

**EXCLUSIVE: Home-Built Electrostatic Speaker**

# POPULAR ELECTRONICS

JUNE  
1957

35  
CENTS

## Amplifier Peps Pocket Radios

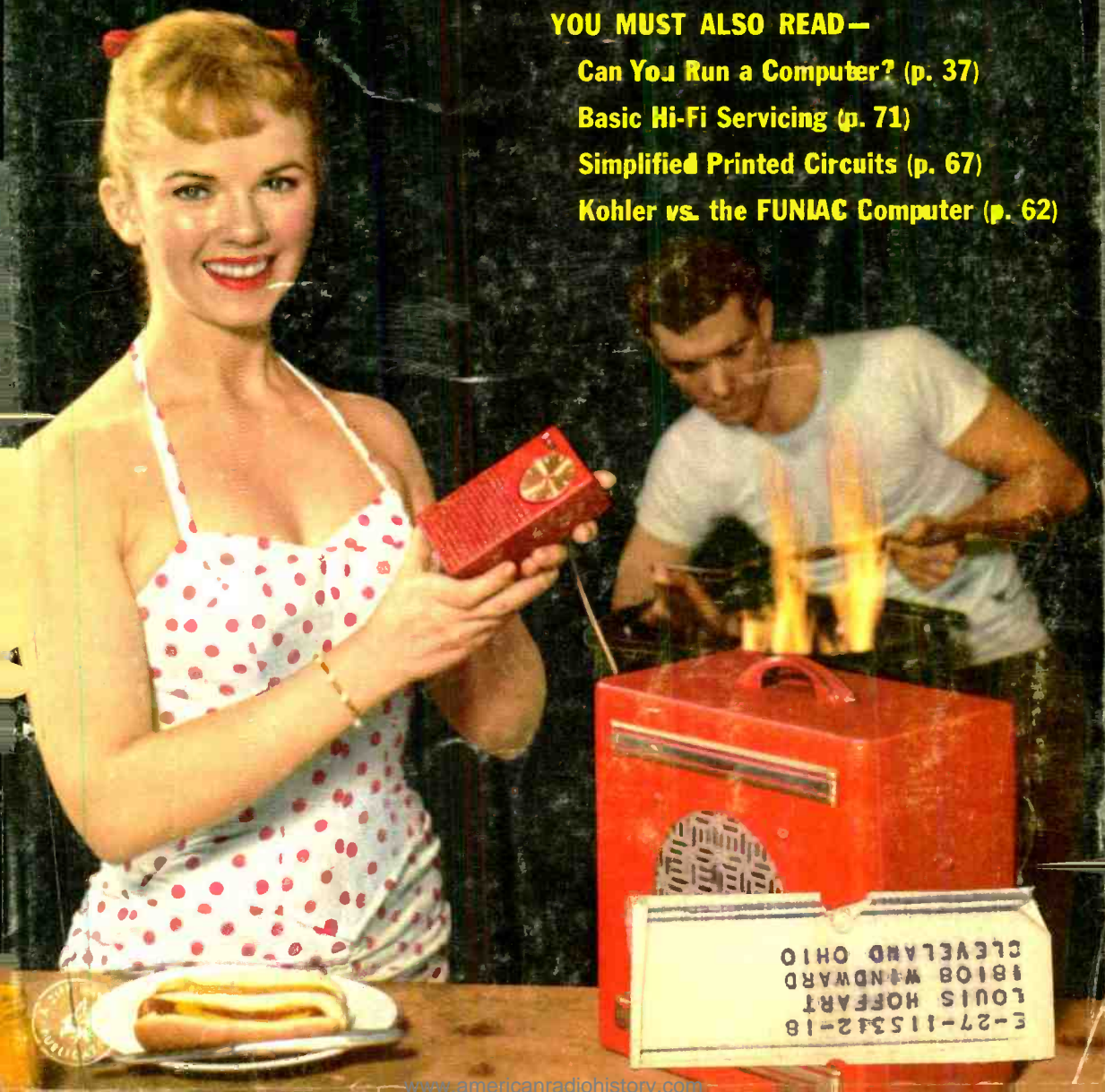
### YOU MUST ALSO READ—

Can You Run a Computer? (p. 37)

Basic Hi-Fi Servicing (p. 71)

Simplified Printed Circuits (p. 67)

Kohler vs. the FUNIAC Computer (p. 62)



E-27-115342-18  
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**NEW! NC-109**



BURTON BROWNE/New York

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SATURDAY, JUNE 29TH  
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C	4.7-15 mc	6.9-7.30 mc (40 meters)
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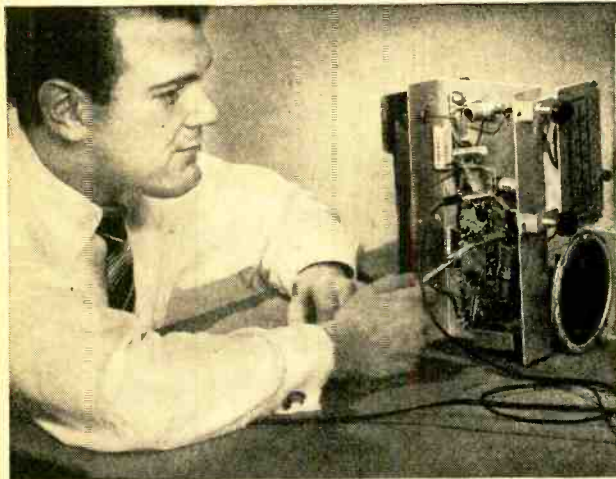


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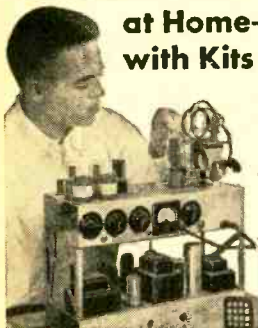
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# POPULAR ELECTRONICS

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1957

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POPULAR ELECTRONICS



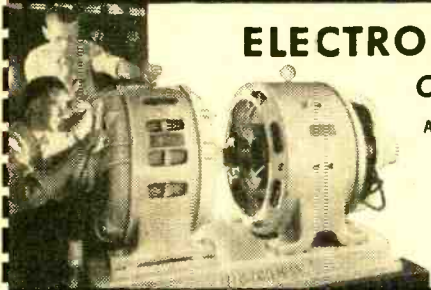


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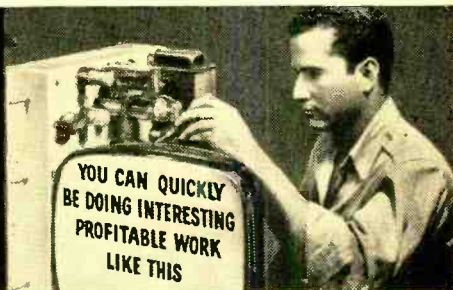
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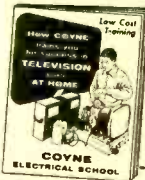
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This is the house  
that Jack built.



This is the clatter  
that came from the house  
that Jack built.



For all was the matter  
with the musical clatter,  
that came from the house  
that Jack built.

This was the platter?  
Which made all the matter  
with the musical clatter,  
that came from the house  
that Jack built.



Reviewing the data  
'twas not the platter  
which made all the matter  
with the musical clatter,  
that came from the house  
that Jack built.



*The difficulty was traced and  
was found to arise from the  
loudspeaker. It was promptly  
replaced with a Norelco FRS  
Speaker. And now...*

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and the maiden who's  
no longer forlorn.



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discovered the platter  
was not ere the matter  
that made musical clatter,  
that came from the house  
that Jack built.



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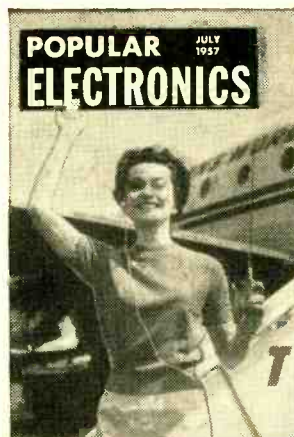
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## COMING NEXT MONTH (JULY)



(ON SALE JUNE 20)

Our July issue will provide interesting summer-time reading on a variety of topics. Most of the electronic construction projects will be kept to a bare minimum of components, so that they can be assembled in a few hours. For lazy reading, we will have several subjects to choose from, including a very enlightening piece on diathermy. The hi-fi authors will be active and have scheduled stories on turntable "bounce" and rumble, an ultra-miniature enclosure, damping, etc.

Our nomination for the most interesting article is the one illustrated on the cover—the "V.H.F. Ear."

## IN THIS MONTH'S RADIO & TV NEWS

JUNE

Geiger Counter with Transistor Power Supply  
Multiband FM Receiver  
One-Tube 10-Meter Transceiver  
A Reverberation Unit for Hi-Fi Reproduction—  
the "Xophonic"  
Batteries for Transistor Radios



*Lafayette*

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F-205—Less Case.....Net 19.49  
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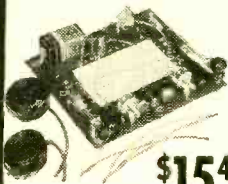


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Model Y-740. Net only ..... **\$11.75**

Y-746. Matching cabinet for above ..... **\$2.90**

Y-741. Long Wave Coil (155-470 kc) ..... **79c**

Y-742. 1.65-470 kc coil. Y-745. 7-17.5 mc coil } **Eq.**

Y-743. 2.9-7.3 mc coil. Y-744. 15.5-35 mc coil } **65c**



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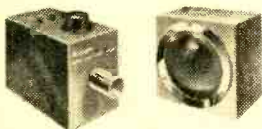


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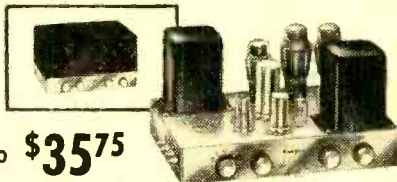
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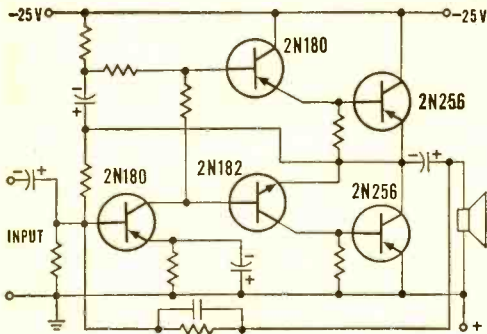
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By JOHN T. FRYE

### Out of the Depths

CARL AND JERRY were stretched out flat on their stomachs on a grassy bank peering down into the clear depths of an abandoned gravel pit. Swimming lazily around in the limpid water below were bass that would go four or five pounds at least. Every now and then Jerry pinched a bit of bread from the sandwich he was munching and flipped it into the water. Huge fish would dart toward the descending bread from all directions, only to turn disdainfully away as they saw what it was.

"These gravel-pit bass are the smartest fish in the world," Jerry said with conviction. "I've tried every lure in my tackle box on them, and I've even stooped to bait fishing; but I've never lifted one of those pot-bellied beauties out yet, nor have I seen anyone else do it."

"It's funny how they come from all sides when that bread hits the water," Carl remarked, rolling over on his back and throwing an arm across his face to shield his eyes from the warm June sun. "You'd almost think they had some way of talking to one another."

"Maybe they do. I was reading the other day where scientists—working with submarine detecting devices—had discovered that ocean-going fish, at least, are quite noisy. Croakers make grunting noises; shrimp make a noise like a Halloween rattle; other fish make barking noises. Maybe these fresh-water bass yell back and forth to one another down there when one of them spots something good to eat. Sound carries well in the water, you know; so a bass wouldn't have to holler 'come and get it' very loudly to be heard all over the pit."

"Hey! I'm getting an idea!" Carl announced, as he sat bolt upright.

"Just lie down and be quiet and maybe it will go away," Jerry suggested sleepily.

"No, listen: if we could get a recording of some of those bass telling their scaly chums that soup was on, and then if we played that recording back into the water where we were fishing—"

"Hm-m-m-m," Jerry said. "You're getting through to me. I've read that commercial fishermen record the feeding sounds of a school of small fish and play them back



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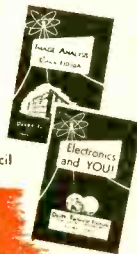
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**Carl & Jerry** (Continued from page 10)

into the water to attract larger fish into their nets. Of course, we'd have to have some way of powering the tape recorder—"

"I can lick that one," Carl interrupted. "The junk yard where I help the fellow fix up his car radios recently took in a wreck that had an inverter for powering a tape recorder in the car. I can borrow the inverter and a 12-volt battery any time I want to."

"So let's go!" Jerry said, scrambling to his feet. "The idea is just crazy enough to work; and even if it doesn't, it'll be fun trying."

This pretty well stated the philosophy behind the boys' electronic experimenting. No idea was too outlandish for them to try, and the fun they got out of it was entirely independent of how the experiment turned out. What's more, they were steadily stockpiling electronic experience that would be invaluable to them in later years.

**I**N LESS THAN AN HOUR they were back at the edge of the pit. The recorder, inverter, and storage battery had been transported in a wheelbarrow pushed by Carl and "steadied" by Jerry.

"I'm not going to risk a good microphone on this experiment," Jerry announced, pull-

ing a limp red rubber balloon from his pocket. "I think I can seal up the mike in this balloon so water can't get in, but you never know. This cheap crystal mike cartridge may not be perfectly flat in its response, but it has a very high output and it's expendable. I'll just slip it down into the balloon and tape the rubber neck very tightly around the mike cord with this thin plastic tape, like so. That does it. Let the mike down into the water so the fish can be getting used to it while I connect up the power for the recorder."

It didn't take long to connect up the inverter so that it could change the 12 volts d.c. of the battery into 117 volts a.c. for powering the tape recorder. When the tape machine was switched on, the reels revolved in normal fashion.

"Guess we're ready," Jerry announced. "I'll run the gain wide open; that way we'll get the faintest possible sounds down on the tape. You toss some bread crumbs in so they'll settle right down past the mike, and we'll see what the finny dwellers have to say."

Carl did as directed. The fish came rushing toward the location of the microphone and then turned away just as before.

"This tape is going to be a doozy to edit," Carl reflected as he stared down at the submerged microphone. "How are we going

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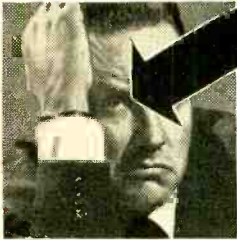


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**Carl & Jerry** (Continued from page 12)

to know, by listening, when the fish stop saying: 'Oh looky; there's a goody;' and when they start saying: 'False alarm! It's just an old piece of bread?'"

"You've got a point there," Jerry admitted; "but let's worry about that later. I'm going to rewind the tape now and see what we've got."

**W**HEN THE BEGINNING of the tape was played back, the results were disappointing. Only some very faint rubbing, swishing sounds could be heard.

"All I've got to say," Carl remarked, "is that those bass may be large-mouthed, but they certainly aren't loud-mouthed."

"Maybe we'd better try it again," Jerry suggested, reaching for the tape-movement knob. At the very instant he touched it, there came faintly from the speaker the unmistakable meowing of a cat.

"Holy cow!" Carl exclaimed, shading his bulging eyes and looking down at the microphone still dangling in the water. "I didn't see any catfish down there."

"Get hold of yourself!" Jerry commanded, although he was visibly shaken himself. "Catfish don't make sounds like cats—or at least I don't think they do. Maybe that sound was already on the tape and wasn't perfectly erased. Just a minute. I'm going to put this thing on 'Record' and switch the monitor speaker in so we can hear what's being put on the tape. That way we can tell if we *are* actually picking up the cat on the submerged mike."

He did this, and sure enough, the meowing came from the speaker. When the volume control of the recorder was turned down, the sound disappeared, no matter how carefully the boys listened. Jerry turned the gain of the recorder amplifier back up and Carl carefully lifted the mike from the water. At the instant the microphone broke surface, the meowing sound in the speaker stopped, only to be followed quickly by a feedback howl. By switching off the monitor speaker and dunking the crystal microphone in and out of the water, they soon produced a recording which showed plainly that the sound of the cat was heard only when the microphone was immersed.

"We've got to think this thing through," Jerry announced as he switched off the recorder to save the storage battery. "It simply *must* have a logical explanation—having nothing to do with cat-ghosts or meowing fish. That sound must be coming from a real cat, and that cat must somehow be alive down there in the water."

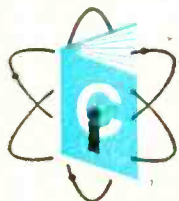
"Nice reasoning so far," Carl applauded sarcastically; "now all you've got to do is

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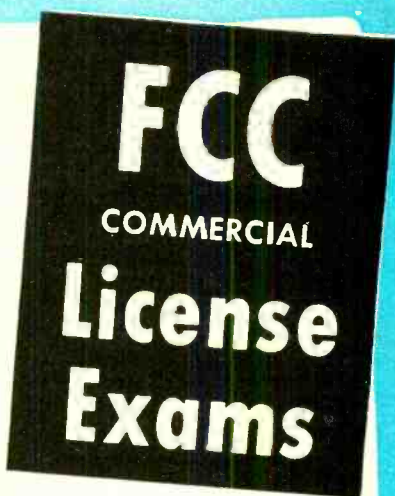
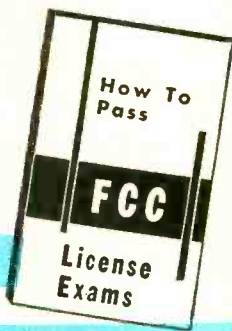


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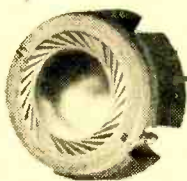
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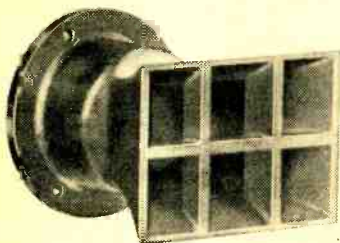
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L1 Pressure Unit



\*For those interested in the detailed performance above 22,000 cycles, references to the acoustical textbooks which contain charts and data on the L1 Pressure Unit will be provided.

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## Carl & Jerry (Continued from page 14)

explain how a cat can live under water."

"While I'm thinking about it, let's try something else," Jerry suggested. "Let's load the recorder into that old boat down there and row around over the gravel pit while we listen. If we can tell what part of the pit the sound is coming from, that may help."

**I**T DIDN'T TAKE THEM LONG to set up the recorder and its power supply in the mossy old boat. They left the monitor speaker on while they slowly and quietly moved around the small pit. It only took a very short time to establish definitely that the sound was much louder when they were on the side next to the road.

"Try letting the microphone down near that oil drum lying on the bottom," Carl suggested, using the oars to ease the boat into position directly over the drum.

Jerry let the microphone down until it was actually resting on the top of the drum some eight or ten feet below the surface. As he did so, the sound of the meowing became very loud.

"There's a cat inside that barrel!" Jerry said in amazement.

Carl didn't say anything. He kicked off his shoes and socks, pulled the sweat shirt off over his head, and then stood up, unbuckled his belt and stepped out of his trousers. Wearing only his shorts, he slid over the side of the boat and handed his glasses to Jerry as he said:

"I'm going down and tie the anchor rope around the drum. Then I'll come back up and help you pull that thing out on the

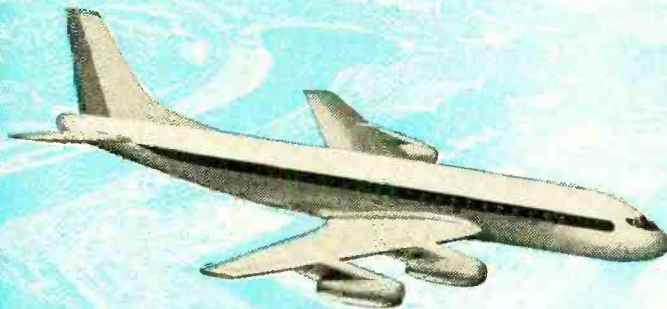


... By dunking the microphone in the water, they soon produced a recording which showed that the cat was heard only when the mike was immersed ...

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## Carl & Jerry (Continued from page 16)

bank, and we'll see what gives. A cat can't last too long inside there."

As he finished speaking, he let go of the side of the boat and started swimming down to the barrel with the anchor rope trailing behind him. It took two or three dives, though, before he was finally able to tie the rope around the middle of the drum.

As soon as he was out on the bank, the boys started pulling on the rope. The metal barrel came up easily until it reached the surface, but then Carl and Jerry had to pull with all their might to get it out on the bank. They discovered it was really a grease drum with a tight press-on lid.

Once the drum was out of the water, the boys could hear the distressed yowling of a cat inside very plainly, and they lost no time in prying off the lid. As they did so, a very black, very bedraggled cat shot out of the opening as though it were jet-propelled and sailed right up the trunk of the nearest tree. There it perched in the crotch of a limb, glaring down at its liberators with a pair of angry golden eyes.

"**T**LL BE DARNED," Jerry said, peering down into the drum. "This thing has a lot of old junk iron in it. No wonder it was

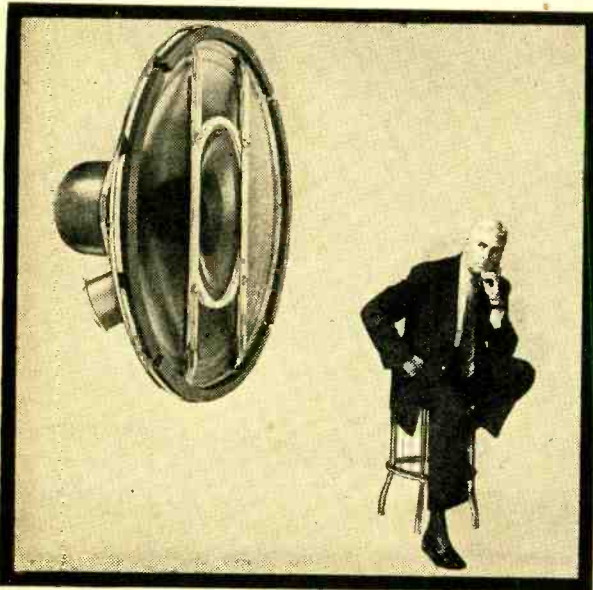
so heavy. There's a hole punched in the bottom that let in enough water to allow it to sink. Fortunately for Mr. Cat, it sank with the hole down; so a pocket of air was trapped in the top of the drum. That, plus the fact that he could keep out of water on the old iron, was what saved him."

"How on earth did he get in there in the first place?"

"Some poor excuse for a human being put him there," Jerry said, his normally good-natured round face solemn with anger. "The miserable joker was probably getting this barrel ready to haul out here to the pit, and he just picked up the cat, tossed him inside and clamped on the lid. He must have thrown the drum into the pit while we were getting the recorder."

"I think I'll take that cat home with me," Carl announced. "I'd sort of like to prove to him that not everyone is as mean and ornery as the person who put him into that barrel. He doesn't look too friendly but maybe a little warm milk will win him over. Wonder what we should call him?"

"Well, considering that a cat is supposed to have nine lives, and thinking about what would have happened if we hadn't picked this precise spot at this exact time to make our underwater recording, why not call him Eight-to-Go?" Jerry suggested. -30-



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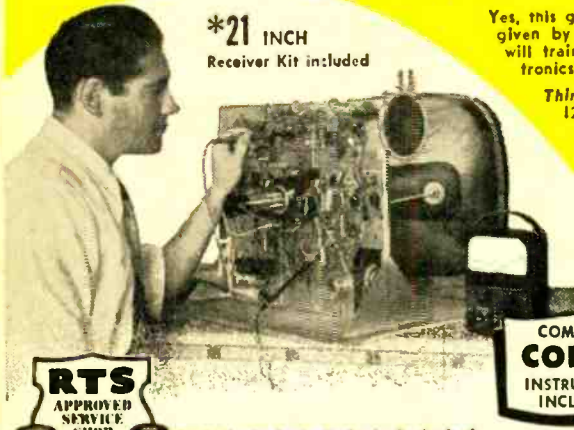
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## BOOKSHELF

"HANDBOOK OF SOUND REPRODUCTION" by Edgar M. Villchur. Published by Radio Magazines, Inc., Box 629, Mineola, N. Y. 218 pages. Hard cover. \$6.50.

We are always partial to magazine articles that eventually find their way into print as a part of a book. Since the chapters can cover a complete topic, they are frequently easier to read and digest. This is the case with Ed Villchur's long-awaited handbook on sound from the technician's and engineer's viewpoint. It is presented in an interesting, spritely fashion, maintaining a steady pace but not skipping any necessary facts or figures.

*Recommended:* If you missed the individual parts of the series as published in *Audio* magazine, you will find this book an important and valuable addition to your library. The serious hi-fi fan can do no better than have this book in place of many pseudo-scientific hi-fi paper backs.

☐ ☐ ☐  
"RCA RECEIVING TUBE MANUAL, RC-18." Published by Tube Div., Radio Corporation of America, Harrison, N. J. 352 pages. Soft cover. Price, 75 cents.

Like its preceding editions, the current issue of this manual is comprehensive and authoritative. Revised, expanded, and brought up to date, the book contains technical data on more than 575 receiving tubes, including TV types. In addition, it covers theory and circuit applications in easy-to-understand style. The section on applications has been broadened to include TV information. Circuits presented, using some of the tubes described in the manual, include those for a code practice oscillator, various receivers, and hi-fi units.

*Recommended:* to all those who are actively interested in electronics.

☐ ☐ ☐  
"VHF HANDBOOK" by William I. Orr and H. G. Johnson. Published by Radio Publications, Inc., Danbury Road, Wilton, Conn. 210 pages. Soft cover. \$2.95.

Something on the order of 18% of all radio hams operate their equipment in the v.h.f. spectrum. Up until this moment,





Bell Laboratories researchers Henry S. McDonald, Dr. Eng. from Johns Hopkins, and Max V. Mathews, Sc.D. from M.I.T., examine magnetic tape used in new research technique. Voice waves are converted into

sequences of numbers by periodic sampling of amplitudes, 8000 samples per second. General purpose electronic computers act on these numbers as a proposed transmitting device might.

## They send real voices on imaginary journeys

In their quest for better telephone service, Bell Laboratories researchers must explore many new devices proposed for the transmission of speech signals. For example, apparatus can be made to transmit speech in the form of pulses. But researchers must always answer the crucial question: how would a voice sent through a proposed device sound to the listener?

In the past it often has been necessary to construct costly apparatus to find out. Now the researchers have devised a way to make a high-speed electronic computer perfectly imitate the behavior of the device, no matter how complicated the device may be.

The answer is obtained without building any apparatus at all.

The researchers set up a "program" to be followed by the computer. Actual voice waves are converted into a sequence of numbers by sampling the waves 8000 times per second. Numbers and program are then fed into the computer which performs the calculations and "writes out" a new sequence of numbers. This new sequence is converted back into real speech. Listeners hear exactly how well the non-existent device could transmit a real voice.

With this novel technique, new transmission ideas are screened in only a fraction of the time formerly required. Thus valuable time and scientific manpower are saved in Bell Laboratories' constant search to provide still better telephone service for our subscribers.

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however, there has been no book especially devoted to the problems of receivers, transmitters, and antennas for the v.h.f. frequencies. These hams have been depending upon partial information published in other handbooks which also cover the lower frequencies. Personally, we feel that Bill Orr's latest handbook (his first one deals with beam antennas) is a refreshing breath to a part of the hobby that has suffered from lack of comprehensive published information. He has packed this book with plenty of facts and has rounded it out with good discussions on propagation and test equipment.

**Recommended:** to all hams and Novices (don't forget 2-meter phone), and to those wanting some insight on v.h.f. circuitry problems and their solutions.



"TV—IT'S A CINCH" by E. Aisberg. Translated from the French by Fred Shunaman. Published by Gernsback Library, Inc., 154 West 14th St., New York 11, N. Y. Soft cover. 224 pages. \$2.90.

From the transmitting studio to the picture tube in your receiver at home, the technology of television is covered in breezy dialogue form between two characters—Will (who asks the questions) and Ken (who answers them). The result is a popu-

larly written treatise on video which covers the points most likely to be raised by anyone interested in the subject who has a background in basic electronics. The text is amply illustrated with clever drawings that amuse as they instruct.

**Recommended:** as an excellent introduction to the subject of television.

### Free Literature Roundup

Which tape to use for a specific recording job is the subject of a small folder available from Minnesota Mining & Manufacturing Co., Dept. M7-56, St. Paul, Minn.

A representative selection of test equipment is described in Bulletin No. 2058, issued by the Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.

Low-cost speaker systems and other hi-fi equipment are listed in Brochure HF-250. Write to Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y., for a copy.

"Speaking About Loudspeakers" is a 32-page booklet written for the layman. Send 10 cents to cover mailing and handling costs to University Loudspeakers, Inc., 80 South Kensico Ave., White Plains, N. Y., and you'll receive your copy.

-30-

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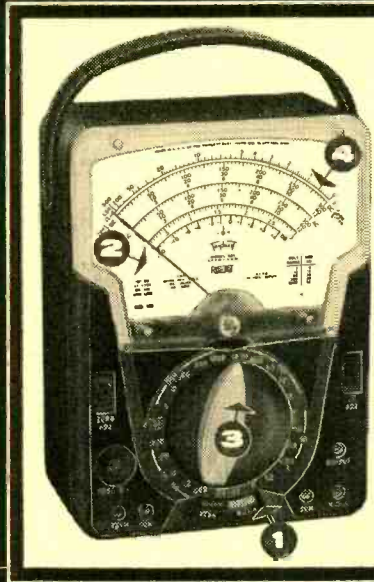
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# LETTERS FROM OUR READERS

## Citizens Band DX

■ I want to let you know how much I appreciate POP'tronics. I think it's the finest for fellows who are interested in radio but may not want to bother with a ham license. I particularly enjoy the Citizens Band on 465 mc. and would like to hear of DX contacts on this frequency.

A. J. COLELLA, 2A2101  
541-18th Street  
Brooklyn 15, N. Y.

## Vokar Improvements

■ A few experimenters may find it valuable to make some changes suggested by the Vokar Company after publication of my article in the May 1957 issue, page 63.

Make TR1 a 2N113 instead of a 2N136.

Make R1 39,000 ohms instead of 6800 ohms.

Make R2 18,000 ohms instead of 6800 ohms.

Make R10 18,000 ohms instead of 100,000 ohms.

Add a new resistor (2700 ohms) from lug 1 of T2 to circuit ground.

FRANK TOOKER  
Lakehurst, N. J.

## Clubs Asking For Help

■ Your POPULAR ELECTRONICS is avidly read by many young boys who are training in our Social Service Squad. This organization is the only one of its kind in London, and is a club built by its members, rendering any type of public service to the community. All members are under 18 years of age. Our home-built radio station repairs radio receivers free of charge for the disabled and aged.

If there are any similar organizations in the USA, we would be indeed happy to hear from them.

JAN FOSTER  
Springfield Social Service Squad  
Training Center 10a, Big Hill  
Clapton, London E.5, England

■ We have just started a hi-fi club for our students. Our treasury consists of dues alone and we were wondering if your readers might have some back issues of POP'tronics that they could send us. I think we would be able to pay postage from anywhere in the USA.

NORMAN METHOT  
Tantasqua Regional High School  
Sturbridge, Mass.

## Cost of Projects

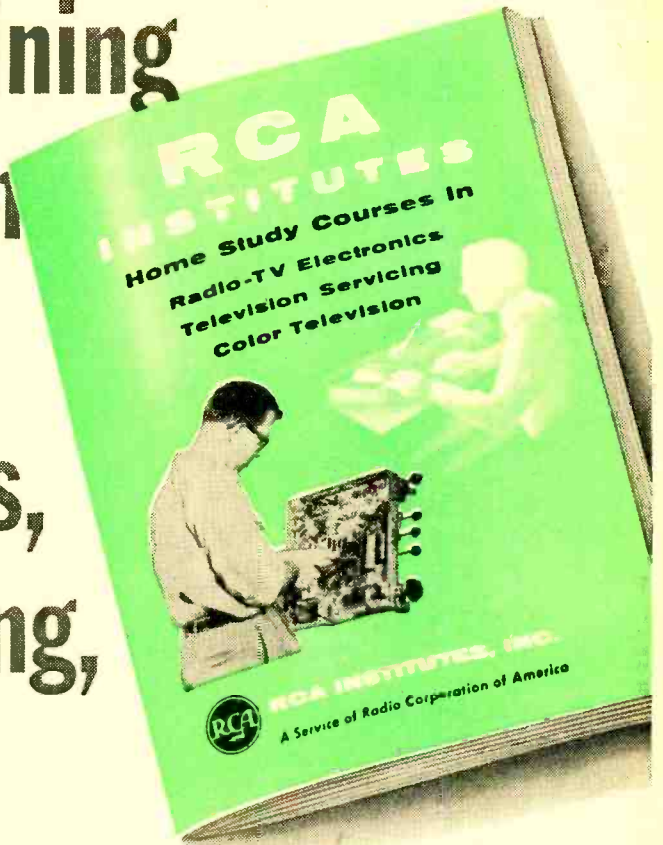
■ I am writing to congratulate you on a very fine magazine. I especially enjoy the experimenter and ham sections. The only improvement I can suggest would be to re-continue the estimated price of the projects in construction articles. I noticed that you did this some time ago, but apparently stopped.

DAVE MILLAR  
University City, Mo.

Dave, you have a good point there, but unfortunately it just didn't seem to work out in (Continued on page 28)



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**"... beautiful simplicity ... good graded instructions."**

## TECHNICIAN

"I am very happy to say I have derived many hours of entertainment as well as education from this instrument."

T/Sgt. W. B., USMC

## ELECTRONICS AMATEUR

"I have purchased your kit and have become greatly interested in electrical brains. I want to thank you for the infinite amount of knowledge contained in this moderately priced kit."

W. P., Cleveland, Ohio

## EXPERIMENTER

"I am enjoying the 'GENIAC' kit and have been trying to design new circuits in my spare time."

L. S., Fontana, Wisconsin

## HOME STUDENT

"You have an ingenious design of beautiful simplicity accompanied by good graded instructions."

A. S., Cleveland, Ohio



**"... our son has found ... enjoyment and knowledge."**



"I am very delighted with my kit and we boys here at the dormitory at York College who are planning to become engineers are having a very interesting time assembling the various machines."

B. B., York, Nebraska

"Our son has found considerable enjoyment and knowledge working with this kit."

Mrs. S. S., Havertown, Pa.

"My son has enjoyed your GENIAC and I feel that this kit is an ideal arrangement for giving anybody the basic ideas for the principles of computers."

P. M., Electrical Engineer and Instructor, L. A., California

## COLLEGE STUDENT

## HIGH SCHOOL STUDENT

## FATHER AND SON TEAM

**"... you have a fine teaching instrument."**

## INTERNATIONAL EDUCATOR

"We believe GENIAC will serve a useful purpose as a training aid in our ICA technical assistance mission with the Turkish Ministry of Education in the field of technical education."

W. V., Program Chief

## ELECTRICAL ENGINEER

"I am a former electrical engineer (now a physician) and I was delighted to read your instructions and see the way your apparatus is put together. I think you have a fine teaching instrument."

J. M., Baltimore, Md.

## MATH DEPARTMENT HEAD

"I am interested in your 'GENIAC' kit both for my own school and for possible wider use in the city."

W. M., Chairman of Math Dept., Brooklyn, N. Y.



## Advanced Courses in Computer Operation

### DIGITAL COMPUTER COURSE

Shows how to set up and build computers and experiment with pulses, gates, storage, add, subtract, multiply, design circuits. Manuals, wiring diagrams and texts provide a complete introduction to theory and practice.

Course C-2..... **\$28.00**

### ANALOG COMPUTER COURSE

Lists sources of materials parts, theory and practical instructions plus wiring diagrams and schematics for adding, multiplying, integrating and differentiating; gives practice in calculating scale factors, choice of time scales, machine equations and block diagrams.

Course C-3..... **\$28.00**

### ELECTRONIC MEMORY COURSE

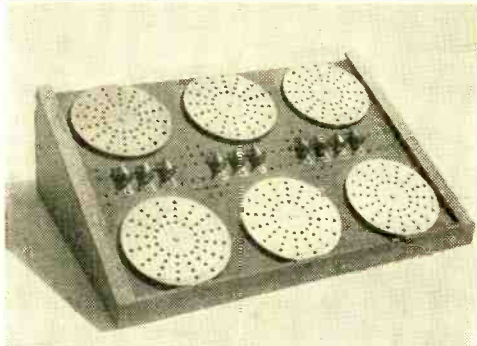
The course contains instructions for building relay memories, magnetic core memories and tube storage memories, with detailed descriptions of methods of storing information and automatically giving instructions to electronic devices. Suitable for all levels—particularly designed for people who have some knowledge of electronics. Including

Course C-1..... **\$28.00**

**ALL THREE COURSES TOGETHER \$75.00, SAVING OF \$9.00**



# New! A MACHINE THAT COMPOSES MUSIC



Actual tune composed on GENIAC

**COMPUTES, "REASONS"  
PLAYS GAMES**

**GENIAC  
ELECTRIC BRAIN**

**BUILD IT YOURSELF in a few hours!**

Yes, you build any one of 33 exciting electric brain machines in just a few hours by following the clear-cut, step-by-step directions given in a thrilling booklet! No soldering required . . . no wiring beyond your skill! GENIAC is a genuine brain machine—not a toy. The **only** logic machine kit that not only adds, subtracts, etc., but presents the basic ideas of cybernetics, Boolean algebra, symbolic logic, automation, etc. So simple to construct that even a twelve-year-old can make a machine that will fascinate people with advanced scientific training! With the special circuitry of GENIAC, the Electric Brain Construction kit, you can compose tunes automatically. These new circuits were never available before!

**OVER 400 COMPONENTS AND PARTS.** Circuits operate on one flashlight battery, and the use of ingeniously designed parts makes building circuits one of the most fascinating things you've ever done! You set up problems in a variety of fields—and get your answers quicker than you can set them up! Play games with the machine—nim, tic-tac-toe, etc.—and pit your brain against its logic! Solves puzzles in a few seconds that would take you hours without the aid of the machine. You actually see how computing and problem-solving is analyzed with algebraic solutions transferred directly into circuit diagrams.

**YOUR COST FOR GENIAC KIT:** only \$19.95 postpaid. The 1957 Model GENIAC KIT contains: (1) a complete 200-page text, "Minds and Machines"—a basic introduction to computers. (2) "How to Construct Electrical Brains At Home"—a fully illustrated text book on basic computer design theory and circuits with specific instructions for building circuits. (3) Wiring Diagram Manual. A special booklet with full scale diagrams that you can tear out and place on your work bench for easy assembly. (4) Beginners' Manual. Starting from scratch, the manual adds extra experiments, thoroughly tested using GENIAC components to teach the basic symbols of electric circuits. (5) Over 400 components and parts.

So—mail the coupon for your GENIAC today! Your money back if not delighted!

**Some Firms and Institutions that have ordered GENIAC:**

- |  |   |   |  |
|--|---|---|--|
| Allis-Chalmers<br>Remington-Rand<br>International<br>Business<br>Machines<br>Wheeldex Mfg. Co.<br>Manuel Missionary<br>College | Walter V. Clarke<br>Associates<br>Barnard College<br>Westinghouse<br>Electric<br>Phillips<br>Laboratories | General Insurance<br>Co. of America<br>Lafayette Radio<br>Rohr Aircraft Co.<br>Albert Einstein<br>Medical College<br>Naval Research<br>Laboratories | Los Angeles<br>Public Schools<br>Kansas State<br>University<br>Duke University<br>Coral Gables<br>Bell Telephone<br>Laboratories |
|--|---|---|--|

**K1—Only**  
**\$19<sup>95</sup>**  
(Add \$1.00 W. of Miss.  
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Please send me GENIAC Kit. \$19.95 (Add \$1.00 West of Mississippi or \$2.00 Outside U. S.)

**OLIVER GARFIELD CO., Dept. PE-67A, 31 Broadway, New Haven, Conn.**

Name ..... Age ..... Occupation .....

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

# "the finest transmitter that a novice can buy"

These are the words of **KN4MGL!**

Dear Leo,

This is a letter of gratitude and appreciation. I want to thank you and your fine staff for manufacturing the little Globe Chief Transmitter.

In my opinion the Chief is the finest transmitter that a novice can buy. It is undoubtedly the best transmitter under \$100 that can be bought, and I think the Chief out performs transmitters in higher price ranges.

I have basis for my belief, Leo. In only one month and sixteen days, I have worked 43 states, three VE's, one VP7 and a G3. This is proof enough that the Chief is a great little transmitter. If every ham knew just how good the Chief is and what kind of results I have obtained from it, you would be flooded with orders for the fine little transmitter. There are about 17 hams in Tifton, and they are all impressed with the Globe Chief I own. I, with the Chief, have worked twice as many states in one month as these hams in a year.

As you are reading this letter, Leo, you are probably thinking, "This guy must stay on the air 8 hours a day to rack up so many states in a short time." Well, Leo, that seems to be what everybody thinks, but the truth is, I remain on the air for an average of 7 hours a week, about an hour a day, sometimes less than that. And, Leo, I'm just an average operator. I'm not a speed king with a key, I don't use a bug, and I don't use a fancy antenna. I owe everything I've accomplished to the Chief. It just goes to show what fine results can be obtained by using the Chief. In closing, let me say this, I will own WRL products for the rest of my ham career and I will always be assured that I will own the best.

Sincerely,  
Bob Patrick KN4MGL  
Box 330  
Tifton, Georgia

And you can own the WRL "Chief"

Only **\$5.00** per mo.  
or \$49.95 Cash

Completely Wired:  
\$64.95 Cash



90 Watt Xmtr.; 75 Watts for Novice Use. Power Supply included. Completely bandswitching, 160-10M, and a host of Top-Notch Features.

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"The World's Largest Distributor of Amateur Radio Eqt."  
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## Letters

(Continued from page 24)

actual practice. We attempted to estimate the cost of parts in our construction projects but found that it fouled up several advertisers. For example, if we said it cost \$20 to build such-and-such a receiver and a kit manufacturer put it together for only \$15, our readers got suspicious. They thought they were getting incomplete kits or junk from war surplus stocks. The fact of the matter was that some manufacturers had the components necessary in large reserve stocks and were passing their savings along to the POP'tronics readers. This left some advertisers holding the bag, and I'm sure you'll agree that they didn't deserve to do so.

### Frye-Kohler Fans Sound Off

■ Please thank John Frye for his great work with "Carl & Jerry." I haven't missed a story. By the way, are these two real boys, or just fictional characters?

JAMES LISSON  
Depew, N. Y.

■ I sure like the way your articles are written—clear and concise. Please continue those wacky stories by Kohler—he's the greatest!

HARVEY SAWYER  
Redlands, Calif.

■ As a journalism student with an interest in electronics, I have one request to make. Keep those side-splitting stories by Kohler coming in every issue. I believe that I enjoy laughing at the Boy Wonder and Friend Wife as much as I enjoy the informative articles. Through Kohler and John Frye, we get a sugar-coated pill on basic electronics.

RALPH SANDERS  
Fort Smith, Ark.

*Thanks, Jim, Harvey and Ralph, and the rest of the Frye-Kohler fans that wrote in last month. You will particularly like the twist at the end of Kohler's latest episode (p. 62). "Carl & Jerry" introduces a new character this month which will play an important part next fall.*

*Jim, in answer to your question about the boys, I can only report that I haven't personally seen them, but it's pretty definite that they come from somewhere around Indiana.*

### Success With Projects

■ In looking through some back issues of POP'tronics, I came across the "Simple Proximity Detector" (April 1956). I gleaned the necessary parts from my junk box and proceeded to build it. The unit worked on the first try and the sensitivity was far greater than I had expected it would be.

STEVE BELL, K2POV  
Forest Hills, N. Y.

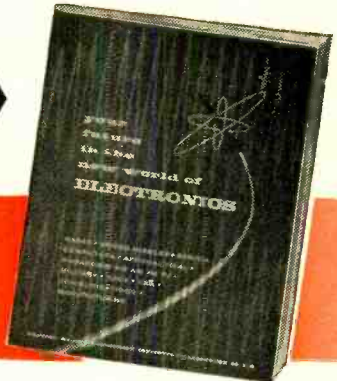
■ Thank you for the article by Eugene Coriell on fixing up old radios. It permitted me to locate the trouble in my Marconi '38.

ANDRE LAPOINTE  
St. Hyacinth, P. Que.

*Thanks for the kind words. We're always glad to hear from POP'tronics experimenters.* —30—



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



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

Whether you're an amateur . . . a hobbyist . . . or already in electronics . . . Let us show you how to have a bright career in

## **RADIO! TELEVISION! ELECTRONICS!**

### **TURN YOUR HOBBY INTO A HIGH-PAY CAREER!**

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

### **ELECTRONICS HAS GOOD PAYING JOBS FOR TRAINED MEN LIKE YOU!**

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

Here are just two of the typical high-level opportunities available to CREI-trained men:

"Just about four months have passed since I made my first recruiting trip to CREI. As a result of that visit Messrs. Kohs, Plante and Wenger are now members of the Laboratories and Mr. Kresge soon will be . . . we have some openings now and will have others . . ."—Bell Telephone Laboratories, Murray Hill, N. J.

"Two openings in our Field Service . . . aircraft electronics . . . starting salary is \$380 and up . . ."—North American Aviation, Inc., Columbus, Ohio.

### **YOU NEED ADVANCED TRAINING**

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

### **ACQUIRE NECESSARY TRAINING AT HOME**

Use spare-time hobby hours for CREI Home Study as thousands of successful technicians have done since 1927. Get concentrated training in minimum time, then step into a good job and enjoy good pay in the mushrooming electronics industry.

### **SEND FOR FREE BOOKLET. IT TELLS YOU HOW**

How to gain career success in the tremendous electronics industries. It pinpoints opportunities which exist. By 1960, the electronics industries will do no less than \$15 billion worth of business per year, not counting military orders. Take TV for example: there are about 39,000,000 TV sets and over 425 TV stations on the air. Color TV is pushing ahead furiously. Electronics is the ONE field of maximum opportunity in this electronic age.

### **CREI TRAINS YOU IN MINIMUM TIME AT HOME**

Thousands of men before you have benefited quickly from CREI Home Study training. Thousands of CREI graduates are now employed in industry here and abroad. Here is what they say:

*"In this time of less than two years, I have almost doubled my salary and have gone from wireman, to engineering assistant and now to junior engineer. I have CREI to thank."*—Frank A. Eckert, 22 Clover Lane, Levittown, Pa.

### **FAMOUS FOR 30 YEARS**

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

### **VETERAN?**

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

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IN WHAT BRANCH OF ELECTRONICS ARE YOU MOST INTERESTED? .....

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Send booklet "Your Future in the New World of Electronics" and course outline.

- CHECK FIELD OF GREATEST INTEREST
- Electronic Engineering Technology
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  - Television Engineering Technology



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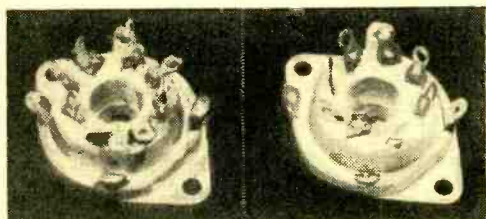
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Check:  Home Study     Residence School     Korean Veteran

# TIPS and TECHNIQUES

## CLEANING RADIO PARTS

Have you been discarding perfectly usable ceramic and metal components simply because they have become dirty or discolored? Don't do so any longer—it's easy to restore them. Just half-fill a two-pound



coffee can with hot water and a heaping tablespoon of strong powdered laundry soap. Add the components to be cleaned,

and bring to a boil for five minutes. No matter how old and dirty your brass or aluminum capacitor plates, ceramic tube sockets and stand-off insulators, APC trimmers, etc., this method is guaranteed to restore their sheen and lustre! —R.B.K.

## IMPROVING CHASSIS PUNCHES

To protect your chassis punches and make them more readily available, mount them in a wood block with sizes marked. To make them cut better, carefully sharpen



the cutting edges of the punch and ring die on fine emery cloth as shown. Put the abrasive on a flat surface. Then, using a circular motion, lap each edge—being careful not to rock the punch.

The punch will operate much easier with less effort if the screw and other moving parts are covered with a thin film of grease or oil. Wipe off the excess after using to

## The ALL NEW "20-POUNDER" MYSTERY PACKAGE

**1 KW ANT. CHANGE-OVER 10 VAC RELAY**  
40 Cycle 15 Amp 2500 Volt D.P.D.T.  
**\$4.95**

**TUNING UNITS**  
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From BC 375 TRANS YOUR CHOICE OF TU 26B, TU 8B, or TU 10B. Wt. 12 lbs.

**HI-FI CROSS OVER NETWORK KIT**  
**\$2.95**  
High Pass Filter Network Type. Exceeds HIGH FREQ. Range. Smooth Low Freq. Roll-off. Used with 8 or 16 ohms. speaker systems. No network loss in pass region.

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It's Another THRILLING HERSHEY SURPRISE. 20 pounds of BRAND NEW usable Govt. Surplus. Perfect gift for Hams, etc.

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2 VOLT 20 AH  
**\$1.65**

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PRI. 117 v. 40 cyc. sec.  
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Both Units Only  
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P.P. 811 WATTS 28  
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**100 ASSORTED CRYSTALS**  
FT-242 FT-241A FT-171B  
Type 1 Holders FREQ. RANGE 2015 KC to 38.1 MC.  
\$50.00 Value  
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**PHOTO ELECTRIC CELL**  
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1/2" CE Vacuum photo. cell. useful for opening alarm doors, and Alarm Systems.

**SWING CHOKE**  
29.75 510 Ma. Theratron Y4803.  
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**CARRYING ALL-PURPOSE CASE**  
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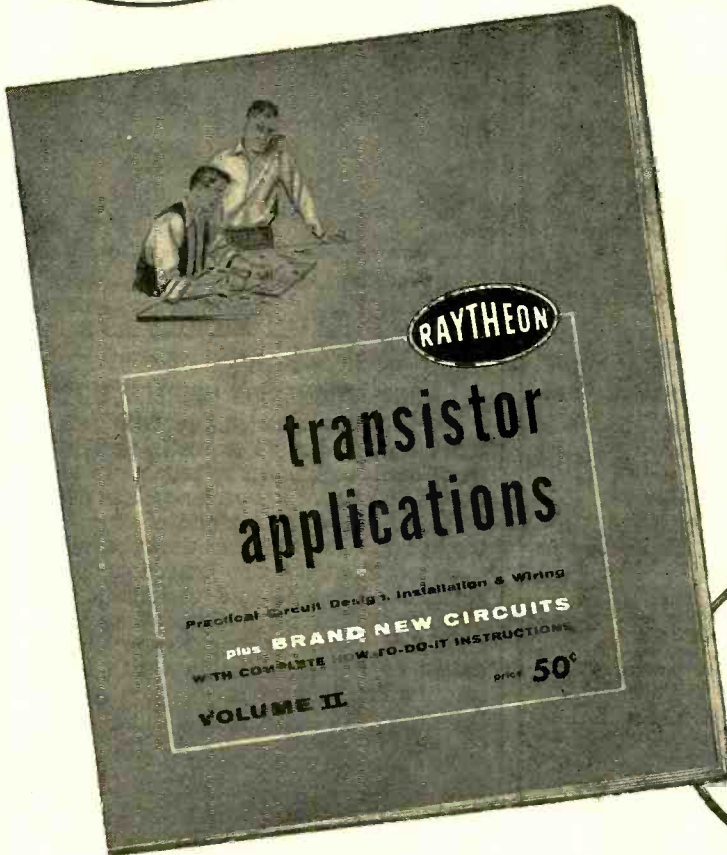


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### F.C.C. License—the Key to Better Jobs

An FCC commercial (not amateur) license is your ticket to higher pay and more interesting employment. This license is Federal Government evidence of your qualifications in electronics. Employers are eager to hire licensed technicians.

### Grantham Training is Best

Grantham School of Electronics specializes in preparing students to pass FCC examinations. We train you quickly and well. All courses begin with basic fundamentals—NO previous training required. Beginners get 2nd class license in 8 weeks, 1st class in 4 additional weeks.

### Here's Proof!

A few of our recent graduates, the class of license they got, and how long it took them:

	License	Weeks
B. A. Willms, 1401 E. Muriel, Orlando, Fla. . . . .	1st	12
Paul Schuett, 1314—20th Av., Longview, Wn. . . . .	1st	10
Lawrence L. Alzheimer, Collins, Montana. . . . .	1st	4
W. Reynolds, 238½ Washington Bl., Venice, Cal. . . . .	1st	12
Robert Todd, 216 West End Av., Cambridge, Md. . . . .	1st	13
Joe C. Davis, Station WABO, Waynesboro, Miss. . . . .	1st	11

### Grantham Training is Complete

The Grantham course covers all the required subject matter completely. Even though it is planned primarily to lead directly to a first class FCC license, it does this by TEACHING you electronics. Some of the subjects covered in detail are: Basic Electricity for beginners, Basic Mathematics, Ohm's and Kirchhoff's Laws, DC Circuit Analysis, Magnetism, Alternating Current, The Sine Wave, Frequency and Wavelength, Inductance, Capacitance, Impedance, Resonance, Basic Principles of Vacuum Tubes, Transistors, Principles of Amplification, Classes of Amplifiers, Vacuum Tube Circuit Analysis, Oscillators, Power Supplies, AM Transmitters and Receivers, FM Transmitters and Receivers, Antennas and Transmission Lines, Measuring Instruments, FCC Rules and Regulations, and extensive theory and mathematical calculations associated with all the above subjects explained simply and in detail.

### Learn By Mail or In Residence

Correspondence training from Washington, D. C. and Hollywood, Calif. Also, resident DAY and EVENING classes held in both cities.

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Washington 6, D. C. Hollywood 27, Calif.

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

Name.....

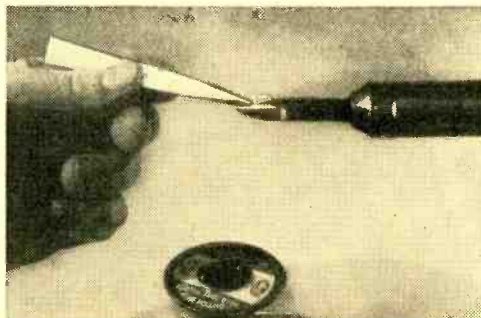
Address.....

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

keep the parts from attracting dirt particles. A cardboard or plastic dust cover could be fitted over the base. —C.R.E.

### WHEN IS IRON HOT?

In heating a soldering iron, you will not have to guess when it reaches the soldering temperature if a small piece of rosin or acid core solder is rested on the tip. When the



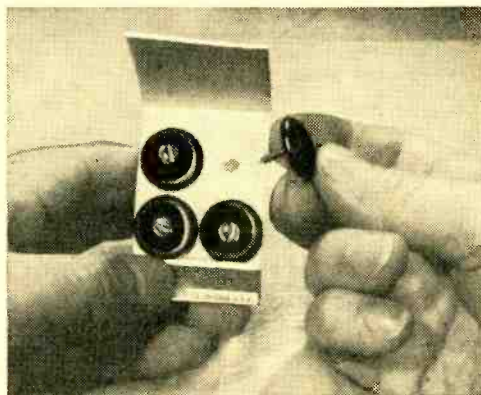
iron becomes hot enough for soldering, the bit of solder will melt and at the same time a smoke signal will rise from the burning core material. —K.M.

### ROOM ACOUSTICS "BUILD" HUM

Hum in an otherwise hum-free hi-fi system may be due to acoustic build-up of weak hum frequencies by repeated and sustained reflections between opposite parallel walls, or between floor and ceiling. When the speaker location and the room dimensions required for this condition are just right, the room is said to have a "resonance" at the frequency involved. The easiest remedy is to change the speaker location or the direction in which it faces into the listening room. —E.F.C.

### STORAGE IN MATCH FOLDER

To store the proper screws with a set of felt-cushioned or rubber cabinet feet, press the screws through the back of an empty



paper match folder. The cover may then be closed and the set of feet stored for immediate use when wanted. —K.M.



# A frank statement about the future in Field Engineering

At first glance, Field Engineering may not seem to possess the potential and stature often associated with other engineering activities.

At *Hughes*, however, nothing could be further from the truth.

Men who undertake the responsible task of evaluating Hughes-produced military equipment in the field are in the enviable position of becoming thoroughly familiar with the complete design and operation of the advanced electronics systems involved.

Essentially, Field Engineering embraces all phases of support required to assure maximum field performance of Hughes armament control systems and guided missiles. E. E. and Physics graduates selected for this highly important and respected phase of our engineering activities work with the armed forces and airframe manufacturers at operational bases and plants in continental United States and overseas.

The knowledge, background and experience so gained assure unusual opportunities for more specialized development in other divisions of the Research and Development Laboratories at Hughes. In fact, few openings in engineering today

offer the rewards and opportunities which are available to the Technical Liaison Engineers, Field Engineers, Technical Training School Engineers, Technical Manuals Engineers, and Field Modifications Engineers who comprise the Field Service and Support Division.

Engineers and physicists selected for this highly respected phase of our activities at Hughes enjoy a number of distinct advantages. These include generous moving and travel allowances between present location and Culver City, California. For three months before field assignments you will be training at full salary. During the entire time away on assignments from Culver City, you'll receive a generous per diem allowance, in addition to your moving and travel expenses. Also, there are company-paid group and health insurance, retirement plan, sick leave and paid vacations... and reimbursement for after-hours courses at UCLA, USC, and other local universities.

E.E. or Physics graduates who feel they are qualified to join the Field Engineering staff at Hughes are invited to write for additional information about this exciting and rewarding opportunity to establish a challenging career in electronics. Write to:

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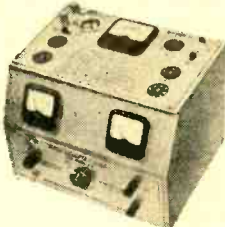
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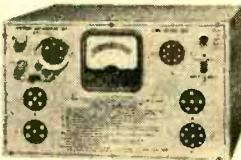


Model 905-6A (Comb.) ..... \$67.90 Wired  
 \$44.90 Kit Form

Model 905 Battery Eliminator and Charger (only) ..... \$37.50 Wired  
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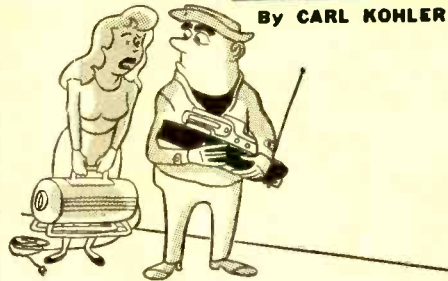
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**EMC** Electronic Measurements Corp.  
 625 B'way • New York 12, N. Y.  
 Ex. Dept. 370 B'way, N. Y. 13

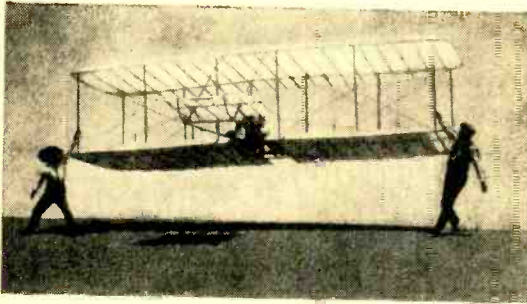
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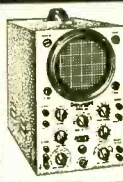


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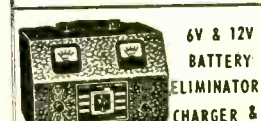
TV-FM SWEEP  
GENERATOR  
#360  
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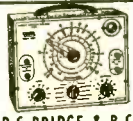
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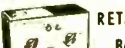
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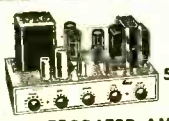


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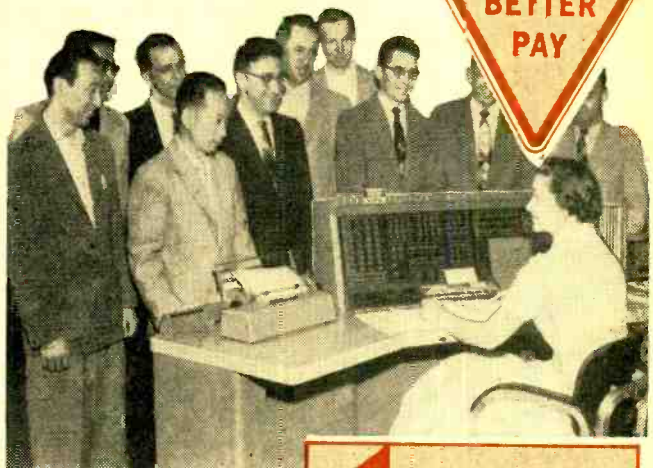
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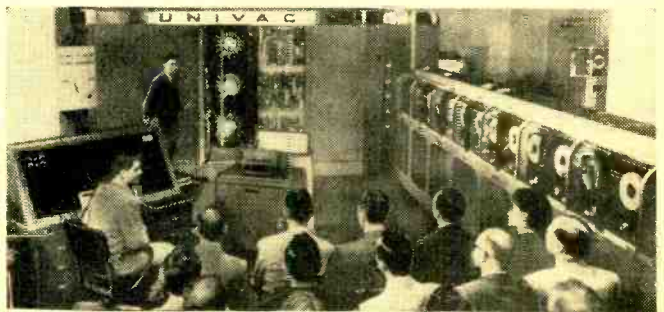
## Can You Run a Computer?

*Learn how—if you want to forge a career in the electronic future of automation*

**A** STRONG BACK was about all my grandfather needed to get a job. Then came the machines that took the sweat out of work. Manual skill in tending the machines replaced brute strength as the sure way to get hired when my father was young. That was the heyday of the skilled mechanic. But what does it take nowadays to go after the best jobs in the electronic age of computers and automation? And where do you come in?

Far from making men superfluous, the growing use of electronic computers has created an urgent need for people to run these super-machines. No longer are computers confined to highly specialized research that concerns only top scientists. Branching out into ordinary, everyday jobs, computers are now writing insurance policies, taking warehouse inventories, planning sales and advertising campaigns, checking railroad reservations, and tackling new jobs every day.

Can you run such a computer? Probably



**Computer center** becomes classroom for UNIVAC's training program.

not. It is a new field, unknown to most. But do you want to learn?

**Computer Careers.** Keep in mind that computer jobs pay better than average and that there is an urgent demand for qualified men and women. This need is so vital that the principal manufacturers of electronic computers (Remington Rand's UNIVAC Division and International Business Machines Corp.) threw open their doors to us and provided us with the facts for this article.

"What do you look for when you pick



**Students at IBM** convert the organizational chart on the wall into circuits set up on the patch panels on their desks. The panels are later plugged into the computer. These students will operate equipment leased or bought from IBM by their clients.

people for computer work?" we asked a UNIVAC man, expecting him to stress the importance of some special training. His answer took us by surprise:

"What we need most is hard to define. You might call it an analytic frame of mind."

"Just what do you mean by that?"

"It's a sort of personality trait. You find it in people who use their intelligence as an athlete uses his muscles. They keep it exercised and nimble. They are curious. They develop a habit of constantly asking themselves questions—taking nothing for granted . . . mentally taking everything apart to see how it fits together."

"What's that got to do with computers?" we asked.

"Just this: with these mental habits as a background, they can teach the electronic 'brain' how to work out a given type of problem. That's what we mean by 'programming the computer.' The programmer does for the computer what the setup man in a machine shop does for an automatic lathe. Without human guidance, the machine can do nothing."

Remington Rand and IBM spot promising applicants for this type of job with special aptitude tests. Usually, the applicant has some college background, but no degree is necessary. Even people with a high school diploma can qualify for training as computer programmers, provided they have the necessary basic intelligence, emotional maturity, and that "analytic frame of mind."

**Picnic vs. Grindstone.** Contrary to popular belief, the automated future is no perpetual picnic where machines do all the work and everybody gets time off for fishing. The simple fact is: the needs of busi-

ness, industry and government are growing so fast that if we hadn't invented automatic machines and computers, there just wouldn't be enough people to do the necessary paper work to keep the country going. Even with automation in full swing, the best we can hope for are three-day weekends and perhaps longer vacations to give us more opportunity for travel.

At any rate, trainees at Remington Rand and IBM "computer schools" get their noses rubbed so deep in computer theory that they don't even know what the weather is like outside for about three months. During this time, they learn how the computer works and how to work the computer.

**Nursemaid to Robots.** The reason why it is so difficult to "instruct" a computer to



**Automation** upgrades jobs. The file clerk now becomes a tape librarian like this employee of the New York Life Insurance Company who keeps track of the mass of tape-recorded data constantly gobbled up and spewed out by the never-tiring "brain." Higher qualification usually brings better pay.

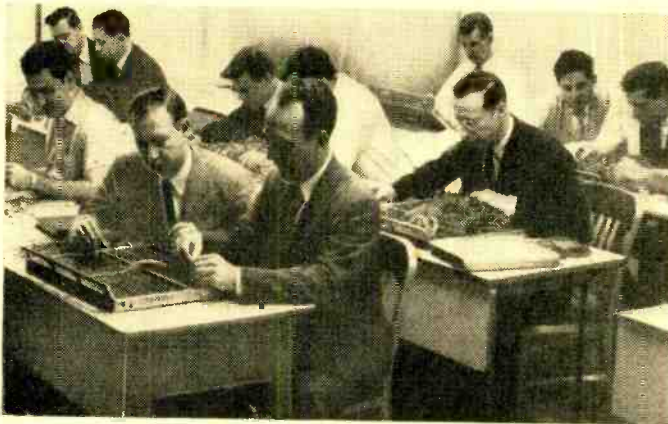


do a certain job is that these giant gadgets don't understand English—or any other human language. Scientists are now trying to build machines capable of reading and recognizing the meaning of words. But for the time being, the human masters of the computer can “talk” to the machine only in its own language—a code of figures and symbols. Outwardly this code seems complex. But it is actually far simpler than human speech—more like robot baby-talk.

Translating information into computer code is called *programming*. The programmer is a nursemaid to the machine, boiling down hard facts into the symbolic baby-talk that computers can digest. For instance, for a digital computer everything must be reduced to simple yes-or-no propositions. From these yes-or-no's, the com-



Loading reels or running the tape “reader” (above) merges clerical and technical job categories even at ground-floor level. At the N. Y. Life Insurance Co., electronic data storage saved space equivalent to four basketball courts.



Programming trainees infuse business procedures into IBM computer innards. Wire connections set up on plug-in type panel boards (left) represent the sequence and logic of a thought process.

puter arrives at conclusions somewhat like a game of “Twenty Questions”—except that it runs through millions of questions every minute and the resulting mass of information is correspondingly complex.

Computer programming requires no technical or scientific background and is a wide-open field for any intelligent person willing to take a special training course. The pay is high, and it is one of the few jobs where women can compete on equal terms with men.

**Business Unusual.** The growing importance of computers in big business shows up best by example. We are not talking about machines for automatic production in factories. That's another story. Here we are concerned with machines that quickly eat their way through the mountains of paper work that used to dam up the flow of business and skyrocket the cost. This is called “office automation” or “data processing.”

Let's take the case of an insurance company using a computer. Insurance is basically a game of chance and the computer

## WHOM TO WRITE

### for information about training in computer programming

#### Computer Manufacturers:

Mr. E. F. Klausman, Director of Training  
Remington Rand UNIVAC Division  
315 Fourth Ave., New York 10, N. Y.

Sales Assistance Dept., Education Division  
International Business Machines Corp.  
590 Madison Ave., New York 22, N. Y.

Electrodata Div., Burroughs Corporation  
110 East 40th St., New York, N. Y.  
(for eastern United States)

460 Sierra Madre Villa, Pasadena, Calif.  
(for western United States)

#### Correspondence School:

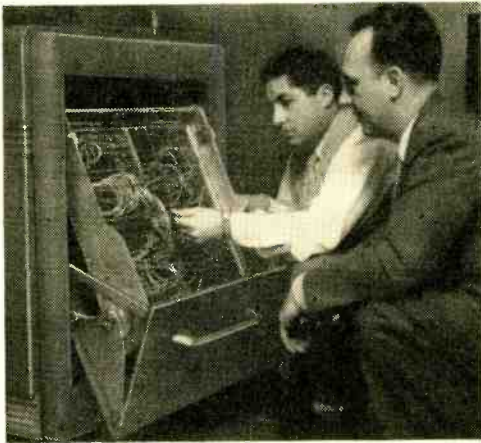
Oliver Garfield Co., Inc.  
31 Broadway, New Haven, Conn.

Readers are also urged to write other correspondence schools advertising in FOP'tronics since new courses are expected to be announced within the near future. To find out what colleges or universities in your region offer computer courses, contact the State Board of Education in your own state capital.

**A high school class (right)** looks over a scale model of the computer at the N. Y. Life Insurance Co. This firm maintains a permanent computer exhibit to interest young people in programming careers.



**Inward mysteries of IBM** computer circuits are clarified for a student by his instructor (below).



### WANT TO KNOW MORE?

The following books can give you a basic knowledge of how computers work and what they can do.

**ELECTRONIC COMPUTERS.** Edited by T. E. Ivall. Published by Iliffe & Sons, Ltd. Available in USA from Philosophical Library, New York, N. Y. \$10.00.

*A well-planned book built around the writings of eight specialists. Accurate and thorough, this book is nevertheless easy to read. There is much emphasis on British designs, but that's not necessarily a drawback. Highly recommended.*

**COMPUTERS, THEIR OPERATION AND APPLICATIONS** by E. C. Berkeley and L. Wainwright, Reinhold Publishing Corp., New York, N. Y. \$8.00.

*Taking a practical approach from the viewpoint of the prospective user, the authors explain the basic elements of various computer types and their application in many fields. Plainly written, the book is quite understandable to the layman. The extensive listing of references and varied source material is especially valuable.*

figures the odds of profit and loss much the same way as a Nevada gambling casino—always slapping on a safe margin for the house. The difference between the gambler and the computer is that the gambler may spend months figuring out a single roulette wheel while the computer assesses reams of insurance statistics and hundreds of policies in almost no time flat. What's more, it can automatically coordinate its findings with other aspects of business, such as accounting, overhead, sales planning, payroll, personnel, etc.

In this way, the computer can make a business operation matchlessly efficient. It can keep more things "in mind" and, by relating them to one another, draw conclusions faster than any human executive. Often it spots hidden trouble brewing before it boils over and becomes plainly visible. That, incidentally, is why computers are called "brains"—even though they actually "know" nothing and are just a dead and stupid pile of metal and glass.

It is the programmer who brings the metal heap to life and "teaches" it the insurance business—or any other business the computer is supposed to serve. Therefore, it is just as important for the programmer to know the nature and organization of the business utilizing the computer as it is to know the computer itself.

**How To Get In.** Naturally, the programmer can't know everybody's business—and that raises a problem in training. The problem is basically the old question of whether the chicken preceded the egg. What should you know first? The operation of the computer or the operation of the business in which it is employed? Remington Rand and IBM decided to be on the safe side and play it both ways.

You can get yourself hired outright as a trainee for these companies, or you can

*(Continued on page 104)*



**You'll race to see new  
French movie telling  
about ham radio in action**

**W**E'RE TALKING about producer Christian Jaque's film, "If All The Men In The World," now touring the U. S. His plot revolves around the part that radio amateurs play in saving the lives of twelve sailors.

At sea, two days from the coast of Norway, the crew of the fishing trawler "Lutece" falls prey to a mysterious illness. When the ship's radio equipment fails, the skipper turns in desperation to his ham set.

His distress signal is first picked up by FD8IM in French Togoland, Africa. This amateur summons a local doctor, and from him the captain learns that his crew is suffering from *botulism*—a form of food poisoning, fatal unless checked by a special serum within fifteen hours after attack.

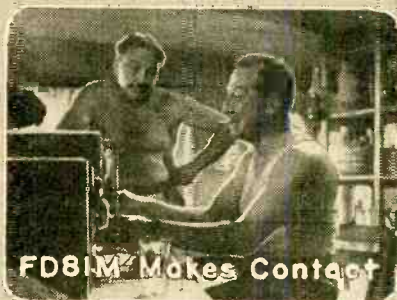
Now the race is on. The serum is available in Paris. FD8IM contacts F8YT, a young Parisian radio mechanic. Through his efforts, the medicine is eventually obtained and placed aboard a Polish airliner headed for Berlin.

A blind amateur in Munich is subsequently instrumental in the progress of the precious package, and at one point an American Air Force sergeant is called upon to enter Red territory at his own risk to retrieve the serum.

With time rapidly running out, we finally find the package aboard a Norwegian Air Force plane bound for the site of the stricken "Lutece." The captain's ham equipment is now responsible for directing the plane to the exact location. At last the ship is approached; the count is given; and the serum is parachuted to the twelve waiting men whose lives it will save.

Aside from being a good movie in any sense, "If All The Men In The World" is of particular interest to the radio ham world. It has been received with great acclaim in Paris, Rome, Berlin and Oslo, and should go a long way here in the U. S. toward pointing out the important part radio amateurs often play in real-life emergencies. —Bernard Malandain

## *If All The Men...*



## Nehru Electioneers with Mobile P.A.

Electioneering throughout India posed a severe problem for Prime Minister Nehru. The solution, in a country where few people read and radio receivers are not too common, was to travel with a mobile p.a. system. Developed by Electronics Ltd., New Delhi, it used a nest of University loudspeakers (White Plains, N. Y.). A powerful amplifier and a special microphone completed the system, which was mounted on an American jeep.



## "Writing" Faster Than Light

An electron beam swishes across the face of the tube above faster than the speed of light—to limn patterns of physical change in matter during nuclear bombardment. The incredible tracing speed of this tube, developed by Du Mont Laboratories, Inc., will help explore ultra-fast atom motions.

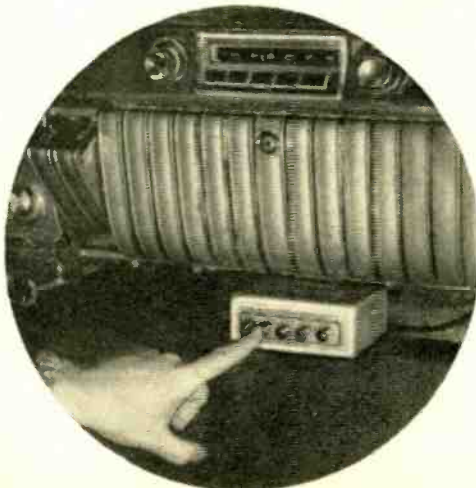
## SWL's Now Roll Along

A push of a button and the driver of the car below listens to an Australian news broadcast on his way to work. Coming home, he chooses between London, Moscow, Paris, or Rome. Like many died-in-the-wool SWL's, he has installed a Gonset push-button mobile short-wave converter. With radio receiving conditions at an all-time peak, short-wave reception is often better than ordinary AM broadcasts.



## Did The Motor Stall?

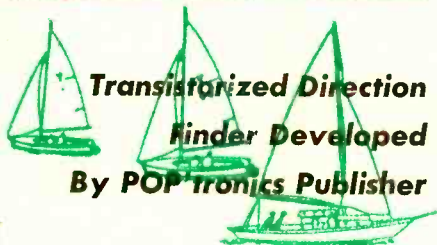
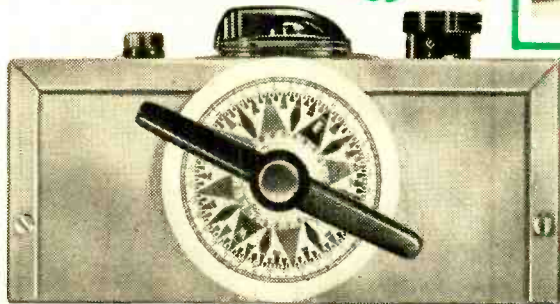
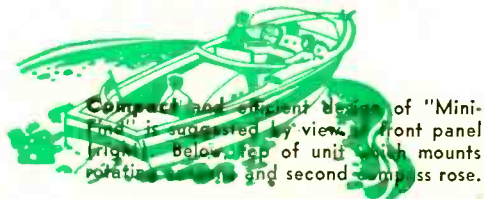
This is not an uncommon question. Automobiles are getting quieter and quieter. If you drive in city traffic, you may find out too late that your motor has stalled at the fast traffic light. Avoid that embarrassment by connecting up a Kar-Aid ignition indicator (above). It's available at moderate cost from Kar-Aids, Inc., 25-11 49th St., Long Island City 3, N. Y. A capacity-coupling "gimmick" attached to the distributor cable renders positive indication of motor function, including overload, missing plugs, and run-down batteries.



POPULAR ELECTRONICS



# Mini-Find Takes You Home



**B**OATSMEN can travel over the waves without ever being "at sea" as far as position and direction are concerned—with the aid of "Mini-Find," a remarkable radio direction finder no bigger than a box camera and as simple to use as a table-model radio receiver.

You don't have to be an engineer or skilled marine navigator to use it, or a wealthy yachtsman to own it. The prototype of this all-transistor device, shown here, was designed and built for less than \$40.00 by Oliver Read, publisher of RADIO AND TV NEWS and POPULAR ELECTRONICS.

"Mini-Find," weighing only two pounds and measuring a mere 5" x 7" x 3", sits at the helm, "sights" on broadcast stations, and practically tells you where you are and how to get home.

Most small boats are piloted from a sitting position. Consequently, Read built his DF unit to permit line-of-sight homing and control. Its two compass cards ("roses")

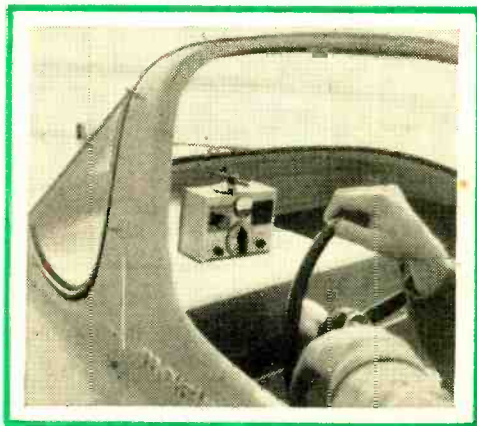
provide visible bearing data from either sitting or standing positions.

"Mini-Find" uses a loop antenna, rotated by a knob on the front panel. Maximum signal pickup occurs when the ferrite loop is broadside of the received station. Minimum signal, or "null," results when the loop points directly at the broadcast station.

Marked on the tuning dial are the call letters and locations of broadcast stations in the most widely traveled area for each boat. Conelrad frequencies are also indicated.

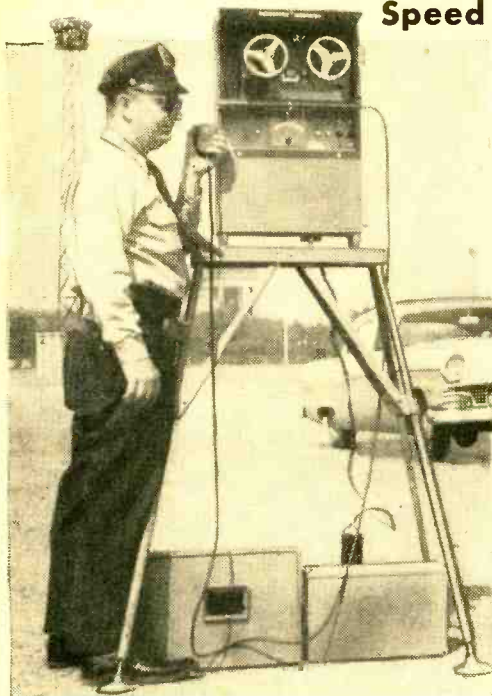
In addition to a loudspeaker for listening to stations, the set features a meter which makes for precise tuning and serves as a sensitive nulling device for taking bearings to learn one's position.

Details on circuitry and construction may be found in the June issue of RADIO AND TV NEWS. The Heath Company has just announced that it will make the unit available in the near future as a kit. —50—



DF unit installed at helm for convenient use.

## Speed Meter Remembers Violators



If you're driving below the speed limit, this radar speed meter will only ignore you. Drive faster and it will record your speed, take your photograph, and await the attending officer to report that you were apprehended. Designed by Admiral Corporation, it is claimed to overcome deficiencies of earlier models by other manufacturers.



## Dragon's Tooth Radio Energy Absorber

The man in the photo above hasn't unearthed the lower jawbone of a dragon—he's admiring an electromagnetic energy absorber. Wedges of a special material developed by Emerson & Cuming enable radio engineers to simulate "in-flight" performance of antennas while locked in a dark room. Walls, floor and ceiling are lined with these wedges to absorb over 98% of all radio waves.

## Splice for Life

Never underestimate the power of a tape recorder! Daphne and Alan Wilson, shown here cutting their wedding cake (molded in the shape of a Grundig recorder), will owe their future happiness to tape correspondence. Daphne's voice attracted Alan, a Singapore resident, and he was soon returning her tapes with marriage proposals. Sure enough, his voice did the trick!



## Radio Dealer Is Still No. 1

The do-it-yourself tube testing trend is not making strong headway in the replacement market. A survey conducted by Sylvania in four major strongholds of the do-it-yourself tube testers showed only minor sales. These cities were Dallas, Indianapolis, Minneapolis, and San Francisco. The greatest number of drug store tube sales were being made in Indianapolis, while in the other three cities between 92 and 96% were made through radio-TV servicemen.

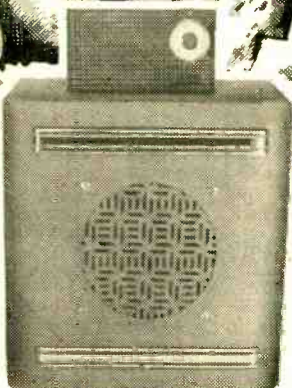


# Picnic PowerAmp



By LOUIS E. GARNER, JR.

**Speaker** amplifier, with radio on top. You'll find it's just the thing for beach parties and picnics.



**Power transistor**  
**adds pep and volume**  
**to pocket radio**

**D**O YOU OWN a personal portable radio receiver? If you do, or if you've ever listened to one, you know why they are called "personal" receivers—the output volume is not exactly room-filling. But most pocket receivers are equipped with an earphone jack. Earphone listening is possible under background noise conditions that would make loudspeaker listening impossible with the limited volume available.

If you'd like to provide your receiver with truly "room-filling" loudspeaker volume, you'll find it's a cinch if you use the "Picnic PowerAmp." It can be plugged into the "phone" jack of any piece of equipment designed to power a moderate-impedance (1000 to 8000 ohm) magnetic headset. The instrument takes the low-power signal, amplifies it, and drives a good-sized (6") loudspeaker.

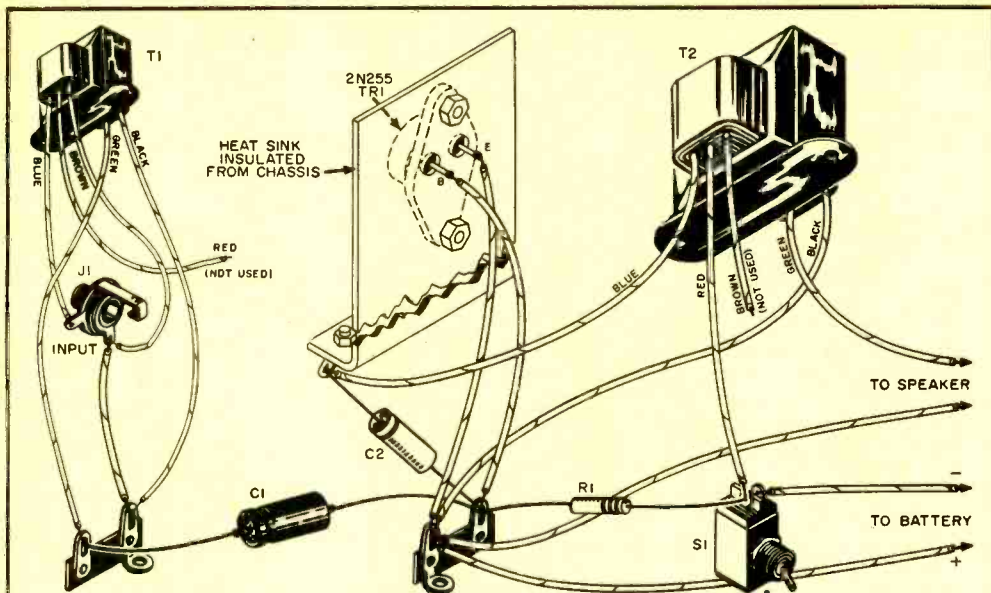
**Construction Hints.** The simple design of the Picnic PowerAmp is made possible

by the use of CBS-Hytron's new low-cost *p-n-p* power transistor—the 2N255. Aside from the battery, only nine electrical components are required. If you're handy with a soldering iron and other shop tools, you should be able to assemble this project in a single evening . . . even allowing time for a "coffee break" or two.

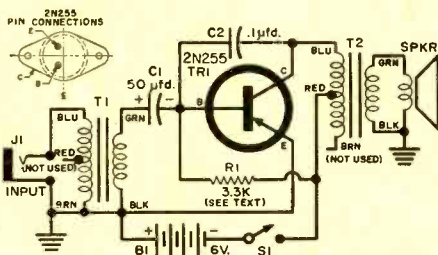
You'll need two small chassis. One is used as a *heat sink* for the 2N255 power transistor . . . it serves to absorb and to dissipate heat generated by the transistor and keeps the transistor's temperature from rising to a dangerous level. The other chassis is for wiring the circuit proper.

To insure good heat dissipation, mount the 2N255 flat against its heat sink using small machine screws and nuts. Provide over-sized holes for the base and emitter pins. Transistor pin connections are identified in a sketch on the next page.

The transistor's collector electrode is



**Pictorial and schematic diagrams** for the amplifier circuit. Transistor pin connections are identified in the sketch at the left of the schematic. See parts list below.



- B1—6-volt battery (Burgess No. 2F4)
- C1—50- $\mu$ d., 25-volt electrolytic capacitor
- C2—0.1- $\mu$ d., 200-volt tubular capacitor
- J1—Input jack

- R1—3300-ohm, 1-watt carbon resistor (see text)
- S1—S.p.s.t. toggle switch
- T1—500-ohm to 8-ohm transistor transformer (Argonne No. AR-164)
- T2—48-ohm to 3.2-ohm output transformer (Argonne No. AR-503)
- TR1—2N255 power transistor (CBS-Hytron)
- PM SPKR—PM loudspeaker, 6" to 8" diameter, 3.2-ohm voice coil
- 1—Heat sink chassis, 4" x 3 $\frac{1}{8}$ " x 1" (ICA No. 29082)
- 1—Main chassis, 3 $\frac{3}{4}$ " x 4 $\frac{1}{8}$ " x 1 $\frac{1}{2}$ " (ICA No. 29079)
- 1—Cabinet (ICA No. 3935)
- 1—Battery plug
- Misc. terminal strips, soldering lugs, fiber shoulder and flat washers, rubber grommets, assorted machine screws and nuts

connected directly to its outer case, thus insuring an adequate transfer of heat from its junction to the external heat sink. This construction makes it necessary to insulate the heat sink chassis from the main circuit chassis.

### HOW IT WORKS

The Picnic PowerAmp uses a *p-n-p* power transistor as a single-stage transformer-coupled Class A power amplifier. The common-emitter circuit configuration is employed.

In operation, input transformer *T1* matches the moderate output impedance of the radio receiver or other equipment with which the unit is used to the low input impedance of the power transistor. *C1* serves as a d.c. blocking capacitor to prevent the low resistance of *T1*'s secondary winding shorting the base bias current of the transistor, supplied through base resistor *R1*.

Output transformer *T2* matches the output impedance of the amplifier stage to the low impedance of the loudspeaker's voice coil. Feedback capacitor *C2*, between the collector and base electrodes, introduces an out-of-phase feedback signal into the base circuit—which tends to reduce harmonic distortion.

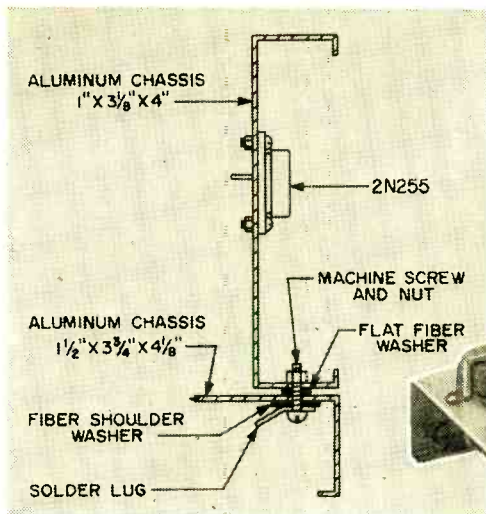
As far as the main chassis wiring is concerned, neither circuit layout nor wiring arrangement is critical. However, keep the input (*T1*) and output (*T2*) transformers reasonably well separated and mounted with the cores at right angles.

The battery power supply may be mounted in the same cabinet with the amplifier chassis and the loudspeaker. Use a secure mounting arrangement to keep the battery from shifting position when the completed amplifier is carried about. You can mount the battery securely by using a small "L" bracket.

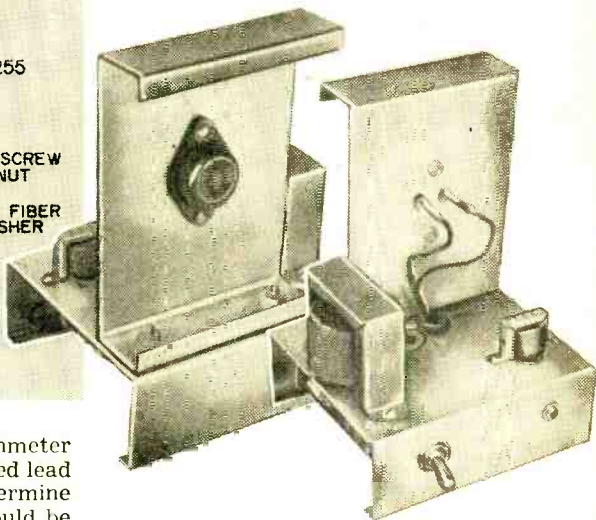
Don't feel limited to a 6" or 8" loudspeaker. You can use any PM loudspeaker having a 3.2-ohm voice coil—from 3" to 12" in diameter. However, best results are obtained with larger speakers.

If you want more output power and are willing to accept the penalty of shorter battery life, drop the value of *R1* until collector





Mounting details of the heat sink for the power transistor appear at left. Below are two views of the heat sink chassis. You can also see top of main chassis in view at right.



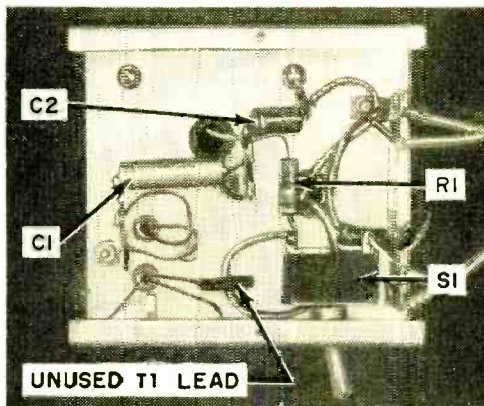
current—as measured with a millimeter inserted between switch *S1* and the red lead of *T2*—equals 500 ma. You can determine *R1*'s value by experiment, but it should be in the neighborhood of 100 ohms or less. Under these conditions, the circuit will deliver very close to a full watt when driven to maximum output.

**Operation and Use.** You'll need to prepare a short two-conductor connecting cable. At one end, mount a small plug which fits input jack *J1*. The "hot" or signal connects to the center terminal . . . that is, with the plug in place, to the blue lead of *T1*. At the other end of the cable, mount a plug which fits the headphone jack of the pocket receiver. Then plug in both ends of the connecting cable to the appropriate jacks and turn on the equipment.

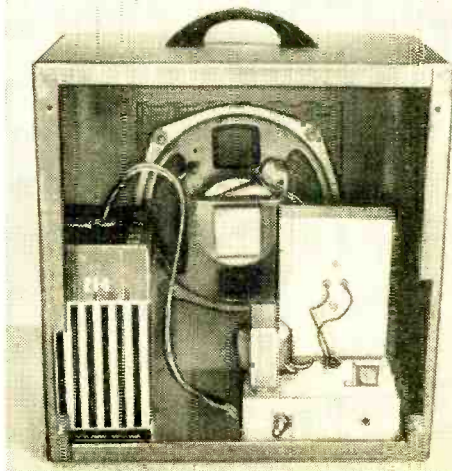
Note that no gain control is provided. You simply use the volume control in the receiver.

Most builders will ask . . . "how many hours can I get from a battery?" . . . whenever they are contemplating a battery-operated piece of equipment. This is similar to asking . . . "how many miles to a tank of gas?" . . . when discussing automobiles. However, if you employ the battery specified in the parts list, and do not attempt to increase the output power by dropping the size of *R1*, you can expect about two hundred (200) hours total operation, assuming you run the Picnic Power-Amp only about six hours per day. If you use it for shorter periods, you can expect longer battery life.

-30-



**Below-chassis view** of the wired amplifier (above, right) identifies some of the parts. Directly at right is a rear view of the complete amplifier assembly installed in cabinet.



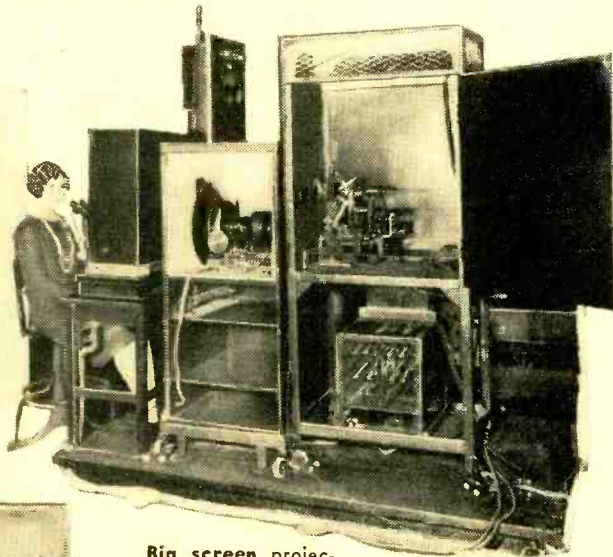
## TV's 30th BIRTHDAY

**S**EEMINGLY rapid developments in electronics actually stretch their roots far back in time. For instance, if you think that TV is strictly a postwar development, it will surprise you to hear that this year marks the 30th anniversary of television in America. Of course, TV in 1927 was strictly experimental. But, as a milestone in electronics, it was spectacular—even without "spectaculars." These pictures of the pioneer equipment built by Bell Telephone Laboratories recall the technical foresight and accomplishment in what now seems a bygone age. —50—

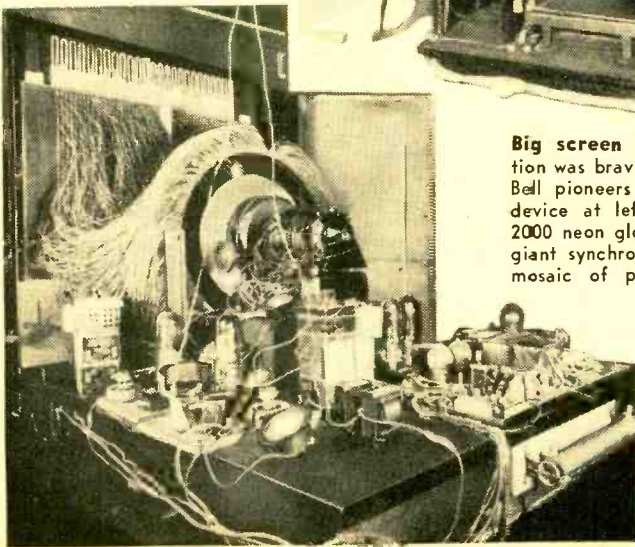
A TV "star" of 1927, the girl below is pushed into background by the cumbersome camera employing mechanical scanning. She had to stay put on her chair to remain within view.



**Watching TV**, the man above concentrates his attention on a tiny image appearing in the square window above the round disc. With cathode-ray scanning yet to be invented, the picture had to be broken down into separate points by a rotating disc with critically spaced perforations. Such discs, turning at the same speed in both transmitter and receiver, provided image synchronization. Brightness of each picture point was controlled by amplitude modulation of a neon glow tube.



**Big screen projection** was bravely attempted by Bell pioneers in 1927 with the monstrous device at left, shown here from the rear. Some 2000 neon glow tubes, each individually wired to a giant synchronized commutator switch, made up a mosaic of picture points. Slow scanning speed blurred the picture but permitted transmission on limited bandwidth then available. Prior to Dr. Zworykin's cathode-ray developments, TV had no sweep circuits. Instead, mechanical devices built up the picture. The difficulty and cost of producing such devices with the requisite precision and reliability stunted television's early growth. However, this work laid the foundation for future picture transmission systems.





# Make Your Own Electrostatic Speaker System

**H**I-FI refinements seem to run in cycles, if you'll pardon the pun! The "first awakening" involved the quest for higher highs; supersonic amplifier response and tweeter capabilities were all the rage.

Next, attention was turned to bass and its attendant problems of baffling, enclosures, loading, placement and power. The results of this phase of sound improvement were so startling that they virtually revolutionized the whole concept of sound in the home.

Now, perhaps it is time to go back a bit and re-evaluate what has happened to those early highs, particularly in light of a major new development—the electrostatic tweeter.

Details on the theory and operation of electrostatic speakers may be found in POPULAR ELECTRONICS, September, 1956. It is *theoretically possible* to design an electrostatic speaker capable of reproducing the entire audible range (and some have actually been constructed in the labs). However, problems of size and spacing of the plates, as well as the voltages necessary to produce sufficient movement of the diaphragm, make such a loudspeaker a thing of the future.

At the moment, though, many excellent units are available for use on high frequencies. We have assembled a pair of these little, inexpensive units to provide a very serviceable tweeter to supplement your existing speaker system.

**Why Two Units?** Highs and lows in sound reproduction behave quite differently from one another. Low tones seem to fill the room and have little or no directional

Covered with grille cloth, new electrostatic tweeter sits atop woofer in two-way speaker system.



Photos by Bert Goodman

**First time in print—  
a do-it-yourself tweeter system  
featuring low cost and simple design**

characteristic. Treble tones, on the other hand, are very directional. That's why, if you've ever listened to your neighbor's hi-fi system through an apartment wall, only the dull, boom-bass tones seem to come through.

The directional characteristics of the Iso-phon electrostatic tweeters used in this construction are such that if you sat directly in front of one you would hear an absolute level of sound of about 50 decibels. If you moved away from "dead center" to an angle of 60° from the perpendicular to the speaker, the level of sound would be only about 38 db. To an extent, this is true of all tweeters—electrostatic or magnetic type. To solve the problem, we used two

tweeters mounted at an angle of 120° from each other to give a more uniform distribution of sound.

Still another source of trouble lies in your room furnishings. A tweeter aimed at a heavily draped wall will seem to produce much less sound than another aimed at a hard, non-covered wall. Treble tones are substantially absorbed by soft materials. Therefore, in the design of our "tweeter box," provisions were made for adjusting the mounting angles of the two units to suit individual requirements.

**Electrostatic Tweeter Circuits.** Electrostatic speakers require high audio voltages, generally taken from the primary or plate side of the output tubes, through suitable d.c. blocking networks and frequency-determining RC networks. It's not a good idea to pass *all* frequencies on to these tweeters because the large-amplitude low-tone voltages—while not producing any sound—will cause the movable plate to distort to a point where the audible highs may be distorted.

This type of hookup works fine if your speakers are very close to your amplifier. Since the opposite situation is true in many hi-fi setups, we decided to work out a method whereby it would not be necessary to drag around high-impedance, oscillation-susceptible plate leads.

Speaker efficiencies vary tremendously. A high-efficiency speaker fed with one watt of audio power can easily be deafening, whereas the same amount of power fed to a low-efficiency speaker may cause barely

a murmur. Simply to install a pair of electrostatic units in conjunction with an existing speaker system, with no provision for adjusting levels between the old and the new, would be inviting severe unbalance—the odds are just too great.

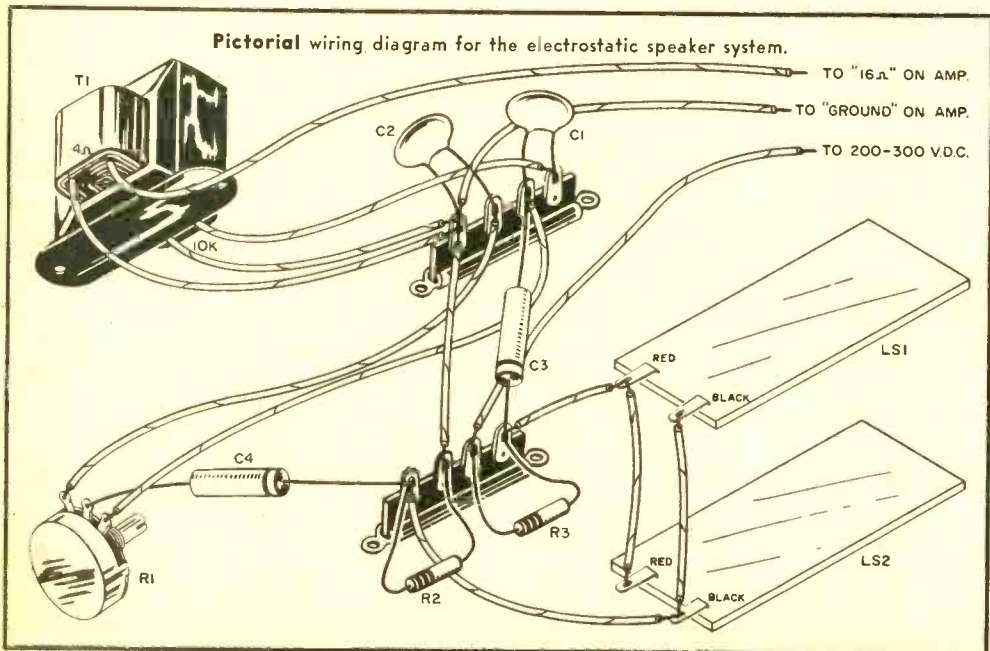
We decided, therefore, that our tweeter design would have to include a means of varying the amount of highs both to suit the companion speaker efficiencies and to allow for differences in taste, room furnishings and—in some cases—even program material.

**The Final Circuit.** A suitable circuit, arrived at after the above considerations, is shown in the schematic at right. Transformer *T1* is any inexpensive, single-ended audio output transformer. This unit is called upon simply to step up the voltage available at the voice-coil connections of your present amplifier to a usable value, and therefore handles practically no power.

*The transformer is hooked up in reverse.* What would normally be the voice-coil secondary is used as the primary of this circuit. Conversely, what would be the primary of the output transformer serves, in this case, as a secondary to drive the tweeter circuit. This connection enables you to feed audio into the "tweeter box" from the same pair of leads now feeding your main speaker system.

A crossover network—to keep low frequencies out of the tweeter—is provided by *C1*, *C2*, and *R1*.

**Building the Box.** A layout diagram of the necessary wood to build the tweeter





## PARTS LIST

C1, C2—0.005- $\mu$ fd., 500-volt disc ceramic capacitor

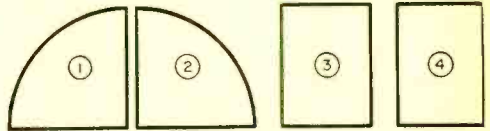
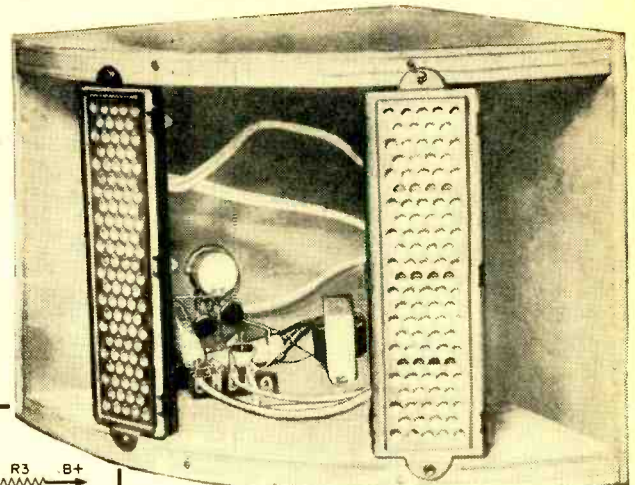
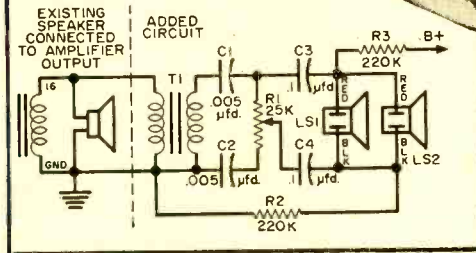
C3, C4—0.1- $\mu$ fd., 200-volt paper capacitor

LS1, LS2—Rectangular electrostatic speaker, Model ST-H-5/16 (Arnold Ceramics, Tweeter Div., 1 E. 57 St., New York, N. Y.)

R1—25,000-ohm linear taper potentiometer (IRC Type RQ-11-120 or equivalent)

R2, R3—220,000-ohm, 1/2-watt resistor

T1—Audio output transformer (Stancor A-3879 or equivalent)



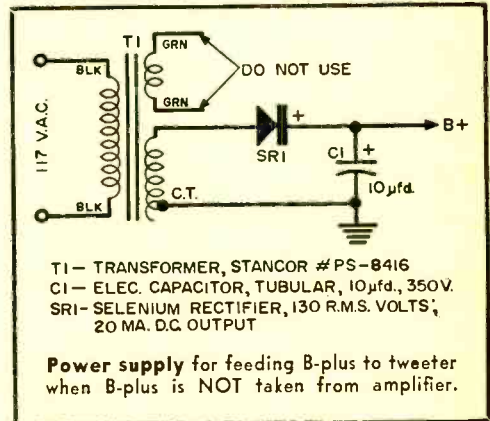
**Schematic diagram** and parts list are given at upper left. Photo shows completed unit. Note level control mounted on one of the wooden sides. Directly above are panels required for housing. Pieces 1 and 2 are each 8 1/2" x 8 1/2" quarter circles. Pieces 3 and 4 are each 8 1/2" x 7 3/4" rectangles.

housing is shown at right. This is not a speaker enclosure in the traditional sense, but merely an attractive and convenient housing. Cautions usually applied to speaker enclosure construction need not apply here.

Thin 1/4" plywood can be used for the rectangular sides. The top and bottom arc sections were made of 5/8" plywood only so that the edges of the arc, top and bottom, could serve as a mounting surface for the two tweeter units. The enclosure need not be airtight.

All electronic parts for the circuit can be built right into the rear of the wooden box itself, by screwing down terminal strips to top or bottom panels. Note the wiring layout on page 50. The third wire, which comes from the hi-fi amplifier, is for the d.c. polarizing voltage—it may be any amount from about 200 to 300 volts and it need not be particularly well filtered (remember, you can't hear 60 or 120 cycles from an electrostatic tweeter). This B-plus wire can be run right along with your regular speaker leads back to the amplifier where a suitable voltage point can be found readily. For those who may be a bit hesitant about running such voltage around the house, we have also shown a small, separately built power supply which can be housed right inside the tweeter box.

**Angling In.** After the entire unit is assembled and the circuitry wired, mount the two tweeter units vertically, at an angle of



about 120° from each other, as shown in the photograph. The tweeter level control should be mounted on one of the side panels, preferably out near the rear, through small, 1/8" holes. Connect the two transformer leads to the 16-ohm tap of your amplifier. Connect the d.c. lead to the appropriate source of voltage, turn on your rig, and gradually increase the tweeter level control setting until you hear these clean, crisp highs as you like them.

Position the box in its final location and  
 (Continued on page 116)

# Rejuv-a-chek

By  
JOHN P. SHIELDS

THE "REJUV-A-CHEK" is a device designed to restore many hours of useful life to weak TV picture tubes and to other radio tubes. It is also a rapid tester of tube heaters, resistors, coils, pilot bulbs, and household appliances for continuity or burn outs.

Simply constructed and easy to build, this useful instrument can be duplicated for \$8.00 or less, even without resort to your junk box.

**Construction.** Mount the tube sockets, switch, and a  $\frac{3}{8}$ " rubber grommet—which holds bulb *NE1* in position—on the 4" x 5" top of the box. Then mount the filament transformer and the two-terminal tie strip on one end of the box. Also drill a  $\frac{3}{8}$ " hole in this end and insert the other grommet.

## HOW IT WORKS

In everyday use, the oxide coating of receiving tubes is gradually replaced by a layer of inert oxide "ash." As a result, cathode emission slowly decreases until it becomes insufficient for proper operation of the tube. In TV picture tubes this shows up as a dim picture with poor contrast, in others as low output, fuzzy quality, or loss of gain.

By operating the tube heater at approximately 30% above its rated voltage for about 10 minutes, with no connections to the other elements, this layer of dead ash may often be burned away to uncover a fresh layer of active oxide, thereby giving the tube new life. Of course, rejuvenation is only possible in tubes that have a reserve of cathode oxide to be uncovered and that do not have other defects.

The low current requirements of the neon indicator and the high value of dropping resistor *R1* limit the maximum current that may flow to less than 2 ma., making it possible to test even fairly high resistance components for continuity.

**Test and rejuvenate your  
radio and TV tubes with  
this easily built device**

It will pass the power cord and the connections to the TV picture tube socket.

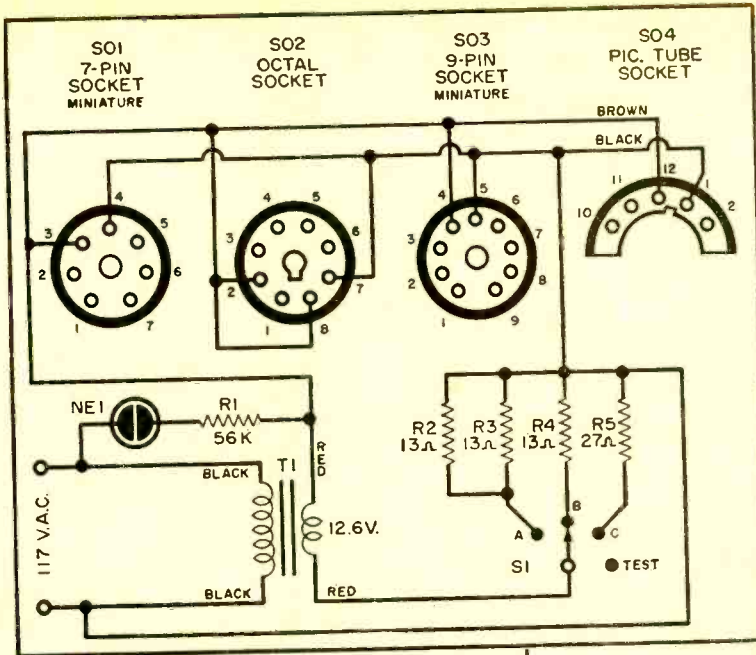
Wiring consists of connecting one heater terminal of each tube socket to the same red lead of the filament transformer and to *R1*. The other heater terminals of the sockets are similarly connected together and to one end of *R2*, *R3*, *R4* and *R5*. One black transformer lead and one side of the 117-volt power cord are also connected to the above junction.

Although there are five wires in the cable from the TV tube socket, only the black and brown wires are used in this circuit. The other three may be cut off short, taped up and pushed into a corner.

Turn switch *S1* to the limit of its rotation in one direction. It is now in the *Test* position. Leave this fixed contact connection blank. Connect *R5* to the next one (*C*), *R4* to contact *B*, and *R2-R3* to contact *A*. Connect the remaining red transformer lead to the rotor terminal of *S1*.

**Using the Rejuv-a-chek.** Turn the switch to *Test*, insert the power plug into a 117-volt receptacle, and plug a tube into the appropriate socket. If the tube heater is intact, bulb *NE1* will immediately glow.





**Simplicity** of circuit is shown in diagram at left. Pictorial wiring diagram appears on p. 54. Although the transformer has a 12-volt output, the circuit tests 6.3-volt tubes. Footnote on next page tells how to vary circuit for other tubes. Photo at bottom of this page shows location of parts under the chassis box.

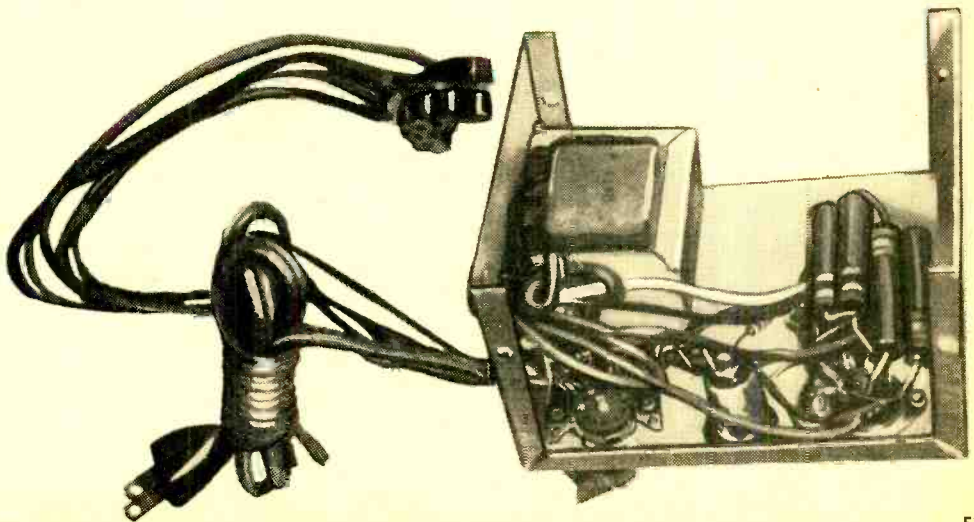
If *NE1* does not glow, the tube is burned out.

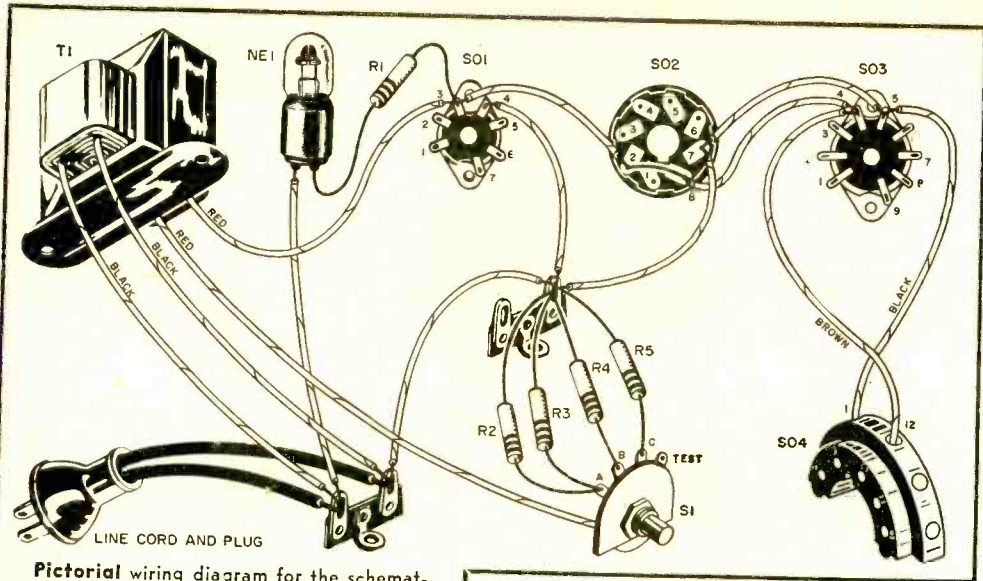
Assuming that *NE1* does glow, turn the switch to position *A*, *B* or *C*, selected as described below, and allow the tube to "cook" for about 10 minutes. Then test the tube in a tube tester or in the equipment from which it was removed. If it is weak, repeat the rejuvenation process once or twice. If it still does not respond, the tube is too far gone to be salvaged.

It's not necessary to remove a picture tube from a television receiver to apply the rejuvenation process. Simply pull the TV receiver plug from the 117-volt recep-

#### PARTS LIST

- NE1—NE-16 neon bulb
- R1—56,000-ohm, 1/2-watt resistor
- R2, R3—13-ohm, 2-watt resistor (a single 6.5-ohm, 3 to 5 watt resistor may be substituted)
- R4—13-ohm, 2-watt resistor
- R5—27-ohm, 2-watt resistor
- S1—5-position rotary switch (Mallory 32151 or equivalent)—use 4 positions
- SO1—7-pin miniature tube socket
- SO2—Octal tube socket
- SO3—9-pin miniature tube socket
- SO4—Picture-tube socket with leads
- T1—12.6-volt filament transformer (Stancor P-8130 or equivalent)
- 1—3" x 4" x 5" aluminum box (Bud CU-2105 Minibox or equivalent)
- 1—Line cord with plug
- 1—2-terminal tie point
- 2—3/8" rubber grommets
- Misc. hookup wire, 6-32 machine screws and nuts, decal transfer letters





**Pictorial** wiring diagram for the schematic shown on p. 53. The three extra leads on TV tube socket SO4 are clipped off.

tacle and replace the regular picture tube socket with the socket from the Rejuv-a-chek. After the treatment, replace the regular tube socket, insert the TV set power plug, and check the received picture for increased brilliance and better contrast.

The Rejuv-a-chek is designed for use with tubes containing 6.3-volt heaters requiring 0.15 amp. (switch position C), 0.3 amp. (switch position B), or 0.6 amp. (switch position A). Consult a tube manual for heater current data before plugging in an unfamiliar tube.\*

You can check the continuity of components with the Rejuv-a-chek by means of a pair of test leads plugged into socket holes 2 and 7 of the octal socket. Be careful not to touch the bare tips of the prods together or touch them to a grounded object, because one of the two test prods is connected directly to the 117-volt power line.

Although the Rejuv-a-chek will not rejuvenate every weak tube plugged into it, its batting average is surprisingly high. Try it and see.

-30-

\* More sockets may be included to accommodate additional tubes if their terminals are connected in parallel with those of the present sockets. For example, another 9-pin socket, with pins 4 and 5 strapped together as one heater terminal and pin 9 as the other heater terminal, will accommodate most of the 6.3/12.6-volt, 9-pin tubes such as the 12AU7, 12AT7, etc.

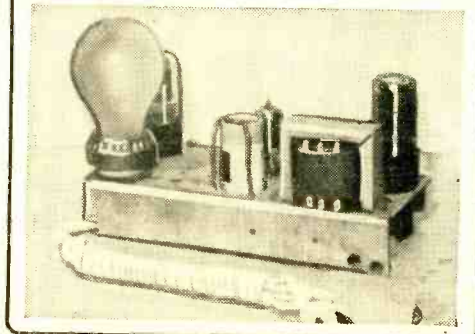
To calculate the values of dropping resistors for tubes with different voltage and current requirements, multiply the rated voltage by 1.35. Subtract the product from 12.6 volts. Then divide this answer (4 volts for 6.3-volt tubes) by the rated heater current in amperes. The result will be the required resistance in ohms. Multiply the voltage drop by the current to obtain the required wattage rating. Use the next larger wattage resistor.

## Bulbs for Series Heaters

Every now and then an unusual value of heater dropping resistor would solve a voltage problem. Most experimenters forget that the ordinary lamp bulb can be used. I built a phono-amplifier (shown in the photo) using a 40-watt household bulb in series with a 12AU7, 50L6 and 35Z5; this provided the correct heater voltage drop and has been in use for several months. Another circuit that I put together using a lamp bulb employed a pair of 25L6 tubes, in parallel, fed from a single 6SN7 tube; the heater voltage here was obtained from a 100-watt bulb.

Experimenters can easily duplicate these experiments using other tubes and bulbs if they follow a rule-of-thumb approach. You cannot calculate the resistance of the lamp in advance since the values change with the amount of current flowing. Start with 6- or 10-watt bulbs and work up to the desired filament drop.

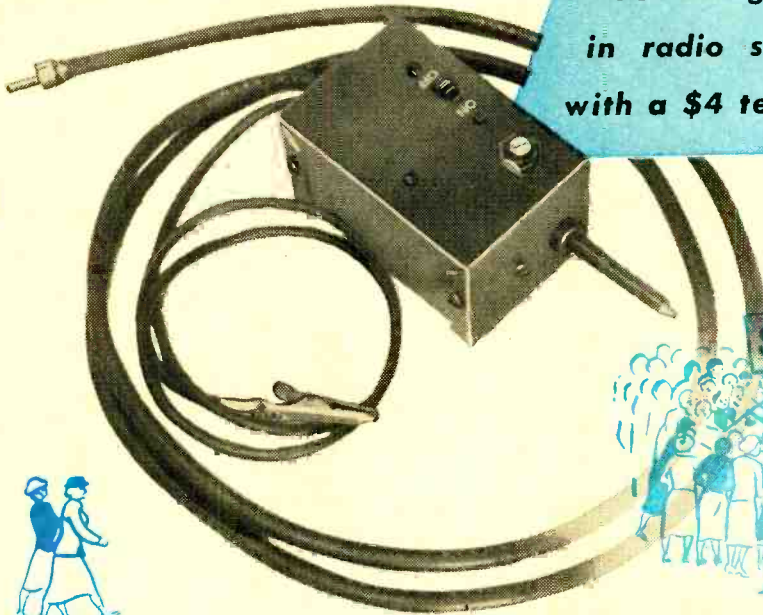
—Don L. Roberts





By R. L. WINKLEPLECK

You can get started  
in radio servicing  
with a \$4 test unit



## Bargain Basement Signal Tracer

**S**IGNAL TRACERS are useful in troubleshooting radio receivers since they permit checking a circuit under operating conditions and use the received signal itself as the common denominator. They quickly and easily check for the presence, strength and distortion of the signal at various points in the circuit. Here is a junior-grade signal tracer which performs on a par with the best, yet is so cheap and so simple to construct that anyone who ever probes the innards of an ailing radio will really treasure it.

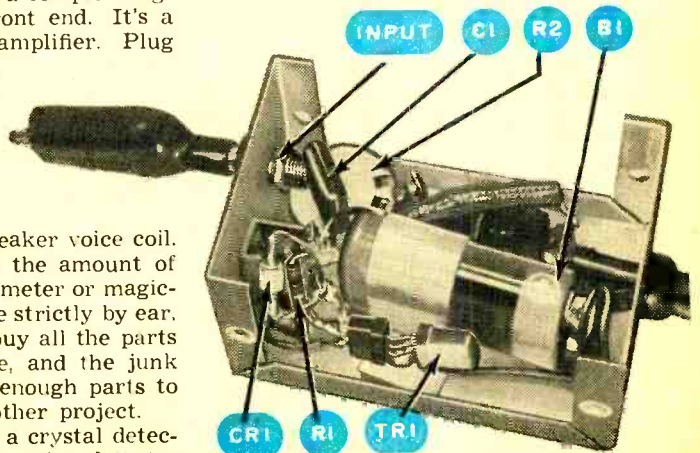
Actually, the gadget isn't a complete signal tracer: it's just the front end. It's a very compact detector/preamplifier. Plug it into the phono jack of a working radio or a small amplifier, and you'll have an r.f. or a.f. tracer which will pick up the signal from the antenna of the set under test and follow it through to the speaker voice coil.

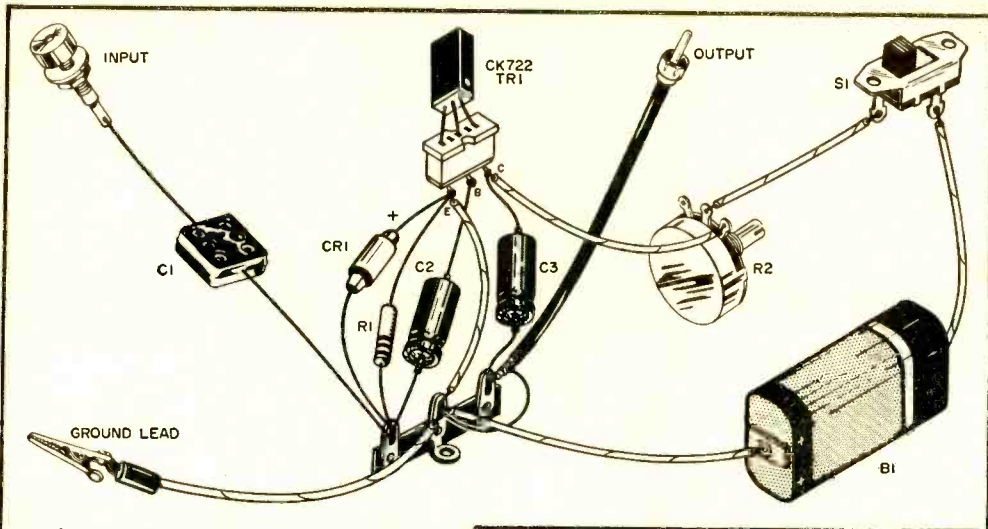
This unit won't tell you the amount of gain in each section with a meter or magic-eye tube. You must operate strictly by ear. But a five-dollar bill will buy all the parts if you shop around a little, and the junk box probably will provide enough parts to leave some change for another project.

The tracer consists of a crystal detector using a 1N34A diode. The detector

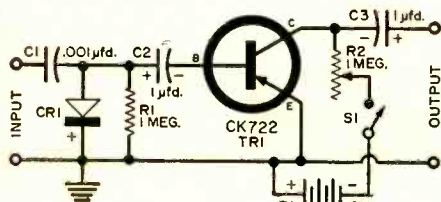
feeds into a single-stage, grounded-emitter transistor preamplifier using a CK722. A potentiometer ( $R2$ ) between the battery and the collector is adjusted once for maximum gain with minimum distortion, and then touched up only occasionally as the battery ages. All this is fitted into one of those small aluminum boxes and connects, via a length of microphone cable, to the

**Interior view of tracer.** All components—except B1, C3, R2 and S1—are attached to three-point tie strip before being installed in box. An insulated alligator clip is used in input jack.





Hook up the "bargain basement" signal tracer's components as shown in the pictorial diagram above; schematic and complete parts list for this simple test unit are given below.



- B1—9-volt mercury transistor battery (Mallory TR-146R)
- C1—0.001- $\mu$ fd. mica capacitor
- C2, C3—1.0- $\mu$ fd. miniature electrolytic capacitor
- CR1—1N34A crystal diode
- R1—1-megohm,  $\frac{1}{2}$ -watt resistor
- R2—1-megohm linear potentiometer with stub shaft
- S1—S.p.s.t. slide switch
- TRI—CK722 transistor
- 1— $1\frac{5}{8}$ " x  $3\frac{1}{4}$ " x  $2\frac{1}{8}$ " aluminum case
- 1—Three-point tie strip
- 1—Insulated banana jack
- 2—Banana plugs
- 1—4' length of microphone cable
- 1—1' length of limp test lead wire (for ground lead)
- 1—Phono plug
- 2—Alligator clips

phono jack of a convenient radio receiver.

Most of the components are hung on a 3-point tie strip with the center point grounded. These are all soldered in place before being installed in the box. The input connection is an insulated banana jack, so it's easy to substitute an alligator clip for the simple probe—both of which are soldered to banana plugs—when you want to clip the tracer to the section being examined.

A strip of aluminum or tin can stock

holds the battery in place. And the transistor can be soldered directly into the circuit, thus eliminating the socket. Remember not to overheat the diode and transistor while soldering.

**The tracing technique** is very fast and simple. Tune the set under test to a strong local station or feed a modulated signal into the set from an r.f. signal generator. Plug the tracer into the phono input of a working radio and turn the volume clear up.\* Then clip the ground lead of the tracer to the chassis of the test set.

Starting with the antenna, pick up the signal at the input and output of each stage. This is easily done at the input grid and the plate of each tube. As you progress through the set and signal strength increases, the gain of the radio being used as an amplifier can be cut back. Best results may be obtained through disabling the a.v.c. of the set being tested by grounding the black lead from the first i.f. coil; this isn't strictly necessary but it will give you a better idea of the gain contributed by each stage.

When a stage is reached where the signal disappears, weakens, or becomes distorted, the trouble is localized. Then it is only necessary to check out the few components in this stage to find the trouble.

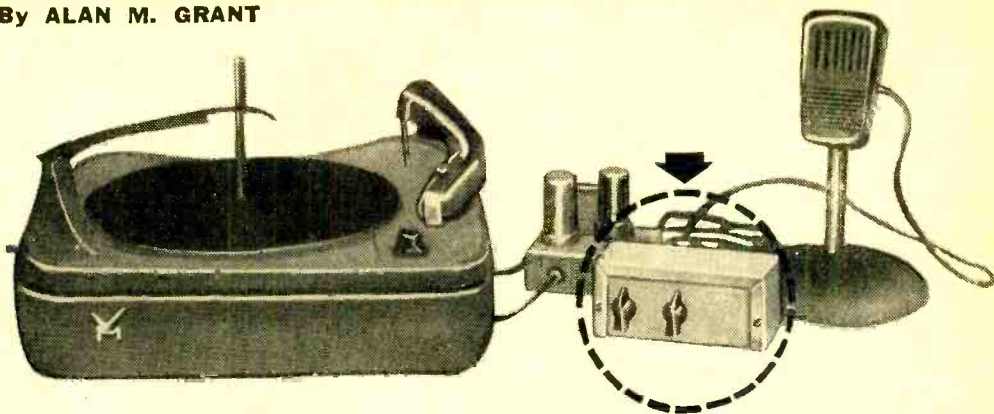
Do your friends and neighbors bring you their old radios for you to fix? Are you just getting started with a little part-time service work? If so, this junior-grade signal tracer is for you.

—30—

\*If you're using a transformerless radio for your amplifier and are checking out another transformerless set, both chassis should be at ground potential. This is always a good precaution whatever you're doing. With each set plugged in and turned on, take a voltage reading from chassis to a good ground. If any voltage is present, reverse the line plug.



By ALAN M. GRANT



## Simplified Hi-Fi Mixer-Equalizer

**T**HIS mixer-equalizer adds signals from a mike and magnetic phono pickup to be fed into a tape recorder or public address system. It can also match two microphones of different sensitivity, or "gain down" the signal from a crystal pickup or tuner to the lower output level of the magnetic pickup.

Many experimenters and technicians have high-gain p.a. amplifiers which would be excellent for use with a magnetic pickup except for the fact that they do not provide for equalization of the incoming signal. This easily built device provides the desired equalization for the pickup.

Note, however, that this unit does not take the place of a preamplifier. It cannot be used unless the amplifier possesses sufficient gain to be driven by a crystal mike.

For those who already have preamplifier-equalizer circuits in their amplifiers, this circuit provides a means of adjusting the amount of bass boost and also provides variable high-frequency roll-off, a feature not found in many hi-fi amplifiers.

**Circuit Features.** Switch *S1* enables you to switch the equalizer network in or out of the circuit. With the equalizer out of the circuit, jack *J1* can be used for another microphone.

There are two potentiometers. *R5*, which controls the amount of high frequencies to be amplified, can be used to reduce surface noise on old records as well as the boosted highs found on some high-fidelity recordings. The other potentiometer, *R1*, serves as a gain control across the mike input.

### *Tubeless circuit permits mixing and equalizing of signals from phono pickups and microphones*

Relative loudness of the phono pickup can be controlled by the gain control located at the amplifier input.

Before this unit is used with an amplifier, it is wise to check the input circuit to make sure that there are no

*RC* networks which will affect the tone quality of the material to be amplified. For instance, a mike input often has a small ceramic capacitor and resistor-to-ground network to peak voice frequencies. Naturally, this must be removed if any kind of high-quality response with records is to be obtained. Also, any phono equalization networks designed for magnetic pickups must be removed if the equalizer is to function properly; failure to do this may result in unnaturally boosted lows and exaggerated highs, caused by "double equalization."

If you want to be able to vary the

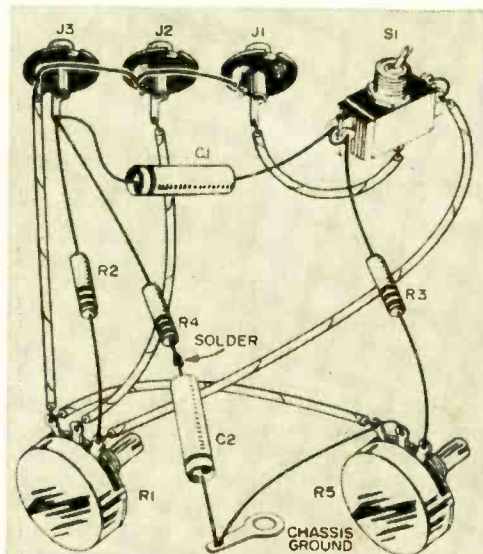
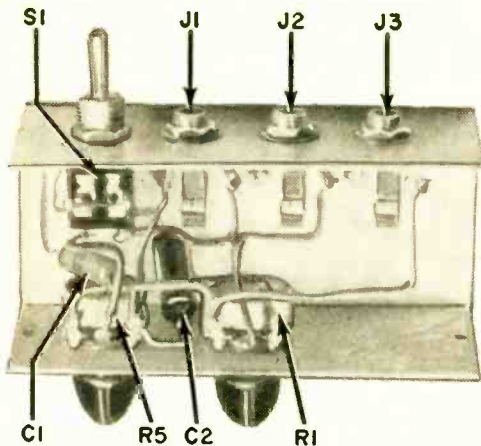
### HOW IT WORKS

The signal from the magnetic pickup enters via *J1*. Switch *S1* sends it either through the equalizer or through *R2* to output jack *J3*. In the latter case, part of the signal is impeded by *R2* and part of its high-frequency component shunted to ground through *R4* and *C2*, thus boosting the bass.

*R5* serves as a variable load resistor across the pickup. *R3* serves as a "limiter" to keep *R5* from shorting the input in its minimum resistance position.

Signals from another program source enter by way of *J2*. *R1* serves as a volume control. These signals also go to *J3*.

The bass boost portion of the equalizer is common to both the microphone and phono inputs. If the user feels that this additional bass interferes with speech intelligibility, a small capacitor (on the order of 0.001  $\mu\text{fd.}$ ) may be inserted at point ② which will effectively cancel the effect of the equalizer on the mike circuit.

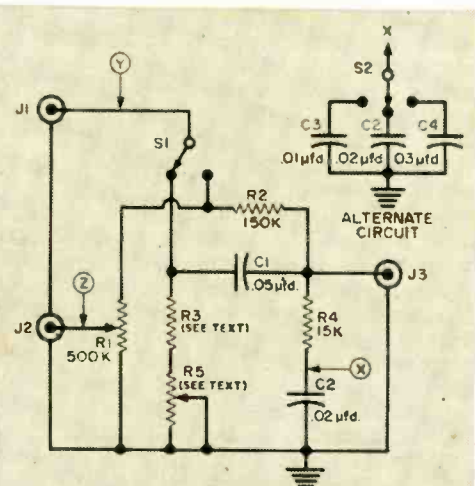


and  $R3$  (see pictorial diagram). The 0.05- $\mu\text{fd}$ . capacitor,  $C1$ , serves to block any voltage from the pickup that might flow back from the amplifier as a result of a short circuit to high voltage. It can be omitted if desired.

To have as much maneuvering room as possible in the small chassis box, it is recommended that  $\frac{1}{2}$ -watt resistors and 150- to 200-volt capacitors be employed to reduce the physical size of components.

Use the shortest possible lengths of wire and fasten all ground lugs to a common negative with heavy bare copper wire. Keep all components as close to the box as possible.

**Using the Mixer-Equalizer.** Connect a microphone to  $J2$  and a magnetic pickup to  $J1$ . Adjust the amplifier gain control to a moderate level. Then, talking in a normal voice, adjust the microphone volume control,  $R1$ . If the phonograph volume level  
(Continued on page 108)



- $C1$ —0.05- $\mu\text{fd}$ ., 200-volt paper capacitor
- $C2$ —0.02- $\mu\text{fd}$ ., 200-volt paper capacitor
- $C3$ —0.01- $\mu\text{fd}$ ., 200-volt paper capacitor
- $C4$ —0.03- $\mu\text{fd}$ ., 200-volt paper capacitor
- $J1, J2, J3$ —Connector jack, either microphone type or RETMA standard type
- $R1$ —500,000-ohm potentiometer, audio taper
- $R2$ —150,000-ohm,  $\frac{1}{2}$ -watt resistor
- $R3$ —About 7000 ohms (minimum resistance value allowable as a load resistor for specific magnetic pickup used—see manufacturer's recommendations)
- $R4$ —15,000-ohm,  $\frac{1}{2}$ -watt resistor
- $R5$ —10,000-15,000-ohm potentiometer (depending on the recommended load resistor)
- $S1$ —S.p.d.t. switch
- $S2$ —Three-position rotary switch
- 1—Miniature aluminum chassis box
- \*For variable bass boost (see text)

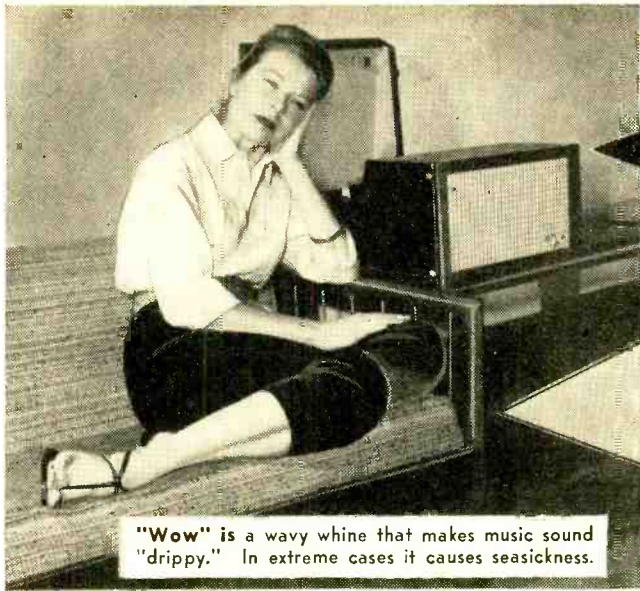
**Complete details** for building the mixer-equalizer are given above. Note recommended positions of parts shown in photo at top.

amount of bass boost to compensate for various record characteristics, you may insert two additional capacitors and a three-position rotary switch at point X (see schematic). Capacitor  $C2$  provides a slight bass boost. A 0.03- $\mu\text{fd}$ . capacitor will provide essentially flat response, while an 0.01- $\mu\text{fd}$ . unit will increase the bass. If you don't want to bother with the switch, simply experiment with different values until you find one that is pleasing to your ear.

**Construction Hints.** This mixer-equalizer will have very little insertion loss or hum if properly constructed in a small aluminum chassis box. Don't use a wooden box or an open chassis.

Because of the extremely low level of magnetic pickups (about 15 millivolts), it is imperative that all "hot" leads be kept as short as possible and close to the sides of the chassis box. One of the switch lugs on  $S1$  serves as the tie point for  $C1$





**"Wow"** is a wavy whine that makes music sound "drippy." In extreme cases it causes seasickness.

*Wow!*

**You  
Should Watch  
That Flutter!**

**S**OME HI-FI TROUBLES sneak up on you slowly. After years of unalloyed listening joy, you may encounter alarming symptoms. Instead of pouring forth in a solid, sonorous stream, the music just seems to wobble out of your loudspeaker. That's the tell-tale sign of "wow and flutter," usually the result of gradual wear on the mechanical parts of the turntable drive or tape transport.

"Wow" is hi-fi jargon for a wavy, undulating kind of speed variation. It makes the music sound so "drippy" that you keep looking for puddles under the phonograph. In extreme cases, it can make you seasick.

"Flutter" is basically the same thing, except that the speed variation happens more quickly. It's a kind of fast chugging of the turntable or tape that makes you think the music got squirted between hummingbird wings.

In the past, wow and flutter were mostly checked by ear. You put on a record or a tape with long, sustained notes played on an instrument with absolutely constant pitch—a piano or an organ, for instance. If the music sounded "wavy" or "trembly," you knew that the speed was uneven.

Yet with rising hi-fi standards, this haphazard test was no longer accurate enough. Specialized hi-fi service technicians, wanting to keep turntable and tape speeds constant within a fraction of 1%, had to know just *how much* wow and flutter beset any given hi-fi system.

To satisfy this need, the D & R Company developed a "Wow and Flutter Meter." By integrating frequency variations, this instrument provides direct dial reading of the precise amount of wow and flutter. —30—



**"Your trouble is flutter"** says the audio expert, checking phonograph with "Wow and Flutter Meter."



**"That's much better,"** exults customer, after whines and whirring are banished.





the battery mounting problem is eliminated.

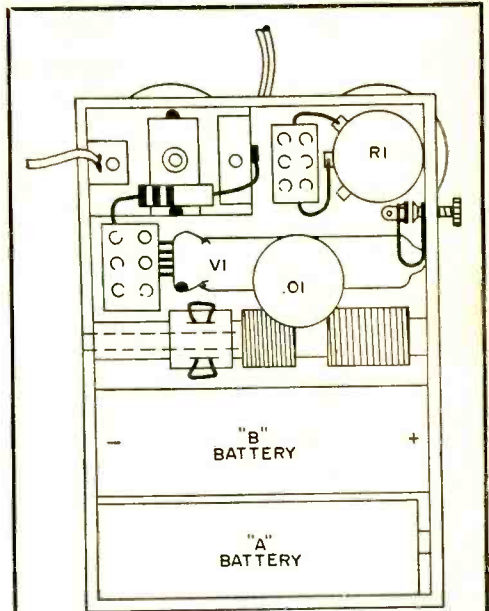
Connections to the ground side of the batteries are made by cutting out a thin copper strip about 1½" long, bending its ends at right angles, and pressing it into the inside wall of the plastic box with the gentle persuasion of a hot soldering iron. After the softened plastic sets, in a few seconds, the copper strip is firmly embedded in the wall of the box. The other two battery connections for the A+ and B+ are pressed into the other side of the box in a similar manner. Bending the ends of these two battery connections to act as springs will assure good electrical contact to the batteries.

As the current drain is very small, the batteries may be soldered directly into the circuit. Several months of operation can be obtained from one set of batteries. No switch is necessary for the 22½-volt supply, as no plate current is drawn when the filament is turned off.

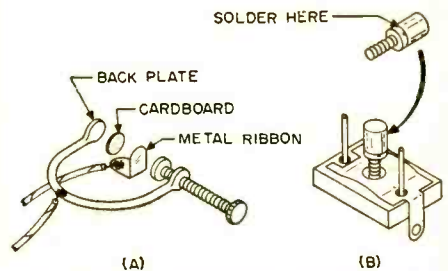
Solder the CK533AX directly into the circuit without a tube socket. When soldering the tube leads into the circuit, it is wise to grip the leads with a pair of long-nose pliers near the tube to conduct the heat away and reduce the danger of cracking the envelope.

Make the tuning capacitor mount by soldering two ½" No. 12 busbars into the two mounting holes. After these busbars are heated, they can be pressed into the plastic box to make a very rigid unit. Before doing so, however, the shaft of C1 must be modified. Cut a 3/16"-diameter copper rod (a machine screw may be used) to a suitable length (about 3/8") and hold it in a vise with the flat end up. Take out the flat-

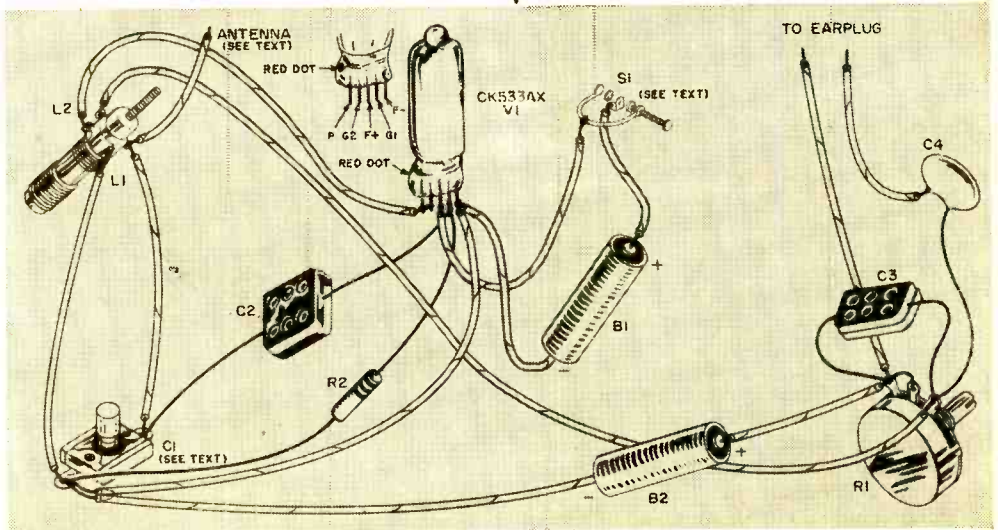
(Continued on page 116)



Parts layout above shows how components can fit into very small case. Compare this diagram with the pictorial at bottom of page.



Two special components assure complete miniaturization: on-off switch (A) made from an earring, and (B) extension to capacitor C1.





## There's No Fun in

# FUNIAAC

By Carl Kohler

**H**UDDLED around a cup of coffee, I squinted groggily across the breakfast table at my wife. She enthusiastically attacked her scrambled eggs with the appetite and energy of a woman who gets nine hours sleep every night.

"Up pretty late last night, weren't you?" she observed between mouthfuls. "What's the matter—those cartoons giving you trouble again?"

I nodded foggily and poured myself more coffee.

"Run out of funny ideas?"

"Must be in a mental slump," I muttered. "Just can't seem to toss off the ho-ho with ease any more. Sometimes I find myself wishing I'd gone in for a sensible career—like sand-hogging or tearoom-managing, maybe—instead of magazine-cartooning."

"Well, you better snap out of it—and darn fast, too," she advised cold-heartedly. "The competition is turning out funny stuff as if they had cartoon machines instead of drawing by—"

"Hey!" I gurgled.

Mental circuits hummed with a sudden overload of idea-juice. Little light-banks of inspiration blinked furiously in the switchboards of my head.

"Say that again!" I demanded, my eyes flapping wide-open—my entire being alert now.

"You mean about the competition—"

"Nah! The cartoon machine! Don't you see it? That's the answer! The solution! Hurray for your accidental genius and all that jazz!" I rose from my chair and executed a deft, impromptu clog around the table. "That's what I need—a cartoon machine!"

"Oh, come off it," she scoffed. "Whoever heard of a machine drawing cartoons?"

"Drawing-schmawing," I hooted happily. "I'm talking about a machine—an electronic device—that *thinks up the ideas for cartoons*. The drawing is the least of my worries. What I really need is help with

the funny *ideas!*" I broke into a time-step and cavorted merrily.

"You've been working too hard," she stated flatly. "Any time you begin coming up with ideas that only a *maniac* might—"

"Sure, *that's it!*" I hollered joyously, hugging her until her collarbones groaned. "MANIAC! ENIAC! BIZMAC! SEAC!"

"What are you ranting about?"

"Electronic brain machines! Digital computers and all that ultra-modern tech-talk! I'll build one designed to compose and analyze humor situations! Feed a few basic concepts into it and—presto—out come fresh, original cartoon ideas!"

"Oh, galloping grief, and to think—"

"I'll call it FUNIAAC!"

"—that I thought I had finally—"

"It'll revolutionize the field!"

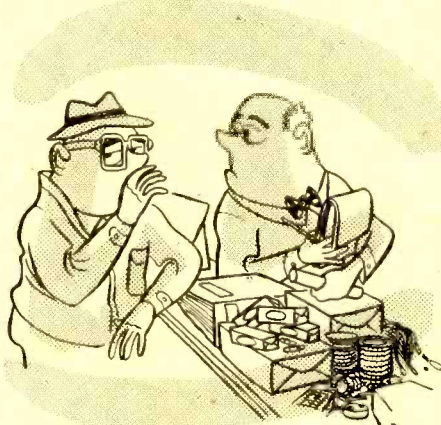
"—heard everything insanely possible in—"

"Sure! Automation comes to cartooning!"

"—this zany hobby of—"

"Naturally, it'll be *my* little professional secret. Can't have the clever, clever com-

(Continued on page 90)



... Lowering my voice to a hoarse whisper, I detailed my planned project to dealer Golenpaul—particularly embellishing the profits to follow ...





# "TransCal" a Transistorized Calibrator

**N**EARLY EVERYONE who works with radio signals should be able to check frequencies with fair accuracy. The amateur radio operator is responsible for the operation of his transmitter within assigned frequency bands. The SWL may want to check the calibration of his receiver and make sure that he doesn't miss picking up a particularly interesting station by tuning to the wrong frequency. Even the experimenter must be able to check frequencies with a reasonable degree of accuracy if his r.f. projects—receivers, tuners, etc.—are to be successful.

One of the best techniques for checking the frequency of a signal is to compare it with another signal of known frequency, such as the signal from an AM broadcast station or from the Bureau of Standards Station WWV. Since this provides only a limited number of known frequencies, the next best thing is to use a crystal calibrator. A 100-kc. crystal-controlled oscillator is particularly valuable for frequency checks. The output signal of such an oscillator can be made rich in harmonics, and so used to establish "check points" on a communications receiver well into the short-wave bands.

The instrument described in this article operates from a self-contained, long-life battery. With no connection to the a.c. power line, it is free from shock and its output is free of hum and line noise. Only standard, readily available components are used, and although its external appearance is that of a "factory-built" instrument, its assembly and wiring should be within the capabilities of beginners.

**Construction.** You can obtain the components from your local radio parts distributor or from one of the large mail order supply houses advertising in this magazine. Not all distributors will have the 100-



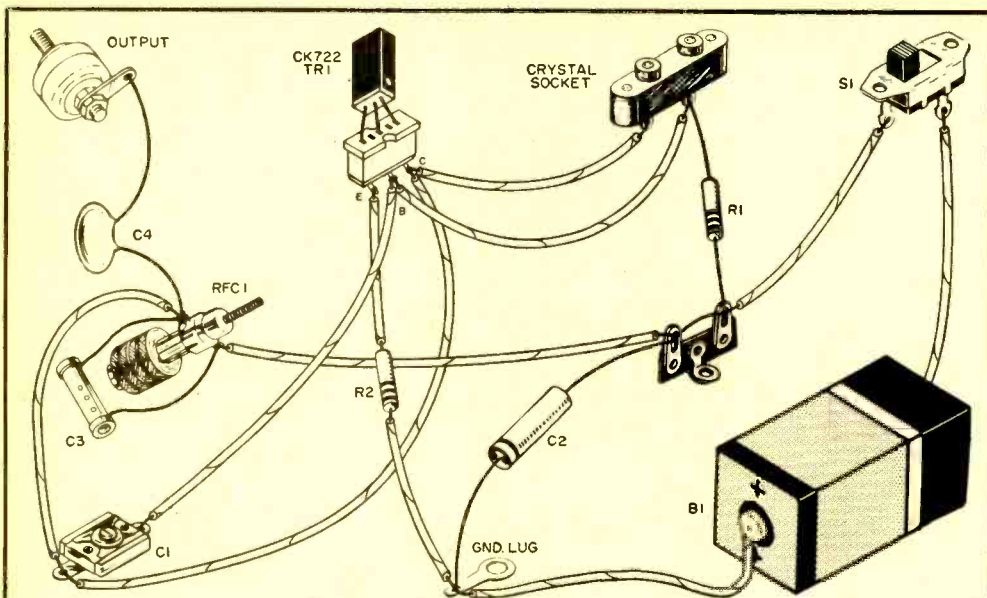
By **LUIS VICENS**

**Novices and SWL's can  
check received frequencies  
with this midget  
100-kc. oscillator**

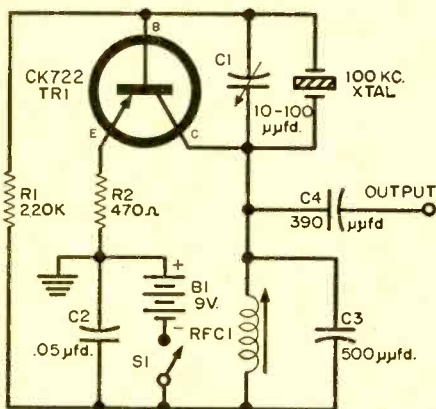
kc. crystal in stock, but most can obtain it for you on order.

You can make substitutions for some of the electrical components if you wish. *R1* may have values ranging from 180,000 ohms to 240,000 ohms. Any value from 0.05  $\mu$ fd. to 0.25  $\mu$ fd. is satisfactory for *C2*. Output capacitor *C4* may be any value from 270  $\mu$ fd. to 470  $\mu$ fd. Either mica, ceramic, or paper capacitors may be used throughout the circuit.

The chassis layout is not critical and you can either duplicate the model, as shown in the photographs, or make up a



Follow these diagrams when you build the crystal calibrator. Parts list is given below.



- B1—9-volt transistor battery (Burgess No. P6)
  - C1—10-100  $\mu$ fd. trimmer capacitor
  - C2—0.05- $\mu$ fd., 200-600 volt paper capacitor
  - C3—500- $\mu$ fd. tubular ceramic capacitor
  - C4—390- $\mu$ fd. disc ceramic capacitor
  - R1—220,000-ohm,  $\frac{1}{2}$ -watt carbon resistor
  - R2—470-ohm,  $\frac{1}{2}$ -watt carbon resistor
  - RFC1—5-35 mhy. adjustable r.f. choke (Suprex No. V-25)
  - S1—S.p.s.t. slide switch
  - TR1—CK722 p-n-p transistor (Raytheon)
  - XTAL—100-kc. crystal (Bliley No. KV3)
  - I—Small "Channel-Lock" aluminum case (ICA No. 29400)
  - 1—Transistor socket
  - 1—Crystal socket (Millen No. 33102)
  - 4—Rubber feet
  - 1—Insulated feedthrough terminal
- Misc. wire, solder, battery clips, ground lug, small brackets, terminal strips, etc.

new layout. Lead dress is also completely non-critical. Just make sure you observe the battery's polarity.

Of course, if you decide to solder the transistor permanently in position instead of using a socket, you'll have to take the usual precautions to avoid heat damage. Use fairly long leads and grasp the lead you are soldering with a pair of pliers at a point between the body of the transistor and the connection point. The pliers will absorb excess heat.

**Adjustment.** Install the battery and adjust the slug on RFC1 about three-quarters of the way "in." Adjust C1 to a setting about two or three turns back from "fully closed."

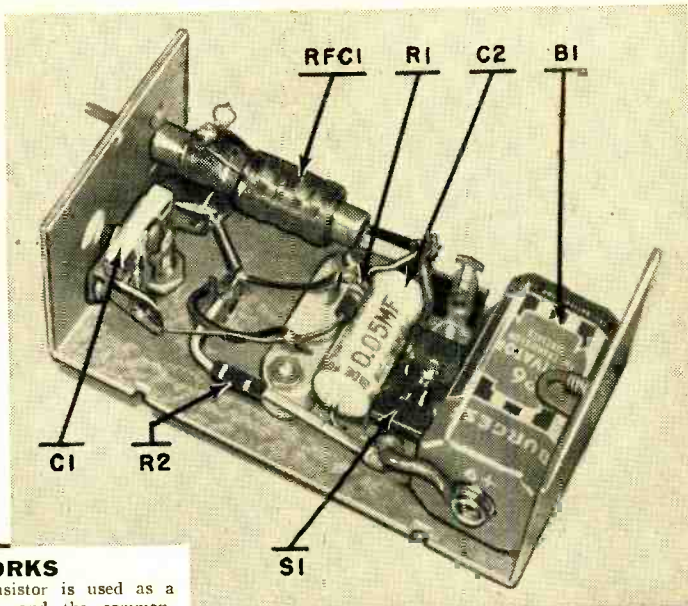
An insulated lead is connected to the calibrator's output terminal and the free end wrapped tightly around a receiver's

antenna lead-in wire, forming a small "gimmick" capacitor. Five or six tight turns should be ample. The "gimmick" capacitor coupling technique will not work if your receiver uses a coaxial lead-in cable. In such a case, connect a 25 to 100  $\mu$ fd. capacitor between the free end of the output lead and the receiver's antenna terminal.

If you have a local AM broadcast station with a frequency which is an even multiple of 100 kc. . . . such as 600 kc., 700 kc., 800 kc., etc. . . . you can make a preliminary test against this station. Simply tune to the station frequency and listen for an audio beat note indicating that the signal from the calibrator is interfering with the reception of the AM station. You can identify it by switching the calibrator off—the audio note should disappear.



**Open-chassis** view of the transistorized calibrator shows wiring details clearly. Only standard, readily available components are used. The major parts are identified here, but neither the circuit nor chassis layout is critical. Be sure to mount the battery securely.



### HOW IT WORKS

A single *p-n-p* junction transistor is used as a crystal-controlled r.f. oscillator, and the common-emitter circuit configuration is employed. Because of the low frequency (100 kc.) and circuit efficiency, a low-cost audio-type transistor—instead of the more expensive r.f. type—is specified.

Base bias current is supplied through *R1*. Adjustable coil *RFC1* and fixed capacitor *C3* serve as collector load, with the feedback obtained through the 100-kc. crystal. A small trimmer capacitor, *C1*, across the crystal, permits a slight control over operating frequency, providing the operator with the means to adjust the output frequency to exactly 100 kc.

Unbypassed emitter resistor *R2* helps stabilize circuit operation by adding a slight amount of negative (degenerative) feedback. The output signal is obtained through blocking capacitor *C4*.

If you cannot obtain an audio note, try readjusting *RFC1* and *C1*. If you are very lucky, you may have immediately set the 100-kc. calibrator on the exact frequency and be "zero beat" (meaning no audible beat note) with the broadcasting station. By juggling *RFC1* and *C1*, you should get a "zero beat" with a good 100-kc. crystal.

**Operation.** Now switch on the receiver's BFO and tune the receiver. You should obtain beats at 100-kc. intervals up to sev-

eral megacycles. The beats will become fainter at higher frequencies as the strength of the 100-kc. harmonics falls off.

On the upper bands of your receiver, and especially if your set has only moderate sensitivity, you may have to connect the calibrator's lead directly to the receiver's antenna terminal instead of using capacitor coupling. The maximum frequency at which you can still obtain beats depends primarily on the sensitivity of your receiver. Used on a low-sensitivity a.c.-d.c. "communications type" receiver, the model supplied beats up to 7 mc. On a better receiver, you should obtain beats at 100-kc. intervals up to 20 or 30 mc.

To double-check the calibrator, it should be adjusted with Station WWV at either 2.5 mc., 5.0 mc., 10 mc., or 15 mc. Operating 24 hours a day at these four frequencies. Station WWV (Beltsville, Md.) provides an accurate standard for your equipment. -50-

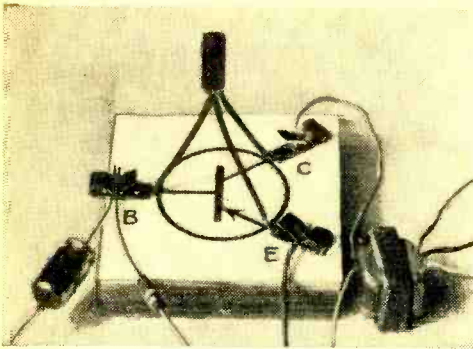
## You Can Help "Operation Smoke Puff"

If you are located in Texas, Oklahoma, New Mexico, Arizona, Kansas, Colorado, Utah, Nevada, or southern California, and regularly listen to the ham bands, you are an observer candidate for a special U. S. Air Force project. It is called "Operation Smoke Puff."

Later this year, several rockets will be fired from Holloman Air Development Center, near Alamogordo, New Mexico. These rockets will reach a height of approximately 70 miles, at which level they will discharge nitric oxide gas to form an artificial

patch in the ionosphere. Should the patch be sufficiently dense, it is quite probable that unusual ham band conditions will occur. A record of these effects is desired by the Air Force.

Observers participating in the project will be warned by mail, while others can listen to the "count down" station on 4870 kc. for word of the actual rocket firing. Further concise details may be obtained by writing directly to Prof. O. G. Villard, Radio Propagation Laboratory, Stanford University, Stanford, Calif.



## Graphic Transistor Mount

This transistor mount is designed to aid students and novice transistor experimenters. With it, many different hookups can be made without soldering and unsoldering transistor leads. The diagram on the mount will help students and novice experimenters to memorize transistor symbols.

The mount is a wood base measuring  $2\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{1}{2}''$ . A  $2\frac{1}{2}''$  square was cut from double-weight white paper and then the transistor symbol was drawn in the center, using India ink. —Art Trauffer

## Series Capacitor Filament Circuits

There are three general methods of obtaining filament voltage for electron tubes. Two of these methods, namely, the use of a transformer and a series resistor, are well known. The third method, which utilizes a capacitor in series with the tube filament, is less well known, although it has some interesting advantages.

A series capacitor has an advantage over a series resistor in that no heat is dissipated. Such a capacitor is also light in weight as compared to the usual filament transformer.

Another feature of series capacitor operation is its excellent regulation. When a tube filament is cold, the resistance is low. To maintain a properly rated current, the filament voltage should be reduced when the circuit is switched on. The series capacitor circuit is a constant current regulator at lower filament voltages, which means that regardless of the resistance an almost constant current will flow through the tube filament. This is easier on tube

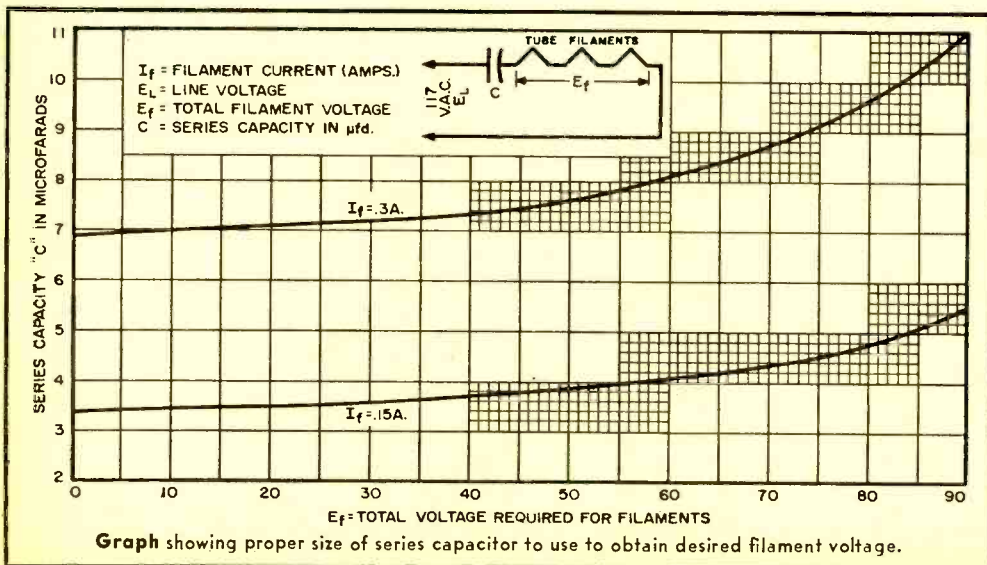
life since the tubes warm up without damaging current surges.

The series capacitor type of circuit really shines when the total filament voltage is below approximately 60 volts. The superior regulation as well as a more reasonably sized capacitor is then obtained. It is also evident that a smaller-size series capacitor can be used with 150-milliamperere filament string-type tubes.

The ordinary variety of electrolytic capacitors cannot be used in this application since these capacitors are good for d.c. circuits only. Paper capacitors should be used and the value required can be obtained by paralleling capacitors. In general, the voltage rating of the series capacitor should at least equal the line voltage. Metalized paper capacitors\* are extremely compact and come in the low-voltage ratings desired for this type of operation.

—Richard Graham

\* Good buys on these capacitors can often be obtained at electronic surplus houses.





# Simplified Etched Circuits

**New products and old ideas  
combine to ease  
preparation of printed circuits**

By LOUIS E. GARNER, Jr.

**M**ORE AND MORE electronic equipment manufacturers are turning to printed-circuit wiring boards as a means of producing quality equipment at a lower cost. Along with this increase in the use of wiring boards by manufacturers has come an increased interest in such techniques on the part of experimenters.

In the August and September, 1956, issues, POP'tronics published a two-part article on "Printed Wiring" Techniques for the Experimenter." This article concluded with the promise of information on more "advanced" techniques provided that there was sufficient reader interest.

There is no doubt that many readers are interested in printed circuits, but the demand has been for *simpler* rather than for more *advanced* techniques. So, in response to your letters and postcards, here is more information on simplified methods of making up etched circuits.

**Review of Basic Steps.** The basic steps followed in preparing a printed wiring or etched circuit board are outlined in the block diagram on page 68.

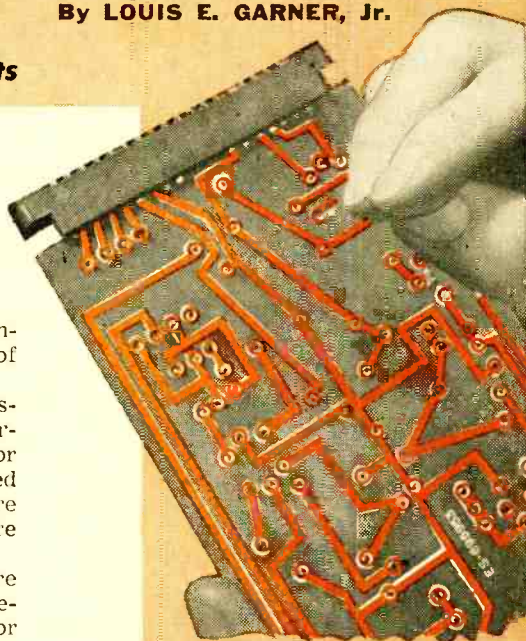
First, make a wiring layout of your circuit. Redraw the circuit full-size and show actual lead connections and placement of parts on a circuit board. Take care to minimize wiring crossovers and to insure that there is ample space for all parts needed. Graph paper is handy to use in making up this layout.

With the layout completed, cut a piece of copper-clad phenolic board to required size. The surface of the board is prepared for etching by cleaning with steel wool or with "gritty" household cleanser and a dampened cloth.

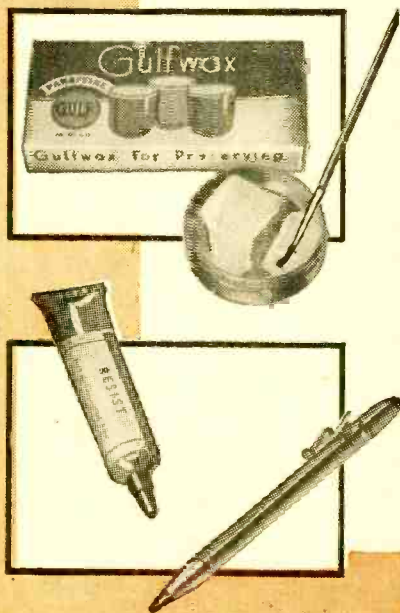
The layout is transferred to the board as a pattern of *acid resist*. As you may recall, recommended *resists* included asphalt-based ink and Scotch electrical tape.

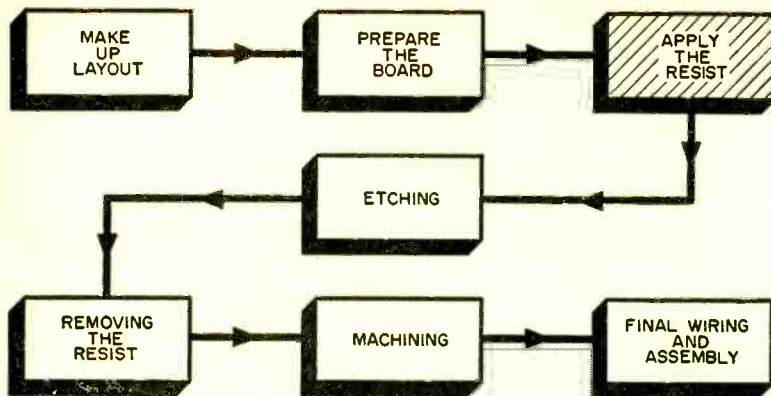
With the *resist* applied, the board is etched in a special ferric chloride solution or in *etchant* obtained from a commercial printed-circuit kit. Inspect the board frequently during etching to insure that all bare copper is removed.

The etching step may require from as lit-



Special resists with tools for applying them are shown below: paraffin wax and small brush, Techniques ball-point ink tube, Mark-Tex pen.





Basic steps in the preparation of an etched circuit. It is in the step labeled "APPLY THE RESIST" that simplified techniques can be used and time saved.

tle as three to as many as fifteen minutes, depending on the amount of copper to be removed, the condition of your *etchant* solution, and whether you use a cold or hot etching process. Cold etching may be done in a plastic, glass or enamel tray at room temperature. Hot etching requires the use of a *resist* that is unaffected by heat, and you must use a Pyrex glass or enameled metal tray. Of the two methods, hot etching is by far the fastest. It is carried out while the *etchant* is heated over an electric hot plate or similar source of heat.

Next, the etched board is removed from the *etchant*, washed and dried. Remove the *resist* either by buffing with steel wool, wiping with a soft cloth dampened in general-purpose solvent or, in the case of tape, by simple "peeling."

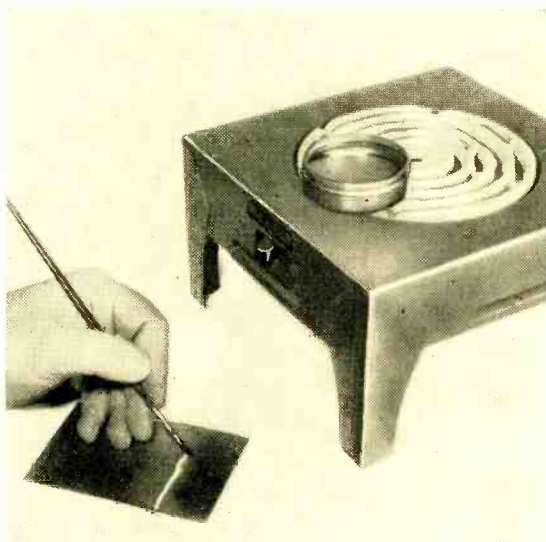
Machining is the next operation. Holes are drilled for mounting parts, any necessary cutouts are made, and the board is readied for final wiring.

The last step is final wiring. All components are mounted in position, leads and connections are soldered, and all hardware—such as mounting brackets and tube sockets—is installed.

**Simplified Techniques.** The most time-consuming steps in the preparation of an etched circuit are laying out the circuit and applying the *resist*. It is here that you can use simplified techniques to accomplish your objective.

You can acquire skill in designing circuit layouts by making up practice designs based on the schematic diagrams of construction projects described in POP'tronics. You needn't carry your circuit through to final etching and assembly to make this practice of value. Rather, you should learn to visualize a circuit in terms of two-dimensional wiring.

Once you have acquired skill in layout, you'll find that you can eliminate the initial step entirely and design your layout as you apply the *resist* to the copper-clad



Applying paraffin wax resist with a fine brush.

board. Then you can simplify the latter step by using a type of *resist* that is easy to apply. However, be sure to clean the board before applying the resist.

The conventional *resist*, asphalt-based ink, is rather messy to use; it dries rapidly and becomes thick, making it difficult to apply. Tape *resist*, while cleaner to use, is tedious to apply; the tape must be burnished against the copper-clad board to insure good adhesion—if care isn't taken here, the *etchant* will eat under the tape and ruin your circuit board.

Fortunately, there are other *resists* suitable for etched circuit work that do not have such disadvantages. Paraffin wax is a *resist* used for centuries in the acid etching of metals and glass. And, more recently, several manufacturers have introduced free-flowing acid resistant inks with suitable ball-point pens for application. Using such a pen, you can actually draw your



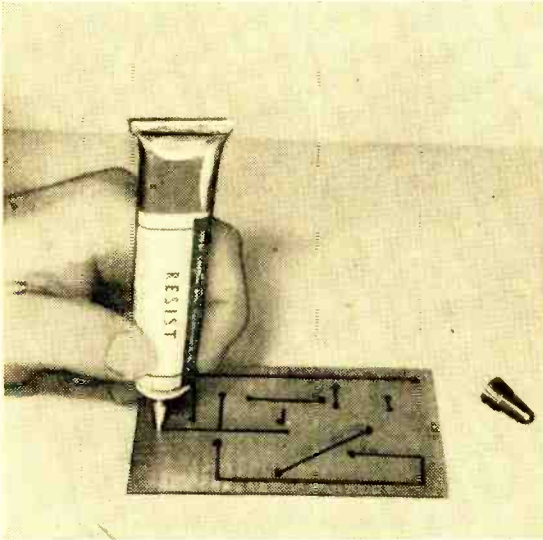
circuit layout directly on the copper-clad board.

Especially designed ball-point pens with acid-resistant inks are manufactured by: (1) Mark-Tex Corp., 453 W. 17th St., New York 11, N. Y., and (2) Techniques, Inc., 178-84 Central Ave., Hackensack, N. J. Both of these manufacturers can also supply acid-resistant inks in a variety of colors. By obtaining several colors, you can color-code your etched circuit board, drawing r.f. circuits in one color, power supply wiring in another, and so on. Later, after etching, you remove the ink only where you plan to make soldered connections. The result is an attractive color-coded wiring

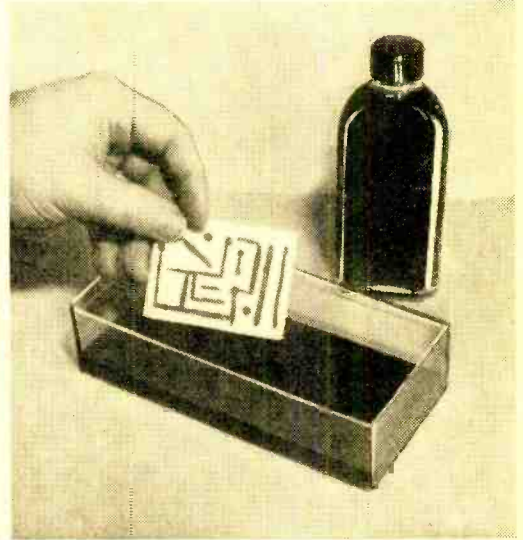
you use a wax *resist*—a hot *etchant* will melt the wax and ruin your circuit board.\*

**Using a Ball-Point Pen.** This is perhaps the easiest technique of all, but there are a few precautions to observe: (1) keep a scrap of board handy for "starting" the pen; (2) hold the pen vertical; (3) keep the point clean of excess ink, hair or dust; (4) don't use too much pressure—simply allow the ink to flow into place; and (5) don't touch the inked surface until dry.

The inks supplied by the Mark-Tex Corp. for use with its pens are resistant to heat as well as to acid. The red ink can stand quite high temperatures. If you use this type of ink *resist* in preparing your circuit



Using a ball-point ink tube to draw the circuit.



Placing prepared circuit board in the etchant.

board . . . with a circuit that is easy to trace in case future servicing is needed.

**Using a Wax Resist.** There is a definite technique to applying a paraffin wax *resist* to a circuit board.

First, melt the wax in a small metal container. Make sure that all the wax is thoroughly melted (good quality wax will look like water when liquid), but don't allow it to overheat or to smoke.

It is very important to preheat the copper-clad board. If the board is too cold, the applied wax will freeze on its surface and not adhere properly. If the board is too warm, the wax will spread and flow over the surface.

The wax is applied to the board using a fine brush. Simply "paint" the pattern you wish directly on the board.

A paraffin wax *resist* is suitable for all types of etched circuit boards. However, you must use a cold etching process when

board, you can employ the faster hot etching process.

If you make a mistake in drawing your circuit, don't worry. Simply allow the ink to dry, then scrape off and redraw the circuit on the clean board.

**Completing the Job.** Once the *resist* is applied in the desired circuit pattern, you can proceed with the other steps shown in the block diagram.

Wax *resist* may be removed by scraping or by wiping with a warmed cloth. Ink *resist* can be removed by scraping or by wiping with a cloth dampened with a suitable solvent, such as acetone. Or you can scrub off either of these special resists with steel wool.

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\* An interesting variation of the wax *resist* technique is the use of an ordinary wax crayon. Sharpen the crayon to a moderately fine point, and simply draw your circuit on the preheated copper-clad board. If you wish, you can use different colored crayons for color-coding the wiring.

# Living with Kids — and Hi-Fi

**T**HAT DEVILISH gleam in your enterprising offspring's eye may be a source of parental pride—but if you have a hi-fi set, WATCH OUT!

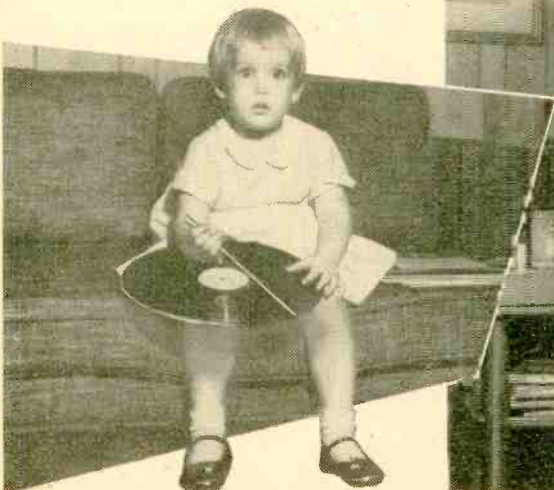
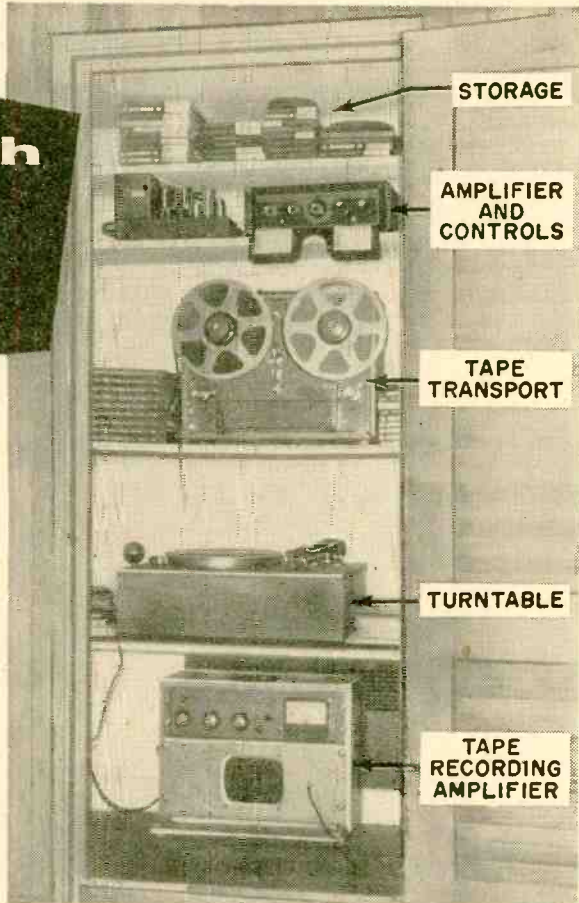
Our four-year-old Lindy and two-year-old Shannon can't resist whirling tape reels and glowing tubes. And a turntable seems to them just right as a merry-go-round for teddy-bears. The old and usually futile admonitory "Don't touch!" only serves as a tickler to stimulate their interest in all these fascinating gadgets and gizmos.

As the exploratory proings of four tiny hands proved disastrous to the hi-fi set and a severe strain on parental patience and the family budget, we had to devise a method of defense, which is now known as "Welch's Recessed Repository of Electronics"—in other words, a hi-fi closet for housing and hiding the various components of our music system.

The finished closet is shown above. Now

that all the hi-fi gear is stowed beyond reach of the small fry, switches and knobs are at last safe from experiments by the next generation of hi-fi enthusiasts, whose former activities are duly documented in the illustrations below.

—Nat Welch







By Eugene F. Coriell

Lt. Col., USAF

FIRST

STEPS

## in **SERVICING** Hi-Fi Equipment

*Some day you may have your own workbench or service shop—  
in the meantime, try these simple cures for hi-fi headaches*

**W**HEN IS A NOISE not a noise? When it's a hum. Maybe that's too sweeping, so let's say that hum is a special kind of noise—a steady low-pitched sound whose causes and cures were discussed in "Mum That Hum" in the October 1956 issue of **POPULAR ELECTRONICS**.

Now we're going after other kinds of noise—clicks, hiss, plops, hash, howls and crackles. Incidentally, sometimes hum and noise arise from the same causes—and sometimes they don't.

### **OUTSIDE YOUR GEAR**

Occasionally you may spot some obvious cause of noise such as a broken ground wire. Less obvious would be bad connections between cables and plugs, or broken strands in the cables. Wiggling the plugs in their sockets and flexing the cables will usually show up these defects.

Various home appliances may cause clicks or plops when going on and off. Fluorescent lamps and brush-type motors often generate a rough steady hash. Such disturbances, called "r.f. noise," reach your gear by radi-

ation or conduction along the a.c. power wiring. In the latter case, a small plug-in filter between the wall socket and the audio equipment a.c. line cord, or between the offending device and its wall socket, may lick the problem. A filter may be needed in both locations. Sometimes reversing the a.c. plug in the socket reduces noise.

**Ground Loop.** Once in a while, your speaker may give forth with a broadcast program that certainly isn't coming in on your tuner. A common cause of this trouble is the "ground loop." In Fig. 1A, the interconnecting cable shield (used also as the return leg of the signal circuit) is grounded at both ends to chassis already bonded together by an external grounding wire. The resulting loop acts as a one-turn pickup coil for stray r.f. energy.

The easiest way to break the loop is to remove the ground wire from one chassis (Fig. 1B). If this produces hum, restore the connection and remove it from the other chassis. If the hum persists, replace the ground connection and run the external ground wire alongside the interconnecting

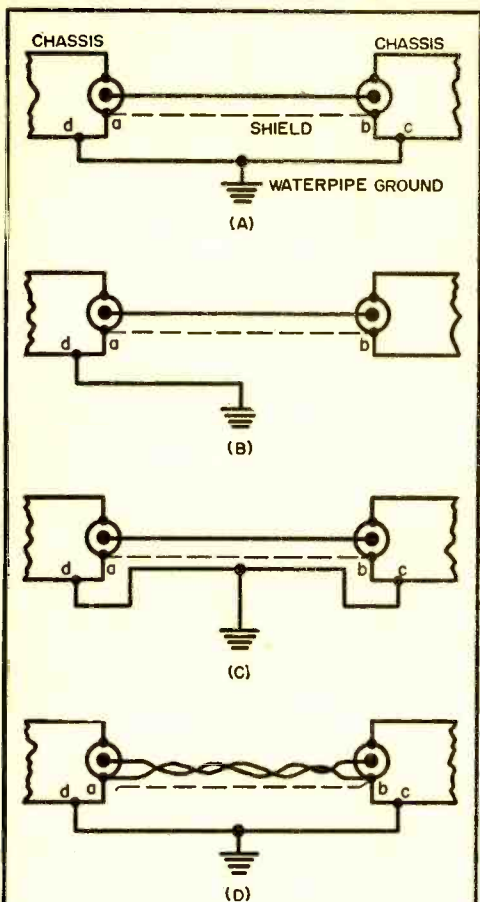


Fig. 1. Types of ground connections.

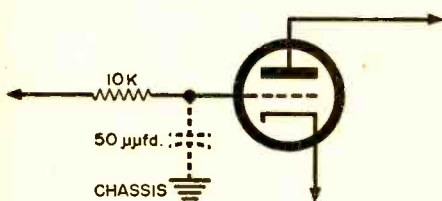


Fig. 2. Inserting anti-r.f. capacitor.

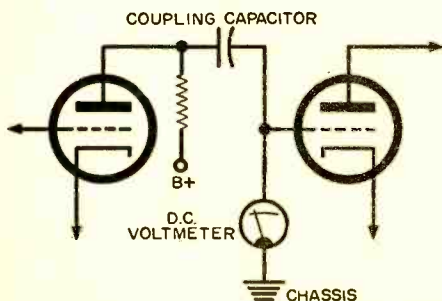


Fig. 3. Measuring d.c. grid voltage.

cable (Fig. 1C) thus reducing the area of the loop and the effect of the r.f. voltage induced in it. If this doesn't work, try replacing the original shielded single-conductor cable with shielded two-conductor cable, and ground the shield only at one chassis (Fig. 1D). You will still have the original loop path "abcd"; but the shield of the connecting cable is no longer part of the troublesome loop.

Sometimes r.f. interference dies hard. If none of the above methods work, try inserting a resistor (approximately 10,000 ohms) in series with the grid of the first stage tube of the amplifier or preamplifier. An alternate procedure is to shunt a very small capacitor, about 50 µfd., between the grid and chassis or cathode (see Fig. 2). Since either of these solutions may affect the audio quality somewhat, try variations of the suggested component values if this problem develops. Additional hints: keep the volume controls of any unused input channels turned off, and try a new tube in the first stage as the original may be gassy and thereby act as a rectifier for r.f. voltage.

### INSIDE YOUR GEAR

If it appears that the equipment itself is producing noise, localize the trouble to a major component by turning on one at a time. If the noise persists no matter which signal source is used, your amplifier or preamplifier or speaker is misbehaving.

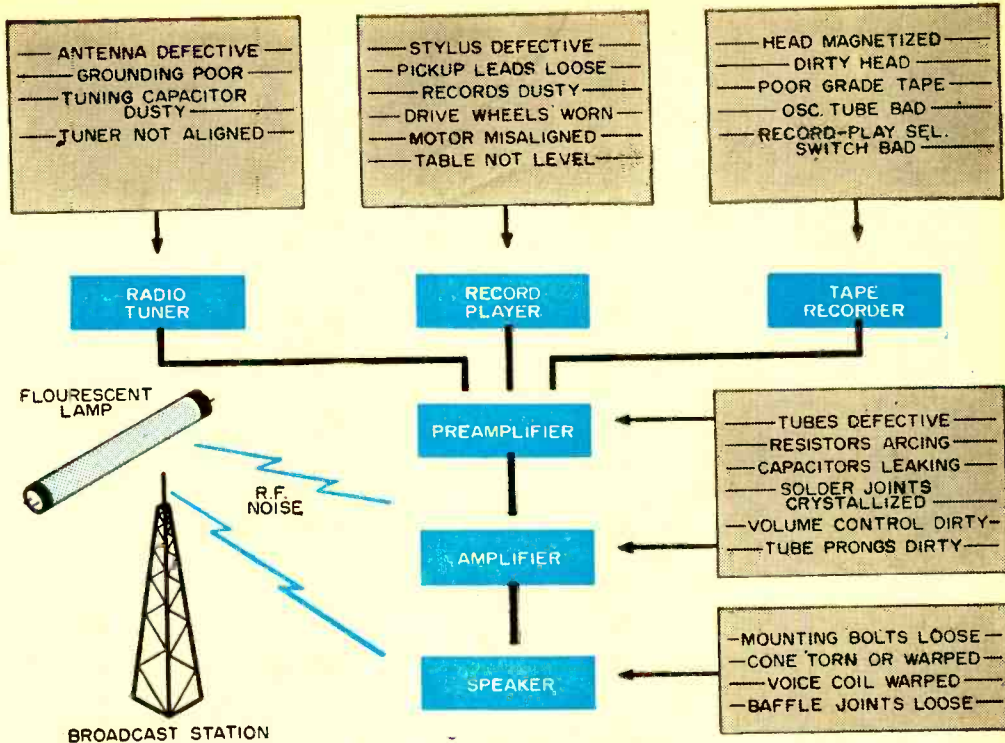
**Record Player.** Let's assume the noise is heard only when the record player operates through the amplifier. The pickup stylus may be worn or broken. Pickup leads may be loose or poorly soldered. The plug or mating socket may have loose or broken contacts.

Have you perhaps been playing an old 78-rpm record, or a worn or scratched LP record? If so, use your scratch filter. If you don't have a scratch filter, reduce the high-frequency response with the tone control or the compensator.

What about the motor and drive mechanism? Are the driving pucks worn out-of-round or misaligned? Perhaps the rubber motor mounts are dried out or squeezed solid by the mounting screws, throwing the motor shaft or drive shaft out of alignment and transmitting vibration. Any roughness in mechanical operation will be heard in the speaker as thumps or rumble via the pickup. This effect is greatly reduced by a rumble filter; if you have one, make sure it's working.

Don't overlook the possibility of loose motor connections, and the possible need for sparing lubrication if called for by the instruction book. Make sure the motor board is bolted tightly to the cabinet. Final-





**Block diagram** of hi-fi system shows common causes of noise in each unit. See text for details.

ly, how long has it been since you checked the leveling of the turntable and the alignment of the tone arm? Both of these factors affect the side-pressure on the stylus and therefore influence the noise level.

**Tuner.** If the noise has been localized to the tuner, an obvious possibility is the antenna. Cracked insulators, antenna swaying against other objects, frayed insulation on the lead-in, loose ground connections—all these are common sources of noise.

The antenna itself may be located in a noise field, in which case the alternate antenna arrangements mentioned below may be helpful. Sharp crackling noises when tuning may be due to dust between the plates of the tuning capacitor. Blow out the dust or remove it with a pipe cleaner.

An annoying whistle may be heard on AM tuners. This is due to the carrier of another station "heterodyning" with that of the desired station. In the absence of a whistle filter, it may be helpful to reduce the r.f. input to the tuner by shortening the antenna or the lead-in, by pointing the antenna in a different direction, or by using a short indoor antenna. Another solution is to use a loop antenna which can be rotated to the point of minimum interference consistent with adequate signal strength.

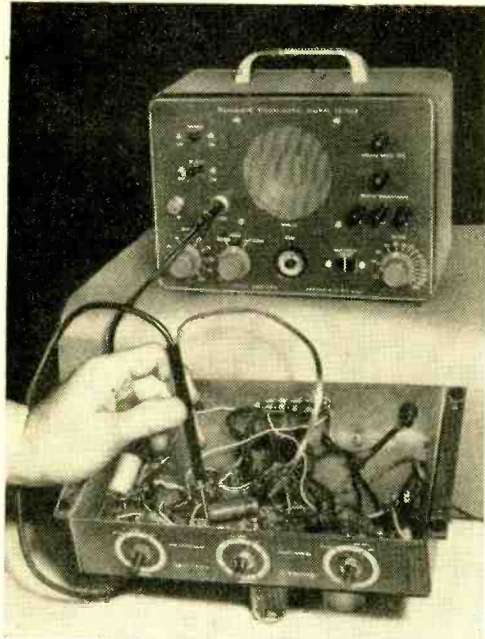
If these measures don't solve the problem, the tuner may need realignment. The

tuner is also subject to the same problems of loose plugs and poor cables as the rest of the system, and also suffers from the same troubles with tubes, resistors, capacitors, etc., as the amplifier, of which more later.

**Tape Recorder.** Suppose the noise has been localized to the tape recorder. If the noise is a steady background hiss, the record-playback head may have become demagnetized. This can be demagnetized by passing the tip of a plugged-in soldering iron or gun back and forth near the head. A confused chatter behind the program is probably due to failure of the machine to erase an old recording completely.

Incomplete erasure is generally due either to a defective oscillator tube or to an excessively loud recorded level of the material to be erased. The remedy for the latter—other than avoiding such levels in the future—is to run the poorly erased tape through the machine with the controls set for recording and the volume control turned down. This "erasing run" will generally get rid of the old recording.

A dirty record-playback head having an accumulation of tape residue is another cause of steady noise. Heads should be cleaned frequently with a cotton swab moistened with alcohol. Remember, too, that a poor grade of tape increases the hiss



**Signal tracer**, used for point-to-point servicing, permits experimenter to follow audio signal right through the amplifier.

behind the signal. Paper-base tape is noisier than the plastic-base variety.

Sharp crackling noises are usually due to poorly soldered joints, defective cables and plugs, and loose connections on the record-playback selector switch. And, finally, the tape recorder shares with the tuner and amplifier the noise troubles due to tubes, resistors, etc., so let's talk about the amplifier now.

**Amplifier.** Practically every component in an amplifier is a potential source of noise. To make matters worse, the gain of each stage beyond the one where the trouble originates serves to increase the original noise.

Tubes may produce an unholy trinity of "hiss, hash and howls." Howling is often due to a microphonic tube being vibrated by sound from the speaker. This acoustic coupling sets the entire amplifier into oscillation. Slipping a rubber band around the tube (if it isn't too hot for the rubber), replacing the tube with one selected for quietness, and relocating the speaker are the usual remedies.

Howls are also caused by failure to replace the metal shielding cans on glass tubes originally so equipped. The first stage tube and, to a lesser extent, later tubes may generate hiss or hash due to gas or internal electrical leakage between elements. To cure, substitute known good tubes—one at a time.

If the tubes are okay, check the resistors. Since there are so many of them, narrow down the search to a particular stage. To

do this, disable the various stages one by one. Start with the input, either by removing the tube or by grounding the grid to the cathode, until the noise stops. The trouble is in the last stage disabled.

Noise caused by resistors (usually a hiss or "frying" sound) is due to age, overheating or poor internal lead connections. You can sometimes locate the defect by tapping or wriggling the resistor.

Capacitors often cause noise, too. A coupling capacitor between the plate of one stage and the grid of the next may become electrically "leaky," and pass some of the positive plate d. c. voltage to the following grid. This can usually be detected by measuring the d.c. grid voltage, which normally will be two or three volts of negative bias. A push-pull output stage might show as much as  $-22$  volts (see Fig. 3). Replacements should be of the molded type which have less leakage tendency than the paper kind.

Plate, screen and cathode bypass capacitors can also give trouble. The simplest procedure here is to replace these one by one in the defective stage after the coupling capacitors have been checked.

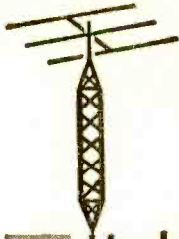
Defective electrolytic filter capacitors in the power supply section are common causes of plops or crackling noises due to temporary internal short circuits resulting from momentary breakdown of the insulating material. While a defective filter capacitor may give itself away by hum or by causing overheating of the power transformer, the general procedure is to disconnect one leg of each filter in turn, clip in a test capacitor and note whether the noise is eliminated or greatly reduced.

**Signal Tracing.** Occasionally, noise develops from arcing between winding turns in the power transformer and/or the filter choke. An ohmmeter check will not show up this trouble if it occurs only under load. Since you don't ordinarily have spares on hand for these components, use the noise-locating feature of a signal tracer as shown in the photo above.

A signal tracer can be connected across each stage in succession, beginning with the output, while the amplifier is in operation. The defective component is in the last stage in which the noise is heard in the tracer speaker. Signal tracers, available in inexpensive kit form, offer a more convenient way of localizing defects than disabling stages by shorting or by tube removal. Elements which can be checked for noise

*(Continued on page 90)*





# THE TRANSMITTING TOWER

Herb S. Brier, W9EGQ

**T**HE TRANSMITTER pictured below indicates how simple a thoroughly practical amateur transmitter can be. It was assembled from an AMECO AC-1 transmitter kit and is capable of transmitting signals over hundreds and thousands of miles.

Contained on an 8" x 6" x 2½" chassis finished in grey and lettered in white, the complete transmitter consists of a 6V6G crystal oscillator (working into a pi-network tank circuit) and a 6X5G rectifier in a conventional full-wave circuit. It has a rated power input of approximately 15 watts.

This transmitter is designed to operate in the 3.5- and 7-mc. amateur bands, and thus covers both the 3.7- and 7.15-mc. Nov-

half an evening, but it might take an inexperienced constructor a couple of evenings.

The chassis is predrilled and all parts plus complete instructions are furnished, although the constructor must supply a few feet of hookup wire and rosin-core solder. A small soldering iron, pliers, knife and screwdriver are the only tools required.

After wiring the AC-1, I fed its output into a 117-volt, 15-watt light bulb to check its power output and to see if it had any special tuning quirks.\*

In tuning the transmitter into a radiating antenna, follow the same procedure as in tuning it to a dummy antenna. However, some type of tuning indicator must be provided to do it intelligently. AMECO

suggests temporarily connecting a 100-ma. meter across the key or using a pilot bulb in the antenna circuit for the purpose.

Tuning a transmitter with the aid of a plate milliammeter was last discussed in the April, 1957, *Transmitting Tower*; so let's investigate using a pilot bulb in the antenna circuit as a tuning indicator with the aid of the systems shown in Fig. 1 (page 77).

When a single-wire antenna is used, the arrangement in Fig. 1(A) is convenient. Solder two wires about 2' long to tip

and shell of the base of a 2-volt, 60-ma. pilot bulb (type 48 or 49) and clip them across three feet of the antenna. This system is not too easy to apply to an antenna fed with coaxial or "twin-lead" transmission line, however. Instead, the

\* One quirk that might cause an inexperienced operator some difficulty was discovered on 40 meters, although it is actually not unusual. If the transmitter were adjusted for maximum power output, the oscillator would not "start" when the key was pressed—after a short standby period. The cure was to tune the plate capacitor a shade to the low-capacitance side of the maximum-output point. This adjustment reduces power output a trifle.



Kit transmitter (AMECO AC-1) assembled by author (key not supplied).

ice bands. Also, as will be discussed in more detail a bit later, a couple of watts of power can be obtained from the transmitter on the 21-mc. band.

Shifting the band of operation involves changing the plug-in coil and the crystal. The output tank circuit will match the transmitter into almost any reasonable length of wire as an antenna, as well as into a doublet antenna.

**Assembling the AC-1.** Because of its simplicity, the AC-1 kit can be assembled and wired in a few hours. I did it in

## HELP US OBTAIN OUR HAM LICENSES

In this section of the Transmitting Tower, the names of prospective amateurs requesting help and encouragement in obtaining their licenses are listed. To have your name listed, write to Herb S. Brier, W9EGQ, % POPULAR ELECTRONICS, 366 Madison Ave., New York 17, N. Y. Please print your name and address clearly. Names are grouped geographically by amateur call areas.

### K1/W1 CALL AREA

Galen Hamilton, Hampden Highlands, Me.  
John Tyler (15), Box 201, Clinton, Mass. (Code and theory)  
Emanuel Netti, Tobey Ave., Methuen, Mass. (Code)  
Stephen L. Saks, North St., Greenwich, Conn. (Theory)  
Arthur Teal, Box 219, Chester, Conn. (Code and theory)  
Eddie McLean, Packers Falls Rd., Durham, N. H. (General Class code)  
Roland LaRoche, Newmarket Rd., Durham, N. H.  
David Silver, 437 Burlington Ave., Bristol, Conn. (Code and theory)

### K2/W2 CALL AREA

Stanley Koscink (14), 206 Hawthorne Ave., Newark, N. J. (Code)  
Stephen Wilhelm, 120 Fairview Ave., Great Neck, N. Y. (Theory)  
Louis Vlesmas, 509 E. 77th St., New York 21, N. Y. (Code and theory)  
Tom Wendel, 28 Schuler Ave., Tonawanda, N. Y. (Code and theory)  
Ori S. Adler, Pennington School, Pennington, N. J. (Code)  
Jacinto Negron, 215 Chester St., Brooklyn, N. Y. (Code and theory)  
Alan Lefkow, 1832 Bryant Ave., Bronx 60, N. Y. (Code)  
Richard Shavel, 1963 Bryant Ave., Bronx 60, N. Y. (Code)  
Kenneth Traver, 74 1/4 E. Main St., Wappingers Falls, N. Y. (Code and theory)  
Ira B. Kraemer (15), 899—18th Ave., Newark, N. J. (Code and theory)  
Joseph Clerecuzio, 163 Cedar St., Cliffside Park, N. J. Phone: WH 3-1432. (Code and theory)  
Edward Kantorski, 61 Ave. "E", Lodi, N. J. (Code)  
Marc Hersh, 121 E. 69th St., New York 21, N. Y. (Code)  
Vernon Nugent, 109-28—196th St., Hollis 12, Long Island, N. Y. (Theory)  
Thomas Pitt (13), 137 W. Park Ave., Pearl River, N. Y.  
Jethro Eisenstein, 309 W. 104th St., New York 25, N. Y.  
James Lisson, 47 Dean Road, Depew, N. Y. (Code and theory)  
Irwin M. Morgan, 509 Reads Lane, Far Rockaway 91, N. Y. Phone: FAR Rockaway 7-2116. (Code and theory)  
Marc Miller, 7 Glenwood Dr., Ellenville, N. Y. (General Class theory)  
Allen J. Schwartz, 424 Sheridan Ave., Albany 6, N. Y. (Code and theory)

### K3/W3 CALL AREA

Ernest Lyght, 412 N. Clayton St., Wilmington 5, Del. (Code)  
John David Crockett, Gulph Rd., Bridgeport, Pa. Phone: BR 9-2583.  
Cecil Dillinger, 1611-C Dartford Rd., Baltimore 21, Md. Phone: MURdock 6-4028.  
Richard Glassbrenner, 1141 Woods Run Ave., Pittsburgh 12, Pa. (Code and theory)  
Robert Schaffer (15), M.R. 11, Butler St., Butler, Pa.

Edward H. Boyd III, Rollyston Farm, St. Michaels, Md. Phone: TA 2-0117.

John B. George III (15), 230 Beechwood Rd., Penn Sq. Village, Norristown, Pa. (Code and theory)

### K4/W4 CALL AREA

Carlos G. Wilson, Jr. (12), 1335 E. Crestwood Dr., Memphis, Tenn. (Theory)  
William E. Whitworth, Rt. 1, Elm Hill Rd., Nashville 14, Tenn.  
Erie Bartlitt (13), P.O. Box 1427, Plant City, Fla. Phone: 30853. (Code and theory)  
Jim Bartlett (14), 4230—21st St., N., St. Petersburg, Fla. (Code)  
Glen Whitehouse (13), 633—70th Ave., St. Petersburg Beach, Fla. (Code and theory)  
David W. Davis II, Box 175, Bassett, Va.  
Buzz Buster, Curry Rd., Harrodsburg, Ky. (Code and theory)  
John Bell (13), 404 Ridgeway Rd., Lexington, Ky. (Code and theory)  
James M. Swinson, 900 12th Ave., Conway, S. C. (Code and theory)  
Doug Tidwell, Jr. (12), 475 Willard Ave., S.W., Atlanta 10, Ga. Phone: PL 3-1678. (Code and theory)  
David Liles, 414 W. Fourth St., Siler City, N. C.  
William Martin, 510 E. 21st St., Lumberton, N. C. Phone: 5714.  
Jim Broadbudd, 750 Mt. Paran Rd., N.W., Atlanta 5, Ga. Phone: CE 7-1423. (Code, theory and selection of equipment)

### K5/W5 CALL AREA

Bill Free, Jr., Luling, La. (Code and theory)  
Joe Hester (16), 142 Blossom Dr., San Antonio, Tex. (Code)  
Billy Gibson, Rt. 2, Box 350, Victoria, Tex. Phone: HI 3-7293. (Code and theory)  
Edward Cook, 118 E. Fifth St., Russellville, Ark. (Code and theory)  
Darce Shugart, Box 12, Kemp, Tex. (Code)

### K6/W6 CALL AREA

James E. Laukus (12), 103 Mabrey Rd., Palm Springs, Calif. (Code)  
Don Wallace, 524th Military Police Co., A.P.O. 958, San Francisco, Calif. (Code and theory)  
Don Etheredge, 11169 Glen Oaks Blvd., Pacoima, Calif. Phone: EM 9-2329. (General theory)  
Pat Marsh, 3319 W. 116th St., Inglewood, Calif. (Code and theory)  
Dave Cooper (14), 848 Arguello Blvd., Pedro Valley, Calif. (Code and theory)  
Stan Peterson, Jr., 3647 Hollister Ave., Carmichael, Calif.  
Chuck Penning, 2316-64 Ave., Oakland 5, Calif. (Code and theory)

### K7/W7 CALL AREA

Eddie G. Young, 1350 Spring Lane, Murray 17, Utah. (Code and General theory)  
Donald W. Cooper, 1843 Amelia St., Walla Walla, Wash.  
Harold O. Peterson, 13721 39th Ave. N.E., Seattle 55, Wash.  
Steven Smith, Roy, Utah. Phone: 4-0848.

### K8/W8 CALL AREA

David Wagner (15), 145 E. Fifth Ave., Berea, Ohio. Phone: BE 4-1752. (Code and theory)  
Jeff Boyles (16), Box 191, Lomberport, W. Va. (Code)  
John R. Horvat, 9118 St. Clair Ave., Cleveland 8, Ohio. (Code and theory)  
Willard J. Karle, 15620 Fordham, Detroit 5, Mich. (Code and theory)  
Byron Steele, 820 Academy Rd., Holly, Mich. (Code, and Technician license)



Larry Clafin, 820 Academy Rd., Holly, Mich. (Code, and Technician license)

Robert Le Bowsky (15), 506 Walbridge Ave., Toledo 9, Ohio. (Code and theory)

John W. Knaffla, 9003 Culver, Detroit 13, Mich. (Code and theory)

Henry Zabielski, 7535 Trafalgar, Dearborn 9, Mich. (Code and theory)

Joe Leonard (13), 7933 E. Galbraith, Cincinnati 27, Ohio. (Selection of equipment)

Joseph P. Micallef, 20650 Patton Court, Detroit 28, Mich. (Code)

Joe Ansman, 1118 Starr Ave., Toledo, Ohio. (Code and theory)

David Beyerlein, 1376 Ives Ave., Flint 6, Mich. Jimmy Wood, Rt. 1, Chestnut Ridge Rd., Hubbard, Ohio. (Code and theory)

David Gardner, 1820 W. Genesee St., Lapeer, Mich. (Code)

Harold Clement, 523 Gladstone, Grand Rapids, Mich. Phone: CH 3-1405.

Rollin Girulat, 1430 Russell, Lincoln Park, Mich. Phone: DU 1-6348.

Michael Smith, 50336 Bay Court, New Baltimore, Mich. (Code and theory)

James Baggione, Box 205, Palmer, Mich. Phone: GR 5-4939.

Charlie Benner, 1822½ Adams St., Toledo, Ohio. (Code and theory)

#### K9/W9 CALL AREA

Jackson Wyatt, Jr., 4129 S. Michigan Blvd., Chicago, Ill.

Dave Bydaleb, 680 S. Rosewood, Kankakee, Ill. (Code and theory)

Leroy Devries, R.R. 1, Box 16X, Chesterton, Ind. (Code)

Dave Jones, 6703-05 N. Oshkosh Ave., Chicago 31, Ill. (Code)

Nicholas L. Manosus, P.O. Box 1, Lisle, Ill. (Code and theory)

James Washburn, Box 271, Augusta, Ill. (Code and theory)

Carl Hunsaker, Box 85, Camp Point, Ill. (Code)

Eugene Huff, Augusta, Ill. (Code and theory)

Phil Walesby, Elliott, Ill.

#### K0/W0 CALL AREA

Byron L. Green, Jr. (15), 3618 Nebraska Ave., St. Louis 18, Mo. (Code and theory)

Lee Roy McCarter, 3225 Dakota St., St. Louis, Mo. (Code and theory)

Dwight Keller, 403 Stewart Road, Columbia, Mo. (Theory and regulations)

Brian Crombie, Route 6, St. Paul, Minn.

Bill Sprague, 2229 N. Michigan, Davenport, Iowa. (Code and theory)

Gary G. Gerlach, St. Ansgar, Iowa. (Theory)

Tom Milstein (14), 870 Hudson, Denver 20, Colo. Phone: EA 2-9219. (Code and theory)

J. O. Allen, R.R. 1, Frankfort, Mo. (Code and theory)

Delbert Nystrom, R.R. 3, Ogden, Iowa.

Roy A. Bunch, R.R. 2, Leon, Iowa. (Code and theory)

John Raydo Jr., 5116 W. 51st St., Mission, Kans. (Code)

Richard H. Wagner, Rt. 1, Waterloo, Iowa.

#### VE AND OTHERS

Bob Bidwell, Garibaldi, B.C., Canada. (Code and regulations)

James Hassinger, 4045 Wilson Ave., Montreal, Que., Canada. (Code and theory)

R. R. McLeod, 1257 King St., W., Hamilton, Ont., Canada. (Code and theory)

John Labow, 100 Dunloe Rd., Toronto, Ont., Canada. (Code and theory)

To help prospective amateurs obtain their Novice licenses, the Radio-Electronics-Television Manufacturers Association offers a set of code records (recorded at a speed of 33½ rpm) and a Novice Theory Course for \$10.00, post-paid. The complete course or more information on it is available from RETMA, 1721 DeSales St., N.W., Washington 6, D. C.

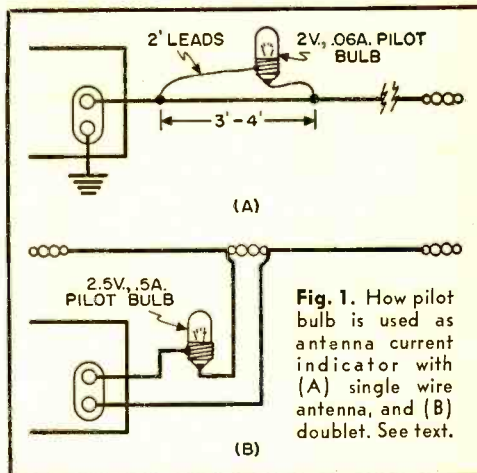


Fig. 1. How pilot bulb is used as antenna current indicator with (A) single wire antenna, and (B) doublet. See text.

system in 1(B) may be employed. Just connect a 2.5-volt, 0.5-amp. pilot bulb (type 40 or 41) in series with one of the conductors of the feed line (the center conductor if it is coaxial cable). With either arrangement, correct tuning of the AC-1 is indicated by maximum glow of the bulb.

When the system in Fig. 1(A) is used, its sensitivity is controlled by the distance across which the indicator is tapped. Some experimenting with the spacing may be necessary with different antenna lengths. In 1(B), sensitivity is controlled by the current rating of the pilot bulbs used. The data given are about correct for a 10- to 15-watt transmitter. For a 50-watt, the distance between taps in 1(A) will be about 18", and two 0.5-amp. bulbs in parallel will be about right for 1(B).

A 2-volt, 50-ma. bulb draws so little current (0.2 watt) that it may be left in the circuit at all times. However, a 2.5-volt, 0.5-amp. bulb consumes 1¼ watts; therefore, it is advisable to connect a wire jump-

(Continued on page 112)



Donnie Redwine, KN5IRB, at controls of station she and her son Ed, K5ERJ, operate together.

# Sound Impressions

RECORDS FOR HI-FI DEMONSTRATING, TESTING, AND JUST PLAIN LISTENING

**B**EFORE the days of hi-fi, record listeners fancied themselves lucky if they could recognize melody and harmony on their discs. Subtle overtones, details of orchestral structure, and the unique timbres of different instruments were beyond the technical ken of most records and playback equipment.

**New Kind of Rehearsal.** Today, musician and engineer work together so that a modern recording session is not just a matter of getting the music right, but of getting the *sound* right as well. Insight into this phase of the art is provided by Westminster's *Hi-Fi in the Making* (XWN-18372).

This record takes you behind the scenes at a rehearsal of Sir Adrian Boult conducting the Philharmonic Promenade Orchestra in the popular *Young Person's Guide to the Orchestra* by Benjamin Britten. We enter the rehearsal during the struggle for hi-fi balance between the choirs of the orchestra, and between the orchestra as a whole and the acoustics of the auditorium. The music itself, and its correct interpretation, have been mastered; now comes the subtle influence of the recordist in the person of Kurt List, musical director for Westminster. A lively dialogue—interspersed with takes and re-takes by the orchestra—ensues between Boult and List. Finally, the problems of a hi-fi session are solved to mutual satisfaction.

The results of this cooperation are admirably displayed on the other side of the

record, which contains a brilliant and exciting performance of the music.

**The Roving Spotlight.** Vox Productions has been recording a series of albums that comprise a panorama of the history and sounds of all the instruments of the orchestra—as well as several you'd never hear unless you visited a music museum or a primitive tribe in some far-off spot. Produced by Ward Botsford, these records—the first of which was *Spotlight on Percussion* (DL 180)—demonstrate the potential of the recording medium as a means of edifying as well as entertaining.

Since the advent of DL 180, Botsford has trained his audio spotlight on three new areas: *Keyboard* (DL 362), *Brass* (DL 300) and *Strings* (DL 320). With one more to come, on *Woodwinds*, the spotlight will have completed its first sweep around the assorted and assembled musical instruments of the world. The scope of this project is encyclopedic, and it is the kind of thing that workers and hobbyists in many areas—including historians, teachers, anthropologists, musicians, collectors, and audiophiles—may have been hoping would happen for a long time. The advantages of hi-fi recording are here realized in the aural close-ups provided, which distinguish each instrument and suggest to the listener how one may have evolved from the other. Selections played on the instruments are interesting if not inspired.

In the handsome booklets enclosed with each disc, R. D. Darrell writes engagingly



**Musicians** these days go through what amounts to two rehearsals—one for the music and the other for hi-fi tone. During the latter, the recording technician has as much to say as the conductor. Here, Sir Adrian Boult rehearses Philharmonic Promenade Orchestra for Westminster recording of "Hi-Fi in the Making" (see text).



and informatively about the record and the instruments it surveys. In fact, the booklets themselves assume an importance greater than mere "program notes" or the conventional jacket blurb. The "package" of printed text and recorded sound is a new kind of literature, an attractive hybrid in which your reading and your listening go hand in hand, the one illustrating the other. In this sense, hi-fi has unfolded a new vista for creative communication to an ever widening audience.

**Roster of Kings.** A similar approach to one instrument characterizes Columbia's release (ML 5032) of E. Power Biggs playing on fourteen of Europe's finest organs. Recorded in their original settings, these organs afford a rare comparison of the

ML 5167). Organ fanciers will discover a virtually unknown repertory of rare beauty, far different from the more familiar organ music of the North. The Iberian instruments themselves sound different. Particularly stirring is the *Trompeta Real* (Royal Trumpet) stop of the great organ in the cathedral of Zaragoza. This is an array of giant trumpets, greater than any that could be played by a human trumpeter, jutting out from the organ loft. Their clamor, especially in the bass, is truly majestic. The astonishing quality of the recording preserves much of their power and full, rich tone.

**More Reaching Back.** Music—made by mechanical contrivances rather than by musicians playing instruments—has long

### PICK OF THE RECORD RACK

RECORD	PERFORMERS	COMMENT
Copland: <b>Appalachian Spring</b> <b>Billy the Kid</b> Columbia ML 5157	Philadelphia Orchestra E. Ormandy, cond.	Cross-breeding American folk music and symphony, Copland comes up with a healthy hybrid strain that tells of Pennsylvania valleys and the midwestern prairie in the language of the classical orchestra. The beauty and excitement of the scores are matched by the richness of the recorded sound.
Schumann: <b>Piano Concerto</b> Strauss: <b>Burlesque</b> Columbia ML 5168	R. Serkin, piano Philadelphia Orchestra E. Ormandy, cond.	Between them, these two discs provide a fine sampling of 19th-century piano concertos. All are melodious, lush and showy—and altogether beautiful music. Serkin's performance has the assurance and discipline of a master. Yet the free-wheeling romanticism and inner excitement in the playing of young Richard Farrell is a more compelling listening experience. This 30-year-old New Zealander, who studied music in New York, is evidently someone to watch in the future. In this recording, he enjoys the pliant support of a conductor and orchestra who really get into the spirit of his playing and some of the best engineering we ever heard.
Grieg: <b>Piano Concerto</b> Liszt: <b>Piano Concerto No. 1</b> Mercury MG 50126	R. Farrell, piano Halle Orchestra C. Weldon, cond.	
<b>A Tribute to Dorsey</b> Vols. 1 and 2 RCA Victor LPM-1432	Tommy Dorsey et al.	The age of swing is recalled by the late "Sentimental Gentleman" and his mellifluous trombone. Bunny Berigan, Ziggy Elman, Buddy Rich and a young newcomer named Frank Sinatra help to bring back a beloved period of popular music. Not quite hi-fi, but nostalgic swing addicts won't care.
Suppe: <b>Poet &amp; Peasant</b> <b>&amp; Other Overtures</b> Westminster XWN-18238	Philharmonic Promenade Orchestra, London Sir Adrian Boult, cond.	The popular overtures to Suppe's operettas include <i>Light Cavalry</i> , <i>Boccaccio</i> , <i>The Beautiful Galathea</i> , and others. Zestfully played and brilliantly recorded, the music alternates between lilting waltzes and fiery gallops. Very pleasant listening throughout.

sonorities of keyboard titans as well as the music of those countries in *The Organ* the acoustics of different types and periods of architecture. Biggs plays Bach's *Toccatina in D Minor* on all of them, adding the *Fugue* on the last organ in the collection. Covering instruments that date from the 15th century to the 20th, the master plays organs from Sweden, Germany, Denmark, Holland, and England—imparting through his playing his own personal enthusiasm for this kind of hi-fi adventure, and demonstrating his avowed point that Bach composed with the *sound* as well as the *music* in mind—a fact perhaps not fully understood until this day of hi-fi. Aside from all this, the record should provide a tremendous workout for any hi-fi system.

Swinging South, Biggs also sampled the organs of Spain and Portugal, recording *Music of Spain and Portugal* (Columbia

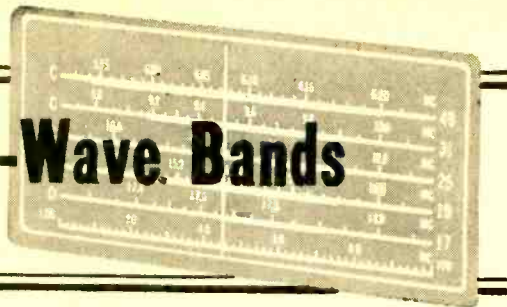
been a pursuit of gadgeteers and enterprising hobbyists. Some, with a flair for fineness and a fast buck, developed such concoctions as "orchestrans," "pianinos," and "orchestral pianos." This trend toward mechanized one-man bands started in Europe during the 1880's, and the sonic monsters soon found their way into many ice-cream parlors, dance-halls, and skating rinks on this side of the ocean, where they would issue forth the popular tunes of the day when stimulated by a nickel or, in some cases, a dime.

A collection of such pre-electronic jukeboxes, preserved at the Musical Museum in Deansboro, New York, has been re-pressed into service by Westminster. The result is *Honky-tonk* (WP 6033), a disc containing such relics as: *All Alone*; *Waiting for the Robert E. Lee*; *Ma, He's Making Eyes*

(Continued on page 126)

# Tuning the Short-Wave Bands

with Hank Bennett



**I**N LOOKING THROUGH the station listings in this column, have you ever picked out one or two that you particularly wanted to add to your short-wave log, and then been disappointed when you were unable to hear the station? This is a relatively common occurrence, but not one that should be taken too seriously. There may be good reasons for your inability to hear some of the stations listed.

First of all, as you know, at the time of compilation all station listings are correct to the best of our ability, and they have been heard by your Editor or one of our veteran monitors. Many of the s.w. stations change frequency and/or schedule

without any prior notice, however, which could contribute largely to the apparent discrepancies.

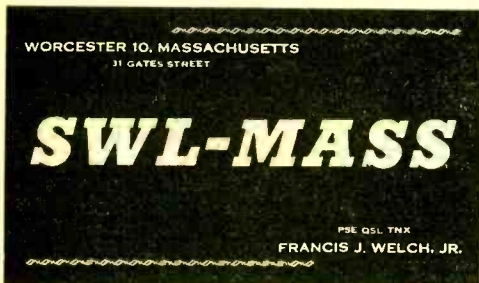
Secondly, propagation conditions can change from day to day. While you may be able to hear any given station with a loud and clear signal one day, that station may be completely inaudible on the following day—even though it is operating on the same frequency and schedule.

Sunspot activity affects s.w. radio to a great degree, too. Generally speaking, when it is high, the higher frequencies will prove to be the best for pulling in DX stations. The lower channels will be spotty, with perhaps even the regularly heard stations noticeably disturbed by a rapid flutter fading, especially when there is a display of the *aurora borealis* (northern lights). During the past few years, sunspot activity has been on the upswing, and it apparently reached its peak early in 1957. Indications are that sunspots will gradually diminish for the next several years, bringing a decline of stations operating in the 17-, 21-, and 25-mc. bands and an increase in the 6-, 9-, and 11-mc. bands. Even the so-called "tropical band" (3000-5000 kc.) will bear watching.

Finally, make sure that you have your receiver tuned to the correct frequency. While this may sound a bit ridiculous, it is a fact that many DX'ers are unable to tune in certain stations because their receivers are not properly calibrated. You can check the accuracy of your receiver dial by tuning in WWV at 2500, 5000, 10,000, 15,000, 20,000, or 25,000 kc. By making necessary allowances if you find your dial to be a few points off, you will be able to come fairly close to the desired frequency.

**SWL State Cards.** Deviating from the usual practice of having SWL cards printed with "calls" such as W2-SWL, K6SWL, or SWL-W5, Francis Welch, Jr., of Worcester, Mass., has come up with an SWL "state" card. Silver on black, it features the call of "SWL-MASS" and is, to our knowledge, the first of its kind. We would

(Continued on page 117)



The first SWL "state" card to be received by your S.W. Editor. Have you seen any of these yet?



**Bob Coomler**, one of our contributors from Los Angeles, Calif., with his Hallicrafters S-76 receiver and (right) Webster-Chicago wire recorder.



# Transistor Topics

By LOU GARNER

**M**ANY circuit design engineers raised two principal objections when transistors were first introduced commercially: (1) that junction transistors were usable *only* at audio frequencies and (2) that transistors couldn't deliver reasonable amounts of power. But time marches on, and so does semiconductor research.

The poor frequency response objection has been answered by transistors now commercially available which will operate up to 250 megacycles. Laboratory prototypes of experimental types have been operated up to 1000 mc. And a new semiconductor device recently announced by Bell Telephone Laboratories, although not a transistor, has been used as an oscillator delivering a useful power output at 9000 mc.!

The low power objection has been answered by the development and commercial production of multiwatt transistors. In fact, many newer auto receivers use a single transistor to replace the power output tube! More recently, the DELCO Division of General Motors announced the production of transistors capable of switching 1-kilowatt loads! Even experimenters can get "into the act" . . . on page 45 you'll find an article describing a single-stage power amplifier using one of CBS-Hytron's new low-cost power transistors.

Unfortunately, very-high-frequency and

very-high-power transistors are rather expensive. But as production methods improve, prices will drop. Last month we announced the introduction of Sylvania's new 75-cent experimenter's transistor. You can expect further reductions in transistor prices before the year is over!

**Readers' Circuits.** Both of the simple oscillator circuits to be described use a single inexpensive transistor, require a single battery for operation and are compact

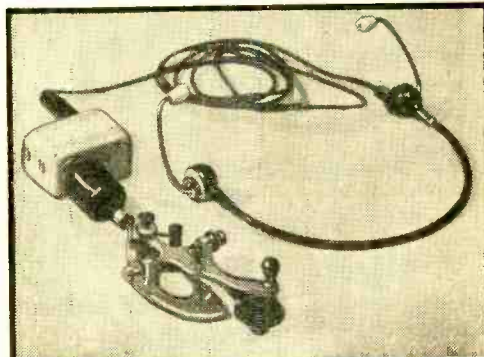
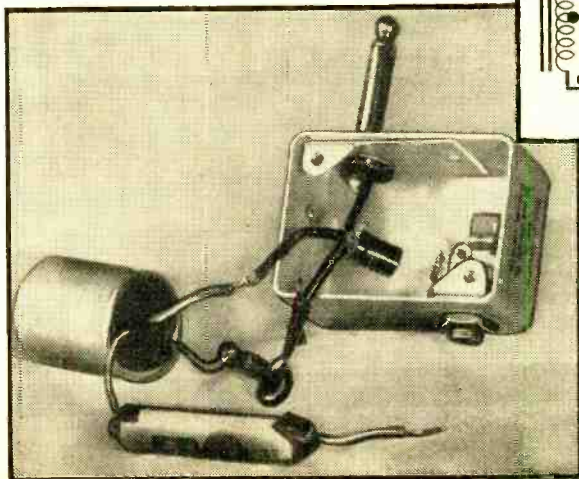
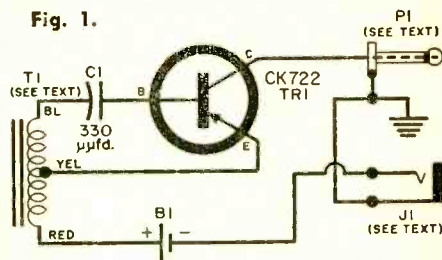


Fig. 1.



**Code Practice Oscillator.** This simple, low-cost circuit was submitted by reader M. R. Weinstein. The photo above shows his CPO set up and ready for code practice; the one at left shows the interior of the unit. In the schematic diagram, B1 is a penlite cell (Eveready No. 912), C1 a 330- $\mu$ fd. ceramic disc capacitor, and TR1 a CK722 transistor (Raytheon). J1, P1 and T1 are discussed in text.

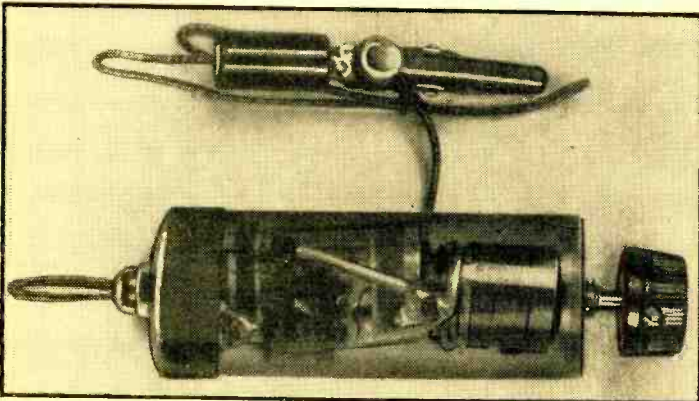
and easy to assemble, but each is intended for a different application. The first is a low-cost *code practice oscillator*, submitted by M. R. Weinstein, of 10747 Moorpark St., N. Hollywood, Calif. The second is a useful, pocket-sized test instrument, dubbed a "*trans-probe*" oscillator by its designer, author-reader Joe Chernof.

**Code Practice Oscillator.** If your pocket-book is a little on the thin side, you'll like this circuit. You can knock out "dots" and "dashes" to your heart's content without worrying about replacing expensive batteries . . . a single low-cost penlite cell is

tainers for small hardware makes an excellent housing; such boxes measure about 1" in diameter by about 2¼" long.

Layout and circuit lead dress are not especially critical. All parts are simply "bunched" together to fit into the plastic box. The *output* control, *R2*, may be mounted at one end of the box, with the output terminal, a banana plug, mounted at the opposite end, on the cap. A flexible "ground" lead may be brought through a small hole in the side of the box.

In operation, transformer *T1* serves a dual function. It provides the positive feed-



**"Trans-Probe" Oscillator.** Submitted by Joe Chernof, this useful probe-like device fits inside small plastic box. In the diagram below, *T1* is a Standard Transformer UM-111 (primary, 1000 ohms; secondary, 50 or 60 ohms), *R2* and *S1* represent a miniature potentiometer and switch assembly (Lafayette VC-40 or Clarostat Type "S"), and *B1* is a Burgess Y-10 miniature 15-volt B battery.

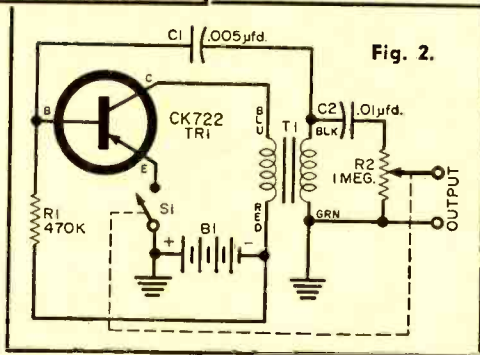
used. According to Weinstein, the entire unit can be assembled in about a half hour at a total parts cost of *less* than \$2.00!

The secret lies in a surplus high-low impedance headset adapter, Model MC-385, which is available from many surplus dealers for well under one dollar. This unit supplies the chassis box, transformer (*T1*), 'phone jack (*J1*) and a chassis-mounted 'phone plug (*P1*) that can be used to connect the oscillator to the hand key.

Circuit assembly is simple and straightforward. The auto-transformer (*T1*) is first removed from the case and its leads identified. These three leads are color-coded red, yellow and black, and are identified in Fig. 1.

In operation, a pair of magnetic headphones (2000-ohm impedance) is plugged into jack *J1*. The hand key is connected to plug *P1*. Auto-transformer *T1*, by means of its tapped winding, provides the feedback necessary to start and sustain oscillation. Capacitor *C1* serves as a coupling capacitor between the transformer and the transistor's base. Operating power is supplied by *B1*.

**The "Trans-Probe" Oscillator.** You can build yourself a useful probe-like test instrument by assembling the circuit in Fig. 2 to fit inside a small plastic tube. One of the cylindrical plastic boxes used as con-



back between collector and base circuits necessary to start and sustain oscillation, and it serves as an "output" transformer, supplying a signal to *output* control *R2* through coupling capacitor *C2*.

The feedback signal is coupled to the transistor's base electrode through d.c. blocking capacitor *C1*. Base bias current is supplied through *R1*, with operating power for the entire circuit supplied by a 15-volt battery, *B1*, controlled by s.p.s.t. switch *S1* on the *output* control.

According to Joe, total battery drain is only about 100 microamperes. Under these conditions, and assuming normal intermittent use, the useful life of the battery should approximate its "shelf life."

(Continued on page 110)

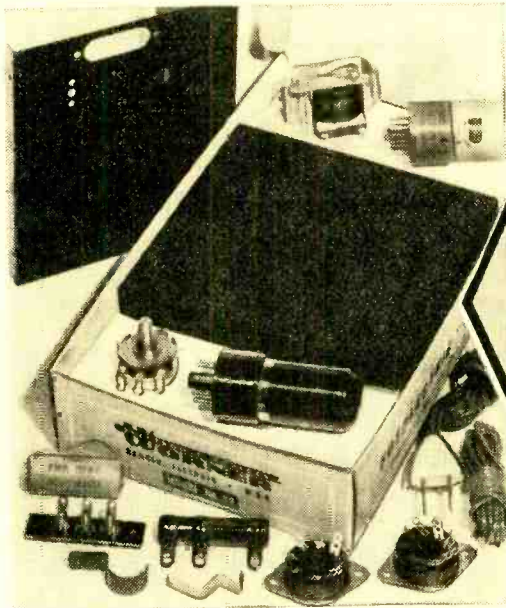


# K I T

# BUILDER'S KORNER

**W**HETHER you are an experimenter, student or hobbyist, you can have a good deal of fun experimenting with a simple "electric eye" relay—and you'll find a lot of practical applications for such a device around the home. You can use it as a burglar alarm, as an "annunciator," or

you may think you've been "short-changed" when you open this one. Few electrical components are furnished . . . and, as you'll find out when you start assembling it, few components are needed. "Electric eye" circuits are generally much simpler than amplifier or receiver circuits. By actual count, this circuit uses only two tubes (a CE-30 or 930 photocell and a 50C5 amplifier tube), one potentiometer, one relay, two



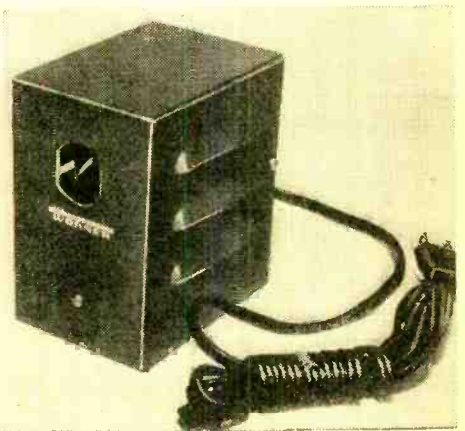
## Worner Model 69 Kit Photocell Relay

in a variety of simple toys and games.

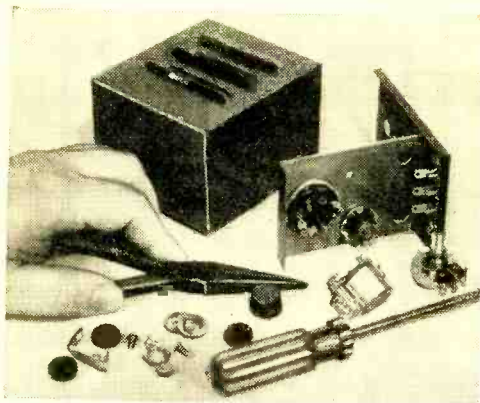
Suitable for beginners or advanced workers, the Worner Model 69 Photocell Kit assembles into a compact, reliable, and easy-to-use "electric eye." Available through most local and mail order radio parts distributors, it is manufactured by Worner Electronic Devices, Box 10A, Rankin, Ill.

**Putting It Together.** Designed for operation from the household a.c. line, the Model 69 kit assembles into a small, ventilated metal cabinet measuring approximately 2½" x 3½" x 4". An opening in the front of the cabinet permits light to strike the sensitive surface of the photo-electric tube. A sensitivity control is mounted on the back of the cabinet.

If you have assembled kits in the past,



The kit described in this issue consists of the photoelectric "receiving" unit. A separate light source must be supplied by the experimenter or may be obtained as an additional kit from Worner.



**A minimum of parts** is required in the photoelectric unit. The manufacturer supplies everything but the screwdriver and pliers, which every experimenter already has at his fingertips.

resistors, and just a single capacitor!

The only tools necessary for assembling the kit are a screwdriver, a pair of long-nose pliers, and a small soldering iron. The stranded hookup wire furnished is supplied in pre-cut and pre-stripped lengths of appropriate sizes.

**Special Features.** In operation, the contacts of an electromagnetic relay are opened and closed as the light falling on the photocell is interrupted and restored. The relay contacts, in turn, available through a screw-type terminal strip on the rear of the cabinet, are used as a switch to control a motor, buzzer, gong, lights, or other external electrical device. These contacts have a maximum rating of from 2 to 5 amperes.

Effective range of the Model 69 photo-cell relay will vary with the type of light source with which the unit is used. An especially designed "exciter lamp" is available in kit form from the manufacturer (Worner Model 39 Exciter Lamp Kit). With this light source, the operating range is approximately 15 feet.

The most interesting feature of this kit is its simple circuit and ease of construction. It should make an excellent "first project" for the experimenter who wants to work with electronic controls. The ease of assembly also makes it a good project for anyone who is looking for a low-cost photocell relay, whether or not he is interested in assembling kits.

**Installation.** With the line cord plugged into a 117-volt receptacle, turn the sensitivity control fully clockwise. Arrange the unit so that light can fall on the photocell, and cover the opening with your hand (or a piece of cardboard) to block the light. Adjust the control in a counterclockwise direction until the relay "clicks." Then un-

cover the cabinet opening. The relay should "click" again.

When the sensitivity control is properly adjusted, the relay should "click" each time the light is interrupted and restored. Each "click" indicates that the relay is opening (or closing) its contacts.

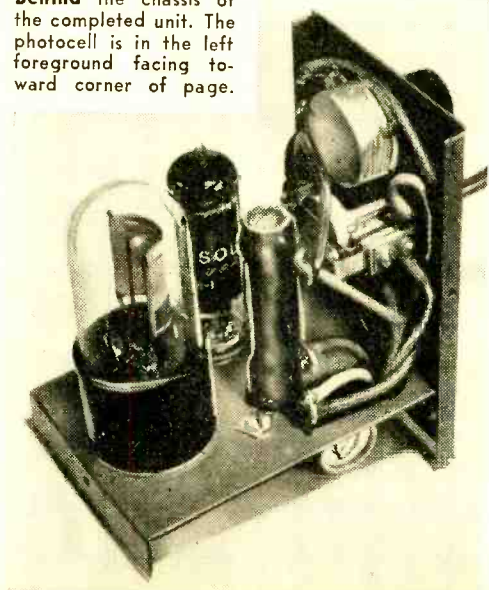
Almost any type of light source may be used with the completed instrument. In tests with a standard two-cell flashlight, the unit could be made to operate at about 15 feet. A more powerful (6-volt) flashlight should operate it at a much greater range.

In use, a light source is placed on one side of the doorway or window and the photocell relay on the other side. As the light source is interrupted by, say, a person entering a room, the relay is operated. The relay contacts, in turn, are used as a simple switch to operate some other device. A separate power supply must be furnished for the external device to be controlled by the relay. For example, if you use the photocell relay to control a door bell, the relay contacts should be connected *in series* between the door bell transformer (or battery) and the door bell itself.

**Comment.** Your staff kit reviewer experienced just a little difficulty in mounting the relay. The chassis mounting hole was off slightly and had to be enlarged with a small rat-tail file. Otherwise, the assembly was carried through without difficulty. The instructions that come with the kit are fairly clear and easy to follow. All in all, the Model 69 is a pretty good kit for the home builder.

-50-

**Behind** the chassis of the completed unit. The photocell is in the left foreground facing toward corner of page.





# AFTER CLASS

Special Information on Radio, TV,



Radar and Nucleonics

## THE TRAVELING-WAVE TUBE

**E**THYLENE GLYCOL, a chemical obtained as a by-product in the manufacture of certain synthetics, was once unceremoniously dumped into the waters of the Delaware River. Then someone discovered that it possessed unique anti-freeze properties. The waste disposal chute was promptly diverted from the river into gallon cans which today, under the name of "Prestone," sell for \$3.75 each!

The same kind of thing has happened in the development of microwave electron tubes. Ordinary triodes and pentodes are very satisfactory amplifiers at medium frequencies, but they begin to misbehave at the ultra-high frequency end of the spectrum. Among the more important causes of this misbehavior is the effect called *electron transit time*, an effect in which the time required for an electron to travel from the cathode to the plate of a tube is almost as great as the time needed for the r.f. signal to complete one full cycle. This effect renders the tube incapable of "following" the signal frequency, so that it fails completely as an amplifier or oscillator.

Like the man with the anti-freeze inspiration, ingenious electronic engineers have designed microwave tubes which actually make use of the transit time effect in generating and amplifying frequencies so high in the spectrum that they approach the wavelengths of light. Now, instead of preventing microwave operation, electron transit time phenomena enable us to work with frequencies higher than 50,000 megacycles! The traveling-wave tube is an example of such an application. One can

hardly scratch the surface of microwave techniques without coming upon this tube or others like the klystron and magnetron.

**Basic Parts.** All traveling-wave tube amplifiers incorporate the basic parts shown in Fig. 1. These include an electron gun—such as one finds in the picture tube of a TV set, a "slow-wave" structure—generally in the form of a loosely wound coil, a collector which receives the electron beam at



**What it looks like.** Here, low-level, low-noise traveling-wave tubes are shown undergoing a final check at RCA Tube Division, Harrison, N. J.

the other end of the tube, and an attenuator for preventing unwanted oscillations.

The electron gun produces a beam of electrons which moves through the hollow center of the coil. It is restricted to a tight beam by a strong magnetic field around the body of the tube (not shown in the diagram). Its velocity is controlled by varying the d.c. voltage between the coil and the cathode of the gun. If nothing more were done, the beam would simply move through the length of the coil in a uniform stream as in Fig. 2 and be returned to the circuit via the collector electrode. But something else must happen if amplification is to be realized.

**How Wave Travels.** Imagine that a radio signal of ultra-high frequency—say 20,000 mc.—is applied to the coil. Such a wave travels at a speed approaching the velocity of light—186,000 miles per second—around the turns of the coil. It does not advance from one end of the tube to the

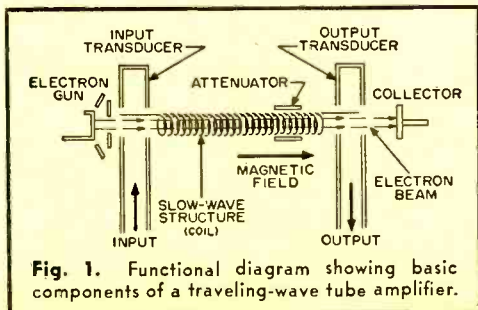
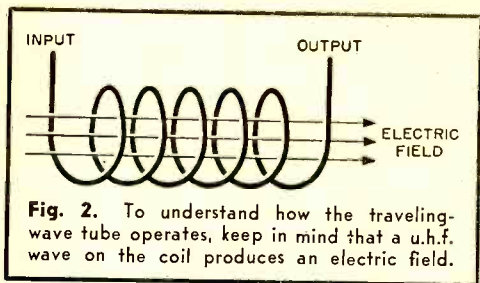


Fig. 1. Functional diagram showing basic components of a traveling-wave tube amplifier.



**Fig. 2.** To understand how the traveling-wave tube operates, keep in mind that a u.h.f. wave on the coil produces an electric field.

other end of the tube at this rate, however.

The actual velocity of propagation of the wave *along the axis* of the coil is found by multiplying the speed of light by the distance between turns of the coil and dividing the product by the circumference of the individual turns: rate of advance = velocity of light  $\times$  turn spacing/turn circumference. Since the ratio of turn spacing to turn circumference is always a small fraction, the total product is considerably less than the speed of light.

While the wave moves around the turns of the coil, it thus produces an electric field through the axis of the coil which moves with this velocity, as shown in Fig. 2. The electric field advances from one end of the tube to the other and, as it does so, an interaction takes place between the moving field and the electron beam from the cathode gun. This interaction results in delivery of energy from the electron beam to the wave from the coil, causing the signal to become larger as the coil's output end is approached.

**Energy Transfer.** The electric field moving axially through the coil consists of ultra-high frequency pulsations which alternate into the positive and negative regions. This is illustrated as a wave on the horizontal axis in Fig. 3. Let us consider three electrons,  $e_1$ ,  $e_2$ , and  $e_3$ , which belong to the beam passing through the coil, and observe them at the time shown in Fig. 3.

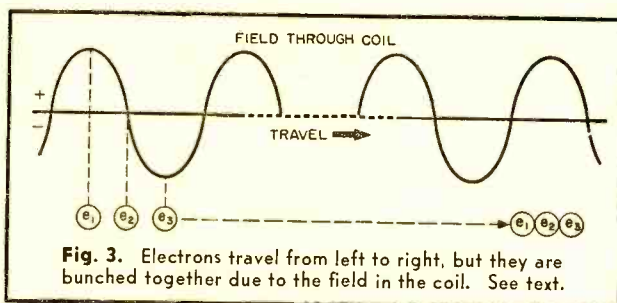
At this instant,  $e_1$  is in the presence of a positive portion of the field and is therefore accelerated in its motion through the coil. The velocity of electron  $e_2$  remains unaffected, however, because it is in a position of zero field strength while  $e_3$  is decelerated, being enmeshed in a field of negative polarity. This starts a *bunching* process in which all the electrons in the immediate vicinity of  $e_2$  begin to concentrate around this particle, some decelerating while  $e_2$  catches up with them while others speed up to overtake  $e_2$ .

As the wave continues through the axis

of the tube, the bunching action intensifies. This strong concentration of moving electrons induces a second wave in the coil which lags behind the original signal wave. The effect of this lag is to produce a new decelerating action on the electron beam.

**Amplification.** At this point we have to draw upon the Law of Conservation of Energy to understand how amplification is produced. Energy can neither be created nor destroyed but only changed in form. Before being decelerated, the electrons in the beam possess a given amount of kinetic energy. Conservation tells us that when they are decelerated the energy these electrons lose must be transferred to the agent which has caused the slow-down. Thus, the electron beam adds some of its energy to the content of the signal, causing the latter to emerge from the output end of the coil larger than it was when it first entered. Hence, amplification has been realized.

Our troubles are not yet over, however. Whenever a wave travels through a guiding medium, there are likely to be reflections from the remote end. In the traveling-wave tube, such reflections are prone to start os-



**Fig. 3.** Electrons travel from left to right, but they are bunched together due to the field in the coil. See text.

cillations which, of course, are highly undesirable in an amplifier. This tendency is controlled by introducing an attenuator near the output end of the tube, usually in the form of a coating of graphite inside the glass. This conductive area absorbs energy from the reflections, preventing them from reaching the input end of the tube in sufficient strength to maintain oscillatory feedback.

One of the most appealing features of traveling-wave tubes is their ability to amplify all signals over a very wide band of frequencies. Familiar amplifier circuits for radio frequencies usually involve resonant circuits which tend to limit the passband by the very nature of their resonance curves. The traveling-wave tube, being an essentially nonresonant device, is not limited in this manner. A well-designed traveling-wave tube can provide approximately equal amplification over the unbelievably wide band of 2000 mc.!





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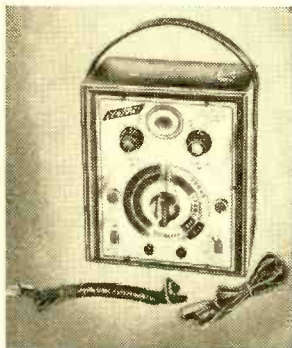
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A new Amperite Kontak Mike, Model No. KKH-3, is now available for all fretted and



stringed instruments, including the piano. It enables such musical instruments to project to the farthest part of an auditorium and can be used with any amplifier or recorder.

Frequency range of the KKH-3 is 40 — 10,000 cps  $\pm 2$  db. Output level is -55 db. A fingertip volume control is included and the unit is unaffected by temperature, pressure or moisture. It can be wedged or strapped onto any instrument without the use of tools. List price, \$18.00. (Amperite Company, Inc., 561 Broadway, New York 12, N. Y.)

-30-

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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 trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester & the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur License. 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.

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 \$19.95. 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.

Here is an excerpt from a letter that we received from Loren DePriet, 1496 4th St., Mansfield, Ohio: "I have spent many pleasant hours in constructing the radios from the schematics in your book, and have learned a great deal from them. Being as I am interested in Radio, I consider the money spent for your course as a wise investment. I have learned more from your course by actually doing than I did from an expensive course."

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 70 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.

The "Edu-Kit" is also used for courses of study, extra-curricular activities, industrial personnel training and rehabilitation. The "Edu-Kit" is used by Jr. High Schools, High Schools, Technical Schools, Jr. Colleges, Colleges, Universities, Industrial firms, Rehabilitation Hospitals, Boards of Education, U. S. Govt. agencies, United Nations Educational, Scientific and Cultural Organizations (UNESCO), Veterans Administration, and numerous adult, radio and young peoples' groups and clubs. The "Edu-Kit" is also popular with servicemen throughout the country and abroad. Designed for universal use, the "Edu-Kit" operates on your regular house electric current, whether AC or DC.

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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.

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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 and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, 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 all parts, tools, instructions, etc. Everything is yours to keep.

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J. Stalialis, 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."

### CONSULTATION SERVICE

One of the most important aspects of the "Edu-Kit" is the Free Consultation Service which we provide. Our staff of experts carries on an extensive correspondence with students in all parts of the world, concerning all phases of electronics. We welcome and encourage students to send us their problems, whether related to any of the material covered in the "Edu-Kit" course, or encountered in other experiences in the field of electronics.

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## Servicing Hi-Fi Equipment

(Continued from page 74)

with a signal tracer include resistors, capacitors, transformers, chokes, coils, and even poorly soldered joints.

**Miscellaneous Noise Causes.** Dirty volume and tone controls can produce clicks or raspy sounds when rotated. Clean by allowing a few drops of carbon tet or commercial contact cleaner to flow down the shaft, and then rotate the shaft back and forth.

Noisy selector switches can be cleared up by applying a drop of cleaner directly on the contacts. Dirty tube prongs and their mating socket contacts should be scraped clean; the same goes for the top grid terminal and its cap. Loose bolts or rivets holding parts to the chassis, and even metal tube shields loose in their clips, may be sources of noise. Noise that can't be cured by any of the above steps should be handled by a service technician. -30-

## There's No Fun in FUNIAC

(Continued from page 62)

petition latching onto a good thing like FUNIAC!"

"—weird wiring and—" she stopped and peered closely at me. "You're really serious about this nutty scheme, aren't you?"

I winked roguishly.

"You just get ready to live on Easy Street—thanks to FUNIAC! Oh, man! No more long, weary hours trying to revamp old ideas! No more mind-searing sessions switching other guy's stuff! No more head-buster attempts at creating really original cartoons! No sir! Just feed a card into FUNIAC and watch the supremely top-notch fresh situational humor pop out at me!"

"Well," she sighed, "it *sounds* great."

"You actually entertain doubts?"

"Let's just say I don't think the damn thing'll work worth beans. In fact, if it turns out anything like your past fiascos, it'll probably dream up stark drama!"

"Cynic," I accused crisply.

"All us realists are cynics," she said. "Especially those of us married to meter-heads like you, dear."

**M**Y FIRST STEP toward creating FUNIAC was, of course, purchasing the components and parts necessary to construct a digital computer. I sauntered into the Golenpaul Electronics Supply Shop and carefully began selecting the necessary parts. When the items passed the 200 mark,

(Continued on page 96)

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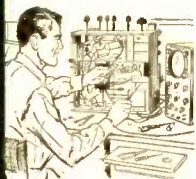
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**\$24.50**

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\$2.06 MO.

*Largest selling VTVM  
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*. . . etched circuit board*

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Sensitivity and reliability are combined in the V-7A. It features 1% precision resistors, large 4½" panel meter, and etched circuit boards. AC (RMS) and DC voltage ranges are 0-1.5, 5, 15, 50, 150, 500 and 1500. Peak-to-peak AC ranges are 0-4, 14, 40, 140, 400, 1400 and 4000 volts. Ohmmeter ranges provide multiplying factors of X1, X10, X100, X1000, X10K, X100K and X1 megohm.



*New  
improved . . .  
full 5" size  
. . . etched  
circuit  
for only*

**\$42.50**

Shpg. Wt. 21 lbs.

\$4.25 DWN.,  
\$3.97 MO.

MODEL OM-2

## HEATHKIT 5" PUSH-PULL OSCILLOSCOPE KIT

This new and improved oscilloscope sells for less than the previous model. You can have a full 5" oscilloscope at the remarkably low price of only \$42.50. The OM-2 provides wider vertical frequency response, extended sweep generator coverage, and increased stability. Vertical channel is essentially flat to over 1 MC, and down only 6 DB at 1.5 MC. The sweep generator functions from 20 CPS to over 150 KC. Amplifiers are push pull, and modern etched circuits are employed in critical parts of the circuit. A 5BP1 cathode ray tube is used. The scope features external or internal sweep and sync, one volt peak-to-peak reference voltage, three-position step attenuated input, adjustable spot shape control, and many other "extras."



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Shpg. Wt. 3 lbs.

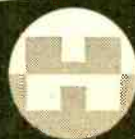
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and in the service shop*

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Measures AC or DC voltage at 0-1C, 30, 300, 1000, and 5000 volts. Direct current ranges are 0-10MA and 0-100MA. Ohmmeter ranges are 0-3000 and 0-300,000 ohms. Sensitivity is 1000 ohms/volt. Features small size and rugged construction in sleek black bakelite case.

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*A Subsidiary of Daystrom, Incorporated*





\$3.60 DWN.,  
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MODEL DX-20

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Shpg. Wt. 18 lbs.

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### CW TRANSMITTER KIT

Here is a straight-CW transmitter that is one of the most efficient rigs available today. It is ideal for the novice, and even for the advanced-class CW operator. This 50 watt transmitter employs a 6DQ6A final amplifier, a 6CL6 oscillator, and a 5U4GB rectifier. It features one-knob band switching to cover 80, 40, 20, 15, 11 and 10 meters. It is designed for crystal excitation, but may be excited by an external VFO. A pi network output circuit is employed to match antenna impedances between 50 and 1000 ohms. If you appreciate a good signal on the CW bands, this is the transmitter for you!



MODEL SG-8

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\$1.64 MO.

Shpg. Wt. 8 lbs.

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### RF SIGNAL GENERATOR KIT

Produces RF signals from 160 KC to 110 MC on fundamentals on 5 bands, and covers 110 MC to 220 MC on calibrated harmonics. Output may be pure RF, RF modulated at 400 CPS, or audio at 400 CPS. Preamplified coils eliminate the need for calibration after completion.



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### ALL BAND RECEIVER KIT

This receiver covers 550 KC to 30 MC in 4 bands, and is ideal for the short wave listener or beginning amateur. It provides good sensitivity and selectivity, combined with good image rejection. Amateur bands clearly marked on illuminated dial scale. Employs transformer-type power supply — electrical bandspread — antenna trimmer — separate RF and AF gain controls — noise limiter — headphone jack — and automatic gain control. Built in BFO for CW reception.

CABINET: Fabric-covered cabinet with aluminum panel as shown. Part 91-15A. Shipping wt. 5 lbs., \$4.95 incl. Fed. Ex. Tax, \$.50 dn., \$.42 mo.



MODEL GD-1B

**\$19<sup>95</sup>**

\$2.00 DWN.,  
\$1.68 MO.

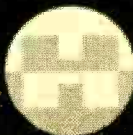
Shpg. Wt. 4 lbs.

### FULL SET OF COILS INCLUDED WITH KIT HEATHKIT GRID DIP METER KIT

An instrument of many uses for the ham, experimenter, or serviceman. Useful in locating parasites, neutralizing, determining resonant frequencies, etc. Covers 2 MC to 250 MC with prewound coils. Use to beat against unknown frequency, or as absorption-type wave-meter.

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**EASY TO BUILD**  
**... A "LEARN-BY-DOING" EXPERIENCE**  
**HEATHKIT BROADCAST BAND**  
**RECEIVER KIT**

You need no previous experience to build this table-model radio. It covers 550 KC to 1620 KC and features good sensitivity and selectivity. A 5½" speaker is employed, along with high-gain miniature tubes and a new rod-type antenna. The power supply is transformer-operated. The kind of a set you will want to show off to your family and friends. Construction is simple. You "learn by doing" as the project moves along.

**CABINET:** Fabric-covered plywood cabinet as shown. Shipping Wt. 5 lbs., .50 dwn., .42 mo., part No. 91-9A. \$4.95 incl. Fed. Excise Tax.



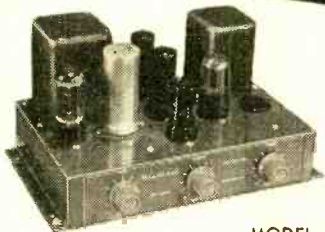
MODEL BR-2

**\$18<sup>95</sup>**

incl. Fed.  
Excise Tax  
(less cabinet)

\$1.90 DWN.,  
\$1.59 MO.

Shpg. Wt. 10 lbs.



incl. Fed.  
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MODEL A-7D

**\$17<sup>95</sup>**

Shpg. Wt. 10 lbs.

**REAL HI-FI PERFORMANCE**  
**AT MINIMUM COST**  
**HEATHKIT 7-WATT**  
**AMPLIFIER KIT**

This 7-watt amplifier is more limited in power than other Heathkit models, but still qualifies for high fidelity, and its capabilities exceed those of many so called "high fidelity" phonograph amplifiers. Using a tapped-screen output transformer, the model A-7D provides a frequency response of ± 1½ DB from 20 to 20,000 CPS. Total distortion is held to surprisingly low level. The output stage is push-pull, and separate bass and treble tone controls are provided.

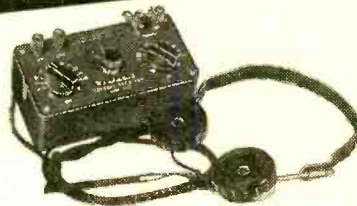
**Model A-7E:** Similar to the A-7D except that a 12SL7 tube has been added for preamplification. Features two inputs, RIAA compensation, and extra gain. \$20.35, incl. Fed. Excise Tax, \$2.04 dwn., \$1.71 mo.

MODEL CR-1

**\$7<sup>95</sup>**

incl. Fed.  
Excise Tax  
Shpg. Wt. 3 lbs.

\$.80 DWN.,  
\$.67 MO.



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**HEATHKIT**  
**ENLARGER**  
**TIMER KIT**



MODEL ET-1

**\$11<sup>50</sup>**

Shpg. Wt. 3 lbs.

\$1.15 DWN.,  
\$.97 MO.

This is an easy-to-build device for use by photographers in controlling their enlarger. It covers the range of 0 to 1 minute with a continuously variable control. Handles up to 350 watts. Timing cycle controlled electronically for maximum accuracy.

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**NEW EDGE-LIGHTED  
TUNING DIAL FOR  
IMPROVED READABILITY**

### **HEATHKIT HIGH FIDELITY FM TUNER KIT**

This FM tuner can provide real hi-fi performance at an unbelievably low price level. Covering 88 to 108 MC, the modern circuit features a stabilized, temperature compensated oscillator, AGC, broad-banded IF circuits, and better than 10 UV sensitivity for 20 DB of quieting. A ratio detector is employed for high efficiency, and all transformers are prealigned, as is the front end tuning unit. A new feature is the edge-lighted dial for improved readability, and a new dial cord arrangement for easier tuning. Matches the models WA-P2 and BC-1. Easy to build.

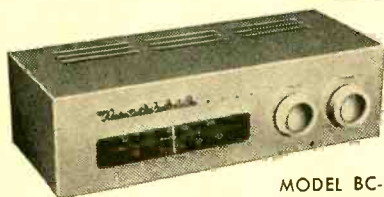


MODEL FM-3A

**\$25<sup>95</sup>**

*incl. Fed.  
Excise Tax  
(with cabinet)  
Shpg. Wt. 7 lbs.*

\$2.60 DWN.,  
\$2.18 MO.



MODEL BC-1

**\$25<sup>95</sup>**

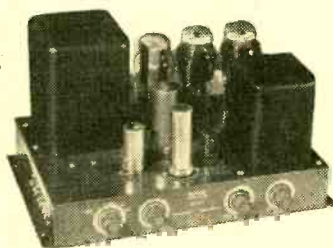
*incl. Fed. Excise  
Tax (with cabinet)  
Shpg. Wt. 8 lbs.*

\$2.60 DWN.,  
\$2.18 MO.

**NEW EDGE-LIGHTED TUNING  
DIAL. MATCHES MODEL FM-3A**

### **HEATHKIT BROADBAND AM TUNER KIT**

The BC-1 was designed especially for high fidelity applications. It features a low-distortion detector, broad band IF's, and other characteristics essential to usefulness in hi-fi. Sensitivity and selectivity are excellent, and audio response is within  $\pm 1$  DB from 20 CPS to 2 KC, with 5 DB of pre-emphasis at 10 KC to compensate for station rolloff. 6 DB signal to noise ratio at 2.5 UV. Covers 550 to 1600 KC. RF and IF coils are prealigned, and the power supply is built in. Features AVC, 2 outputs, and 2 antenna inputs. Tuning dial is edge-lighted for high readability.



MODEL A-9B

**\$35<sup>50</sup>**

*Shpg. Wt.  
23 lbs.*

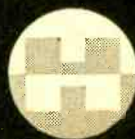
**\$3.55 DWN.,  
\$2.98 MO.**

**FULL 20 WATTS FOR PA  
OR HOME APPLICATIONS**

### **HEATHKIT 20-WATT AMPLIFIER KIT**

This high-fidelity amplifier features full 20-watt output using push pull 6L6 tubes. Built-in preamplifier provides 4 separate inputs, selected by a panel-mounted switch. It has separate bass and treble tone controls, each offering 15 DB boost and cut. Output transformer is tapped at 4, 8, 16, and 500 ohms. Designed primarily for home installation, but used extensively for public address applications. True high-fidelity performance with frequency response of  $\pm 1$  DB from 20 CPS to 20,000 CPS. Total harmonic distortion only 1% (at 3 DB below rated output).

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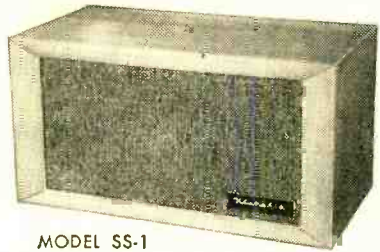


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**AND HIGH PERFORMANCE**

**HEATHKIT HIGH FIDELITY  
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The model SS-1 covers 50 to 12,000 CPS within  $\pm 5$  DB, and can fulfill your present needs, and still provide for the future. It uses two Jensen speakers and has a cross-over frequency of 1600 CPS. The speaker system is rated at 25 watts, and the impedance is 16 ohms. The enclosure is a ducted-port bass reflex type and is most attractively styled. It is easy to build and can be finished in light or dark stain to suit your taste.



MODEL SS-1

**\$39<sup>95</sup>**

\$4.00 DWN.,  
\$3.36 MO.

Shpg. Wt. 30 lbs.

**ATTRACTIVE STYLING  
MATCHES MODEL SS-1  
HEATHKIT HIGH FIDELITY  
RANGE EXTENDING  
SPEAKER SYSTEM KIT**

The SS-1B is designed especially for use with the model SS-1. It consists of a 15" woofer and a compression-type super tweeter to add additional frequency coverage at both ends of the spectrum. Cross-over frequencies are 600, 1600, and 4,000 CPS. Together, the two speaker systems provide output from 35 to 16,000 CPS within  $\pm 5$  DB. The kit is easy to assemble with precut and predrilled wood parts. Power rating is 35 watts, and impedance is 16 ohms.



MODEL SS-1B

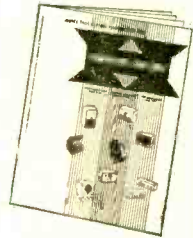
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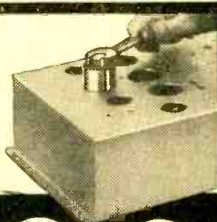
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## FUNIAC

(Continued from page 90)

Mr. Golenpaul finally released his ill-concealed curiosity.

"An invention you're building?" he inquired casually.

I glanced around the shop.

"Can I trust you with a very important secret?"

"Well, I trust you." Golenpaul studied the list of components. "As of now, you're on the books for \$162.33 worth. If I can trust you for a small fortune in electrical equipment, I think your secret is in good company."

Lowering my voice to a hoarse whisper, I detailed my planned project to him—particularly embellishing the profits to follow its initial operation. He just shook his head sadly.

"What's the matter?" I demanded.

"Such craziness," he said gloomily. "And what about those nice boys who sometimes write gags for you? What happens to them when you replace them with this machine?"

"Oh, I suppose they'll go into something more reliable—like tearoom-managing or sand-hogging," I replied evenly, reminding myself that a true scientist has to be totally objective, and a pox on sentiment.

Golenpaul shrugged.

"No, there's nothing like a little greed to make the world go around." He shot me a shrewd glance. "And the wife? What does she think?"

"She thinks I'm batty. Flipped."

"Such a smart girl, that one," said Golenpaul, chuckling softly.

**TWO HOURS LATER** I began building FUNIAC. In between putting components into properly relative positions and fussing with miles of circuitry until it made sense, I studied the short ton of books on Computer Theory and Electronic Information Banks.

Once, the wife entered the workshack long enough to look at the growing profusion of cabinets, wiring layouts, phase-control units, storage-gate setups, pulse-regulators and flip-flops. Darkly, she peered at the entire half-assembled instrument and then transferred her fascinated attention to me.

"Will it work?" she asked timidly.

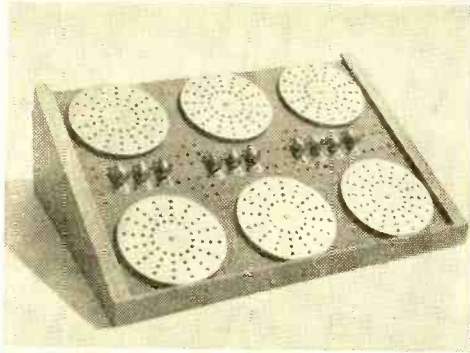
"It had better!" I declared feelingly. "I haven't slugged my courageous way through tomes on Boolean Algebra and Cybernetics for the sheer mathematical fun of it!

"Jeezely!" She was unashamedly impressed.

"Two more weeks of this," I complained,



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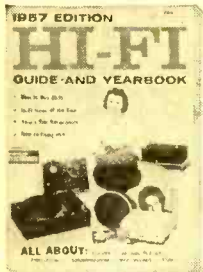
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"and I'll be able to write my own ticket at Cal-Tech."

**A**ND THEN—suddenly—FUNIAC was finished and ready for testing.

"Stop quivering," suggested the wife as I prepared to feed situation elements into the maw of the Material Analyzer Receiver. "You're as nervous as a mouse at a cat rally."

"You're telling me? I've immersed myself so thoroughly in this thing—I don't think thoughts any more; I've got equations on the brain."

"What exactly happens?" she asked.

"I'll feed an ordinary locale, an unfunny set of characters and an insipid word or phrase into it. Then, unless FUNIAC turns out to be a complete flop, it'll rearrange these elements into a humorous situation. A gag, in other words."

"Amazing!" she gasped.

I chose a slip of paper upon which I'd written:

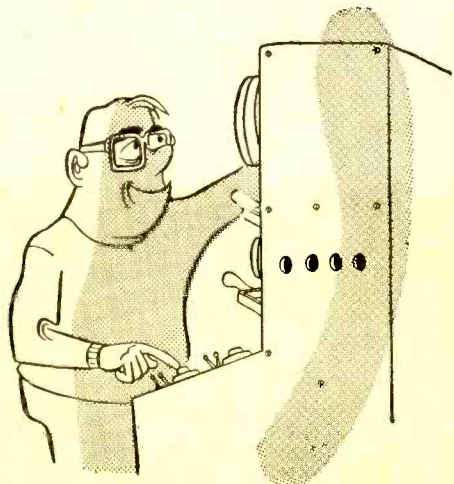
*Man. Woman. Desert Island. "May I borrow a cup of sugar?"*

I fed it to FUNIAC.

There was no clanking, whirring or mad flashing of indicator lights . . . no ominous clicking or warning whines . . . only a smooth humming as the brain-machine digested this intelligence in oily silence. Fretfully we waited, the wife abstractly gnawing her polished nails while I cracked my knuckles in an agony of uncertainty.

**S**UDDENLY FUNIAC's card-file-selector began clacking furiously. Seconds later, a small white slip of paper popped out of the solution-slot, bearing the words:

*This is not a bona fide gag-idea. Situa-*



. . . I fed the slip of paper to FUNIAC. There was no clanking, whirring or flashing of indicator lights—only a smooth humming. Fretfully we waited . . .

Always say you saw it in—POPULAR ELECTRONICS



tion stated is based upon gross tragedy. Tragedy cannot be evaluated, in this instance, into humorous terms.

Stunned, I turned the slip of paper over and over, wondering what could have gone wrong. FUNIAC was supposed to create gags, not analyze them.

"Well, I guess you've been told!" snickered the wife. "And by a machine of your own making, no less!"

"Quiet!" I rasped. Quickly, I jotted down another situation and gag-line. I fed it to the computer and waited. A moment later the solution-slot spat another slip of paper. It read:

*Situation stated is not potentially humorous. Suggest you get authorized gagan.*

"My God!" howled the wife. "A mechanical editor! You've gone and built yourself a mechanical editor! Now I've seen everything!"

Despair nibbled at the edge of my mind. Then, a desperate idea came to me: feed the machine the most basic of humorous situations—the rawest material upon which more refined humor is based.

Swiftly, I scribbled this material:

*Man throwing custard pie into another man's face.*

FUNIAC accepted and digested this of-

fering in one-half the time previously taken. The ensuing slip of paper read:

*Situation absurd. Have you ever considered sand-hogging or tearoom management?*

The wife lurched about the room in a spasm of advanced hysteria . . . happy-type hysteria. I slumped into a chair—staring at the gleaming computer with haunted mien and dull eyes. It was quite obvious what automation in the humor field was going to do to the hackneyed set. I shuddered. A vision of a dank tunnel materialized in my mind. It was followed by a montage of tea cups, silverware and a small, chintz-horrible room.

"Y-You've had it!" said the wife, wiping the tears of warped merriment from her eyes and slowing to an infrequent simper. "Admit it. This is just like all your other mad ideas. Come on, admit it!"

**D**ESPERATION is a powerful emotion. Built up sufficiently, it breeds a rare, insanely brilliant courage. Even the most frightened mouse will bite when finally cornered.

My gorge rose like a guided missile.

"Okay," I hissed. "Okay, sister. This . . . machine thinks it's so . . . smart. We'll see. We'll just see how smart this

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mess of electronic wise-guy really is!" I snatched up pencil and paper, and began writing savagely.

"Don't be a diehard," groaned the wife, still not completely recovered from her recent spasms.

Ignoring her faithful encouragement, I studied what I'd written.

*Man is professional humorist. He's having difficulty producing suitably fresh humor ideas. In fact, he's mentally, emotionally and physically exhausted. Man's wife is unsympathetic, well rested and more interested in her breakfast than in hearing his professional problems. Situation is set at the breakfast table.*

Chuckling wickedly, I carefully inserted it into the computer. There was a long silence.

"W-What's happening?" asked the wife, fearfully backing off toward the door. "H-How come it isn't *d-doing* anything?"

My chuckle took on a positively unhealthy tinge of ill-concealed triumph. "Well, I imagine FUNIAC is about to short-circuit its fine, fat little electronic mind trying to play fast and loose with *this* contribution!"

"W-Will it blow up?"

"It might."

"Don't s-stand so close t-to it."

"Hah!" I chortled. "Listen to those puzzled clicks and clacks! Listen to that bewildered stream of mystified static!" I slapped my knee in joyous appreciation of having finally given FUNIAC a real, root-in'-tootin' brain buster. "Wanna make a small bet it asks me to repeat the statement?"

FUNIAC suddenly set up a shrill whine, punctuated by anguished sputtering and fizzling. The entire cabinet fairly quivered with labored effort and intense electrical strain. A faint odor of burnt wiring filled the room.

"Now *there's* a diehard for you!" I cackled.

Without warning a continuous strip of paper shot from the *solution-slot* and began piling up at FUNIAC'S base. I grabbed the top of it and started reading:

*Huddled around a cup of coffee, I squinted groggily across the breakfast table at my wife. She enthusiastically attacked her scrambled eggs with the appetite and energy of a woman who gets nine hours sleep every night . . .*

FUNIAC is safely disconnected and stored away down in a quiet corner of the basement these days. Some day I may plug it in again and try something else; but the world isn't ready for FUNIAC yet.

And, frankly, neither am I.





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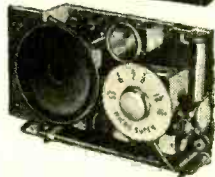
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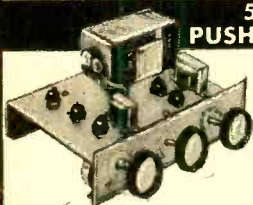


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**Can You Run a Computer?**

(Continued from page 40)

take a job with some outside firm intending to buy or rent a computer. There you first learn the business of that firm (whatever it may be), and then your boss sends you to Computer School at Remington Rand or IBM. Since practically any firm big enough to do business on a national scale is now giving serious thought to automation, this is a good time to let their personnel managers know that you are interested in computer programming.

The computer manufacturers themselves mostly prefer people with some background in mathematics, accounting and business administration, and are usually able to pick and choose. Yet the average business firm going in for automation is so eager for applicants that it will often spend the time and money to have you trained from the ground up if they consider you capable of logical thinking, responsible, and serious in your purpose.

Burroughs Corp., UNIVAC and IBM training centers are located in major cities all over the country, training their own as well as their clients' computer personnel. These schools maintain separate training facilities for programmers, who operate the computer, and for service and maintenance personnel, who keep the electronic gear in trim. Maintenance personnel are a breed apart from the programmers. Their training proceeds more along the lines of a conventional engineering education.

Run like colleges, IBM's 23 training centers have a present enrollment of 7000 trainees, taught by about 100 instructors. The Remington Rand training schools have already trained 5000 graduates who are now running UNIVAC installations in a variety of applications. These paid-for special training programs lead to secure jobs, since the firm paying for your training wants to profit from its investment over many years. Good careers can be built on this basis.

**Upper Brackets.** The only drawback to these special training programs is that you are trained mainly for practical work on a particular type of computer in a particular type of business. The broader basic aspects of computer theory and mathematics are usually skimmed rather lightly. For a deeper understanding of computers in general and their applicability to many different tasks, there is no real substitute for thorough study at college level.

The mathematics departments of some universities now offer courses in computer programming theory, which qualify their

(Continued on page 108)



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"Not necessarily," says Dick Brani, Instructor in Project Sage at IBM—Kingston, New York. "Oh, sure—I'm aware of my limitations to design electronic equipment—that's the big advantage of a formal degree. But I am qualified to maintain it. The point is . . . there are many management positions in IBM for men like myself, and I'm convinced that comparable positions elsewhere would probably require an engineering degree."

Some years ago, IBM took the initiative with respect to technical training within its own organization. It realized, even then, that a great number of intelligent and capable men were falling by the wayside because they lacked 4 years of college engineering. Statistics indicated that because of financial difficulty or improper high-school preparation, close to 50% of the potential engineers in the country became lost in the educational shuffle. While some people ignored or bemoaned the fact, IBM did something about it. Consequently, men like Dick Brani now enjoy satisfying, more rewarding work than ever before.

**Great Interest in Mathematics.** While Dick was attending high school, his principal academic interest was mathematics. And, like many other young men of that time, Dick was realistic about his future. He decided his best bet might be business accounting. When Dick graduated, he accepted a position with a New York banking firm. It was not until he entered the Army that he had the opportunity to pursue a more advanced form of mathematics—an A.S.T.P. training program at Lehigh University. This all-too-brief experience convinced



Dick trouble shooting  
Magnetic Drum Frame.



He studies computer  
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Dick that he should make his career in a field related to electrical technology.

**Postwar Education.** Discharged with the rank of Staff Sergeant, Dick returned home to marry a girl he had met at Lehigh. During this period, he successfully supported his family selling various lines of food. In the evening, however, Dick continued his study of radio, TV, and electronics at the Allentown Branch of the Temple Institute. In two years' time, he graduated and secured an F.C.C. license—his technical career began to take shape.

**IBM Looks Especially Good.** Glancing through an issue of *Time Magazine* one evening, Dick happened to read an article about Thomas J. Watson, Jr., the president of IBM. The story emphasized Mr. Watson's great faith in the future of electronic computers . . . the wonderful promise it holds for the ambitious, intelligent young man. Later, Dick spotted a classified ad describing IBM's association with Project Sage. That was all Dick Brani needed.

**Asked to Become an Instructor.** Three-quarters of the way through his nine-month computer systems course, Dick was invited to remain at Kingston as an instructor. "It was like a bolt out of the blue," he recalls. "I knew I'd enjoy teaching, but I always thought it was out of the question. I accepted all right. I can't tell you how much I've enjoyed helping these fellows and watching them grow within the organization. Right now, there's a fellow in my class whose education is limited to correspondence school. He's in the top third of his class, and has a real future with IBM—all because he has the native talent and is willing to work."

**What Does Dick Brani Teach?** "Actually, I teach three separate courses in field engineering. One is computer systems testing, which is for the more advanced student. It lasts for 33 weeks—a long

time, perhaps, but it's well worth it. Another is a program of 24 weeks' duration that deals with computer input-output units. Finally, I teach a course in computer units displays. This also lasts for 24 weeks. Each one of these courses is an education in itself." Experience has shown that IBM's educational programming is most successful. Men accepted receive their training with no strings attached. Upon graduation the road to success is wide open in *all* divisions of the corporation.

**What About Dick's Future?** "Well, right now, I'm doing work that most technicians couldn't touch with a ten-foot pole. I guess it's a matter of approach, but I know of few companies other than IBM where technicians are actually doing engineering work. Both kinds of companies will get the job done, but IBM prefers to think in terms of the man, encouraging him to grow into more responsibility. You might say that IBM gets more out of the man. In the final analysis, it seems a lot more efficient from the corporation's and employee's viewpoint. Personnel policy at all levels—management, engineering, or technical—is the same. The future is wide open."

**What About You?** Permanent opportunities in the nationally important Project Sage program are still growing. If IBM considers your experience equivalent to an E.E., M.E. or Physics degree, you'll receive 8 months' training, valued at many thousands of dollars as a Computer Systems Engineer. If you have 2 years' technical schooling or the equivalent experience, you'll receive 6 months' training as a Computer Units Field Engineer, with opportunity to assume full engineering responsibility. *Assignment in area of your choice.* For more information, please write to: Nelson O. Heyer, Dept. 12606, IBM, Kingston, New York. You'll receive a prompt reply.



Dick explains computer logic to a Systems Class.



At the Operating Console.



At home Dick plays with one of his three children.

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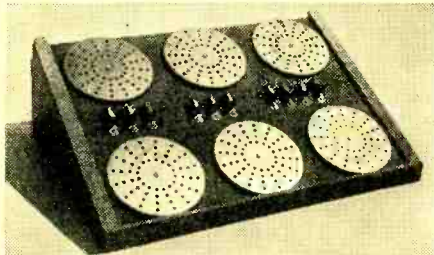
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## Computer (Continued from page 104)

graduates to understand the principle of any computer and adapt it to any feasible job. This training on a higher level usually leads to scientific or executive employment in the upper brackets. The country's top firms are bidding high for graduates of this caliber. Persons qualified by their study of basic theory to set up rather than follow a computing routine command high salaries.

The latest wrinkle in computer training is a correspondence course in computer programming offered by Oliver Garfield Co., Inc. This makes it possible for anybody, anywhere, to learn programming principles in his spare time. As in other correspondence courses, the value of such training depends largely on the individual student since examinations cannot be supervised.

The job opportunities created by electronic data processing machines are well summarized in the words of a Remington Rand training executive: "You don't have to be a genius to run a computer. If you are smart enough to learn to solve quadratic equations, you are potentially one of 170,000 people needed right now to set the age of automation rolling into the future . . . your future."

-30-

## Hi-Fi Mixer-Equalizer

(Continued from page 58)

tends to override the mike (as may be the case with a dynamic type), insert a 150,000-ohm resistor at point  $\oplus$  to balance the two inputs.

Many amplifiers do not have equalization in their "tape-in/tape-out" sections. You can use the equalizer when transcribing discs to tape to insure flat response. Be sure that the signal does not go through equalization twice, however.

The RC values in this equalizer network were selected to match most G. E. cartridges. However, the G. E. people have recently placed on the market a cartridge for which they recommend a 220,000-ohm load resistor. Previously they recommended lower values. Using a 220,000-ohm unit would necessitate replacing R5 with a 200,000-ohm potentiometer, with R3 becoming 20,000 ohms.

From this example, you can see how the circuit could be modified to accommodate any type of magnetic pickup. Simply pick a resistor-potentiometer combination that equals the manufacturer's recommended load resistance for maximum high-frequency response. The impedance of the pickup is taken into consideration in computing this resistance.

-30-

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## Transistor Topics

(Continued from page 82)

The completed instrument is a compact, self-contained audio signal generator, valuable for servicing p.a. systems, intercoms, phonograph amplifiers, or the audio sections of radio and TV receivers.

**Transistor Multivibrators.** A multivibrator is essentially a two-stage resistance-capacity-coupled amplifier in which the output of the second stage is coupled back to the input of the first stage. Either vacuum tubes or transistors may be used in the individual stages.

If common-emitter stages are used, there is a 180° electrical phase shift in each stage. As total shift for two stages is 360°, the "output" signal is essentially in phase with the "input." As a result, such an arrangement becomes a vigorous oscillator.

Since there are no LC resonant circuits in such an oscillator, the operating frequency is generally dependent on the circuit's RC time constants. In addition, the output signal is a complex pulse or rectangular wave instead of the sine wave obtained from LC oscillator circuits.

Multivibrators are used extensively in radar, television circuitry, computers, and many types of test equipment. Advanced experimenters and students who have ac-

cess to cathode-ray oscilloscopes find multivibrators interesting because of the various signal waveshapes that can be obtained from such circuits.

Two basic transistor multivibrator circuits are shown in Fig. 3 (p. 111). Values given are typical for low-cost transistors such as Raytheon's CK722, G. E.'s 2N107 and 2N170, and Sylvania's 2N229. The power supply batteries may supply from 3 to 9 volts.

A collector-coupled multivibrator is shown in Fig. 3(A). The two transistors are of the same type . . . *p-n-p* units are shown but *n-p-n* types will work as well if the battery polarities are reversed. *R1* and *R4* are the collector load resistances, *R2* and *R3* the base bias resistors, *C1* and *C2* the interstage coupling capacitors.

A complementary multivibrator, using direct-coupled *n-p-n* and *p-n-p* transistors, is shown in Fig. 3(B). The direct-coupling arrangement used between the first and second stages is made possible by the opposite d.c. characteristics of *n-p-n* and *p-n-p* transistors. The two transistors may be interchanged if the battery (*B1*) polarity is reversed. *R1* is the base bias resistor for the first stage, *R2* the collector load resistor for the second stage, *C1* the interstage coupling capacitor. The base-emitter circuit of the second stage serves as the

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"collector load" for the first stage, while the emitter-collector of the first stage serves as the base resistor of the second.

In either circuit, the resistors may be rated at 1/2 watt, while the capacitors may be either disc ceramic or tubular paper units. When choosing transistors for these circuits, remember that the CK722 and 2N107 are *p-n-p* types while the 2N170 and 2N229 are *n-p-n* types. Again, in either circuit, changing the *RC* time constant by varying either resistor or capacitor values will change both the operating frequency and the signal waveshape.

**Overseas Source of Supplies.** Your columnist receives a fair amount of mail from POP'tronics readers in other countries . . . Canada, Mexico, Spain, Portugal, France, and so on. Almost every letter asks the same question . . . "where can I buy transistor parts and components?"

We've done a little checking, and we've found a source of supplies for our overseas friends. Lafayette Radio (165-08 Liberty Ave., Jamaica 33, N. Y.) has a fully staffed Export Department and welcomes orders from other nations. They will gladly send a free copy of their latest catalog to *anyone* requesting it.

**Product News.** From Century Electronics Co., Inc., 111 Roosevelt Ave., Mineola, N. Y., comes news of a low-priced

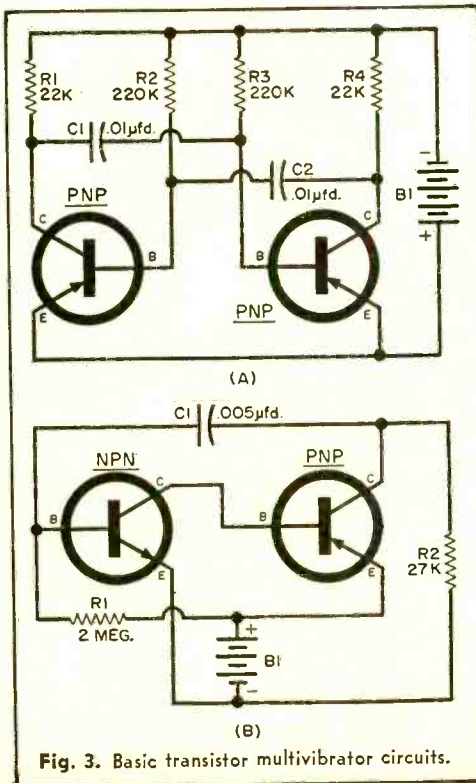


Fig. 3. Basic transistor multivibrator circuits.

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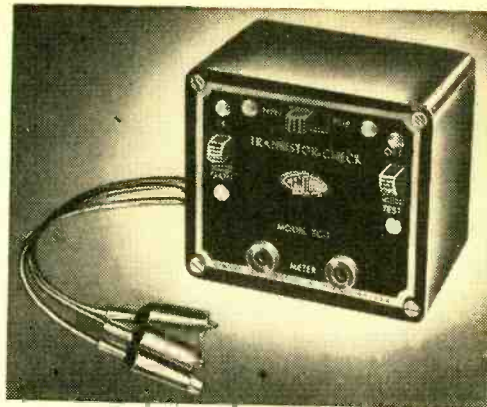


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## SYLVANIA

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Century Electronics' new transistor checker.

transistor checker. Model TC-1 sells for \$6.95 and is used in conjunction with a standard multitester. . . . General Electric indicates that the only truly portable television receiver will have to be transistorized—and expects to see such sets manufactured within two or three years.

Radio Corporation of America has announced the availability of two new power transistors, Types 2N301 and 2N301A. Both are *p-n-p* types and very similar, except for their maximum voltage ratings. A pair of these in Class B push-pull can deliver 12 watts, with a power gain of 30 db. For technical data, write to RCA, Semiconductor Division, Somerville, N. J. . . . The R. E. Dietz Company, Syracuse, N. Y., has announced the manufacture of a transistorized hazard flasher lamp. Developed in cooperation with G. E., the units flash at a rate of 60 to 70 times per minute. Battery life is over 1200 hours.

Well, fellows, that's the show for now . . . see you next month.

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## The Transmitting Tower

(Continued from page 77)

er across the bulb in Fig. 1(B) once the transmitter is tuned.

**Results.** Tuning the AC-1 to my all-band doublet, between 3:00 and 4:30 p.m., I made five contacts in four states. Two were on 80 meters, and three were on 40 meters. One report was RST579X, three were RST589X, and one was RST599X. I was surprised at the ease with which I made contacts and at the excellent reports I received.

Incidentally, while the manufacturer suggests using 7-mc. crystals for 7-mc. operation, I found that 3.5-mc. crystals, doubling frequency in the transmitter, worked



well, too. The 599X report was received while using a 3.5-mc. crystal on 7 mc.\*

A few watts of power may also be obtained from the AC-1 on the 14-mc. and 21-mc. amateur bands—not enough power to set either band afire but sufficient for making an occasional contact when conditions are favorable. Obtain a 5-prong, 1¼"-diameter coil form (Amphenol 24-5-P or equivalent), and wind 5½ turns of #18 or #20 enameled wire, spaced to occupy three-quarters of an inch on it, and plug it into the transmitter. Use 7-mc. crystals. Fourteen mc. is tuned with the plate capacitor set at slightly less than half capacitance, and 21 mc. is tuned with the capacitor about three-quarters of the way open. The exact settings are naturally affected by the adjustment of the output loading capacitor.

**Conclusions.** The AMECO AC-1 transmitter is easy to assemble, and it works well. How far any transmitter "gets out" is determined largely by the antenna with which it is used. This is especially true of a low-power transmitter. Used with a reasonably good antenna, the AC-1 does get out, and it would make a good first transmitter for any Novice.

The AC-1 transmitter kit sells for \$16.95, with a coil kit for one band, but less tubes and crystal. Extra coil kits, consisting of a drilled coil form and wire, are 50 cents each. The kit may be ordered from the manufacturer, the American Electronics Co., 1203 Bryant Ave., New York 59, N.Y., or from any of the amateur supply houses that advertise in POPULAR ELECTRONICS.

#### News and Views

**Lloyd, WN7GDD**, offers to help stations needing a Utah contact. He started out on 15 meters, where he worked 28 states, Canada, and Alaska, but he is also on 40 meters now. Lloyd uses a Heath AT1 feeding a doublet antenna and a Hallicrafters SX-99 receiver. . . . In 29 days on the air, mostly on 80 meters, **Bob, KN4MJJO**, has made 81 contacts in 10 states. He uses a home-built, 10-watt transmitter, a 120' "long-wire" antenna, and a National NC-125 receiver. . . . **Henry, K2VBL**, is one of those who cannot put up an outside antenna. He lives in a 25' long, first-floor apartment in a five-story building. For an antenna, he strung 100' of wire down one side of the apartment, across the back, and up the other side, with plenty of loops to get in the full length of wire. His WRL Globe Scout 65B transmitter loads the antenna well on 40, 20, 15, and 10 meters. Henry has not worked much DX with this antenna, but his local reports are excellent.

"**Hart of Dixie**," **KN5IVA**, (32), has parlayed his Globe Scout transmitter, Hallicraft-

\* A minor advantage of this arrangement was that it made it unnecessary to detune the plate capacitor slightly for easy starting of the crystal. This largely compensated for the slightly lesser power output theoretically obtained when doubling frequency.

June, 1957

## NEW WRL Globe Scout 680

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- ★ Complete detailed manual and assembly instructions accompany kit form.

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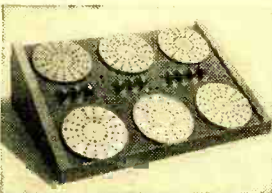
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ers S-53 with Q-Multiplier, and 40-meter  
doublet antenna into approximately 120 con-  
tacts in six weeks on the air. All contacts  
have been on 40 meters and have covered 26  
states and Canada. Of 100 cards sent out, he  
has received 60 in return, so far. . . . Short-  
wave listener **Fred Saide** complains that the  
percentage of replies he gets from SWL cards  
sent to amateurs is disappointing, even when  
he includes return postage. He is not alone.  
About all that can be done is to make reports  
as accurate and interesting as possible to the  
recipient. Mail them promptly, and use a lit-  
tle discrimination as to whom you send them.  
For example, you are much more likely to get  
an answer to an SWL card sent to a ham  
2000 miles away using a DX-35 on 20-meter  
phone than you are to get one from a ham  
500 miles away running a kilowatt. . . . **Don-  
nie, KN5IRB**, (XYL), and her son, **Ed, K5ERJ**,  
have been keeping their station busy in the  
seven weeks she has had her license. She has  
made 109 "solid" contacts in 32 states and  
Canada, so the Heath DX-35, SX-99, and  
new, 2-element, 15-meter beam must all be  
working well. Donnie and her OM (husband)  
have passed their Conditional tests.

**Peter, KN1ADJ**, offers to tell anyone using  
a transmitter with an 807 how to change the  
tube to a 6146. Since making the change in  
his E. F. Johnson Adventurer, he runs 75  
watts input. His receiver is a National NC-88,  
plus a Heath QF-1 Q-Multiplier, and his DX  
record is 28 states and two countries. . . .

**Stan, KNØIGH**, operates his Globe Chief 90  
on 40 and 15 meters, and he also has an  
ARC-5 surplus transmitter on 40 meters. He  
receives with an Electro-Voice RME-84, to  
which he has added a Q-Multiplier and an  
S-meter. Twenty-six contacts in 16 states in  
20 days on the air is his record. . . . In Cali-  
fornia, **Dick, KN6TBX**, feeds a 100' bent an-  
tenna from an E. F. Johnson Adventurer  
transmitter on 80 meters and a couple of con-  
verted ARC-5's on 40 meters. All transmitters  
run about 50 watts. He receives with a Halli-  
crafters S-38D. High school keeps Dick busy,  
but he has made 150 contacts, his best DX  
being a KN9 on 80 meters.

**Jose, DL4CD**, denies that he is "nuts" for  
putting aside his ½-kw. BC-610 transmitter  
to use his DX-35. One reason is broadcast  
interference (BCI). There are over 20 broad-  
cast receivers in his barracks, and the 610  
really does a "job" on them. The DX-35 does  
not bother them. Using the DX-35 into a  
3-element Gotham beam on 15 meters, he has  
worked all U.S. call areas—30 states con-  
firmed—and 30 countries in five continents.  
DL4CD is now on 15-meter c.w. looking for  
KN's and WN's. Also, **DL4MM**, who operates  
from the same location, has worked Japan,  
Guam, and Hawaii with the DX-35 on 15  
meters with a 10-meter "ground plane" an-  
tenna. Here are two bits of useful information  
from DL4CD: (1) it costs only two cents to  
send a QSL card to any A.P.O. or F.P.O. ad-  
dress, four cents airmail; and (2) many DL4  
addresses in the Call Book are incorrect. As  
soon as one holder of a DL4 call is "rotated,"  
his call letters are reassigned; so be sure that  
you are actually sending your card to the  
right address. Ask the operator "Address o.k."



in Call Book?" . . . **George, WH6CAC**, operates in the 40-meter Novice band and is particularly interested in working other medical men, as well as working all states. This is a darned good trick for a Novice in Hawaii! . . . From Israel, **Quintino Z. Sapir**, 329 Shikun Amidar, Beer-Yacob—Israel, who is an amateur but who did not include his call letters, is looking for correspondents in the USA to exchange technical information and to make friends.

**Bob, KN6YBB**, has been on the air for not quite a month running a "full pint" to a Globe Chief 90 on 40 meters. His receiver is a Hallicrafters S-20R with a Q-Multiplier. He has worked 13 states with nine confirmed. . . . It took **Bud, KN9GRY**, six weeks of trying after getting on the air to make his first contact. Now that he has found the combina-

### New Receiver

Electro-Voice, Inc., Buchanan, Mich., has just released a new amateur receiver, Model 4359. It features high sensitivity and selectivity, and excellent stability combined with ease of operation. A dual conversion receiver, it covers the amateur bands exclusively to permit maximum efficiency. Model 4359 sells for \$229.00. More data is available from the manufacturer.

tion, he will do fine. He thanks the contributors to the *Transmitting Tower* for their encouragement. Their results with simple equipment convinced him that he could do it, too. . . . In five months of operation, **Cliff, WN1NYK**, has worked 335 stations in 45 states and nine foreign countries. He used a DX-35 feeding a "long wire" on 80 meters and a folded dipole on 40 meters and 15 meters. Fifteen is his favorite band. He needs Arkansas, New Mexico, and Utah.

**Offer of Help:** **PFC Lee Drake**, P.O. Box 131, Cincinnati, Ohio, (phone: JA 1-9916) offers help to any prospective amateur between 17 and 25 years of age. Lee operates MARS station AA8WBW and amateur K8WBW.

**Contributors to News and Views:** **Lloyd Arnesen, WN7GDD**, 1584 Harvard Ave., Salt Lake City 5, Utah; **Bob Lipp, KN4MJO**, 222 Lawrence Dr., Falls Church, Va.; **Henry Klapholz, K2VBL**, 20 Sicles St., New York 40, N. Y.; **Sheldon Hartel, KN5IVA**, 814 Porter Ave., Biloxi, Miss.; **Fred Saide**, 2435 Haring St., Brooklyn 35, N. Y.; (Mrs.) **Donnie Redwine, KN5IRB**, Box 95, Tahoka, Texas; **Peter Guber, KN1ADJ**, 407 Ward St., Newton Center 59, Mass.; **Stan Pedersen, KNØIGH**, R. #2, Festus, Mo.; **Richard Allbright, KN6TBX**, 10515 Hunt Ave., South Gate, Calif.; **Jose I. Alvarado, DL4CD**, Hq. Btry., 34th AAA Brigade, A.P.O. 28, New York City; **Capt. George B. Purvis, WH6CAC**, Hq. Det., 25th Med. Bn., A.P.O. 25, c/o Postmaster, San Francisco, Calif.; **Bob Simmons, KN6YBB**, 101604 Tinker Ave., Tujunga, Calif.; **Bud DuChaine, KN9GRY**, Star Rt. #3, Tomahawk, Wis.; **Cliff Hall, WN1NYK**, (14) 25 Park Ave., Webster, Mass.

Until next month, keep your letters and pictures coming. 73,

Herb, W9EGQ

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Peter H. of River Edge, N. J., created an averaging machine.

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## Superregen Pocket Receiver

(Continued from page 61)

head machine screw from the trimmer and place it on top of the copper rod. Then solder the two together. Now screw the whole unit back in the trimmer and drill a hole in the plastic box to clear the rod.

The antenna is a coiled-up, three-foot length of insulated wire. Cut down the cardboard coil form of the Feri-Loopstick and clip off a piece of the screw to make it fit into the box. When the coil tuning slug is flush with the end of the main winding of the coil form, almost the entire broadcast band can be covered. Pushing the slug back and forth before cementing it in place will best determine the coverage.

The most serious mechanical problem is presented by the extremely small size of switch *S1*. In this receiver, the switch is improvised from a cheap screw-type earring. Unsolder the base of the earring with the screw in it from the metal earring. Then cement a piece of cardboard to the backplate facing the screw. A thin metal ribbon cemented to the cardboard serves as the other switch contact. Electrical connection between the two switch contacts is established by turning the screw until contact is made between the screw and the ribbon.

**Trying It Out.** Put the earplug in your ear and turn on the receiver by turning the earring screw until a crackle is heard. Set the regeneration control (*R1*), and tune the trimmer capacitor until a strong whistle is heard. The station is tuned in best when the pitch of the whistle is lowest. Now decrease the regeneration (increase *R1*) until the whistle disappears and the station's program is clearly heard.

To minimize the effect of body capacitance on detuning the receiver, the set should be held at the bottom near the batteries. Tuning the receiver rapidly requires a little practice; but once the experience is acquired, this pocket receiver will give you many hours of enjoyment.

—50—

## Electrostatic Speaker System

(Continued from page 51)

move about your listening room, noting the pattern of sound distribution. It may help to disconnect your woofer and mid-range speakers at this point so that you can more easily discern the distribution of highs alone in the room. If you find that the distribution is deficient in certain areas, simply change the "mounting angle" of your tweeters (either one or both) to favor the deficient sectors of the room.

—50—

Always say you saw it in—POPULAR ELECTRONICS



## Tuning the Short-Wave Bands

(Continued from page 80)

like to encourage card-swappers to consider having their next batch of cards made in this form. It would help eliminate the confusion that is developing between the SWL's and certain licensed radio amateur operators who have been assigned the calls "W2SWL," "K6SWL," etc.

**Club Notes.** Joel Whitaker, III, Indianapolis, Ind., a regular POP'tronics reporter, has obtained an editorial position with the Universal Radio DX Club. We've read his column and he's doing a fine job. Congratulations, Joel!

The Newark News Radio Club will hold its annual dinner on Saturday, June 1, at 7:30 p.m., EST, at Doppelt's Hofbrauhaus, Ocean Blvd. (Scenic Drive), Atlantic Highlands, N. J. All NNRC members and friends, as well as anyone interested in SWL'ing and DX'ing, are cordially invited to attend. Tickets are \$5.00 each and may be obtained from Chairman A. J. Koempel, 75 Neptune Ave., Neptune City, via Avon P.O., N. J.

### Current Station Reports

The following is a résumé of the latest reports received. All times are 24-hour E.S.T.  
**Argentina**—LRA, *Radio Del Estado*, Buenos

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PORTABLE PROJECTION

**\$25 Down — Pay as You Build**

This portable, transistorized, Color Projection, Television Receiver, has been developed using the most modern techniques of transistor and vacuum tube circuitry. A 3x4 foot full color picture may be projected upon the wall with the Carrier Color Receiver. Yet, this receiver is simple to construct as supplied in kit form, and easy to buy on our tailored pay-as-you-build plan.

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Model 19K . . . for only \$79.95

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Aires Calling." Spanish music, played by a girl disc jockey, and English newscasts make up this program. (11, FC, RM)

**Australia**—VLX9, 9610 kc., a domestic service outlet in Perth, is heard well Saturdays at 0525-0600 with weather, news, and sports news. The address is Box 190D, G.P.O., Perth, Western Australia. VLI6, another domestic station, Sydney, is noted on 6090 kc. Saturdays at 0600-0615 with a newscast. This outlet is 2000 watts. Reports go to Box 487, G.P.O., Sydney, N.S.W., Australia. (104)

VLX4, 4897 kc., Perth, is noted on the west coast at 1700-2200 and 0515-1030 with good signals. It is also noted in the mid-west at 0700-0900 with weak signals. World and local news is heard at 0800-0815. Your Editor has also caught this one at times from 1700 to 1730

**Unidentified**

A station announcing as *The Voice of Novaya Zemlya* has been tuned on 6200A kc. at 0021-0030 with chanting, weather reports, and Eng. news. Any help in identifying it will be appreciated. (MA)

with an early morning "Wake-Up"-type program of music, news, weather, and various anmts. (133, 188)

**Bolivia**—A new station, heard by your Editor, is CP3, *Radio Bolivia*, on 6090A kc., at 1930-2030 with various musical programs and talks. All Spanish, the ID is very easily recognized. Don't confuse this with *Radio Belgrano*, Argentina, which is well heard at times. CP3 has only been noted on Sundays to date, after *Radio Luxembourg's* s/off.

**Brazil**—ZYC9, *Radio Tupi*, Rio de Janeiro, is again heard on 15,366 kc. after a long absence, at 1700-2230. *Radio Jornal do Comercio*, Recife, has changed from 9565 kc. to 9785 kc. and is heard well at 1600-2120. (100)

**Ceylon**—The Commercial Service of *Radio Ceylon* is heard in the west at 0600-0630 with variety music, and in the south at 0730-0815 with BBC news from 0800. These English programs are heard on 9520 kc., and the location is Colombo. (188, 226)

**Cyprus**—ZJM4, Limassol, is noted on 6120 kc. at 1555, dual to ZJM6 on 6790 kc., with an Arabic program. Both stations s/off at 1600 after final ID. (ML)

**Ecuador**—*Radiodifusora Cenit*, 4700 kc., Portoviejo, has been identified as the station on this channel. It is heard at 1900-2330. HC1MI, *La Voz de Imbabura*, Ibarra, has been noted on 4738 kc. at 1900-2230. (100)

A station in Otavalo, believed to be HC1JH, is being heard on 3945 kc. at 2100 with Spanish music and language. This will be difficult to dig out from the 75-meter amateur phone stations. (166)

**China**—*Radio Peking*, 17,745 kc., is being heard at good level at 2200-2215 with English news and talks, and at 2215-2230 with Oriental music. (226)

**Egypt**—Cairo is being heard on new frequencies of 17,778 kc. at 0700-0900, causing QRM to Netherlands on 17,775 kc., and on 15,380 kc. at 1000-1715 and 1830-2000 with an





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English newscast at 1530. (51, 100, 202, 226)  
 The 15,315-kc. xmtr is beamed to L.A. & S.A. in Spanish at 1830-1905 s/off. (44, 82)  
 The outlet on 9795 kc. was heard in the European beam from 1440 s/on; French news at 1445, music at 1500, English news at 1530, s/off at 1550. (JC)  
**Formosa**—The Voice of Free China, noted on BED8, 15,300 kc., at 2355-0200 with an all-English feature, is dual to BED4, 11,910 kc., which is usually not audible. (11)

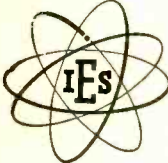
Another English session is noted over BED6, 11,815 kc., and BED3, 15,225 kc., from 0000 s/on to 0030 s/off with news at 0005. This xmsn continues to 0100 but in native languages and dialects. A xmsn to the mid-east is heard Sundays at 1430-1450 on the same channels. (26, 27)

**French Equatorial Africa**—Brazzaville is now on a new frequency of 17,885 kc. at 0830-1030 but is usually covered by jamming directed at Radio Free Europe on the same channel. (100)


The 5970-kc. channel apparently has moved to 5987 kc. This one opens at 2357 with a native IS, and is parallel to 9730 and 11,970 kc. English news is heard at 0015-0027 followed by French music. News in French is broadcast at 0000 and 0100. (61, 166)

**Ghana** (formerly Gold Coast)—The stations in Accra are now identifying as *The Ghana*


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**SHORT-WAVE ABBREVIATIONS**

- A—Approximate frequency
- annt—Announcement
- BBC—British Broadcasting Corporation
- c.w.—Code
- Eng.—English
- ID—Identity, identification
- IS—Interval signal
- L.A.—Latin America(n)
- N.A.—North America(n)
- QRM—Station interference
- QSB—Fading
- QTH—Address; location
- R.—Radio
- S.A.—South America(n)
- s/off—Sign-off
- s/on—Sign-on
- V—Varies in frequency
- xmsn—Transmission from station
- xmtr—Transmitter used by station

**B/C Service.** The 3366-kc. station is scheduled in English at 1245-1300 and 1400-1500. The outlet on 4915 kc. is audible from shortly before the s/off, which may be from 1715 to 1730. (FW, 11)

**Haiti**—Your Editor recently noted that *Radio Commerce*, 6090 kc., Port-au-Prince, has moved to 5980A kc., thus leaving 6090 kc. open for *R. Luxembourg*, *R. Belgrano*, and *R. Bolivia*. The 5980-kc. outlet is heard with excellent signals all evening with various musical programs.

**India**—All India Radio, Delhi, is noted on the East Coast in Eng. at 1445-1545 on 15,415 and 11,705 kc. and in the west at 2325-2335 and 1045-1055 with Eng. news on 15,105 and 17,705 kc. (AM, 11)

**Indonesia**—The Voice of Indonesia, P.O. Box 157, Djakarta, has Eng. xmsns to N.A. at 0600-0700 and 0930-1030 on YDF6, 9710 kc. (very good level), and YDB2, 4910 kc. (not audible), and at 1400-1500 on YDF2, 11,770 kc., and YDF8, 9865 kc. (both audible). (11)



A new Indonesian outlet, as yet unidentified, is being heard with news at 0830-0850 on 4760A kc., followed by old American pop records to 0900/close. (DK)

**Iran—Radio Teheran** is often heard on 15,100 kc. from 1500 to 1530 s/off with music and news, daily except Fridays. On religious holidays they have news until 1505 and s/off at 1506. (208)

East coast DX'ers with a lot of patience should look for Teheran on 3960 kc., in Eng., at 1500 (dual to 9680 kc.), or on 3782 kc. from 1528 with weak but readable signals. Clock chimes, a final call in language, and the anthem signify the s/off at 1530. (26, 166)

**Ivory Coast**—A good opportunity to hear **Radio Abidjan**, 4940 kc., is provided until 1730 s/off. A portion of the "William Tell Overture" is played at 1700. S/off is "La Marseillaise." Programs are mostly music; language is French. This is not often heard and you should check the frequency daily for band openings. (62, 208)

**Japan—Radio Japan**, Tokyo, is now operating in Eng. to Eastern N.A. at 1800-1830 and 1930-2000 on JOA22, 17,795 kc., and JOB21, 15,325 kc., replacing 11,705 and 15,225 kc. The same channels are also used at 0000-0100 to Western N.A., replacing 11,705 and 9525 kc. (WM, 59, 92, 149)

**Kenya—The African B/C Service**, ZHW2, Nairobi, operates on 4934 kc. on weekdays at 2230-2330 and 1045-1310, Sundays at 0100-0530 and 1000-1315. Address is Dept. of Information, P.O. Box 30025, Nairobi. (27)

**Sauti Ya Mvita (The Voice of the Coast)**, Mombasa, was verified by QSL letter. They are on 4923 kc. at 1000-1125 in Swahili and at 1125-1330 in Arabic. QTH is P.O. Box 2200, Mombasa. (DW)

**Lebanon—FXE**, Beirut, is scheduled on 8036 kc. as follows: weekdays at 2230-0200, 0500-0800, 1000-1630; Fridays at 2230-0200, 0415-0800, 1000-1630; Sundays at 0100-0300, 0445-0800, 1000-1630. This station has been noted as low as 8010 kc. (27)

**Liberia—ELWA**, Monrovia, is being widely reported on 9670 kc. with a new Eng. religious service to N.A. at 2000-2130. Operation is dual to 11,800 kc., but this is often QRM'ed by **Radio Moscow**. Reports are requested and should be sent to ELWA, P.O. Box 192, Monrovia, Liberia, West Africa. (60 reports)

**Luxembourg**—With **Radio Commerce** having moved off the frequency of 6090 kc., **R. Luxembourg** is being well heard daily at 1700-1900 and later with Eng. programs beamed to England. Good music and numerous commercials.

**Malaya**—The BBC Far East Station, Singapore, has resumed use of 11,725 kc. and operates at 0400-0745 and 0800-0815. Possibly a new outlet on 9725 kc. is also being tuned with Eng. news at 0600-0615 s/off. (25, 100)

**Mauritius—V3USE**, Forest Side, 15,027V kc., opens at 2200; music to 2230; news in French to 2243; music to 2300; Eng. to close around 2315-2320. World news is presented at 2300. (48, 59)

**Mexico—XEWV**, Mexico City, 9500 kc., is

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14" .....	\$33.00	21" .....	\$72.00
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When ordering TV's, state whether table model or console is desired. Also preference on make of set. All TVs sent railway express F.O.B. Newark. On any quantity WIRE or CALL today!

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0A3	3A4	6AG5	6SK7
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0B2	3AL5	6AH4GT	6BL7GT
0C3	3AU6	6AK5	6BQ6GT
0Z4	3BC5	6AL5	6BN7GT
1A7GT	3CB6	6AM8	6BY5G
1B3GT	3C4	6AN4	6BZ7
1C7C	3Q5GT	6AS5	6C6
1F4	3S4	6AQ5	6CB6
1H4	3V4	6AQ7GT	6CD6G
1H5GT	4B27	6AS5	6CF6
1J6GT	4B97	6AS7G	6C56
1L4	5AM8	6AT6	6CU6GT
1L6	5AN8	6AU4GT	6E5
1L6G	5AQ5	6AUSGT	6HG6T
1LC5	5AT8	6AU6	6J4
1LH4	5AW4	6BV5GT	6J5GT
1LNS	5AZ4	6AV6	6J6
1NS5GT	5J6	6K4GT	6KG6T
1S4	5T4	6BA6	6L6
1S5	5T8	6K5GT	6L7GT
1T4	5U4G	6C5	6M4
1U4	5U8	6BC7	6M7G
1U5	5V4G	6BE6	6M7
1V2	5V6GT	6BF5	6M87Y
1X2	5Y3	6BG6G	6SC7
2A7	5Y4G	6BH6	6SF5
2D21	6AB4	6BJ6	6SF7
			6SH7
			6SJ7GT
			6SK7GT
			6SL7GT
			6SN7GT
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a fairly easy one to log if you need this country. It is scheduled at 1055-0500. Spanish news is heard at 1300, 1700, and 0345. Good around 2200 with music and commercials. (184, 217)

XEBR, *El Heraldo de Sonora*, Hermosillo, 11,820 kc., is noted at 1715-1745 with Spanish songs and commercials. (220)

**Mozambique**—CR7BG, *Radio Clube de Mozambique*, Lourenco Marques, 15,083 kc., is heard in Portuguese from 0015 to 0100 s/off with a variety of music and a strong signal. Another xmsn was noted at 1300-1400 but the signal was only fair. (61)

**Netherlands**—Hilversum is operating on a new frequency of 15,445 kc. at 1515-2255, including 1615-1700 and 2130-2210 xmsns in Eng. to N.A. (Many)

**New Zealand**—The Foreign Service of *Radio New Zealand* is currently operating from Wellington as follows: to Australia on ZL4, 15,280 kc., at 1500-0140, and on ZL2, 9540 kc.,

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William McK. Bing (226), New Orleans, La.

from 0155 to close/down; to the Pacific Islands on ZL3, 11,780 kc., at 1200-1430, on ZL4, 15,280 kc., at 1445-0140, and on ZL7, 6080 kc., at 0155 to close/down. The close/down time is as follows: weekdays at 0545, Saturdays only at 0620, Sundays only at 0500. The widely reported outlet on 15,280 kc., ZL4, often relays the programs of 2YA, and is frequently heard to announce as 2YA rather than ZL4. (61, 90, 226)

**Nicaragua**—One of the stations that is not in the regular short-wave broadcast bands is *Radio Atlantico*, Bluefields, on 7753 kc. It has been noted at 2150-2201 with popular



music and Spanish language anmts. ID is 2200; they reportedly close at 2300. This will be another station to pull the heavy c.w. QRM. (WF)

**Norway**—LLM, 15,175 kc., Fredrikstad, can be heard on Wednesdays and Saturdays at 2300 with the "Letter-Box Program" in Eng. and Norwegian. On other days, the entire program is in Norwegian. "Norway This Week," in Eng., is heard Sundays at 2100-2120 and Mondays at 0000-0020. (173)

**Peru**—R. Nacional del Peru operates stations in Lima on 9562 kc. (OAX4T) and 6082 kc. (OAX4Z), and in Tacna on 6185 kc. (OAX6F) and 9530 kc. (OAX6L). The 9562-kc. outlet is heard at 1700-2100 and the 6082-kc. xmtr at 1900-1930 in Spanish. (DM, SL)

**Radio El Sol**, Lima, is heard with Eng. news and music over OBX4C, 15,180 kc. (fair to good), and on OBX4Q, 5970 kc.; the latter channel is usually heavily QRM'ed. (11)

**Reunion**—St. Denis, 7170 kc., has been noted around 2300 in French with music. The signal, when free of c.w. QRM, is usually good. (BL)

**Sao Tome**—CR5SB, Radio Clube de Sao Tome, can be heard weakly on Sundays and Thursdays at 0700-0800 in Portuguese. The frequency is 17,667 kc. (BL)

**Sarawak**—Another very good catch is Radio Sarawak, 5052 kc., heard with an Eng. session on Thursdays only at 0800-0820. Heavy QRM and QSB make this a difficult one to log. (11)

**South Africa**—The South African B/C Co., P.O. Box 8606, Johannesburg, has Eng. scheduled on 4810 kc. at 2340-0145, on 9680 kc. at 0149-0830, on 7229 kc. at 0149-0300, and on 7295 kc. at 2300-0200. An outlet on 7275 kc. is good from 0024 with classical music, NOT dual to 7229 kc. (11, 166)

**Springbok Radio** has been heard on 9720A kc. at 1040-1100 with plays. (28)

**South Korea**—HLKA, Seoul, has an Eng. session on 7935 kc. at 0530-0600 at fair-to-good level. (11)

**Switzerland**—Stations HER6, 15,305 kc., HER5, 11,865 kc., HER4, 9535 kc., and HER3, 6165 kc., can be tuned as follows: to the United Kingdom and Ireland at 1435-1530 on HER6 and HER5; to N.A. at 2030-2215 on HER3, HER4, and HER5; to Western N.A. at 2315-0000 on HER4 and HER5. (AM, 226)

**Syria**—Radio Damascus, 15,165 kc., can be heard daily with Eng. news and music at 1545-1630. Reports go to Rue de la Victoire, Damascus. (11, 104)

**Tangier**—Radio Tangier is being noted on 9325 kc. (new) from 1400 with popular and classical music and frequent Eng. anmts. Excellent level. They asked for reports to be sent to Grand Hotel, Southville Garden, Sweden. (166)

**Thailand**—R. Thailand, Bangkok, 11,670 kc., carries an Eng. program at 0500-0530 and 0700-0800; Thai language with far eastern music at 0815-0900; English ID at 0900. (BH, 11, 61)

**Windward Islands**—Grenada has moved from 3390 to 3365 kc. and is heard evenings around 1930-2000. This would be a fine catch for the west coast boys! (59)

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1LB4	.59	6AT6	.39	7A5	.53	12SJ7GT	.45
1LC5	.49	6AU4	.65	7A6	.45	12SK7	.48
1LN5	.47	6AU6GT	.60	7A7	.45	12SK7GT	.50
1NSGT	.50	6AU6	.43	7A8	.45	12SL7GT	.60
1R4	.66	6AV6	.39	7B5	.41	12SN7GT	.57
1R5	.51	6AX4	.67	7B7	.43	12SQ7GT	.40
1S4	.59	6AX5GT	.57	7B8	.47	14A7	.45
1S5	.51	6BA6	.47	7C4	.39	19B06GT	1.18
1T4	.51	6BC5	.50	7C5	.42	19T8	.70
1U4	.47	6BE5	.46	7E6	.30	24A	.39
1U5	.50	6HG6T	.38	7F8	.70	25B06GT	.85
1U6	.53	6J5	.39	7Y4	.35	25L6GT	.47
1V	.57	6J6	.49	12AT6	.41	25Z6GT	.37
1V5	.66	6J7	.43	12AT7	.66	35A5	.46
1X2A	.68	6J7GT	.45	12A06	.43	35B5	.48
3AU6	.57	6J8G	.80	12A07	.59	35C5	.48
3AV6	.57	6K5GT	.47	12AV6	.42	35L6GT	.47
3Q5GT	.57	6GG6T	.39	12AV7	.67	35W4	.39
3V4	.58	6K7	.39	12AX7	.63	35Y4	.40
5AT8	.80	6K7GT	.39	12AY7	.90	35Z3	.41
6A7	.57	6K8GT	.65	12BA6	.46	35Z5GT	.39
6AB4	.45	6L7	.42	12BA7	.60	45T5GT	.40
6AB7	.80	6N7	.60	12B4	.68	50A5	.46
6AC5GT	.59	6S4	.40	12BE6	.46	50B5	.48
6AF4	.70	6S7	.48	12BH7	.50	50C5	.48
6AG5	.50	6S7	.48	12BY7	.64	50LGGT	.45
6AG7	.69	6SD7GT	.57	12J5GT	.40	70LGGT	.45
6AH4	.80	6S7	.41	12K8	.49	70L7GT	.60
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Servicing Equipment, First Steps in (Coriell)	71 June
Speaker System, Make Your Own Electrostatic (Feldman)	49 June
Tuner Performance, Improving AM-FM (Smith)	65 Apr.
Watts, Why's and Wherefore's of (Feldman)	49 Jan.
What's New	87 Jan.
WOW, Flutter, Watch That	59 June

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'57 Look in R/C (Winter)	51 May
Permissible Operating Range (Turner)	82 Apr.



## TELEVISION

London—New York TV in '57?	41 Jan.
Over the Hill and Into the Dale (Scher)	39 Jan.
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Rejuvenate Your Picture Tube (Lynott)	61 Feb.
TV's 30th Birthday	48 June

## TEST EQUIPMENT

Multivibrator, 2500-Cycle (Scism)	58 May
Oscilloscope Calibrator, "Economy" (Graham)	55 May
Rejuv-a-chek (Shields)	52 June
Signal Generator, "Economy" (Graham)	61 Apr.
Signal Tracer, Bargain Basement (Winklepeck)	55 June
Tube Tester, "Economy" (Graham)	73 Jan.

## TRANSISTORS

Amp Perks Up Your Ears, Transistor (Garner)	79 Feb.
Audio Photometer, Transistorized (Vicens)	55 Mar.
Calibrator, Transistorized, "TransCal" (Vicens)	63 June
Code Practice Oscillator—Experiment No. 15 (Garner)	85 Feb.
"Command" Circuit, Transistorized (Banks)	78 Mar.
Loudspeaker Metronomes—Experiment No. 16 (Garner)	83 Mar.
Mount, Graphic Transistor (Trauffer)	66 June
"Musical Light" Magic Toy—Experiment No. 17 (Garner)	79 Apr.
PowerAmp, Picnic (Garner)	45 June
Power Supplies, Subminiature A.C. (Tooker)	62 Mar.
Reflex Transistor Superhet, How to Build (Garner)	53 Jan.
Signal Generator, "All-Frequency"—Experiment No. 14 (Garner)	85 Jan.
Superhet, "Vokar," Building the (Tooker)	63 May
Tandem Transistors, Make (Dunant)	58 May
TSF Unit—Transistorized Slave Flash (Winklepeck)	73 Apr.

## WORKSHOP

Adapter Connects "Tiny Plug" (Trauffer)	86 May
Battery Power Pack (Louis)	86 Jan.
Bulbs for Series Heaters (Roberts)	54 June
Chassis-Drilling Hint (Tooker)	86 May
Crystal Diode Mount (Trauffer)	58 May
D.C. Supply for Small A.C./D.C. Motors (Phillips)	47 May
Dimmer Control for Photofloods (Pollack)	56 Apr.
Dial Plates, Make Your Own (Blachford)	88 May
Dynamic Pillow Speaker (Trauffer)	66 Jan.
Etched Circuits, Simplified (Garner)	67 June
Intermittents, Stop Those (Coriell)	59 May
Metal Faucet Microphone Connector (Trauffer)	62 May
Meter, Mount Your (Winklepeck)	90 Jan.
Mike Connection Adapter (Trauffer)	82 Apr.
Mounted Variable Resistors (Dunant)	54 May
Neon Flasher, Improved (Smith)	116 Feb.
Neon Flasher, Sequential (Scism)	62 May
Old Radios, How to Fix Up (Coriell)	76 Feb.
Power Supply, Filament Transformer (Tooker)	56 Mar.
Relaxation Oscillator, Light-Sensitive (Becker)	56 Apr.
Series Capacitor Filament Circuits (Graham)	66 June
Soldering Stand, Heat-Controlled	65 Feb.
Space-Saving Idea (Rasmussen)	83 Apr.
Speaker Cabinet for Communications Receivers (Welch)	65 Apr.
Table Radio Speaker, Improve Your (Tooker)	83 Apr.
"Talking" Mike (Adams)	58 May
Telephone Line Antenna (Krauss)	86 May
Vector-Type Sockets, Custom-Design Your (Rasmussen)	81 Feb.

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## Sound Impressions

(Continued from page 79)

at Me; and *The Sheik of Araby*. All these—and eight more—are played in a manner that may be unfamiliar to many of us. The style and sound are as outlandish for the modern listener as they may prove nostalgic for older generations.

Of greater importance, audio-wise, is the fact that this record uses the electronic machinery of hi-fi to capture the sounds of the gadgetry of an age that was stumbling toward some kind of musical reproduction which could be controlled at will by the listener.

**New Test Records.** Musical scales, rather than mathematically spaced frequency tones, constitute the test material on Cook Series 60, *Chromatic Scale Test Record*. Tonal excursions that follow the piano keyboard can be used for testing your phono system's response for equalization, transients, loudness levels, room acoustics, speaker hangover, cabinet resonances, and absolute pitch. All this can be done without meters, if you follow the instructions accompanying the disc. Cut on a Scully lathe, and pressed by Emory Cook's new "Microfusion" process, this release boasts very clean surfaces and high technical accuracy; it represents another step toward the common meeting ground of audio technician and music lover.

Also checked out as highly accurate and fairly simple to use—for those who

possess at least a vacuum-tube voltmeter—are two recent test records, RCA Victor's *New Orthophonic Frequency Test Record* (No. 12-5-49) and Elektra's *Playback System Calibration Record* (EKL-35). Either of these pressings can be used to calibrate a phono system for playing microgroove records with RIAA equalization as well as to check the accuracy of your present equalization settings. Both records use frequency tones to do the job, with some clever gimmicking at the upper end of the band that makes for remarkable accuracy even when used on "non-professional" sound equipment. Details and instructions accompany the records.

A unique set of test records is the series of six 7" discs issued by Components Corp., Denville, N. J., and labeled *Do It Yourself Test Records*. Numbered 1106 through 1111, these records deal with wow and flutter, stylus wear, rumble, tracking, compliance and hum. One side of each disc contains a spoken explanation of the hi-fi problem being tackled and instructions for using the test portion which appears on the record's other side. These tests—best conducted with such equipment as an oscilloscope, shorting leads, and replacement tubes—seem accurate, and the narration is quite interesting but possibly difficult for the technically uninitiated to follow. The occasional "commercials" praising other equipment made by the company are really unnecessary. Straightforward printed instructions would have been more helpful. —30—

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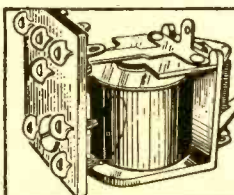
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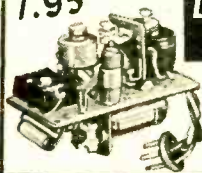


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Each "TAB" Kit Contains the Finest Selection of Top Quality Components in the Most Popular Values and Sizes

33 Precision Resistors	40 Insulators
10 Switches	35 Power Resistors
7 Resistors IAC etc/1/2W	75 Mica Condensers
150 Carbon Resistors	5 Crystal Diodes
45 Panel Lamps	250 ft. Hook Up Wire, Ass't'd
12 Electrolytic Cond's	100 Fuses, ass'd. all types
15 Volume Controls	100 Ceramic Condensers
36 Tube Sockets	150 Coil Forms
65 Tubular Condensers	6 Crystals & Holders
50 Lugs & Eyelets	65 Inductors & Coils
10 Ball-Tub Oil Cond's	5 Microswitches
5 lbs. Surprise Package	10 Wheat Lamps
10 Transist Mica Cond's	3 Transistor Xfmr's

Free Kit with Each \$10 Kit order      EACH KIT ONLY..... **99c**

TUBES	TESTED	NEW FIRST QUALITY GUARANTEED					
0A2	.80	9L7	\$1.00	6BQ6	1.19	7Q7	.79
0B2	.72	3C22	20/51	6B7	.99	12AT6	.58
0B3	.82	7193	20/51	6C4	.49	12AT7	.79
0C3	.84	434A	1.98	6CB6	.69	12AU7	.69
0D	.80	619A	2/3	6CD6	1.49	12B7	.59
0Z4	.50	CK722	.98	6H6	.59	12A6	.59
1AX2	.98	5U4	.59	6J5	.59	12AX4	.79
1B4	.72	5V4	.89	6J6	.59	12AX7	.79
1L4	.82	5Y3	.59	6K6	.69	12BE7	.89
1R4	.78	6AB4	.59	6K7	.79	12BY7	.89
1R5	.78	6AC7	.79	6L6	1.19	12SA7	.69
1S5	.72	6AB7	.99	6S4	.69	12SK7	.69
1S5	.68	6AH4	.89	6SA7	.79	12SN7	.69
1T4	.69	6AH6	.95	6SH7	.69	12SQ7	.69
1U5	.69	6AK5	.79	6SJ7	.69	14A6	.69
1X2	.66	6AL5	.59	6SK7	.69	19B6G	1.69
2D21	.68	6AQ5	.66	6SL7	.69	25BQ6	1.29
2X2	.48	6AS5	.75	6SN7	.69	25Z6	.79
2Y3	.48	6AT6	.49	6S7	.69	25C5	.59
3A5	.69	6AU4	.89	6T4	1.19	35L6	.59
954	10/51	6AU6	.59	6T8	.98	35W4	.59
955	.33	6B4	.79	6V4	.69	32K7	.69
957	.30	6BA6	.59	6V6	.59	50A5	.69
1619	4/51	6BC5	.59	6W6	.79	50B5	.79
1625	.29	6BE6	.59	6X4	.39	50C5	.69
1626	7/51	6BF5	.79	7C5	.79	50L6	.69
1629	4/51	6BG6	1.49	7CS	.79	75	1.00
807	1.15	6BK5	.89	7F7	.79	76	5/51
89B	.78	6B7	.79	7F8	.79	77	5/51
5P81	1.49	6BN6	.89	7N7	.79	117L7	1.75

### SPECIALS | "THAT'S A BUY" | SPECIALS

TRANSISTOR MIN. TRANSFORMERS MATCHED SET AUDIO HI-FI INPUT & OUTPUT Mixer, cost \$9 SPECIAL per pr. \$2  
 TRANSISTOR MIN AUDIO INPUT HI-FI SPECIAL..... \$1  
 MINFAN (AC) COOL THAT TUBE, TRANSISTOR OR EQUIPMENT:  
 TAPPED for 6-12VAC operation..... \$1.89 @ 3 for \$5  
 DC MINFAN 12 to 28VDC MOBILE USE..... \$2.89 @ 2 for \$5  
 AN-METER 30VDC/2% ACCY/2" Sq or RD mtg. \$1.98 @ 3 for \$5  
 MINIATURE METER 1MADC/2% ACCY. Rd. or Sq. Mfg..... \$3.89

### ARC 5 TRANSmitters

BC457/4to5.3mc Tested \$4.95; BC457 AS IS..... \$1.39  
 BC458/5.3to7mc Tested \$5.95; BC458 AS IS..... \$1.98  
 ARC5/T19/3to4mc Tested \$6.89; AN-ARR2CVR AS IS..... \$3.98  
 SLIM JIM HiGain Dynamic Mike & Tilt Stand & xfmr..... \$3.98  
 RELAY 4PDT 12to24VDC miniature Type..... \$1 @ 6 for \$5  
 RELAY 4P/2N02/2NC/16to28VAC Min. Type..... \$1 @ 6 for \$5  
 BRONZE Hwy Duty 115V/60cy Synchro Selsys..... 2 for \$9  
 TRANSMITTING HV Mica .006 @ 2500Vwkg Capacitor..... 7 for \$1  
 TLA Type Oil upright 4 mid 900 W/DC Capacitors..... 3 for \$2  
 CIRCUIT BREAKER 3AG FUSES 3.5, 5.7, 10, 16, 30amp..... 6 for \$1  
 SNOOPERSCOPE 2" TUBE & DATA \$50 Value, \$4.75 @ 2 for \$9  
 CIRCULAR SLIDE RULE Equiv 12" Rule Data & Case..... \$1  
 THERMO-REGULATOR 105-632 Bert Mercury Type..... \$10  
 GR. VARIAC 200Cu/860watt/0to115V. Used Record..... \$10  
 RUBBER STAMP 8DIGIT/0to9/16pt Type NEW Reg \$4, Spcl \$1 @ 3 for \$12  
 READY TYPE 2 coil SEARCHLIGHT BATTERIES..... 2 for \$1  
 MICROSWITCH B-1/S.P./30amp CASED&ARC magnet..... 6 for \$1  
 NEW T30 THROATMICA Reg \$5 SPECIAL..... \$1 @ 3 for \$2  
 SWEDISH STEEL WOOD SAW FINEST \$16 value \$3 @ 4 for \$10  
 THOR 1/4" JACOBS CRUCK B.B. DRILL \$20 VALUE..... \$14 @ 2 for \$26

### NEW IMPROVED "TAB" HI-FI SPEAKERS!

15" TRIAX, 25 WATT/20-20000 CYCS. #F15M3X..... \$37.50  
 12" TRIAX, 20 WATT 40-20000 CYCS. #F12A3X..... 28.50  
 12" COAX, 20 WATT/35-18000 CYCS. #F12A2X..... 22.00  
 SONOTYPE CA12/COAX/12 WATT, 40-14000 CYCS..... 19.11

### "TAB" FINEST HI-FI RECORDING TAPE

7" Reel—1200 Ft. Per Reel  
 Sold on Money Back Guarantee **\$1.45** of 12  
 Highest quality Hi-Fi Precision Coated & Silt, FERRO-SHEEN processed, quality controlled, constant output, noise FREE, Splice FREE Plastic Tape, Freq. 7 1/2 KPS, 40 to 15000 cycles Oxide Wnd. In "TAB" @ \$1.59 ea. 3/\$1.50 ea.  
 New 1st Quality "MYLAR" 2400 Ft. 7" Reel  
 Ferro-Sheen processed RECORDING TAPE @ \$4.49, 3/\$12  
 Guaranteed Replacement Needles—4 Cartridges 12 or 78  
 1/Diamond \$8; 2/Diamonds \$16; Diamond Sap. \$10  
 Please Send Cartridge Name & Number

### \$59 ELECTRONIC FLASH! 400 II SHAWLITE \$\$\$20

Assembled & ready to work! Not a Kit! Latest features SUPER CIRCUIT—Lowest cost flash system than 3ac, inbuilt AC & Batteries\* all in one case, powerful, compact, Guide No. Color 60+, B&W 200+, Recycle, 2 feeds includes 60WS/2 \$24/\$25 mfd/450WV Flash cond. Special \$20 \*Batteries not included. 2 (2) 240V..... \$10



### PHOTOFASH SLAVE "PE" APRIL 57

PF598 COMPLETELY BUILT READY TO FLASH..... \$20  
 PF59K BUILT KIT FORM..... \$20  
 "TAB" PHOTO ELECTRONIC FLASH BOOK..... 17  
 ILLINOIS PHOTO FLASH HANDBOOK..... 50  
 NEW GTD-FLASH \$25mfd/450WV CAPACITORS, \$6 @, 2/\$11, 5/\$30

## "TAB"

TERMS: Money Back Gtd. (Cost of mfg. only), 5% min. order F.O.B. N.Y.C. Add ship. charges or C.O.D. 25% Dep. Prices shown are subject to change.  
 WRITE A CATALOG: OUR 12TH YEAR IN BUSINESS  
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 Rector 2-6245

Superior's New Model 670-A

# SUPER-METER



A Combination VOLT-OHM MILLIAMMETER PLUS CAPACITY, REACTANCE, INDUCTANCE AND DECIBEL MEASUREMENTS.

### SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts

A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts

OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts

D.C. CURRENT: 0 to 1.5/15, 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. (Good-Bad scale for checking quality of electrolytic condensers)

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

**ADDED FEATURE:**  
Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

**28<sup>40</sup>**

Superior's New Model 770-A

## The FIRST POCKET-SIZED

# VOLT-OHM MILLIAMMETER



USING THE NEW "FULL-VIEW" METER.  
**71% MORE SCALE AREA!!**

Yes, although our new FULL-VIEW D'Arsonval type meter occupies exactly the same space used by the older standard 2 1/2" meters, it provides 71% more scale area. As a result all calibrations are printed in large easy-to-read type and for the first time it is now possible to obtain measurements instead of approximations on a popular priced pocket-sized V.O.M.

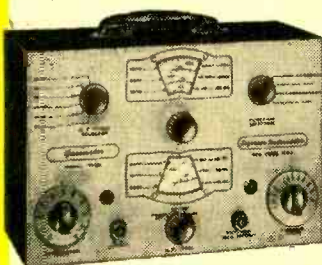
6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 Volts. 6 D.C. VOLTAGE RANGES: 0-7.5/15/75/150/750/1500 Volts. 2 RESISTANCE RANGES: 0-10,000 Ohms 0-1 Megohm. 3 D.C. CURRENT RANGES: 0-15/150 Ma., 0-1.5 Amps. 3 DECIBEL RANGES: -6 db to +18 db, +14 db to +38 db, +34 db, to +58 db.

**FEATURES**  
Compact — measures 3 1/2" x 5 1/2" x 2 1/2"  
Uses "Full View" 2% accurate 850 Micro-ampere D'Arsonval type meter. Housed in round-cornered, molded case. Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use.

Model 770A comes complete with self-contained batteries, test leads and operating instructions.

**15<sup>85</sup>**

Superior's New Model TV-50



MODEL TV-50 comes absolutely complete with shielded leads and operating instructions. Only

**47<sup>50</sup>**

# GENOMETER

7 SIGNAL GENERATORS IN ONE! R. F. Signal Generator for A.M. • R. F. Signal Generator for F.M. • Audio Frequency Generator • Bar Generator • Cross Hatch Generator • Color Dot Pattern Generator • Marker Generator

**R. F. SIGNAL GENERATOR:** Provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics. • **VARIABLE AUDIO FREQUENCY GENERATOR:** In addition to a fixed 400 cycle sine-wave audio, the Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal. • **BAR GENERATOR:** Projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars. • **CROSS HATCH GENERATOR:** Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect. • **DOT PATTERN GENERATOR (FOR COLOR TV):** The Dot Pattern projected on any color Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence. • **MARKER GENERATOR:** The following markers are provided: 189 Kc., 262.5 Kc., 496 Kc., 800 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

# SHIPPED ON APPROVAL NO MONEY WITH ORDER — NO C. O. D.

SEE FOLLOWING PAGE FOR COMPLETE DETAILS

MOSS ELECTRONIC DISTRIBUTING CO., INC. DEPT. D-346, 3849 TENTH AVENUE, NEW YORK 34, N. Y.



# For the first time ever: ONE TESTER PROVIDES ALL THE SERVICES LISTED BELOW!

Superior's

New Model

# 76



### Specifications

#### ✓CAPACITY BRIDGE SECTION

4 Ranges: .0001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. This section will also locate shorts, and leakages up to 20 megohms. And finally, this section will measure the power factor of all condensers from .1 to 1000 Microfarads. (Power factor is the ability of a condenser to retain a charge and thereby filter efficiently.)

#### ✓RESISTANCE BRIDGE SECTION

2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms. Resistance can be measured without disconnecting capacitor connected across it. (Except, of course, when the R-C combination is part of an R-C bank.)

As Design Engineers, we the undersigned would like to say that the Model 76 is in our opinion the best combination unit of its kind we have been privileged to design. Although it is comparatively a low-priced tester, it will, after you become acquainted with its multiple services, be your most frequently used instrument.

S. LITT  
L. MELENKEVITZ

IT'S A

## CONDENSER BRIDGE

with a range of .00001 Microfarad to 1000 Microfarads (Measures power factor and leakage too.)

IT'S A

## RESISTANCE BRIDGE

with a range of 100 ohms to 5 megohms.

IT'S A

## SIGNAL TRACER

which will enable you to trace the signal from antenna to speaker of all receivers and to finally pinpoint the exact cause of trouble whether it be a part or circuit defect.

IT'S A

## TV ANTENNA TESTER

The TV Antenna Tester section is used first to determine if a "break" exists in the TV antenna and if a break does exist the specific point (in feet from set) where it is.

#### ✓SIGNAL TRACER SECTION

A built-in high gain pentode voltage amplifier, plus a diode rectifier, plus a direct coupled triode amplifier are combined to provide this highly sensitive signal tracing service. With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc. Provision has been made for use of phones and meter if desired.

#### ✓TV ANTENNA TESTER SECTION

Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? The Model 76 will enable you to locate a break in any TV antenna and if a break does exist, the Model 76 will measure the location of the break in feet from the set terminals. 2 Ranges: 2' to 200' for 72 ohm coax and 2' to 250' for 300 ohm ribbon.

Model 76 comes complete with all accessories including R.F. and A.F. Probes; Test Leads and operating instructions. Nothing else to buy . . . . . Only

**\$26<sup>95</sup>**

# SHIPPED ON APPROVAL NO MONEY WITH ORDER - NO C.O.D.

We invite you to try before you buy any of the models described on this page, the preceding page and the following page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

**NO INTEREST  
OR FINANCE  
CHARGES ADDED!**

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

MOSS ELECTRONIC DISTRIBUTING CO., INC.  
DEPT. D-346 3849 TENTH AVENUE, NEW YORK 34, N.Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payments when due, the full unpaid balance shall become immediately due and payable.

- |   |   |
|---|---|
| <input type="checkbox"/> Model TW-11 . . . Total Price \$47.50<br>\$11.50 within 10 days. Balance<br>\$6.00 monthly for 6 months. | <input type="checkbox"/> Model TV-50 . . . Total Price \$47.50<br>\$11.50 within 10 days. Balance<br>\$6.00 monthly for 6 months. |
| <input type="checkbox"/> Model TD-55 . . . Total Price \$26.95<br>\$6.95 within 10 days. Balance<br>\$5.00 monthly for 4 months.  | <input type="checkbox"/> Model 76 . . . Total Price \$26.95<br>\$6.95 within 10 days. Balance \$5.00<br>monthly for 4 months.     |
| <input type="checkbox"/> Model 670-A . . . Total Price \$28.40<br>\$7.40 within 10 days. Balance<br>\$3.50 monthly for 6 months.  | <input type="checkbox"/> Model 770-A . . . Total Price \$15.85<br>\$3.85 within 10 days. Balance \$4.00<br>monthly for 3 months.  |

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

**SEE OTHER  
SIDE**

CUT OUT AND MAIL TODAY! ▶

Superior's New Model TD-55

Streamlined

# TUBE TESTER



## FOR

The Experimenter or Part-time Serviceman, who has delayed purchasing a higher priced Tube Tester. The Professional Serviceman, who needs an extra Tube Tester for outside calls. The busy TV Service Organization, which needs extra Tube Testers for its field men.

- You can't insert a tube in wrong socket. Separate sockets are used, one for each type of tube base.
- "Free-point" element switching system Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or even the "top-cap".
- Checks for shorts and leakages between all elements. Provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals. Continuity between various sections is individually indicated.
- Elemental switches are numbered in strict accordance with R.M.A. specification. The 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system.

Speedy, yet efficient operation is accomplished by: Elimination of old style sockets used for testing obsolete tubes (26, 27, 57, 59, etc.) and providing sockets and circuits for efficiently testing the new Noval and Sub-Minar types.

Model TD-55 comes complete with operating instructions and charts and streamlined carrying case.

**\$26<sup>95</sup>**

Superior's new Model TW-11, STANDARD PROFESSIONAL

# TUBE TESTER

- Tests all tubes, including 4, 5, 6, 7, Octal, Lock-in, Hearing Aid, Thyatron, Miniatures, Sub-miniatures, Novals, Sub-minars, Proximately fuse types, etc.
- Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TW-11 as any of the pins may be placed in the neutral position when necessary.
- The Model TW-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.
- Free-moving built-in roll chart provides complete data for all tubes. All tube listings printed in large easy-to-read type.

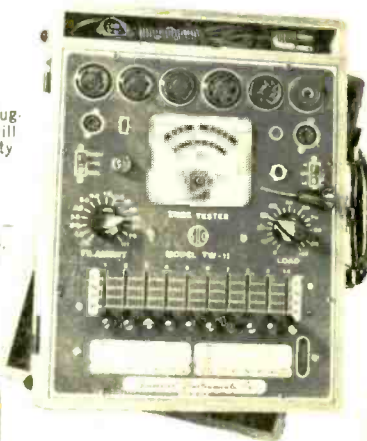
- NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

### EXTRAORDINARY FEATURE

- SEPARATE SCALE FOR LOW-CURRENT TUBES - Previously, on emission type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types

The Model TW-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

**\$47<sup>50</sup>**



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Permit No. 61430

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**NO INTEREST  
OR FINANCE  
CHARGES ADDED!**

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

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