadcast to the next tower, as well as between towers to the various mobile and fixed stations along the road. The car-to-car 2-way system utilizes 5 automatic

[*Continued on page* 100]

Police further along the road halt speeding car, after receiving a radioed description.

Trooper comes to aid of disabled vehicle. He will use a 2-way radio to call service truck.

Special Project

All Transistor Ham Rig

By Carl Todd

Go mobile—or carry it in a suitcase. This is a complete advanced ham station for low power.

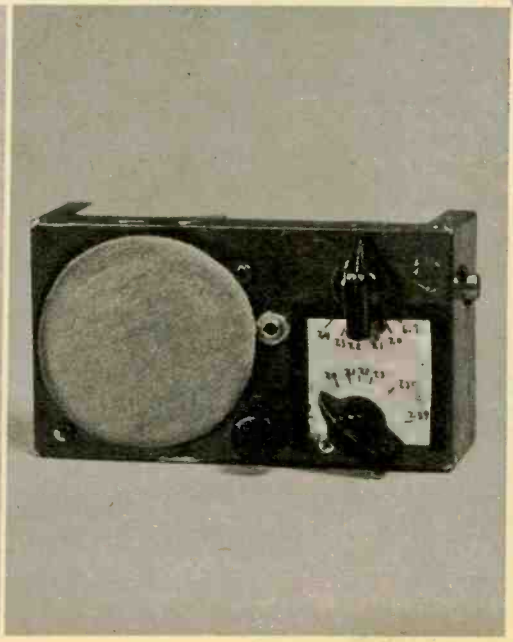
A FEW years ago, an amateur radio operator would have been justly proud of a contact by means of a transistorized rig even if the distance were a few yards. Transistors available today are cheaper, yet are far superior to those available five years ago. Of prime importance is the improvement in frequency response and power handling capabilities.

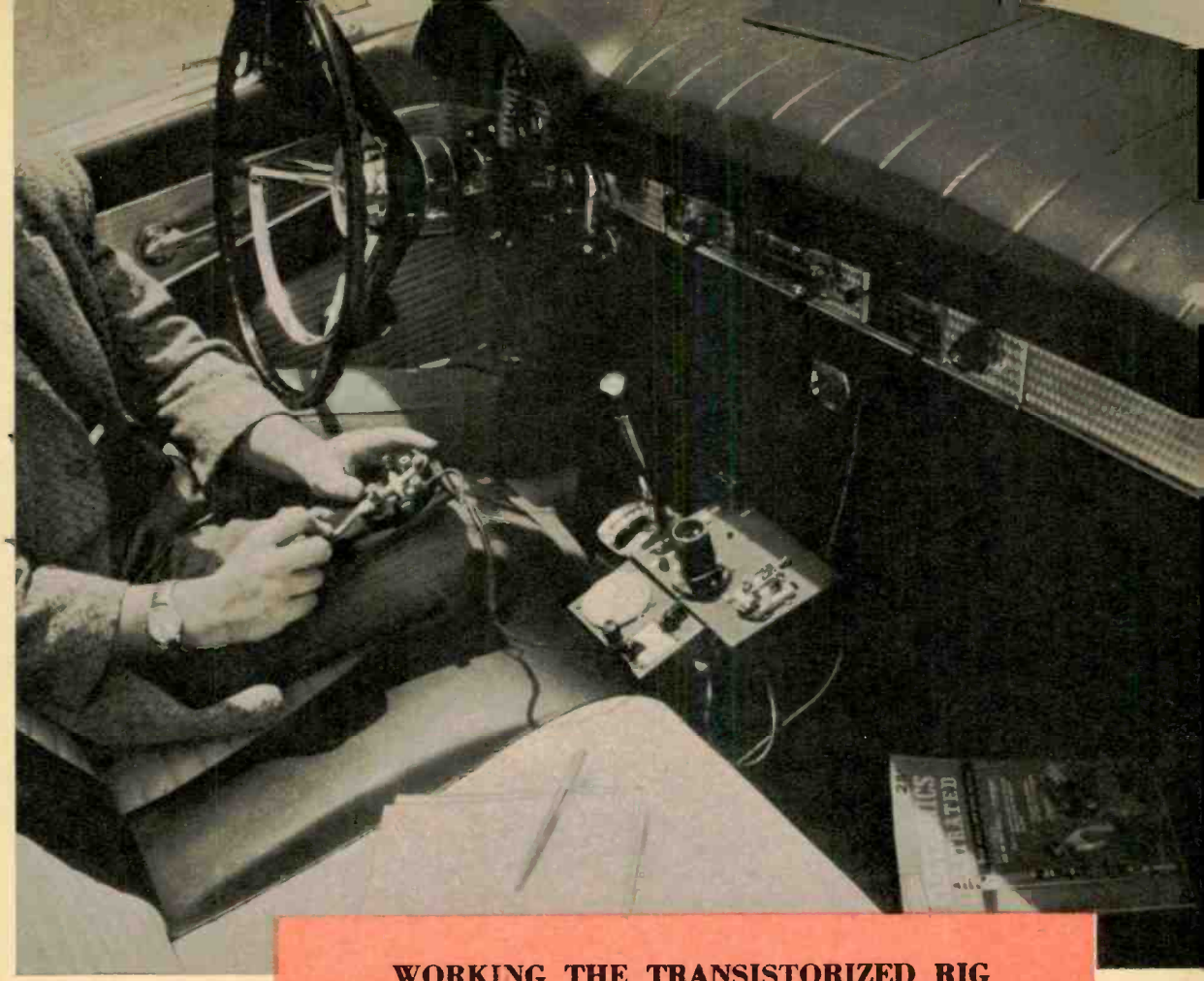
The receiver to be described uses a General Electric 3N36 NPN tetrode as its star performer. The transmitter uses two other recent additions to the General Electric line of transistors, the 2N635 and the 2N636. These are high frequency NPN alloy triode transistors.

Receiver

The original goal was to design a simple, compact CW receiver for the 40 meter band. It was desired that sensitivity of the receiver be comparable with that of the

Below left, is transmitter showing antenna knife switch, final coil, crystal, and transistors. Pin plug to left of coil goes to receiver. Receiver, below right, has 2½" speaker. Top knob tunes, lower is BFO.





WORKING THE TRANSISTORIZED RIG

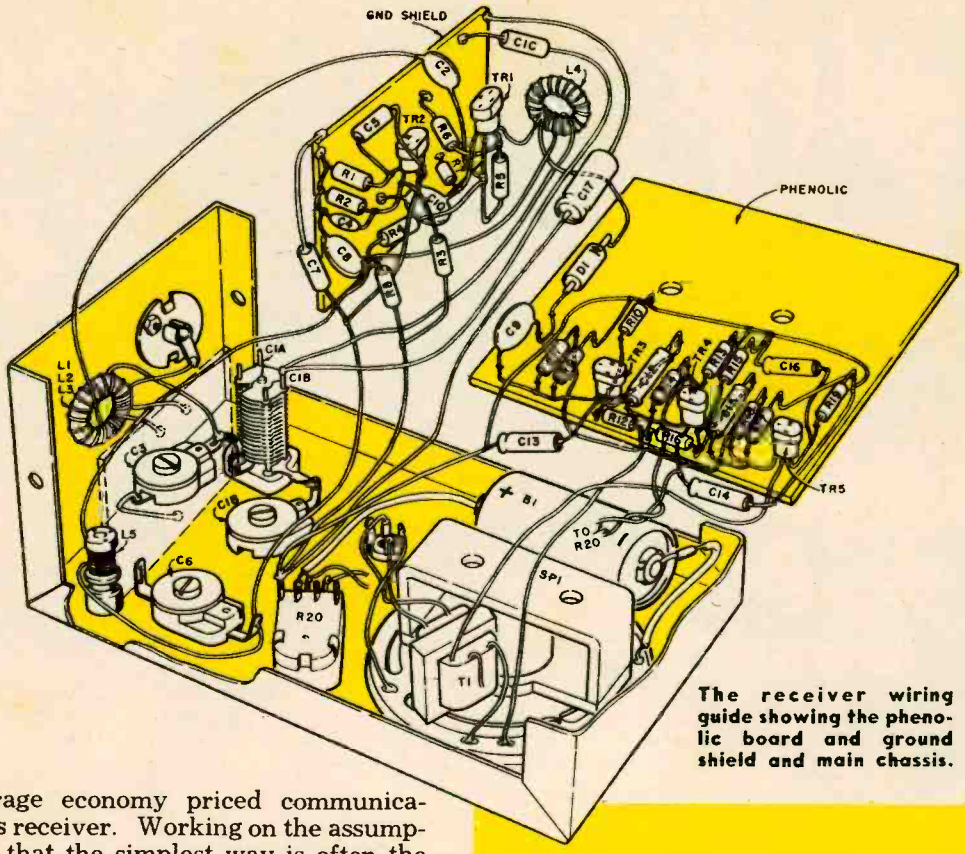
By Julian N. Jablin, W2QPQ

WE HAD the opportunity to take the transistorized station described by Mr. Todd home for a "ham's-eye-view" of what it could do. It was an exciting weekend.

Typically amateur, our first impulse was to open up the receiver to inspect the "works." While we've become accustomed to the tiny components and new layout techniques associated with transistor rigs, it was hard to believe that this little handful could do much of a job on 40 meters.

As a quick test, we hooked it up to the feeders of a 2 meter conical dipole. This is a peculiar antenna arrangement for the lower frequencies, but when we switched the little receiver on, the familiar 40 meter mess popped right out of the miniature speaker. As we became accustomed to the tuning characteristics of the receiver, the individual CW signals began to make sense. Without any difficulty we read off the call of a W1 calling CQ. A shift of the dial upward brought in a pair of KN2 stations working each other.

For the rest of the day, until the [*Continued on page* 94]



The receiver wiring guide showing the phenolic board and ground shield and main chassis.

average economy priced communications receiver. Working on the assumption that the simplest way is often the best way, a straightforward TRF receiver was designed.

As may be seen from the diagram, TR1 is merely used as an RF amplifier. L1, L2, and L3 comprise the input coil and L4 is the output coil. Transistor TR2 is a simple variable frequency oscillator which acts as the BFO and relies on proximity coupling with the ouput signal of the RF amplifier.

Diode detection occurs in the crystal diode, D1, and the resulting audio signal is amplified by transistors TR3, TR4, and TR5. Low impedance earphones may be connected to the receiver for that "extra" sensitivity or for use in noisy locations. The jack automatically disconnects the loudspeaker when the earphone plug is inserted.

Receiver construction is somewhat critical although reasonable precautions will eliminate major difficulties. The input coil (L1, L2, L3) must be isolated from L4 by the use of a grounded

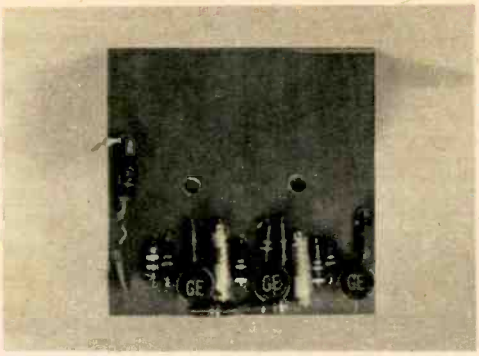
RECEIVER PARTS LIST

TR1—3N36 NPN Tetrode transistor (GE)
TR2—2N168A NPN transistor (GE)
TR3,4,5,—2N321 PNP transistor (GE)
D1—1N64 germanium diode
L1—3 turns # 28 wire wound on ground end of L3
L2—2 turns # 12 wire wound on ground end of L3
L3—60 turns # 30 wire close wound on toroid form (see text)
L4—60 turns # 30 wire close wound on toroid form (see text) tapped at 30 turns
L5—20 turns # 28 wire on Millen 69043 form
C1A,1B—2.7-10.8 mmfd. butterfly air capacitor
C2—.05 disc ceramic
C3,11—7-45 mmfd. ceramic trimmer
C4—.001 mfd. disc ceramic
C5—12 mmfd. tubular ceramic
C6—2-7.5 mmfd. ceramic variable
C7—82 mmfd. ceramic
C8—.1 mfd. disc ceramic
C9—.05 mfd. disc ceramic
C10—.01 disc ceramic
C12,15—5 mfd. 6 v miniature electrolytic
C13,14,16—10 mfd. 6 v
C17—15 mfd. 25 v
All resistors ½ watt
R1—2.2 K
R2,9,12,13,17—10 K
R3,11—270 K
R4—5.6 K
R5—4.7 K
R6—2.7 K
R7—8.2 K
R8—470
R10,15,19—1 K
R14,18—91 K
R16—4.7 K
R20—10 K, with switch
T1—2500 ohm to voice coil (Lafayette AR-114)
B1—9 volt battery
Misc—transistor sockets, chassis, speaker 2½"

metallic shield. If this is not done, capacitive coupling will exist between the two coils, which will either cause unwanted oscillations or a severe reduction in gain.

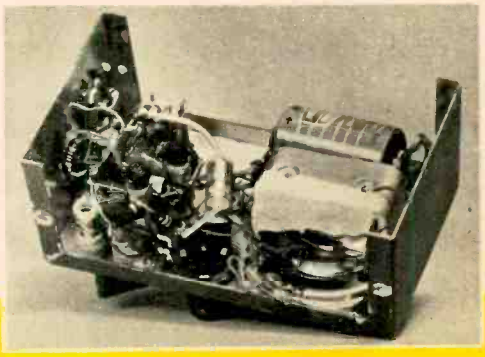
The BFO tank coil should be placed within an inch or so of the diode lead which connects to L4. The distance is not critical although experiment will show that an optimum distance does exist. The remaining circuitry is not critical and may be arranged according to the space available and the builder's wishes.

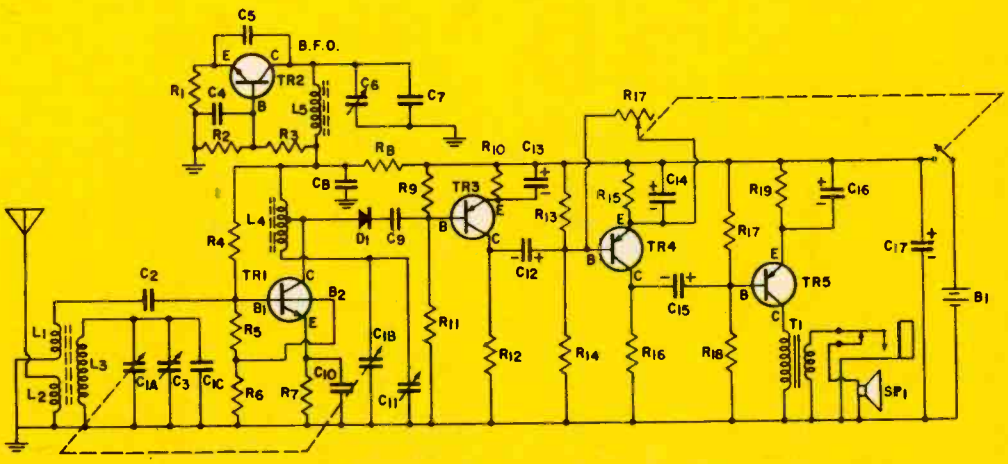
The coils used were wound on powdered iron toroid cores. In fact, all the toroid forms called for in both receiver and transmitter may be secured from Quality Components, St. Marys, Pa. Write for toroid powdered iron form, Q-5 material, $\frac{11}{16}$" O.D., $\frac{5}{16}$" I.D. They allow a minimum of intercoupling between adjacent coils, yet with maximum couplings between windings of the same coil. The number of turns for L1 and L3 were selected to give optimum performance for the transistor used. The reader may find that for his receiver a slightly different turns ratio



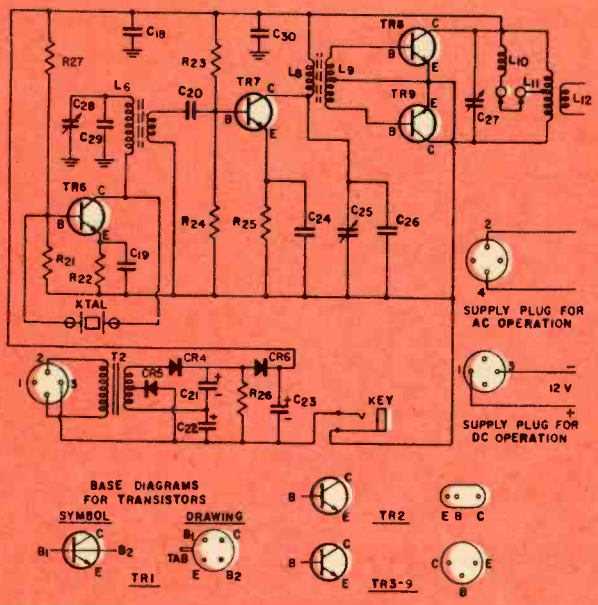
Phenolic board, top view, simplifies mounting of audio section and screws to speaker frame.

Underside of receiver chassis with board removed. Note upright ground shield at left.





Receiver schematic. The new tetrode transistor appears as TR1. The added element is Base 2.



TRANSMITTER PARTS LIST

TR6—2N635 NPN transistor (GE)
TR7,8,9—2N636 NPN transistor (GE)
CR4,5,6—1N91 Germanium junction rectifier
L6—14 turns #28 wire wound on Millen 69042 form
L7—5 turns #28 wire wound over L6
L8—27 turns #28 wire wound on toroid form (see text)
L9—16 turns #28 wire centertapped and wound over L8 at ground end
L10—1 Mh RF choke
L11—16 turns #12 wire space wound (12 turns per inch) on 1 5/16" Bakelite form, centertapped
L12—Link coupling to antenna, 8 turns inside L11
C18,30—.1 mfd. disc ceramic
C19—.1 mfd. ceramic
C20—.01 mfd.
C21,23—500 mfd. 12 v
C22—100 mfd., 6 v
C24—.05 mfd. ceramic
C25—10-140 mmfd. air trimmer
C26—56 mmfd. ceramic

Transmitter schematic and parts list. Note removable link on L11 centertap for inserting meter.

will give improved performance. A 3N36 tetrode transistor was used for the RF amplifier. While it is true that other transistors could be used, overall sensitivity may suffer greatly. The audio amplifier is straightforward and the reader may wish to add a push-pull stage to give more audio power. An additional stage of gain also will improve the sensitivity of the set allowing better reception.

Dial calibration and alignment may be performed with a signal generator. The main tuning dial should be roughly calibrated. Of greater importance, however, is the calibration of the BFO.

The tuning capacitor used is a small miniature butterfly air trimmer. For this application, the capacitor is used as a dual gang unit.

In use, an antenna and ground (the input is designed for a 50 ohm antenna system) are connected to the receiver and the volume is turned up. The main tuning dial is set to approximately the desired frequency and the BFO is tuned to bring in the desired station. The main dial may then be adjusted for maximum volume.

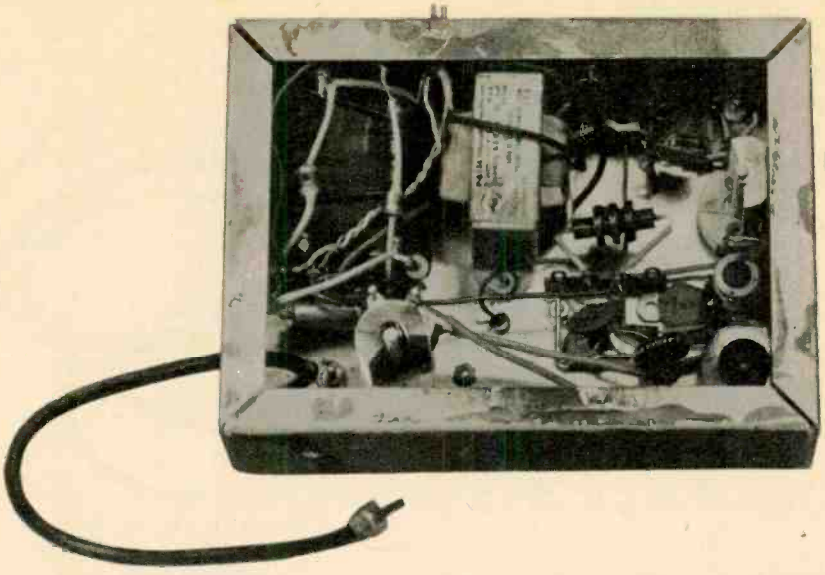
Transmitter

In designing the transmitter, the goal was to build a 40 meter CW transmitter with an actual RF power output of between 100 milliwatts and 1 watt. The best performance for the number of transistors used was obtained with 2N635 and 2N636 NPN alloy transistors.

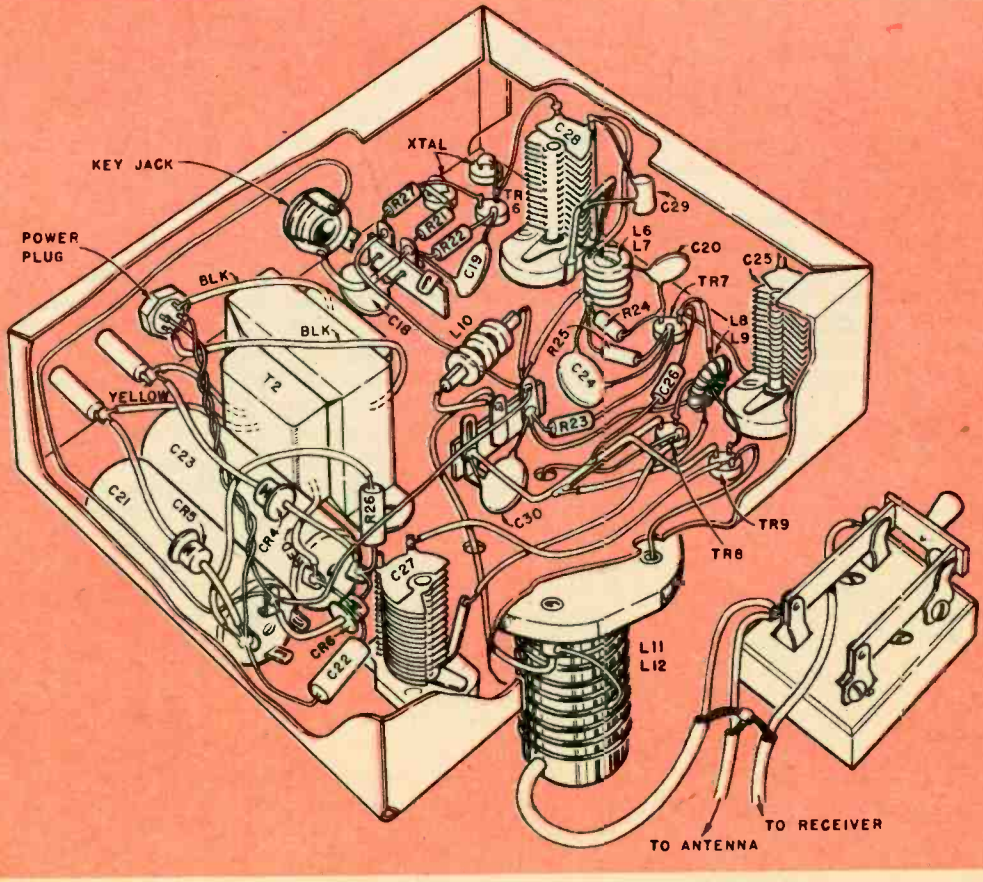
Transistor TR6 is a simple crystal oscillator. If desired, a VFO could be fed into the base of TR6. It may be necessary to adjust the DC bias slightly in order to obtain optimum performance. A second transistor is used as a buffer and amplifier to drive the two output transistors which are operated Class B.

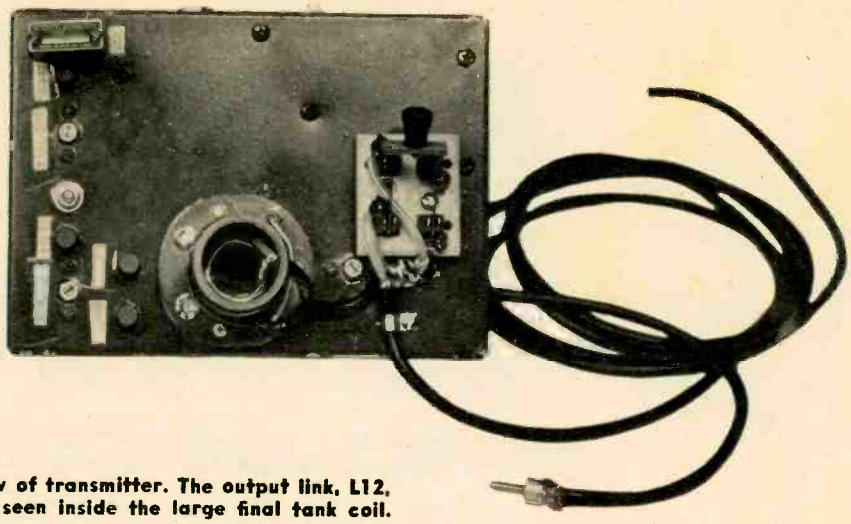
While it is quite true that the output stage could have been made to operate under Class C conditions with an improvement in efficiency, the maximum output was obtained by using Class B. The power output could be increased considerably if the reader wished to modify the final for Class C. About a watt is possible with this type operation.

In the transmitter, as in the receiver, the turns ratios were selected to give optimum performance for the author's circuit and the reader may find it to his



Underside of transmitter. C21 and C23 upper left, are taped for insulation from ground. The knife switch shown in wiring guide is optional, depending on type of antenna feed.





Top view of transmitter. The output link, L12, may be seen inside the large final tank coil.

advantage to vary these ratios slightly.

The power supply for the transmitter may either be a 12 volt battery or the 117 volt AC line. Germanium diodes are used as rectifiers when operation is from the AC line. However, when battery operation is used, the rectifier diodes act as switches to prevent unnecessary battery drain. The change-over from AC to battery operation is accomplished by using two supply cables as shown.

Keying of the transmitter is performed by keying the entire supply voltage. This arrangement works very well with clear and distinct output. The use of this technique also assures a minimum power supply drain. It should be noted that while the author chose to key all stages, it is not a "must" even though no "protective" biases are used. With no input signal to the final amplifier, the collector currents of transistors TR8 and TR9 are on the order of micro-amperes!

Mechanical layout should follow the general pattern shown in the illustrations. It may also be noted that the variable capacitors used were designed for screwdriver adjustment. This is fine if the user only operates on one frequency or seldom changes frequencies. A more preferable arrangement would allow knob tuning.

In operation, the transmitter may be tuned by several different methods. The author chose to measure the RF output power and tune for maximum voltage across the dummy antenna resistor (50 ohms). However, a milliammeter may be inserted in the jacks provided on the output tank coil (these are normally shorted). The oscillator and buffer amplifier tuning should be for maximum collector current in the output stage. The final should be tuned for a minimum collector current. A third method is to connect a small 2-volt pilot lamp across the output link and tune for maximum brilliance.

The first contact using the transmitter was made by Mark Chilcote, K2CBQ, with Joe Dreher on the receiving end. The first test gave a 4-2-9 report over a distance of about 10 miles. This was increased to 4-5-9 with better tuning the next morning.

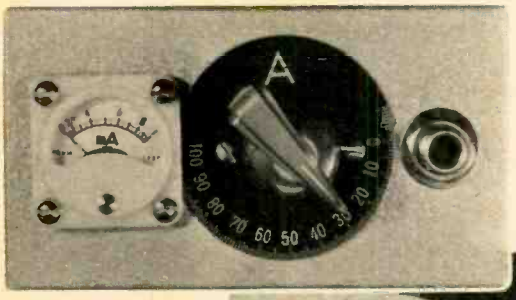
The surprise of the morning came when a contact was made with K3CTS in Philadelphia, a distance of some 250 airline miles. The signal report was 5-6-9. K3CTS was received here in Syracuse, N. Y. with only a 5-7-9 and his input power was 65 watts! All of the above contacts were from K2CBQ's indoor antenna stretched across his 34 foot attic and only 16 feet from the ground!

Think of the possibilities of such a set during a local emergency. Capable of battery operation and being quite portable, a complete station may be set up in minutes with operation from the power line or batteries.

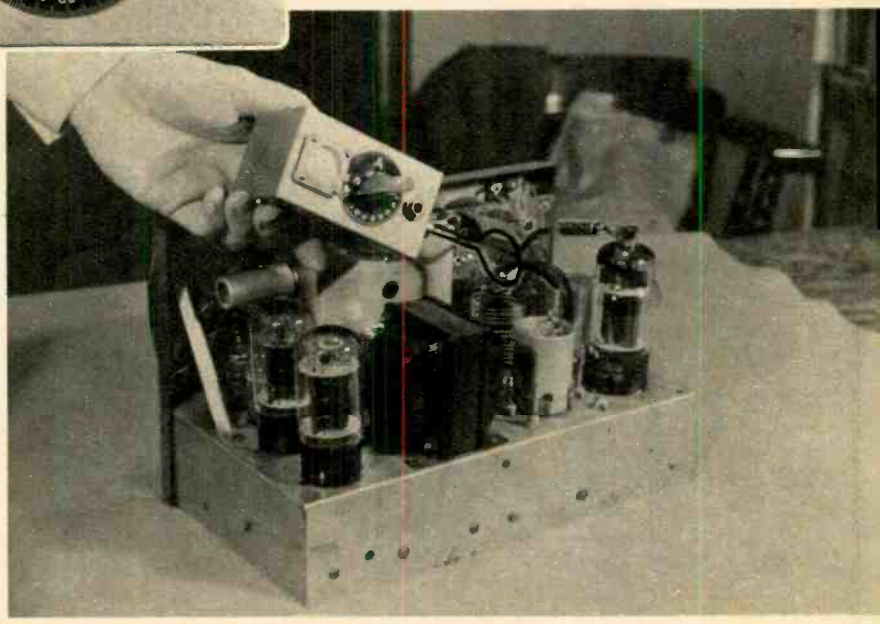
Ham Station Monitor

By Joe Doherty

Tune up, speak up, load up accurately—get top transmitter performance with a simple wavemeter.



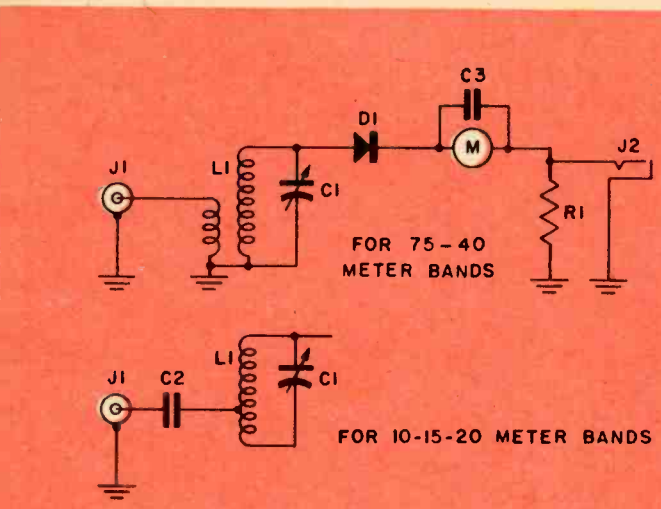
The front panel (left) includes the meter, tuning knob and the phone jack. Below, the frequency of a transmitter is checked by coupling to the final coil. To check the quality of the phone signal, plug earphone into jack provided.



IS that new transmitter you've just finished tuned up on the correct harmonic? Is your antenna loading adjusted for maximum efficiency? How clean is your signal with or without modulation? In order to eliminate guesswork you should have the means on hand to enable you to check three things:

a) the frequency to which transmitter circuits are tuned
b) the relative strength of the signal being radiated by the antenna
c) the purity and modulation quality of the signal.

The station monitor incorporates these three functions in one unit that measures 4″ long x 2¼″ high x 2¼″ wide, weighs less than 2 pounds, is entirely self-contained and requires no power



PARTS LIST

C1—140 mmfd. (Hammarlund HF 140X)
C2—10 mmfd. disc ceramic
C3—100 mmfd. disc ceramic
R1—4000 ohm ½W
D1—1N34 germanium diode
J1—Auto type jack and plug
J2—Phone jack
L1—10-15-20 meters, B&W 3011, 11 turns, tapped at 5 turns from ground end. 40-80 meters B&W 3012, 48 turns with 3 turn insulated link of #18 wire at center
M—0-1 MA, 1 inch (see text)
Aluminum Case—Bud Minibox #CU-2103

Schematic showing high and low frequency coils. Wire either one to D1 for desired operation.

supply. Its compact size and light weight make the unit ideal for mobile and portable applications and its inherent ruggedness makes it extremely useful in the field.

Basically this instrument consists of a parallel resonant circuit tuned to the frequency of the signal you wish to check, a germanium crystal diode that rectifies the applied radio frequency in the same manner as the second detector in a typical receiver, a meter to measure the diode current that is proportional to signal strength, and a jack where headphones may be plugged so you may hear any amplitude modulation on the signal.

The chassis consists of an aluminum minibox completely enclosing the internal parts. Holes are drilled in the front panel to accommodate the meter, tuning control (C1) and phone jack (J2). Drill a hole for J1 on the side. This jack should be located slightly off center to leave room for mounting the coil (L1). Follow the same general layout of parts shown in the photos to come as close to the author's calibration as possible.

The probe consists of a single loop of No. 14 insulated solid wire, constructed so one end terminates in the center pin of the pin plug, and the other soldered to the outer part of the plug. When the plug is inserted in jack J1 one side of the loop is grounded.

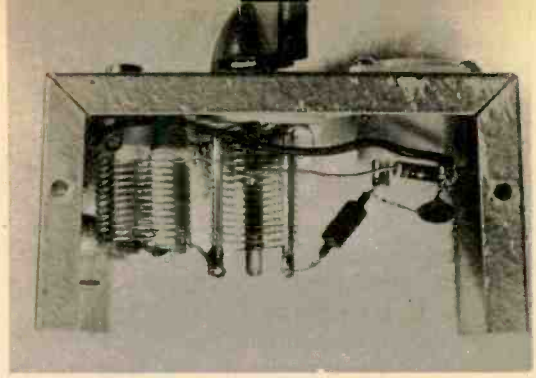
The coils used for L1 are cut to give the proper inductances for frequencies from approximately 3.5 through 38 megacycles depending upon the setting of C1 and the coil used. The low frequency coil B&W No. 3012 is 1½ inches long x ¾ inch, 48 turns in all. Wound around the center of this coil are 3 turns of No. 18 insulated hookup wire forming a link for the wavemeter probe. One end of the coil and one end of the link are grounded. The other end of the link is connected directly to the center connector of jack J1. The top of the B&W coil is connected to the stator plates of C1.

The photos show the high frequency coil in place with a slightly different coil arrangement for L1 than described for the low frequency coil. This high frequency coil is a B&W No. 3011 tapped at 5 turns from the ground end with 11 turns in all. This coil is ¾ inch diameter and has 16 turns per inch. The tap connects to J1 through C2 and the top of the coil connects to the stator of C1 as shown.

The miniature meter, one of the smallest available, is readily obtained by writing to Mr. Gilbert Rose, Polk's, 314 5th Avenue, New York, N. Y. Ask for an Aristo Micro Craft one inch 0-1 milliammeter. The price is $5.95.

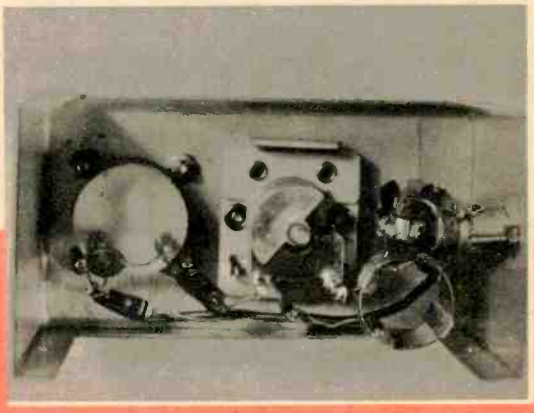
If the station monitor has been con-

[*Continued on page* 108]

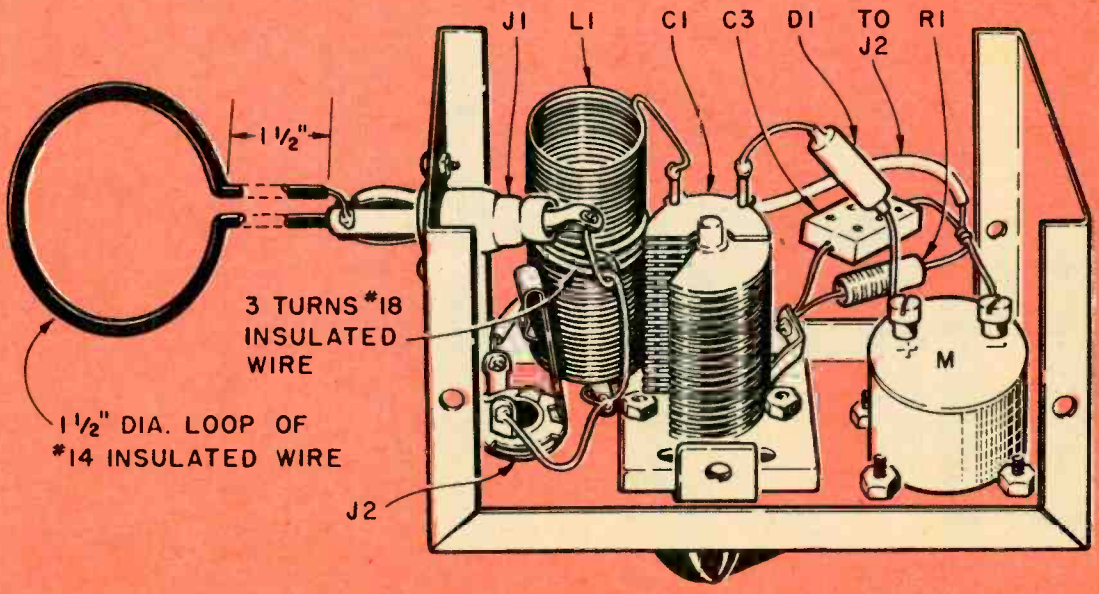


Top view, back off. Black object near center is diode. Grip leads with pliers while soldering to avoid overheating.

Rear view showing major parts. Keep wiring short and rigid, keep condenser meshed while building to avoid damage.



Wiring guide shows low frequency coil in place for 40 and 80 meters. For 10-15-20 use alternate coil described in text.



Wire Your Patio for Sound

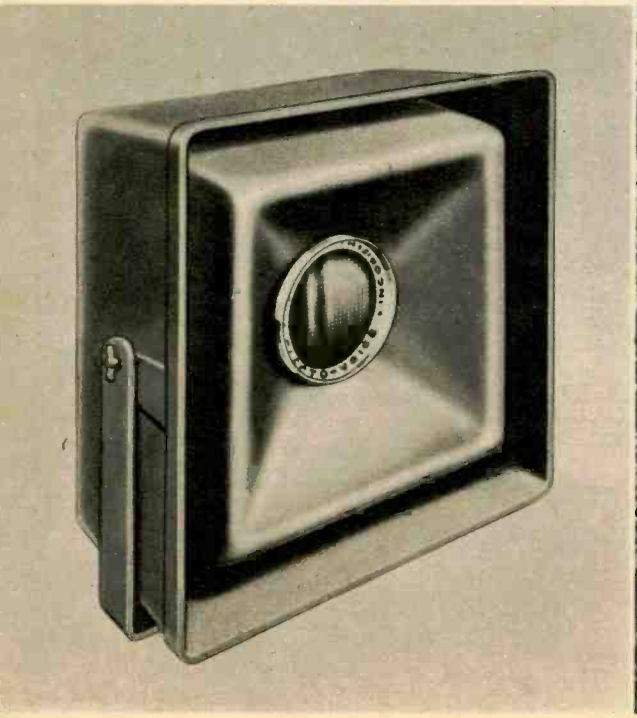
By Matt Johnson

Plug in a speaker and listen to hi-fi in outdoor comfort—without disturbing your inside set-up.

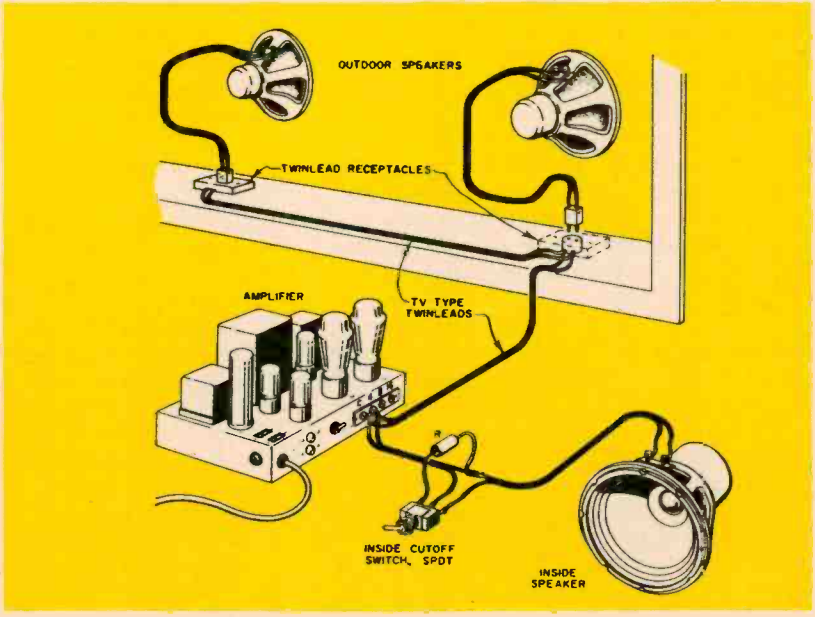
EASY LIVIN' is merely a dream to most harried homeowners —the grass needs cutting, the barbecue tending, the screens fixing and the kids walloping. But after all these chores are done, there's usually a bit of time to relax in the patio sling chair with a good book and the soft strains of good music floating on the breeze.

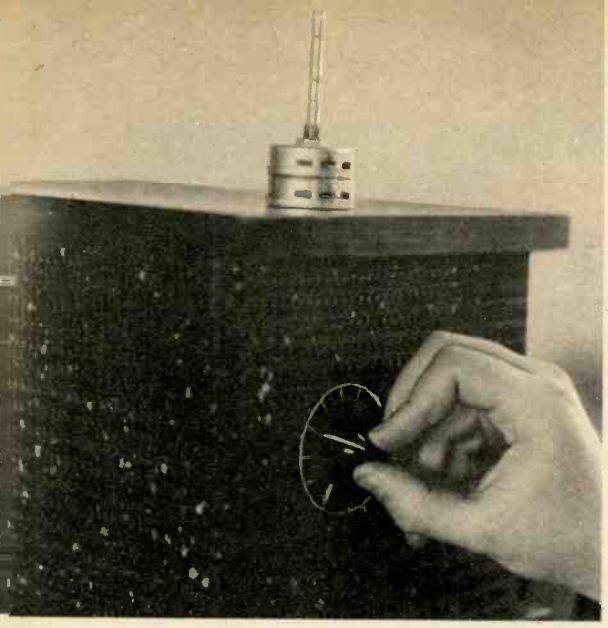
Wait a minute, now. Good music, did you say? And just how are you going to achieve *good* music; that is, the quality you're accustomed to if you're a hi-fi fan? Surely not with a portable phonograph that's advertised as high fidelity and certainly not by keeping the screen door open and turning up the volume on your amplifier.

The Electro-Voice "Musicaster," lower left, is a light and weatherproof unit. At lower right a University BLC with built-in crossover network is installed high on a tree trunk for dispersion of sound throughout the garden.



If indoor type enclosures are used, follow wiring guide below for plug-in arrangement. This will permit quick and simple removal in case of bad weather.





The L-pad control (on top of cabinet) is installed to adjust individual speaker volume.

The TV type twinlead plug and receptacle may be mounted at convenient spot outside house.

Of course not. With just a little bit of know-how and a minimum of finances you can wire your patio for sound and be the envy of the neighborhood.

But, be that as it may, your requirements are simple. One or two speakers or speaker systems (according to the volume and quality of sound you want) is the first necessity.

In addition, you'll need enough 300 ohm twinlead to run from your amplifier to the outside of the house (although for this part of the installation zip cord will do, if you have it around), and another length to reach from your outside speakers to the house. What you're going to do, of course, is install outdoor sockets—weatherproof—and leave them there permanently so you can plug in your speakers whenever you wish to use them.

It would be best to lay out the exact placement of the speakers and measure the distance involved, then buy enough lead to provide for wastage and error.

In addition you'll need one or more wall-mounted twinlead sockets and plugs, waterproof, at less than $1 a pair. Also, for best listening, an L-pad volume control of the same resistance as your speaker for each installation. With a pad for each speaker, you can control your volume individually, which may prove necessary under outdoor conditions.

Determine what the total impedance of your speaker line will be. If you're using one speaker, it will be the impedance of the speaker. (See instructions if in doubt.) If you use two, in parallel (generally the best method for most conditions) it will be the product divided by the sum of their impedances. If they are matched speakers or unmatched but with the same impedance values, they will simply be half the value of one.

With the 4 ohm Telematic, their parallel impedance is 2 ohms. Since most output transformers do *not* have 2 ohm taps, you can connect to the 4 ohm outlet, and the mismatch will be insignificant.

Outside, attach the wallmount socket to the lead and fasten it to the frame of the door or window or other spot you've chosen with the two woodscrews provided. If you wish to install a second outlet for a second speaker, run the additional length of lead from the socket (in parallel) to the second spot you've selected for an outlet.

Next, work on the speaker. If you're going to install a control mounted inside

[*Continued on page* 106]

Hi-Fi Clinic

Got a question on hi-fi—how to install, how to repair, how to listen? Send it in to us; the clinic will send an answer to each query.

Viscous Damped Tone Arms

I use a GE VRII magnetic cartridge on a 16-inch tone arm. Recently I changed my stylus pressure from 6 to 4 grams and found a change in the dynamic range of the sound. My records do not seem as "alive" as they used to be at 6 grams. Am I right, or is my sub-conscious playing tricks on me?

E. W. Emond, So. Weymouth, Mass.

From here in New York it's difficult to tell what your sub-conscious may be doing. However, there are certain checks you might make on your system to resolve the problem.

There's a distinct possibility that the viscous damping of your arm is set too high. The tendency of most owners of arms with adjustable damping is to set the damping control so the arm will drift down to the record when released over the lead-in groove. This makes an interesting demonstration, but is not the best adjustment from the point of view of fidelity, record wear, or stylus life. High damping in the vertical plane will cause the stylus pressure to increase many times at any point in the record where there is a slight ripple and the stylus has to ride uphill. On the downhill portion of the ripple, the stylus may be unable to follow the groove and lose contact with it. With the damping adjusted to a very low value, no difficulty should be encountered when tracking at 4 grams.

Tape Motor Whine

When I am tape recording from my two favorite radio stations, the recording is ruined by a loud whine that resembles the sound put out by a vibrator. It fades when the radio is tuned to other frequencies. The noise occurs only when the tape transport mechanism is working. I substituted a transistor portable radio and, in this case, the noise was not heard. Can you tell me the cause of the noise and how to eliminate it?

Edwin F. Wiegand, San Bernardino, Calif.

The whine that is bothering you is most probably noise that your tape recorder motor is feeding back into the AC line. The reason the transistor portable isn't picking it up is simply that it isn't connected to the AC line. The usual solution is to install a line filter on your radio. The Sprague F-400 and the Cornell-Dubilier IF-18 are good choices for this purpose.

In general, best results will be obtained with the filter installed between the recorder and the AC line rather than between the radio and line.

Speaker Wires

I would like to know the best wire or cable to use to connect a hi-fi speaker to the output terminals of my amplifier. I want to be sure that I am not losing any power or causing hum in the speaker. What should the maximum length of this wire be from a ten watt amplifier?

Jeff Milman, Scarsdale, N. Y.

The factors to be considered when choosing speaker lead wire are the following: the resistance of the wire, the capacity between its two conductors, and the ease of installation. Standard AC "zip cord" can be used for runs up to 50 feet or more without detectable loss of volume or affect on the amplifier's damping factor.

For shorter runs, where it might be convenient to place the wire under the carpet, TV type 300 ohm flat line works well. Shielding is not needed because the low impedances and absence of gain in the speaker line eliminate the possibility of hum pickup.

The wattage of the amplifier is not significant.

can you get hi-fi from

A Turntable Kit?

ELECTRONICS ILLUSTRATED assembled the Weathers turntable kit to find the answer. Here is our report.

A GOOD turntable is not easy to make. Most manufacturers use a fairly large, well-regulated motor with a heavy turntable to overcome any tendency of the motor to spin unevenly which would cause "wow." The heavy turntable operates as a flywheel, keeping the speed precisely that called for. The Weathers company uses a different technique in their turntables. They use a synchronous light motor which, because of its low mass, has little trouble running smoothly and precisely on speed. To maintain this condition, they use a light aluminum turntable with a

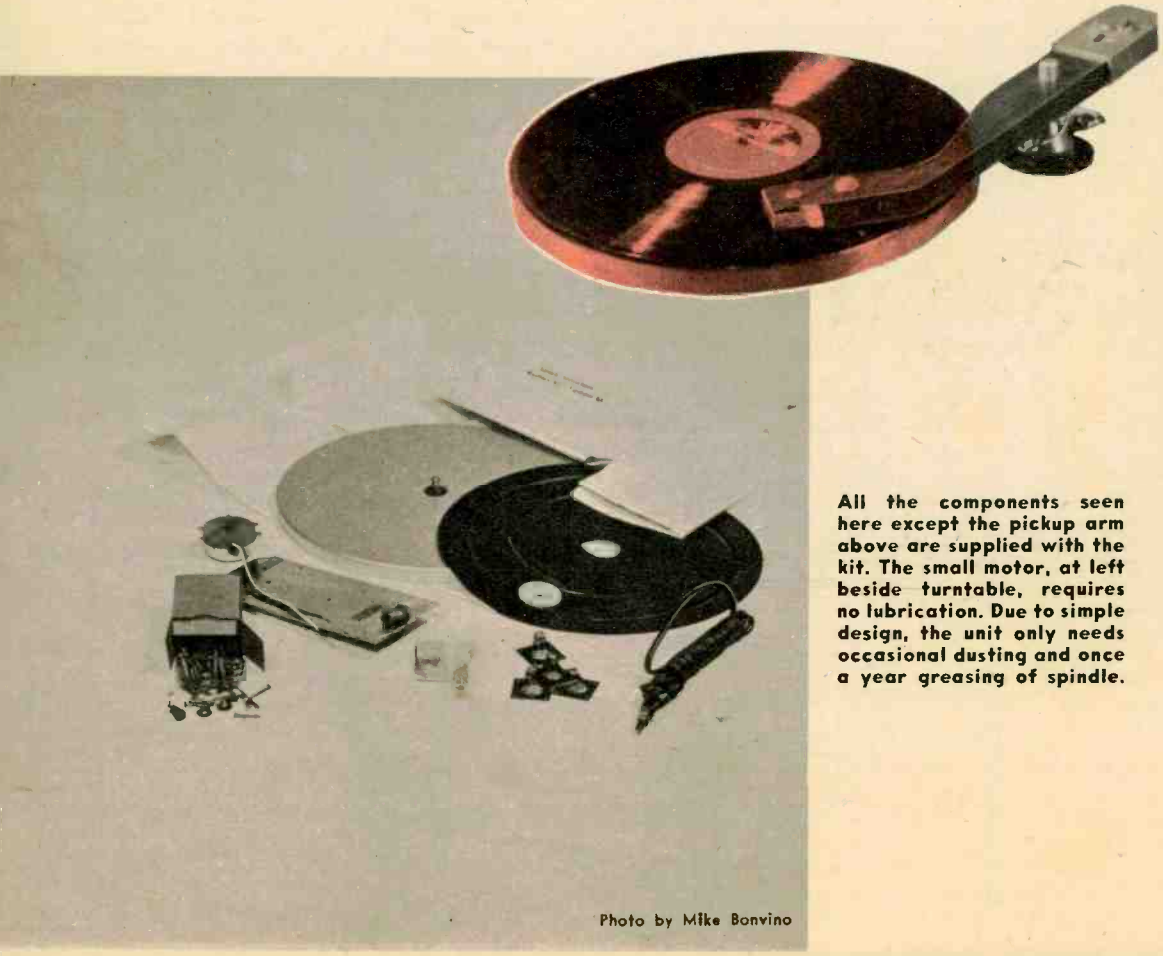
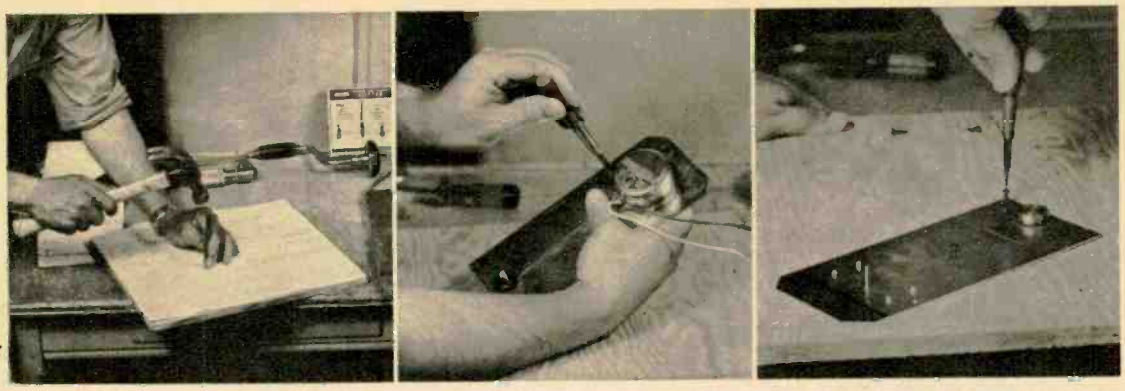


Photo by Mike Bonvino

All the components seen here except the pickup arm above are supplied with the kit. The small motor, at left beside turntable, requires no lubrication. Due to simple design, the unit only needs occasional dusting and once a year greasing of spindle.



The mounting board (not supplied with kit) is cut from ⅜" plywood with the aid of a full scale template. Holes are marked and drilled to accommodate motor, spindle, pickup, and four leveling screws. At center, motor is fastened to mounting plate. The assembly is then attached to board.

"live rubber" drivewheel. Their models are widely accepted and now, they are making essentially the same unit available in kit form, without base and some refinements found on the completely assembled one.

The instruction pamphlet accompanying the kit is adequate. It is not as thorough as those prepared by some kit manufacturers, but then assembling this kit is basically a mechanical job, there is no circuitry involved. The whole thing can be completed in less than an hour after you have the base cut out. Large, full-size templates are furnished for the mounting board (they call it the "seismic platform") and a base if this should be desired. We did not build the base because we would like to try mounting this unit onto a sheet of 2-inch white foam rubber.

The only special tool required was an expansion bit or drill for two holes, 2½" and 1¼", on the wood platform.

The instruction pamphlet calls the builder's attention to a "thrust bearing" which is to be inserted under the spindle. It will not be found in the parts box, and for good reason, it is already in the spindle assembly.

A reminder: after you assemble the turntable you will have to add a tone arm and cartridge before you can play a record.

Our evaluation of the $34.50 Weathers turntable kit on the basis of our assembly and use: This is a Good Buy

The light aluminum turntable with its rubber "Discushion" is lowered onto spindle. With the addition of pickup arm, base, and switch, the unit is complete. Turntable speed is 33⅓ RPM.

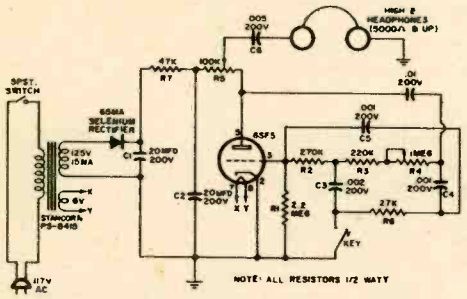
The Electronic Brain

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

A Reliable Code Oscillator

I have tried three times to build a good code practice oscillator without success. The finished products were either unreliable or completely inoperative. Can you provide me with a circuit that has a volume and frequency control, uses 110 volts AC, costs less than $15 to build, and that really works?

Joseph Samaua, New York, N.Y.



The circuit illustrated meets all of your specifications. Apart from the fact that it produces a pure sine wave tone that is pleasant to hear, it is very stable. The frequency of the sound can be varied over quite a large range by potentiometer R4. The volume control is R5. We have seen many simpler circuits, but very few could compare with this one for dependability and sheer steadiness of tone. If you are interested in the type of oscillator this is, it is known by the high sounding name of "Bridged-T variation of a phase shift oscillator."

Measuring Responses Electronically

How does a lie detector work?

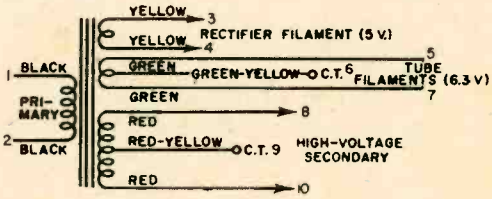
Robert Vaughn, Denton, Texas

The simplest type of lie detector is based upon the principle that emotional strain during the test affects the nervous system and stimulates the sweat glands. This causes a reduction of skin resistance measurable by a sensitive electronic ohmmeter. Many authorities maintain that this is not sufficient to conclude whether the subject being questioned is lying. They say that breathing rate and depth, blood pressure changes, pulse rate variations, and muscular movement must all be examined and evaluated together before a conclusion can be reached. In most instruments, only skin resistance is determined electronically. The other responses are matters of mechanical measurement using normal medical instruments.

Using Old Transformers

I have an old power transformer that I am sure is still usable. How can I tell which is the primary and which are the secondaries?

Reginald Wilson, Tulsa, Oklahoma



If the transformer is not too old, its windings may still be identifiable by the standard color code illustrated here. Another method is to check with a volt-ohmmeter. First, find all the *pairs* of leads in the same winding. When *three* leads show continuity, one will prove to be the center tap, in most cases. Here are typical resistance values; Leads 1-2, 10 ohms; 3-4, .3 ohms; 5-6, .25 ohms; 6-7, .25 ohms; 5-7, .5 ohms; 8-9, 250 ohms; 9-10, 250 ohms; 8-10, 500 ohms.

Carefully separate the wires to prevent a short circuit. Determine which is the primary winding and plug it into the wall outlet. With an AC voltmeter you may now read the voltages of the various windings. Due to the unloaded condition of the transformer the readings will be higher than normal.

Henry and Me
Electronic Handymen

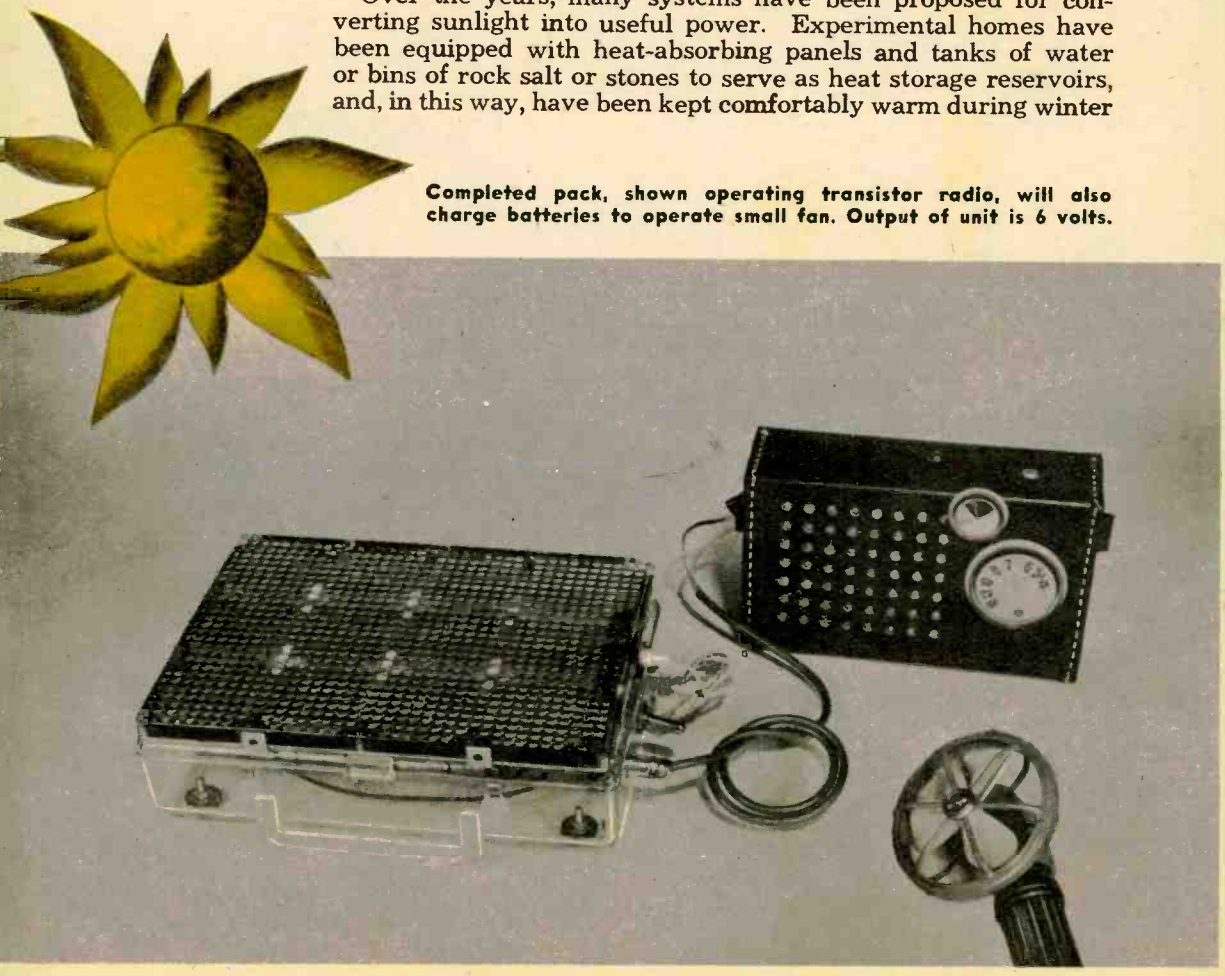
Use the Sun for Power

By Lou Garner

Free solar energy—Power pack recharges batteries for small radios, flashlights, amplifiers, and fans.

EVERY day our nearest star, the Sun, bombards the Earth with fantastic amounts of energy in the form of light and heat rays. If Mankind could utilize a fraction of the total energy poured freely upon the Earth each day, he would have more than enough power to satisfy his every requirement . . . heat and light for his homes, and power to operate his transportation systems, his communication networks, and his industries. Man no longer would have to worry about possible shortages of radioactive fuels for atomic power plants or the depletion of his coal, gas and oil reserves.

Over the years, many systems have been proposed for converting sunlight into useful power. Experimental homes have been equipped with heat-absorbing panels and tanks of water or bins of rock salt or stones to serve as heat storage reservoirs, and, in this way, have been kept comfortably warm during winter



Completed pack, shown operating transistor radio, will also charge batteries to operate small fan. Output of unit is 6 volts.

months. The heat stored in the reservoirs during sunny days was used at night and on cloudy or overcast days.

Of all the methods that have been tried in the past, perhaps the most promising has been the *direct conversion* of light energy into electricity by banks of "self-generating" photocells. These *sun batteries* are made up of such semiconductor materials as selenium and silicon.

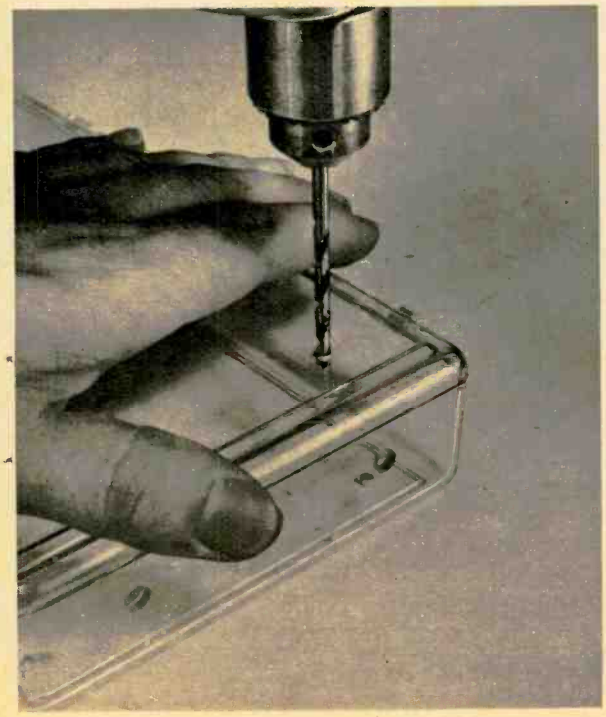
A typical cell consists of several thin layers of semiconductor material deposited on a metal base plate. The bottom layer is two to three-thousandths of an inch thick. The second, or "barrier," layer is much thinner, hardly thicker than the width of a molecule. The top layer, too, is of molecular thickness, and is transparent to light. It has a sprayed-on metallic collector ring which serves as one electrode . . . the metal base plate serves as the other electrode.

In operation, light passes through the transparent top layer and, striking the lower layers, wrests electrons from the semiconductor material. These free electrons travel across the intervening barrier and transparent layers to the collector ring, accumulating there and developing a negative voltage with respect to the metal base plate. In a selenium photocell, then, the base plate becomes the *positive* and the outer collector ring the *negative* terminal of the

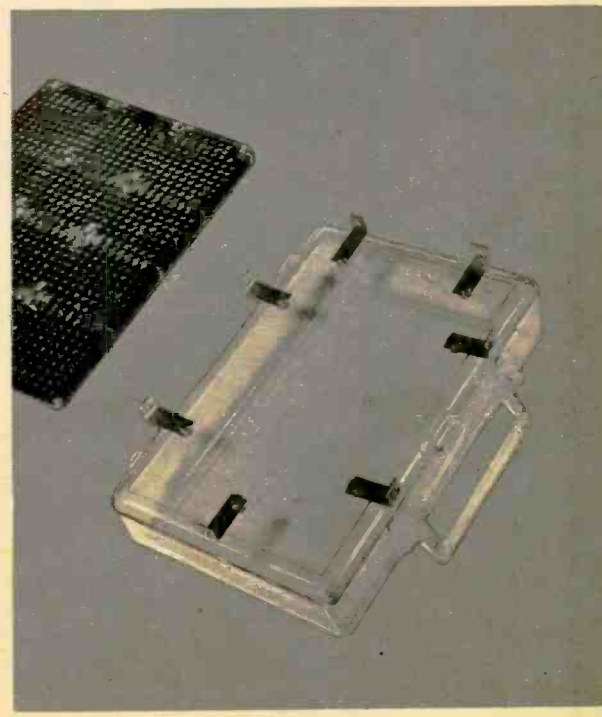
PARTS LIST

Sun Battery—6 volt high output Solar Battery (Argonne No. AR-300)
B1, B2, B3, B4—1.5 volt rechargeable flashlight cells (Argonne AR-290)
J1—Miniature jack (Lafayette No. MS-282)
J2—Phono jack
SW1—DPDT toggle switch
Battery plug—to fit miniature jack J1 (Lafayette No. MS-281)
Plastic case, 7½"x5"x1½" (Lafayette No. MS-300)
2—Battery holders (Lafayette No. MS-174)
4—Rubber feet
7—"L" brackets, steel or brass, approx. 1"x⅜"x⅜" wide
Misc.—Wire; solder; phono plug (to match J2); (2) small alligator clips; hardware.

Plastic case may be drilled without cracking using a sharp bit and a minimum of pressure.



Small "L" brackets made of springy metal are mounted on the case and hold the Sun Battery.



Accessory cable has insulated alligator clips on one end, with plug for jack J2 on the other.

A dab of red fingernail polish on the positive terminals will simplify battery installation.

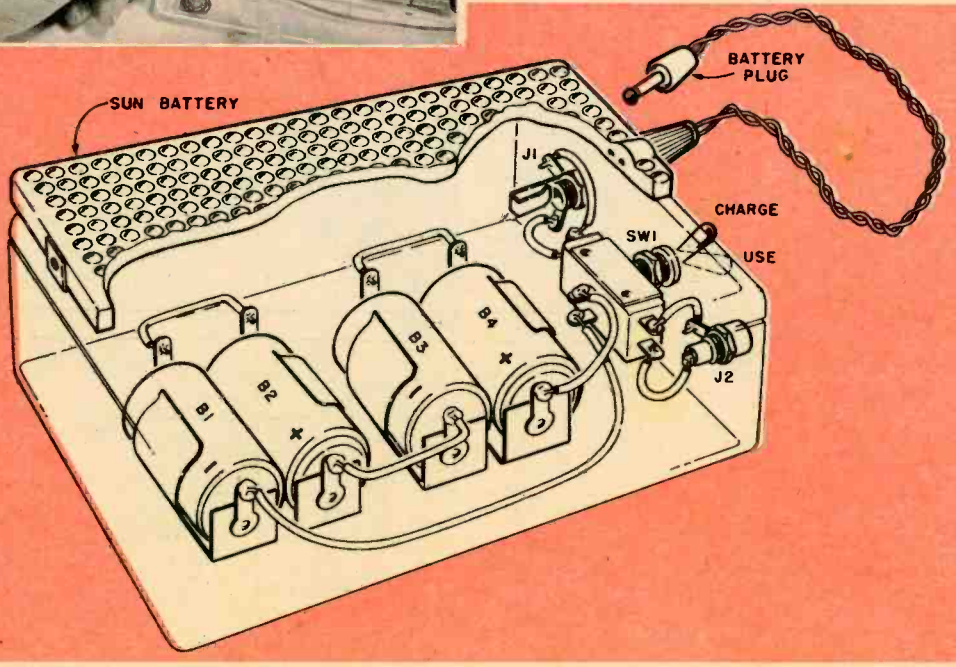
cell. A Selenium cell converts 1% of the light striking it into electrical power, while the more expensive silicon cells may have efficiencies running as high as 11%.

By combining a multi-cell semiconductor Solar Battery with a set of rechargeable electric cells, you can assemble a valuable Solar Power Pack. Such a unit will permit you to use the "free" power supplied in sunlight to operate transistorized receivers and amplifiers, small motors, or other electrical devices requiring small to moderate amounts of power, and will provide you with perpetually "fresh" batteries for use in your flashlights or battery-powered fans, vacuum cleaners, or mixers.

Assembly and Wiring

A commercially available plastic case measuring approximately 7½" by 5" by 1½" deep was used for assembling the model. However, you can use any plastic, metal or wooden case having similar dimensions for assembling an equivalent unit. If you prefer, for ex-

Follow the guide, below, for wiring the unit. Accessory cable plugs into the output jack J2.



ample, you can use a small wooden cigar box.

The Solar Battery itself is held in place on the case's lid by small clips, permitting its ready removal whenever necessary. The spacing of the brackets should be determined experimentally to provide as snug a fit as possible.

A pair of dual battery holders are mounted inside the case, and wired to the DPDT "function" switch (SW1) and "input" (J1) and "output" (J2) jacks mounted on one of the end walls. The battery holder terminals are connected so the four rechargeable cells (B1, B2, B3, B4), when installed, are wired in series to supply six volts.

As supplied by the manufacturer, the Solar Battery is equipped with a small output jack and a separate flexible cable, fitted with a pair of subminiature plugs. Replace *one* of these with a miniature plug to match J1.

With the wiring completed, recheck your work for possible errors. Install the rechargeable cells in their battery holders, snap the Solar Battery in place on the power pack's lid, connect the *input* cable between J1 and the sun battery's output jack, and the unit is ready for use.

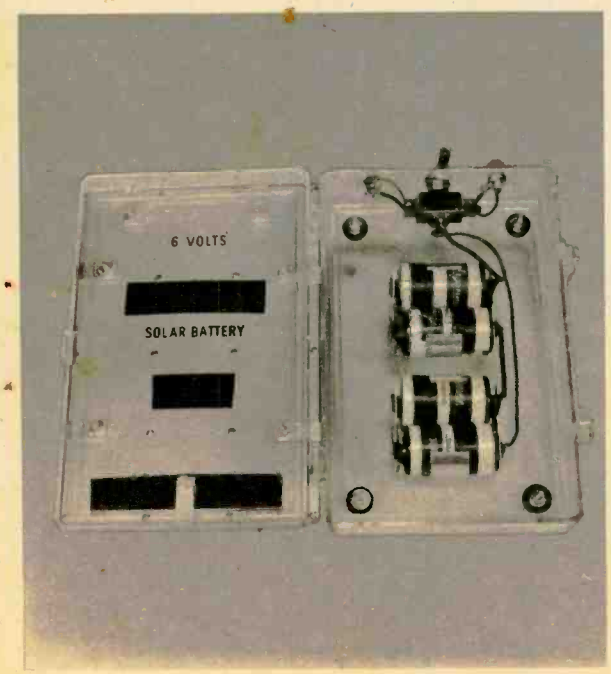
You'll need one accessory . . . a small *output* cable. Use any two-conductor cable for this . . . a piece of lamp cord, a short length of coaxial microphone cable, two pieces of hook-up wire twisted together . . . or whatever you have available. Fit one end with a plug to match *Output* jack J2, and the other end with small insulated alligator clips.

The power pack's "function" switch (SW1) has two positions. When in the *Charge* position, the Solar Battery furnishes power to recharge cells B1, B2, B3, and B4. When in the *Use* position, the cells are connected to the *Output* jack (J2) and can furnish DC power to operate external electrical or electronic equipment.

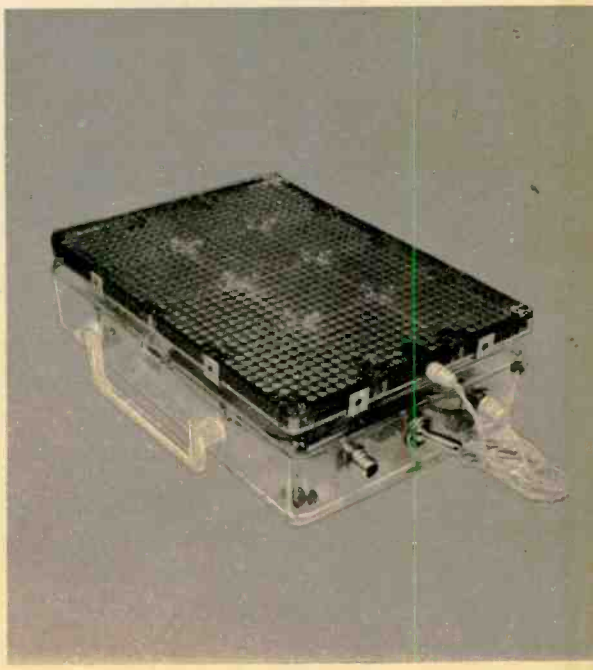
When charging, the Solar Battery should be exposed to a moderately strong light source. Full sunlight is best, but good results can be obtained if the unit is placed reasonably close to fair sized incandescent or fluorescent

[*Continued on page* 107]

Interior view of wired power pack with the Sun Battery clipped in lid, dry cells in holders.



With a source of light the cable brings energy to rechargeable cells. Switch is on "Charge".



How to Check Your TV Tubes

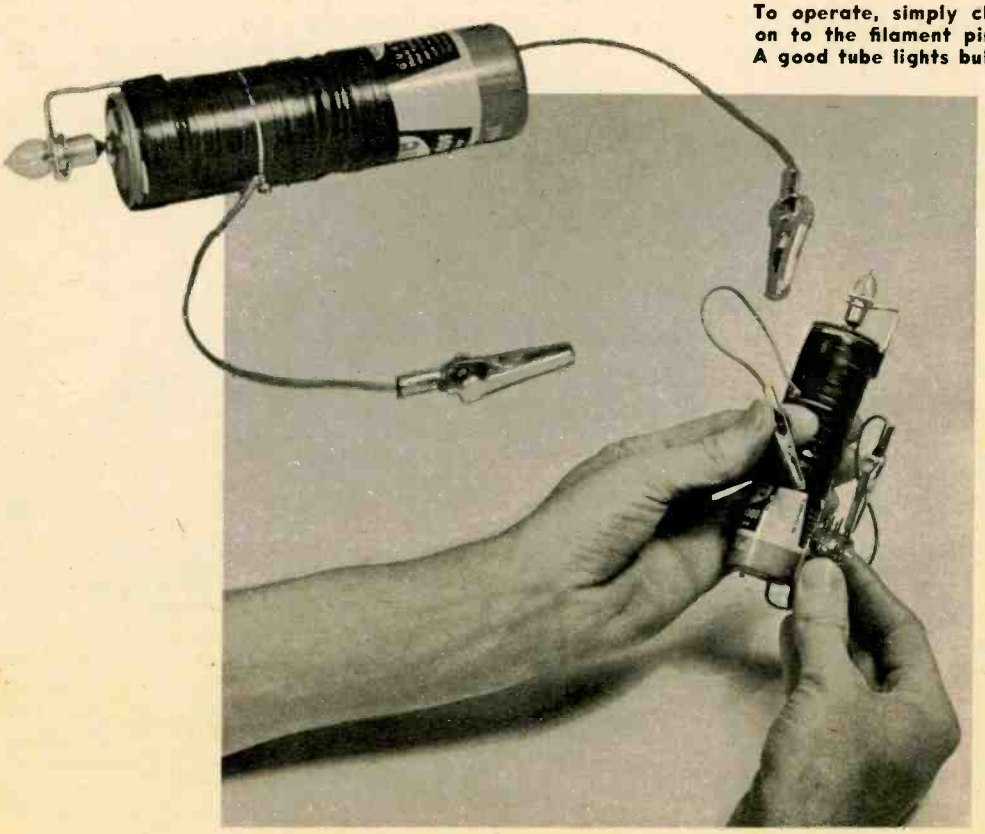
By Lawrence Herrick

Build a filament tester for less than a dollar—and you can repair over 50% of your TV troubles

WANT to save money on TV repairs? Then test the tubes yourself the next time your receiver goes on the blink. You need no meters of any kind, and the skill or knowledge required is, in most cases, slight. Since a defective tube is responsible for improper TV receiver operation most of the time, the chances are excellent that you won't be wasting your efforts.

Tube defects may, for our purposes, be divided into two categories: 1. open filament. 2. other defects. Since the two kinds of trouble require different methods of troubleshooting, we will discuss each one separately.

The filament (sometimes called the heater) has the function



To operate, simply clip on to the filament pins. A good tube lights bulb.

of heating the cathode to make it emit electrons. When the filament opens, it is no longer able to pass current and heat up, making the tube inoperative. An open filament in a glass tube will not light up visibly, as a normal one will. This is, in many cases, a helpful clue in locating the faulty tube.

Turn the power on and observe the tube filaments. If they are all glowing red make sure there are no filaments present that you can't see. If the lighting of the filament cannot be detected in a shield tube, remove the shield.

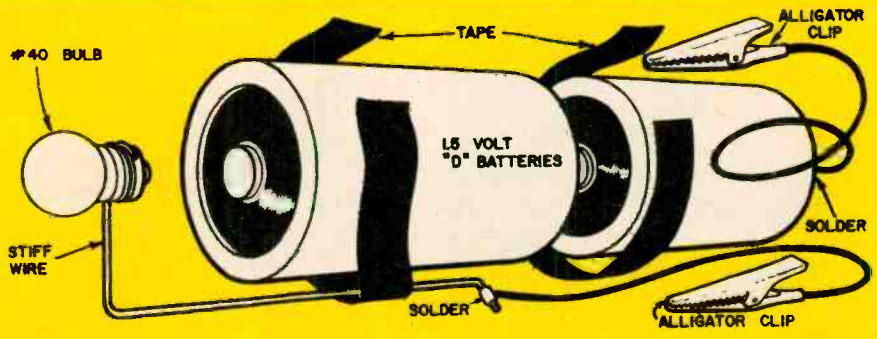
When a tube has a metal envelope, it will not be possible to check it visually. An indirect check, however, may be made as follows: turn the set on for a few minutes. Now turn the set off. Immediately thereafter, touch the tube envelope lightly with your finger. If the tube feels cold to the touch, its filament is probably open.

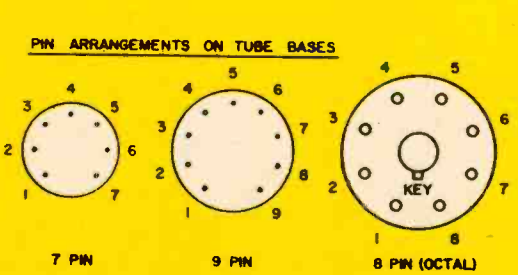
Look into the high voltage cage during your filament inspection. You will generally be able to check the lighting of the filaments of all the tubes in the cage except the high voltage rectifier without removing the cage. The glow of the rectifier filament is often too dim to be readily seen through the ventilation holes of the cage. If the filaments of the other tubes in the cage are lit, you can give the tubes in this high-voltage section a clean bill of health for the time being, unless the screen is completely dark, and sound is normal.

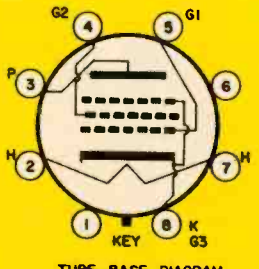
If this symptom is present, and all other tube filaments light normally, remove the screws that keep the high voltage cage in place, take the plate clip off the cap of the high voltage rectifier, and remove and test the tube. In most sets this will be a 1B3 or 1×2. The cage should also be removed when a tube in the high voltage cage other than the rectifier has a filament that doesn't light, or when it cannot be determined without closer inspection.

Several devices for checking tube fila-

Below the wiring guide is a chart showing how to locate pin numbers of tubes to be tested. The tube base diagram, found in any tube manual, indicates the heater pins. Here, they are 2 and 7.







ments are illustrated in this article. The home built tester must be used with a tube manual to locate the filament pins.

It was constructed from inexpensive parts and is operated by clipping on to the filament pins of the tube. If the pilot lamp lights, the filaments may be considered good. No light indicates an open filament and the tube should be replaced.

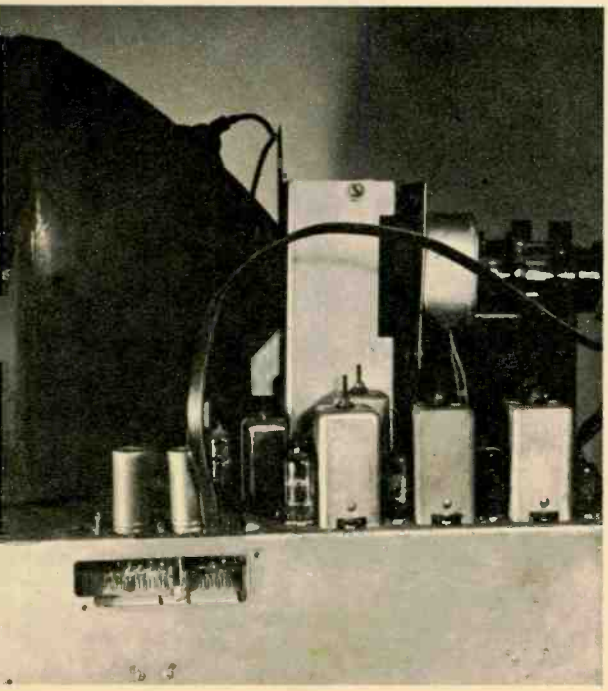
When a receiver defect is present, and all the tube filaments light, a defect other than an open filament may be present. To test for such a defect, one method is to keep a complete set of duplicate tubes. You can get the type numbers of the tubes directly from the tubes themselves. Obtain identically numbered tube replacements.

Each tube in the set should be replaced in turn, and a test of receiver operation made immediately thereafter. If the original symptoms disappear after a particular substitution, a defect in the original tube is indicated. A touch-up of one or two rear-of-chassis controls may be needed after a tube is replaced. The manufacturer's service data provides information on such control readjustments. (You can obtain this data for a small fee from the set manufacturer, or service data publisher, if you write to him, giving the chassis number of your set. It is generally stamped at the rear of the chassis.)

Before substituting a tube, put a dab of nail polish on the old tube to avoid any mixup. If the new tube doesn't correct the trouble, restore the old tube to its socket immediately. It is also important that the position of any lead is not changed, especially when checking around the high voltage cage.

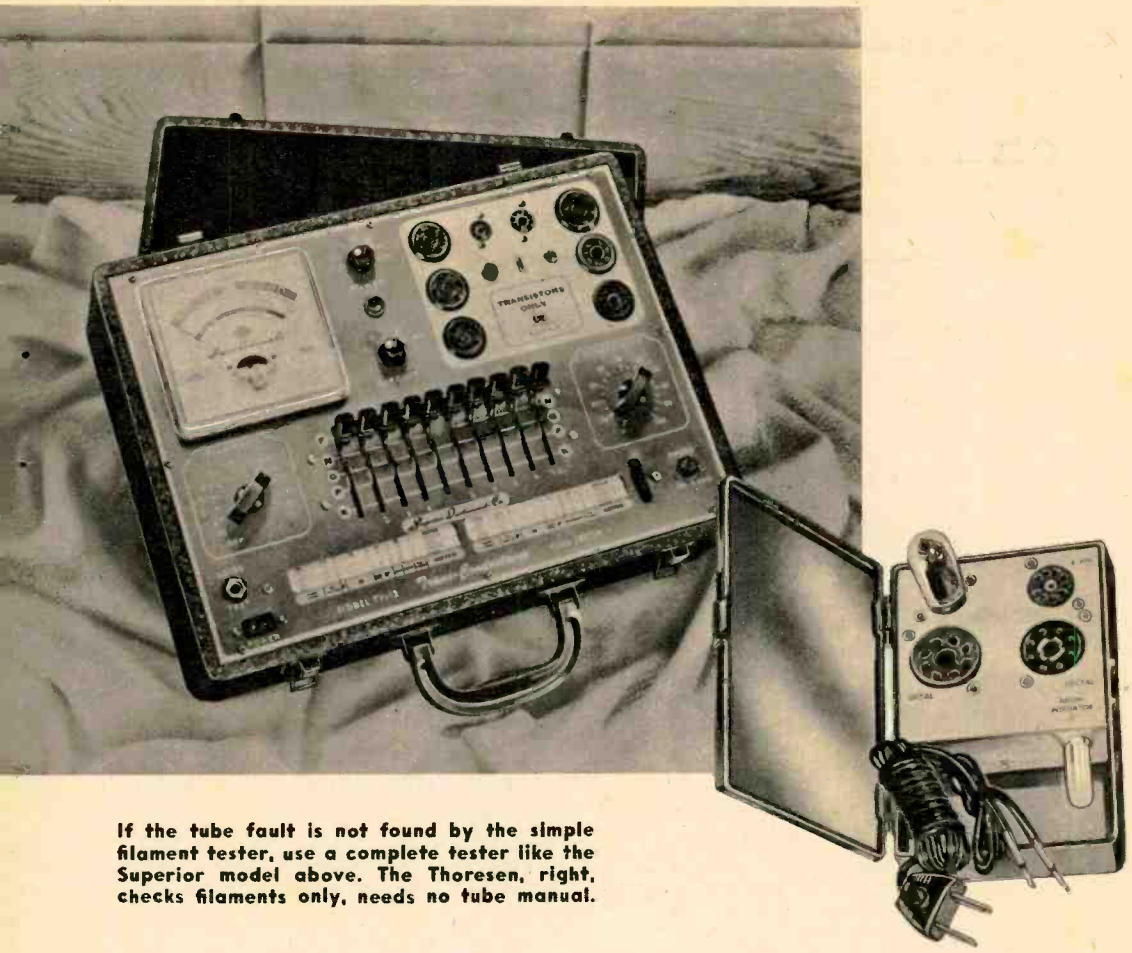
When inserting a miniature tube in its socket, line it up so the wide space between prongs matches the space on the socket. The base of the larger octal, or 8 pin, tubes has a key that fits into a slot on the socket.

If, with the methods described, you find a bad tube, you have saved yourself money. Next month we'll show how to localize some TV set troubles by symptoms.



Always replace tube shields, lower left, after test. Do not scratch or strike picture tube.

A "cheater" cord will permit you to operate TV set with back cover removed to see filaments.



If the tube fault is not found by the simple filament tester, use a complete tester like the Superior model above. The Thoresen, right, checks filaments only, needs no tube manual.

COMMONLY USED FILAMENT PINS

7 pin miniature	pins 3 and 4
9 pin miniature	pins 3, 4, 5, and 9
8 pin octal	pins 2, 7, and 8

The above information, when used with the home built tester, will help you find the filament pins for the majority of tubes. For the 8 and 9 pin types, try different combinations of pin numbers. Consult a tube manual for additional data.

AVOIDING INJURY

- Don't bring any sharp edged tools near picture tube. A sudden movement of your hand may cause the tool to strike the tube and a dangerous implosion could result.
- Metal cone picture tubes should be discharged by touching one end of an insulated wire to the chassis, and then, the other end to the metal cone. Do this several times.
- Don't touch or replace any components unless the power is off.
- Make sure there is no external ground (exposed steam or water pipe) within touching distance.

how to build a safe rocket–part 3

Testing Your Rocket

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

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

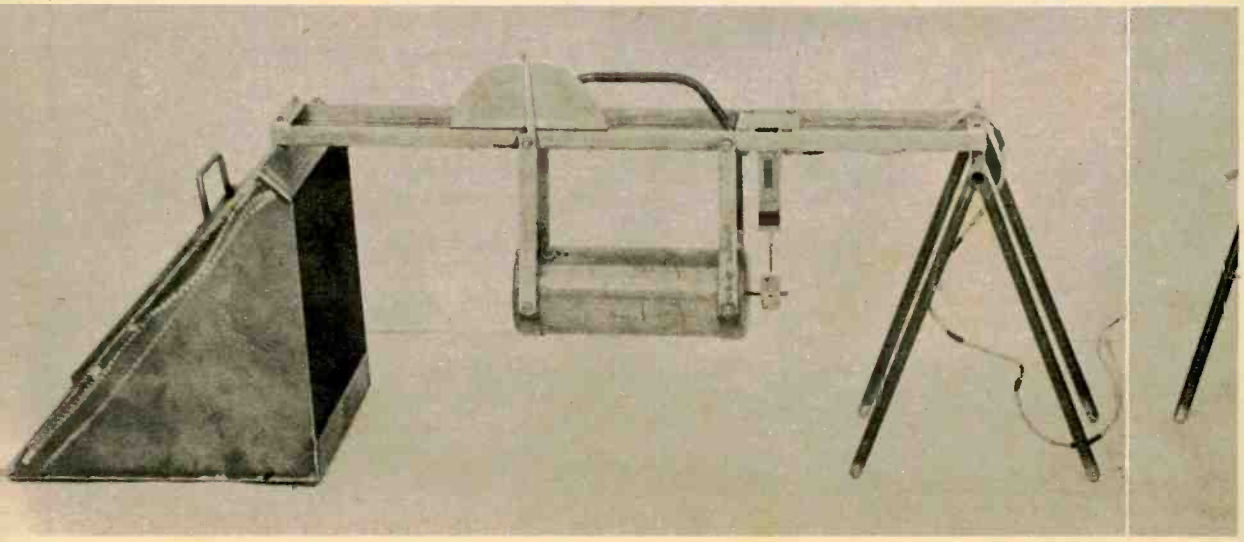
Before launching your rocket, measure its thrust on the simple test stand described here in detail.

BUILD a safe model missile parts 1 and 2 were concerned with the overall safety aspects of amateur rocket operation, building a small simple rocket, and then fueling it. You now know how to build, fuel, and fire a rocket, but remember, a good engineer will always test the item and its components many times before he puts it on the market, or in our case, before he takes it to a supervised range for firing.

There are, of course, many different tests that can and should be conducted by the amateur if he is to become thoroughly familiar with rocket test procedures and all the "whys and wherefores" of rocket operations. It is not the purpose of this article to outline in detail all these different test procedures, but to mention just one simple test, describe it in some detail, and then tell the amateur how to build the equipment.

Early in our schooling, we were introduced to an English gentleman by the name of Sir Isaac Newton. Sir Newton's basic laws of motion are the foundation for what follows; especially the 3rd

The complete test stand (details on P. 78) permits static firing of rocket. Shell deflector, left, receives hot gases and cable, right, is for ignition.



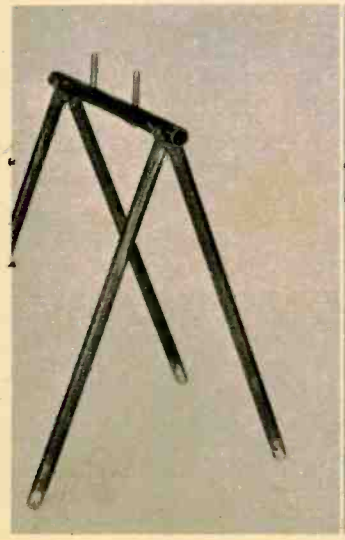
law which essentially says that for every action, there is an opposite and equal reaction. When a rocket burns gas pressure is formed. It is this pressure that forces the burned and unburned particles and gases out through the rocket nozzle. This is called *thrust.* Though this is the *action,* we will measure the *reaction.*

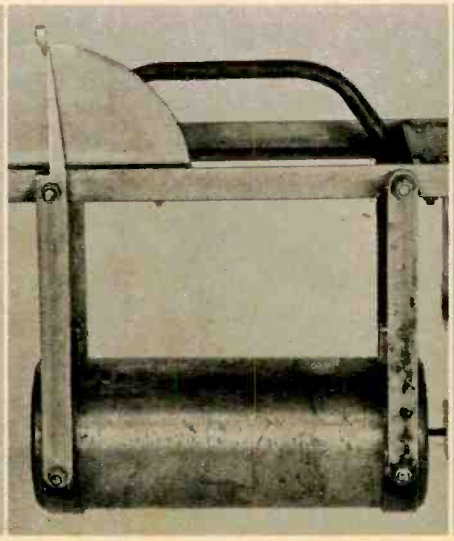
The thrust stand is made in three major components, shell deflector, rack, and the rack support. It was designed this way so the rack support could be placed within the shell deflector. Then there are two loads that can be carried as two suitcases. Another consideration of this design was that the rocket container (cylinder) is removable so that larger, heavier, and stronger cylinders may be interchanged. A final consideration of design was that the shell deflector and rack support be interchangeable. This becomes necessary where larger rockets are statically tested, otherwise the rocket blast would blow the deflector to the left, and this is not desired. There is no need to go into the details of how to make the thrust test unit for the drawings are detailed enough. There is one point, however, that does not show on the drawings; that is when the cylinder is made, a 4½-inch OD steel pipe is used. This pipe should be ½ inch thick for rockets up to 14 inches.

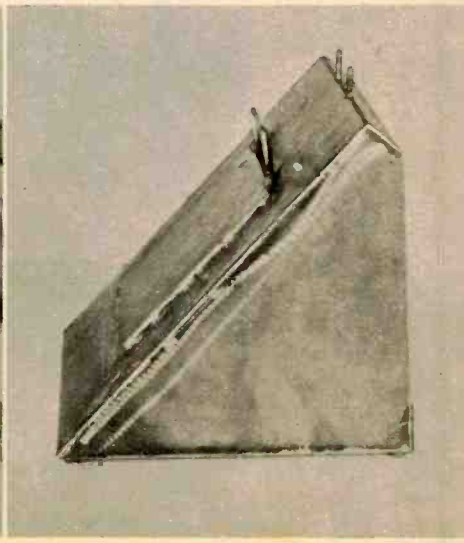
After completing the thrust stand, the rocket casing is first inserted into 2 cardboard disks (see illustration). The assembled and fueled rocket casing and rocket nozzle, with the two cardboard disks and an electrical squib, are then placed into the rocket container of a thrust stand. The rocket casing is pushed well forward with the rocket nozzle to the rear so that firm contact is made with the forward part of the rocket casing and the inside of the forward part of the rocket container. The two cardboard disks are essential. If the rocket casing develops a hot spot that results in a blowout of the rocket casing, there is then a tendency for the rocket casing to remain in the rocket container. If the disks are not used, the casing will jump around in the rocket container and the results are unpredictable. Using the two cardboard disks also prevents overheating at the area of contact between the rocket casing and the rocket container. Then again, if you purposely wish to overload the rocket with a fuel that will rupture the rocket casing, no matter what casing thickness is used, or

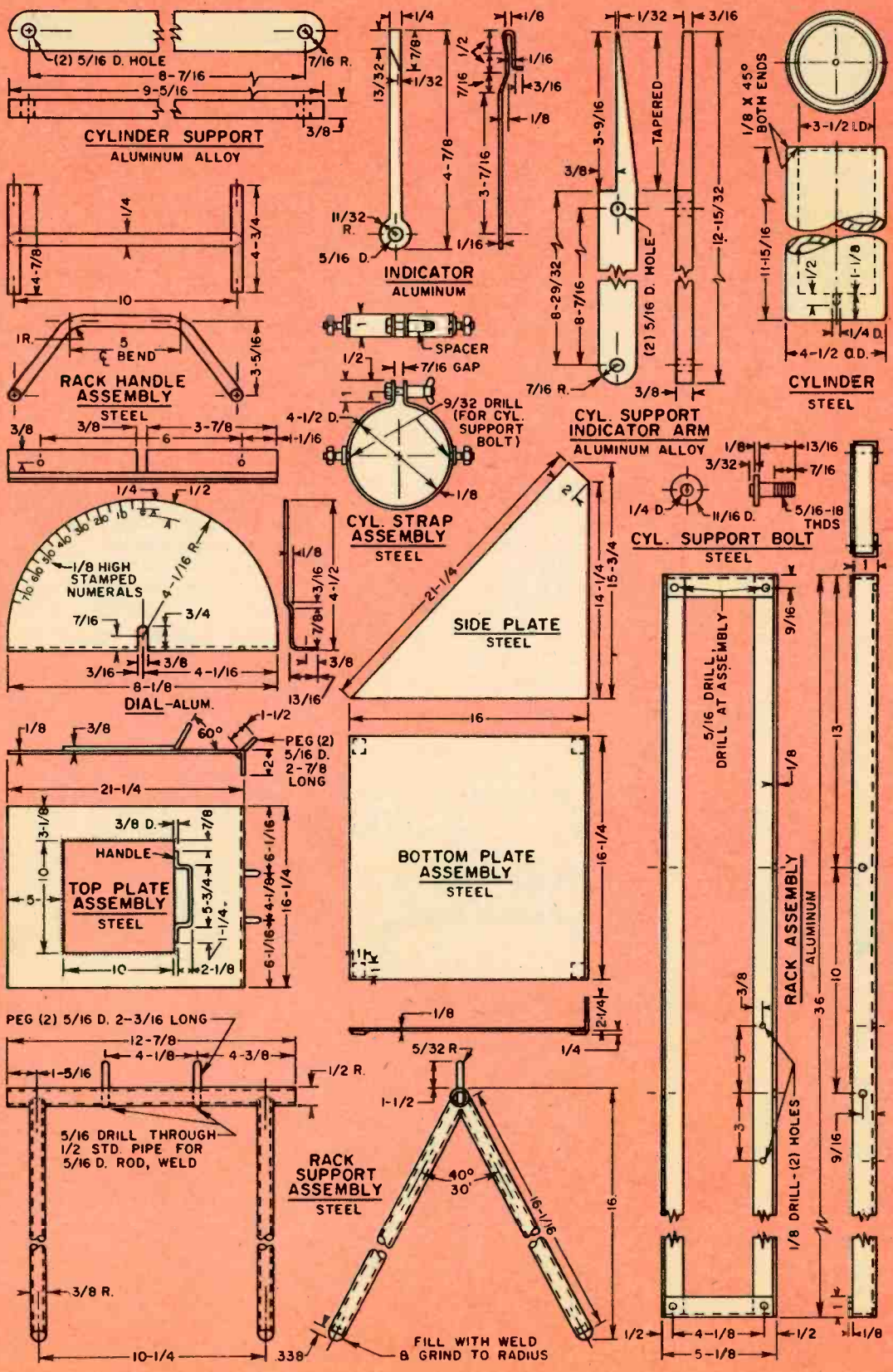
[*Continued on page* 91]

The three major sections may be dissassembled for portability. To the left is the rack support, rack and rocket container are at center. Note pointer and dial arrangement for reading degree of deflection (used to calculate thrust). To the right is the shell deflector made from ⅛" steel.








CYLINDER SUPPORT
ALUMINUM ALLOY
(2) 5/16 D. HOLE
7/16 R.
8-7/16
9-5/16
3/8
INDICATOR
ALUMINUM
5/16 D.
11/32 R.
4-7/8
3-7/16
13/32
7/16
1/2
1/4
1/8
1/16
3/16
1/32
3/16
TAPERED
3-9/16
3/8
8-29/32
8-7/16
(2) 5/16 D. HOLE
12-15/32
7/16 R.
3/8
1/8 X 45° BOTH ENDS
3-1/2 I.D.
11-15/16
1-1/2
1-1/8
1/4 D.
4-1/2 O.D.
CYLINDER
STEEL
RACK HANDLE ASSEMBLY
STEEL
1R.
5
℄ BEND
3-5/16
4-7/8
4-3/4
10
SPACER
1/2
7/16 GAP
9/32 DRILL (FOR CYL. SUPPORT BOLT)
4-1/2 D.
1/8
CYL. SUPPORT INDICATOR ARM
ALUMINUM ALLOY
1/8
13/16
3/32
7/16
1/4 D.
11/16 D.
5/16-18 THDS
CYL. SUPPORT BOLT
STEEL
3/8
3/8
3-7/8
6
1-1/16
1/4
1/2
1/8 HIGH STAMPED NUMERALS
4-1/16 R.
7/16
3/4
3/16
3/8
4-1/16
8-1/8
DIAL-ALUM.
CYL. STRAP ASSEMBLY
STEEL
1/8
3/16
4-1/2
7/8
3/8
13/16
SIDE PLATE
STEEL
21-1/4
14-1/4
15-3/4
2
16
1/8
3/8
60°
1-1/2
PEG (2) 5/16 D. 2-7/8 LONG
2
21-1/4
3-1/8
3/8 D.
7/8
HANDLE
TOP PLATE ASSEMBLY
STEEL
10
5
5-3/4
1-1/4
10
2-1/8
6-1/16
4-1/8
6-1/16
16-1/4
BOTTOM PLATE ASSEMBLY
STEEL
16-1/4
1/8
2-1/4
1/4
5/16 DRILL; DRILL AT ASSEMBLY
9/16
1/8
RACK ASSEMBLY
ALUMINUM
13
10
36
3/8
3
3
9/16
1/8 DRILL-(2) HOLES
1
1/2
4-1/8
5-1/8
1/2
1/8
PEG (2) 5/16 D. 2-3/16 LONG
12-7/8
4-1/8
4-3/8
1-5/16
1/2 R.
5/16 DRILL THROUGH 1/2 STD. PIPE FOR 5/16 D. ROD, WELD
3/8 R.
10-1/4
RACK SUPPORT ASSEMBLY
STEEL
5/32 R
1-1/2
40°
30'
16-1/16
16
.338
FILL WITH WELD & GRIND TO RADIUS

Transistor Slave Photo-Flash

By R. L. Winklepleck

Remote flash unit for backlighting and modeling built in just an evening with simple components.

IN the face of all the amazing interest in flash photography very little attention is being given to equipment for multiple flash. Every photographer knows that a single flashbulb produces harsh, flat lighting. Various kinds of diffusers and bounce lighting are employed to help correct this difficulty but they're only moderately successful. A second flashbulb, used as a modeling light and flashed in unison with the bulb on the camera, will produce exactly the lighting desired. But who wants to work with the long tangled cords for these extension lights? A remote flash, fired by the light impulse from the camera, is a logical

Completed unit is shown on the left. It is triggered by light received from the flashbulb located on the camera. No bulky parts or interconnecting cables are necessary.

Bottom view showing battery, transistor TR1, and capacitor. At lower end is photocell, TR2 at top.

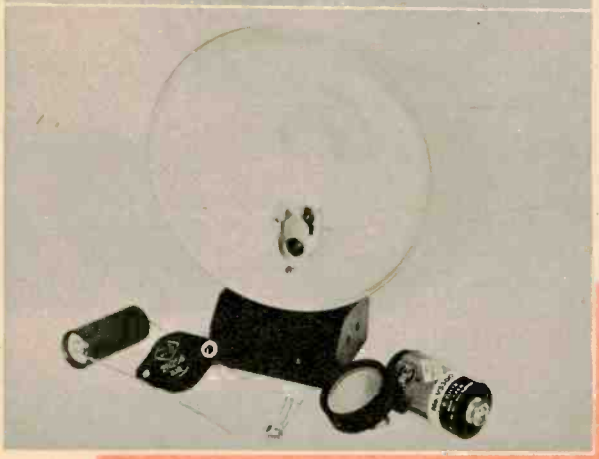
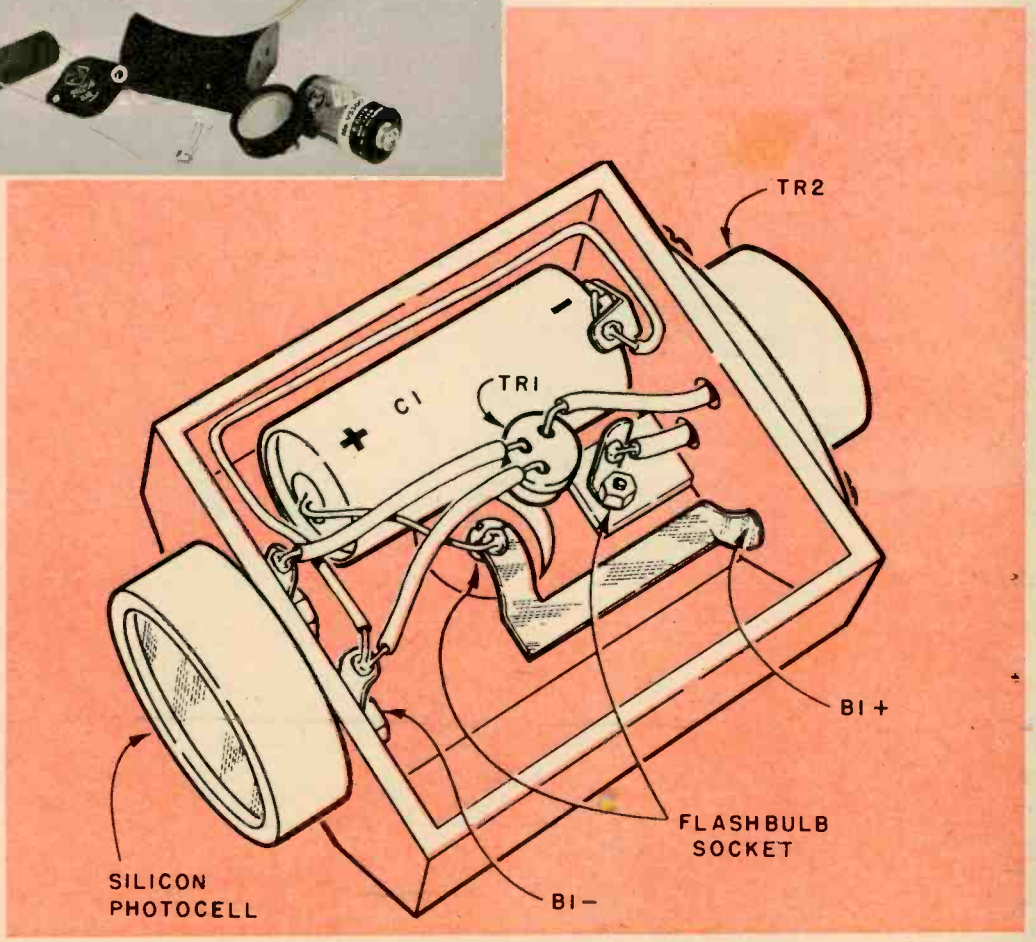
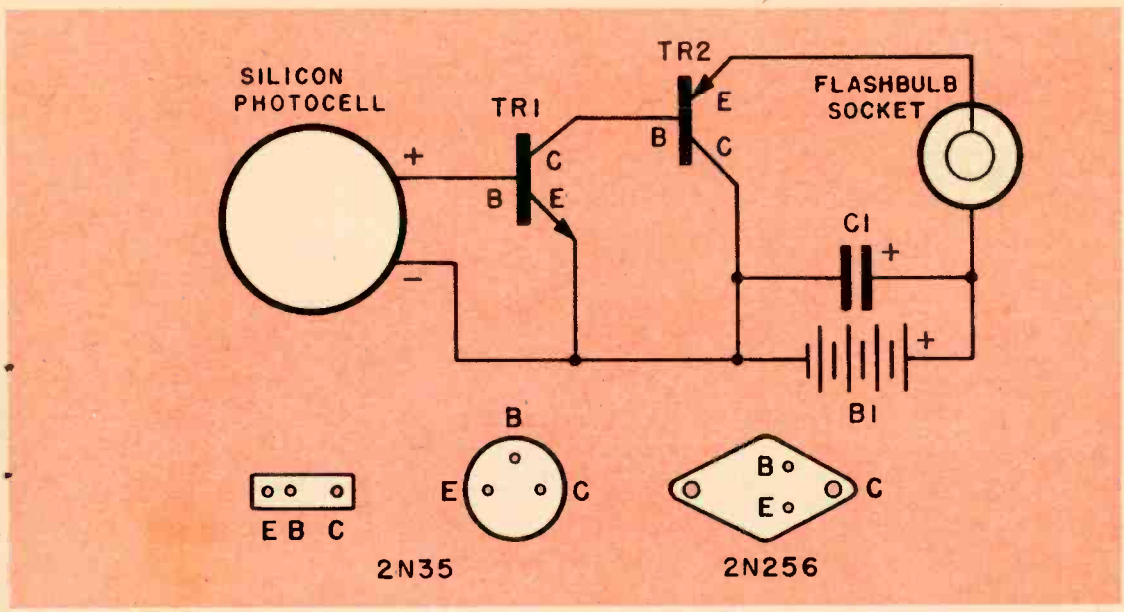


Photo of all the parts. Almost any small flashgun may be modified for the outside case, as is shown here.

Follow the wiring guide below. If a metal box is used, insulate TR2 with fiber washers, thin plastic.





PARTS LIST

Silicon photocell—International Rectifier SA5-M
TR1-NPN Transistor, 2N35
TR2-PNP Transistor, 2N256
C1-100 mfd., 25 v electrolytic capacitor
B1-9 volt battery, RCA VS300

answer. The few "remotes" or "slaves" on the market, however, have many disadvantages. Most of them are bulky and heavy, they require several batteries which are exhausted rapidly and, worst of all, they're just too expensive for most amateur photographers.

The best solution is to build your own light-actuated remote unit utilizing some of the newer electronic components to eliminate the objection of commercial models. Anyone who can solder two wires together can assemble his own remote flash unit in one evening without the least difficulty.

Five components, readily available from a local or mail-order electronic supply house, are connected to a flash socket to produce a light-actuated unit as dependable as the flashgun on your camera. The silicon cell is a new component that actually produces a small amount of electricity when exposed to light. This is wired to two transistors and powered by a small battery designed for use in transistor radios. The dark current of this circuit is essentially zero since the two transistors buck each other when there's no signal. The capacitor isn't absolutely necessary but adds to the dependability of the unit. It stores enough electricity from the battery to fire the bulb quickly as the battery gets weaker. The photocell won't produce enough current to fire a bulb under ordinary interior illumination since the amplified current through the flashbulb will be under five milliamps. The bright burst of light from the flashbulb on the camera, however, will cause well over 300 ma to blast through the bulb in the remote with a delay so slight they seem to fire together.

The components may be arranged as the space available dictates. The smallest of the aluminum Miniboxes is more than large enough. If you can find an old Kalart Compact flash gun you can make a handy little remote like the one shown in the illustrations. For that matter, almost any flashgun which uses two "C" or "D" size dry cells side by side offers enough space to house these components.

The photocell has two machine screws protruding from the rear for the positive and negative connections. It must be mounted so it faces the camera when the unit is in position with the reflector facing the subject to be photographed.

[*Continued on page* 91]

The ABC's of Electronics-4

By Donald Hoefler

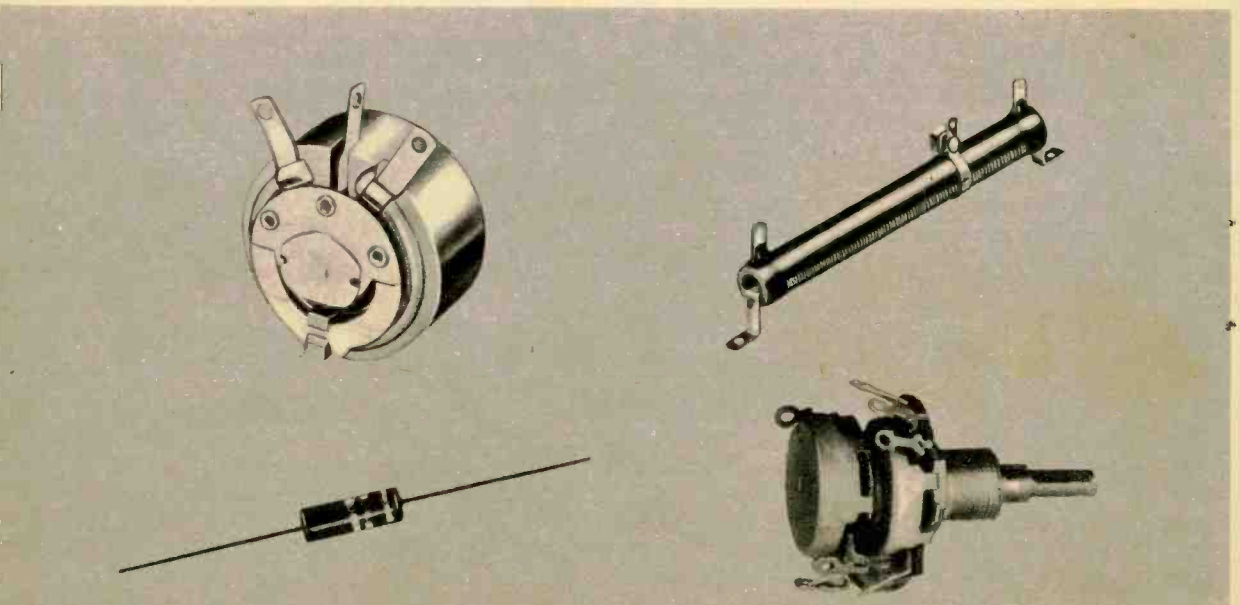
Part 4 in this series describes the basic types of resistors and how to use the various color codes.

THE resistor is one of the most commonly encountered components in electronic circuits. Its primary use is to convert electrical energy into heat energy. This heat may serve some useful purpose, as in the thermionic emission of vacuum tube filaments. It may be wasted where the purpose of the resistor is simply to provide a needed voltage drop.

The rate at which heat is produced when current flows through a resistor is expressed in watts. The heat production, and hence the power loss, is determined by the ohmic value of the resistor and the current flowing through it. The formula is $W=I^2R$, where W is the power in watts, I is the current in amperes, and R is the resistance in ohms.

The watts consumed by a resistor, often called the I^2R loss, appear entirely as heat. It is obvious then, that the larger the surface area of the resistor, and the freer the circulation of air around it, the more easily the heat can be dissipated. Thus,

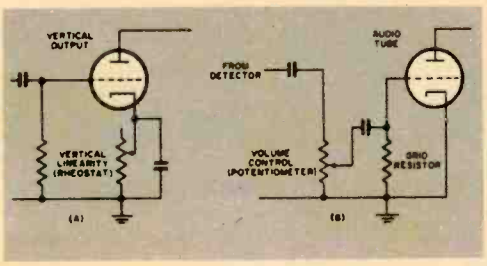
Commonly used resistors are shown here. At top left is a power rheostat by Clarostat, top right is an adjustable wire wound by Ohmite. Bottom left is a fixed composition IRC unit and bottom right, a Mallory dual potentiometer.



resistors are made in a wide variety of sizes, not only in terms of resistance, but also in the amount of power they can safely handle without danger of burnout. These ratings, however, are based on ideal conditions, and in a crowded electronic chassis conditions are never ideal. As a rule of thumb, when you are designing a piece of electronic gear, always specify a resistor rated at two to four times the actual power you expect to be dissipated.

Resistors may be either fixed, adjustable, or variable. The fixed resistor has an ohmic value that is constant. The adjustable type has a sliding contact that permits only a part of its length to be used. The variable resistor is similar to the adjustable type, except that adjustment is through a shaft or lever that is continuously variable. Two types of variable resistors are known as rheostats and potentiometers. The first noticeable difference is that the rheostat usually has two terminals and the potentiometer, three. The reason for the difference is that the rheostat is connected in a series circuit while a potentiometer is used in parallel.

The potentiometer controls voltage and the rheostat limits current. This is



Used in a TV set, the rheostat limits current while potentiometer acts as a voltage divider.

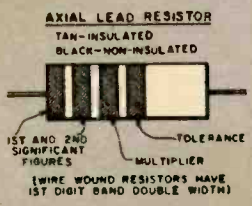
illustrated in the drawing, where two typical sections of a TV receiver are shown. A rheostat is connected in series with the cathode of the vertical output tube where it acts as a linearity control. By regulating the amount of cathode current the control determines the "operating point" of the tube.

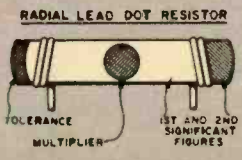
The other circuit shows a potentiometer used as a simple audio volume control. The resistive part of the potentiometer acts as a fixed load in parallel with the detector output. The voltage impressed across the grid resistor, how-

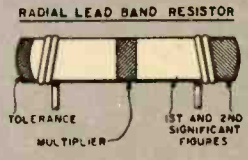
[*Continued on page* 102]

Solution to last month's Resistor problem on page 111.

By referring to this resistor body type and color code chart, resistor values may be determined.







Color	First Figure	Second Figure	Multiplier	Tolerance %
BLACK	0	0	None	—
BROWN	1	1	0	—
RED	2	2	00	—
ORANGE	3	3	,000	—
YELLOW	4	4	0,000	—
GREEN	5	5	00,000	—
BLUE	6	6	000,000	—
VIOLET	7	7	0,000,000	—
GRAY	8	8	00,000,000	—
WHITE	9	9	000,000,000	—
GOLD	—	—	0.1	± 5
SILVER	—	—	0.01	± 10
NO COLOR	—	—	—	± 20

EI assembles

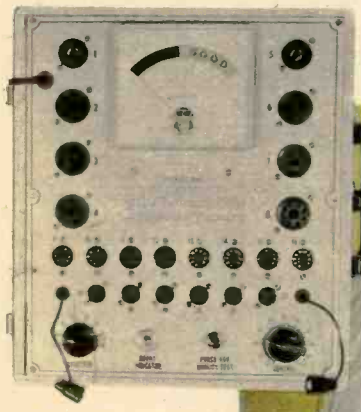
A Tube Checker Kit

The EMC 301 is a basic tool for troubleshooting—but be sure this model fits your particular needs.

THE prospective buyer of a tube checker is confronted with quite an array of sizes and shapes. The simplest type is conveniently carried in a hip pocket, with the more elaborate models comfortably parked on a bench in the lab. This month we built the EMC Model 301 to point up some of the advantages, and limitations, of a specific type. This unit, at $33.20, accents low cost and extremely simple operation.

Though it's a very uncomplicated piece of equipment, the manufacturer apparently didn't gear the instructions to the rank beginner. Various items such as resistor color codes, definite tie points, and wiring techniques are omitted. This probably will present no problems to the accomplished hobbyist, but might

[*Continued on page* 105]



Front panel of checker shows 4½" meter with three operating controls at bottom. The oak case, with handle, lends itself to portability. Over 375 different tube types may be checked.

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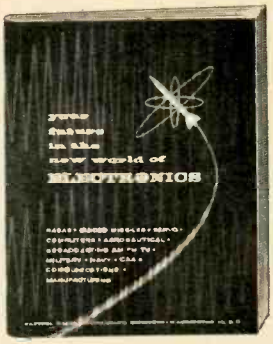

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- Model 77 completely wired and calibrated with accessories (including probe, test leads and portable carrying case) sells for only $42.50.
- Model 77 employs a sensitive six inch meter. Extra large meter scale enables us to print all calibrations 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.
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- 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.
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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.

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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.

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Model 77 comes complete with operating instructions, probe and leads. Use it on the bench—use it on calls. A streamlined carrying case, included at no extra charge, accommodates the tester, instruction book, probe and leads. Operates on 110-120 volt 60 cycle. Only **$42.50**

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Also Tests **SELENIUM AND SILICON RECTIFIERS, SILICON AND GERMANIUM DIODES.**

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

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

Now, Model 79, the latest SUPER-METER includes not only every circuit improvement perfected in 20 years of specialization, but in addition includes those services which are "musts" for properly servicing the ever-increasing number of new components used in all phases of today's electronic production. For example with the Model 79 SUPER-METER you can measure the quality of selenium and silicon rectifiers and all types of diodes—components which have come into common use only within the past five years, and because this latest SUPER-METER necessarily required extra meter scale, SICO used its new full-view 6-inch meter.

• **D.C. VOLTS**: 0 to 7.5/15/75/150/750/1.500. • **A.C. VOLTS**: 0 to 15/30/150/300/1.500/3,000. • **D.C. CURRENT**: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes. • **RESISTANCE**: 0 to 1,000/100,000 Ohms. 0 to 10 Megohms. • **CAPACITY**: .001 to 1 Mfd. 1 to 50 Mfd. • **REACTANCE**: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms. • **INDUCTANCE**: .15 to 7 Henries. 7 to 7,000 Henries. • **DECIBELS**: —6 to + 18, + 14 to + 38, + 34 to + 58.

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

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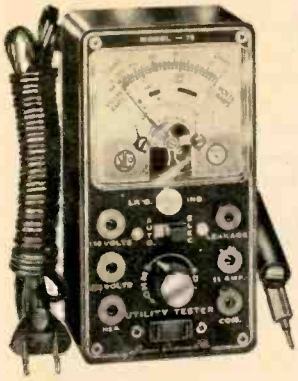

As an electrical trouble shooter the Model 70:

- Will test Toasters, Irons, Broilers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorescents, Switches, Thermostats, etc.
- Will test *all* TV tubes for open filaments, inter-element shorts, burned out tubes, etc. (Will not test TV tubes for *quality*. An emission type tester such as the model 82 described below, is required to test tubes for *quality*.)
- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakage, etc.
- Will measure current consumption *while the appliance under test is in operation.*
- Incorporates a sensitive direct-reading resistance range which will measure all resistances commonly used in electrical appliances, motors, etc.
- Leakage detecting circuit will indicate continuity from zero ohms to 5 megohms (5,000,000 ohms).

As an Automotive Tester the Model 70 will test:

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

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3. Press down the quality button—

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- Tests OZ4 and other gas-filled tubes.
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- Use of 22 sockets permits testing all popular tube types and prevents possible obsolescence.
- Dual Scale meter permits testing of low current tubes.
- 7 and 9 pin straighteners mounted on panel.
- All sections of multi-element tubes tested simultaneously.
- Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.

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

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Inside Russian Electronics

Continued from page 31

of metallurgy I saw something which we do not have, a microprobe.

Ques. *What is their attitude toward our electronics work?*

Ans. They have considerable admiration for the U.S. They feel we are their number-one competitors. We are the goal they are trying to achieve. Their statement that they were going to make good transistors in a couple of years would indicate that they have at least that much of a goal in mind.

Ques. *What do you think of their present transistors?*

Ans. We brought some back with us for testing. They were anxious for us to do that. Our tests show that their transistors seem to be about in the same status as ours were three or four years ago. They had chosen good models to copy.

Ques. *These transistors were copies of American models?*

Ans. Yes. They were essentially duplicates of GE transistors. They were germanium. But they were also making Bell diffused-base transistors, very nice high frequency units running well up to 100 megacycles.

Ques. *Do they seem to have sufficient manpower in their electronics plants?*

Ans. Yes. Their mechanization is relatively simple and their job breakdown is pretty good. On a whole they would compare, production-wise, reasonably well with American electronic factories. But there are many comparisons you could make with respect to working conditions which are not favorable. They don't seem to pay too much attention to safety, for instance. They work on dangerous machines but have no safety devices and they are completely indifferent to such things as holes in the floor.

Ques. *According to the April, 1958, bulletin of UNESCO, a well known Russian scientist, K. Klimenko, claims that "Russian industry will release 2,000,000 workers from dull and dangerous jobs by 1960," because they are moving that fast in automation. This would constitute a tremendous achievement in manpower conservation and would increase their production potential enormously. Based on what you have seen of Russian electronics, do you think this is an idle boast?*

Ans. No. Based on what I have seen, I'd say that they are fully capable of such an achievement.

Ques. *Before you had visited Russia, how would you have taken the above statement?*

Ans. As something in the order of propaganda.

Ques. *In general, were you surprised by what you had seen of Russian electronics?*

Ans. Very much so. It was much better than what I had expected.

Ques. *How do you account for the fact that you were surprised, since normally, one would expect scientists and engineers to keep up with developments in their field?*

Ans. The problem is that we had very few people here who had accurate information and at the same time could be listened to. There are also a large number of people who think they have to censor this kind of information.

Ques. *You mean in this country?*

Ans. Absolutely.

Ques. *In other words, channels of communication here have not been entirely comprehensive for technical experts?*

Ans. To say that they have been plugged is putting it straight. I understand that something like 50 tons of untranslated Russian technical magazines have been accumulating here since 1946.

Ques. *Isn't this largely due to the fact that most American engineers and scientists cannot read Russian and that getting all this material translated would have been an enormously expensive and time consuming undertaking?*

Ans. This is only partially true. Actually, many of these publications were not circulated here and then the translations, when made, were classified so that no one could read them.

Ques. *Has this channel of communication been unplugged recently?*

Ans. I have been told that it has, though I don't know for certain.

Ques. *How do the Russians keep abreast of developments in electronics?*

Ans. They read everything that is published. Nearly all scientists and engineers belong to a variety of technical organizations and they purchase foreign publications wherever and whenever they can. These are translated and circulated throughout Russia. If an issue of a technical publication is important enough it may be duplicated in its entirety and distributed directly and promptly. In one case, I learned that the copy of an American publication had a greater circulation in Russia than its original printing in the U.S.

Ques. *Did you notice many of our technical electronic publications and papers lying around in various plants and research laboratories?*

Ans. Oh yes. Often. In the Physics Institute in Moscow they have a complete file of such things as the Bell System Technical Journal and the Philips *Review*. They had the technical journals of French, German and Italian companies—I think there was no significant magazine in the field that they did not have.

Ques. *Where you surprised when you saw this?*

Ans. By this time, no.

Ques. *Did the Russians appear to be interested in the electronic developments in other countries?*

Ans. Yes—France and Germany particularly.

Ques. *Do you think our government should do all it can to try to make translations and abstracts of Russian technical literature available?*

Ans. Yes.

Ques. *As an overall observation, would you say Russian electronic developments are on a par with ours, above ours, or below?*

Ans. Below ours. But they are coming ahead fast in certain areas.

Ques. *How would you compare Russian electronic facilities and developments with what you have seen in other countries outside the U.S.?*

Ans. I think in general France, Germany and Italy are roughly on a par with the U.S. and considerably ahead of the Russians in manufacturing facilities and developments.

Ques. *What is your personal attitude now toward Russian electronic developments and electronic experts?*

Ans. I'd be strongly inclined to treat Russia as our equal in many respects. I would certainly not underestimate their electronic potential.

Ques. *If you went back to Russia five years hence, what outstanding achievements would you expect to see in the electronics field?*

Ans. In all likelihood, I think they might have a good color TV system and a good color TV network.

They certainly will have a much improved internal communication network with an effective microwave system.

They will probably also have a pretty fair transistor and semi-conductor industry, which will make their communications easier and more reliable.

Ques. *In which particular area do you believe Russia is strongest electronically?*

Ans. Right now they are particularly strong in those areas where pure theory gives them a real advantage—anything to do with applied mathematics, especially in the field of information theory and transmission of data. I believe they are far ahead of our own understanding in those areas. Their components, I believe, are somewhat slighted. But with them it is a problem of putting the best men to work on the areas where they think it will give the maximum return for a given period of time. Let me explain:

Their tendency has been to fix on what they thought would be about the best and most applicable component for a wide range of equipment, even though it might mean for ordinary commercial equipment an unduly expensive component. For instance we saw hermetically sealed capacitors used throughout in home TV sets. This is definitely not standard in the U.S.

Ques. *What do you believe an engineer in this country can learn from his Russian counterpart?*

Ans. Most of us here, I feel, are too prone to think of fine quarters and the best instruments are necessary for the accomplishment of scientific objectives. The Russians, on the other hand, have had to do in most cases with a bare minimum of available equipment. Creativity is essentially a state of mind.

I think a big problem of American

engineers is their feeling that all of the good ideas have originated only recently in the U.S. If American engineers were to start reading foreign technical literature they would soon find out what they have been missing.

I was astonished at the depth and breadth of Russian developments. I had been led to expect that we would see examples of a deep penetration in only very narrow areas. Actually, this is not what we found . . . I did not get the feeling that they had slighted anything to any extent.

Ques. *What are they aiming for in the future?*

Ans. Russia appears to have had one objective in mind for the last 25 or 30 years—to equal or surpass the United States in those areas which they considered sufficiently important.

In most of these areas I think they are in a position where they feel they have equalled or surpassed us.

Ques. *What should we feel about this?*

Ans. We must not fall into the trap of thinking that our objective is to equal or surpass the Russians. Rather we must continue to play the game in which we have been involved all the time: to satisfy the needs of the people at minimum cost.

If we can do this and do a better job than the Russians, then eventually we will come out all right.

I am reminded of a story about a newspaperman who was asked to explain why Willie Hoppe kept winning billiard championships. Said the newspaperman: "I think Willie Hoppe wins billiard championships because he plays billiards; the others keep playing Willie Hoppe."

Stereo On A Shoestring

Continued from page 40

The circuit of the amplifier includes optional volume controls since headphone listening doesn't really require them. If necessary, the gain of each triode can be set to the preferred level by changing the values of feedback resistors R1 and R4. The *higher* the value of the resistors, the *less* the feedback and hence, the *higher* the gain. Values of 1 to 4.7 megohms are about right. If the headphone response seems a little shrill and peaky, it can be flattened by adding 33 mmfd. capacitors across R1 and R4. The component values given in the schematic were arrived at after considerable experimentation and were judged to provide the best response for all types of recorded material.

The switch connected across the headphone terminals parallels the outputs for monaural records. If an LP only Power-Point cartridge (E-V 61) and 33⅓ RPM, single-speed motor is used, the switch is omitted.

The silicon diode used as a rectifier can provide far more current than the single amplifier tube requires. The silicon type was chosen because of its very small physical size and greater power demands that are going to be made on the rectifier when the two output tubes are added for loudspeaker operation. If you don't intend to add speakers to your setup, one of the small 25 ma. selenium rectifiers will be adequate. Other components in the parts list remain the same.

The turntable base can be constructed of scrap wood or a commercial one used. In either case, make sure there is enough room beneath the base to mount the amplifier. The turntable is less than $6.00, either single speed LP or a 4-speed model.

Note that the amplifier has an AC-DC type circuit with the chassis connected to one side of the AC line. Since the only exposed and possibly "hot" conductor is the phono shielding wire, it can be insulated with tape. (If control knobs are used, make sure their set screws are not exposed.) Recheck your wiring, and you're ready to go.

Set the stereo-phones into your ears and a Jamaican steel band is all about you hammering melodies from their oil-drum tops. A moment later, the Scots Guards with bagpipes march by you in review. The click of Flamenco castenets rouses "oles" as the dancers weave back and forth before your ears, to be replaced by the Dukes of Dixieland strutting down South Rampart Street.

This is the wonderful world of stereo. And next month we'll tell you how to get the rest of the family into that world, by modifying the amplifier so it will operate two loudspeakers.

Transistor Slave Photo Flash

Continued from page 81

If a metal box is used, a couple of composition shoulder washers will insulate the photocell terminals from the box. TR1 has three flexible leads which can be soldered directly into the circuit. Remember that heat will damage the transistor so, when soldering, hold the leads with a pair of pliers between the body of the transistor and the point of soldering to draw off the heat. TR2 is a power transistor with the collector connected to the case and the base and emitter connected to short stiff wires projecting from the case. If a metal box is used, this transistor can be mounted on the outside opposite the silicon cell and insulated with a thin sheet of plastic and shoulder washers. The same care to draw off the heat should be exercised when soldering its leads. Snap fasteners are available which fit the battery terminals. These aren't needed if you convert a Kalart flashgun. To do this, remove all interior fittings except the battery clip connected to the center bulb contact. Arrange the components as illustrated. Note that the capacitor, as well as the battery and the photocell, has positive and negative terminals. Polarity must be observed since a reversal will make the unit inoperative and ruin the transistors.

Double-check your wiring which should be insulated where necessary to prevent an accidental short circuit, insert the battery and you're ready to go. There are no adjustments. In use, there's generally someone available to hold the remote for you or a spring clamp may be attached so it can be fastened in position. There is no real need for the reflector to swivel since the whole unit can be turned upside down.

Notice the way the socket is wired in the circuit. With no bulb in place the battery is disconnected. Inserting a good bulb in the socket connects the battery through its filament to the rest of the circuit and turns it on. When the bulb flashes it's turned off again. This is one unit you'll never forget to turn on and off. Just don't leave a bulb in the socket when you're not using it.

The remote bulb generally will be flashed well before the bulb on the camera reaches its peak but, obviously, it lags behind by a very few milliseconds. This is probably of no significance. If, however, your shutter is closing before the remote bulb reaches peak light output use an SF or SM bulb (which peaks in five milliseconds) in the remote and a 5 or Press 25 (20 ms peak) on the camera. This combination will result in virtually simultaneous peak output from both bulbs.

Testing Your Rocket

Continued from page 77

throat area of the nozzle design, there is a tendency for the casing to remain within the rocket container of the thrust stand. (See pages 30 and 31 of "Build a Safe Model Missile," ELECTRONICS ILLUSTRATED, July 1958).

For the test, we will not measure thrust vs. time, but we will simply measure the maximum thrust of the small simple rocket that has been loaded as described in "Build a Safe Model Missile Part 2."

Now that the assembled rocket casing and nozzle together with the electrical squib and two cardboard disks have been inserted in the rocket container of the thrust stand, the angle indicator is now set to zero. You then retire to a safe distance and behind a safe barricade. (Design of this will appear in Build a Safe Model Missile Part 4.) The firing device (Build a Safe Model Missile Part 2) is then connected. The count-down procedure is then applied and, on the command to fire, electrical contact is made. This results in the electrical squib being fired which, in turn, ignites the mixture of potassium nitrate and sugar in the rocket. Hot gases then shoot out of the rocket nozzle resulting in the action. The reaction is equal to the action and is in the opposite direction causing the rocket container of the thrust stand to move to the right. This causes an angle to be indicated on the angle indicator. The tangent of this angle multiplied by the total weight of everything that moves equals the maximum thrust of the rocket tested.

Next issue: building a safe barricade and launching the rocket.

All About Stereo Hi-Fi Pickups

Continued from page 45

differences among the top units in this group, including the Grado, will be very small.

Another unit heard in the laboratory was the Weathers variable capacitance stereo pickup. This also is of extremely high quality, with mechanical impedance at an extreme low. Again, we must wait for production models before we can make useful evaluation.

Among the ceramic-crystal pickups, the Ronette stood out, as already indicated. But not by much. All of the ceramic-crystal units have the advantage of very high output, on the order of half a volt as against the 2 to 20 millivolts of the magnetics. With the Electrovoice, Sonotone, and CBS-Hytron units you will need an input load of 2 to 5 megohms to get full bass response. Most high fidelity preamplifiers have an input resistance of 100,000 to 500,000 ohms, and so you may need a simple resistor replacement at the "high-level" input if you are going to use one of the ceramic pickups.

This Grado arm was used in some tests.

It looks as though the stereo disc will not stumble over pickup troubles. We hope to make a more complete analysis in a later issue.

The Stereo Pickups Covered in Home Listening Test

Maker and Model No.	Price
CBS-Hytron Model SC-1	$24.25 Net
Elac (Audiogersh) "Stereotwin" Model 200	44.50 Net
Electrosonic "Gyro-Jewel" C-100	69.95 Net
Electrovoice Model 21D	19.50 Net
Fairchild Model 232 (XP-4)	49.50 Net
Pickering Model 371	29.85 Net
Ronette BF-40 "Binofluid"	18.60 Net
Shure Professional "Dynetic" Model M3D	45.00 Net
Sonotone Series "8T"	24.50 Net

Working The Transistorized Rig

Continued from page 51

call for dinner came, we indulged in an almost-forgotten sport, listening to 40 meter CW just for the fun of it. And it *was* fun, despite the fact that the volume was on the low side and the tuning dial (on C6) was a bit touchy. We copied long one-sided conversations about the start of the Maine fishing season, the difficulties of getting the chirp out of a home-made rig, as well as endless antenna coupling suggestions.

When the various bits of scratch paper were gathered together, we discovered that we had copied station calls from all of the east coast and well out into the midwest. Later, with a proper 40 meter antenna, we extended the range. The receiver picked up signals from every U. S. call area except W6 and W7 (perhaps we didn't listen hard enough!) as well as VE1, VE2, and VE3.

In working with the transmitter we used a 40 meter half-wave antenna. Unfortunately, our skywire is in a very bad location, about 25 feet up in a courtyard and close to a building with a steel structure. This, together with the 100 milliwatts mentioned by Mr. Todd, did not make us very optimistic about the results to be expected. To be sure that we would make at least one contact we opened up on 2 meters and raised K2AXS, a few miles away, asking him to listen for us on 7016 kcs.

This procedure, incidentally, was a switch on the way we did things ten or eleven years ago; then we called on 40 and asked our contacts to listen to our experimental 2 meter gear.

After a long series of "Vs" interspersed with our call, I went back to 2 meters to see if the little transistorized transmitter was working out. K2AXS gave us an unqualified 5-9-9. There had been a W3 on our frequency, but the 100 milliwatt peanut whistle wiped him out completely! K2AXS then went on 40 and we completed the QSO there.

The next contact was with K2BBO, also not too far from our location, who confirmed that local signals from the little rig, even with a poor antenna, were 5-9-9.

One check we wanted to make was to see how feasible it might be to work from a car. The car in question had a 20 meter loading coil at the base of its whip antenna, but it was available. Nevertheless, we made a local contact with W2BNW, who said that we were quite readable. Coupling the rigs to the whip proved to be quite a chore, as Mr. Todd had neglected to include an antenna change-over relay, probably because it would have drawn more current than both transmitter and receiver! We clipped a short length of wire to the center contact of the co-ax connector on the transmitter output link, ran this to a little knife switch and hooked the other side of the switch to the receiver. This meant that there was a slight unbalance in the transmitter antenna system, and the transmitter was in the circuit while the receiver was operating, but it didn't seem to matter much.

Now, to sum up, what is this flea-power combination good for? First, it might be better to state what it is *not* suited for. It is definitely not a practical first project for the novice; it requires some experience in construction and operation to get the most out of these rigs. Neither is this a good transmitter for the amateur who burns with frustration when his "CQs" are not answered every time.

Either of these rigs *is* the answer for the amateur who has become just a bit bored and wonders what to do next. For the experimenter, these little marvels offer a chance to go off on a tangent which is rewarding to the extreme in terms of satisfaction. Although there is no guarantee of "QSOs" (is there ever?) the rig is an ideal combination for the traveling man who would like to drop a wire out of a hotel window to try for a few contacts, but who doesn't want to carry an extra piece of luggage for his equipment. Ditto the operator who prefers CW, who motors a great deal, and who would enjoy a small rig to set up whenever he parks for a while in the country. Hikers and campers can pack the whole works without being overburdened. For all of the latter purposes, a half-wave (66 feet) of fine stranded wire with plastic insulation will wind easily on a typewriter ribbon spool to make a fine portable end-fed antenna.

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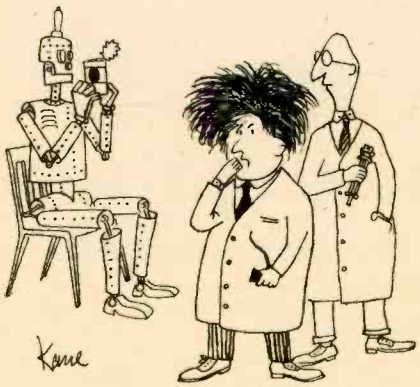
If we were to build this equipment for our own use—and the likelihood is that we will—we would, like any amateur, make a few changes. In the receiver, it would be worthwhile to experiment a bit with the values of L5, C6, and C7 to achieve better bandspread. The added audio stage suggested by Mr. Todd should be tried, as more volume would be welcome, if it didn't include too much added noise.

In the transmitter, we'd like to try a VFO; with this low power, every operating aid is useful. Also we'd try to adapt the final tank to a pi-network, or even add a pi-network coupler for using a random length antenna. But we don't feel that the added push-pull Class C stage to raise the power to about a watt would be worth the effort in terms of increased signal strength at the other station.

Physically, this station might be built better as one unit in two sections. Using a shallow chassis as a "cabinet," a two-piece aluminum panel would accommodate, on one section, the receiver, and on the other, the transmitter. Internal shielding would keep the circuits isolated. We would be willing to sacrifice some of the compactness of the receiver to give it the vernier tuning dial (on the BFO) it deserves. We would also add a simple antenna switching arrangement. Finally, we'd like to have a built-in tuning indicator for the transmitter such as a miniature milliammeter in the final collector circuit or the small pilot bulb mentioned by Mr. Todd.



"Frankly Boris, . . . I'm worried, this is the third one he's fallen in love with this week."

Buried Treasure

Continued from page 35

gear in the vicinity. The indication of its presence could conceivably be by any conventional readout, such as audio, a meter or oscillograph; the gear on our ship used a pen recorder.

The Search Begins

It was early on a bright Sunday morning when airship K-43 cleared Lakehurst tower and headed northeast to Fire Island, New York and the final resting place of the world's first ocean-going steamship.

We were nearing our objective now, for Fire Island was just a few miles to the northeast. Seeming to rise out of the sea, there lay before us a long, narrow strip of sand, just a mile or two off the south shore of Long Island; this was Fire Island. We knew the *Savannah* should be about a mile off shore, somewhere between Long Cove and the new bridge being built between Mastic Beach and the island.

We circled over Coast Guard Station No. 79, establishing it as our western landmark, and Captain Hanley gave instructions to Cdr. Star for sweeping the area. The airship dropped down to a few hundred feet and the search was on. Capt. Hanley had his chart and instruments at the navigator's table, and radioman Westhaver operated the MAD gear while rigger Pfeifer took over on the radio. Flight mechanic Potter had an after hatch open, ready to throw out smoke markers, and flight engineer Nadler kept a sharp eye on the softly purring engines.

The first sweep was less than a minute old when Westhaver sang out over the intercom, "contact!". Immediately Steve Potter heaved a smoke bomb over the side. Straight down it went, diving into the water with a splash, and then a moment later bobbed back to the surface. I lost sight of it as the airship continued on its way, and then about a half-mile back I saw a flash of fire on the water, followed by billows of smoke.

With Cdr. Star on the elevator control and Cdr. Burger on the rudder control, the ship was turned around and returned to the spot, where she hovered

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directly over the smoking marker below. Now began one of the most important phases of the operation. If divers were to know where to start digging through sand and silt, the exact positions of our contacts would have to be determined.

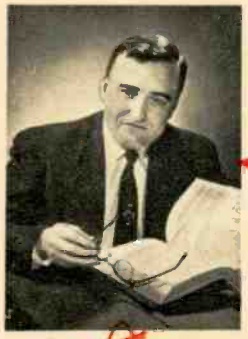
We could establish our position by radio direction-finder, but in this case it would be even easier to get visual fixes. Using the pelorus, Capt. Hanley sighted position lines on known landmarks, in this case the Coast Guard Station, the bridge, and a nearby radio tower. With these lines plotted on the chart, their intersection gave us our position, and the position of whatever was in the green water below.

On we went for several miles. Then just as we were about to circle around, the pen on the MAD recorder swung crazily, Westhaver hollered "contact!", and another marker went over the side. Once again we doubled back, hovered and waited while Capt. Hanley got a second fix.

In the third pass we got yet another strike. We continued. The fourth pass turned up nothing, but early in the fifth we got contact number four. I was aft now, and I tossed the fourth marker into the ocean. It wobbled on the way down, hit with a splash, and then just lay there. I thought I had tossed a dud, and was about ready to go over the side myself, when after an agonizing wait there finally appeared the now familiar flash on the water. Mr. Hanley got a good fix and we moved on. Four down, and I happily handed the bomb-tossing detail back to Steve Potter.

Shortly, another contact was sounded, another bomb sped for the water. Again we turned back for the fix, and again the MAD recorder pen went wild, to confirm the initial contact. Now it was five down and we were rapidly running out of search area. The captain decided to try one more sweep, however, and that turned up contact number six. It was a little remote from the calculated *Savannah* area, but worth plotting for the record.

At lunch I learned from Lt. Commander Jack Hannigan, Information and Recruiting Officer of the Unit, about the next steps in the *Savannah* search. Our part of the job was done.



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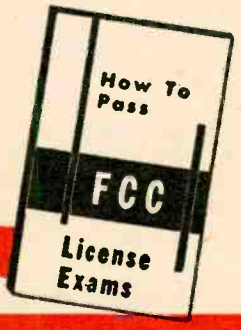

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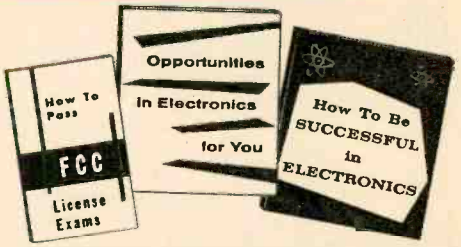

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EI-1

Soon, skin divers would head for the six wreck sites which had been found on earlier missions, and which we confirmed. Diving headquarters are the 105-foot yacht *Sea Owl*, owned by New York University and manned by cadets of the U. S. Merchant Marine Academy. Also scheduled to be on hand was *Huntress II*, of the Kings Point Trident Club of skin divers.

The divers would be equipped with aqua lungs, underwater magnetic detection gear, and coring equipment for sand samplings. After the samples are analyzed, the next step is probing with crowbars and finally, it is hoped, actual contact, salvage and identification. The success of their venture may even be known by the time you read this.

Electronics Controls The Turnpike

Continued from page 49

base repeater stations, located at 25-mile intervals along the Turnpike.

Obviously, because of the proximity of metropolitan areas, it is essential to concentrate the broadcasts along the axis of the Turnpike. With a 2-element broadside antenna using half-wave dipoles, a figure eight radiation pattern confined to the Turnpike right of way was achieved.

Another type of electronic equipment used extensively on the Turnpike is the radar speed meter. Operating on a frequency of 2455 megacycles, it detects the velocity of moving objects by utilizing the principle similar to that described in sound behavior as "the Doppler Effect." A transmitted signal strikes a moving car which changes its wavelength and reflects it back. The difference between the reflected wavelength and original indicates speed of car and is displayed directly on a meter and graph.

Turnpike electronic equipment is tested here.

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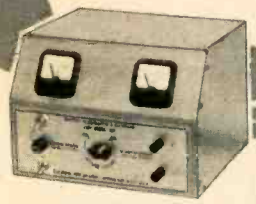

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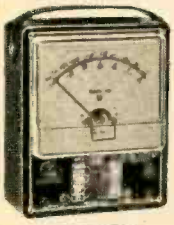

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Balance $5.00 for 4 mos.

The ABC's Of Electronics

Continued from page 83

ever, will depend upon the setting of the control. Let's assume that a signal of 2 volts appears across the full control. If the sliding contact is set at its midpoint, only 1 volt will appear between the slider and ground and be applied to the grid of the tube.

The commonest type of resistor is the carbon composition variety. Powered carbon in a suitable binding material is compressed into a tubular form, with wire "pigtails" protruding from either end. While the carbon resistor is the all-purpose workhorse of electronic circuits, it cannot be used for precision applications since its value can vary as much as plus and minus 20%. Where both high resistance and high accuracy are required the film-type resistor is used. A thin film of resistive material, either carbon, or a metal such as tungsten, is deposited on a length of insulating material. The form is glass, porcelain, or ceramic.

Most resistors, particularly of the carbon composition type, have their values indicated by color coding. Let's find the first figure on any of the common types of resistors. On the axial-lead type the end band of color tells the first figure. On the radial-lead types the main body color gives this information. If this color is blue, then from the table we see that the first figure is 6.

Proceeding to the second figure, we find that for the axial resistor it is shown by the color of the second band. For the radial types, the color is found at one end of the resistor. If both ends are colored, then one of them will be either silver or gold. Since neither of these two colors appears in the second figure column, they can be ignored for the moment. If the second band or end color is gray, for example, the second figure will be 8.

With the first two significant figures determined, we now find out how many zeros must be added to the first two digits to give the final value. The code color for this factor is found on the third band of axial resistors, and on a center dot or band on radial resistors. If this color is orange, there would be three

zeros and the value of our resistor is 68,000 ohms.

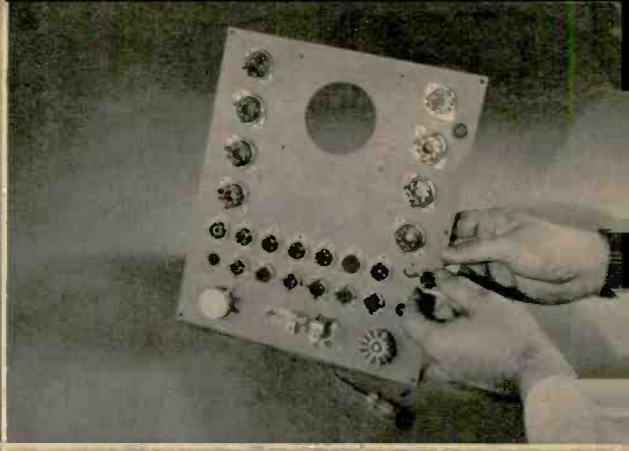
Further examination of the table shows that resistances as high as 99,000,000,000 ohms can be indicated by the code. But we haven't yet considered a way to handle values of less than 10 ohms. This can be done when we look at the multiplier column of the table from a slightly different angle. Doesn't this column really tell us where to place the decimal point? Consider our blue-gray-orange resistor again. If the third color were black, wouldn't it mean that the decimal point should come immediately after the first two figures, for a value of 68 ohms? And doesn't the orange tell us to move the point three places to the right, for a value of 68,000 ohms?

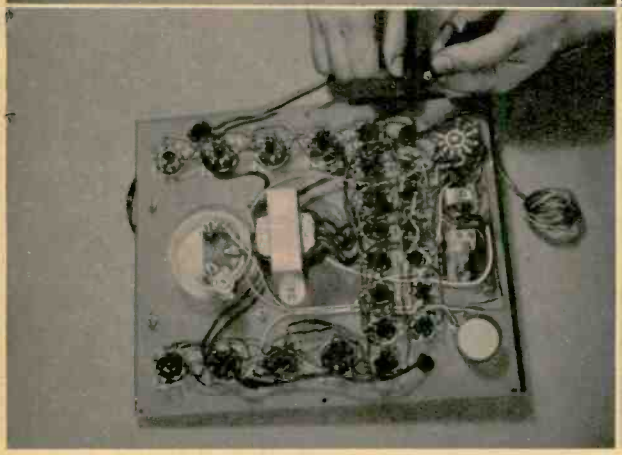
This being the case, there is no reason why we can't also move the decimal point to the left. For this purpose we have two additional numbers in the multiplier column, gold and silver. When the multiplier color is gold, it means that the decimal point should be moved one place to the left. For example, a blue-gray-gold resistor would have a value of 6.8 ohms. Similarly, a silver multiplier indicates that the point should be shifted two places to the left. Thus, a blue-gray-silver resistor would have a value of 0.68 ohm.

The colors gold and silver also serve a second purpose in our coding as well. This has to do with the tolerance, which is the percentage variation of the resistance from its assigned value. The color for tolerance is found on a fourth band on axial resistors, and on the remaining end of the radial types.

If the value by actual measurement is within plus or minus 5% of the assigned value, the tolerance color becomes gold. If the measured value is within $\pm$ 10%, the color is silver. If there is no color at all (other than the body color), the indicated tolerance is within $\pm$ 20% of the assigned value.

Although we are now familiar with practical forms of resistors and Ohm's Law problems regarding them, there are many types of complex circuits encountered where this method of solution is not adequate. We'll begin with this subject next month.





Upper left shows components supplied. The chart, seen in the top cover, may be changed periodically for new tubes.

Tube sockets, above, are oriented and installed. To help avoid error, the pin numbering appears on each socket.

The final stage of assembly, left, is wiring sockets. An adaptor at $4.50, may be added to test TV picture tubes.

A Tube Checker Kit

Continued from page 84

stymie someone building this as a first project.

Most of the actual construction time, about eight hours, consisted of running wires among the twenty-two tube sockets. Here, the drawings are straightforward and easy to follow. If the sockets are oriented properly, and correct pin numbers observed, virtually no difficulty should be encountered.

To avoid splitting the fragile meter case don't tighten the mounting nuts too energetically. Incidentally, the plastic meter cover is replaceable if it becomes cracked or badly scratched. The line cord should be knotted before it emerges from the front panel to take up the strain. Also, have some extra hook-up wire handy.

The operation of the completed model is simple. The chart is consulted for the settings of the "Selector" and "Control" knobs and the tube plugged into the indicated socket. After a 10 second warmup, the neon light remains on if the tube is not shorted. Depressing the "Quality" switch and reading the meter completes the test.

As tube checkers go, simplicity usually compromises some of their effectiveness. For this reason, the EMC 301 is useful only for particular applications. It appears to be a miniature version of the "self-service" emission type tube checker found in retail stores throughout the country that permit shoppers to test their own tubes. It is not sufficiently flexible to be recommended for the advanced hobbyist or repairman. Since many of the socket pins are tied together (to eliminate a bank of operating levers) only certain types of shorts will appear on the neon indicator.

However, the unit is effective if placed on a store counter to encourage the sale of tubes. The public's affinity for the "do-it-yourself" checker accounts for a sizeable chunk of today's tube sales.

Wire Your Patio For Sound

Continued from page 62

the speaker cabinet, you'll have to open the back of the enclosure and drill a hole to accommodate the control shaft. Mount it just as you would a volume control. With the pad you're using, you'll find a diagram for inserting it into the speaker line. Follow these instructions—they're simple and you can't go wrong. Then run a length of twinlead through the back of the enclosure, attach to your pad terminals, and close up the back. Measure off sufficient lead to reach the socket that you're going to plug into, then cut and attach the plug.

If you wish to use the second speaker, adapt it in exactly the same manner and plug it into the second outlet.

Now you're in business. Make sure your speaker or speakers are plugged in, controls at maximum. Turn up your hi-fi system to what you consider the normal listening level for inside, then go outside and listen to your patio set-up. You will probably have to play with the speakers for best results, but it's all a matter of taste. A two-speaker system should be arranged for best distribution of sound.

Back now to the inside:

Since you probably don't know the efficiency of your inside system compared to the outside, you won't know exactly how high to turn the amplifier volume for the best listening level outside. Therefore you may find that if the inside speaker is a high efficiency type it may blare at a deafening volume for proper outdoor speaker listening level.

It might be necessary, therefore, to install a cutoff switch for the inside system. Wire it according to the diagram and shunt a 5 watt resistor of the same impedance (ohms) as the inside speaker into the circuit when in the off position. This will keep the output match constant and prevent the accidental use of the amplifier with no load.

With the cutoff switch in the circuit, you can snap off the inside speaker. Then turn up the amplifier volume to a slightly high listening level for the extension system and mark the position of

the control for your future reference. Now you will be able to modify the volume of the outdoor system to your liking.

Now, let's take up the problem of tapping the amplifier output transformer. Since we know what the total impedance of the extension system is, we must be sure we take into account the inside speaker, which we have not yet done. We now can consider the outdoor system *one* value of impedance, since although the two speakers are in parallel, they feed from a common line. Use the procedure described to determine the total impedance of the entire system, inside and out, then tap the closest value of the transformer to prevent serious mismatch.

In the system described, the inside speaker has an impedance of 8 ohms. The outside, 2. We find that we have a total impedance in parallel of 1.6 ohms. Since we have no 2 ohm tap, we connect to the 4 ohm, which is close enough to prevent serious mismatch.

One last tip. If you install two coat hooks on each speaker—just screw them into the back—you can wind up the leads when you pack up the speakers. This will keep them out of the way and prevent them from getting tangled. —

Use The Sun For Power

Continued from page 71

lamps . . . but take care that the battery is not exposed to excessively high temperatures.

Transistorized receivers and amplifiers or similar equipment requiring 6 volts at moderate currents may be powered by the Solar Power Pack by connecting the accessory output cable between J2 and the equipment's battery terminals and throwing SW1 to the *Use* position. In addition, one or more of the charged cells (B1, B2, etc.) may be removed from the pack and used as fresh replacements in flashlights, small vacuum cleaners or fans, or similar types of battery-operated equipment. If you obtain a spare set of cells, you can have batteries both "in use" and "on charge" at all times. —

Ham Station Monitor

Continued from page 58

structed as described, using the listed parts and placement shown in the photographs, calibration of your finished unit should be reasonably close to the original model. For calibration purposes, a 0-100, 180 degree dial scale was secured that reads zero with C1 at minimum capacity. For convenience a paper scale could be hand drawn, with equal divisions from zero to 100. The scale is mounted on the face of the panel with C1.

Some variations in calibration will no doubt arise as these units are constructed by various readers. If the general outline is followed, no serious errors will be introduced. Dial calibration of the original unit reads as follows:

Low Frequency Coil
75 Meters 90-65
40 Meters 25-15
High Frequency Coil
20 Meters 45-55
15-10 Meters 20-15, 10-5

To use the station monitor as an absorption wavemeter for determining the frequency to which your oscillator, buffer, or final amplifier circuits are tuned, the pickup loop must first be inserted in the antenna jack (J). The tuning control C1 is adjusted approximately to the operating frequency of the circuit under test. Of course this circuit must be energized and tuned to resonance. The wavemeter is held so the pickup loop can be inductively coupled to the coil of the tank circuit whose operating frequency is being checked. Observe the

meter, taking care not to couple too closely to prevent driving the meter past its full scale reading. Rotate the tuning control until maximum meter deflection occurs. The frequency on the scale is the same frequency to which the tank circuit under test is tuned. This feature is extremely useful in aligning multi-stage transmitters and may also be employed to determine the frequency of oscillators. In coupling to an oscillator circuit it is necessary to keep the probe as far as possible from the oscillator coil to prevent pulling the oscillator off frequency as C1 is rotated through resonance. Of course, you must get close enough to obtain a reading and under such conditions the frequency indicated is only approximate. Couple only as close as necessary to give you a reading on the meter.

The field strength indicator is a valuable tool for determining that point of adjustment of your transmitter and antenna tuner which will put the maximum amount of power into the antenna. To use the station monitor as a field strength indicator substitute a suitable length of antenna in jack J1 in place of the probe. The sensitivity of the monitor may be adjusted to provide maximum readings at any desired point on the meter scale by lengthening or shortening the wire.

To check the modulation quality of your AM signals insert a high impedance headset into the phone jack and tune C1 for maximum signal strength. The loudness of the signal will depend on how long an antenna you connect to jack J1, as in the case previously mentioned when using the unit as a field strength meter. With this feature you can monitor your signals aurally as well as visually, and even record your signal quality on tape if you desire.

Remember that the station monitor is not intended to be a precision device but an absorption wavemeter that triples as a field strength meter and modulation monitor, three useful instruments in anybody's radio shack. After you've built this tri-purpose tool you'll know for sure if you've tuned up, loaded up, and spoken up, in true ham fashion.

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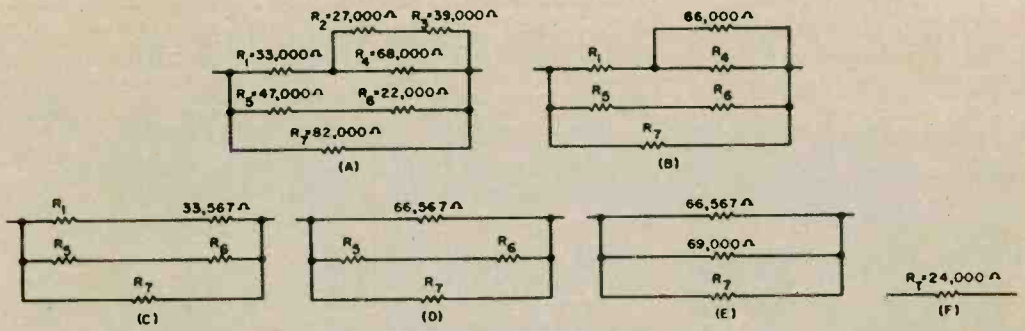
Solution of Resistor Problem From September ABC'S OF ELECTRONICS



R2 and R3 are in series, so the total resistance of that branch is 27,000 +39,000=66,000 ohms. The circuit thus simplifies to B. Now we can find the resistance of this branch when shunted by R4.

Since there are only two parallel resistors involved, we can use the simplified formula for finding the total resistance. In this case it becomes (66,000x68,000) ÷ (66,000+68,000) =4,488,000,000÷134,000=33,567 ohms. And the circuit simplifies again to that of C.

The top leg now has simply two resistances in series. We can quickly combine them by straight addition. Thus, the total resistance of this leg is 33,567+ 33,000=66,567 ohms. Then the circuit becomes that shown in D.

The middle leg similarly has two resistors in series, and when we add their values, 47,000+22,000 ohms, we get a total of 69,000 ohms for this path. The equivalent circuit at this point is simply three resistances in parallel, as shown in E.

Since there are more than two resistors involved, we'll have to apply the formula for parallel resistances:

$$R = \frac{1}{1/66{,}567+1/69{,}000+1/82{,}000}$$

$$= \frac{1}{0.0000150+0.0000145+0.0000122}$$

$$= \frac{1}{0.0000417}$$

$$= 24{,}000 \text{ ohms}$$

The total resistance of the entire group is approximately 24,000 ohms. We say *approximately* because the calculation has been simplified by rounding off in each case to three significant figures.

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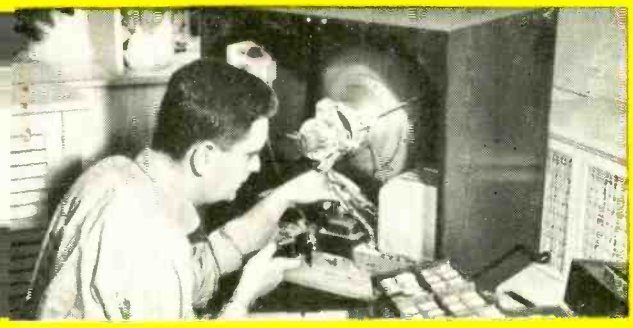

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- ☐ TOWN HALL CONCERT PLUS — Louis Armstrong
- ☐ LET'S DANCE with the THREE SUNS
- ☐ SOUTH PACIFIC — Original Sound Track
- ☐ FAMILY ALL TOGETHER — Boston Pops
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- ☐ MUSIC FOR DINING — Melachrino Orchestra
- ☐ BOUQUET OF BLUES...Dinah Shore
- ☐ SWEET 17..... ..Ames Brothers
- ☐ LET'S CHA CHA WITH PUENTE
- ☐ EYES OF LOVE....Hugo Winterhalter
- ☐ THINKING OF YOU.....Eddie Fisher
- ☐ MOONGLOW.....Artie Shaw
- ☐ IN A MELLOTONE....Duke Ellington
- ☐ VICTORY AT SEA..Rodgers' TV Score
- ☐ YES INDEED!.....Tommy Dorsey
- ☐ BLUE STARR ..... Kay Starr

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