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DECEMBER 1958

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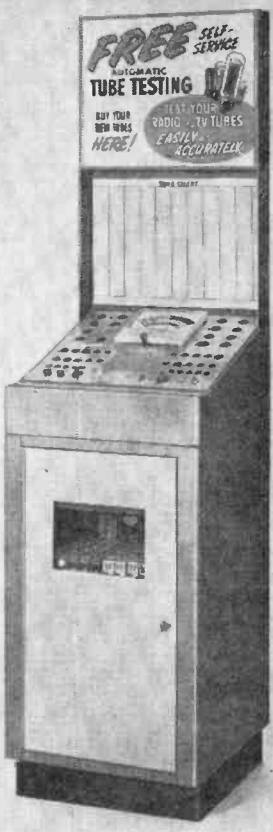

Earn big money and achieve financial stability

If you've ever longed for a business of your own... to be your own boss and to work your own hours, then here's your opportunity to get in on one of today's biggest money-making opportunities – *the self-service tube-testing business.* It's the easiest business to get into... requires no experience, little time and small investment.

A basic principle for making money is to have something work for you, rather than you yourself doing the work. As an operator of a FAST-CHECK SELF-SERVICE TUBE TESTER ROUTE you can be the proud owner of a solid fast-growing business... earning money while you take life easy. Business can be started without giving up your present source of income and can be operated from home. All you do is make calls once a week to restock testers and collect profits.

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The self-service tube testing business is a take-off on the highly profitable vending machine business... but with several decided advantages. *Larger unit sales* and *greater flexibility in operation.* You place testers and tube stock in stores on consignment – the store location contributes floor space for the self-service tube tester – store patrons are offered the use of the tube tester free – they in turn buy their replacement tubes from the tube stock in the tester. The store pays you for all the tubes sold less his commission. Each tester placed can net up to $1000 a year for you.

NO SELLING REQUIRED

Century's self-service tube testers check and sell TV and radio tubes automatically 12 hours a day – 7 days a week. Consumers do their own testing and defective tubes are replaced on the spot for highly profitable sales. *Your testers are your high powered salesmen.*

THE FIELD IS WIDE OPEN

Drug stores, luncheonettes, supermarkets, candy stores, hobby stores, etc. welcome having a tube tester placed in their store. All they have to do to earn commissions, is hand over tubes required and accept payment. And they go for the extra traffic the tester attracts to their store.

FREE BOOK TELLS ALL ABOUT THIS BOOMING BUSINESS

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

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- ✓ Completely self-service — easy to operate.
- ✓ Built-in 7-pin and 9-pin straighteners on panel for customers convenience.
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VOLUME 9 NUMBER 6

Feature Articles and Electronic Developments

Electronic Construction Projects

Audio and Hi-Fi Features

Experimenter's Workshop

Departments

POPULAR ELECTRONICS

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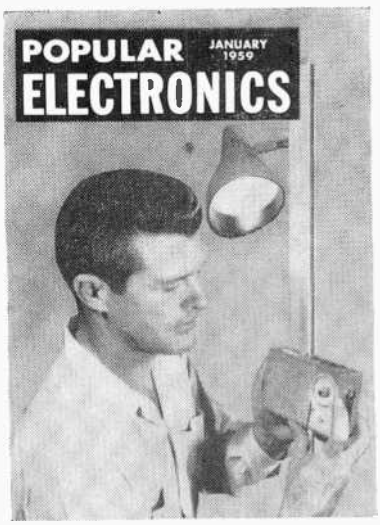
This month's cover drawn by Gaylord Welker

COMING NEXT MONTH



(ON SALE DECEMBER 23)

In January we will present an interesting feature on solar energy and its conversion to useful applications in electronic equipment. On the cover a man is seen listening to a portable radio which is powered by light falling on solar cells.

The build-it-yourself fans will enjoy several transistor projects as well as the concluding article on SPARKY the Robot Pup. An added treat will be a one-tube antennaless FM radio. And as an aid to those who are building projects for the first time, there will be useful articles on test equipment and troubleshooting.

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Under the Mistletoe

"FOR the last time, no!" Carl shouted at his friend, Jerry, sprawled on the old leather divan of the basement laboratory; "I'm not going to take your visiting cousin Patricia to the Christmas party."

"And why not?" Jerry demanded truculently. "With those blue eyes, black hair, and dimples, she isn't exactly a crow, you know. And didn't she win the science award? She knows darned near as much about electronics as we do. Lots of guys would jump at the chance."

"Let 'em jump," Carl said firmly. "I'll not deny she's easy on the eyes, quite hep, and nice, too, for a girl. It's simply that I've *had* it as far as these Christmas party capers are concerned."

Jerry exchanged a knowing look with his chum. "Mistletoe?" he asked sympathetically.

Carl nodded vigorously. "Yep. Last year Cindy Hawkins, who goes around with her lips pursed all the time like a goldfish, got me talking about radio and somehow maneuvered me under a sprig of the stuff. Before I realized it, she was looking up into my face expectantly and batting her eyes like a toad in a hailstorm. Then some joker spied us and yaks, 'Gwan; kiss her, Carl. You chicken or somethin?' I was trapped like a rat," he finished with a shiver as he drew the back of his hand across his mouth as if to erase the thought.

Jerry's round face took on the bland, cherubic look it got when the little wheels inside his head were racing like mad. "If I help you give Kissing Cindy the cure, will you take Pat to the party?" he asked rather hopefully.

Carl's face wrinkled into a suspicious frown. "Let's hear your idea before we make any deals."

"It's beautifully simple. You'll wear a few of these miniature B— batteries connected in series to produce about 130 volts;

Carl & Jerry (*Continued from page* 8)

a current-limiting resistor will be inserted between the positive terminal and an electrode taped to your skin. The negative lead will connect through a small wire to your metal wrist-watch band. We'll spray the inside of this band with plastic spray to insulate it from your arm. Now, when Osculation Hawkins corners you under the mistletoe, you casually bring the wristband in contact with her arm and let her have it right smack on the kisser. Do you get the picture?"

"Yeah-h-h-h," Carl breathed with mounting enthusiasm for the picture in his mind's eye. "Girls are afraid of electricity anyway. Man, I'll take the curl right out of her hair. We'll cure her of this smooching habit, but good!"

"Then you'll take Pat?"

"Sure, why not? But let's get started on this mistletoe antidote."

The boys had been so interested in their conversation they failed to notice a slender, blue-eyed girl who had started down the basement steps in the other room a few minutes before and had paused to listen to their conversation. Now, with a thoughtful look on her face, she turned around and tiptoed back up the stairs and out of the door.

ONCE his word was given, Carl did things up brown. A pretty little corsage was delivered to Pat the afternoon of the party, and Carl showed up that evening looking scrubbed, handsome, and dressed in his best. Pat was lovely in a deceptively simple dress with Carl's corsage at her shoulder, and her only jewelry was a heavy silver bracelet. Jerry's "date," a neighbor girl from across the street, was already there; and

. . . "It's beautifully simple," Jerry said. "You'll wear a few of these miniature B— batteries connected in series to produce about 130 volts . . ."

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Carl & Jerry (*Continued from page* 10)

the four young folks set out for the party in high spirits.

The party was in full swing when they arrived. As the boys helped the girls off with their coats, Carl caught sight of a sprig of mistletoe fastened to the chandelier and favored Jerry with a broad knowing wink. Blonde Cindy Hawkins, her scarlet mouth standing out starkly in her white face, spied Carl and started making her way in his direction immediately; but before she reached him Pat intercepted her and practically dragged her off up the stairs. This struck Jerry as a little odd at the time, but he had no time to think about it because he and Carl were caught up in a boisterous "ice-breaker" game that was just starting.

A few minutes later, though, he glanced up to see Cindy and Pat descending the stairs with their arms about each other's waists. In passing he idly noticed that they had exchanged bracelets. Pat's heavy silver bracelet was on Cindy's right arm.

The hostess had planned the party well, and for almost the entire evening everyone was kept so busy with interesting, hilarious activity that the mistletoe got no play at all. But finally, after refreshments, Jerry saw Cindy artfully guiding an innocent-looking Carl under the chandelier. They stopped beneath it, and Carl allowed his gaze to follow the girl's to the branch of mistletoe; then, with a wicked smile of anticipation on his face, he slowly lowered his face to hers as his left arm casually searched for her right. Just before their lips met, he heard a little "clink" as his watchband touched her bracelet. "All the better contact!" he thought gleefully, bracing himself for the shock that he knew was coming.

None came! In a panic he felt her warm clinging lips against his. Maybe the lipstick was acting as an insulator! Deliberately he rocked his head from side to side so as to reach an unprotected area. There was still no shock; but he could hear hollowly ringing in his ears the jeers and admiring wolf whistles of the other kids, "Break it up, Lover Boy . . . that will never get past the censor . . . hey, how about coming up for air!"

Carl stepped back and looked around with glazed eyes at the ring of grinning faces. Then he bolted for the kitchen, paus-

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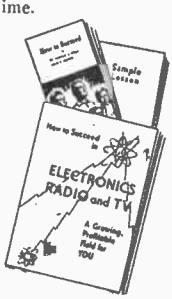

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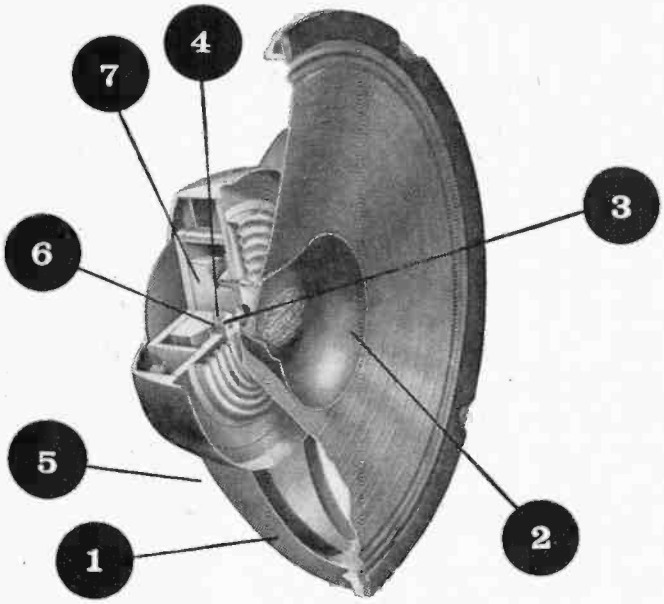

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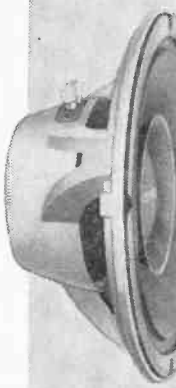

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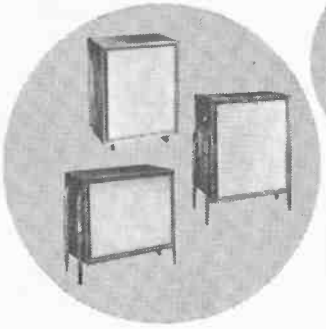

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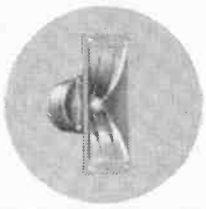

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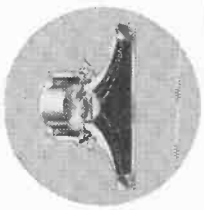

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ELECTRO-VOICE, INC., BUCHANAN, MICHIGAN

Carl & Jerry (*Continued from page* 12)

ing only long enough to grab Jerry by the coat collar and drag him along. Inside the kitchen, Carl slammed the door shut and leaned against it as he used his handkerchief to scrub the crimson lipstick from his mouth.

"You and your stupid ideas!" he grated as he scowled down at Jerry. Suddenly he grabbed his rotund friend and roughly pushed his wrist watch against Jerry's right cheek while he pressed his lips firmly against the left cheek. "Testing, testing, testing!" he muttered.

"Hey! Cut that out! Quit slobbering on me!" Jerry said indignantly as he jerked himself free. "What's the matter with you? Did you catch Cindy's kissing bug?"

"Did you feel anything? Did you feel a shock?" Carl asked intently.

"Sure I did. Why shouldn't I?"

"I felt it then, too, but there was nothing when I kissed Cindy. What could have gone wrong?"

Carefully the boys checked every connection of their electronic mistletoe antidote. Everything was in perfect order. Mystified, they finally went back to the party, only to discover that it was breaking up. In spite of himself, Carl let his eyes meet Cindy's and flinched at the amused mocking expression in them. He glanced away quickly and saw almost the same look in Pat's blue eyes, but there it seemed to be tempered with sympathy.

As the boys and girls put on their wraps, they were still razzing "Hot Lips Carl" about his sizzling technique under the mistletoe. He did his best to take it good-naturedly, but Jerry knew he was writhing inside.

AS the four of them walked home through a gently falling snow, the girls tried to keep up a lively chatter about how beautiful the lighted Christmas trees looked in the windows and how sweet the muffled Christmas music that seeped out of nearly every home sounded in the night; but the boys had little to say. Carl was morose; Jerry seemed to be miles away and buried in thought.

After seeing Jerry's companion to her door, the other three crossed the street and went into Jerry's kitchen, where his mother

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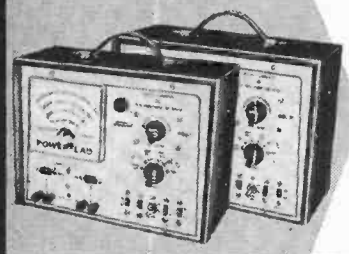

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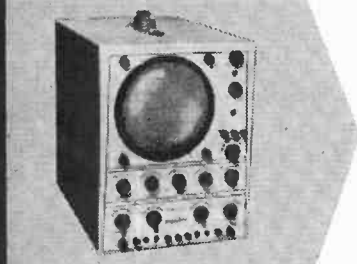

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precise DEVELOPMENT CORPORATION
OCEANSIDE, N. Y. Cable Address: CHURCHIN

Carl & Jerry (*Continued from page* 16)

had left a plate of cookies and some hot chocolate for them. They still had little to say until suddenly Jerry reached over and spun the silver bracelet Pat was again wearing on her arm.

"Cousin Pat," he exclaimed, as he stared down at the bracelet curiously, "*You* are a traitor!"

The girl opened her blue eyes wide as she set down her cup of chocolate. "Whatever can you mean, Jerry?"

"This is what I mean," Jerry said, and he touched a little broken end of fine wire that had been fastened to the bracelet with a speck of solder.

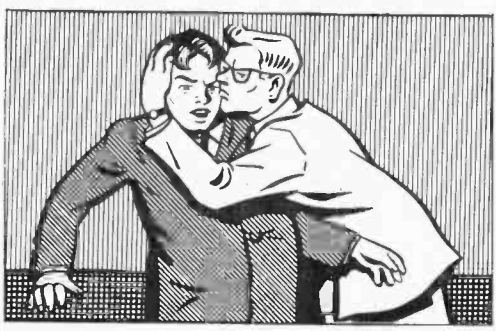
For a long second the two cousins looked straight into each other's eyes, and then they simultaneously collapsed into peals of laughter.

"If someone would tell me what was so funny, maybe I'd laugh, too—and I could use a laugh," Carl said plaintively, still somewhat depressed.

"I may as well confess," Pat said, wiping her eyes with a wisp of a handkerchief. "I happened to overhear you boys cooking up that deal on Cindy. I didn't object to that in the least, for her type has it coming; but I did mind very much, Carl, your acting so stuffy about taking me to the party. I don't like to think that any of my escorts have to be bribed."

A wave of red came up out of Carl's collar and spread over his face.

"I decided to get even, and it was very nice of you boys to furnish all the details I needed about polarity, voltage, etc. Since I knew that if two equal sources of potential are connected together, positive-to-positive and negative-to-negative, no current



. . . Suddenly he grabbed his friend and roughly pushed his wrist watch against Jerry's right cheek while he pressed his lips against the left cheek . . .

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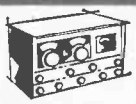
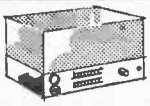
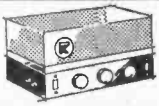


knight-kit Amateur Communications Receiver Kit
Y-726 $104.50

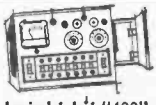


knight-kit Dual 30-Watt Stereo Hi-Fi Amplifier Kit
Y-777 $84.50

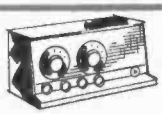


knight-kit 12-Watt Hi-Fi Amplifier Kit
Y-784 $19.95 (less case)

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

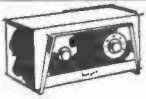


knight-kit "400" Tube Checker Kit
Y-707 $19.95



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

knight-kit "Ranger" Clock-Radio Kit
Y-737 $24.95



knight-kit "Ranger" Radio-Intercom Kit
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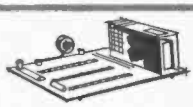

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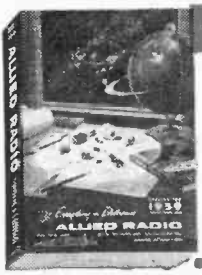

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Carl & Jerry (*Continued from page* 18)

flows, all I had to do was rig up a battery identical with the one Carl was wearing and persuade Cindy to wear it. The negative lead was connected with a very fine piece of wire to this bracelet of mine which is insulated in the same way your watchband is."

"I get it!" Carl exclaimed. "Cindy maneuvered so that my watch touched that bracelet instead of her skin. That connected our separate batteries positive-to-positive and negative-to-negative."

"That's it," Pat said, her face sobering; "and let me say, Carl, that I am sorry. I *do* feel like a traitor. I want you to know, though, that your precious woman-hating reputation is intact. By this time everyone at the party knows that you were double-crossed and that you didn't suddenly change character under the mistletoe. Only your pride is hurt."

CARL stared down at his wrist watch for several seconds, but when he raised his head his blue eyes were twinkling behind the horn-rimmed glasses. Swiftly the twinkle spread into a grin, and in a moment all three were laughing together at the memory of the evening.

"All is forgiven, Pat," Carl said at last. "Any time a girl can make fools out of a couple of guys who like to think they are electronic hot-shots—and at their own game, mind you—*she's* all right. From now on Jerry and I want you down in the laboratory instead of up here. You belong with us."

They went back to chatting and laughing and drinking chocolate. Even though December 25th was still a few days away, the beautiful, warm, companionable feeling of Christmas swirled about the three young people in the kitchen. —30—

. . . "This is what I mean," Jerry said, and he touched a little broken end of fine wire that had been fastened to the bracelet with a speck of solder . . .

LETTERS FROM OUR READERS

Tape Recorder Pen Pals

■ In connection with September's *Letters from Our Readers,* here is a list of a few of the national tape-recording organizations in the United States:

American Tape Exchange
181 E. Main St.
Gouverneur, N. Y.

Aurora Science Tape Society
Box 91
Sierra Madre, Calif.

Global Recording Friends
125 Hamilton St.
Round Brook, N. J.

International Tape-worms
Box 215
Cedarhurst, L. I., N. Y.

National Tape-Sponding Club
Box 866
Birmingham, Ala.

Tape-Respondents International
Box 125
Little Rock, Ark.

United Recording Club
2516 S. Austin Blvd.
Chicago 50, Ill.

Voicespondence Club
Noel, Va.

World Tape Pals
Box 9211
Dallas 15, Texas

The best way for the newcomer to join a tape club is to write to all of them and find out what facilities are offered. All tape clubs have a "tape-pal" service. If you are interested mainly in finding tape-pals, join one of the larger organizations. If you are interested in the services offered by one or more of the smaller clubs, or if you want to join a club to which you can contribute your services, join one of the smaller groups.

WALT RICHARD SHEASBY, JR.
Sierra Madre, Calif.

Aluminum Solder

■ In your excellent September issue, on page 66, is an article about "Chemalloy" aluminum solder. I have been unable to obtain any information about it locally—in fact, several of the local suppliers have asked that I inform them if I can locate the manufacturer.

H. D. SPATZ
University Heights, Ohio

Here's where to get aluminum solder:
Montgomery Ward
Western Auto Supply Stores
W. T. Grant Stores
J. J. Newberry Stores
Woolworth (79 largest stores)
Allied Radio Corp.
W. W. Grainger, Inc. (62 major cities)
Pep Boys Auto Supply Stores (both coasts)

Invitation to Radio Amateurs

■ "Join a Radio Club Month" is being sponsored by the Chicago area Amateur Club Council during November, 1958, to help everyone interested in amateur radio locate a club that features his special interests. A free directory of all member radio

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Letters

(Continued from page 22)

clubs has been published. It is available at the Amateur Radio Supply Stores in the Chicago area, or by sending a self-addressed envelope to W9MSG Ray Birren, 702 Spring Rd., Elmhurst, Ill., or W9SPT George Boyd, 3540 N. Seeley Ave., Chicago, Ill.

This directory lists the meeting places, dates, officers, and activities of the clubs. Each amateur is invited to get a copy and pick out a club with activities he likes. Clubs range from "Ultra High Frequency" to "Mobile" as well as social. Also there are two clubs for lady hams only.

RAY P. BIRREN
Elmhurst, Ill.

Too bad your letter was late for our November issue. But any month is a good month to join a ham radio club.

A Happy Hi-Fi'er

■ I just finished building your Float-Phase Amplifier (January 1958) and like it so well that I dug out the November '55 issue and built the $2.00 baffle. Between them they give our 3-speaker hi-fi a run for its money (beat it in some respects).

There is a possible trouble point in the amplifier. If you have a pot at *R7* which has the arm connected to the shaft, it must be insulated from ground. Keep up the good work.

MYRON D. HILTON
Freeport, Maine

After Class

■ What happened to *After Class* in the September issue of POP'tronics? I sincerely hope you haven't dropped it. It adds a lot of depth to your magazine.

RICHARD LIETZKE
DeWitt, Mich.

After Class *is here to stay. Many of our readers increase their knowledge through this column. In the future our readers' education will always come first.*

Semiconductor Spans Space

■ You may be interested to know of the good luck that I have been having with "The Semiconductor Space Spanner." At 0730 on September 20, I had the good fortune to work ZS6KD in Johannesburg, South Africa, over the long path, for a distance of more than 16,000 miles. The power input at the time was 90 milliwatts and my report was 548. ZS6KD reported that it was similar to the sound of Sputnik. As a result of this contact, he is planning to build the SSS and we should be going on two-way skeds soon.

The contact was made on the 20-meter band. Constructors of the transistor transmitter can modify it for 20 as follows: use the 15-meter coils, connect a 30-$\mu\mu$fd. disc in parallel with *C3*, connect a 40-$\mu\mu$fd. disc in parallel with *C6*, and short out capacitor *C7*.

DONALD L. STONER, W6TNS
Ontario, Calif.

Mercury Batteries

■ Mr. McRoberts' article entitled "Check Your A.C. Calibration" (August, 1958) looks well

This book is a Gold Mine Send for it immediately!

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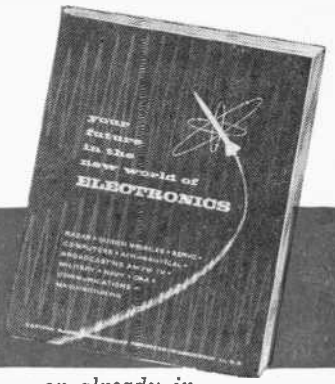

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Many of the men currently on the street are there for a reason. "As many as 8 out of 10 are deadwood," estimates the chief engineer of a medium-sized Philadelphia firm; the problem is to find the live ones.

—from ELECTRONICS MAGAZINE

If you're interested in an honest-to-goodness career in the vigorous young electronics industry, here's how you can step ahead of job-competition, move up to a better job, earn more money, AND BE SURE OF HOLDING YOUR TECHNICAL JOB, EVEN WHEN THE "DEADWOOD" IS BEING CLEANED OUT.

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Letters

(*Continued from page 24*)

founded but may I make one suggestion—use mercury batteries as a d.c. calibration source. Where the voltage of a regular dry cell tends to vary with temperature and age (including shelf life), mercury cells retain a voltage of 1.34 volts ±0.5% over their entire life and over relatively wide temperature ranges.

BRICE L. WARD, JR.
Norfolk, Va.

Rally Round the Bedside, Boys

■ Some of the patients at Longview Hospital, Cincinnati 16, Ohio would appreciate it if your readers would donate their old radio magazines (particularly POP'tronics, if they can bear to part with them) to the Patients' Library. Also wanted are old handbooks, radio textbooks, etc. Some of these boys expect to get their ham tickets some day, so how about helping them with your donations?

CARL THOSAND
Cincinnati, Ohio

Stop Thief!

■ On page 76 (October, 1958) there is a circuit to prevent car thefts by jumping the ignition. I would like to suggest a circuit change. I think a double-pole switch wired to ground the coil in the off position would be helpful. When the thief tries to jump the coil, he will get a short!

EDWIN KIRCHHUBER
Neshanic Station, N. J.

Right! The thief will get a "short"—but so will your battery. The result may turn into a race. Will the car's wiring burst into flame before the battery runs down? We're betting on the wiring.

Windmill-Generator Anyone?

■ For the past three months I have tried to purchase a windmill-generator without any success. A former manufacturer was unable to help. Since your magazine is very popular in the electronics field, is it possible that one of your readers would be able to help locate one for me, either new or used?

L. M. COLOM
6007 Chenango Lane
Orlando, Fla.

Maybe one of our readers in a wind-blown region has made his own windmill-generator. We would like to see pictures of them and obtain their specifications.

Crossword Puzzle Corrections

■ I was recently working your crossnumber puzzle in the August 1958 issue of POP'tronics and noted an error in number thirty (30) across. You state that the velocity of electromagnetic radiation in free space is 186,000 miles per hour. But, according to Maxwell's electromagnetic theory of light, all electromagnetic waves, regardless of wavelength, travel at 186,000 miles per second.

More recent studies have placed the speed of

AT LAST!

RADIO-TV and ELECTRONICS TRAINING

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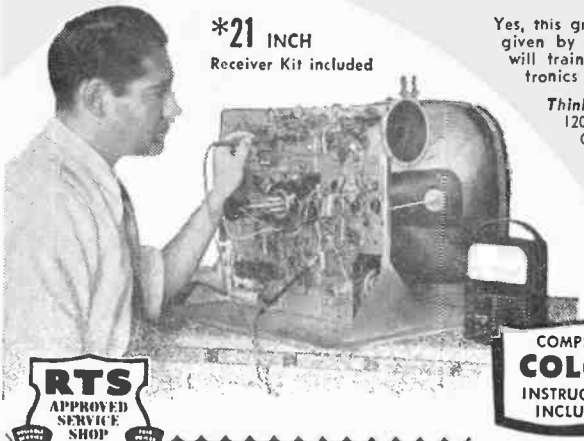


Yes, this great course costs *far less* than *any* training of its kind given by other major schools! Radio-Television Training School will train you for a good job in Television or Industrial Electronics — **AT HOME IN YOUR SPARE TIME.**

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

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

We Want 100 More Shops This Year

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

RTS APPROVED SERVICE SHOP

COMPLETE **COLOR** INSTRUCTION INCLUDED

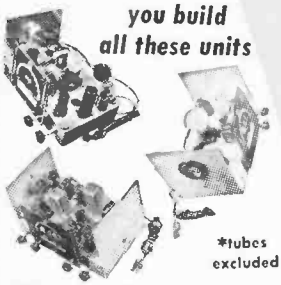
Get your free book on the
FAMOUS RTS BUSINESS PLAN
find out how you can open
A REPAIR SHOP OF YOUR OWN

We supply and finance your equipment

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

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

you build all these units



*tubes excluded

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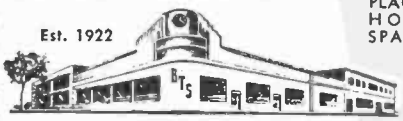

FOR UNSKILLED INEXPERIENCED MEN ONLY — WE TRAIN YOU OUR WAY!

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

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ALL THESE FREE!

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Los Angeles 37, California

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

☐ Radio-Television ☐ Industrial Electronics (Automation)

Name _____ Age _____

Address _____

City & State _____

300

Letters

(*Continued from page 26*)

light in a vacuum at 186,272 miles per second. (Birge, 1941). This being true, the answer to number two across which deals with the speed of an electromagnetic wave (namely radio) would be 599.5537743203840 meters.

Then, in number nineteen down, you state that the velocity of a radio wave traveling in a vacuum is 300,000 meters per second. Your answer would be less than 100 miles per hour. Try 300,000 kilometers; it's a little more accurate. Actually it would be 299,776.84320 kilometers per second.

You also state that the velocity of sound waves in free space is 1128 feet per second. Free space, or that portion of our atmosphere over 200 miles above the earth, is a vacuum. Sound cannot travel in a vacuum.

I would like to see more of these crossnumber puzzles in future issues of P. E.

ROBERT GENNAN
Bradford, Pa.

Wonderful! But please, use 300,000 kilometers per second in your computations, not 299,776.-84320. This way no smoke will rise out of your slide rule.

Transformer Isn't Critical

■ I just finished making the "Pocket Transistorized CPO" (page 76, June '58). I built mine in a plastic box, and it works great. You didn't specify what kind of transformer to use, so I used an old output transformer.

J. B. JOHNSON
Lockhart, Texas

Batt-inator Problem and Solution

■ I have recently completed the "Batt-inator" (August, 1958). I built it in a 3"x4"x5" Minibox and used a s.p.d.t. toggle switch instead of the rotary switch. I have only one complaint. The 10-22 ohm, 1-watt resistor (*R1*) to the rectifier overheats. To keep the eliminator going, I have to turn a fan on the resistor.

I am hoping that some time in the near future I will be able to see a transistor receiver for the 80- and 40-meter bands.

I enjoy *Carl and Jerry* and the way they devise some of those hairbrain schemes.

RONNIE TENNY
Scottsville, N. Y.

Try using a wire-wound resistor. They take the heat much better than the composition type.

AMATEUR TELEVISION TRANSMITTING

We would like to receive letters from hams who have successfully transmitted video signals. Tell us about your transmitting setup. Also, we are interested in studio setups and program material used. Let us know your problems.

BUILD 16 RADIO CIRCUITS AT HOME

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

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A Practical Home Radio Course

Now Includes

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

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ EXCELLENT BACKGROUND FOR TV
- ★ School Inquiries Invited
- ★ Sold in 79 Countries

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

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

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

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

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

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

THE KIT FOR EVERYONE

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

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

PROGRESSIVE TEACHING METHOD

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

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

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

THE "EDU-KIT" IS COMPLETE

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

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

FREE EXTRAS

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

SERVICING LESSONS

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

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

FROM OUR MAIL BAG

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

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

PRINTED CIRCUITRY

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

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

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

UNCONDITIONAL MONEY-BACK GUARANTEE

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

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PROGRESSIVE "EDU-KITS" INC.
1186 Broadway, Dept. 551D, Hewlett, N. Y.

POP'tronics BOOKSHELF

"ELECTROSTATICS" edited by Dr. Alexander Schure. Published by John F. Rider Inc., 116 West 14th St., New York 11, N. Y. 72 pages. Soft cover. $1.35.

Basic to understanding electric current is a knowledge of electric charges and electric fields. This book covers a lot of ground in explaining one of the cornerstones of electricity. Fundamental physical units and quantities preparatory to the study of Coulomb's law, Gauss's law and others are discussed.

The electric field is covered both quantitatively and qualitatively, making liberal use of worked-out examples. The cgs and mks unit systems are explained; capacitance and capacitors are analyzed. A final chapter is devoted to electrostatic applications. This is an excellent explanation of a basic—but little understood—area in the field of electronics.

Recommended: to anyone entering or already in the fields of electricity and electronics.

"YOUR CAREER IN ELECTRONICS" 1959 EDITION, edited by David A. Findlay and Furman Hebb. Published by Ziff-Davis Publishing Co., One Park Ave., New York 16, N. Y. 134 pages. Soft cover. $1.00.

This is the second edition of *Your Career in Electronics,* and reflects some of the changes that have taken place in the industry in only one short year.

It starts with a general look at the industry—where it came from, where it is now, and where it is going. The need for trained people in all branches of this mushrooming field is explored, with charts showing the types and approximate salary ranges of each job.

The second section is devoted to nine case histories of people now employed in elec-

Learn from men who are pioneering electronics!

Choose your electronics training in Today's Army

***Launch your** electronics career in Today's Army!* . . . Development of guided missiles and electronics for defense was *pioneered* by the Army. That's why Today's Army electronics schools are among the *world's finest*. That's why Today's Army offers you training and equipment so advanced—much of it isn't yet available *anywhere* else in the world!

***Choose your training** before enlistment!* . . . The Army's Graduate Specialist Program makes it possible for qualified young men to choose their training *before* enlistment. To be accepted, you must pass certain qualification and aptitude tests, and be a high school graduate. (High school seniors can apply *now* and enlist *after* graduation.)

***Successful candidates** for this unusual program can choose from 107 technical training courses—and have their choice guaranteed *before* enlistment! You enlist as a Graduate Specialist, an important member of the Army's select team of key personnel. And you enlist for only *three* years. Here's a unique opportunity for a tremendous headstart toward a successful electronics career!*

Choose from 107 Graduate Specialist courses like these:

- Atomic Weapons Electronics
- Microwave Radio Equipment Repair
- Radio Relay & Carrier Operations
- Electronic Navigation Equipment Repair
- Medical Equipment Maintenance
- Fire Control Instrument Repair
- Telephone Installation & Repair
- Radar Repair
- Guided Missile Electronic Equipment Repair
- Teletypewriter Equipment Repair

APPLY EARLY! Graduate Specialist appointments in each course are *limited*. This week, get the details from your Army Recruiter.

Former Servicemen—you may have electronics or other skills which the Army needs. See your local Army Recruiter for information on what the Army is offering men and women with prior military service.

Get choice, not chance, in Today's Army

Bookshelf

(*Continued from page* 30)

tronics. They talk about their training, their present jobs, and their future plans. These case histories bring the abstract idea of an electronic career down to earth.

"Getting the Know-How" is the title for the third section, which tells what schooling is necessary for each type of job and includes a six-page listing of schools that specialize in electronics. An aptitude test and a career planning chart are also included.

The last section outlines ways for those possessing some electronics knowledge to make spare-time money, such as starting a service shop, writing for magazines, installing intercoms, etc.

Recommended: to anyone who wants to know just what the field of electronics is, where it's going, and—particularly—where he might fit in.

"COMMERCIAL RADIO OPERATOR'S QUESTION AND ANSWER LICENSE GUIDE—ELEMENT 4" by Martin Schwartz. Published by American Electronics Company, 1203 Bryant Ave., New York 59, N. Y. Soft cover. 73 pages. $1.25.

All of the study questions issued by the FCC for the Element 4 examination are contained in this book. A sample FCC-type examination, using multiple choice questions similar to those on the actual FCC test, is included. This is the third in the series of books preparing one for the Commercial Radio Operator Licenses; the first volume covered Elements 1 and 2 and the second covered Element 3.

Recommended: to those working toward their First-Class Radiotelephone License.

"HI-FI ANNUAL AND AUDIO HANDBOOK," 1959 EDITION, edited by David A. Findlay and Furman Hebb. Published by Ziff-Davis Publishing Co., One Park Ave., New York 16, N. Y. 132 pages. Soft cover. $1.00.

The big feature of this book is a nine-part, 23-page section written by Gilbert A. Briggs, who, as every hi-fi bug knows, is the designer of the famous Wharfedale speakers and the author of several distinguished books on hi-fi topics. Mr. Briggs concen-

Bookshelf

(*Continued from page 32*)

trates, and quite properly so, on problems relating to loudspeakers and enclosures. His "byline" practically amounts to a guarantee that the material will be the latest information direct from "the horse's mouth."

The remainder of the 1959 *Hi-Fi Annual and Audio Handbook* is filled with information about amplifiers and preamplifiers, tape recorders, microphones, loudspeakers, enclosures, FM, and, of course, stereo. The build-it-yourself'er will find many money-saving projects—a low-cost amplifier, a stereo control center, and many other ideas for improving a hi-fi system.

Recommended: to all people interested in high fidelity. The section by Briggs is worth the $1.00 cover price in itself.

"MAGNETIC RECORDING TECHNIQUES" by W. Earl Stewart. Published by McGraw-Hill Book Co., 327 West 41st St., New York 36, N.Y. 271 pages. Hard cover. $8.50.

Here is a practical guide to the technology of magnetic recording methods and devices for use by engineers and technicians in the various fields that utilize magnetic recording. Principles of the recording and reproducing processes, recording materials, theory of ferromagnetism, recording mechanisms, and established standards are all covered at a realistic engineering level. Included are definitions, tables, derivations of key formulas, and practical test circuits.

Recommended: as a reference and guide for people engaged in areas concerned with the tape recording medium.

"ELECTRONIC ENGINEER'S REFERENCE BOOK" edited by L. E. C. Hughes. Published by The Macmillan Company, 60 Fifth Ave., New York, N.Y. 1311 pages. Hard cover. $18.00.

Consisting of over 1300 pages of rather small type, this monumental book endeavors to put before industrial and developmental engineers some of the latest knowledge and techniques which might otherwise be unavailable to them. It is divided into sections on the history of electronics, fundamentals, radiations, electrics, valves, mate-

only SOUNDCRAFT dares prove its superior quality!

Only when you buy Soundcraft Tape... you get an actual demonstration of superior tape quality... a premium recording that's yours in Soundcraft's new budget-priced Premium Pack. This is Soundcraft's way of proving how:

• *exclusive Micropolished tape surface* preserves your "highs."

• *exclusive Uni-level Coating* assures greater uniformity within a reel and from reel to reel.

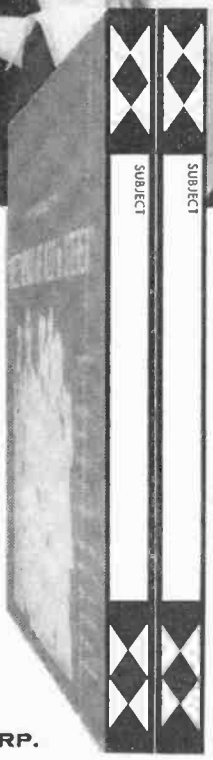
• *exclusive plasticizer-free* Soundcraft oxide formulation gives complete tape stability.

Insist on Soundcraft Tape... in the new budget-priced Soundcraft Premium Pack... two 7" reels of Soundcraft tape with the "Sweet Moods of Jazz in Stereo" recorded on one of the reels.

ASK ABOUT THESE OTHER SOUNDCRAFT PROMOTIONAL RECORDINGS!

"Sounds of Christmas"—traditional Christmas melodies, full orchestra and chorus (monaural only).

"Dixieland Jamfest in Stereo"—a jazz classic with an All-Star combo. Ask your dealer, or write Soundcraft.



Hear it for yourself in "SWEET MOODS OF JAZZ IN STEREO"

...an exclusive new full half hour recording... yours for just $1.00 extra... when you buy two 7" reels of tape in SOUNDCRAFT'S NEW

PREMIUM PACK

containing two reels of Soundcraft tape with "Sweet Moods of Jazz in Stereo" recorded on one of the reels.

"Sweet Moods of Jazz in Stereo" features Coleman Hawkins, "Red" Allen, Marty Napoleon, George Wettling and other jazz greats in memorable interpretations of "Summertime," "Stormy Weather," "Tea for Two" and other old favorites — directed by Larry Clinton, recorded exclusively by Soundcraft... not for sale anywhere else at any price!

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Bookshelf!

(*Continued from page 34*)

rials, vibrations, computers, and automatics.

Recommended: to engineers and those with a serious interest in electronics.

"RCA PHOTOSENSITIVE DEVICES AND CATHODE-RAY TUBES" published by Tube Division, Radio Corporation of America, Harrison, N.J. 32 pages. Soft cover. 30 cents.

Revised and expanded to 32 pages, this new edition presents technical data, basing diagrams, and brief text descriptions of more than 130 RCA tube types. Photographs of representative types appear throughout the publication. Covered for the first time are various new types of image-converter tubes, photoconductive cells, storage tubes, cathode-ray tubes, camera tubes, etc.

Recommended: to people employed in fields that use these special-purpose tubes.

Free Literature Roundup

Specification sheets on four new General Electric hi-fi components are available. Among those covered are the "Stereo Classic" compatible stereophonic and monaural tone arm, extended bass bookshelf speaker systems, and equipment cabinets. The specs are available on request from: General Electric Co., Specialty Electronic Components Dept., W. Genesee St., Auburn, N. Y.

The J. W. Miller Co., 5917 South Main St., Los Angeles 3, Calif., has announced two new catalogs of interest to the electronic experimenter and to technicians and servicemen. Catalog No. 59 is a general one, listing over 1000 r.f. chokes, line chokes, i.f. transformers, line filter chokes, etc. Catalog No. 159 is the "TV Technician's Coil Replacement Guide" and contains coil replacements for more than 2000 different chassis and 11,000 TV model numbers.

A revised transistor interchangeability chart has been published by General Transistor. It is complete to date and covers all E.I.A. registered types comparable to G.T. types. To obtain a chart, write to General Transistor Corp., 91-27 138th Place, Jamaica 35, N. Y. —30—

Weathers Originals
set new highs in performance

Weathers products are not copies, adaptations, or mere improvements over other Hi Fi components or systems. Unfettered by precedent, Weathers equipment is designed on bold new principles which add astonishing quality and brilliance to Hi Fi reproduction.

Weathers Pickups

FM Monaural • **FM Stereo** • **StereoRamic** • All Weathers pickups play both monaural and stereophonic records without damage. All are available with diamond or sapphire styli. **FM Monaural** and **FM Stereo** cartridges are designed only for the Weathers Tonearm in which an oscillator develops the signal. They track at 1 gram . . . cannot damage records. They have exceptionally wide frequency range, low intermodulation, low cross modulation, and low harmonic distortion. **The Weathers StereoRamic Cartridge** fits all other tonearms and is superior to any magnetic pickup. Tracks at 2 grams. Complete absence of hum. 25 db separation between channels.

The Weathers Micro Touch

Tonearm is designed exclusively for the Weathers FM Pickups. It is light and so perfectly balanced that accurate levelling of turntable is unnecessary. Shock mounting isolates it from outside vibrations. Viscous damping prevents tonearm resonance down to 15 cps.

The Weathers Oscillator-Modulator

Transforms the impulse from the pickup and produces the FM signal. Signal-to-noise ratio is considerably higher than that of the best magnetic pre-amps.

The Weathers Turntable is unquestionably one of the World's finest. Exceptionally light construction eliminates the mechanical noises inherent in heavy turntables. Noise level is 25 db lower than that recorded on today's best records. Shock mounting eliminates floor vibrations. A cool running 12-pole synchronous motor brings the platter up to correct speed in ¾ of a revolution and maintains correct speed regardless of variations in load or line voltage. Cueing features make the Weathers Turntable ideal for broadcasting station use. $59.95. Also available in kit form, without base or mounting plate, $34.50.

The Weathers Discushion suspends any size record on its outer rim and protects playing surfaces from dust and contamination. Only $2.95.

Weathers Stylus Gauge

A simple and accurate way to measure and control exact tracking force. Makes records last longer—sound better. Priced at only $2.00.

Four Superb Speaker Systems

The Fiesta, Decorator, Monte Carlo, and Barrington fill every need from den to concert hall. From $59.95 to $510.00.

See your dealer or write for booklet number 658E.

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WEATHERS TECHNICAL MAGIC IS SOUND

A.B.C.

—The Publisher's Right Hand

Many of you may not be interested in problems of editing or publishing a magazine, but we'd like to mention one organization which makes our work easier, the Audit Bureau of Circulations, known as A.B.C.

If you'll look on page 6 of this issue, you will see the A.B.C. symbol, one which we believe is of great importance to our readers as well as to ourselves. Few people outside of the field of publishing are aware of its significance.

The A.B.C.'s function is as elementary and important as the alphabet. The Bureau measures our readers' decision to buy or not buy the magazine. This measure, known as "circulation," is a vital statistic to publishers. The A.B.C., therefore, is an organization which measures the performance of a magazine in terms of its circulation.

As circulation figures increase from month to month, we know that P.E. is gaining new readers as well as pleasing many old and faithful subscribers. It means that P.E.'s articles are interesting and that the magazine is alive and growing.

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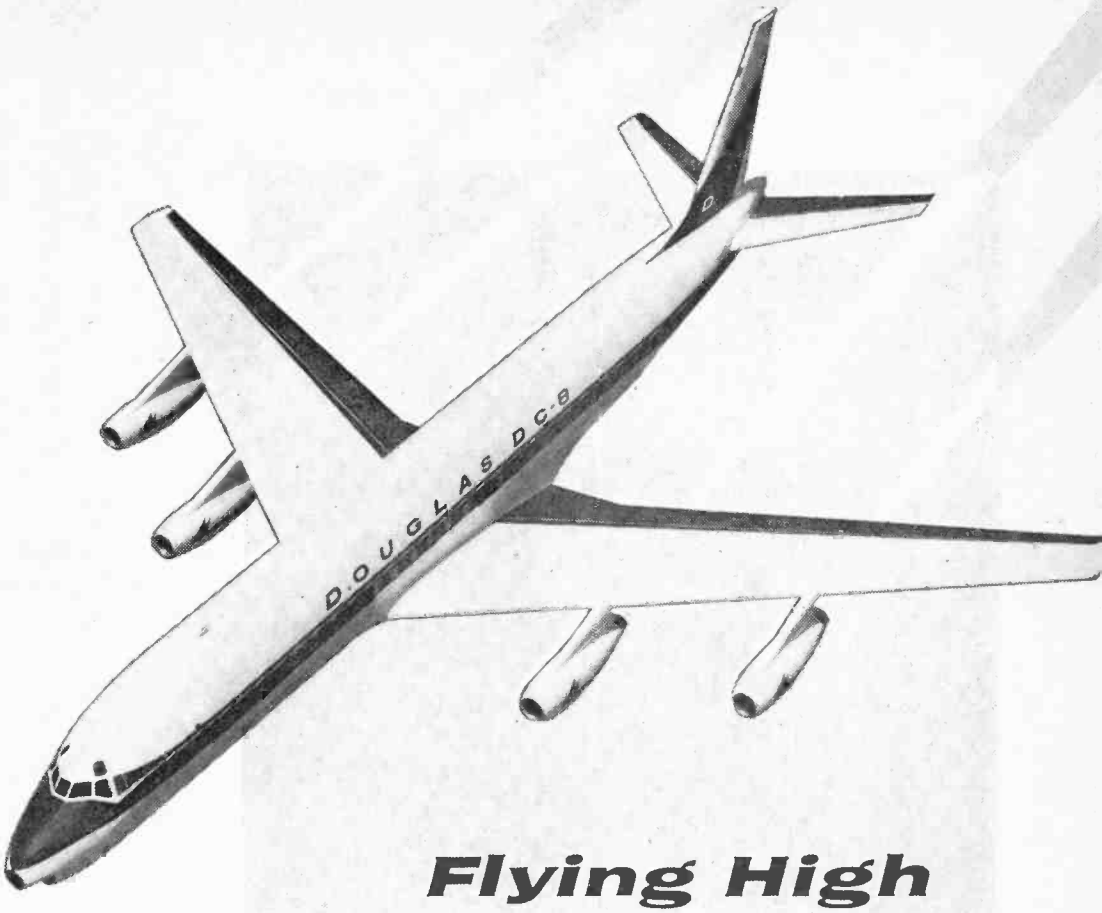


Flying High at Zero Altitude

By
BEN PREECE

THE PILOT and copilot of the Douglas DC-8 Jetliner couldn't see anything through the windshield. It was totally dark outside. The altimeter was winding down as the giant plane dropped through the overcast. The crew chief watched his instrument panel.

"We'll be out in a minute," the pilot said, referring to the cloud bank he'd been in since take-off. Then the lights of the field appeared below.

"There it is," the copilot gestured. A bright, double row of lights, outlining the runway, could be seen ahead and below. The DC-8 Jetliner dropped slowly until it was over the runway. The pilot pulled the nose up, there was a slight bump, then a squeal of tires as the brakes were applied, and the ship had landed.

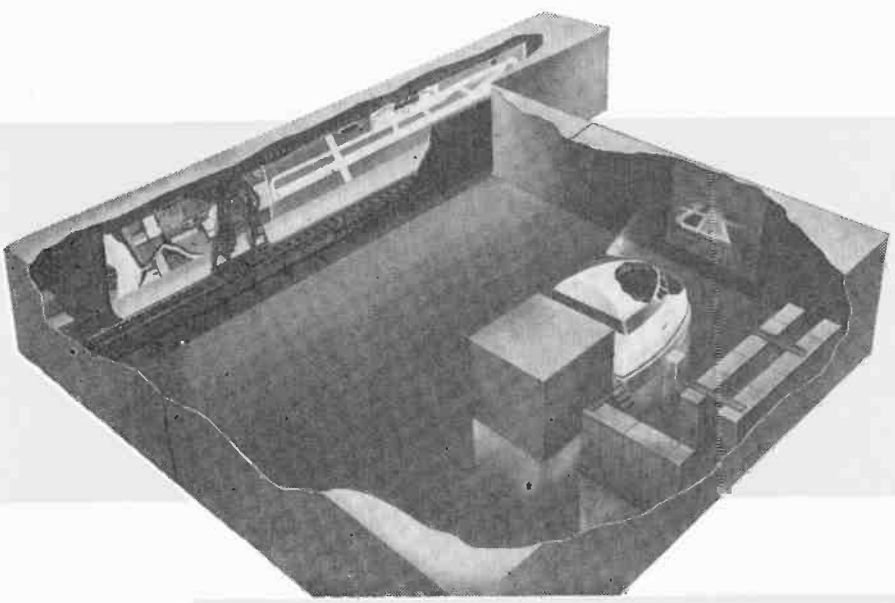
The pilot, copilot and crew chief had just experienced a coast-to-coast flight. However, their greatest altitude had been *under ten feet,* the greatest speed zero miles an

hour. Yet, except for the gravitational forces, this crew had experienced every sensation of being in an airplane flying five hundred miles per hour at 35,000 feet. They had just completed a "ride" in the DC-8 flight simulator!

Electronic Flight. The DC-8 simulator works electronically to produce all the sensations of flying, including correct instrument readings, climb and bank altitudes, everything. It even has a closed-circuit television system which shows you an airfield, just as you would see it in the real DC-8.

Such simulators train pilots to fly planes that haven't rolled off the assembly line. he experiences all the motions he would feel in real flight, except the g-loads. There are air pockets, sudden wind gusts, the sound of the jet engines, even the two quick jars the real DC-8 feels when it slips into a bank at high altitude and the wings lose their lift.

The crew of the simulator consists of the pilot, copilot, crew chief and instructor. Additional personnel outside operate the radio signal system and the closed-circuit television. The instructor can simulate any emergency a pilot will find in flight. The crew in the radio control room can duplicate the signal of any radio station in the world,



An artist's concept of the DC-8 Jetliner simulator setup. As the pilot "flys" the simulator, a television camera traces the plane's path along a three-dimensional model of an airport and approach area on the rear wall. The TV picture is projected on the screen in front of the cockpit. At the side of the room are racks which house the electronic "brain" of the simulator.

Swift, new planes like the Douglas DC-8, the Boeing 707 and the Lockheed Electra will be "old hat" to airline pilots when they go into service.

A DC-8 simulator is as realistic as the actual airplane. It consists of a cockpit section, a scale model airport, a closed-circuit television system, and a computer system and servomechanisms to control the position of the cockpit section.

Realism in Training. The cockpit has all the dials, levers and gauges of the DC-8 itself. When the pilot "flys" the simulator, and send six signals at once. Thus, the pilot may receive every radio indication that he is flying over Chicago, New York, Los Angeles or London. The radio crew can even vary the compass reading to allow for the magnetic variation typical in any part of the world.

In short, once the pilot and his crew take their seats, they are in a *real* airplane. When the jet engines are running, the cockpit may buck against the brakes, depending upon the throttle setting. When the brakes are released . . . off they go! The runway

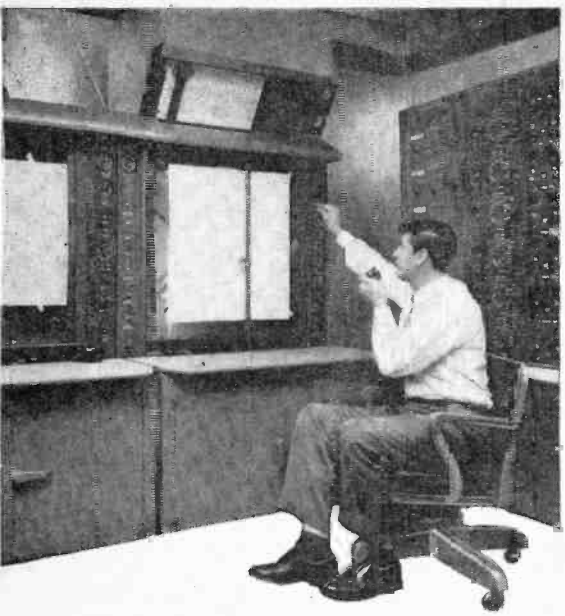
Pilots learn to fly the Douglas DC-8 Jetliner on terra firma. Here, a pilot "checks out" for the first time. The cockpit exactly duplicates the DC-8 controls. Closed-circuit TV projector provides realistic visual impression encountered during landings and take-offs. The simulator was produced by Link Aviation, Inc.

A television camera scans a miniature relief map built to a 300:1 scale. The camera is automatically positioned along the aircraft course and altitude, and assumes the aircraft attitude. Movement of camera is governed by electronic response of simulated Jetliner to pilot's controls. The relief map is wall-mounted to save floor space.

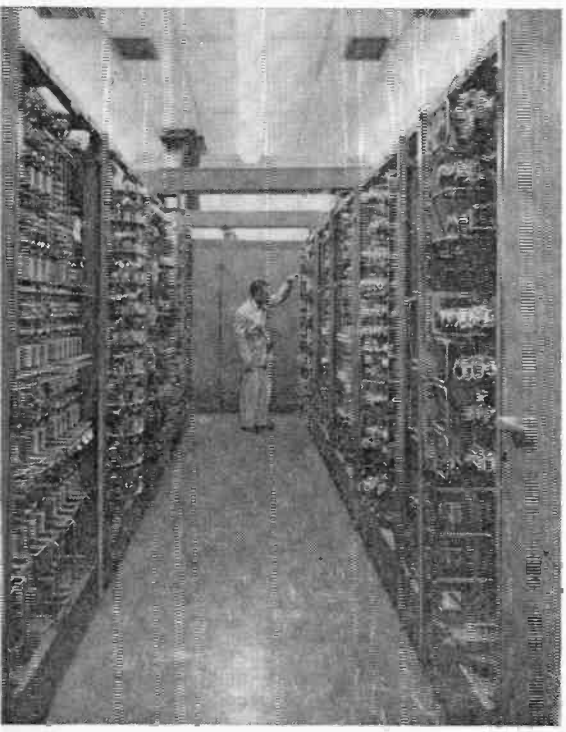
lights whirl by on either side. Looking straight ahead, the crew has the illusion of motion as the lights go by.

In the air, the instructor throws the book at the pilot. Engine failure may "occur," hydraulic failure, cooling system failure, a change in the plane's center of gravity, or any other trouble. More than one pilot has been saved by his simulator training. It teaches him to think fast and to do the right thing in a split second.

The DC-8 simulator does everything but fly. "It's really an electronic brain," one



The simulated DC-8 Jetliner's flight is traced on these maps in the control room of the simulator. The instructor makes the necessary control tower and check-point voice communications. Controls at the extreme right provide radio and navigation signals.



"Brain" of the simulator. Two rows of electronic devices comprise the analog computers and servomechanisms. In addition to literally thousands of electron tubes and resistors, the "brain" contains 100 servo motor-generator sets, 540 amplifiers and 2200 gears.

engineer said. "It must handle as many as forty variables at one time, including the six differential equations of motion. Then it must solve the problem and translate the answer into airplane motion, instrument readings and a visual television picture for the pilot."

Among those forty variables are engine thrust, fuel pressure, Mach number, altitude, rate of climb or descent, and many others.

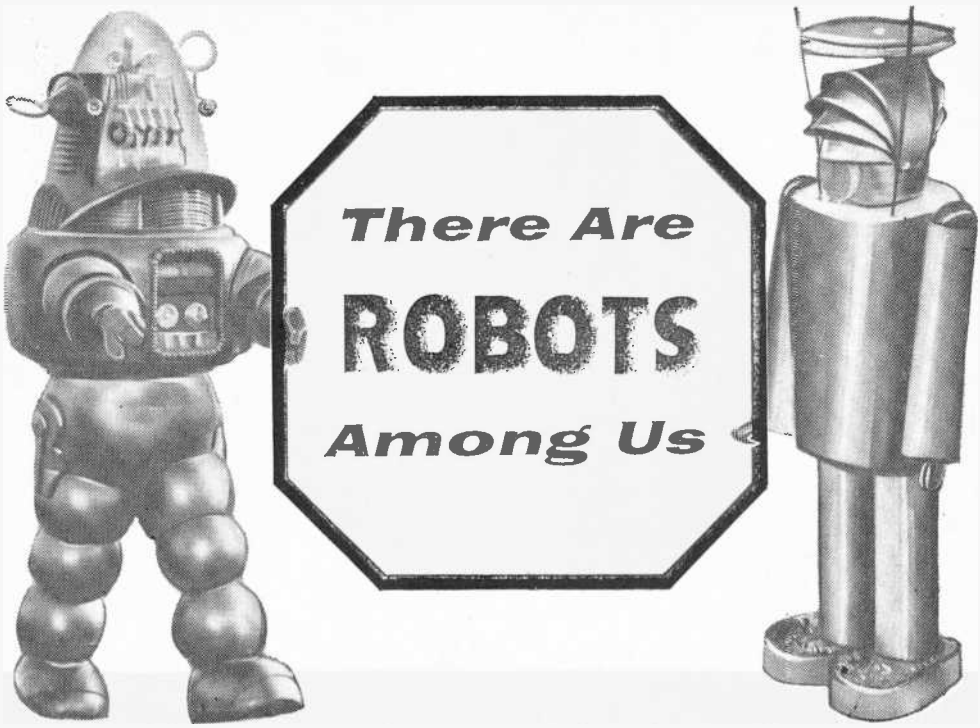
Simulator Design. D.c. circuits are used throughout for several reasons. Direct current provides a higher degree of accuracy, eliminates the possibility of phase shift, harmonic distortion, erratic instrument motion and noise pickup. The circuits are simpler and therefore easier to maintain. Direct current also eliminates the fluctuations and variations inherent in most of the alternating current supplies.

The DC-8 simulator uses printed-circuit boards and utilizes various electronic systems. For example: the characteristics of the engines are carried electronically on one circuit board. If another engine with an extra 500 horsepower is to be inserted, the old engine circuit board is removed and the new one plugged in. This way "engines" can be switched in only half an hour.

A room behind the cockpit section is lined with tall, grey cabinets. On the left are racks holding various amplifiers and other electronic gear. On the right are small circuit boards and motors with spinning dials. Under each unit is a label: *Fuel Flow, Bank, Altitude,* etc. The computer essentially takes a rate of change, integrates it, and tells the crew through cockpit motion or instrument readings just what is happening.

Televised Airport. In the TV room there is a model airport made to scale mounted on a long wall. A television camera is mounted on two tracks which run the length of the model airport. The model is built to a three-hundred-to-one scale, and represents an area 21,000 feet by 3000 feet. The TV camera is connected to the computer system. If the pilot dives, the camera tilts down. If he climbs, the camera

(*Continued on page* 121)



By WILLIAM TENN

Electronic robots, in one form or another, are influencing our daily lives . . . are we due for an "electronic revolution"?

THE AGE OF SCIENCE has made the word "robot" the focus of popular fears and hopes. The hope is that machines with minds, machines that can talk, think, and work like men, will give everyone a life of leisure. The fear is that robots will replace mankind, that they might run amuck and destroy their masters, that the robots will get us if we don't watch out. What was conceived as a work-saving machine has become the popular bogeyman of the age of science.

The robot nightmare hasn't been with us long, a little over 25 years. It pops up in films, in fiction, in newspaper editorials, every time someone develops a more advanced piece of programing for automatic machinery. When Remington Rand unveiled a computer which responded to written commands in ordinary English rather than computer code, prophets of mechanical doom made dire predictions on the future of mankind.

It's about time we ask some straight questions and try to work out some reasonably clear answers:

- What are robots?
- Where did the idea come from?
- How close are we to developing mechanical men?
- How much do we have to fear that robots may "take over"?

What Are Robots? Various dictionaries and encyclopedias define a robot as a piece of machinery which does a job you'd expect a human being to do.

The first robot ever mentioned occurs in Greek mythology. He was Talos, a bronze "man" made by the god Hephaestus as a gift from Minos, King of Crete. The job of Talos was to run three times around the island of Crete in the course of a day,

The human mind has great difficulty keeping up with computations of IBM's 610 Auto-Point computer. This specialized mathematical robot solves a wide variety of problems in seconds. Hours of human effort are required to check the machine with pencil and paper.

This digital control computer—the Ramo-Wooldridge 300—performs human functions. It controls manufacturing processes automatically. Vice-presidents-in-charge-of manufacturing—BEWARE!

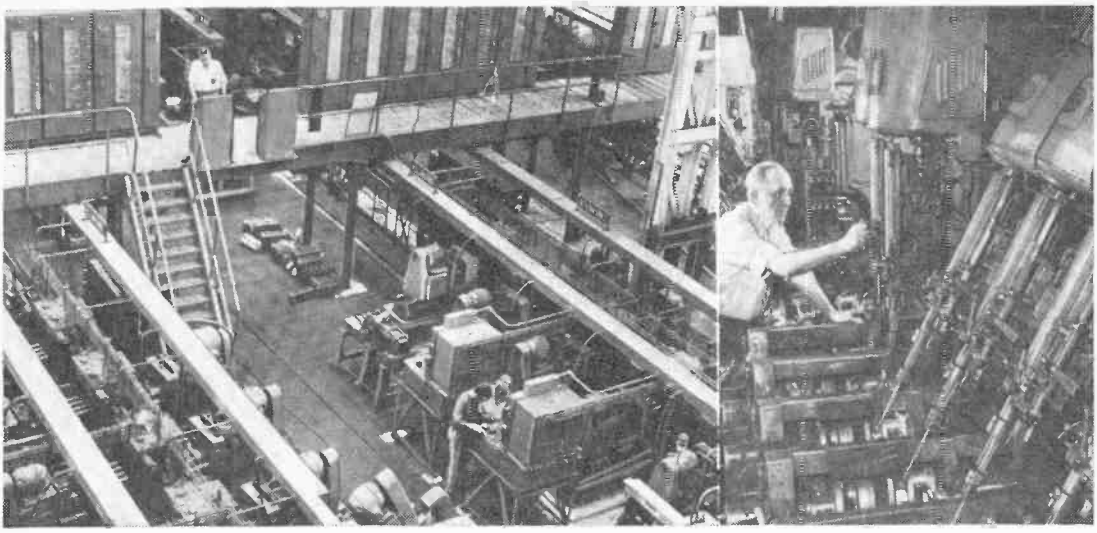
throwing huge rocks at any invaders from the sea—a Weapons Alert System and Guided Missile in one package! Talos had a single "vein" running from his neck to his ankle, stoppered somewhere in his foot by a large bronze pin. Medea, the wife of Jason, killed Talos during an invasion by pulling out the pin. In modern terms, that single vein could have been his main power cable and the pin his fuse.

Ali Baba's door in the Arabian Nights' story of the "Forty Thieves" which responded to the sound sequence signal of "Open Sesame" may have been the inspiration for the Televox, a telephone system invented in 1927 for the remote verbal control of various factory mechanisms.

Frijthof's Saga, written about the fourteenth century, supplies a tantalizing early hint of computer-directed sonar, Direction Finder *and* Televox. According to the saga, this redoubtable Icelander used no helmsman: he merely told his ship where he wanted to go—and she obeyed.

Most of these robots were more fable than fact, like the "automatic" chess player which fascinated all Europe in the eighteenth century—until some busy-body discovered a man inside the machine! Less wonderful, perhaps, but less phony, too, were the J. N. Maskelyne automatons, exhibited in London between 1875 and 1880. One of them, Zoe, drew pictures; the other, Psycho, played cards and could do simple mathematics. These were, however, only a little more complicated than the flying and singing birds made in Switzerland for hundreds of years: both birds and automatons were merely clockwork mechanisms.

Where Did "Robots" Originate? The origins of the word *robot* are still a matter for argument. It may have been derived from various words meaning "work" or "compulsory service," but the most logical source is the Czech *robotnik*—an ancient name for a serf. The robot can be considered a mechanical serf or slave. The play "R.U.R." by Karl Kapek, produced in 1920, first gave the word *robot* to the languages of the world.



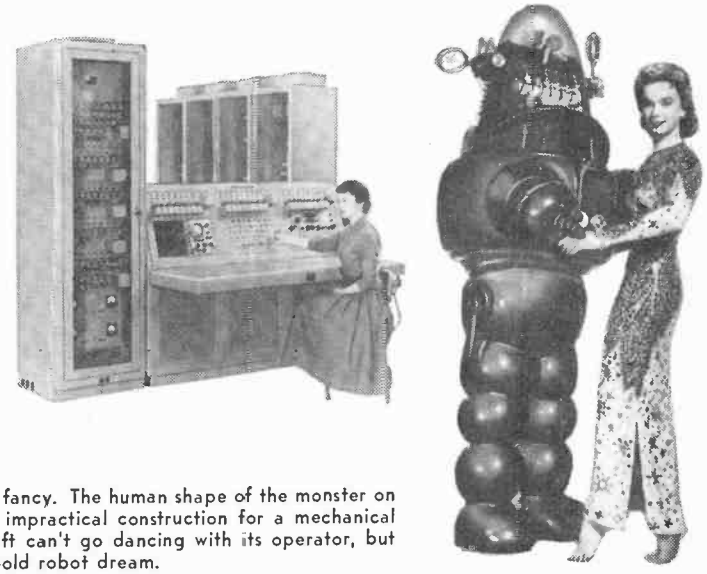
Production line robots grind out cylinder heads. Electronic "brains" control the robot motions. However, humans are required to maintain the highly specialized robot factory for all its ingeniousness.

For over a quarter of a century, the evolution of a mechanical-electronic robot has proceeded, in the pages of fiction, on the widening screens of movie houses, and, above all, in the popular imagination. Fritz Lang's 1926 film *Metropolis* featured a female robot who was the first of a distinguished cinematic line—a line which eventually included such brainy clankers as the robot from another planet in *The Day the Earth Stood Still* and the swivel-headed Robby in MGM's *Forbidden Planet*. A delightful series of stories by Isaac Asimov, which was recently brought out in book form under the title *I, Robot,* even covers the possibilities of a revolt by having "Three Laws of Robotics" built into the circuits of his metallic characters!

Robots, as we visualize them today, are a relatively recent idea, an idea still being developed in the engineering mind as well as in the more colorful imagination of the man in the street.

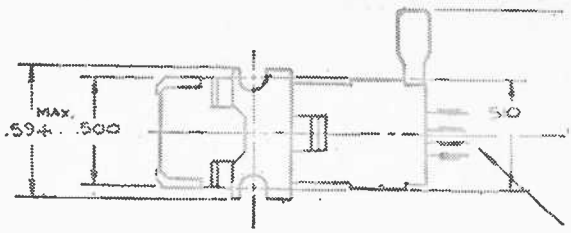
Mechanical Men? Here's a definition in terms of modern conceptions. Robots are basically mechanical rather than protoplasmic creatures, whose control and sensory apparatus is electrical rather than neural.

(*Continued on page* 126)

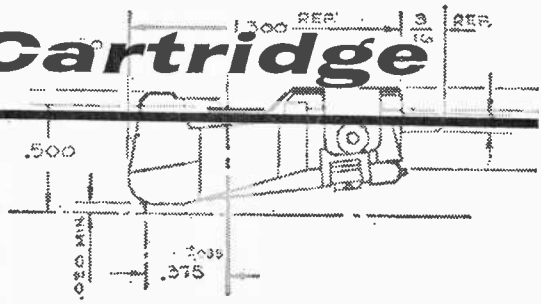


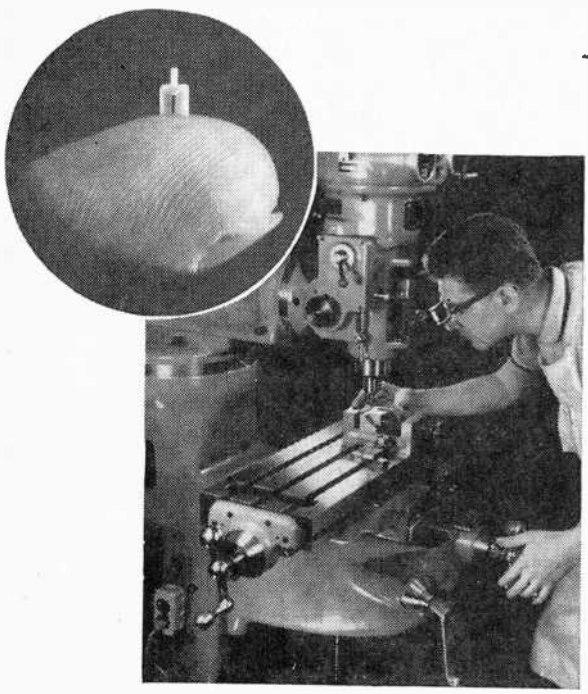
Robots and humans, fact and fancy. The human shape of the monster on the right is probably the most impractical construction for a mechanical robot. The computer on the left can't go dancing with its operator, but it's the real version of the age-old robot dream.

Phonograph cartridge design, always a complicated matter, has become even more complex with the introduction of the stereo disc. POPULAR ELECTRONICS visited the Sonotone plant in Elmsford, New York, to find out how one manufacturer of high-quality ceramic pickups handled the intricate problems of . . .



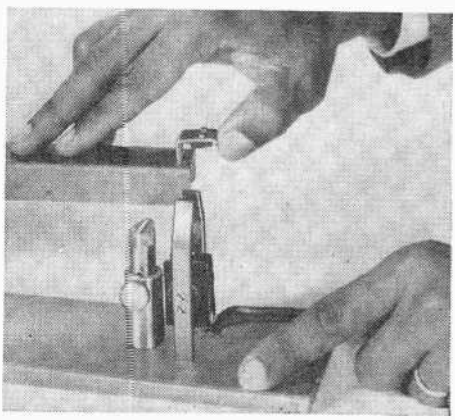
Designing a STEREO Cartridge

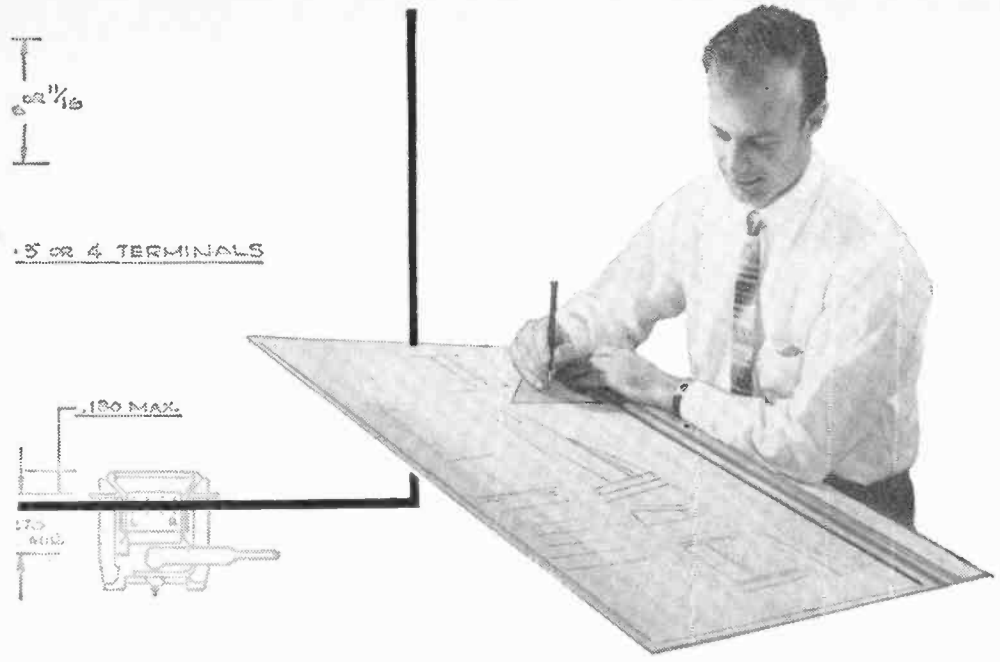




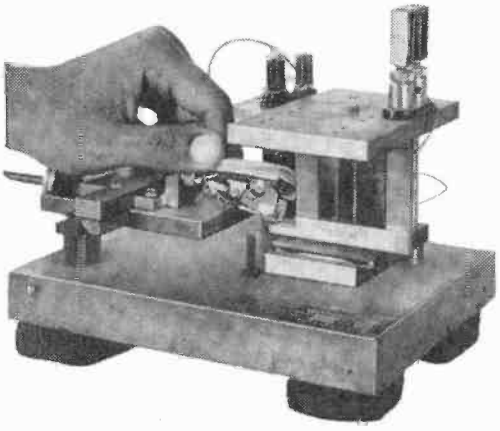
2 Miniature parts for the experimental cartridge were made on this milling machine. Ten-thousandths-of-an-inch tolerances are commonly required. First handmade samples of a new cartridge may represent thousands of dollars in engineering time. The precision needed is illustrated by the magnified view of one of the cartridge's internal elements.

3 Before assembly the tiny ceramic transducer, which is the heart of the stereo unit, is checked for polarity. Unless it is correct, signals from each channel of the cartridge will not be in the proper phase relationship and will cause dips and peaks in the frequency response.

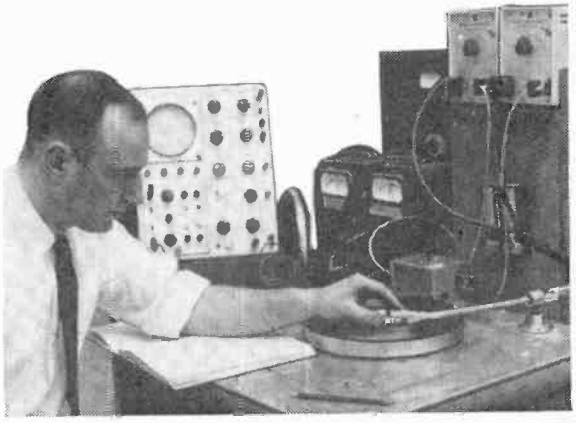




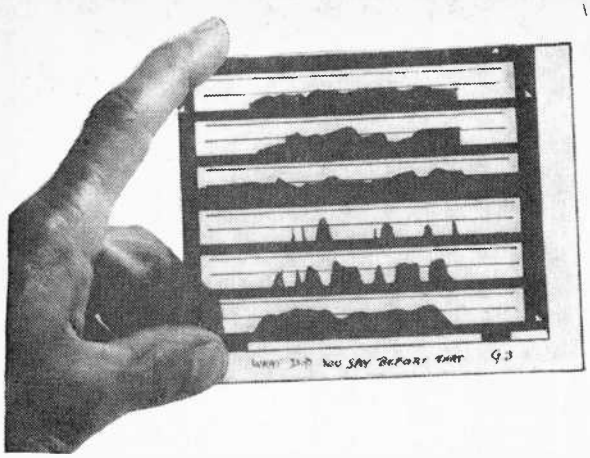
1 Born on the drawing board, every dimension and shape of the stereo cartridge had to be drawn and studied before orders were given to tool up for production. Scale drawings, many times the size of the tiny cartridge, make it possible to spot the smallest potential trouble-spot.



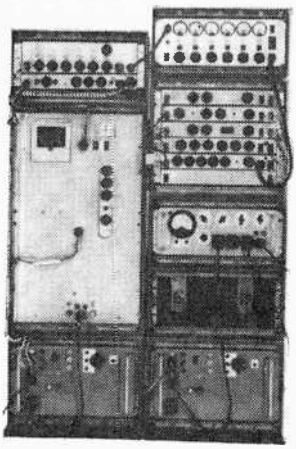
4 A special jig, designed by Sonotone, measures the compliance of the assembled laboratory model. An electrically actuated vibrator moves the stylus in the same way a standard record groove would and thus permits the exact computation of the stiffness of the stylus mounting assembly.



5 As the cartridge is checked on a standard test disc, a graphic record of stereo channel separation is made. A recording oscillograph, in conjunction with highly accurate filters, decade amplifiers, and meters, is used for simultaneous testing of both of the channels of the completed cartridge.



Breathing, tongue and lip action is painted in profile on a glass slide (left). The machine (below) reads the slide and "speaks" the printed phrase.



PAT does the talking

"PAT" is the nickname given to a British talking machine which creates all the sounds that are normally used in speaking, and can string them together to produce the illusion of complete words and phrases. It can, in fact, talk.

In place of the human vocal cords, PAT (short for Parametric Artificial Talker) has an electron tube oscillator. In place of tongue and lips which normally vary the size of the mouth cavities, electrical resonators are provided and their resonant frequencies varied.

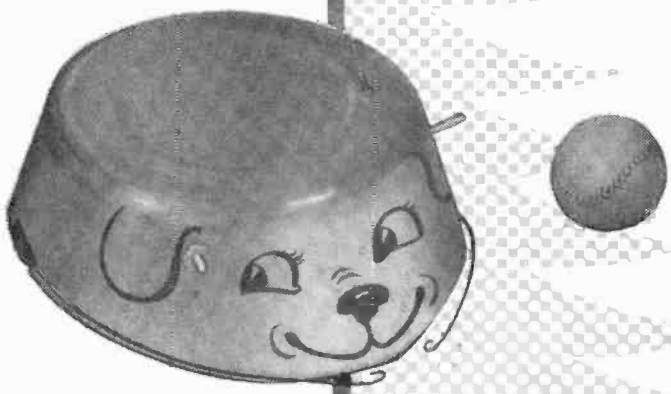
When the machine has to make hissing noises, it turns on an electronic "random noise generator." By the manipulation of six different controls, it is possible to make tolerably good imitations of all the different sounds normally used in speaking. The six "parameters" control the loudness and pitch of the vocal cord oscillator, the loudness of the hiss generator and the frequencies of three resonators (which correspond to particular positions of tongue and lips.)

There is, however, a great difference between making isolated speech sounds and talking, as every proud parent knows. In order that PAT may be able to utter connected words and phrases, a controlling device has been designed which may be likened to the nerves and muscles which control our vocal organs.

Six simultaneous signals are sent by the controller to different parts of the sound synthesizer just as, when we speak, our brain simultaneously regulates air pressure in the lungs, tenseness of the vocal cords, and positioning of the tongue and lips. The values of the signals required to synthesize an utterance are worked out beforehand and presented to the controller in a form that can be "read" electronically, by means of a cathode-ray tube and a photocell.

Why design a machine to do rather badly what any child can do much better? The fact that PAT's speech is intelligible proves that speech can be specified by signals which can be sent over very narrow bandwidths, enabling 20 or 30 times as many simultaneous conversations to be carried on long-distance telephone links. —30—

By
GAYLORD WELKER



SPARKY

This is the first of two articles describing the construction of Sparky the Robot Pup. Sparky will be an interesting project for the advanced gadgeteer. Next month Sparky's "brain" construction will be given. Readers with a well-equipped workbench and relay circuit experience should find Sparky both novel and challenging.

—*The Editors*

SPARKY the Robot Pup

"ROBOT" is still something of a catchword in this age of technology, carrying with it a hint of terrible power and a suggestion of the implacable machine. Yet robots are already with us, doing their jobs quietly and efficiently in our factories and homes.

Not everyone agrees on what a robot "is," but a good idea is given in Edmund C. Berkeley's definition: "A robot is a machine made out of hardware, wire, etc., which can receive or "sense" information from its environment using its sense organs, perform actions or display behavior using its acting organs, and perform

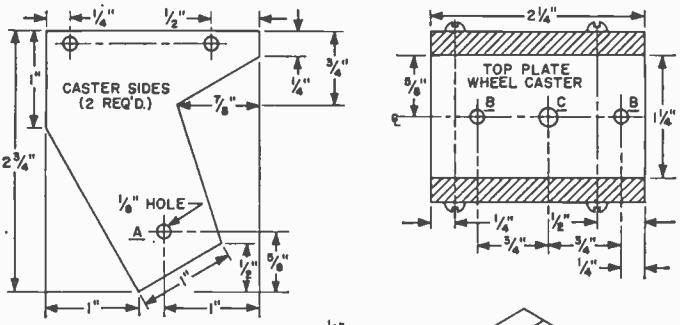


Fig. 1. Caster sides and top should be screwed together. Resultant caster assembly should be rigged.

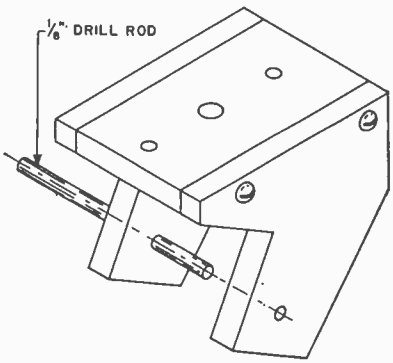
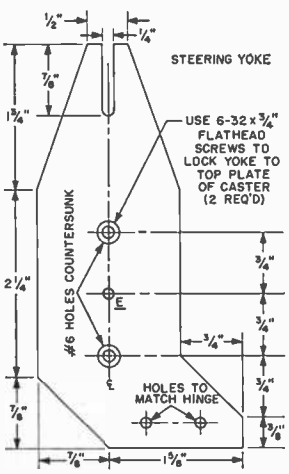
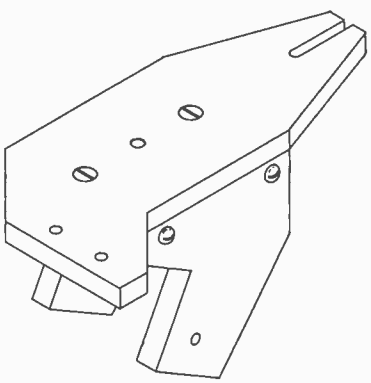


Fig. 2. Carefully cut steering yoke to exact size (below, left). Secure the finished piece to the caster assembly top (below).





logical or arithmetical operations correlating the sense impressions and actions, using its thinking organs for a brain."

This article, the first of two, tells how to construct a simple robot. Since Sparky only has three brain cells to think with, he isn't very bright. But there are other things to recommend him aside from his good disposition. He is the "gadgeteer's dream." And when he's running busily around the floor, he may remind you of an inquisitive puppy, skittering from one attraction to the next. That's the only thing he's been "trained" to do . . . so far.

Platform Details. Basically, the robot pup is composed of a 10"x12" tricycle platform of an approximately oval shape. The platform should be fairly rigid and built of ¼" Plexiglas, Masonite, plywood or heavy sheet metal.

The hole for the drive unit should be cut so that the wheel and motor will have room to turn. Supporting members for the various components are fabricated of Plexiglas or aluminum and can be mounted on the platform with sheet metal screws or nuts and bolts.

Drive Motor Assembly. After shaping the platform, start construction of the drive motor assembly. This installation will determine the position of the other components.

Cut out three rear-wheel caster pieces as per Fig. 1, clamp the two side pieces together in a vise, and drill a ⅛" axle hole at "A." Assemble the caster unit, using washers to space the rear drive wheel in the center of the shaft. The wheel should

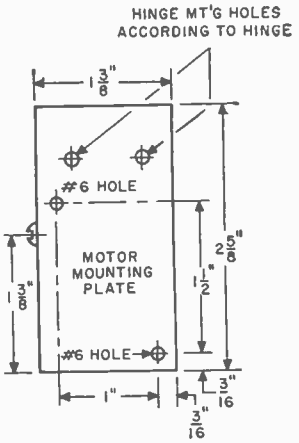


Fig. 3. Mount motor to motor mounting plate. Then attach assembly to steering yoke by means of a hinge.

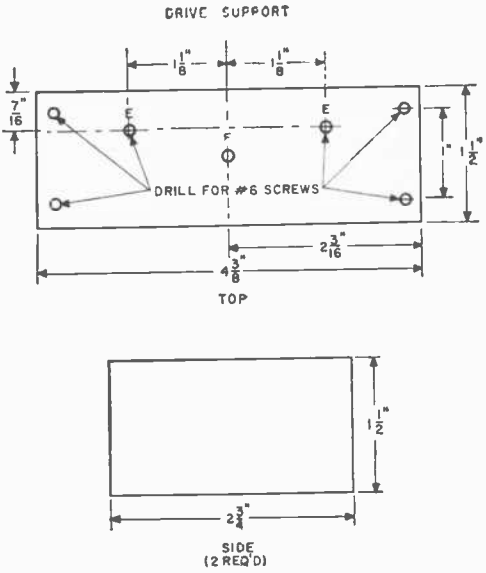
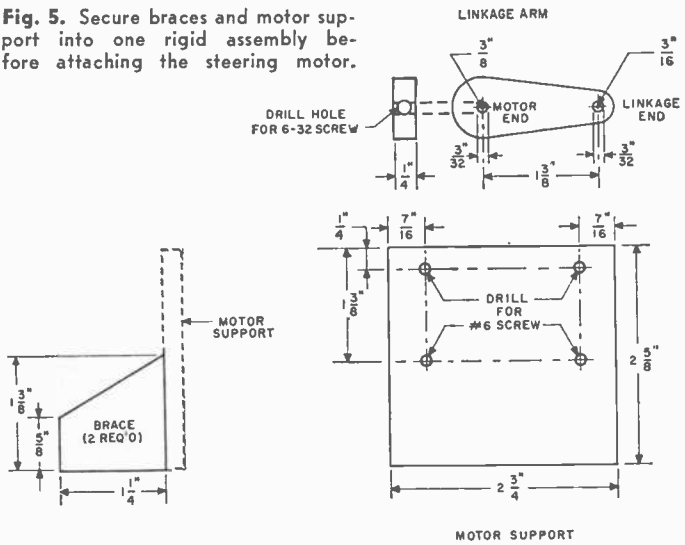


Fig. 4. Drill drive support holes at their exact locations.

Fig. 5. Secure braces and motor support into one rigid assembly before attaching the steering motor.



turn freely on ⅛" axle rod but should not "walk" from side to side.

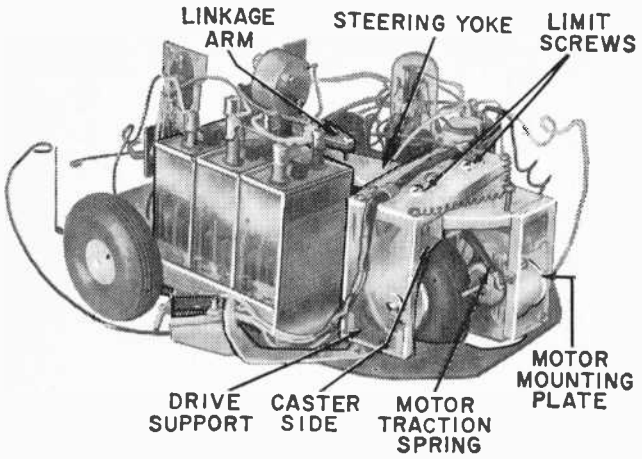
Cut out the steering yoke as per Fig. 2. Place flat-head screws through holes *D* in the steering yoke, and bolt it to the top of the caster assembly through holes *B*. Now drill the pivot bolt hole (*E* in yoke and *C* in caster) and tap for the *10-32* pivot bolt.

Next, install the Aristo #4 permanent magnet motor on the motor mounting plate (Fig. 3) so that the long shaft of the motor will bear against the rear wheel tread. Suspend this motor assembly on the rear of the steering yoke with a small hinge, taking care that the wheel does not rub against the motor body.

The motor mount should be loaded with a small coil spring so that the motor shaft bears against the wheel firmly. Assemble the U-shaped drive support bracket (Fig. 4), and install "limit" screws in top plate holes *E*.

Mount the previously assembled drive unit within the drive support with the *10-32* pivot bolt through *F* and into tapped hole *C* (Fig. 1) and *E* (Fig. 2). Tighten screw, then back it off to allow free swiveling. Place nut on screw end and tighten to lock it. Then mount this whole assembly on the platform so that the wheel assembly can swivel freely between limit screws.

A centering device for the steering yoke



Here is a picture of Sparky upon completion. The constructed assemblies are shown in their required locations.

PARTS LIST

B1—Three 2-volt wet cells (Aristo Type 23)
C1—50-μfd., 25-volt d.c. electrolytic capacitor
H1—Electric horn (Aristo Edu-Kit B 1-35)
L1, L2—6-8 volt blinker light
L3—6-8 volt #47 pilot light
*M1—Steering motor (Aristo No. 5 PM motor)**
*M2—Drive motor (Aristo No. 4 PM motor)**
RL1, RL2—4-p., d.t., 6-volt d.c. relay
RL3—Thermal delay relay (Amperite 6C3)
S1—S.p.s.t. toggle switch
S2, S3—S.p.d.t. feeler switch (V3 Microswitch)
S4—S.p.s.t. cam-operated leaf switch
*3—3" wheels with 1" aluminum hub, ⅛" bore (Perfect)**
*1—12" length of ⅛" drill rod (axles)**
*1—1" cabinet hinge**
1—Shell (any container which conforms to robot shape—author used 14" thin aluminum dishpan)
3—Dial light sockets
1—Octal socket
1—5-pin male and female socket for interconnection of shell and robot's innards
Misc. ¼"-thick Plexiglas scraps (see Figs. 1 to 5); screws; springs; washers; hardware; and plastic metal or cement

** Only these parts are required for the construction details given this month.*

Parts can be supplied by:

Berton Plastics, 79 5th Ave., New York, N. Y.
Gyro Electronics Co., 36 Walker St., N. Y., N. Y.
Microswitch Div., Minneapolis-Honeywell, 24-30 Skilman Ave., Long Island City, N. Y.
Polk Hobbies, 314 5th Ave., N. Y., N. Y.

must be made with two opposing low-tension coil springs which will act to re-center the caster assembly when the steering motor is off. Otherwise, the rear wheel will continue to steer in the same direction given it by the last impulse of the steering motor.

Steering Construction. Cut out the steering motor support, support braces and linkage arm from ¼" Plexiglas as per Fig. 5. Install a 1"-long #4 screw in hole *G*, and mount the linkage arm on the long shaft of the motor with a setscrew. The #4 screw should project down towards the motor body. This steering motor, incidentally, will not be free to rotate fully as it is being used as a "torque motor" to turn the steering yoke.

Mount the steering motor on the steering motor support with the long shaft up. Install the whole assembly in the center of the platform in such a way that the #4 screw in hole *G* seats loosely in the inner end of the steering yoke slot. The yoke and the linkage arm should both be lined up on the center line of the platform; otherwise the camming action will not function correctly.

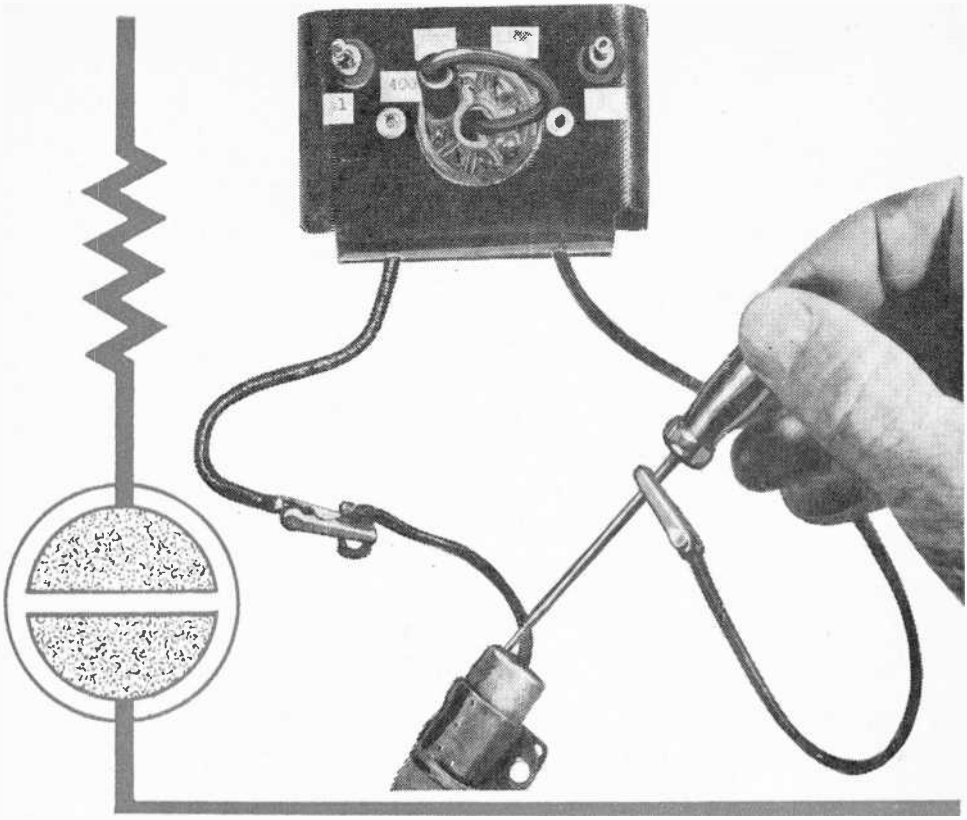
Front Wheels. The front wheels are mounted on separate ⅛" axles and are locked to the axles by a setscrew or a blob of plastic metal. The platform is hung from these axles by Plexiglas or metal bearings.

A sufficient number of washers to keep the wheels from rubbing the side of the platform are installed between the wheel and the bearing. Two washers and a blob of plastic metal are used to anchor the inner end of the axle.

Batteries. Power is furnished by three 2-volt wet cells in series which are rated for 3 ampere-hours. The cells are clamped together and mounted firmly to the platform with a metal strap.

There is a certain amount of bumping around as the little fellow goes his way, and we don't want his power supply tearing loose. The batteries can be connected directly to the drive motor leads for testing purposes. Switch leads to reverse motor direction.

—30—



HV Neon Voltmeter

By I. C. CHAPEL

A HIGH-VOLTAGE VOLTMETER can be built with a sensitivity equal to a vacuum-tube voltmeter at a cost of about one dollar. The secret is in the special characteristics of the neon glow lamp. The circuit shown was used successfully for testing the "Geiger Gun" (POPULAR ELECTRONICS, July '57).

Construction. A folded plastic "breadboard" was employed by the author, but any small plastic box will do. An octal socket serves as a plug-in switch assembly.

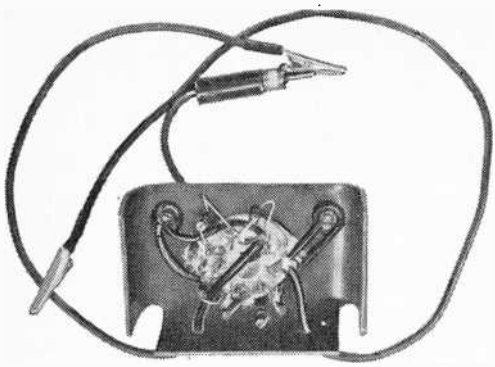
Mount the two neon lamps where they can be easily seen, solder the resistors to the socket terminals as per the numbers in the schematic, and add short lengths of well-insulated test lead wire for the *Selector* probe and clips.

Clean all parts to remove dust, solder flux and foreign particles. (It does not require much dirt to measure 1 megohm, and that much in the wrong place would prevent the proper indications of the neon lamps.)

Calibration. The resistor network *R4*, *R5* and *R6* connected across *NL2* is a shunt resistor which serves as a known load from which a voltage drop can be calculated.

For instance, if the *Selector* probe is connected to prong 2, *R5* and *R6* are shorted out. The shunt is 5.6 megohms and the total circuit resistance is 93.6 megohms. The ratio of the input voltage to the voltage required to flash *NL2* is about 17 to 1. Assuming 70 volts as the breakdown voltage, then 1190 volts will be required across *AB* to flash *NL2*.

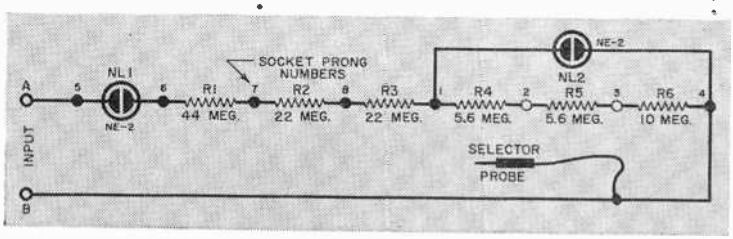
When the *Selector* probe is connected to



PARTS LIST

NL1, NL2—NE-2 neon lamp
R1—44 megohms (two series-connected 22-megohm resistors)
R2, R3—22 megohms
R4, R5—5.6 megohms
R6—10 megohms
1—Octal socket
1—Selector probe
2—Alligator clips

All resistors ½-watt



Note how the socket terminals are used as mounting lugs in the above view of the high-voltage voltmeter.

prong 3, 630 volts are needed to flash *NL2*. If the probe is not used, *NL2* flashes at 350 volts.

The resistor values may be changed to suit other conditions by calculating the ratio of voltage drop across the *NL2* shunt resistor to the total drop across the circuit.

Operation. Connect terminals *A* and *B* across the d.c. voltage to be measured. Neon lamp *NL1* will glow if the applied voltage is *above* 75 volts. *NL2* will also glow or flicker when the applied voltage is 1190 volts (*Selector* probe in prong 2), 630 volts (prong 3) or 350 volts (*Selector* probe not plugged in).

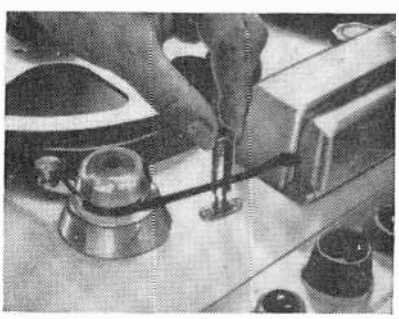
A.c. voltages may be checked also. The readings will be peak a.c., not the standard r.m.s. reading. If *NL2* flickers, the voltage indicated has been reached. A steady supply voltage will cause a steady glow in the neon lamps.

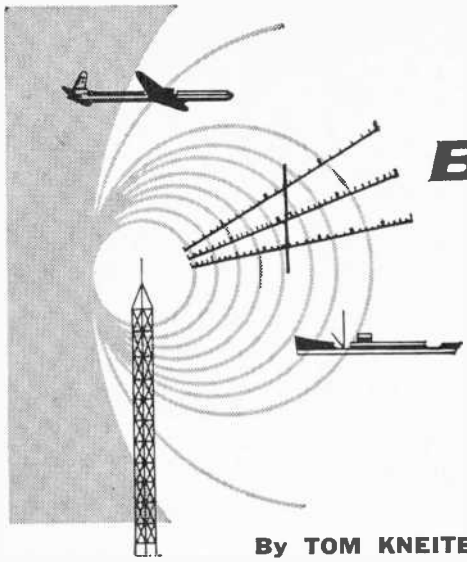
The neon voltmeter can solve such problems as: Is there leakage between transformer windings? How long will capacitors hold a charge? Where is the largest voltage drop in a circuit? Are sockets, tie lugs or switch surfaces leaky, etc? —30—

TAPE PRINT-THROUGH PROBLEM SOLVED

Print-through, an old problem plaguing tape recording fans, has at last met its master, according to Audio Devices Inc., 444 Madison Ave., New York 22, N. Y. An interesting little gadget called the "Echoraser" can provide up to 10 db improvement in the signal to print-through ratio on tapes that are one month old and up to 6 db improvement on tapes three years old.

The "Echoraser" package consists of two erasers, one for removing up to 9 db print-through and a second eraser to remove as much as 18 db from tapes that are more seriously affected. The "Echoraser" needs no power to operate, consisting of a chromium-plated brass upright bar with a small energized area. It can be permanently installed on any tape machine.





Bandspread

By TOM KNEITEL

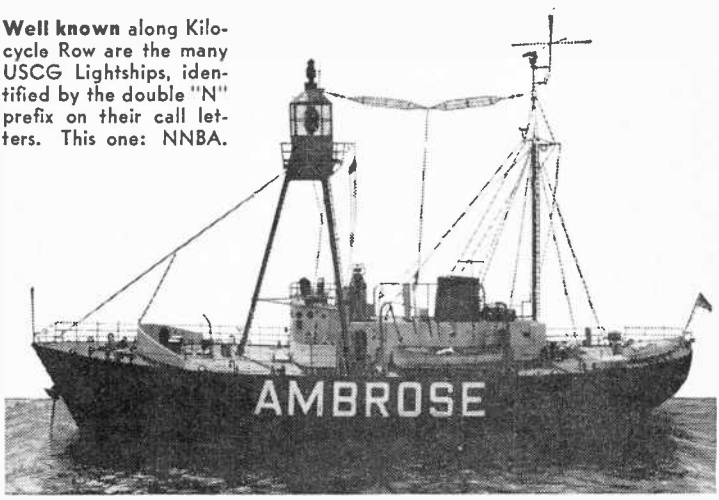
QSL'ing the Coast Guard

THERE CAN BE no denying that the loud clamor heard in recent years has been the sound of receiver bandswitches click-clicking out of the crowded short-wave broadcast and ham bands into the wide open spaces of never-before-used phone and c.w. communications bands. Why? Because more and more of the boys are discovering that you can have some pretty exciting and interesting sessions listening to communications stations (or "utility stations," as they are known). This fever has not only hit SWL's, but also hams, right from Novices to the dyed-in-the-wool Extra-Class boys.

For our money, the U. S. Coast Guard is one of the most "hairy-chested" outfits in business today. In addition to guarding our coasts (no small chore), they also perform a suitcase-full of feats of derring-do such as patrolling icebergs in the storm-tossed North Atlantic, patrolling the weather (and we *don't* mean off the Miami coast), and search and rescue operations . . . not to mention that they maintain many "Life Boat Stations," and some 39,000 aids to navigation, many located at isolated Loran Stations, lightships and lighthouses.

Of course, to try to do all of this without the aid of radio communications would be almost as foolhardy as sending a reception report to the BBC and expecting a QSL. Being the "hep" outfit that it is, the Coast Guard makes more use of radio communications than just about anyone else you can shake an antenna at, thereby providing lively listening for anyone with a short-wave receiver and more interest in what's going on than spending his time watching the antics on Channel 3.

Lively Listening. When you get to know the ropes of listening to Coast Guard stations, you'll feel the salt spray splattering against your log book as you enter any one



Well known along Kilocycle Row are the many USCG Lightships, identified by the double "N" prefix on their call letters. This one: NNBA.

Station	Location	Station	Location
NIK	Argentia, Nfnld.	NMN	Norfolk, Va.
NMA	Miami, Fla.	NMO	Honolulu, T. H.
NMB	Charleston, S. C.	NMP	Northbrook, Ill.
NMC	San Francisco, Calif.	NMQ	Long Beach, Calif.
NMD	Cleveland, Ohio	NMR	San Juan, P. R.
NMF	Boston, Mass.	NMV	Jacksonville, Fla.
NMG	New Orleans, La.	NMW	Seattle, Wash.
NMH	Washington, D. C.	NMX	Baltimore, Md.
NMI	Woods Hole, Mass.	NMY	New York, N. Y.
NMK	Philadelphia, Pa.	NOF	St. Petersburg, Fla.
NML	St. Louis, Mo.	NOY	Galveston, Tex.

Table 1. Call letters of the major USCG radio stations.

A typical USCG shore station radio installation is the International Ice Patrol HQ at Argentia, Newfoundland.

of the many units to be heard, from San Juan, P. R., or Tillamook Rock, Ore., to Honolulu, Hawaii. And after you wring the salt spray out of the log book, you can send them a reception report and stand a pretty good chance of receiving a QSL in return, if you're sharp enough to send them a prepared reply card.

There are hundreds of Coast Guard radio stations and cutters (in case you don't know, a "cutter" is a Coast Guard ship) in operation, so obviously we can't list them here. However, there are a number of "central" high-powered stations, which are the ones most often heard over great distances, and they are listed in Table 1.

The smaller stations, usually 50-watters, are located at lighthouses and Life Boat Stations and are substations of a specific "central" station (their call letters are comprised of the call letters of their "central" station affiliate, plus one or two digits).

Making Reports. Reception reports to the "central" stations should be addressed to: Communications Officer, U. S. Coast Guard Radio Station, city of location. Reports to the substations can go in care of their "central" station affiliate, with the call letters of the secondary station written above the "Communications Officer" line in the address. Also, the envelope should be marked, "Please forward to unit named."

Cutters have four-letter calls, all beginning with the letter "N." If you should hear any call that you want identified, drop us a card and we'll see if we can locate it for you.

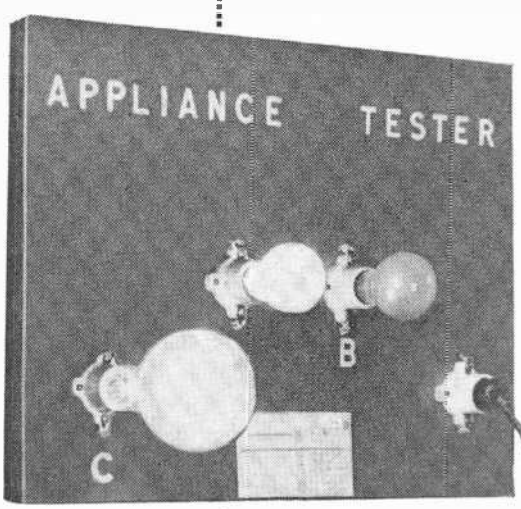
A listing of the major Coast Guard phone and c.w. frequencies is shown in Table 2. Code stations are spread all over the dial, from 2 to 25 mc. In addition to these frequencies, the cutters are usually equipped with crystals for a whole slew of "Marine Operator" frequencies.

Phone (kc.)	C.W. Frequencies (kc.)			
2182	2666	4050	7530	12750
2662	2674	4298	7785	12786
2670	2682	4337	8574	12889.5
2678	2690	4575	8650	16983.2
2686	2698	4795	8682	17146.4
2694	2706	5320	8734	17247.2
2702	3241	6383	11515	18722.5
3253	3389	6509	12150	22545
				25380

Table 2. Most used frequencies of USCG stations.

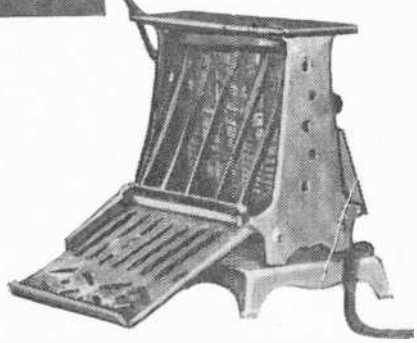
We're interested in receiving information on utility stations you have heard or QSL'd. If you haven't heard any yet, try it the next time the man calls *"CQ DX AC4"* on top of your c.w. practice station, or when Big Ben's chimes clang on top of Radio Lower Slobovia's S-2 carrier. —30—

Appliance Tester



By LEON REISSMAN

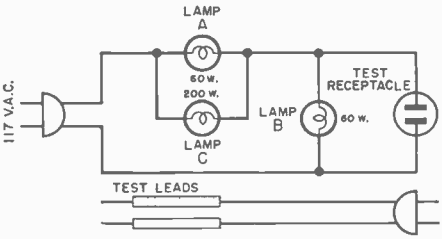
The test indication card shown below can be glued to appliance tester panel for convenience.



AN appliance tester permits rapid checking and testing of all high-wattage electrical appliances. Discarded waffle irons, toasters, lamps and electrical mixers can be dusted off and checked out quick as a wink.

Just plug the tester into 117 volts a.c. and plug the appliance into the *Test Receptacle* on the tester. The appliance tester will immediately indicate a short circuit, open circuit or normal operation.

Insulated test leads can be plugged into the *Test Receptacle* and used to check short or open circuits in the appliance's circuitry at any point. -30-



HOW IT WORKS

With no load, lamp *B* is effectively across the a.c. line and it burns brightly. The combined internal resistance of parallel lamps *A* and *C* is low and there is very little voltage drop; hence they do not light.

When a short-circuited appliance is connected to the *Test Receptacle*, it effectively shorts out lamp *B*. Lamps *A* and *C* are therefore connected directly across the a.c. line and light at full strength.

When a normal operating appliance is connected to the *Test Receptacle*, lamp *A* is fairly bright and lamps *B* and *C* burn with much less than normal brilliancy. The light intensity of lamps *B* and *C* varies with the rated wattage of the appliance under test. Experience with several known good appliances of different wattages will enable you to estimate current drawn.

APPLIANCE TESTER INDICATIONS	
1. OPEN CIRCUIT	LAMP B AT FULL BRILLIANCY LAMPS A AND C DARK
2. SHORT CIRCUIT	LAMP B DARK LAMPS A AND C AT FULL BRILLIANCY
3. NORMAL APPLIANCE	LAMP A CLOSE TO FULL BRILLIANCY LAMPS B AND C LESS THAN FULL BRILLIANCY

PARTS LIST

4—Porcelain surface mounting lamp sockets
1—Screw-in lamp socket receptacle
1—10' length of #18 lamp wire
1—200-watt lamp
2—60-watt lamps
2—Insulated test prods
1—½" x 24" x 12" plywood panel
Assorted wood screws and hardware

Choosing Your TV Antenna

By RUDOLF F. GRAF

THE BEST TV ANTENNA made isn't good enough for *your* set unless it's matched to the needs of *your* location. Distance from the transmitter is the biggest factor affecting TV reception, but local terrain, adjacent buildings, or mountains can cause the signal to come in strong or fade out altogether regardless of distance. The only way to insure a good signal is to choose the right antenna for your location and for the channels used most frequently.

Television reception areas are broadly classified by their distance from the station:

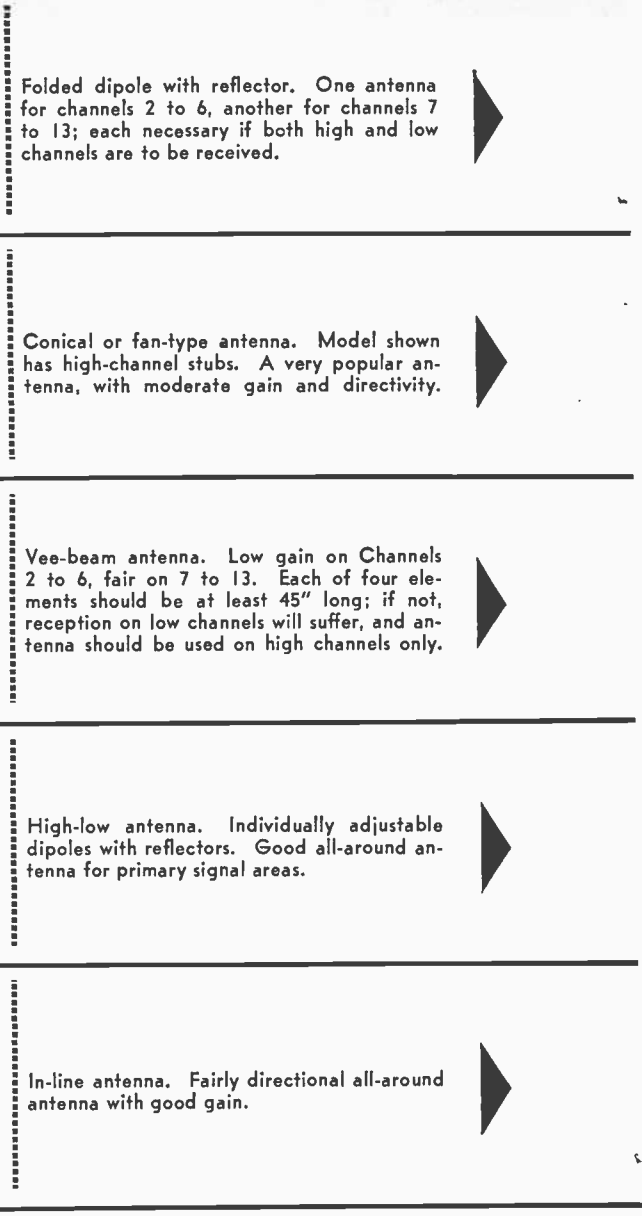
- Primary or local area (up to 35 miles)
- Semi-fringe area (up to 50 miles)
- Fringe area (up to 75 miles)
- Deep fringe area (up to 200 miles)

By the time the signal reaches the receiver location, it may be quite weak. Therefore it's important to have the best possible antenna installation. Height, type and direction are all important factors.

Adjacent-channel interference, which is a frequent troublemaker, seen as weaving diagonal lines, is caused by a signal from the next higher or next lower station. If you are tuned to Channel 11, for example, a strong station on Channel 10 or 12 may cause adjacent-channel interference.

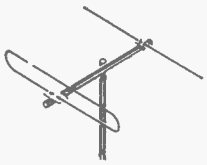
On the other hand, co-channel interference (vertical "windshield wiper" or horizontal "Venetian blind" black bars) is caused by a station operating on the same channel as the one we are trying to receive. This trouble usually crops up if the TV set is about half way between two stations on the same channel.

Both of these types of interference can be eliminated with sharply directional antennas. In the case of adjacent-channel interference, a single-channel Yagi with a filter at the receiver may work wonders.

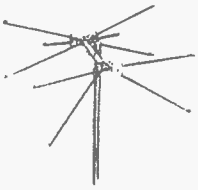


No amount of receiver adjustment will banish a ghost caused by reflections from buildings, mountains or other objects. Antenna re-orientation or replacement are the only certain cures.

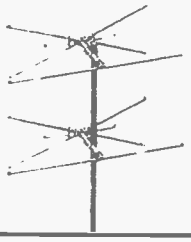
The roof or outdoor antenna is easily the best and most efficient type. It is desirable in primary areas and absolutely essential in fringe areas. It may be a single-channel, selective-channel or all-channel job. About 50 different designs are available today but selection of any particular one depends greatly on the terrain. —30—

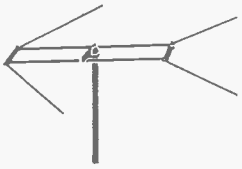


Conical antenna with conical reflectors. Similar to previously mentioned conical antenna but slightly more directional.

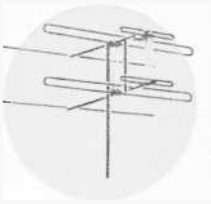


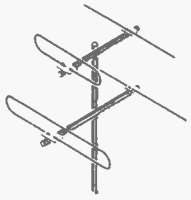
Stacked conical with straight reflectors. A moderate-gain broadband antenna for use in semi-fringe areas.



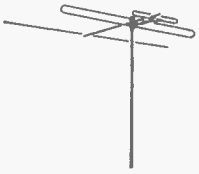


Stacked in-line antenna. Effective moderate gain assembly with good response over all of the various channels.

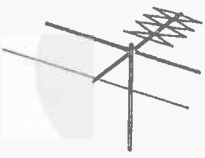




Five-element Yagi. High-gain directional single-channel antenna. Separate antenna required for each channel.



Helical Yagi. All-channel antenna with moderate gain. Performance better on higher channels than on low.



ANTENNA DICTIONARY

Boom (Crossarm)—The horizontal bar or tube which serves as mechanical support for all the antenna elements.

Dipole—The simplest of all TV antennas, consisting of two electrically unconnected rods or tubes arranged end to end. Transmission line is connected in center.

Directivity—Ability of an antenna to select signals from one or several desired directions. Antennas may be "unidirectional"—receive signals from one direction only, or "bidirectional"—receive signals from opposite directions but not from the sides, or "omnidirectional"—receive signals from any direction.

Director—A parasitic element placed in front of the driven element for increased gain and directivity.

Driven Element—That element (or elements) which "collects" the TV signal. It is connected to the TV lead-in.

Element—Every one of the working parts of an antenna is called an element. It may be either driven or parasitic.

Front-to-Back Ratio—A numerical ratio showing how much more signal is received from the front of the antenna than from the back.

Gain—A figure expressed in decibels (db) which indicates the signal gain of a particular antenna type over that of a simple dipole.

Mast—The heavy vertical tubing which supports the antenna. The crossarm is usually bolted to the mast.

Parasitic Element—An element or elements not directly connected to the driven element. Parasitic elements act as directors and reflectors for increased signal strength and directivity.

Reflector—A parasitic element or elements placed behind the driven element for increased gain and directivity.

Stacking—Two or more antennas joined together electrically with stacking bars or a stacking harness.

Twin Lead—The transmission line which carries the signal captured by the TV antenna to the TV receiver.

A temperamental MRS computer doesn't always follow instructions—and self-programs a surprise that only another computer could understand

MRS

FIRST OFF, let me tell you that the MRS is no off-the-shelf commercial computer. MRS stands for Multipurpose Research System, and we designed and built the whole works ourselves at the Research Institute. Consequently, we can blame only ourselves for the design features that led to all the troubles. Everyone on the staff still feels that the basic concepts are sound but we unanimously agree that some changes will have to be made before MRS can be a dependable computer system.

MRS is a well-built hunk of hardware with just about everything a computerman could want. She's got microprograming, built-in compiling routines, half a billion words of high-speed memory, a basic pulse rate of a micromicrosecond, and fantastically fast input-output scanners that work with a whole printed page at a time.

But the most interesting feature is the automatic diagnostic and maintenance circuitry. This is sort of a separate subcomputer in itself. MRS runs her own diagnostic programs and on the basis of the results does her own maintenance. MRS can also do a certain amount of modification of her own circuits and units to improve them or for maintenance reasons. And right there is where we must have goofed.

AFTER the usual initial start-up with its nightmare of cold solder joints, mismatched connections, and other sundry manufacturing bugs, we finally got MRS "on the air" and running. The first month of production computing was a spectacular success with a minimum of intervention from the maintenance unit.

Then the brass of the Institute came around for a demonstration and to hear us brag. A machine difficulty will occur at such times with a probability of one. It occurred.

Right in the middle of the demonstration run MRS stopped computing, and the Maintenance-in-Progress light popped on. This was unexpected, and at first we were pleased. Here was a chance to give a real demonstration of the machine's ability to repair itself.

Everyone in the machine room watched entranced as the removal arms rolled over to the main arithmetic unit, plucked out a rack of adder circuit, and disappeared with it into the maintenance unit. We expected the arms to return within twenty seconds with the new adder and the demonstration to proceed. Instead the Maintenance Monitor flashed, "Part AD 7732, binary adder, out of stock." Every computerman in the room inwardly groaned.

At the time there was nothing to do but plug in an adder by hand and get the show on the road again. The visiting dignitaries were duly impressed by everything, but the computer staff was perturbed. There should have been plenty of spare parts in the internal stock bins to handle the situation,

but later, when we looked in the bins, some of the parts were missing.

AND THAT was just the beginning. For the next several months MRS played this game with us. Parts, both good and bad, disappeared into the innards of MRS, and try as we might, we could find no clues as to what was happening to them. MRS was doing some obscure hardware work internally which we didn't understand. Since this idiosyncrasy caused no large amounts of delays in the computing schedule, the Chief Computerman refused to let us shut down MRS to investigate.

About a month after this cannibalism began, we ran up against a second class of difficulties. MRS refused to accept data for certain types of problems. We would feed the data sheets into the scanners, fire up the program in the usual manner, and almost immediately we would get output. This output consisted of nothing but the input data, unprocessed. No amount of checking of both the data and the machine itself could find the cause of this cute trick. But just when the Chief was ready to say shut her down, the difficulty went away.

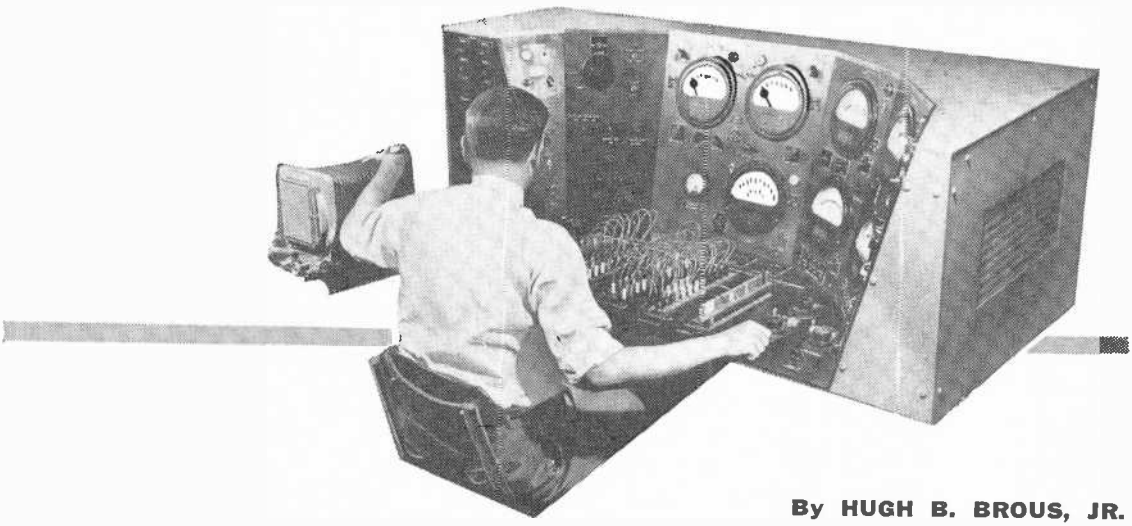
This bug was replaced in a few days with a new one. The warm-up time in the morning, instead of lasting the usual twenty minutes, started stretching out to an hour or longer. There were days when we waited until almost noon for a ready light. During much of this dilly-dallying around, the Maintenance-in-Progress light was shining brightly.

And there were mornings when MRS acted just plain sluggish. We would watch the voltage monitors, and those meters would take just too much time to get up to the proper levels. We checked the power coming into the machine room, and it was okay. This bug also defied discovery. MRS was just going to take her own sweet time about getting ready to work.

THINGS were fast coming to a head. We were running MRS three shifts now just to get the work out. Dozens of times a day the maintenance light would turn on, and the removal arms would go wandering around the room somewhere. Almost continuously we could hear the built-in drills or grinders or something working away inside the maintenance unit. And in spite of a hundred tons of air conditioning, there was always the smell of burnt solder flux in the machine room.

Finally the Chief threw in the towel. He gave the order to shut down MRS for a while and for us to dig in and modify the automatic maintenance. Maybe with part of this operation on a manual basis and dependent upon human decisions, we would be able to get more good time from the computer. However, we had one important job to do before the shut-down, and I drew the duty to sit with MRS on this last run.

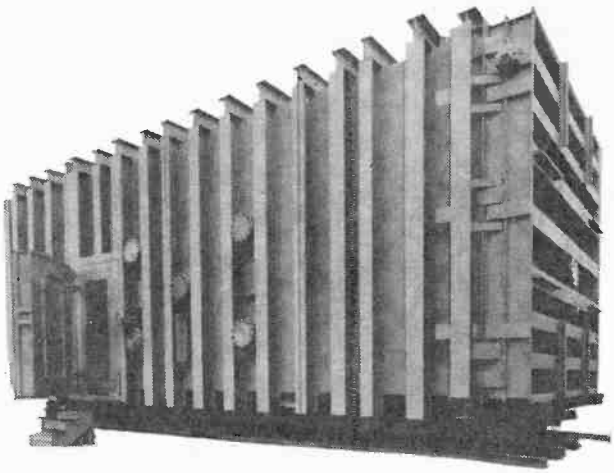
(*Continued on page* 125)



By HUGH B. BROUS, JR.

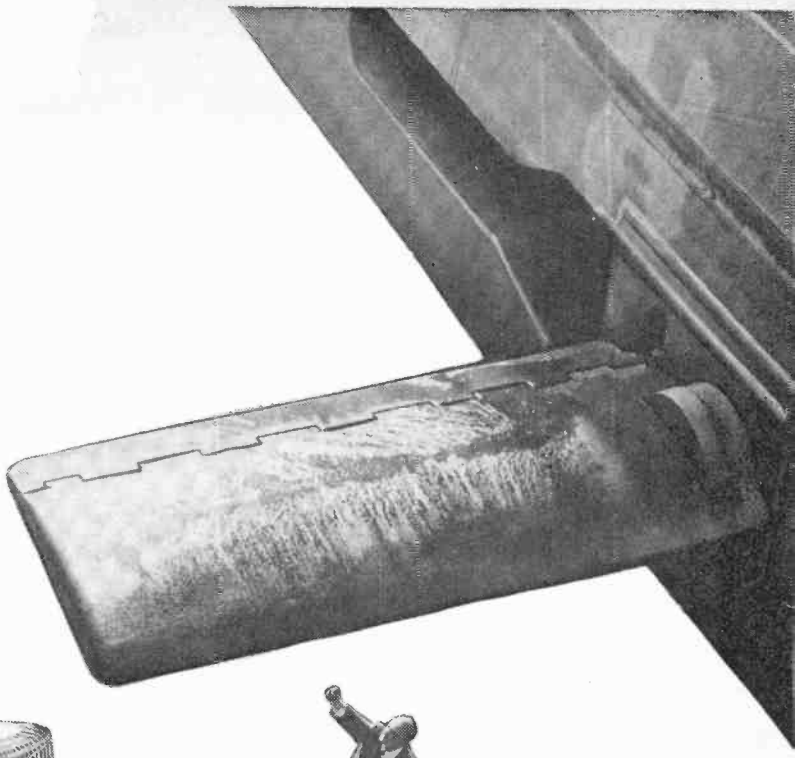
Electronics Today

The phone booth of the future, designed by Bell Telephone Laboratories, will have a plastic bubble dome for maximum visibility. It will be installed in an indoor area, such as a railway concourse.

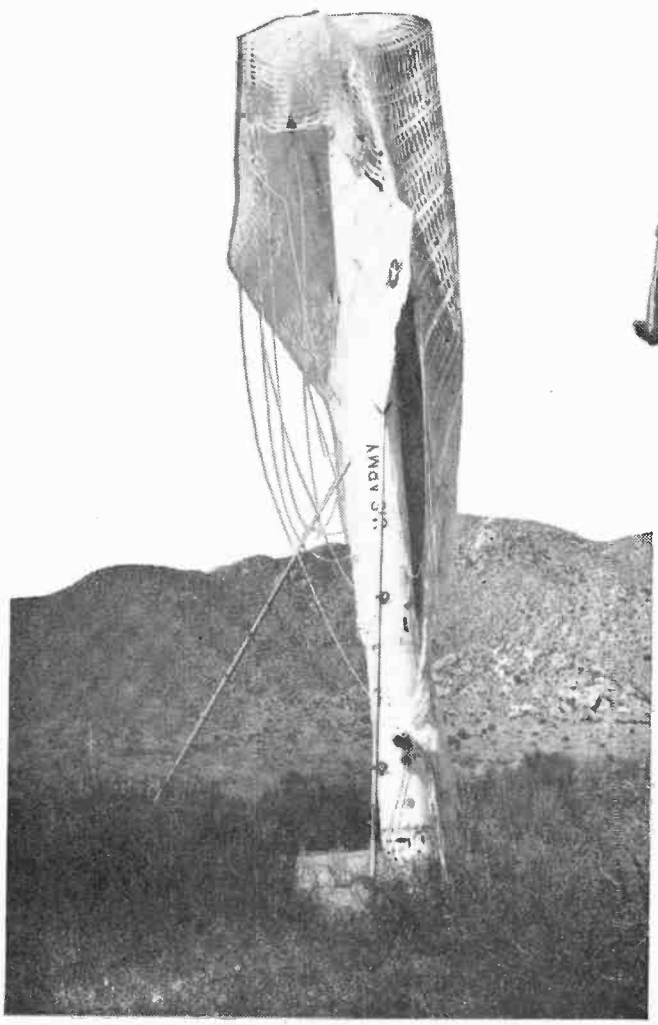


Huge environmental test chamber, designed by Tenney Engineering for supersonic aircraft and missile testing, has temperature range from −100° to +1200° F, and can simulate 150,000-foot altitudes.

Solar cells on top of helmet power a tiny transmitter and receiver during daylight. The silicon cells also charge four small storage batteries to operate the set at night. (U. S. Army Photo)

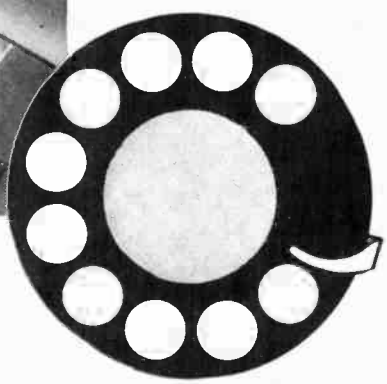


This big flipper protruding from the hull of the "U.S.S. Compass Island" reduces the ship's roll by as much as 90%. A gyro unit controls the fins electronically. The extra stability helps the ship launch missiles with much greater accuracy. (U. S. Navy Photo)



When the "Kingfisher" missile lands, its long nose sticks deep in the ground and prevents damage. The parachute draped over the tail of the Lockheed missile slows it down so it can be used again as a supersonic target missile.

This driver can pick up the phone and dial a number just as he would with a conventional telephone.



Dial While You Ride

By HARRY J. MILLER

A TWO-WAY radio dialing system between roving vehicles and base stations operates through a telephone answering service to provide round-the-clock service in Sarasota, Florida.

The operator of a car or truck can dial other subscribers to the service with the same privacy afforded by conventional telephones. And it's not necessary for the operator of a vehicle to monitor all calls to be sure to get one intended for him.

The system also leaves its calling card. Should the driver be absent from his vehicle, its horn blows for six seconds to announce an incoming call. Then a buzzer sounds for six seconds. This is cut out by a red warning light that glows until the driver returns, telling him that a message awaits. Any subscriber may talk to any other subscriber through the central-office 250-watt transmitter which provides 75-mile coverage.

Each phone unit is designated by special dial numbers of only three digits. The driver simply reaches for his directory as he would for a telephone directory, hunts up the three-digited number of the person he wants to contact, and dials the trio of digits, without alerting others. Or a special number may be dialed to signal a group of vehicles or all mobile units simultaneously.

In addition to the mobile units in vehicles, walkie-talkie units can be used in areas impassable by a vehicle. -30-

This is MARS Station AF4FYC in Barnesville, Ga., opening Eastern Net No. 3 on an assigned frequency of 4595 kilocycles. Roll Call will begin immediately following the next broadcast. Stand by.

This is MARS station AF4FYC in Barnesville, Ga., starting operations. Stations within Eastern Net No. 3 will now answer roll call. . . .

A MARSman TELLS ALL

U. S. Army Photograph

Amateurs are coached in all phases of radio communications —they provide emergency service in times of disaster

EACH WEEK calls such as the above launch amateurs all over the country on a two-hour on-the-air training session with the Military Affiliate Radio System. A joint U. S. Army and Air Force program, MARS has been responsible for teaching thousands of hams, in uniform and out, more about their favorite hobby. By participating in MARS, amateurs have gotten the benefit of topnotch coaching to sharpen their on-the-air technique. They've even received surplus equipment to use in improving their own rigs.

When MARS started out in late 1948 as the Military Amateur Radio System, it was a program for servicemen and reservists only. But today a tremendous number of MARS members are civilians without any military affiliations. Take the Army part of the program, for example. It has about 560 MARS stations on military posts but over 4000 members are civilians.

All it takes to join MARS is an FCC radio amateur license and equipment capable of operating on at least two MARS frequencies. Would-be amateurs who lack both license and equipment can still participate by belonging to a school or private radio club that holds a MARS membership. Enrollment in a Reserve or National Guard unit with a MARS station offers an extra method of participating.

A typical MARS local net might include among its members a high school junior, an electrical engineer, a stock broker and an auto mechanic. To keep in good standing, a member must take part in at least six hours of drill every three months. Considering that each net is usually on the air

once a week, this requirement is easy to meet.

Membership Benefits. Operators of MARS stations find it pays to stay in the program. They get a good deal more than on-the-air training out of it.

A member is eligible to take, without charge, a whole slew of correspondence courses offered by the Army Signal Corps and the Air Force Extension Course Institute. Through this program, members can learn more about such things as electrical fundamentals, radio fundamentals, radio receiver servicing, and amplifiers. They can even get the lowdown on television and cathode-ray tubes. For the advanced amateur, there are courses in FM and microwave propagation, among others.

On top of that, a MARSman in good standing is entitled to long-term loans and outright gifts of certain surplus equipment. A few members have received complete transmitters and receivers, though this is admittedly rare. It isn't at all unusual for a member to get such items as crystals, tubes, chokes, resistors or switches. Generally those who do the most get the most. The Air Force has even worked up a point system along these lines.

The MARS member who finds himself going into the Army or Air Force gets still another benefit. He can obtain a certificate of participation to use during his pre-induction processing. It won't guarantee a communications assignment, but it will go a long way toward getting one.

Services Performed. Both the Army and the Air Force consider MARS a very handy thing to have around. In case of either a civil or military emergency, it provides them with a topnotch backup system that could take over should regular communication channels be overloaded or out of commission.

Personal messages between GI's and their families, which make up much of the traffic during training drills, help boost Armed Forces morale, especially overseas. And, though membership involves no military obligation, MARS offers the Army and Air Force a pool of trained potential operators in the event of a national emergency, as well as a superb after-hours training ground for their own personnel.

The Kentucky floods of 1957 provided an example of how both civilian and military-unit MARS stations can be of real service to a community. For instance, ham station W4RPF was a vital link between stricken areas and Louisville, working both the local MARS nets and the Kentucky Phone Net. Considerable Kentucky Phone Net traffic was also handled by K4WBG/AA4WBG, a military-unit MARS station operated by Regular Army personnel.

Taped lecture being put out over the First Army's MARS Technical Net by Ed Piller, who serves as net control station and program director.

Traffic Setup. When a ham joins MARS, he is assigned a special call sign based on his FCC call sign. Usually, the main difference is the prefix. For instance, the Army MARS call sign for W2XYZ would be A2XYZ; the MARS call sign for K2XYZ would be AA2XYZ. An Air Force MARS member whose FCC license was K4FCV would be referred to as AAF4FCV.

Regular amateur frequencies are never used for MARS traffic. Instead, frequencies assigned to the Army and Air Force and set aside by them for the MARS program are used. Likewise, standard military procedures and message forms are employed.

As in any military-type organization, MARS nets are set up on a pyramid basis.

M/Sgt Kenneth C. Cruisant broadcasts by c.w. from WAR/K4USA, the Army's headquarters MARS station in the Pentagon, as visitors look on. (U. S. Army Photo.)

At the very bottom is the individual station. Together with other stations, it makes up a local or district net, headed by an advanced amateur who serves as net control.

District net control stations form a state net, the net control stations of which in turn form Army-area nets. There are six numbered Army areas in the continental United States. The net control stations of these Army areas form a Department of the Army net, with Pentagon station WAR/K4USA serving as Net Control Station.

Air Force MARS is organized along much the same lines, with stations within the United States coming under the Continental Air Command and its three numbered Air Forces. Sitting alongside WAR/K4USA is AIR/K4AF, the Air Force headquarters station in the Pentagon.

Net Control Stations. For their separate organizations, these headquarters stations serve much the same functions. In addition to heading the Army- and Air Force-wide nets, they listen in on local MARS nets and join in from time to time as participants or teachers.

They broadcast once a week on phone or c.w., on four frequencies simultaneously. These broadcasts contain general-interest items, special-event announcements, and data on new MARS operating methods.

The stations are manned around the clock

1st Lt Ernest Berlucci, MARS officer, looks on as SSgt Robert D. McEvoy and A3/C Roger A. Maloney tune MARS station of New York Air National Guard's 106th Tactical Control Squadron.

by Pentagon-stationed soldiers and airmen. Equipped with an impressive array of the latest gear, they are a mecca for MARS members visiting Washington. During appropriate hours, such visiting members are frequently permitted to operate the stations.

Almost rivaling this Pentagon rig in size and flexibility are some of the larger military-post stations. For instance, Fort Monmouth, N. J., maintains a radio club that embraces both MARS and standard amateur activities. It has seven studios, one of them set aside for MARS work and equipped with BC 610, Viking Ranger and Eldico MIL-100 single-sideband transmitters, together with Hallicrafters SX-100 and military R 390 receivers. All studios have telephone-patch equipment, and the entire setup feeds into a huge Telrex antenna field.

HOW TO JOIN ARMY MARS

While both Army and Air Force MARS are officially open to new members, the Air Force's Continental Air Command is currently reorganizing its program. Anybody who wants to join MARS now would do best to look into the Army's program.

If you are at least 16, have a valid amateur radio license from the FCC, and have equipment that can handle at least two MARS frequencies accurate within 0.01%, you can join. Membership is also open to amateur clubs with trustee-type FCC licenses.

Full details are available from the MARS director of your local Army area. Here are the addresses of the Army headquarters and the states they cover:

First Army, Governors Island, New York—N. Y., Vt., R. I., N. H., Maine, Mass., Conn., N. J.

Second Army, Fort George G. Meade, Md.—Pa., Ohio, Ky., W. Va., Md., Va., Del., D. C.

Third Army, Fort McPherson, Georgia—Tenn., N. C., S. C., Miss., Ala., Ga., Fla.

Fourth Army, Fort Sam Houston, Texas—Okla., Tex., N. Mex., Ark., La.

Fifth Army, Chicago, Ill.—Wyo., Colo., Kans., Nebr., Mo., Iowa, N. D., S. D., Minn., Wis., Ill., Ind., Mich.

Sixth Army, The Presidio of San Francisco, Calif.—Wash., Oreg., Calif., Nev., Ariz., Idaho, Mont., Utah.

A Typical Evening. Let's take a look at a typical evening with an Air Force Mars net. It begins at about 9 p.m. local time with the transmission of routine traffic. This generally consists of personal messages, of which there is usually a plentiful supply. But once in a while, when necessary, dummy traffic will be prepared. The net control station keeps close tabs on everyone's operating technique and credits participating stations.

After traffic has been handled, the NCS may use the remainder of the training period for informal net time, during which a general critique might be held. Sometimes, the NCS may ask a member to give a short talk on some phase of operating procedure.

In addition to this standard MARS net, the Air Force maintains special c.w. nets for reserve personnel. Participating reservists are awarded promotion and retirement credit.

Technical Program. Though the main purpose of both the Army and the Air Force MARS programs is to provide training in radio communications procedure, there are some specialized function nets around the country. One of the most interesting is a technical net operated by the First Army, which covers an area including the New England states, New York and New Jersey. A sort of seminar of the air, it is the brainchild of Ed Piller, W2KPQ/A2KPQ.

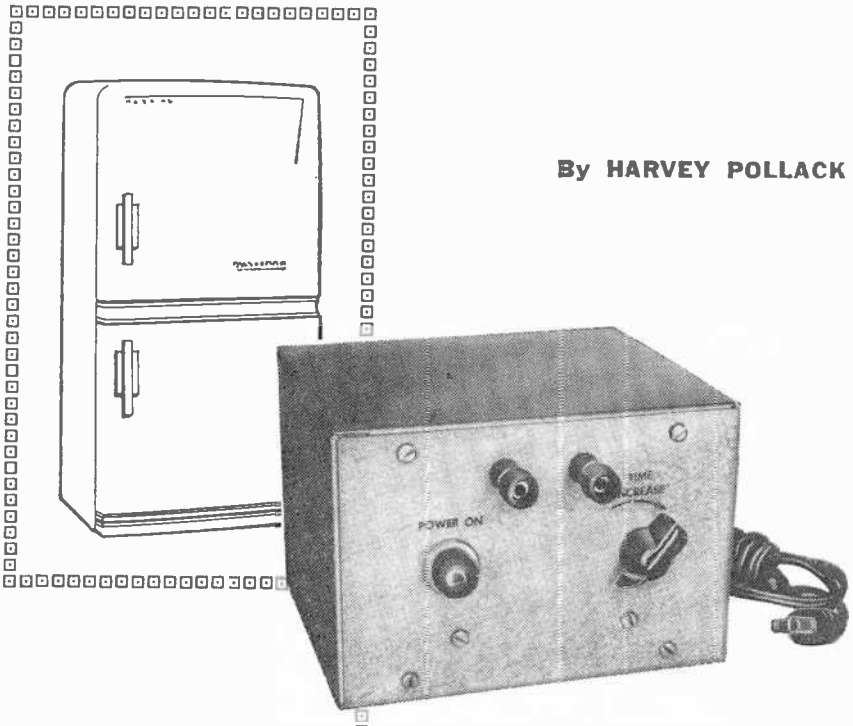
An electronics engineer with the National Broadcasting Company, Ed has been in ham radio since 1937. He joined Army MARS in June, 1957, and after a while got the idea that technical—as well as operational—training should have a place in the program. First Army MARS agreed with him, and last January the Technical Net, operating on single sideband, went on the air with Ed serving as net control station and program director.

Operating from his home in Queens, New York, Ed lines up guest speakers on a broad range of subjects. They generally broadcast from Ed's home or from a net member's station near them, offering about a 40-minute talk on their chosen subject. Following this, the remainder of the period is devoted to an on-the-air question-and-answer session between the net members and the speaker.

If it isn't practical for the speaker to talk directly from one of the member stations, he may deliver his lecture via a phone patch into the nearest station, or his talk may be presented on tape, with a phone patch used for the question-and-answer session afterward. Listeners often tape these talks off the air for later reference.

Some of the subjects already covered include "Little Known Facts About the Broadcast Industry," "Color Television," "Instrumentation for Launching the Van-

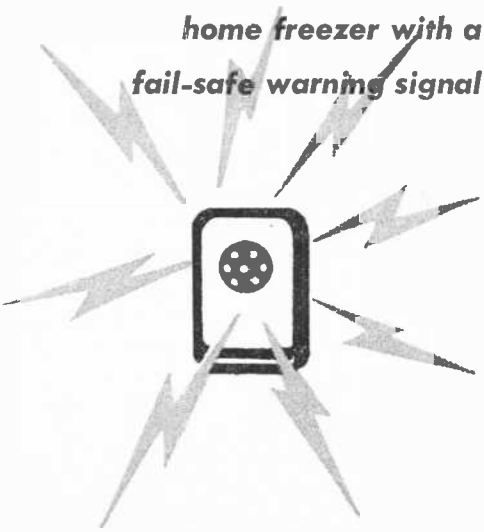
(*Continued on page* 123)



By HARVEY POLLACK

Power Failure Alarm

Protect the food in your home freezer with a fail-safe warning signal



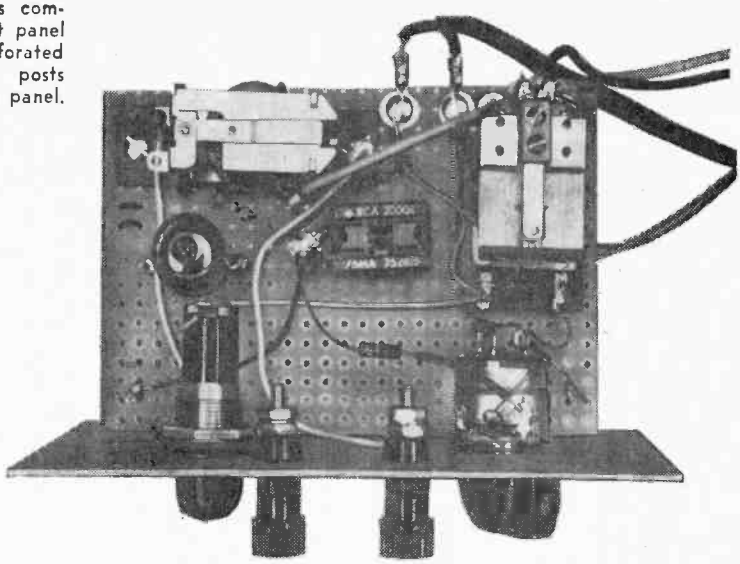
POWER FAILURE can be an expensive tragedy to the suburban home owner. Hundreds of dollars' worth of food stored in the refrigerator or deep-freeze in the summertime could be ruined. With an investment of only a few dollars and a couple of evenings of pleasant work, a power failure alarm can be built that will sound an emergency signal when power is off for a significant interval.

Power may go off for a few minutes and then return. The only casualty from this momentary failure is a slowing down of your electric clock. However, when power is lost for upwards of 15 or 20 minutes, things begin to get serious. Often the trouble may not be corrected for hours.

The alarm system described here was designed with this important time factor in mind. You can adjust the timing period so that the alarm will "wait" anywhere from 1½ minutes to a full hour after the power fails before giving the alarm. A built-in battery supply actuates the alarm relay in the absence of line voltage, but since there is no battery current drain while the line power is normal, the batteries need not be checked more than once a year.

Construction. A small commercial metal cabinet is used with removable front and

Top view of chassis shows components mounted on the front panel of the cabinet and the perforated board. Both of the binding posts should be insulated from the panel.



rear panels that serve as the supports for all the components. A sheet of perforated Bakelite cut to 5" x 3¼" is secured to the panel by means of a homemade bracket roughly 4" long with ⅝" flanges. The perforated panel can be cut to size with metal shears and drilled with ordinary woodworking bits.

Timing capacitor *C1* is mounted below the chassis and is secured by passing its leads through the panel and soldering them to the nearest terminations. The negative lead of the capacitor is connected to the negative terminal of rectifier *SR1* and the positive lead is soldered directly to one terminal of the switch (*S1a*). When fastening the chassis-holding bracket to the front panel, the chassis should be positioned so that the 3S4 tube (*V1*) will slip past the flanges easily.

When the wiring is complete, do *not* connect the batteries until you perform a few simple tests.

Testing and Adjustment. With *S1* open, connect an ohmmeter across the leads that will go to the 1½-volt battery (*B1*). The reading should be infinite. With the leads still connected, and *V1* in its socket, close the switch and observe the ohmmeter; its reading should now show a few ohms—the resistance of the 3S4 filament. Now push down the armature of *RL1* by hand; the ohmmeter reading should again be infinite.

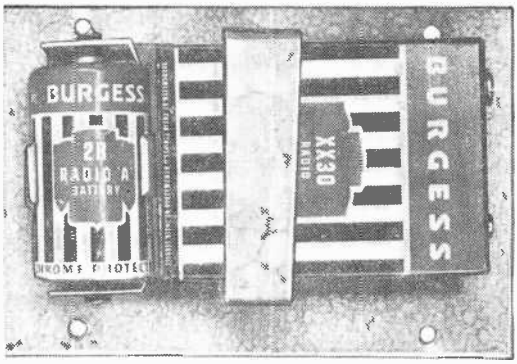
Connect the ohmmeter across the clips that will be connected to the 45-volt battery (*B2*). The reading should be infinite with *S1* in any position. Unless this measurement is obtained, do *not* connect the batteries. Check the wiring for possible errors or short circuits. Make sure that the a.c. line does not contact the metal cabinet.

Connect the battery leads, being sure that the polarities shown in the schematic diagram are carefully observed. Turn the switch on and observe the armature of *RL2*. This should pull in within a second or two of closing *S1* and should release when *S1* is again opened.

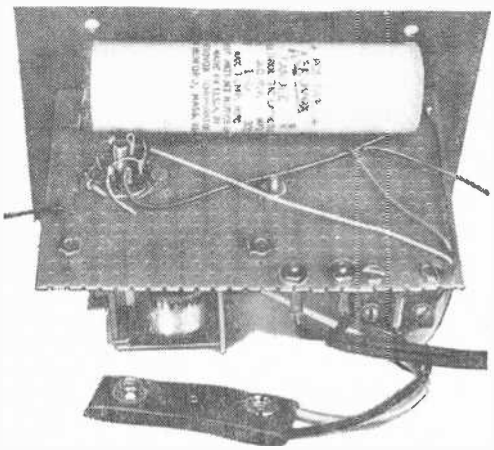
Plug the line into an a.c. outlet. *RL1* should pull in at once and the neon indicator (*PL1*) will glow. After the unit has been on for about one minute, and with potentiometer *R3* fully counterclockwise, remove the line cord from the a.c. receptacle. After about 1½ minutes, *RL2* should pull in and stay in. This is the short timing period.*

Repeat this procedure for various settings of *R3* and note the time delay for each setting. You should get a delay of approximately one-half hour with *R3* fully clockwise. Should you want longer "waiting" periods, *R3* may be changed to a potentiometer of up to 10 megohms. Omitting *R2* and *R3* will provide intervals up to five hours or more, since the discharge of *C1*

* If *RL2* is not activated, adjust its tail spring to obtain pull-in at a lower current. Remove the small screw that holds the tail spring in place and bend the spring *very slightly upward*. Then replace the screw.



Mount timing capacitor C1 by threading its leads through perforated board (below). At right, the batteries are shown mounted on rear panel, the larger one being held in place by a strap of aluminum, cut and bent to fit.



will occur only through its own leakage resistance.

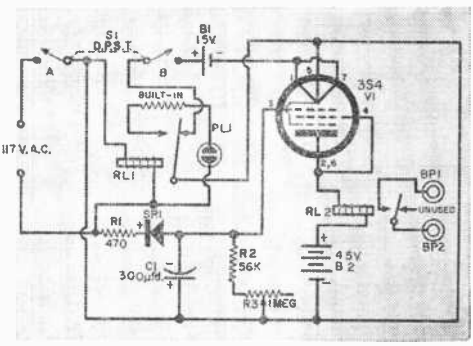
Installation. In most installations, the alarm signal will have to be a loud bell that can be heard quite a long distance away. For this reason, no auxiliary battery supply was included in the case. Large 6-volt or 12-volt bells may be purchased, but the current drain would be prohibitively high for any small cells that might fit in the little cabinet. Thus, it is left to the discretion of the builder to choose his own alarm device and its source of power.

A good choice would be the new low-priced "Scarum" alarm which is powered by a single Size D flashlight cell. Although this alarm was originally intended for burglar protection, a slight modification adapts it for power failure indication. Simply remove the leaf-switch installed on the end of the two-conductor cable of the "Scarum" alarm box and attach one of the two cable conductors to terminal *BP1* and the other to *BP2*. When activated, the built-in siren can be heard 500 feet away. –30–

HOW IT WORKS

With a.c. power applied to *RL1*, the armature is held down. The 1½-volt battery circuit is therefore open and the filament of *V1* cannot heat. At the same time, *C1* charges to peak line voltage (about 150 volts) through rectifier *SR1* and maintains a negative bias on the control grid of *V1*.

If the power fails, *RL1* releases. The upper contacts close *V1's* filament circuit but the negative grid bias due to the charge on *C1* prevents plate current from flowing through *RL2*. This charge, however, will gradually leak off through *R2* and *R3* if power is not restored. When the bias on *V1* falls below about 5 volts, sufficient plate current will flow to close *RL2*, and the alarm sounds.



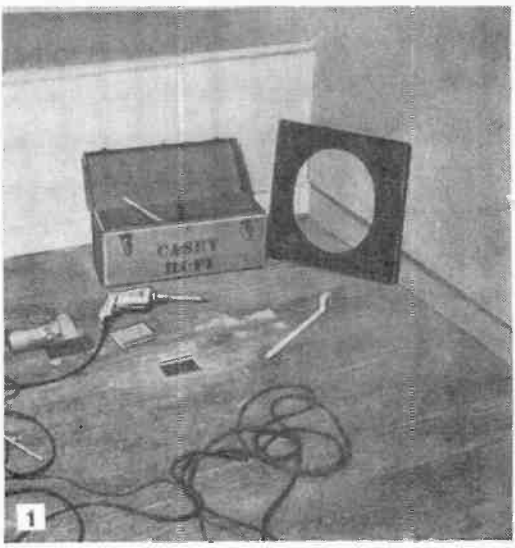
PARTS LIST

B1—1½-volt Size D battery
B2—45-volt battery (Burgess Type XX30)
BP1, BP2—Insulated binding post
C1—300-μfd., 150-volt electrolytic capacitor
PL1—Neon pilot assembly with built-in resistor
R1—470-ohm, ½-watt resistor
R2—56,000-ohm, ½-watt resistor
R3—1-megohm linear-taper potentiometer
RL1—117-volt a.c. coil assembly, s.p.d.t. contacts (coil—Guardian #200-115A; contacts—Guardian #200-M-1)
RL2—5000-ohm coil relay, s.p.d.t. contacts (Potter and Brumfield LB-5)
S1—D.p.s.t. toggle switch mounted on potentiometer R3
SR1—75-ma., 130-volt selenium rectifier
V1—3S4 tube
1—4" x 5" x 6" aluminum cabinet (ICA 29812)
1—Black pointer-type knob for ¼" shaft
1—7⅜" x 6¾" perforated Bakelite sheet
1—7-pin miniature socket
1—"Scarum" battery-operated siren (G. I. Specialty Co., 3361 York Rd., Philadelphia 40, Pa.)

Is speaker cabinet placement a problem in your home? Have you been told by the little woman that either she or your 10-cubic-foot boom-box has got to go? Before you make up your mind, consider the solution shown below. Get your system "off the ground" and try . . .

Ceiling Mounting

1 The first step is to cut a pilot hole to locate the cross beams under the flooring. (You don't want the speaker radiating directly into a 6" x 6" or 2" x 8" floor joist.) The beams are spaced about 16" apart and the speaker mounting board should be centered directly above and between them for proper frequency dispersal.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2 A guide hole should be drilled from above, through the ceiling plaster, to indicate the center of the speaker opening. A circle is scribed from below, its radius dependent on the louver used. In general, the larger the ceiling cutout, the better the results will be.

3 The baffle board is screwed securely to the floor boards above. Weather stripping can be used between the speaker board and floor to insure an airtight seal and prevent loss of bass frequencies. If you use standard wood screws on a hardwood floor, drill pilot holes first.

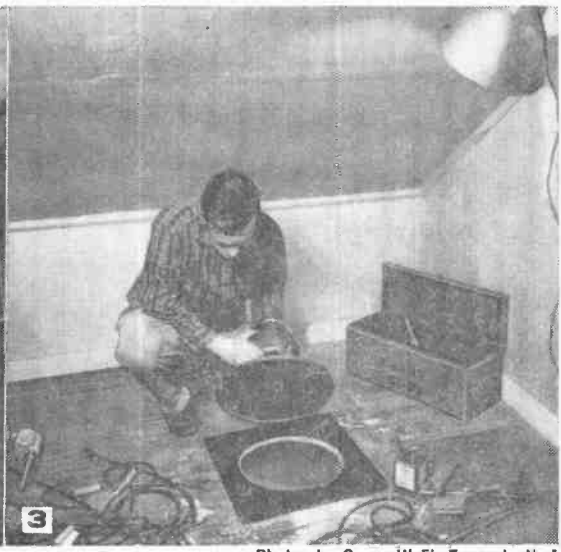
4 The Altec Lansing 604D speaker and crossover are securely mounted, and connecting cable back to the amplifier output is hooked in. Do not box in the speaker from the rear or its bass response will suffer. A small open enclosure, such as a wicker basket, can be placed over the back of the speaker for protection.


4

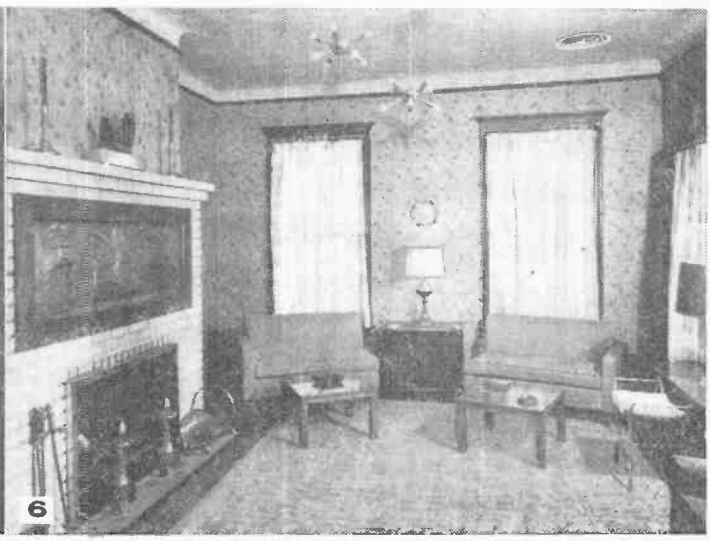
5 The job is completed by attaching the louver to the ceiling from below. If a metal louver is used, make sure it has no resonances that may cause it to vibrate in sympathy with certain musical notes. If desired, an ordinary wooden picture frame of the desired size with a grille cloth covering can be employed instead of the louver.

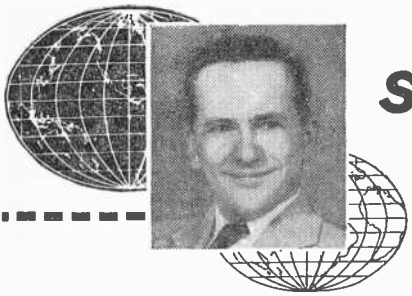
6 A true infinite baffle has been achieved at low cost. The system works best if you have high ceilings, and, of course, a floor above you on which to mount the speaker. Tonal balance can be adjusted by furniture placement. An overstuffed chair or couch beneath the speaker opening will reduce room resonances and smooth out response.

a Hi-Fi Speaker



Photos by Casey HI-FI, Teaneck, N. J.





Short-Wave Report

By HANK BENNETT

BRITISH GUIANA lies in the northeast corner of South America between Venezuela, Brazil, and Surinam. Its total area is estimated at 86,000 square miles; the 1956 population was 508,000. The capital of this country is Georgetown, and it is here that we find *Radio Demerara.*

Wire broadcasting was introduced to the people of Georgetown in 1926. Operated over the telephone lines, it was available to telephone subscribers for a small fee. Programs received from Daventry (London) were relayed over this system.

A year later this service was abandoned upon completion of a low-powered short-wave transmitter which was placed in experimental service. Programs were broadcast for about two hours daily on 47 meters (about 6300 kc.) and later on 6840 kc. until 1931. (Editor's Note: Can any of the old-timers tell us the exact frequency of the early 47-meter transmission?)

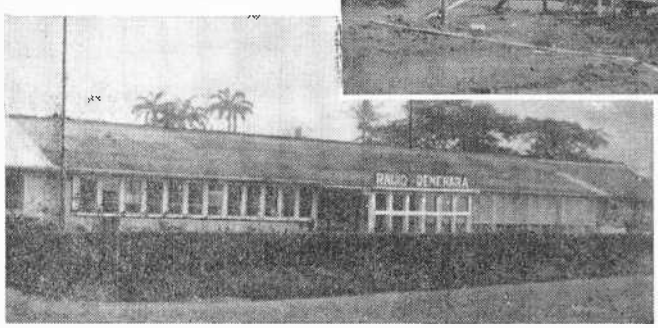
Starting in 1935 two stations, VP3MR and VP3BG, were operated independently on a commercial basis with sponsored programing. In 1938 they were amalgamated into the British Guiana United Broadcasting Co., Ltd., which was financed by local firms and individuals. A medium-wave outlet was placed in service the following year. Then in 1950, Overseas Rediffusion Limited purchased a controlling interest and a 15-year franchise was granted by the government.

In 1955 this company opened a well equipped studio in Georgetown and two years later a new transmitting and receiving station at Sparendaam. Programs from Georgetown are now carried by land wires to Sparendaam.

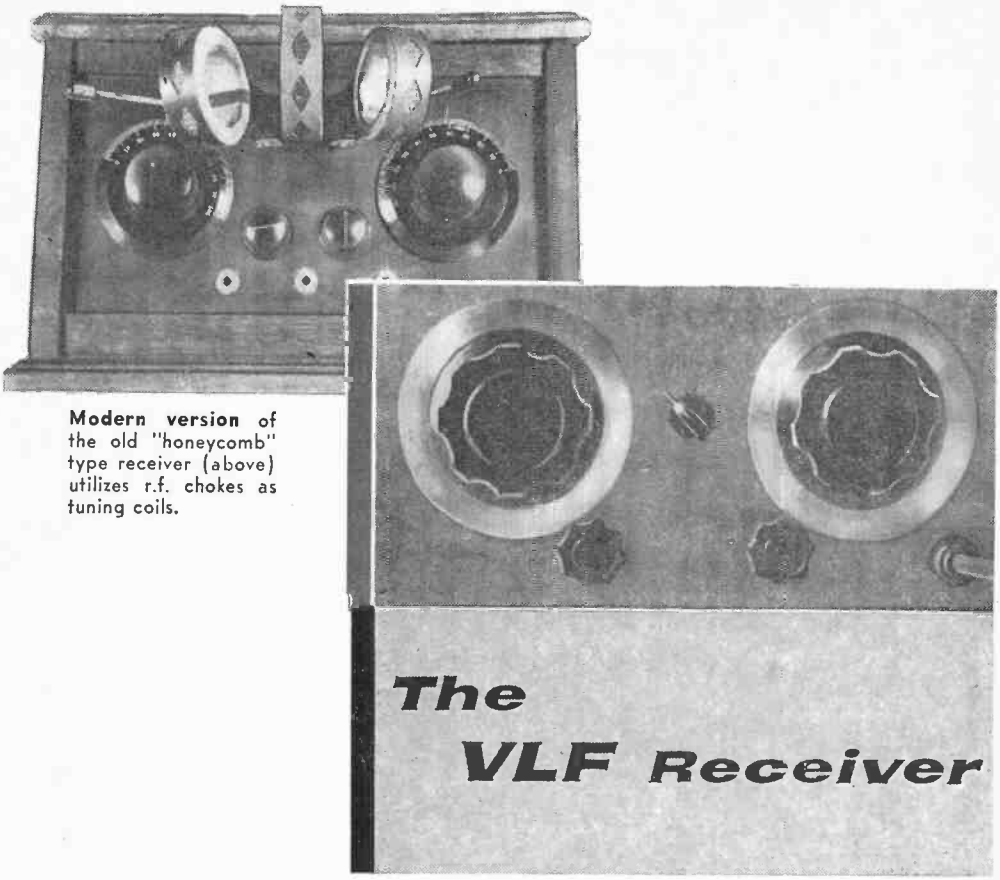
Radio Demerara, ZFY, operates on 5981 and 3255 kc. with 2000 watts power and on 660 kc. (medium wave) with 10 kw. The current schedule reads as follows: Monday to Friday at 0410-1445 on 5981 kc., at 1445-2145 on 3255 kc. (Saturday closing is at 2245; Sunday opening is at 0440).

The antennas used for short-wave transmitting are two spaced dipoles for vertical

(*Continued on page* 130)



Radio Demerara's transmitter building at Sparendaam (right) and studios in Georgetown.



Modern version of the old "honeycomb" type receiver (above) utilizes r.f. chokes as tuning coils.

The VLF Receiver

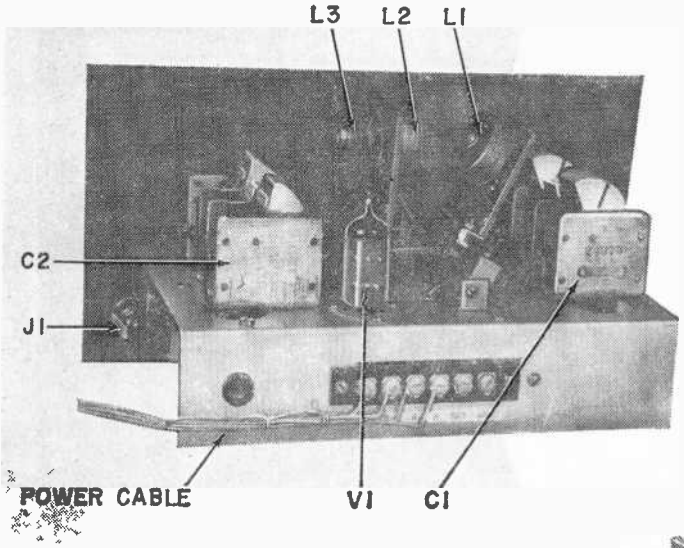
Explore the long waves . . . listen to marine transmissions on the very low frequency band

By **F. J. BAUER, Jr., W6FPO**

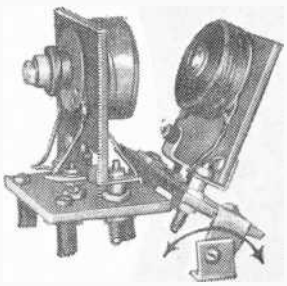
TO MOST EXPERIMENTERS, the radio-frequency spectrum below 100 kc. is an unexplored mystery. In the old days, plug-in "honeycomb" coils were used in receivers tuning up to 30,000 meters (10 kc.) Such a receiver with a set of coils is shown above—it is over thirty years old and is a collector's item.

Although honeycomb coils are no longer available, a modern version of this receiver can be built using readily available r.f. chokes. Their *Q* is not as high as that of the older honeycomb coils, but the chokes work well and enable the construction of a v.l.f. receiver at moderate cost.

Stations NSS, Washington, D. C. (15.5 kc.), NPM, Honolulu (17 kc.) and NPG, San Francisco (19 kc.), were picked up in Los Angeles without difficulty using a low 50′ antenna. These "old reliables" in the v.l.f. band transmit weather and traffic data



Placement of major parts of the v.l.f. receiver is shown in the top chassis view at left. Below is a detailed view of the adjustable coil assembly.



to vessels at sea and are excellent for code practice purposes. Other broadcasts have been picked up including an occasional European station DX'ing through.

The coil socket assembly sketch (see p. 80) is used as a guide for the coil assembly banana jack mounting. Exact spacing is not critical, but make sure that all coils can plug in without binding.

It's best to mount the socket assembly *before* the other top chassis components and panel to allow room for adjustment. Don't forget to put the fiber washers between the mounting brackets. When properly adjusted, they provide the right amount of friction for convenient variation of the antenna coil coupling. (Antenna coupling is varied only occasionally during receiver operation.)

The secondary coil (*L2, L3*) socket is mounted on ⅝" spacers to raise it to the same level as the antenna coil (*L1*) socket. Orient it as shown and position the grid coil lugs for ease of soldering.

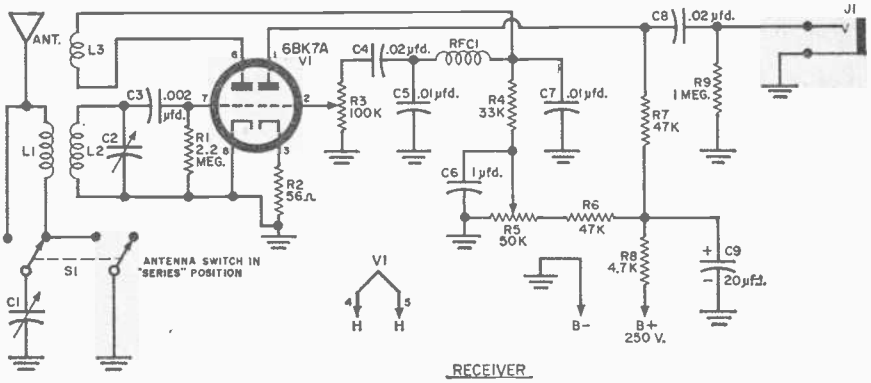
Solder short lengths of hookup wire to the *L3* jacks before mounting since they will not be accessible after installation of the assembly. Run the antenna and plate coil leads through holes in the chassis protected by rubber grommets.

Assembly and wiring of the rest of the receiver is simple, once the coil sockets have been mounted. Be sure that the series-parallel switch (*S1*) is wired correctly; otherwise, it will be impossible to tune the antenna circuit.

Standard three-gang capacitors with all sections connected in parallel are used to obtain the necessary 1000 $\mu\mu$fd. Either a t.r.f. or a superhet type provides sufficient capacitance. Remove all trimmers to enable the minimum capacitance to be as low as possible.

The 150-mh. r.f. filter choke (*RFC1*) underneath the chassis is mounted with a *brass* bolt and a short (¼") spacer. Do not use a steel bolt for any of the coils or performance will be impaired. No other special precautions are needed in mounting the parts.

No power supply is built in since many experimenters may want to use an audio amplifier for loudspeaker operation and



power can be tapped from the amplifier. If a separate power supply is preferred, the one shown works well and decoupling filter *C9* and *R8* may be omitted in the receiver proper. Neither side of the tube filament is grounded at the receiver chassis. Ground is made at the amplifier or power supply used with the receiver.

Connect the receiver to a power supply or amplifier, and start with the lowest frequency coil set first. Mount a 150-mh. and 0.75-mh. coil on one of the coil plates as shown using a brass nut and bolt. The 150-mh. coil is mounted on the side of the coil plate with the widely spaced plugs. Connect the coil terminals to the corresponding plug terminals with short pieces of hookup wire and plug in the assembly.

If the coil socket wiring is correct, the

RECEIVER PARTS

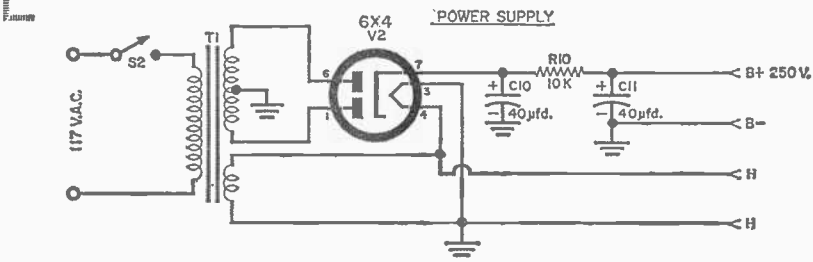
C1, C2—3-gang tuning capacitor (all sections wired in parallel)
C3—0.002 µfd.
C4—0.02 µfd.
C5—0.01 µfd.
C6—1-µfd., 600-volt tubular
C7—0.01 µfd.
C8—0.02 µfd.
C9—20-µfd., 450-volt electrolytic
J1—Open-circuit phone jack
L1, L2, L3—See text
R1—2.2 megohms
R2—56 ohms
R3—100,000-ohm potentiometer (audio taper)
R4—33,000 ohms
R5—50,000-ohm wire-wound potentiometer
R6—47,000 ohms, 1 watt
R7—47,000 ohms
R8—4700 ohms, 1 watt
R9—1 megohm
RFC1—150-mh. r.f. choke (Miller #961 or equivalent)
S1—D.p.d.t. rotary switch
V1—6BK7A tube
1—9" x 4½" x 2" chassis
2—Shaft couplings, ⅜" to ¼" shaft reduction
6—Banana jacks (Johnson 108-740 or equivalent)
20—Banana plugs (Johnson 108-750 or equivalent)
20—Small angle brackets (American Radio Hardware #1 or equivalent)
2—3" or 4" dials
3—Knobs
1—5½" x 11" panel
1—6-lug terminal strip
1—Tube socket for V1
1—Phenolic or Bakelite sheet, approx. 6" x 9", ⅛" thick

All capacitors are ceramic types, 400-volt or higher rating, unless otherwise noted.

All resistors are ½-watt composition unless otherwise noted.

POWER SUPPLY PARTS

C10, C11—40-µfd., 450-volt electrolytic capacitor
R10—10,000-ohm, 2-watt resistor
S2—S.p.s.t. toggle switch
T1—Power transformer; primary 117 volts; secondary 250-0-250 volts @ 10 ma., 6.3 volts @ 1.2 amp. (Chicago Transformer PV10S, Triad R-3A, or equivalent)
V2—6X4 tube
1—7-pin miniature tube socket
1—Small chassis



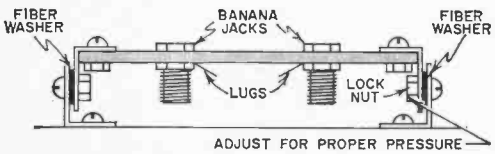
ANTENNA COILS

Frequency Range (kc.)	L1* (mh.)		Switch Setting Ser.	Par.
13–30	150	(#961)		X
34–70	150	(#961)	X	
25–65	30	(#692)		X
80–150	30	(#692)	X	
45–120	10	(#670 or 956)		X
140–280	10	(#670 or 956)	X	
100–240	2.5	(#640 or 953)		X
270–550	2.5	(#640 or 953)	X	

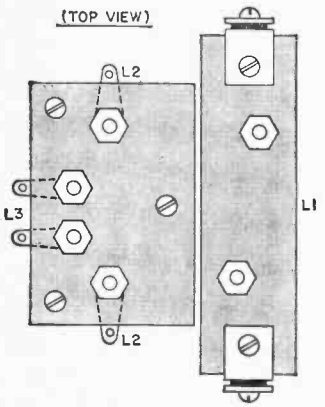
GRID AND PLATE COILS

Frequency Range (kc.)	L2	L3
13–56	150 mh. (#961)	0.75 mh. (#620)
40–180	15 mh. (#690)	0.25 mh. (#610)
140–550	1.5 mh. (#630)	8 turns (see text)

** Four antenna coils are used to tune the antenna properly with no gaps in the tuning range; this listing can be used as a guide for selecting the proper coil. All coil numbers given here are J. W. Miller (5917 S. Main St., Los Angeles 3, Calif.).*



ADJUSTABLE ANTENNA COIL SOCKET MOUNTING DETAIL (SIDE VIEW)



COMPLETE COIL SOCKET ASSEMBLY

detector will oscillate as evidenced by a short "plop" when the regeneration control is advanced rapidly. Make up a 150-mh. antenna coil as shown, plug it in, and check the receiver for operation.

Adjust the coupling with the antenna switch in "parallel" position and the antenna coil tilted about 30°. Advance the regeneration control (*R5*) until the detector is oscillating weakly and set the antenna tuning capacitor for maximum background noise, readjusting *R5* as required. Some signals should be heard at this point.

"Touch up" the tuning capacitors for maximum strength. Experiment with the coupling and tuning adjustments until you are familiar with the operation of the receiver and then make up the rest of the coils in accordance with the coil table.

The plate coil winding for the 140-kc. to 550-kc. band consists of eight turns of wire (salvaged from any r.f. coil) wound in the slot between the choke coil baseplate and the coil proper. Be sure to wind the eight turns in a direction *opposite* to that of the grid coil winding; otherwise the detector will not oscillate. If the tube does not oscillate, simply reverse the winding direction.

Coil connections are specified on the as-

(*Continued on page* 123)

HOW IT WORKS

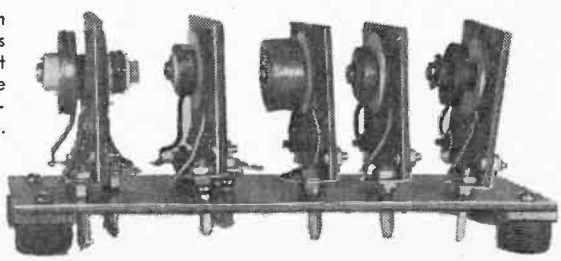
This is a regenerative receiver with positive feedback in the detector obtained through plate tickler coil *L3*. Regeneration is controlled by variation of the detector plate voltage with potentiometer *R5*.

One half of the 6BK7A twin triode (*V1*) functions as a detector and the other half as an audio amplifier. Choke *RFC1* and capacitors *C5* and *C7* supply the carrier frequency filtering required.

Both the antenna and grid circuits are tuned to the incoming signal to obtain maximum signal pickup and selectivity. Coupling is varied by changing the position of the antenna coil with respect to the grid coil.

An audio amplifier will provide loudspeaker operation and the amplifier's power supply may also be used to supply the 5 ma. drawn by *V1*.

A rack on which to store the coils when they are not in use can be made of scrap Masonite or Bakelite.



Among the Novice Hams

By **HERB S. BRIER,** W9EGQ

HOW IMPORTANT is transmitter power in an amateur station? Federal Communications Commission regulations limit Novices to a maximum power of 75 watts, while other amateurs are authorized to use up to 1000 watts. At the other end of the scale are the 50- to 150-milliwatt transistor transmitters, described from time to time in POPULAR ELECTRONICS and other magazines.

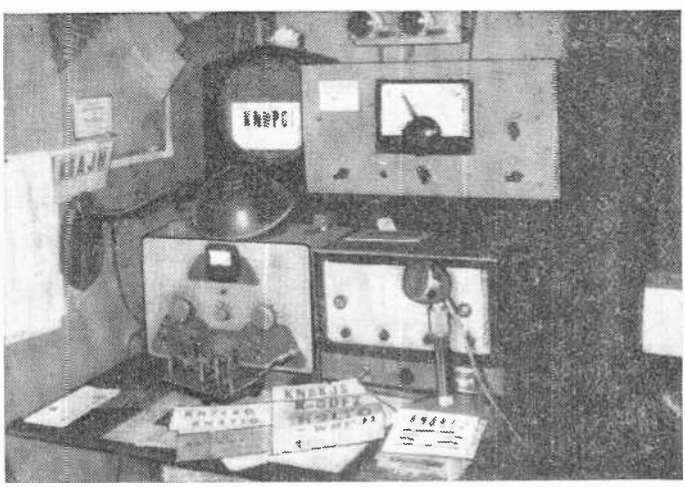
Is a Novice under a tremendous handicap in making successful contacts by being limited to a power of 75 watts, or is he foolish to invest in a 75-watt "powerhouse" when a fraction of a watt will do the job? The answers to these questions are important both to prospective Novices and to licensed amateurs who are sure that they would get out much better if they just had a bit more power.

To be honest about it, a high-power transmitter has an advantage in making contacts. However, it is easy to over-estimate how great this advantage is. When propagation conditions are favorable, a few milliwatts will transmit a readable signal across continents and oceans; but when conditions are unfavorable, 1000 watts or even 10,000 watts will not do it.

Before we can discuss the matter fully, we must first learn how the received signal strength is measured and the relation of transmitter power to it.

Measuring Signal Strength. The standard amateur method of rating the strength of received signals is by "S" (strength) units. S1 indicates a barely perceptible signal. S2 a very weak one, S3 weak, S4 fair, S5 fairly good, S6 good, S7 moderately strong, S8 strong, and S9 an extremely strong signal. These S numbers should not be accepted uncritically, but should be used as a guide with certain limitations.

The difference between consecutive S-units represents the minimum change in volume that the average person can unmistakably detect by ear. Many tests under controlled conditions have shown that this change represents a four-to-one change in power. Thus, to raise the strength of a *received* signal one S-unit requires raising *transmitted* power four times.



Tom Koch, KNØPDI, uses this picture of his station as his QSL card.

Similar tests have shown that the average person can just detect a two-to-one increase in power of a steady tone, if the change is made instantaneously without any other change taking place. A trained ear can detect a 25% increase of power under the same conditions.

Expressed in db (decibels), a four-to-one power increase is equal to a 6-db in-

HELP US OBTAIN OUR HAM LICENSES

K1/W1 CALL AREA

Douglas Wales, 512 Concord Ave., Belmont 78, Mass. (Code and theory)

Bob Birdsey (13), 310 Newfield St., Middletown, Conn. Phone: DI 6-0556. (Code and theory)

Danny Blouin, 27 No. Elm St., St. Albans, Vt. (Code)

Larry Bouchard, 27 No. Elm St., St. Albans, Vt. (Code)

Fred Macary (14), 36 Dixie Ave., Waterbury 6, Conn. Phone: PL 4-5910. (General code and theory)

Philip Schenck (14), Howard Rd., Westminster, Mass. (Code and regulations)

Paul A. Littlefield, Water St., Meredith, N. H. (Code, theory and regulations)

Edward Gomeau (16), 77 Prospect Heights, Pawtucket, R. I. (General code and selection of equipment)

Horace W. Clark (15), RFD #1, Wilton, Me. (Code and theory)

Robert Knapp, Jr. (14), Groton School, Groton, Mass. (Code, theory and regulations)

K2/W2 CALL AREA

Manny Marcel (13), 1112 Van Buren St., Uniondale, N. Y. Phone: IV 5-3314. (Code, theory and regulations)

Brian Yamione, 321 E. 178 St., Bronx 57, N. Y. Phone: CY 9-6383. (Technician code)

Joseph J. Miller, 89-24 92nd St., Woodhaven 21, N. Y. Phone: VI 7-7439. (Code and theory)

Alan Weberman, 50 Lefferts Ave., Brooklyn 25, N. Y. Phone: IN 2-2789. (Code and selection of equipment)

Steve Cohen (14), Box 963, So. Fallsburg, N. Y. (Code, theory and regulations)

Charles Louda, 430 E. 105th St., New York 29, N. Y. Phone: LE 4-2147. (Code and theory)

Sidney Kaplan, 2469 Ocean Parkway, Brooklyn 35, N. Y. Phone: NI 6-7159. (Code)

Roger Gounaud, Jr. (15), 8 Knapp Ave., Florham Park, N. J. (General code)

Stanley Sacharoff, 3155 Grand Concourse, Bronx 68, N. Y. Phone: FO 5-9727. (Code, theory and selection of equipment)

William Payette, Poolsbrook Rd., Kirkville, N. Y. Phone: OL 6-9842. (Code)

Pete Barbella (14), 27 Cottage Place, Tarrytown, N. Y. (Code and theory)

Barry R. Rothberg, 46 Kingfisher Rd., Levittown, N. Y. (Code, theory and selection of equipment)

Joseph Dudzik, 5 Washington Ave., Fords, N. J. (Code and theory)

Howard Ablan, Jr., 9 Sycamore Rd., Dumont, N. J. Phone: DU 4-4362. (Code and theory)

Gordon R. Utter, 326 Carpenter St., Oneida, N. Y. (Code and theory)

K3/W3 CALL AREA

Joseph McConaghy, Jr., 126 E. Lancaster Ave., Downingtown, Pa. (Code, theory and regulations)

William Edelstein (14), 5606 Woodmont St., Pittsburgh 17, Pa. (Code and theory)

Edward Barrows, 231 Main Blvd., Pittsburgh 37, Pa. Phone: FO 4-9142. (Code and theory)

Damon L. Barnhart, Knoxville, Md. (Theory)

Jeffrey Buckingham, R. D. #7, York, Pa. Phone: 4-6945. (Code and theory)

John B. Sevier, 4206 Park Heights Ave., Baltimore 15, Md. Phone: LI 2-1145. (Code and theory)

Avery Comarow (13), 1715 Mayhew Dr., Silver Spring, Md. (Code and theory)

Ken A. Clagett (15), 1811 Tilton Dr., Silver Spring, Md. Phone: JU 8-1939. (Code and theory)

K4/W4 CALL AREA

Danny Shive (13), 418 Elm St., Elberton, Ga. (Code)

Charles D. Curran, Jr., 5110 Columbia Pike, Arlington 4, Va. (Code, theory and selection of equipment)

Vince Hughes, 3417 Hendricks, Memphis, Tenn. Phone: FA 3-9531. (Code, theory and selection of equipment)

Nathan Rosenblatt (15), 752 Lenox Ave., Miami Beach 39, Fla. (Code and theory)

Joe Carr (14), 6137 No. 12th St., Arlington 5, Va. (Code, theory and regulations)

Stephen Gregory, Baylor School, Chattanooga, Tenn. Phone: AM 6-7687. (Code and theory)

Michael Edwards (15), 3400 Elmtree Dr., Atlanta 11, Ga. (Code and theory)

John Frazier, 841 Wooden Blvd., Orlando, Fla. (General code, theory and selection of equipment)

Sammy Winston (13), 2003 Ashe St., Durham, N. C. (Code and theory)

Barry S. Harmer, 5646 34th Ave. N., St. Petersburg, Fla. (Code and theory)

K5/W5 CALL AREA

Olga Ann Killian, 216 S. Dupre St., New Orleans 19, La. (Code and theory)

Don Killian, 216 S. Dupre St., New Orleans 19, La. (Code and theory)

Eugene Ellis, Rt. 1, Box 56, Rudy, Ark. (Code)

Bob Irish, 4322 Ridge Rd., Dallas 29, Tex. Phone: FL 1-3384. (Theory and selection of equipment)

John Cervantes, 619 W. Mountain Rd., Albuquerque, N. M. (Code and selection of equipment)

Alvin A. Ohm, Jr. (14), 3411 Urquhart St., New Orleans 17, La. (Phone: WH 5-8570. (Code, theory, regulations and selection of equipment)

Leonard Wilson, 319 S. Broadway, Box 415, Elsa, Tex. Phone: AM 2-1364. (Code, theory and regulations)

Adrian Davis (15), 6428 Drury Lane, Fort Worth 16, Tex. Phone: PE 8-1640. (Code, theory and selection of equipment)

Onna F. Meredith, R. #5, Wyman Rd., Fayetteville, Ark. Phone: HI 2-2926. (Theory)

Floyd Fewell (24), Box 511, Columbia, Miss. (Theory and selection of equipment)

Tommy Keener, Star Route, Encino, Texas. (Code, theory and regulations)

K6/W6 CALL AREA

Barry Green, 4778 Zelzah Ave., Encino, Calif. Phone: ST 6-5357. (Code and theory)

Bernard C. Flores (8), 719½ Loma Vista Dr., Long Beach 13, Calif. (Code and theory)

General Barnett, 427 E. 91st St., Los Angeles 3, Calif. Phone: PL 5-0537. (Code)

Philip Barr (13), 5208 Etheldo Ave., Culver City, Calif. Phone: EX 8-1962. (Code and theory)

Walt Pyle (14), 484 Bonnie Dr., El Cerrito 8, Calif. Phone: LA 6-5627. (Code)

George Everson, 20227 Seagull Way, Saratoga, Calif. (Code, theory and regulations)

Nate Benedict, 2245 Tustin, Costa Mesa, Calif. Phone: LI 8-6556. (Code and theory)

Richard Barnett (15), 7031 Perry Rd., Bell Gardens, Calif. Phone: TO 2-7414. (Code, theory, regulations and selection of equipment)

Gary Albers (15), 5833 Pennswood Ave., Lakewood, Calif. Phone: TO 6-3871. (Theory, regulations and selection of equipment)

Jim Sloan (15), 1004 Wyale, Ontario, Calif. Phone: YU 6-0859. (Code, regulations and selection of equipment)

K7/W7 CALL AREA

Mike Lee, 23107 7th Ave., N. E., Bothell, Wash. (Code and theory)

Rodney Carlson (14), P. O. Box 346, Harper, Wash. (Code, theory and selection of equipment)

Charles J. Wilson, 700 No. 6th St., Kelso, Wash. Phone: EX 3-4804. (Code, theory and regulations)

Bob Bratton, 923 Sheridan Ave., Cody, Wyo. (Code and theory)

Alice & Chuck Whittington, 744 F., Springfield, Ore. (Theory)

David Borino (14), 3921 Warren Ave., Cheyenne, Wyo. (Code, theory and selection of equipment)

Douglas Burns, 7280 S. W. 81st Ave., Portland 23, Ore. Phone: CH 4-1303. (Code and theory)

Richard Sullivan, 4300 Alpine Place, Las Vegas, Nev. Phone: DU 4-2725. (Code and theory)

Frank R. Levering, P. O. Box #1317, c/o AS & R Co., Hayden, Ariz. (Code and theory)

K8/W8 CALL AREA

Frank Oviatt (16), 333 Fuller Dr., N. E., Warren, Ohio. (Code and theory)

Barry Hart (15), R. #2, Bellevue, Mich. Phone: PO 3-9855. (Code, theory, regulations and selection of equipment)

Richard Crowe (17), 434 S. Pleasant St., Montpelier, Ohio. (General code and theory)

Jim Kladder (15), 1928 Stafford S. W., Grand Rapid, Mich. (Code, theory and regulations)

Chester J. Gronowski, 3268 W. 84th St., Cleveland 2, Ohio. Phone: WO 1-9055. (Code and theory)

Frederik L. Moss, RFD #2, Ford Rd., Madison, Ohio. (Theory and regulations)

Elwyn Kinney, Luke's Trailer Park, Clare, Mich. (Code, theory, regulations and selection of equipment)

Jerry Eck, 308 Donner Rd., North Canton 20, Ohio. Phone: HY 9-4234. (Code)

Wes Grube (13), 1094 Worthington, Birmingham, Mich. Phone: MI 6-3906. (Code, theory and selection of equipment)

K9/W9 CALL AREA

Dennis A. Sokol, 5016 So. Lawndale Ave., Chicago 32, Ill. (Code, theory and regulations)

Thomas Jay Rehm, 2947 No. Farwell, Milwaukee 11, Wis. (Theory)

Davey Champlin, 4621 Stonewall, Downers Grove, Ill. (Code and theory)

Ronald Krueger, 5460 No. 75th St., Milwaukee 18, Wis. Phone: HO 1-0480. (Code, theory and regulations)

John Ferneborg, 5016 N. Ashland, Chicago 40, Ill. (Code and theory)

Rev. Arthur L. Jelks, 509 E. Gum St., P. O. Box 714, Evansville 2, Ind. (General code and theory)

Billy Keehn, 600 4th Ave., East Moline, Ill. (Code, theory, regulations and selection of equipment)

Richie Shewmaker, 412 W. Washington, Newton, Ill. (Code, theory, regulations and selection of equipment)

Ronnie Kammerud (16), Argyle, Wis. (Code, theory, regulations and selection of equipment)

Lee Mies, Saunemin, Ill. (Code, theory and regulations)

Mike Friduss, 8109 S. Jeffery, Chicago 17, Ill. (Code and theory)

KØ/WØ CALL AREA

Kenneth Hirst, Noel, Mo. (Code and theory)

Michael Seibel, 6735 Lynnwood Blvd., Minneapolis 23, Minn. (Code and theory)

David P. McGrew (12), 81 S. Eaton, Denver, Colo. (Code and theory)

Roger Girard, 6837 Bartmer, University City 14, Mo. (Code, theory and selection of equipment)

Bill Hemmingsen, 304 N. 5th, Missouri Valley, Iowa. (Code, theory and selection of equipment)

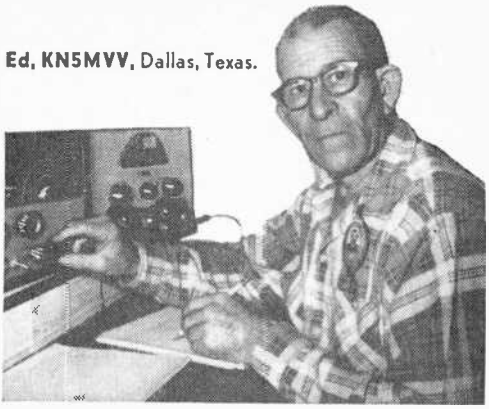
VE AND OTHERS

Rolando Silva, Box 191, Rio Piedras, Puerto Rico. (Code and theory)

Dennis Madokoro, 209—10th Ave. N., Port Alberni, B. C., Canada. (Code, theory, regulations and selection of equipment)

Conrad Stenton, P. O. Box 1018, Banff, Alta., Canada. (Code and theory)

David Wilkins (18), 176 Marlborough St., Box 454, Blenheim, Ont., Canada. Phone: OR 6-3475. (Code and theory)



Ed, KN5MVV, Dallas, Texas.

crease, a two-to-one increase to 3 db, and a 25% increase to 1 db, dropping fractions.

(When measuring power ratios, db = 10 $\log_{10} P2/P1$, where *P1* is the original power, and *P2* is the power after any operation. If *P2* exceeds *P1*, the change is expressed as "db gain." If *P1* exceeds *P2*, the change is expressed as "db loss.")

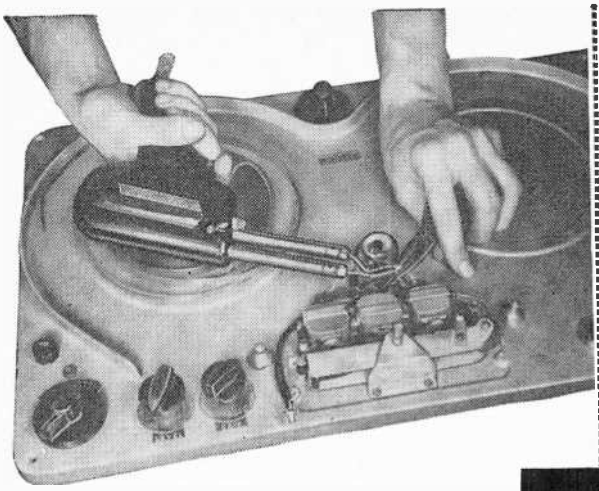
Therefore, one S-unit increase in signal strength is equivalent to a 6-db power increase, although some receiver manufacturers reduce the spread between S-units to only 5 db in calibrating their S-meters.

Evaluating S-Units. With this information, let us evaluate the S-units in terms of transmitter power by assuming that the output of a 1000-watt transmitter is being read as an S9 signal on a distant receiver. Let's observe what happens to the signal as transmitter power is reduced. The results might be: 1000 watts, S9; 250 watts, S8; 62 watts, S7; 16 watts, S6; 4 watts, S5; 1 watt, S4; ¼ watt (250 milliwatts), S3; 62 mw., S2; and 16 mw., S1.

S6 is about the average strength of signals in the amateur bands, although individual transmissions vary greatly. An S6

(*Continued on page* 135)

Dave, KN8JXT, Bitely, Mich.



By
GLENN A. TOWILL

Add an Erase Fader to Your Tape Recorder

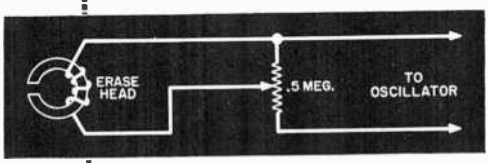


Fig. 1.

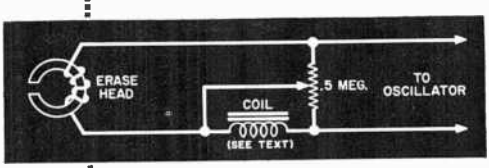


Fig. 2.

THE ERASE FADER described below will eliminate much of the splicing work involved in "cleaning up" tapes marred by undesired noise. It will also allow you to "mix" with previously recorded material and add background music to a prerecorded talk or commentary to music.

Adding this circuit is not expensive. It involves just one potentiometer and possibly a coil. Only three connections to the recorder are required, and these may be "above deck" if necessary. A schematic diagram of your recorder will help you to decide the specific hookup to use.

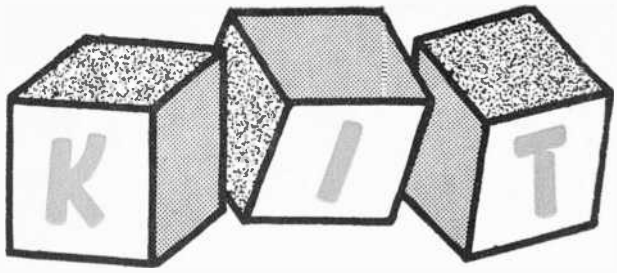
Most recorders have a record-playback head and a separate erase head. If these functions have been combined into a single head as in some older recorders, check the schematic to determine which are the erase coil leads. If you can't get at the record preamp, you can make the connections at the head itself. All leads should be kept as short as possible, since high frequencies are involved and the capacitive balance of the circuit must be maintained.

The basic circuit is shown in Fig. 1. A ½-megohm pot is used to avoid loading the oscillator. This circuit is employed with recorders in which the erase head is *not* an integral part of the bias oscillator circuitry.

Erase head *inductance* of many recorders is important to oscillator functioning. If this inductance is removed, the bias current may vary and distortion will result. To avoid this, a coil should be added as shown in Fig. 2. As the control shunts the erase head out of the circuit, the coil is cut in; thus the bias oscillator always sees the same inductance.

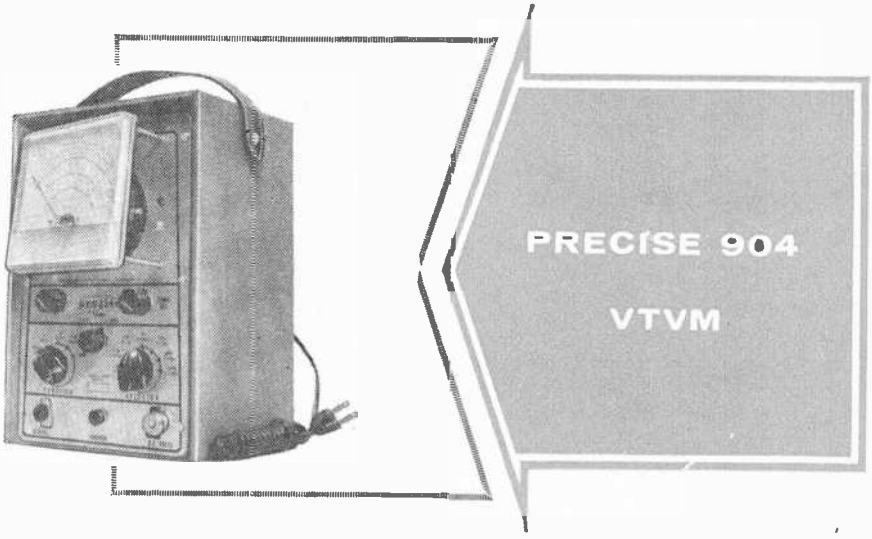
The coil may be a spare erase head or small filter choke but it should have approximately the same inductance as the erase head—which can be determined from the manufacturer's specifications or by measurement. The inductance of a Dynamu head, for example, is 30 mhy.

(*Continued on page* 121)



BUILDER'S KORNER

THROUGH experience, the user of electronic test equipment can imagine improvements which individually often seem insignificant but, when considered collectively, can pay off in ease of operation and general usefulness. The Model 904 Vacuum-Tube Voltmeter, which is offered in either kit form or factory-wired by Precise Development Corp. of Oceanside, New York, includes in its design several such experience-inspired features.

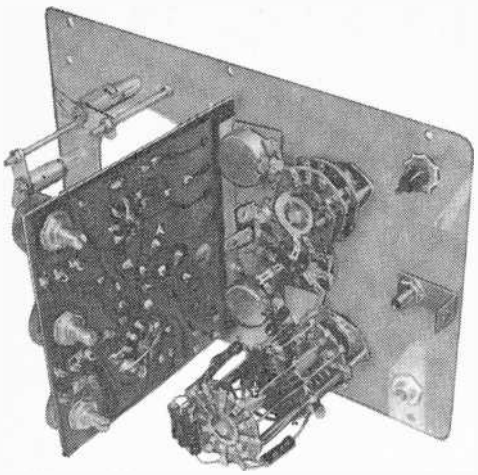


Typical is a movable meter movement which, in effect, permits the user to "see around corners." The meter can be tilted for reading from top, bottom, or either side, simply by grasping the meter movement and pointing it in the desired direction. A novel spring assembly holds the meter in the desired position.

Another feature is a front panel switch which shorts or opens the input leads in use for ease of calibration and adjustment. This seemingly minor feature eliminates the need for holding leads in contact when adjusting a resistance scale for zero, and it electrically removes the external circuit from the instrument for range changing, etc.

Putting It Together. The first step in building the Model 904 VTVM is to mount the small components on the printed-circuit board. Since the holes are not numbered on the board, constant reference to Diagram 1 in the instructions is essential. If at first the hole identification problem seems complicated, the builder should not be discouraged. As more and more parts are mounted, the remaining holes are easier to identify.

Frequent references in the instructions to eight numbers with no additional identification apply to the holes in the printed-circuit board. They may be identified by referring to Diagram 1. However, notice that this diagram is printed backwards as far as this phase of the assembly is con-

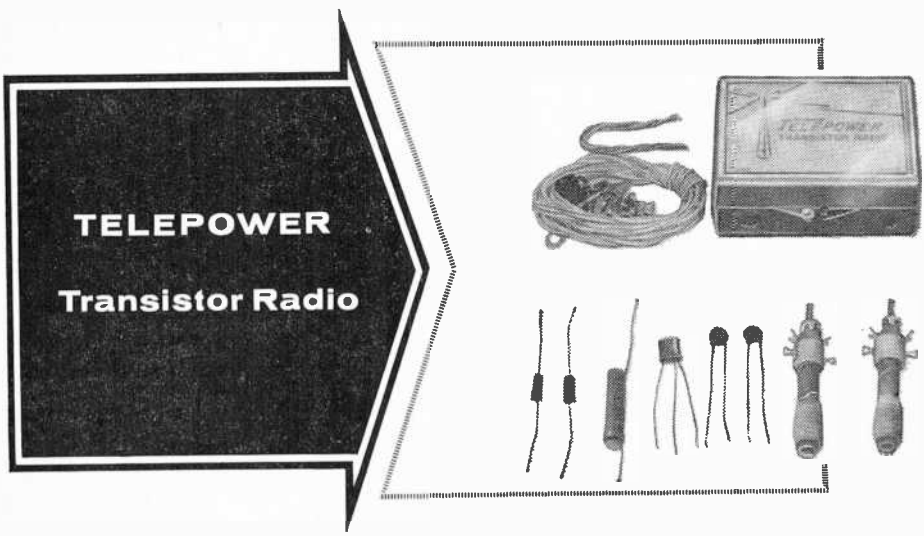


Mounting of the VTVM's printed wiring board and major panel components. Note the position of the three calibration potentiometers on the circuit board.

cerned. Holes may be easily identified by matching the board and the diagram on the reverse side and then locating the same hole on the opposite side of the board.

Hole #54 serves as a common tie point for several connections. When following the instruction which connects a wire to hole #54 through hole #46, hole #54 will be found to be already soldered. This connection, and other, later connections to this point, can be made by soldering the new lead or wire ends to the copper area surrounding hole #54. As you make the new connections, be sure that any previous wiring does not come loose.

Comment. Careful attention to the calibration instructions furnished will result in an extremely useful piece of test equipment which will serve as a valuable tool in the shop of the experimenter, amateur or professional, for years to come.



A FINE educational electronic gift for the youngster this Christmas is a remote-powered transistor pocket radio kit, retailed by the Telepower Company, 12108 Atherton Drive, Silver Spring, Md., for $6.50 postpaid.

The kit was wired in 15 minutes. The eight components mount neatly in the 3" x 2¼" x 1⅛" plastic box. Only seven soldering connections are required.

Two wires were supplied with the kit for use as ground and antenna leads. The ground lead should be connected to a good electrical ground, such as a ground stake or radiator. Headphones (not supplied) are connected to clips on the box.

Connect a dry cell to the radio as directed. Turn the left knob to the loudest local station. Then disconnect the dry cell and turn the right knob until the station is heard again. Now the left knob can be tuned for any station.

In the event the nearest local radio station is not powerful enough, the external dry cell or a solar cell should be left permanently connected. -30-

Transistor Topics

By LOU GARNER

IF PRESENT TRENDS continue, it looks like good old Saint Nick will have to take a refresher course in science. Interest in scientific and science-slanted toys has reached an all-time high.

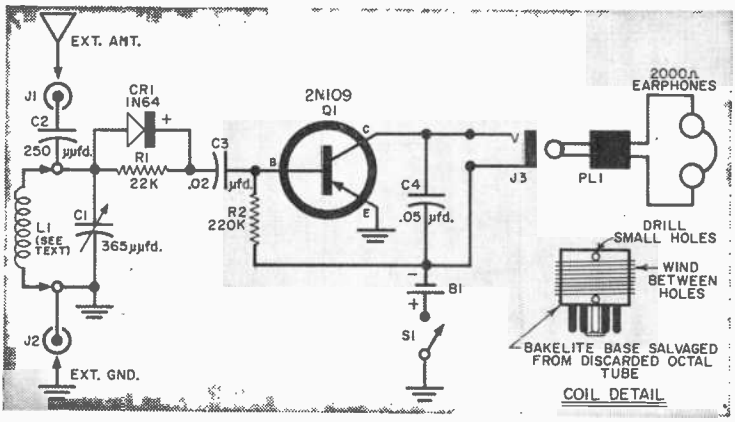
In many respects, the transistor is an ideal electronic device for toys. It is rugged, and can withstand the rough treatment children give their playthings. Its life is long . . . there is little danger of burn out. And, perhaps most important of all, it operates satisfactorily on very low voltages, and toys in which it is used can be made completely shockproof and safe. Finally, its low power requirements insure long battery life, reducing the drain on parents' pocketbooks.

Nor are transistors confined solely to children's playthings. Many an adult will be gladdened by a transistorized gift under the Christmas tree . . . a personal radio, a portable phonograph, or, if the recipient is technically minded, a transistor construction kit or piece of test gear.

Readers' Circuits. Whether the experimenter specializes in broadcast-band receiver construction or tackles any and all projects, he eventually becomes interested in trying his hand at wiring long-wave and short-wave receivers. This month we are featuring circuits for both a multiband and a long-wave receiver.

Reader Edward T. Gelinas, WV6AJY, submitted the circuit shown in Fig. 1. According to Ed, his little receiver tunes stations from 555 kc. to 145 mc., using seven plug-in coils. The single 1½-volt penlight cell (*B1*) which powers the receiver should last for months under normal use.

A conventional circuit arrangement is employed. Signals are picked up by the antenna-ground system, selected by tuned



Frequency Coverage	Number of Turns	Wire Size (enameled)	Form Diameter (inches)
555-980 kc.	70	30	1⅜
980-1650 kc.	40	30	1¼
1650 kc.-4 mc.	21	30	1¼
4-9 mc.	13	30	1¼
9-20 mc.	9	30	1¼
20-70 mc.	4	16	¾
70-145 mc.	1	16	¾

Fig. 1. Reader Edward Gelinas' multiband transistorized receiver uses seven plug-in coils, and tunes stations from 555 kc. to 145 mc. Coil winding data is given in table at left.

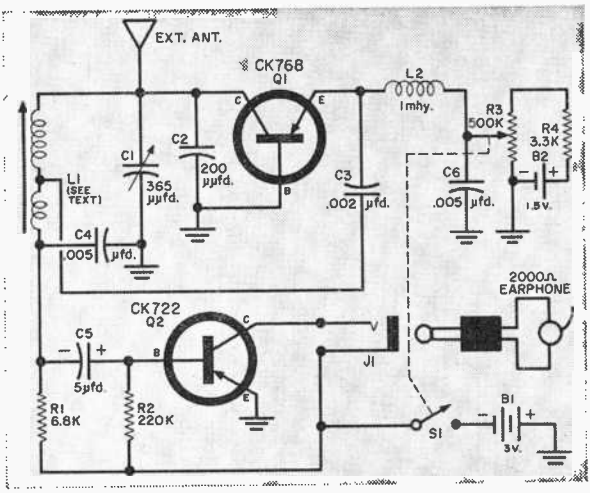


Fig. 2. Joe Stark's long-wave superregenerator. This two-transistor receiver can be used to pick up signals from radio beacons, marine stations and various communications services.

circuit *L1-C1,* detected by a 1N64 diode, and coupled through *C3* to a single-stage common-emitter audio amplifier using a *p-n-p* transistor.

Ed suggests assembling the receiver in a card file box, with a small piece of Masonite or Bakelite as a "chassis." Use short, direct leads.

All of the components are standard. *J1* and *J2* are 'phone tip jacks, while *J3* is an open-circuit phone jack.

You'll have to make up a set of plug-in coils (*L1*). Ed suggests using bases salvaged from discarded glass octal tubes as coil forms. See table on p. 87 for coil winding data.

A moderately long external antenna will give best results. An external ground connection may . . . or may not . . . be necessary, depending on your location and the proximity of short-wave stations.

In contrast to WV6AJY's receiver, which is designed for the broadcast and short-wave bands, the circuit in Fig. 2 covers the long-wave band from about 300 to 550 kc. Submitted by Joe Stark, Jr. (Box 86, R.R. 2, Acampo, Calif.), this is an adaptation of Don Stoner's "Two-Lunger" described in P. E., November, 1957.

In operation, the CK768 serves as a common-base blocking oscillator-detector. The blocking rate is at a relatively high frequency (about 15 kc.). So the CK768 becomes a superregenerative detector. The detected audio signal appearing across *R1* is coupled through *C5* to the CK722, connected as a common-emitter audio amplifier.

All parts are standard and readily available. *L1* is a conventional loopstick with about 40 extra turns close-wound at its "hot" end. *C1* is a standard tuning capacitor, while *C2, C3, C4,* and *C6* are disc ceramics or micas, and *C5* is an electrolytic.

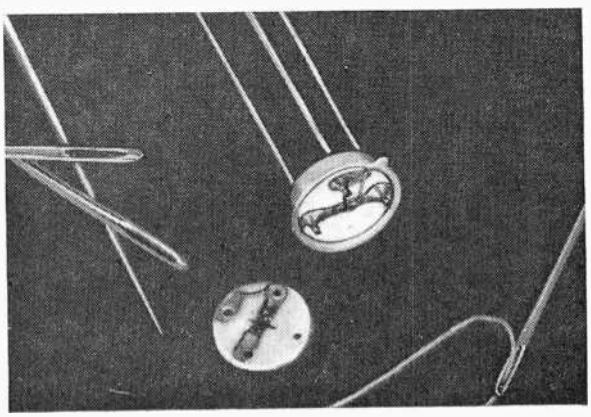
The main power supply battery, *B1,* is made up of two penlight cells connected in series to supply 3 volts. Bias battery *B2* is a single penlight cell supplying 1.5 volts. Note that no switch is provided for *B2;* the current drain on this cell is negligible due to *R3's* high value.

Observe standard practice in layout and lead dress. Keep signal leads short and direct. Control *R3,* ganged with the s.p.s.t. power switch *S1,* should be connected so that its center arm is at "ground" when the receiver is first turned on. Joe suggests using a 50'-long antenna, mounted as high as is practicable.

After you turn the set on, adjust *R3* until hiss or an audio signal can be heard. If you are unable to get a sound, try reversing

(*Continued on page* 128)

Fixed-bed mounting technique developed by General Electric permits the construction of transistors rugged enough to be test-fired from a shotgun into a telephone book.



AFTER CLASS

Special Information on Radio, TV, Radar and Nucleonics

WORKING WITH PHASE-SHIFT OSCILLATORS

MOST OSCILLATORS that utilize resistance-capacitance tuning generate triangular, trapezoidal, or square waves. When one thinks of the generation of sine waves, he usually visualizes an inductance-capacitance tuned type such as the Hartley or Colpitts circuit. There is a class of *RC* oscillators, however, that is capable of yielding excellently formed sine waves and, because of the absence of coils or transformers, these oscillators are very attractive to the experimenter.

Of the three common circuits in the latter group (the Wien bridge, the bridged-T, and the phase-shift oscillator), the phase-shift type is the simplest to build, contains the fewest components, and is very easy to get working.

Basic Oscillator. The fundamental circuit of the phase-shift oscillator is given in Fig. 1. Like all oscillators, action is initiated by some random fluctuation in the tube current or voltage, such as is due to thermal or shot effect.

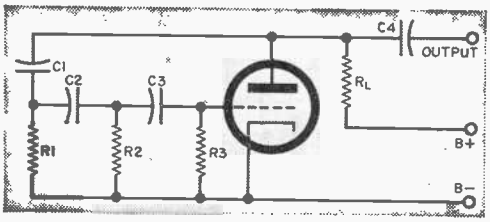


Fig. 1. Theoretical phase-shift oscillator circuit. See text. Practical circuits are shown in Figs. 2 and 3.

To explain the operation, let us assume that the grid of the triode becomes very slightly positive for an instant. When this happens, the plate current increases slightly, causing the voltage drop across plate-load R_L to increase somewhat above its standby value. The extent of this increase depends upon the voltage gain of the tube; the greater the gain, the larger the change in voltage drop across R_L.

A voltage drop of this nature causes the plate voltage of the tube to *go down,* thus making the plate *negative-going.* Since a

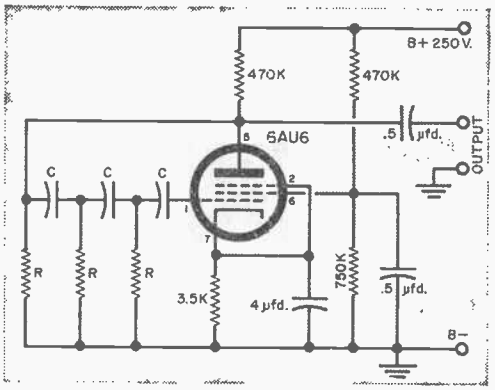
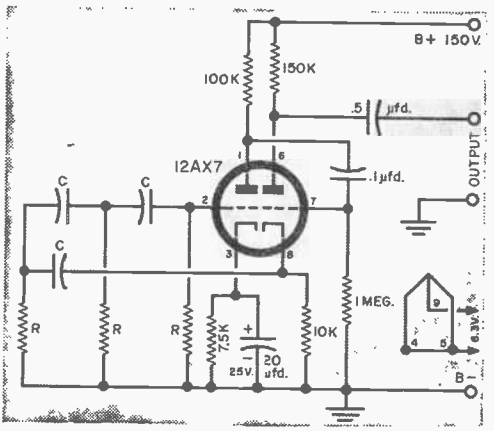


Fig. 2. Pentode phase-shift oscillator. Capacitors labeled "C" have same value; resistors labeled "R" are equal in resistance. Refer to Fig. 4 for "C" and "R" values for given frequencies.

Fig. 3. Dual-triode phase-shift oscillator. All "C's" are equal and all "R's" are equal. The nomogram will help you choose values for given frequencies.



positive-going grid has caused a negative-going plate, we can say that the "signal" on the plate is out of phase with the signal on the grid by 180 degrees.

The plate variation is now fed back to the grid through three *RC* groups: *C1-R1*, *C2-R2*, and *C3-R3*. Each group can produce a voltage phase shift of its own. Considering only the first group (*C1-R1*), the voltage appearing across *R1* will lead the signal voltage pulse from the plate by an amount determined by the ratio of the capacitive reactance (*Xc*) of *C1* and the resistance (*R*) of *R1*. Capacitive reactance depends on frequency as well as on capacitance, so that there must exist some frequency for which the phase shift for *C1-R1* will be exactly 60°.

Now the voltage that appears across *R1* is applied across the *C2-R2* group. Assuming equal capacitors and resistors throughout the circuit, then the phase shift across *C2-R2* will also be 60° for this special frequency, making a total phase shift of 120°.

Finally, a third 60° phase shift across the last group (*C3-R3*) results in an over-all voltage change of 180° from the time the signal leaves the plate to the time it returns to the grid. Adding the normal triode phase change of 180° described above to the *C-R* phase shift of 180° gives us a total inversion of 360° between the initial voltage fluctuation and the amplified pulse that returns to the grid.

This, of course, is exactly what is needed for sustained oscillation —feedback *in* phase with initial signal, or positive feedback—so that a sine-wave voltage appears between the plate of the triode and B−. This voltage may be taken from the plate through a capacitor (*C4*) as the oscillator output.

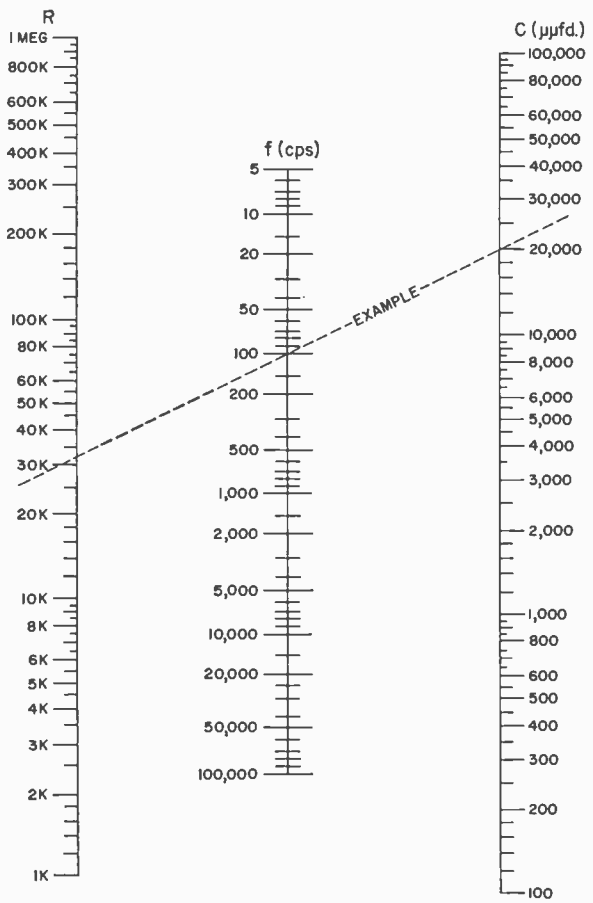


Fig. 4. Nomogram for obtaining required component values. To determine either "C," "R," or "f" if the other two values are known, lay straightedge to intersect vertical axis at known figures and read unknown figure from the remaining axis.

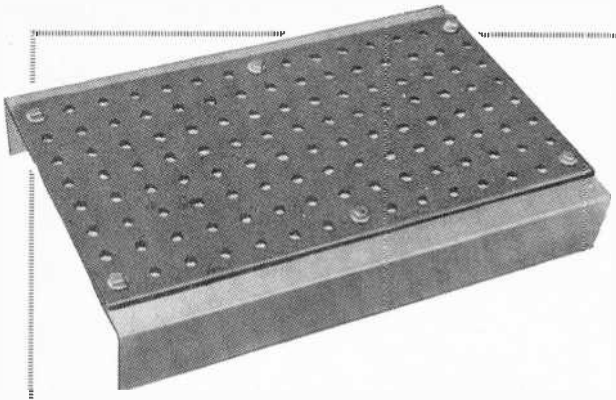
Phase-Shift Frequencies. The frequency of the output voltage is automatically "selected" by the oscillator circuit to conform with the required 60° phase shifts just discussed. This means, of course, that control of frequency is obtainable by varying either the resistances or the capacitances.

In practice, any one of the resistors may be a potentiometer to provide a relatively narrow range of control. Frequency variation over a substantially wider range may be realized by varying all three resistors simultaneously; a three-gang potentiometer is ideal for this purpose.

The versatility of a well-designed phase-shift oscillator is evident when we consider that it can be constructed for frequencies as low as *one cycle per minute* and as high as *100,000 cycles per second*. Phase-shift oscillators can't be beaten for audio testing, code practice, gain control (as in guitar vibrato amplifiers), or for any other application requiring a stable, reliable, pure sinusoidal output.

Practical Circuits. It can be shown mathematically that a minimum voltage

(*Continued on page* 124)

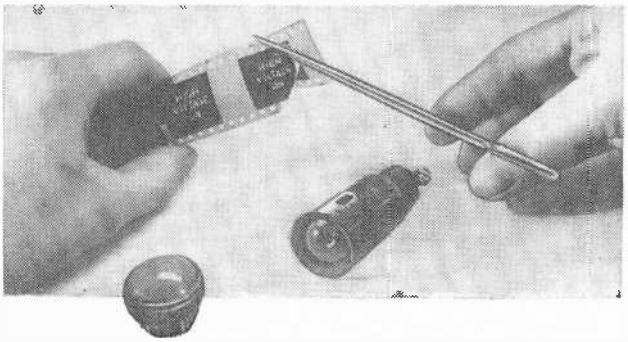


Low-Cost Experimental Chassis

A satisfactory, yet low-cost, chassis can be assembled by mounting a small piece of perforated Masonite on two lengths of L-angle aluminum stock. If you don't have angle stock available, you can make up suitable brackets by bending short lengths of scrap sheet metal in your vise.

Aside from its low cost, such a chassis has several other advantages. The Masonite is easily drilled, sawed, or machined. The regular pattern of holes simplifies layout. And, finally, terminals may be spotted at any point simply by attaching a soldering lug with a screw and nut.

—Louis E. Garner, Jr.



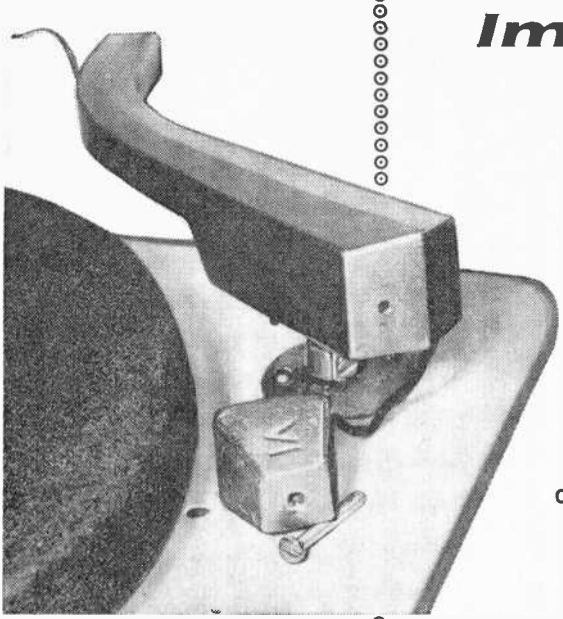
Custom Pilot Lights

Home-built electronic equipment can be improved in appearance by the addition of lettered pilot lights. They are particularly effective in "customizing" hi-fi equipment.

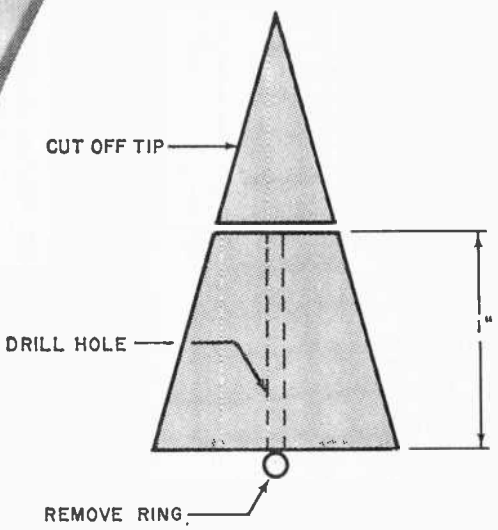
Lettered units are constructed by photographing the desired wording and mounting the negative behind the jewel of a one-inch pilot light assembly such as the Dialco Series 312901. The "originals" may be lettered by hand, but a simpler method is to use individual letters cut from newspaper headlines.

Cut the negative to fit behind the jewel, backing it up with a snug-fitting translucent plastic disc. *—D. Derek Verner*

Improve Your Low-Cost Phono Arm



By
LEONARD C. HOLZER



ONE OF THE DIFFERENCES between a hi-fi tone arm and the arm in the average home phonograph is in the balancing or "loading" mechanism. The usual inexpensive tone arm has little mass and its spring-loading tends to make it unstable and overly sensitive to floor vibration. However, much can be done to improve such an arm.

We start out with a pyramid-shaped six-ounce fisherman's sinker weight (which can be obtained at any fishing tackle retailer) and a #6 machine screw. Cut the top off the sinker and drill a hole through its center. If you have a 6-32 tap, you can drill the hole with a #36 drill and then thread it; if not, you can drill it with a 3/16" bit.

Remove the spring from the arm and mount the weight with its small surface facing the back of the arm. Use a screw or nut and bolt. With the small surface against the rear of the arm, stylus pressure is less than with the larger surface against the arm. Using a stylus pressure gauge, mount the weight in the position that provides the recommended stylus pressure for your phono cartridge.

If the stylus pressure is too light regardless of which way you mount the sinker, you will have to file off some of the weight. Keep checking with the gauge; once the correct stylus pressure is found, no further adjustment will be required unless you substitute a different cartridge. —30—

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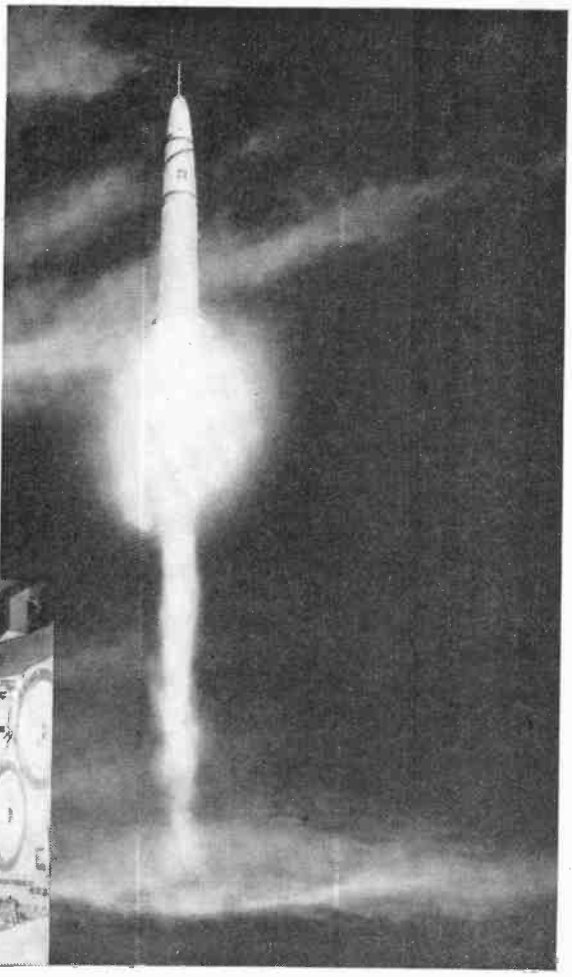

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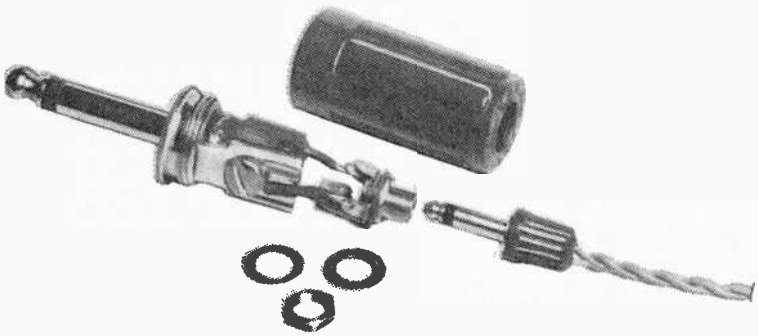
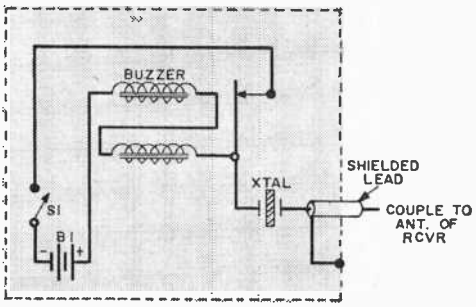
Miniature Phone Plug Adapter

This is the easiest way to make a handy adapter that will connect a subminiature phone plug to a standard phone jack. Obtain a standard phone plug having a ¾"-o.d. barrel and a cord opening not larger than ⅜" in diameter. Simply connect the standard plug and subminiature jack in parallel, using short lengths of insulated hookup wire. The two wire leads should be the right length to allow the jack to seat correctly in the hole in the end of the plug's barrel when the barrel is twisted onto the plug. Use two washers on the jack—one inside the barrel and the other outside. The hexagon nut is twisted onto the jack after the barrel is twisted onto the plug. —*Art Trauffer*



Shock-Excited Crystal Oscillator

Here's an idea developed during World War II for aligning Signal Corps equipment in the field. You can build such a gadget for your test bench and it will pay for itself many times over as a quartz crystal tester, band edge marker, or r.f./i.f. alignment generator.



The only parts required are a small metal box, h.f. buzzer, battery, switch, and length of shielded wire hooked up as shown here. The buzzer puts out a damped wave with both a.f. and r.f. components. Coupled to the "hot" end of the buzzer, the crystal is shock-excited and oscillates at the frequency to which it is ground.

"If you tune in your receiver (with the BFO on), you'll hear a "swishing" sound, sharply defined sidebands, and a dead or low spot in the exact center of the crystal frequency. Crystals from 400 kc. to 28 mc. were tried and work well, even those that would not oscillate in vacuum-tube circuits. Since only the fundamental of the crystal comes through, this gadget is ideal for checking the fundamental frequency of unknown crystals.

It is not necessary to couple directly to the antenna post. Bringing the shielded wire close will give sufficient signal. By substituting a 0.001-μfd., 600-volt capacitor for the crystal, the unit can also be used for signal injection trouble-shooting in audio amplifiers. —*George N. Dugonis*

48¢ ea. for any tube

$45.00 Per Hundred

STANDARD LINE ELECTRIC COMPANY

FREE POSTAGE IN U.S.A. & TERRITORIES

FREE TUBE BRIGHTENER ON ORDERS OF $10.00 OR MORE

ANNOUNCING OUR NEW PRICE SCHEDULE

Effective July 25, 1958 all tubes (Radio & Television receiving) will be sold and shipped at the fantastic price of only .48c ea. or $45.00 per hundred. Any "on hand" orders at that time will receive credit for future purchases.

THE TUBES ADVERTISED HEREIN ARE NOT NECESSARILY NEW TUBES BUT MAY BE ELECTRICALLY PERFECT FACTORY SECONDS OR USED TUBES AND ARE SO MARKED

All TV, & Radio Tubes are tested by our supplier under actual conditions in Radio & TV chassis or in Hickock Tube Testers Model 533A.

And, of course, the famous Standard Line guarantee remains in effect: All tubes guaranteed to be replaced free if they fail to function efficiently within one year's time. (defective tubes must be returned intact, postage paid. Refunds will be cheerfully made within five (5) days if not completely satisfied.)

0B2	3AL5	5V6GT	6BE6	6S4	7F7	12Q7	32L7GT
0Z4	3AU6	5W4GT	6BF5	6S8GT	7F8	12SA7	35/51
1A5GT	3AV6	5X4G	6BG6G	6SA7	7G7	12SG7	35A5
1A7GT	3BA6	5X8	6BH6	6S87Y	7H7	12SJ7	35B5
1B3GT	3BC5	5Y3GT	6BH8	6SC7	7J7	12SK7	35C5
1C5GT	3BE6	5Y4G	6BJ6	6SF5	7K7	12SN7GT	35L6GT
1C6	3BN6	5Z3	6BK5	6SF765G7	7L7	12SQ7	35W4
1C7	3BU8	5Z4	6BK7	6SH7	7N7	12SR7	35Y4
1H4G	3BY6	6A8	6BL7GT	6SJ7	7O7	12V6GT	35Z4GT
1H5GT	3BZ6	6AB4	6BN6	6SK7	7R7	12W6GT	35Z5GT
1L6	3C2	6AC7	6BQ6GT	6SL7GT	7S7	12X4	#37
1LA4	3CB6	6AF4	6BQ7	6SN7GT	7V7	12Z3	#39/44
1LA6	3CF6	6AG5	6BR8	6SQ7	7W7	14A7	#41
1LB4	3CS6	6AG7	6BS8	6SR7	7X6	14AF7	#42
1LC5	3DT6	6AH4GT	6BY5G	6T4	7X7	14B6	#43
1LC6	3Q4	6AH6	6BZ6	6T8	7Y4	14F7	#45
1LH4	3Q5GT	6AK5	6BZ7	6U4GT	7Z4	14F8	#47
1LN5	3S4	6AK6	6C4	6U5	8AW8	14H7	50A5
1N5GT	3V4	6AL5	6C5	6U8	12A8	14N7	50B5
1P5GT	4BC8	6AL7GT	6C85	6V3	12AB5	14Q7	50C5
1Q5GT	4BQ7A	6AM8	6C86	6V6GT	12AQ5	1457	50C6G
1R5	4B58	6AN8	6CD6G	6W4GT	12AT6	17AX4GT	50L6GT
1S5	4BU8	6AQ5	6CF6	6W6GT	12AT7	17DQ6	50Y6
1T4	4BZ7	6AQ6	6CG7	6X4	12AU6	19AU4	50Y7
1T5GT	4CB6	6AQ7GT	6CG8	6X5GT	12AU7	19BG6G	#57
1U4	5AM8	6AR5	6CH8	6X8	12AV6	19C8	#58
1U5	5AN8	6AS5	6CL6	6Y6G	12AV7	19J6	#80
1V	5AQ5	6AS8	6CM6	7A4	12AX4GT	19T8	#81
1V2	5AS8	6AT6	6CM7	7A5	12AX7	19X8	117L7GT
1X2	5AT8	6AU4GT	6CN7	7A6	12AZ7	25AC5	117N7GT
2A3	5AV8	6AU5GT	6CU6	7A7	1284	25AV5GT	117P7GT
2A5	5AW4	6AU6	6DG6	7A8	12BA6	25AX4GT	117Z3
2A7	5AZ4	6AU8	6DQ6	7B4	12BE6	25BK5	117Z4GT
2AF4A	5BK7	6AV5GT	6DT6	7B5	12BF6	25BQ6	117Z6GT
2B7	5BR8	6AV6	6E5	7B6	12BH7	25CD6G	807
2BN4	5BQ7	6AW8	6H6	7B7	12BK5	25CU6	9002
2D21	5BZ7	6AX4GT	6J4	7B8	12BQ6	25L6GT	9003
2E5	5CG8	6AX5GT	6J5	7C4	12BR7	25W4GT	9006
2X2A	5J6	6AZ8	6J6	7C5	12CA5	25Z5	
3A2	5T8	6BA6	6K6GT	7C6	12CU6	25Z6	
3A3	5U8	6BC5	6K7	7C7	12DQ6	#27	
3A4	5U4G	6BC8	6L6	7E6	12J5	#30	
3A5	5V4G	6BD6	6L7	7E7	12L6GT	#31	

ALL RECEIVING TUBES SENT POSTAGE PAID.

Please send 25c handling for orders under $5.00 Send 25% deposit on C.O.D. orders and please send approximate postage on Canadian and foreign orders.

Above is only a partial list — order any type at the same price or send for free tube list and order blank. We have over 5,000 tube types on hand or at easy access, including special purpose, industrial and transmitting tubes which are slightly higher.

ALL TUBES GUARANTEED ONE FULL YEAR...

NOTE: When ordering receiving tubes be sure to enclose 48c for each tube or $45.00 per hundred.

Thousands of TRADE-IN TVs

Please Specify Console or Table Model When Ordering

Reconditioned By Factory Trained Technicians! Guaranteed To Be In Working Condition When You Receive Them!

10"	$25.00	19"	$56.00
12"	$30.00	20"	$63.00
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16"	$42.00	24" (when available)	$95.00
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Get yourself a second set or buy some for re-sale!

All TVs sent motor freight or Railway Express F.O.B. our warehouse. Sorry, no A.P.O. shipments.

FREE INDOOR ANTENNA with each TV Purchase

below is our new price schedule of pix tubes. These famous make tubes contain all new parts with the exception of the glass bulb which does not wear out.

Any 10" Tube	$ 9.95	Any 16" Tube	15.95
Any 12" Tube	10.95	Any 17" Tube	18.29
Any 14" Tube	13.95	Any 19" Tube	20.29
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Prices On Larger Tubes On Request

Remember

Only 48¢ ea.

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ANY TYPE

ANY QUANTITY

Remember — NO Dud Required.

All tubes guaranteed one year.

Picture Tubes shipped F.O.B. Harrison, N. J.

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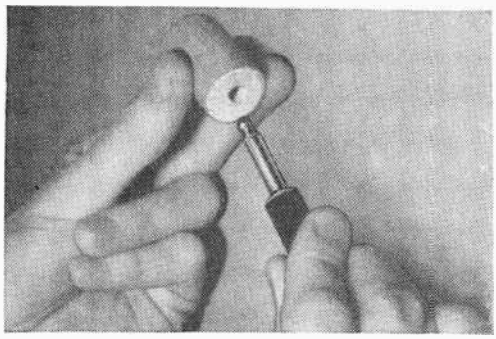
TIPS and TECHNIQUES

CLOSE-FITTING SPAGHETTI

A professional look in terminating wires such as speaker leads with spade lugs can be achieved with ordinary vinyl spaghetti. Choose spaghetti with an opening slightly *less* than the smallest piece it is to cover, and cut off appropriate lengths. Soak these pieces in acetone for about 15 minutes. The spaghetti will swell and increase to three or four times its normal size, so that it can be slipped over the joint and let dry. It will shrink to its former size and form a snug-fitting cover for the joint. —*E. S. L.*

PHONE PLUG GUARD

If you should accidentally step on the plug at the end of a microphone cable, you would probably break it. A 1½" length of broom handle with a hole drilled in its center large enough to accommodate the plug's metal tip will make a good guard. Should you step on the plug with the guard



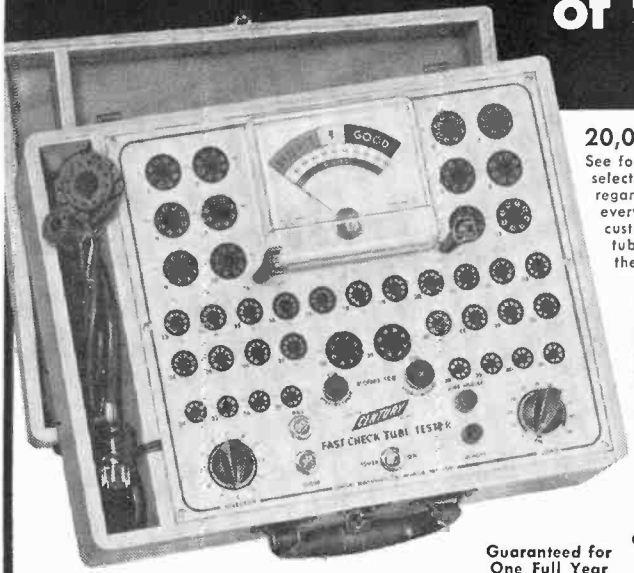
in place, the guard's larger diameter will bear your weight rather than the plug's breakable Bakelite handle. —*A. C.*

SNAP BUTTON CONNECTORS

Try soldering snap buttons on the ends of experimental capacitors and resistors used for in-circuit testing. And try them on tiny alligator clamps using wire on one

(*Continued on page* 104)

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



20,000 SERVICEMEN CAN'T BE WRONG!

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

Just 2 settings on the FAST-CHECK TUBE TESTER

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

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

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

Special compartment accommodates line cord and Picture Tube Test Adapter

Model FC-2—housed in sturdy wood carrying case complete with CRT adapter..

Guaranteed for One Full Year

only **$69.50** Net

Picture Tube Test Adapter Included With Fast-Check

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

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

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

RANGE OF OPERATION

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

IMPORTANT FEATURES

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

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

SHIPPED ON APPROVAL FOR 10 DAY FREE TRIAL

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

PAY IN SMALL MONTHLY PAYMENTS

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

NO MONEY REQUIRED WITH ORDER . . .

CENTURY ELECTRONICS CO., Inc., 111 ROOSEVELT AVENUE Dept. 312, Mineola, N. Y.

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

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

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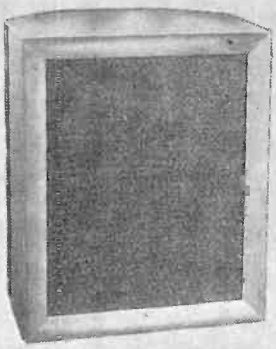
F.O.B., Mineola, N.Y.

build your own HEATHKIT *for fun!*

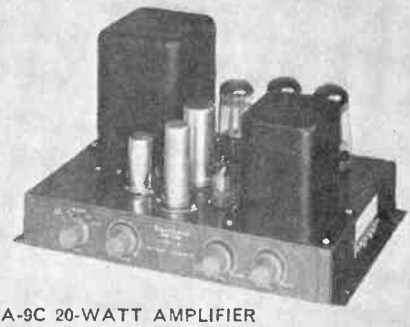
Don't let a lack of experience keep you from enjoying the fun and savings of "Do-it-yourself" kit construction. The easy-to-follow diagrams that come with every Heathkit insure your success. Let our experience be your teacher—and you'll save one-half or more over the price of "built-up" equipment of equal quality.

HEATH COMPANY A subsidiary of Daystrom, Inc. BENTON HARBOR 10, MICH.

"BASIC" SPEAKER SYSTEM



RANGE EXTENDER



A-9C 20-WATT AMPLIFIER

HEATHKIT "BASIC RANGE" HIGH FIDELITY SPEAKER SYSTEM KIT

This amazing speaker system can fulfill your present needs and still provide for future expansion. Fine hi-fi performance the result of using high quality speakers in an enclosure especially designed for them. Features two Jensen speakers to cover 50 to 12,000 CPS within ± 5 db. Power rating is 25 watts, and impedance is 16 ohms. Enclosure constructed of veneer-surfaced plywood, ½" thick, and measures 11½" H x 23" W x 11¾" D. Precut and predrilled for quick assembly.

Model SS-2
$39.95

Shpg. Wt. 26 lbs.

HEATHKIT RANGE EXTENDING HIGH FIDELITY SPEAKER SYSTEM KIT

Designed especially for use with SS-2 "Basic" system. Contains 15" woofer and compression-type super tweeter. Extends basic unit to 35—16,000 CPS, ± 5 db. Impedance 16 ohms. Measures 29" H x 23" W x 17½" D, and is constructed of ¾" veneer-surfaced plywood.

Model SS-1B
$99.95

Shpg. Wt. 80 lbs.

HEATHKIT A-9C HIGH FIDELITY AMPLIFIER KIT

This model incorporates its own power supply and preamplifier. Plenty of power with full 20 watt rating. Four separate inputs, selected by panel-mounted switch, and separate bass and treble controls. Ideal for home or PA applications. Output transformer tapped at 4, 8, 16 or 500 ohms. Response within ± 1 db from 20 to 20,000 CPS.

Model A-9C
$35.50

Shpg. Wt. 23 lbs.

HEATHKIT HIGH FIDELITY FM TUNER KIT

Now you can have full-fidelity FM performance from 88 to 108 mc at reasonable cost. Features temperature-compensated oscillator—built in power supply, and beautiful cabinet. Components prealigned at factory!

Model FM-3A
$25.95
(with cabinet)

Shpg. Wt. 8 lbs.

HEATHKIT BROADBAND AM TUNER KIT

Tunes standard AM band from 550 to 1600 kc with fine sensitivity and broadband characteristics. Features include built-in power supply and low-distortion detector. All RF circuits prealigned for simplified construction.

Model BC-1A
$25.95
(with cabinet)

Shpg. Wt. 9 lbs.

HEATHKIT "MASTER CONTROL" HI-FI PREAMPLIFIER KIT

Provides extra amplification, selection of inputs, volume and tone controls, and turnover and rolloff controls, for Williamson-type amplifiers. Beautiful satin-gold enamel cabinet. Derives operating power from amplifier.

Model WA-P2
$19.75
(with cabinet)

Shpg. Wt. 7 lbs.

HEATHKIT 25-WATT HIGH FIDELITY AMPLIFIER KIT

Outstanding 25-watt Williamson-type amplifier employs KT66 tubes and Peerless output transformer, tapped at 4, 8, and 16 ohms. A fine amplifier for the "deluxe" system. WA-P2 preamplifier required for operation. Express only.

Model W-5M
$59.75

Shpg. Wt. 31 lbs.

HEATHKIT

Choose your own "Do-it-yourself" project from the world's largest kit manufacturer

HEATH COMPANY

A subsidiary of Daystrom, Inc.

BENTON HARBOR 10, MICHIGAN

Now you can have radio wherever you go — with the portable that plays anywhere!

HEATHKIT MODEL XR-1P TRANSISTOR PORTABLE RADIO KIT

This easy to build transistor radio is designed for lifetime operation. Features 6 name-brand (Texas Instrument) transistors for extra good sensitivity and selectivity. A 4" x 6" speaker for "big set" tone, built-in rod-type antenna, and uses 6 standard size "D" flashlight cells for extremely long battery life (between 500 and 1,000 hours). Cabinet is two-tone blue molded plastic with pull-out carrying handle. Measures 9" L. x 7" H. x 3¾" D. Transformers are prealigned eliminating special alignment equipment. Shpg. Wt. 6 lbs.

MODEL XR-1L: Identical to XR-1P except in leather case. Carrying strap included. Shpg. Wt. 7 lbs.

HEATHKIT BROADCAST BAND RADIO KIT

Covers 550 to 1600 kc with good sensitivity and selectivity. Has 5½" PM speaker for good tone quality. Features transformer power supply and built-in antenna. Signal generator recommended for alignment. Cabinet, as shown, available separately. Shpg. Wt. 10 lbs.

Model BR-2

$18.95

(less cabinet)

HEATHKIT CRYSTAL RADIO KIT

Features a sealed germanium diode to eliminate critical "cats whisker" adjustment. Employs two tuning condensers for good selectivity, and covers the broadcast band from 540 to 1600 kc. Requires no external power. Kit price includes headphones. Shpg. Wt. 3 lbs.

Model CR-1

$7.95

HEATHKIT ENLARGER TIMER KIT

The dial of this handy timer covers 0 to one minute calibrated in five-second gradations, so that the timing cycle of a photographic enlarger can be electronically controlled. Built-in relay handles up to 350 watts, and enlarger merely plugs into receptacle of front panel. Also provision for plugging in safe-light. An easy-to-build device that makes a fine addition to any dark room. Shpg. Wt 3 lbs.

Model ET-1

$11.50

HEATHKIT FUEL VAPOR DETECTOR KIT

The FD-1 is a safety device to detect fuel vapor in the engine compartment or other sections of your boat. The detector unit mounts in the area to be checked, and the indicating meter and controls mount on the control panel. Will operate intermittently or continuously, and indicates dangers of fire or explosion to protect your boat and its passengers. Models FD-1-6 (6 volts DC) and FD-1-12 (12 volts DC) operate from boat batteries. Kit even includes spare detector unit. Shpg. Wt. 4 lbs.

6-volt FD-1-6,
12-vt. FD-1-12

$35.95
each

HEATHKIT RF POWER METER KIT

This handy device measures the RF field in the vicinity of a transmitter, whether it be marine, mobile, fixed, etc. Requires no electricity, nor direct connection to the transmitter. Provides a continuing indication of transmitter operation. Merely place it in proximity to the transmitter antenna and it will produce a reading on its 200 ua panel meter when the transmitter is in use. Operates with any transmitter between 100 kc and 250 mc. Includes a sensitivity control for meter. Shpg. Wt. 2 lbs.

Model PM-1

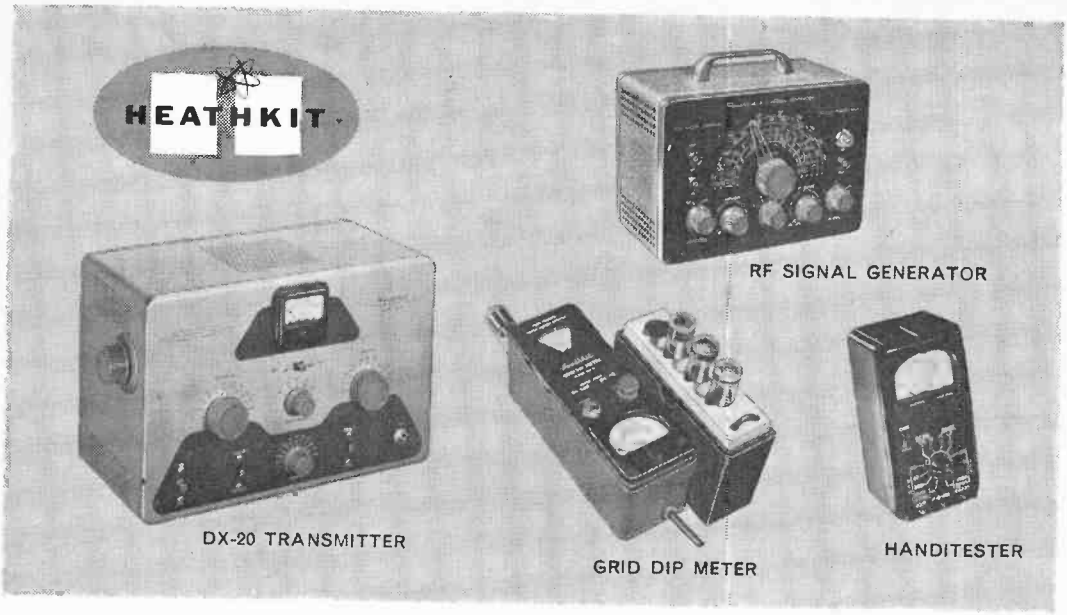
$14.95

HEATHKIT TRANSISTOR RADIO DIRECTION-FINDER KIT

The Heathkit Transistor Radio Direction-Finder model DF-1 is a self-contained, self-powered, 6-transistor super heterodyne broadcast radio receiver incorporating a directional loop antenna, indicating meter, and integral speaker. It is designed to serve primarily as an aid to navigation when out of sight of familiar landmarks. It can be used not only aboard yachts, fishing craft, tugs, and other vessels which navigate either out of sight of land or at night, but also for the hunter, hiker, camper, fisherman, aviator, etc. It is powered by a 9-volt battery. (A spare battery is also included with the kit.) The frequency range covers the broadcast band from 540 to 1600 kc and will double as a portable radio. A directional high-Q ferrite antenna is incorporated which is rotated from the front panel to obtain a fix on a station and a 1 ma meter serves as the null and tuning indicator. The controls consist of: tuning, volume and power (on-off), sensitivity, heading indicator (compass rose) and bearing indicator (antenna index). Overall dimensions are 7½" W x 5⅞" H x 5⅜" D. Supplied with slip-in-place mounting brackets, which allow easy removal from ship bulkheads or other similar places. Shpg. Wt. 4 lbs.

Model DF-1

$54.95



HEATHKIT DX-20 CW TRANSMITTER KIT

This Heathkit straight-CW transmitter is one of the most efficient rigs available today. It is ideal for the novice, and even for the advanced-class CW operator. It employs a 6DQ6A tube in the 50-watt final amplifier circuit, a 6CL6 oscillator and a 5U4GB rectifier. Single-knob band switching covers 80, 40, 20, 15, 11, and 10 meters. The DX-20 is designed for crystal excitation, but may be excited by an external VFO. Pi network output circuit is employed to match antenna impedances between 50 and 1000 ohms.

Model DX-20

Shpg. Wt. 19 lbs. **$35.95**

HEATHKIT GRID DIP METER KIT

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

Model GD-1B

Shpg. Wt. 4 lbs. **$21.95**

HEATHKIT RF SIGNAL GENERATOR KIT

Produces rf signals from 160 kc to 110 mc on fundamentals on five 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. Prealigned coils eliminate the need for calibration after completion.

Model SG-8

Shpg. Wt. 8 lbs. **$19.50**

HEATHKIT HANDITESTER KIT

Measures AC or DC voltage at 0—10, 30, 300, 1000 and 5000 volts. Direct current ranges are 0-10 ma and 0-100 ma. 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.

Model M-1

Shpg. Wt. 3 lbs. **$17.95**

HEATHKIT ETCHED-CIRCUIT VTVM KIT

Sensitivity and reliability are combined in the V-7A. It features 1% precision resistors, large 4½" panel meter, and etched circuit board. 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. X1, X10, X100, X10k, X100k, and X1 megohm.

Model V-7A

Shpg. Wt. 7 lbs. **$24.50**

HEATHKIT ALL-BAND RADIO KIT

This receiver covers 550 kc to 30 mc in four bands, and is ideal for the short wave listener or beginning amateur. It provides good sensitivity and selectivity, combined with good image projection. Amateur bands clearly marked on the illuminated dial scale. Employs transformer-type power supply—electrical band spread—antenna trimmer—separate rf and af gain controls—noise limiter and headphone jack. Built-in BFO for CW reception. Cabinet, as shown, available separately.

Model AR-3

Shpg. Wt. 12 lbs. **$29.95**

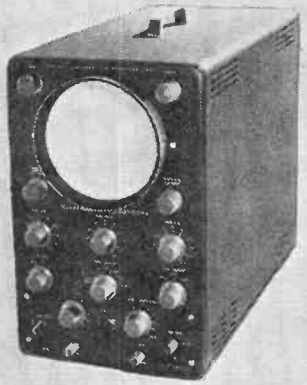
(less cabinet)

HEATHKIT "GENERAL PURPOSE" 5" OSCILLOSCOPE KIT

This oscilloscope sells for less than the previous model, yet incorporates features for improved performance. The OM-2 provides wider vertical frequency response, extended sweep generator coverage, and increased stability. Vertical channel is essentially flat to over 1 mc. 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 design. A 5BP1 cathode ray tube is used. The scope features external or internal sweep and sync, 1-volt peak-to-peak reference voltage, three-position step attenuated input, and many other "extras."

Model OM-2

Shpg. Wt. 22 lbs. **$39.95**



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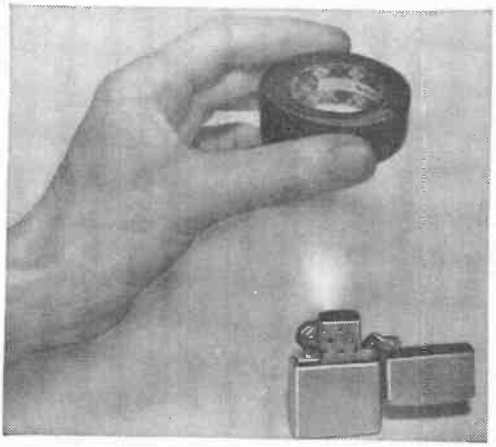
Tips and Techniques

(*Continued from page* 96)

end and the snap buttons on the other. You will be spared much unnecessary soldering. —*B. M. B.*

WARMED TAPE WRAPS BETTER

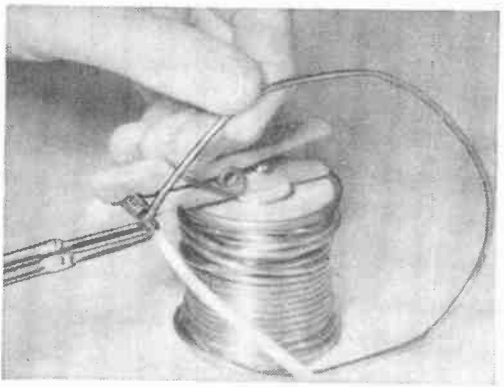
When you have to wrap wire with electrician's plastic tape, you'll find that the tape does a more effective job if you warm the roll just before use. The heat will



soften the adhesive and give it more adherence, and the tape will stretch for a tighter wrap. It is especially desirable to warm the tape before using it outdoors in cold weather. —*L. S.*

SOLVING A SOLDERING PROBLEM

Do you have trouble holding small parts while you solder them? Don't let this be a problem any longer. Plug the hole in the



center of your spool of solder with a large snug-fitting wooden dowel, and attach a spring clothespin with a small wood screw. The attached clothespin makes an ex-

save on hi-fi, ham radio, other electronics devices by using easy-to-assemble kits!

New ELECTRONICS KITS Guide and Directory Now on Sale!

There's lots of fun and satisfaction—as well as big savings—in building electronics devices from kits. And now, for the first time, you can get a publication that tells you all you need to know about putting together your own hi-fi set, electronics laboratory, short-wave receiver, electronics accessories for car and boat, photoelectric eyes, pocket radios—dozens of practical, enjoyable electronics devices.

Whether you're an old hand at kit construction or have never used a soldering iron, you'll find this 160-page guide to ELECTRONICS KITS a windfall of valuable information. Edited by the Ziff-Davis Electronics Division, this new Annual contains 30 construction articles and 640 illustrations. *In addition, it has the world's only directory of electronics kits, including specifications, prices and manufacturers' names.*

PLUS:

KIT BUILDERS GUIDE—Why build kits? What tools you should have, contents of a typical kit.

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FOR YOUR SHOP—What type of test instruments should you buy? How to construct a vacuum tube voltmeter. A Multitester. R.F. Generator. Condenser Checker. Audio Generator. TV Sweep Generator. Tube Tester.

KITS FOR THE HAM—How to build an All-Band Receiver. Variable Frequency Oscillator. Grid Dip Meter. CW Transmitter. Marker Generator. Modulator. CW and Phone Transmitter.

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This big, new builder's guide and directory to ELECTRONICS KITS is now on sale. Be sure to pick up your copy today at your favorite newsstand or radio parts store—only $1.00.

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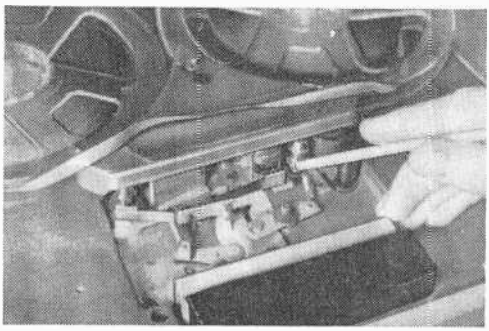
tremely handy "vise" for holding the work. When you buy a new spool of solder, just pull out the plug and insert it into the new spool. —*J. A.*

TAPE RECORDER MAINTENANCE

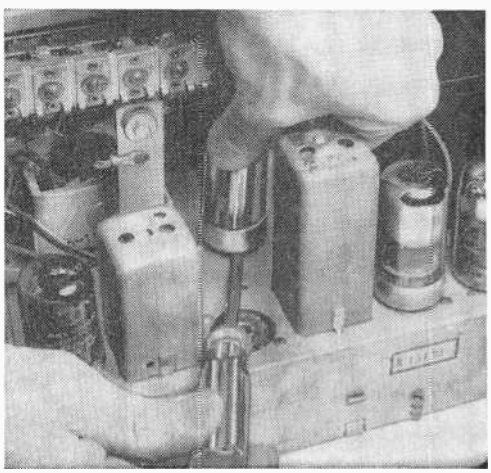
To help maintain your tape recorder's mechanical mechanism in efficient operating condition, add a soda straw (preferably a plastic one) to your recorder cleaning and lubricating kit. You'll find it handy for



blowing loose dust and lint from inaccessible nooks around the recording and playback heads. Select a straw that has a relatively large inside diameter—it offers less resistance to your breath and makes blowing easier. If you don't happen to have a straw readily available, a piece of insulating spaghetti will do. —*J. A. C.*

HARD-TO-GET-AT TUBES

The best way to remove a tube from its socket is to grasp the tube firmly with the hand and pull straight up while rocking



the tube very gently from side to side. However, some tubes are mounted in such hard-to-get-at places that you cannot get your

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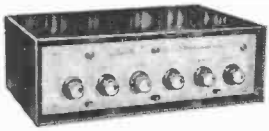
NEW! LAFAYETTE 'STEREO' HI-FI PHONO MUSIC SYSTEM

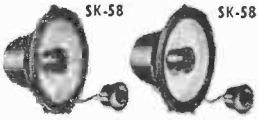
An Ideal Quality System For Listening To The New High Realism Stereo Sound!
FOR STEREO & MONAURAL REPRODUCTION



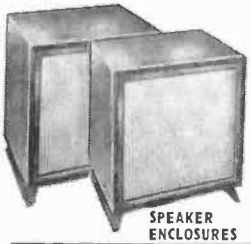
LAFAYETTE LA-90

GARRARD RC 121/II

NEW GE GC-7 STEREO COMPATIBLE CARTRIDGE WITH DIAMOND STYLUS



SK-58 SK-58



SPEAKER ENCLOSURES

A superb complete phono music system brought to you by Lafayette's top stereo engineers. Heart of the system is the **new Lafayette LA-90 28-watt stereo amplifier with 14 watts per channel or 28 watts monaurally** and with all the inputs necessary for a complete stereo control center. Other fine components include the **famous new Garrard RC121/II 4-speed automatic record changer,** ready to accept stereo cartridges; the **Lafayette PK-111 wood base** for changer, of fine selected woods; the **new GE GC-7 stereo/monaural variable reluctance magnetic cartridge** with 0.7 mil genuine GE diamond stylus for microgroove stereo and monaural LP and 45 rpm records; and **2 of the unbeatable, for performance-value, Lafayette SK-58 12" coaxial speakers.** Supplied complete with cables, connectors, and easy installation instructions. Shpg. wt., 66 lbs.

HF-374 Stereo Phono System, with mahogany or blonde wood changer base (please specify) ..... Net **167.50**

HF-375 Same, but with 2-Lafayette CAB-16 mahogany or walnut or CAB-17 blonde speaker enclosures (specify which). Net **222.50**

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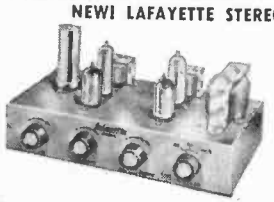
16.75 DOWN ● 12.00 MONTHLY

STEREO FM/AM-PHONO SYSTEM

HF-376 Same as HF-374 but with new Lafayette Model LT-99 Stereo FM/AM Tuner ..... Net **237.00**

HF-377 Same as HF-376 but with 2-Lafayette CAB-16 mahogany or walnut or CAB-17 blonde speaker enclosures ..... Net **292.00**

NEW! LAFAYETTE STEREO AMPLIFIER KIT



- 4 WATTS STEREO OUTPUT
- COMPLETE STEREO CONTROLS
- TRANSFORMER OPERATED

ONLY 18.95

Brand new stereo amplifier kit for that extra small stereo hi-fi set, featuring separate volume controls; ganged tone control; stereo, reverse and monaural switch. 40 millivolt sensitivityl Complete kit with tubes, rectifier, all parts and instructions. Only 9½" x 5" x 4½". For 110-120 60 cycle AC. Shpg. wt., 7 lbs.
KT-126 — Complete Kit, with tubes..... Net **18.95**

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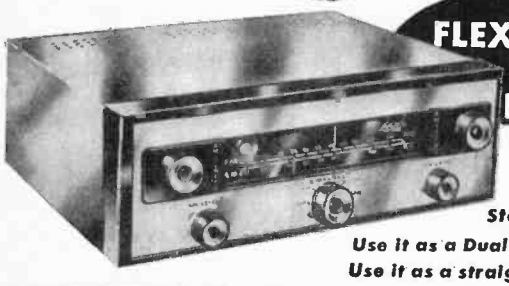
New! YEARS AHEAD! *Lafayette* STEREO TUNER KIT

THE MOST FLEXIBLE TUNER EVER DESIGNED



Use it as a Binaural-Stereophonic FM-AM tuner

Use it as a Dual-Monaural FM-AM tuner

Use it as a straight Monaural FM or AM tuner

- **Multiflex Output for New Stereo FM**
- **11 Tubes (including 4 dual-purpose) + Tuning Eye + Selenium rectifier Provide 17 Tube Performance**
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- **Tuned Cascode FM ● 12 Tuned Circuits**
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- **Separately Tuned FM and AM Sections**
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- **Dual Double-Tuned Transformer Coupled Limiters.**

KT-500
74.50 **IN KIT FORM**
ONLY 7.45 DOWN
7.00 MONTHLY

More than a year of research, planning and engineering went into the making of the Lafayette Stereo Tuner. Its unique flexibility permits the reception of binaural broadcasting (simultaneous transmission on both FM and AM), the independent operation of both the FM and AM sections at the same time, and the ordinary reception of either FM or AM. The AM and FM sections are separately tuned, each with a separate 3-gang tuning condenser, separate flywheel tuning and separate volume control for proper balancing when used for binaural programs. Simplified accurate knife-edge tuning is provided by magic eye which operates independently on FM and AM. Automatic frequency control "locks in" FM signal permanently. Aside from its unique flexibility, this is, above all else, a quality high-fidelity tuner incorporating features found exclusively in the highest priced tuners.

The 5 controls of the KT-500 are FM Volume, AM Volume, FM Tuning, AM Tuning and 5-position Function Selector Switch. Tastefully styled with gold-brass escutcheon having dark maroon background plus matching maroon knobs with gold inserts. The Lafayette Stereo Tuner was designed with the builder in mind. Two separate printed circuit boards make construction and wiring simple, even for such a complex unit. Complete kit includes all parts and metal cover, a step-by-step instruction manual, schematic and pictorial diagrams. Size is 13¾" W x 10⅜" D x 4½" H. Shpg. wt., 22 lbs.

The new Lafayette Model KT-500 Stereo FM-AM Tuner is a companion piece to the Models KT-300 Audio Control Center Kit and KT-400 70-watt Basic Amplifier Kit.

KT-500 ..... Net **74.50**

LT-50 Same as above, completely factory wired and tested ..... Net **124.50**

NEW! LAFAYETTE PROFESSIONAL STEREO MASTER AUDIO CONTROL CENTER

KT-600
79.50
IN KIT FORM
ONLY 7.95 DOWN

Solves Every Stereo/Monaural Control Problem!

- **UNIQUE STEREO & MONAURAL CONTROL FEATURES**
- **AMAZING NEW BRIDGE CIRCUITRY FOR VARIABLE 3d CHANNEL OUTPUT & CROSS-CHANNEL FEED**
- **PRECISE "NULL" BALANCING SYSTEM**

A REVOLUTIONARY DEVELOPMENT IN STEREO HIGH FIDELITY. Provides such unusual features as a Bridge Control, for variable cross-channel signal feed for elimination of "ping-pong" (exaggerated separation) effects and for 3d channel output volume control for 3-speaker stereo systems; 3d channel output also serves for mixing stereo to produce excellent monaural recordings. Also has full input mixing of monaural program sources, special "null" stereo balancing and calibrating system (better than meters), 24 equalization positions, all-concentric controls, rumble and scratch filters, loudness switch. Clutch type volume controls for balancing or as 1 Master Volume Control. Has channel reverse, electronic phasing, input level controls. Sensitivity 1.78 millivolts for 1 volt out. Dual low-impedance outputs (plate followers), 1300 ohms. Response 10-25,000 cps ± 0.5 db. Less than .03% IM distortion. Uses 7 new 7025 low-noise dual triodes. Size 14" x 4½" x 10⅞". Shpg. wt., 16 lbs. Complete with printed circuit board, cage, profusely illustrated instructions, all necessary parts.

LAFAYETTE KT-600 — Stereo Preamplifier kit ..... Net **79.50**

NEW! LAFAYETTE STEREO/MONAURAL 36-WATT BASIC AMPLIFIER

KT-310
47.50
IN KIT FORM
ONLY 4.75 DOWN

- **36-WATT STEREO AMPLIFIER**
- **4 PREMIUM-TYPE 7189 OUTPUT TUBES**
- **RESPONSE 35-30,000 CPS ± ½ DB**
- **18 WATTS PER STEREO CHANNEL OR 36 WATTS MONAURALLY**
- **2 PRINTED CIRCUIT BOARDS FOR NEAT, EASY WIRING**

A superbly-performing basic stereo amplifier, in easy-to-build kit form to save you **lots of money** and let you **get into stereo now** at minimum expense! Dual inputs, each provided with individual volume control. The unit may be used with a stereo preamplifier for 2 18-watt stereo channels, or at the flick of a switch, as a top-quality 36-watt monaural amplifier; **or,** if desired, it may be used as 2 separate monaural 18-watt amplifiers! **CONTROLS** include 2 input volume controls, channel reverse switch (AB-BA), monaural-stereo switch. **DUAL OUTPUT IMPEDANCES** are: 4, 8, 16 and 32 ohms (permitting paralleled monaural operation of 2 speaker systems of up to 16 ohms). **INPUT SENSITIVITY** is 0.45 volts per channel for full output. **TUBES** are 2-6AN8, 4-7189; GZ34 rectifier. **SIZE** is 9-3/16" d (10-9/16" with controls) x 5¼" h x 13¼" w. Supplied complete with perforated metal cage, all necessary parts and detailed instructions. Shpg. wt., 22 lbs.

KT-310 Stereo Power Amplifier Kit ..... Net **47.50**

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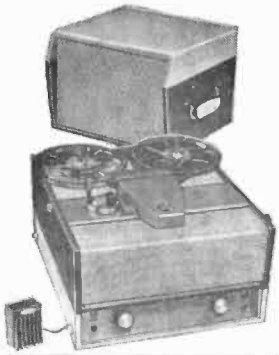


NEW! LAFAYETTE DELUXE STEREO TAPE RECORDER
An Outstanding Quality Value

• 4 TRACK STEREO • 5 WATT AMPLIFIERS • COMPLETE 2-UNIT STEREO TAPE PLAYBACK SYSTEM WITH TWO 5-WATT AMPLIFIERS, 6" WOOFERS, 4" TWEETERS, L/C CROSSOVER NETWORKS. MATCHING PORTABLE CARRYING CASE FOR SECOND STEREO CHANNEL

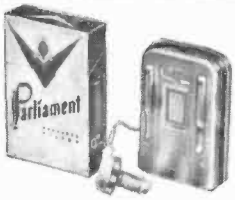
The new Lafayette recorder plays 2-track stereo, 4-track stereo open tape reels or monaural tapes. The unit features new 0.12 mil fine-gap heads for better response at 3¾ IPS than formerly at 7½ IPS; ultra-simple single rotary control; inputs for mike, tuner and magnetic, crystal or ceramic phono; 3¾ and 7½ IPS; speeds up to 7" reels. A separate portable amplifier—speaker in matched carrying case uses the tape recorder's built-in preamp for the second channel. Has heavy duty 4-pole motor and magic-eye recording level indicator. Comes complete with 5" reel of tape, empty 7" takeup reel, crystal mike and instructions. Shpg. wt., 50 lbs.

LAFAYETTE RK-102 Complete 2-Unit Lafayette Monaural R/P, Stereo Play System .....Net **159.50**

LAFAYETTE RK-100 Monaural R/P, Stereo Play Tape Recorder only (Less amplifier-speaker unit for second channel). Shpg. wt., 30 lbs. .....Net **129.50**

LAFAYETTE RK-101 Amplifier-Speaker Combination Only .....Net **37.50**

NEW! 3-TRANSISTOR MINIATURIZED HEARING AID



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A completely self-contained transistorized hearing aid for those with hearing losses. Provides high amplification, good intelligibility and quiet operation. Has "on-off" switch and volume control. Easily carried in the pocket and secured by means of 2 clips. The miniature dynamic earphone has 2 different rubber covered ear plugs and 3 ft. long colorless plastic cord. Comes in zippered case with spare cell.

F-390 3-Transistor Hearing Aid .....Net **19.50**

NATIONALLY ADVERTISED 4-SPEED AUTOMATIC RECORD CHANGER
Plays Stereo and Monaural Records

Reg. ~~59.50~~ **39.50**

Famous brand latest model guaranteed to please or money refunded. With choice of new GE GC-7 Stereo Compatible Cartridge with Diamond Stylus or GE VR-11 Cartridge with Diamond and Sapphire Styli. Regular 59.50 value. Shpg. wt., 21 lbs.

PK-250 RECORD CHANGER with GE 4G-052 Cartridge with Diamond-Sapphire Styli .....Net **39.50**

PK-251 RECORD CHANGER with NEW GC-7 STEREO CARTRIDGE with DIAMOND STYLUS .....Net **39.50**

PK-252 RECORD CHANGER with Pickering Stereo 371.7D Diamond Cartridge .....Net **44.50**

PK-111 WOOD BASE for above. Specify Mahogany or Blonde. Shpg. wt., 5 lbs. .....Net **3.95**

Lafayette's Radio-Control Specialties

LAFAYETTE SPECIAL R/C TRANSMITTER

New crystal controlled 27.255 MC R/C transmitter, completely assembled, tested and guaranteed. Includes tube, crystal and 6 section telescoping antenna. Approx. 1 mile range. Size 8½ x 2½ x 1¾" Shpg. wt., 2½ lbs. Less batteries.

F-249 R/C TRANSMITTER (Less Batteries) Net **14.95**

LAFAYETTE SPECIAL R/C RECEIVER

New factory wired and tested RC receiver. Completely enclosed — for use around water — case may be removed. Ready to operate on exact-free 27.255 MC band. Has fine tuning control, antenna lead, and connector plug. Requires one 1.5V and one 45V battery. Complete with 3S4 tube, less batteries. Size 3 x 2¼ x 1½". Ideal companion for F-249 Transmitter. Shpg. wt., 8 oz.

F-208 R/C RECEIVER (Less Batteries) Net **8.95**

SPECIAL COMBINATION OFFER

Consists of R/C Transmitter (F-249) and R/C Receiver (F-208)

F-259 Combination Net **22.90**

20,000 OHM PER VOLT MULTITESTER SEMI-KIT

• 20,000 OHMS PER VOLT DC—10,000 OHMS PER VOLT AC
• 40 MICROAMPERE 3" D'ARSONVAL METER MOVEMENT
• HIGH INPUT RESISTANCE ON ALL DC AND AC RANGES
• JUST CONNECT A FEW WIRES TO COMPLETE THE KIT

ONLY 11.95

The semi-kit is a new concept in test equipment kits. All the important or difficult parts are already mounted. All that remains to be done is to mount and wire in a few small parts — a job so simple you'll finish before you realize it, and best of all, you'll have one of the finest high sensitivity multitesters on the market. When used in a circuit, the high input resistance on all DC and AC ranges does away with the highly inaccurate readings common to low resistance testers which load the circuit. Ranges: DC Volts, 0-10-50-250-500-1000; AC Volts, 0-10-50-250-500-1000; DC CURRENT, 0-500 ua, 0-10-250 ma; OHMS, 0-10K-100K-1 meg; DECIBELS, -20 to +36; *PLUS* 0-5000 henries and 250 mmf. to .02 mfd. Black case 5¾" x 3¾" x 1⅞". Complete with test leads, all parts, and instructions. Shpg. wt. 3 lbs.

TK-10 KIT .....Net **11.95**

NEW! AUDIO LEVEL VU INDICATOR

Precision loudness meter. Calibrated in Volume Units and percent, with 20 db variable attenuator. Ideal for setting output level in paging and music systems; removes guesswork when used as record-level indicator with tape recorders. Highly damped meter; responds to average level of voice and music. Impedance 10,000 ohms; sensitivity 1.4 volts for 0 VU. With capacitor for blocking DC to prevent burnout, 4" w x 2-3/16" h x 1-3/8" d. Shpg. wt., 1 lb.

LAFAYETTE TM-20 Audio Level Meter .....Net **5.95**

NEW! STEREO BALANCE VU METER

Removes guesswork in providing perfect balance of the 2 amplifier or preamplifier channels in any stereo system. Can be used as record-level indicator with stereo tape recorders, and for balancing stereo tuners. Impedance 10,000 ohms; calibrated 20 db attenuators, capacitors for blocking DC. Calibrated in Volume Units and percent; highly damped, reads average voltage of voice or music signals. Sensitivity 1.4 volts for 0 VU. Shpg. wt., 1 lb.

LAFAYETTE TM-40 Stereo Balance Meter .....Net **8.95**

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PLEASE INCLUDE POSTAGE WITH ORDER

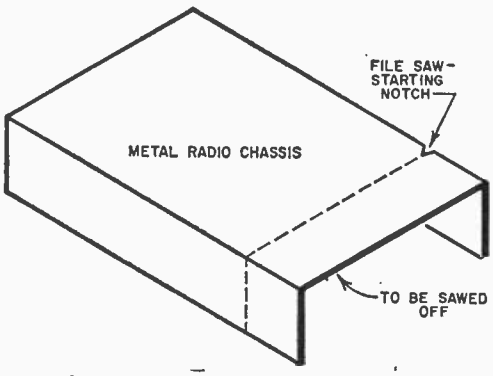
hand in to get a good grip. In such cases, simply slip the end of a screwdriver blade under the base of the tube, and then pry it up by turning the screwdriver, holding the tube straight as you do it. Be very careful if you use this method on glass-base tubes, as the screwdriver can crack the glass. —*A. T.*

SUEDE BRUSH SOLDERING AID

Occasionally you may have to remove dirt or scale from a connection to be soldered. This task is very easy if you use a dime-store metal-bristle suede brush. You can also use it to remove excess solder from a soldering gun or iron and soft materials from the grooves of hand files. —*B. C.*

HACK-SAWING A RADIO CHASSIS

If you saw your own metal chassis to shape when building a radio or other electronic device, here's a hack-sawing tip that you'll find useful. Before attempting the



first few saw bites, file a notch point where you want to begin the cut. When you start to saw, the blade won't jump out of position and bite in at another point a fraction of an inch away. —*P. Q.*

SPAGHETTI SHEATHES FILES

Those small Swiss needle files often found in the radio-electronic hobbyist's tool kit can be protected from dulling nicks by being sheathed with lengths of snug-fitting wire insulating spaghetti. Dust the files with graphite before slipping the sheaths over them to prevent rust. —*B. V.*

SOLDERING PLASTIC COIL PRONGS

Many home constructors find it hard to solder wires on plastic coil form prongs because the prong becomes loose in the plastic. Try doing it this way:

First immerse the coil in a jar or glass of water, just covering the top of the coil

take it from a hi-fi dealer—

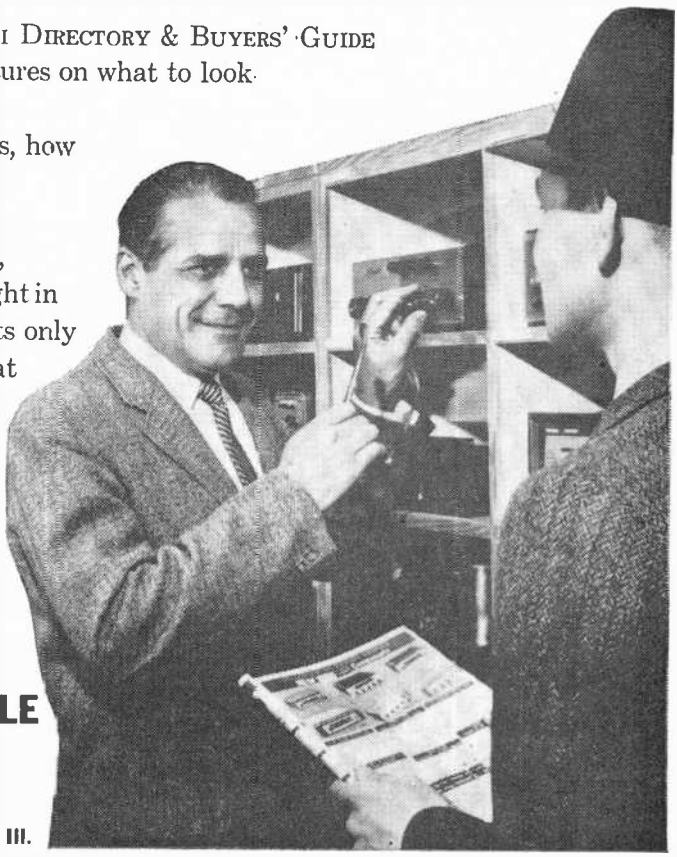
KNOW YOUR HI-FI EQUIPMENT BEFORE YOU BUY!

Any dealer will confirm it. The hi-fi fan who makes the smartest buy usually knows his equipment, prices and specifications before he even steps into a store.

Where can you get such helpful information? It's available in the HI-FI DIRECTORY & BUYERS' GUIDE—the world's only complete reference for the high fidelity fan. Virtually every piece of hi-fi equipment manufactured is listed in the 1959 HI-FI DIRECTORY & BUYERS' GUIDE—complete with prices, specifications and illustrations.

This year's edition is bigger than ever—180 pages of useful information, arranged conveniently into sections on tuners, amplifiers and preamps, record players, changers, turntables, tone arms, cartridges, tape recorders, loudspeakers and systems, enclosures and equipment cabinets.

In addition to listings, the HI-FI DIRECTORY & BUYERS' GUIDE contains helpful articles and features on what to look for, how to buy, advantages and disadvantages of different models, how to judge quality and recognize a bargain. Whether you're a hi-fi beginner or a veteran audiophile, this publication is worth its weight in diamond styli to you. Yet it costs only $1.00. Be sure to pick up a copy at your favorite newsstand, hi-fi salon or electronics parts dealer.



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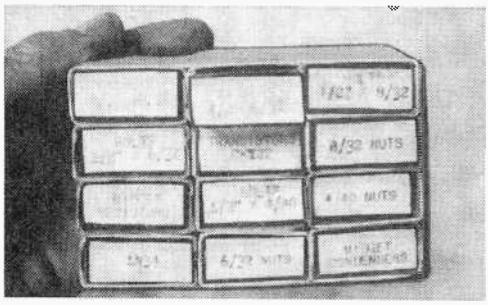
form. Hold the pin of the coil being soldered with pliers to help dissipate the heat. Now solder the wire end and push the whole prong under the water surface. The surplus water can be blown out with an air hose, or left to dry. —*E. H. M.*

MAKE A MATCH-BOX CABINET

A dozen penny match boxes and some masking tape are all you need to make this handy little hardware and small parts cabinet. Wrap the tape around the empty boxes



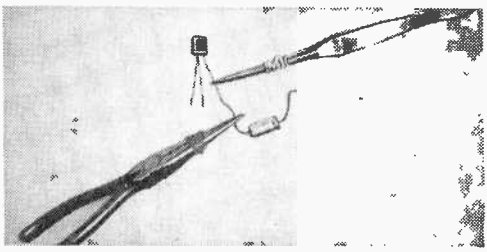
to hold them together. Cut strips of paper to fit the drawers of the boxes, labeling each with the contents, and glue them to the front panels. Push the drawers from the rear to open. —*P. B.*

HANDY FLUX CAN

Do you ever have trouble locating that can of rosin flux amidst the confusion of small parts on your workbench? To insure that flux is always at hand when needed, simply spot-solder the flux can to the end of your solder spool. —*H. J. G.*

HEAT SINK SOLDERING

When soldering transistors and associated miniature components, it is desirable to place a heat sink between *all* parts and the soldering iron. Most people, having only two hands, find this difficult, since the

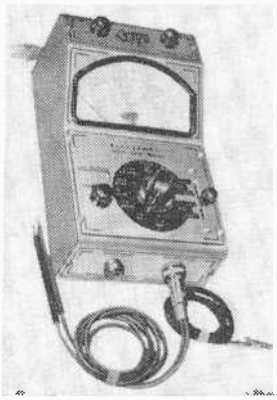


soldering iron and solder must also be held. The solution to this problem is simply to wrap a small rubber band around long-nosed pliers or long tweezers and clip them onto the leads as shown. —*N. E. P.*

TOOLS and GADGETS

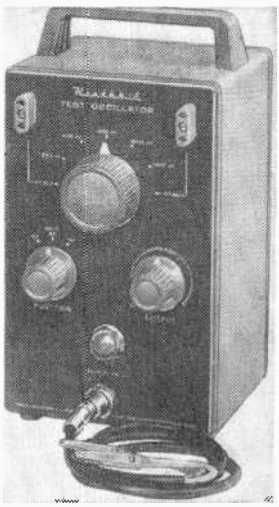
VTVM HAS MANY FEATURES

The Model 208 VTVM provides seven ranges on a.c., d.c., and ohms, plus a special ohms scale to check standard color-coded resistance values and tolerance limits. Accuracy is within 3% on all scales. Special features include a sloping meter panel, a "shift-lever" function switch, a line voltage check independent of VTVM bridge circuit, and a meter-shunting position for portable use. The meter has a 4½" 200-microamp movement with burn-out protective circuit. Net price, $74.50. (*Seco Mfg. Co.*, 5015 Penn Ave., South, Minneapolis, Minn.)



TEST OSCILLATOR KIT

Test frequencies most often used in the repair and alignment of superheterodyne broadcast receivers are provided by the Model TO-1 test oscillator. Five fixed-tuned frequencies (262, 455, 465, 600, and 1400 kc.) can be quickly selected for trouble-shooting or alignment. Two switch-selected crystal sockets are also provided to allow the use of any other necessary frequency. The r.f. output of the TO-1 may be either unmodulated or



modulated, or the audio can be used separately. Price, in kit form, $16.95. (*Heath Company,* Benton Harbor, Mich.)

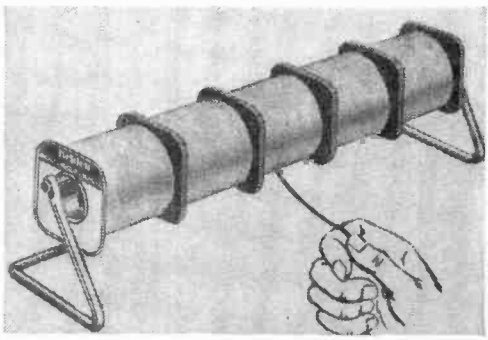
DUAL-PURPOSE POWER SUPPLY KIT

Useful for servicing both transistor portables and 12-volt auto radios, Model KPS-2 powers radio receivers—including hybrid types—with no hum. Complete wiring dia-

grams and assembly instructions come with this easy-to-assemble d.c. power supply kit. Price, $39.95; factory-wired as Model PS-2, $49.95. (*Electro Products Laboratories,* 4500 N. Ravenswood Ave., Chicago 40, Ill.)

HOOKUP WIRE DISPENSER

Fourteen new hookup wire dispenser kits are intended for use by hobbyists, experimenters, servicemen and engineers. Each



of the kits contains a free metal dispenser rack that can be mounted on a workbench or wall, and an assortment of the most popular sizes and colors of hookup wire in sizes 20 through 26. (*Belden Manufacturing Company,* Chicago 80, Ill.)

MINIATURE MULTIMETER

Seven d.c. voltage ranges are featured in the "AVO Multiminor," from 2.5 to 1000 volts, measured with an accuracy of 3%

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YOU BUILD This 17 Inch Television Receiver

As part of your NRI course you can get all components, tubes, including 17" picture tube, to build this latest style Television receiver; get actual practice on TV circuits.

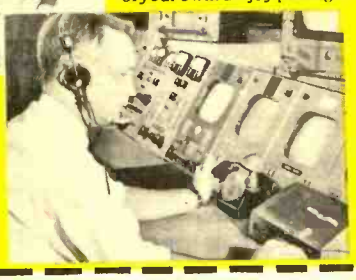
YOU BUILD Vacuum Tube Voltmeter

Use it to earn extra cash fixing neighbors' sets; bring to life theory you learn from NRI's easy-to-understand texts.

For Higher Pay, Better Jobs Be a TV-Radio-Electronic Technician

Servicing Needs More Trained Men

Portable TV, Hi-Fi, Transistors, Color TV are making new demands for trained Technicians. Good opportunities for spare time earnings or a business of your own. Enjoy prestige.



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J. E. Smith, Founder

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8 TRANSISTOR SOCKETS Mice-filled; for sub-mini tubes, too $1

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70 TERMINAL STRIPS Solder-lug & binding; to 20 terminals. 2 lbs. $1

60 ONE-WATTERS Asstd. value carbon resistors. 5%, too!. $1

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1R5	.59	6CE5	.66
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1S5	.59	6CG7	.65
1T4	.59	6CL6	.91
1U4	.59	6CN7	.69
1U5	.55	6CS6	.59
1V2	.57	6CS7	.78
1X2A	.79	6CU6	1.19
3A4	.69	6DB5	.69
3AL5	.54	6DE6	.59
3AU6	.75	6DQ6	1.14
3BC5	.71	6DT6	.59
3BE6	.63	6H6	.79
3BN6	.86	6J5	.49
3BY6	.68	6J6	.69
3BZ6	.65	6K6	.59
3CB6	.59	6S4	.59
3CS6	.68	6SA7	.69
3DT6	.59	6SC7	.75
3Q4	.69	6SF5	.66
3S4	.69	6SJ7	.79
3V4	.59	6SK7	.69
4BQ7	1.14	6SL7	.79
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5AM8	.95	6SQ7	.65
5AN8	1.02	6T4	.99
5AQ8	.89	6T8	.85
5AT8	.89	6U8	.89
5AV8	1.11	6V3	1.21
5BK7A	.98	6V6	.59
5J6	.81	6W4	.61
5T8	.98	6W6	.71
5U4	.59	6X4	.48
5U8	.89	6X5	.59
5V4	.77	6X8	.79
5X8	.93	12AT6	.49
5Y3	.49	12AU7	.79
6AB4	.59	12AU6	.62
6AC7	.79	12AU7	.66
6AF4	.99	12AV6	.47
6AG5	.69	12AV7	.79
6AG7	.89	12AX4	.69
6AH4	.85	12AX7	.69
6AH8	.99	12AY7	.99
6AK5	.49	12AZ7	.69
6AL5	.53	12B4	.69
6AL7	1.65	12BA6	.54
6AM8	.83	12BD6	.63
6AN8	1.20	12BE6	.55
6AN8	.89	12BF6	.49
6AQ5	.59	12BH7	.79
6AQ6	.62	12BK5	.96
6AQ7	1.15	12BQ6	1.29
6AS5	.69	12BY7	.79
6AS6	1.29	12BZ7	.77
6AT6	.49	12DQ6	1.20
6AT8	.91	12L6	.61
6AU4	.96	12SA7	.69
6AU5	1.19	12SK7	.69
6AU6	.59	12SN7	.69
6AU8	.92	12SQ7	.69
6AV5	.99	12V6	.59
6AV6	.45	12X4	.48
6AW8	.95	19AU4	.99
6AX4	.75	19BG6G	1.83
6BA6	.57	19T8	.96
6BA8	1.04	25AV5	1.10
6BC5	.59	25BK5	.92
6BC8	1.13	25BQ6	1.29
6BD6	.65	25DN6	1.64
6BE6	.59	25L6	.59
6BF5	.75	25W4	.78
6BF6	.49	25Z6	.66
6BG6G	1.59	35A5	.89
6BH6	.55	35B5	.75
6BK5	.81	35C5	.55
6BK7A	.89	35L6	.61
6BL7	.95	35W4	.45
6BN6	.75	35Z5	.49
6BQ6	1.15	50A5	.79
6BQ7	.99	50B5	.69
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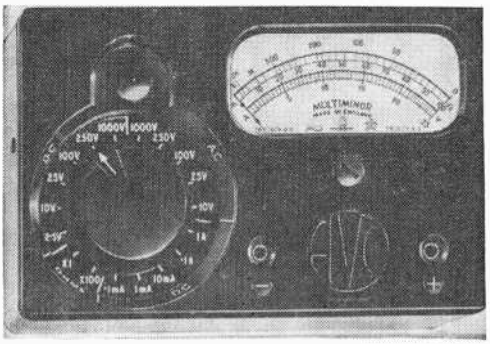
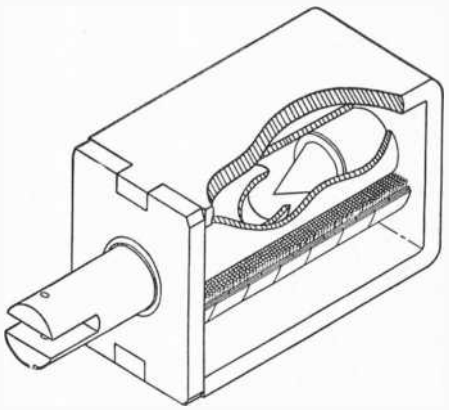
at 10,000 ohms/volt. A.c. voltages from 10 to 1000 volts full scale can be measured in five ranges, with an accuracy of 4% at 1000



ohms/volt. In addition, d.c. current up to 1 ampere and resistance to 2 megohms are covered. (*British Industries Corp.*, Port Washington, N. Y.)

MAGNET-TYPE SOLENOID

The Model 200 solenoid is a combination solenoid-magnet type. Its over-all size with plunger fully inserted (see cutaway drawing) is 1"x1 7/32"x2½". Plunger travel distance is ¾". Weighing 7 ounces, it has a lifting force of 1.4 lbs. /0.75", and operates at



117 volts, d.c., 53 ma. Drop-out current is 12 ma., coil resistance 2000 ohms. The unit is capable of continuous duty with ventilation for a maximum of three hours. List price, $3.00. (*Parks Electronics Corp.*, Redwood City, Calif.)

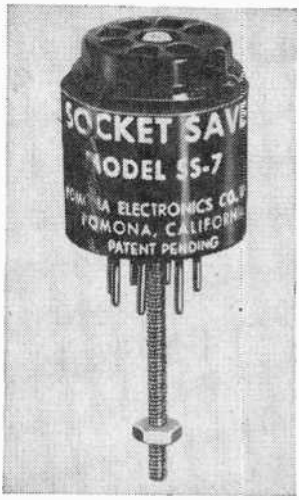
STEREO CONVERSION KIT

You can convert any ordinary three-speed phonograph to stereo with the "Stereo 4" kit and, according to the manufacturer, the entire conversion can be done in less than a half hour. The four main parts of the "Stereo 4" are a 4-watt ampli-

fier, a stereo-monaural cartridge with preattached leads, a coaxial speaker, and an isolation transformer. Cables and hardware are also included. (*Republic Electronic Industries Corp.*, Farmingdale, Long Island, N.Y.)

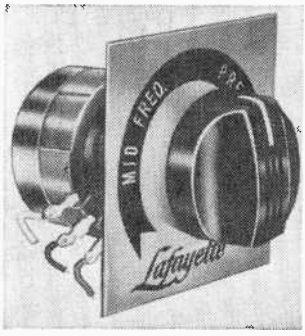
TUBE SOCKET SAVER

The socket saver is designed to be installed on tube checkers and other electronic equipment to prevent wear and tear on original sockets. Easily installed and removed, it eliminates the necessity of replacing and rewiring sockets. With a maximum height of 1 3/16" above equipment, this socket saver comes in 7-, 8- and 9-pin models. (*Pomona Electronics Co., Inc.*, 1126 West Fifth Ave., Pomona, Calif.)



SPEAKER LEVEL CONTROLS

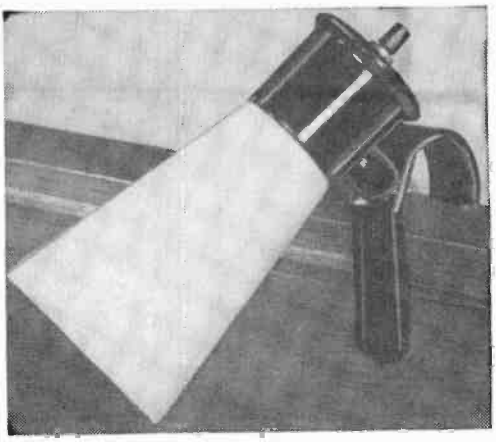
A new set of "brilliance" and "presence" hi-fi level controls is available from Lafayette Radio. Wire-wound 8- and 16-ohm "L" pads, they are designed to vary the level of mid- and high-frequency speakers in multiple speaker hi-fi systems. The resistance elements are mounted concentrically, permitting a much shallower housing than the usual dual-pot construction. Bushing length is 1". Price, $1.95 each. (*Lafayette Radio*, 165-08 Liberty Ave., Jamaica 33, N.Y.)



HANDY CLAMP-ON LIGHT

Here is a handy clamp-on light for your test bench or tool kit. The narrow metal shade will direct light where needed while

occupying a minimum of space. The padded clamp allows you to attach the light to console cabinets temporarily without marring the finish. Price, $4.95. (*Pennington Crafters, Inc.*, 3412 "J" St., Philadelphia 34, Pa.)

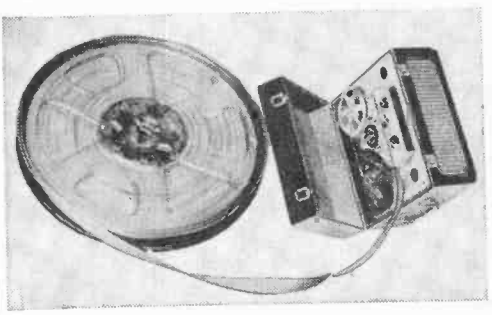


USEFUL TEST LEADS

Designed for strength and versatility, the new Alpha test lead line comprises the 12 most useful combinations of test prod and meter tip types. The full 50" wire length will not break down under 12,000 volts at 60 cycles. Each pair of test leads comes individually packaged in a clear plastic tube. (*Alpha Wire Corp.*, 200 Varick St., New York 14, N. Y.)

TAPE HEAD CLEANER

"Kleen-Tape" is a device for cleaning tape recorder heads without the use of tools. It is a specially impregnated fabric tape on a standard tape recorder reel. When this tape is "played through" the recorder, it removes iron oxide accumulation as well as dust and other foreign materials from the head, leaving the head clean and dry. "Kleen-Tape" can be used over and over again. Price, $2.95. (*Walsco Electronics Mfg. Co.*, 100 West Green St., Rockford, Ill.)



—30—

Flying High at Zero Altitude

(*Continued from page* 44)

tilts up. It follows every motion of the airplane, so it sees what the pilot would see. The picture is then flashed on the screen in front of the pilot.

A television projector is located on top of the DC-8 simulator cockpit. And the televised picture from the map room is projected onto a motion picture screen which covers the visible area viewed by the pilots in training.

The DC-8 simulator gives to the public a well-trained, proficient crew. This flying team practices and "polishes" on the ground. When the Jetliners are put into operation, the passengers can be sure that the pilot and his crew have many hours of simulated and actual flying time under their belts. The simulator offers safety through practice. —30—

Add an Erase Fader

(*Continued from page* 84)

When the control is turned fully counterclockwise, the erase current is cut off and the head is made inoperative, thus permitting a recording to be dubbed over old program material without erasing it. A certain amount of erasure results from the bias current on the record head, but this is negligible.

Now for using the erase fader. Suppose you have a musical recording and you want to add a spoken commentary. First play the tape and note the place where you want

"Sometimes I think you PREFER confusion!"

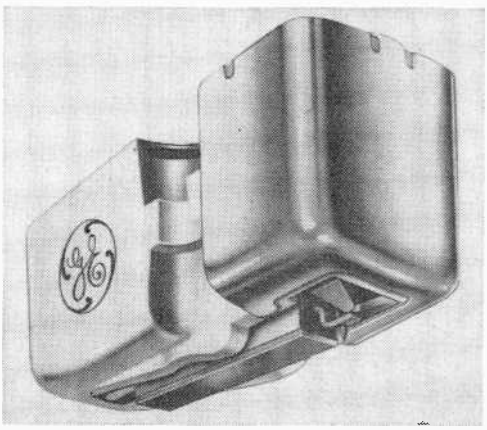
to insert the commentary. This may be marked on the tape with a china marking pencil. Then set the erase fader control full counterclockwise and run the tape through with the machine set for *Record* but the record volume control turned all the way down. When the mark appears, turn the fading control part way up to fade out the music. At the same time, turn up the recorder's volume control to fade in the mike and start your commentary.

If you have recorded a musical program and are annoyed by the hand-clapping which is also present, use the following procedure. Find the spot where the clapping begins and rewind the tape one or two feet from that spot. Set the erase fader to the maximum counterclockwise position and the machine's controls to *Record* (with the record volume control at minimum). Now start the tape and gradually turn the fader to maximum (clockwise position). This will produce a professional-type fade. You must be careful, for mistakes here can't be corrected. Experimentation is recommended before you start to work on your valuable recordings. —30—

IMPROVED STEREO CARTRIDGE

General Electric now has a .5-mil diamond stylus "top audiophile performance" version of its new stereophonic magnetic variable reluctance hi-fi cartridge. Known as the "Golden Classic" Type GC-5, it is designed for application only in turntables with high-quality tone arms.

Although outwardly similar to the .7-mil stylus types made by G.E., the GC-5 will have several performance ratings which are considerably higher. It will have a 20- through 20,000-cycle frequency response at a tracking force of two to four grams. Its lateral compliance will be 4×10^{-6} centimeters per dyne, and its vertical compliance 2.5×10^{-6} centimeters per dyne.



The VLF Receiver

(*Continued from page* 80)

sumption that the manufacturer wound all the coils in the same direction. However, if a coil set refuses to oscillate, reverse the plate coil leads and try again.

With stations in the v.l.f. band only two or three kc. apart, it is necessary for the operator to separate c.w. stations "by ear." If the builder wishes to add a refinement to the receiver, a Type FL-8-A (B) filter may be obtained through surplus dealers.

In the *Range* setting of this filter's 3-position switch, a sharp 1000-cycle peak is obtained, which enables complete separation of stations in the v.l.f. band.

In the *Voice* position, the 1000-cycle peak is attenuated so that aircraft radio range-voice transmissions may be received with minimum interference from the 1000-cycle modulation present on these stations.

In the position marked *Both,* the filter is out of the circuit. The filter input is plugged into the receiver headphone jack and the filter output into the amplifier input.

Short lengths of microphone cable fitted with phone plugs serve as connecting cable.

Operating this v.l.f. job, while not difficult, is much different from operating a superheterodyne type of receiver. Precise adjustment of the regeneration control and careful tuning of the antenna and grid circuits is necessary to bring in those elusive stations. You'll discover that considerable skill is required to get the best from this rig; but as your proficiency grows, so will your DX log. —30—

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A MARSman Tells All

(*Continued from page* 70)

guard," and "Radioteletype for the Radio Amateur."

Informal Procedure. Because its mission is technical training, rather than operational, Technical Net follows extremely informal on-the-air procedure, with first names used more commonly than station call signs. Participation is open to all First Army MARS stations with single-sideband equipment that put in a minimum of 12 additional hours a year on one of the regular MARS communications training nets. Present members include a number of broadcast and electronics engineers and

such non-technical MARS members as a grocery store manager and a news dealer.

There are also non-member listeners. Ed has heard from many such listeners in the Midwest and on the West Coast. He even got one QSL from a ham in the Azores. Such non-members are not permitted to engage in the on-the-air question period, but they are allowed to telephone questions to member stations so that the member can put the question on the air for them.

The welcome mat is out for such non-member listeners Wednesday evenings from 9 to 10 p.m., Eastern time, when the Technical Net goes on the air at 4030 kc., upper sideband. Single-sideband transmissions can be picked up by stable receivers equipped with beat oscillators. —30—

After Class

(*Continued from page* 90)

gain of 29 is necessary to provide satisfactory performance at a single frequency. To insure strong oscillation over a range of frequencies, the gain must be somewhat higher than this. Hence, a practical phase-shift oscillator requires either a high-gain pentode or two triodes in cascade for sure-fire operation.

An example of a pentode oscillator is shown in Fig. 2, and a dual-triode type is shown in Fig. 3. In the latter circuit, the feedback voltage for sustaining oscillation is taken from the *cathode* of the second triode. Since there is zero phase shift between the grid input and cathode output voltage of a vacuum tube, the second triode does not introduce any complications when used this way. Instead, it provides a low-impedance source for the feedback voltage and prevents the output load (headphones, speaker, etc.) from causing oscillator instability due to loading effects.

The nomogram given in Fig. 4 will provide you with the required R and C values for any frequency between 5 cps and 100,000 cps. Merely select a value for C (all three capacitors are equal), then lay a straightedge from this value of C through the desired frequency. The intersection of the edge with the R-axis on the nomograph tells you the value of all three phase-shifting resistors. The same procedure is used for finding f if R and C are known, or finding C if R and f are known.

—Harvey Pollack

MRS

(*Continued from page* 63)

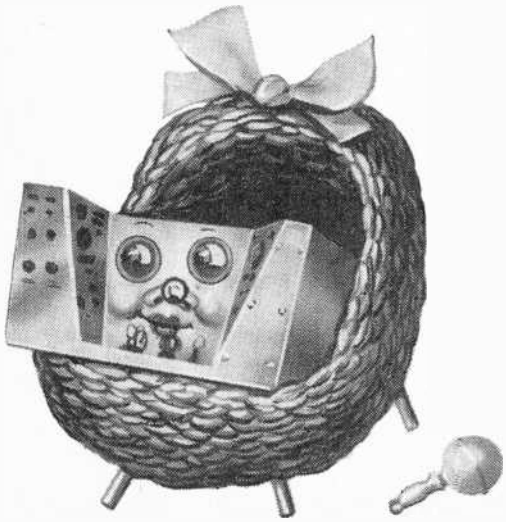
If the machine had run according to design specs, this job would have been done by around midnight. But of course MRS didn't run exactly according to our expectations, and I spent the night in the machine room. More than half the time I sat looking at a glowing maintenance light and wondering what was going on.

JUST a little before daylight, MRS quit computing completely and dumped out the output to date and reams of unprocessed data. Then maintenance lights flashed on all over the room. I figured MRS had had it and dashed around to the rear of the maintenance unit to pull the covers and see what MRS was up to.

The removal arms got there first and dropped the covers right in my path. I skidded to a halt to keep from getting hit. Then the arms pulled out a collection of miscellaneous boxes of hardware that I had never seen before. Then they produced a collection of cables and plugged all these boxes together, and darned if the whole array didn't look like a scaled-down version of MRS. About that time the output printer began to clack away.

I rushed around to the printer to see what this was and read the following message; "MRS, Jr., arrived 4:46, weight 8467 pounds, 12 ounces. MRS and progeny doing fine."

The big question around the Institute now is, if MRS is the mother, then who is the father? —30—



There Are Robots Among Us

(*Continued from page 47*)

They are manufactured units capable of handling and processing a given job of work with a minimum amount of human supervision, thus releasing many *people* for more interesting, more rewarding and less dangerous pursuits. In order to accomplish this, they must be capable of reaching certain decisions completely on their own.

That definition should sound familiar. It is a description of a tape-controlled lathe or production line, built to inspect, catch and correct its own errors. This is automation at its best. It is a description, if you like, of a single electronic computer handling an entire office-load of clerical work, a computer backed by a small programing staff which translates the input data into acceptable form. It is also a description of a guided missile with a proximity fuse, or of the recently announced Hughes' Digitair —an airborne computer that can fly an Air Force jet interceptor from after take-off to landing and all through combat.

This means that we already have robots, that robots have already begun to take over. Where then are the gear-grinding mechanical men who cross metal arms on their breastplates, look at us with dog-like devotion through photosensitive silicon cells, and say, "Yes, master, I have waxed the Buick and changed the flat tire," in absolutely flat, toneless voices?

The answer is that they never were and probably never will be. The hard reality of manufacturing processes has an annoying way of taking an entirely different line from the one that literary imagination and artistic prophecy have projected. Da Vinci, the fifteenth-century Florentine, drew dozens of bird-winged and bat-winged flying-machine suggestions: the drawings have little in common with the airplane as it has actually developed since the time of the Wright brothers. Similarly, the humanoid electronic creatures from the drawing boards of our science-fiction illustrators bear little relationship to the silent, spacious, air-conditioned rooms that house the computers of today or the long rows of automated machinery.

Will the Robots Take Over? Our tape-directed factories and offices, our digital analog computers, our "thinking" weapons

—these are true robots, and they have been here among us for some time now. But what of the future? Will they become more "human," in shape and mind, until—eventually—they are better than we are?

It does not seem very likely.

Suppose we develop space travel and decide we'd rather use robots than relatively delicate men to inspect and repair the outside of the ship if anything goes wrong in the cold, airless, interplanetary deeps. Will it be a man-like creature who will scamper outside with hammer and monkey wrench? Hardly. On the basis of sheer engineering economics, it makes more sense to have a "robot" in the form of a self-repairing hull.

Instead of robot miners going underground with lamps built into their foreheads, it is more probable that we shall see something in the nature of automatic mine shafts, governed by computers capable of geological evaluation. And much more possible than a robot butler responding to a knock on the door is a robot door, programed to open only to certain signals—"Open, Sesame," for example!

All of which gets us back to the fear of robots replacing human beings. A robot is, after all, no more than a machine; and a machine is merely an automatically operating tool. Every tool is made for a specific functional purpose, and so is every robot.

Man, on the other hand, has no *specific* functional purpose. More than that, he has reached his present eminence in evolution largely because he is one of the most *non*-specialized animals ever. He can survive in a great number of environments, civilized or completely savage. A robot cannot. A robot, like any machine, is a product and a native of a single civilization only, built to operate and survive in an extremely narrow set of conditions.

A robot, at best, is a complete prisoner of its own specialization. For hundreds of thousands of years, Man, in his versatile way, has destroyed or domesticated every specialized creature he has ever encountered—from specialized carnivores like the saber-tooth tiger down to specialized parasites like the polio virus.

He has little to fear from the latest of these—the robot made by himself for his own uses.

—30—

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF Popular Electronics published monthly at Chicago, Illinois, for October 1, 1958.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Ziff-Davis Publishing Company, 434 So. Wabash Ave., Chicago 1, Ill.; Editor, Oliver Read, One Park Avenue, New York 16, N. Y.; Managing editor, Julian Sienkiewicz, One Park Avenue, New York 16, N. Y.; Business manager, Howard Stoughton, Jr., One Park Avenue, New York 16, N. Y.

2. The owner is: Ziff-Davis Publishing Company, 434 So. Wabash Ave., Chicago 5, Ill.; Estate of William B. Ziff, One Park Avenue, New York 16, N. Y.; A. M. Ziff, One Park Avenue, New York 16, N. Y.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

H. STOUGHTON, JR., Business Manager.

Sworn to and subscribed before me this 18th day of September, 1958.

[SEAL] WILLIAM PROEHMER, Notary Public. (My commission expires March 30, 1960)

Transistor Topics

(*Continued from page* 88)

the connections of the extra winding added to *L1*. Tune with *C1*, readjusting *R3* as necessary for best reception.

The long-wave band is used for radio-beacons and coastal and aeronautical communications work. The signals all will be c.w.—either code or continuous tones. Joe indicates that reception on this band, in general, is rather poor during the day but it picks up some at night and in the early morning.

How Rugged Can You Get? From the very beginning, most authorities agreed that well-designed transistors should be extremely rugged and quite resistant to shock damage. In fact one transistor manufacturer's representative used to demonstrate the relative merits of his line by dropping a handful of transistors and vacuum tubes on the floor together. The vacuum tubes, of course, were smashed, but the transistors remained undamaged.

Perhaps the ultimate in a shock test is one recently used by General Electric. Having developed a new fixed-bed mounting technique for transistor assembly, G.E. found that conventional methods of testing mechanical stability were inadequate. So they loaded several transistors into a 12-gauge shotgun shell and fired them into a telephone book. The transistors still worked!!

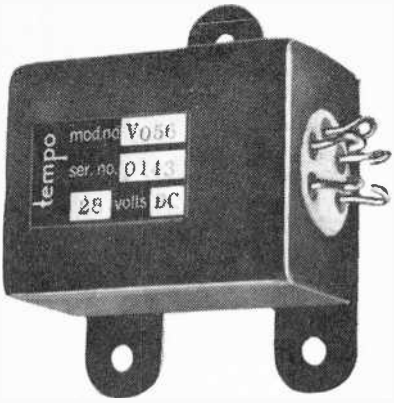
Don't try this test yourself. Not all transistors are manufactured using fixed-bed construction.

Tickler File. If you haven't sent for the "Applications Bulletin for the 2N554" power transistor, why not do it now? Issued by Motorola, this booklet features several practical circuits and is ayailable free of charge. Write to Motorola, Inc., Semiconductor Division, 5005 E. McDowell Rd., Phoenix, Arizona.

And don't forget to pick up a copy of the Third Edition of G.E.'s valuable "Transistor Manual." Selling for only one dollar through all G.E. distributors, this 168-page spiral-bound book features information on semiconductor theory, transistor construction, basic design data, transistor specifications, and literally dozens of valuable circuits. It should be in *every* transistor experimenter's library.

Product News. Tempo Instruments, Inc. (240 Old Country Rd., Hicksville, N. Y.)

has introduced a series of transistorized time delay relays. These units are all-electronic, utilizing transistors and *RC* time-constant circuit elements. All moving parts except the relay contacts have been eliminated. Typical applications include aircraft and missile instrumentation, navigation and guidance systems, automation circuits, computers, motor controllers, communications equipment, and fusing and arming devices. One of the current production models is shown above.



On the "Space" front, CBS-Hytron recently announced that it has developed a solar-powered television camera suitable for mounting in an artificial satellite. This new TV "eye" could be used to observe the Earth, other planets, or the Moon.

A new line of high-frequency transistors has been announced by Motorola. Called MESA transistors, they are designed for use as u.h.f. oscillators and amplifiers or as extremely fast switches. One type, the 2N700, for example, features a power gain of 12 db at 200 mc., and can be used at temperatures up to 100°C. A companion type, the 2N695, has a switching time on the order of ten *millimicroseconds*.

Sylvania has just issued a new booklet featuring "Performance-Tested Transistor Circuits." Selling for 35 cents through all Sylvania transistor distributors, it includes circuits for hi-fi components, electronic toys, and test equipment. This company has also announced the production of several new transistor types, including five power units and seven new renewal types.

That's the story for now, fellows . . . but before signing off . . . SEASON'S GREETINGS!

See you *next year*. . . .

Lou

Short-Wave Report

(*Continued from page* 76)

radiation, matched to 600-ohm open wire feeders. For medium-wave transmission, there is a 180" vertical wire with a capacity top. Seven RCA91 and AR88 receivers are used in the receiving station and two rhombic antennas are beamed on the United Kingdom for receiving programs from London.

Future plans call for a new transmitter for a second program with national coverage. This will be a 10-kw. unit, the antenna a 500" vertical radiator, and transmissions will be on two frequencies. Operations are scheduled to begin soon.

Our thanks go to Cleveland Billey, Monitor #330, of Mahaica, East Coast, British Guiana, for his assistance in the preparation of the above material.

Current Station Reports

The following is a resume of the current reports. All times shown are Eastern Standard and the 24-hour system is used. Stations often change schedules and/or frequencies with little or no advance notice.

Angola—CR6RL, *R. Clube de Angola,* Luanda, 9632 kc., is audible from 0000 with an all-Portuguese xmsn, opening with "La Portuguesa." (*400*)

Argentina—The current schedule from *R. Nacional,* Buenos Aires, reads: to Europe at 1400-1500, Spanish, 1500-1600, German, 1600-1700, French, 1700-1800, Italian, 1800-1900, Portuguese, and 1900-2000, English (news at 1900 and 1950) on 15,345 kc.; to Eastern U.S.A. at 2100-2200, Spanish, and 2200-2300, English (news at 2200 and 2250) on 9690 kc.; to Western U.S.A. and North American Pacific Coast countries at 2300-0000, Spanish, and 0000-0100, English (news at 0004 and 0054) on 9690 kc. This schedule applies Monday to Friday only. Power for each xmsn is 100 kw. Verification is by certified mail. (*PB*)

Austria—A rarely reported station is OEI20, Innsbruck, 6000 kc., noted at 2055 with jazz, 2100 with news, 2105 s/off; all German. (*104*)

Belgian Congo—OTM2, Leopoldville, 9380 kc., is tuned at 0000-0100 with music and songs and at 0100 with news; all French. (*226, 353*)

OTC, Leopoldville, 9655 kc., carries *World Fair Radio* program on Sunday, Tuesday, Thursday, and Friday at 1930-2000, dual to ORU, Brussels, 15,335 kc. (*LL*)

Belgium—*World Fair Radio* is presently scheduled from Brussels on 11,850, 11,720, and 15,335 kc. at 1730-1800 and on 11,850 and 9745 kc. at 1930-2000. This latter segment may also be noted as per the Belgian Congo item above. (*DB, WC*)

Brazil—Another rarely noted station is PSL, *Agencia Nacional,* Rio de Janeiro, 7935 kc. It has been tuned at 1730-1800 s/off. (*465*)

ZYP33, *Petropolis Radiodifusora,* 4815 kc.,

is noted at 1630 with music, talks, ID. (*465*)

Unidentified stations include an outlet on 15,265 kc. at 1800 that may be *R. Excelsior* and one on 4895 kc. that may be PRF6, *Radio Bare,* Manoas. The latter was noted at 2130 with marimba music and Portuguese announcements; it closed at 2137. PRF6 has not been heard with positive ID since 1953. (*7, 466*)

British Guiana—ZFY, *R. Demerara,* Georgetown, 5981 kc., has a program of Oriental music called "Indian Song Time" at 0420-0445; anmts and commercials are in English. (*JT*)

Cambodia—Phnompenh has moved from 7187 kc. to 7148 kc. and is noted opening at 0830 in French with "La Marseillaise." (*400*)

Canada—VE9AI, Edmonton, 9540 kc., *left the air* last July, and any reports of hearing them are in error. No information is available as to whether this station will re-open at a later date or not. The medium-wave counterpart, CJCA, 930 kc., continues to operate at 0800-0200, and we suggest that any reports concerning VE9AI be sent via CJCA, 452 Borks Building, Edmonton, Alberta. (*61*)

The current Eng. schedule for *R. Canada* reads: to U.S.A. at 2000-2040 on 15,190 and 9585 kc.; to Northern Canada at 2200-2230 on 11,720 and 9585 kc.; to Australasia at 0330-0410 on 9630 and 5970 kc.; to Canadian Forces at 0700-0730 Monday to Friday, 0800-0900 Saturdays, on 21,600 and 17,820 kc.; to Europe at 0800-0900 Sundays (partly in French) on 21,600 and 17,820 kc.; to ships at 1345-1400 Monday to Friday on 17,820 and 15,320 kc.; to Europe at 1530-1600 and to the Caribbean at 1705-1735, both on 17,820 and 15,105 kc. All xmsns are daily except where noted. (*AA, AB, KJ, MX*)

Ceylon—The commercial service from Colombo, 15,265 kc., can be heard at 2020 with tone signal; it opens at 2030 with "Strike Up The Band" and "Good Morning" and continues to 2330 with music and commercials in Eng. xmsn to S.E. Asia. (*226, 353*)

Chile—*R. Soc. Nacional de Agricultura,* Santiago, 5750 kc., has been noted at 2000-2030 with xylophone selections in Spanish. Tune through the c.w. QRM for this one. (*226*)

Colombia—HJKJ, *Emissora Nueva Granada,* Bogota, can be easily heard on 6160 kc. at 2345 with music and all Spanish anmts to 0000 s/off. This one also identifies at times as *R. Cadena Nacional.* (*RW*)

Comores Islands—A station is reportedly operating on Sundays only at 0700-0830. Does anyone know the frequency? (*Editor, 465*)

Cook Islands—Rarotonga, 4965 kc., is reportedly on this channel on Thursdays only at 2300-0030. Has anyone tuned it in? (*465*)

Costa Rica—TIFC, *The Lighthouse of the Caribbean,* San Jose, has Eng. religious programs at 2200-0000 on 9645 and 6037 kc. Reports should go to P.O. Box 2710, San Jose. (*LL, WD, 386*)

Cuba—Another Cuban-time-every-minute station is COBH, Havana, on 11,800 kc. This has been noted around 2300 in Spanish, with two announcers. (*121*)

Denmark—OZF, Copenhagen, 9520 kc., is noted to N.A. at 2030-2130 and 2200-2300 with Eng. during last half hour. No Eng. on Sunday. A DX program has been noted Tuesdays at 2115 and a Mailbag session during the

"Saturday Night Club." (*AA, RC, NJ, DL, JL, JT, 405, 442*)

Dominican Republic—HI2D, *R. Hit Musical*, Santiago de los Caballeros, 3391 kc., has been tuned at 1907-2100 in Spanish. This is a rough one to hear due to c.w. QRM. (*443*)

An unidentified station has been noted around 5062 kc. with ID as *La Voz Dominicana* at 2015. (*121*)

Egypt—Cairo's *Voice of the Arabs* opens on 7165 kc. at 1130, paralleling 7055 kc. which is already in progress. (*MEC*)

The South American service from Cairo on 9795 kc. is heard at 1900-1945 in Portuguese to Brazil and at 1945-2030 in Spanish to Latin America. (*443*)

Write Us Again!

We have received letters and cards from some readers who have neglected to include their return addresses or who have given only partial addresses. If the following correspondents will write us again, we will be happy to answer them:

Carter Ruark	Terry McDermott
Thom Politico	Tom Hall
Jack Brower	Fred Ostler
Ronald A. Biron	Jack Carr
Ray L.	Frank Henderson
Pat Morris	Alfred Nowak
Arthur Charap	Don H. Campbell
C. J. Hickman	

France—*Radiodiffusion Television Francaise*, Paris, has Eng. at 1500-1600 on 6045 kc. Reports go to RTF, 107 Rue de Grenelle, Paris. They reply within a month, but if you want a verification, you should say so quite clearly. (*303*)

French West Africa—Last month your Editor listed a *Radio Niamey* as possibly being in Venezuela. Late reports give the location as F.W.A. They are reportedly testing on 5020 kc. with 4000 watts, although no exact times are known. (*465*)

Indonesia—Djakarta has replaced 11,720 kc. with 11,795 kc., dual to 9710 kc., at 0600-1100. English news was noted at 0615, 0945. (*400*)

R. Angkatan Udara, Djakarta, 11,943 kc., apparently concludes its daily xmsn at 0830 although it may run later; the 0730-0830 period usually consists of popular western music. The Djakarta Home Service has moved from 4804 to 4810 kc. and closes daily at 1130. Palembang has moved from 4855 to 4865 kc. where it suffers QRM from Kashmir. Indonesian network news is heard at 0930-0945. A report of Djakarta on 4750 or 4760 kc. is incorrect; this is Makassar, 4755 kc., with ID as *Inilah Radio Republik Indonesia, Studio Makassar;* it usually closes at either 1020 or 1100. (*MEC, 409*)

Iran—Teheran's new schedule for 15,135 kc. reads: 1405-1415, music; 1415-1430, Turkish; 1430-1500, Persian; 1500-1515, French; 1515-1530, English; 1530-1545, Russian; 1545-1600, music. There is no longer any German segment nor are there any broadcasts on Fridays. (*378*)

Iraq—Baghdad also has a new schedule as follows: 0700-1200, Kurdish, on 7180, 6188, and 3297 kc.; 1200-1230, Russian, on 6188 kc.; 1200-

1300, Kurdish, on 3297 kc.; 1200-1300, Eng., on 6188 kc.; 1300-1330, French, 1330-1345, Urdu, 1345-1400, Persian, 1400-1430, Turkish, and 1430-1500, German, all on 6188 kc.; 1500-1600, Arabic, on all frequencies; and 2300-0700, Arabic, on all frequencies. (*378*)

Italy—Rome is noted in Eng. at 1930-1950 on 11,900 and 15,400 kc. and at 2200-2220 on 11,900 and 9570 kc. French to Canada follows the early xmsn at 1950. (*KJ, DL, JM, 442*)

Jordan—Since mid-summer, Amman and Ramallah have announced as *The Radio of the Hashimite Kingdom of Jordan.* (*MEC*)

Kashmir—*R. Kashmir* is said to be operating on 6110 kc. at 2100-2300, 9660 kc. at 0200-0350, and 4860 kc. at 0715-1230. No other details are known at this time. (*61*)

Lebanon—Beirut, 8003 kc., has Eng. news at 0045, 0325, 0725, 1000 and 1225; news in French at 0030, 0630 and 1400; news in Armenian at 0320, 0720 and 1220. All newscasts are five minutes in length. (*MEC*)

The French news at 0030 is heard weakly in the south and suffers considerable c.w. QRM. (*226*)

Liberia—ELWA, Monrovia, has been noted on 11,986 kc. at 0030 in Eng. and 0100 in French on a Monday. The N.A. Service broadcasts on Tuesdays at 2015-2145, dual with 21,515 and 15,200 kc. Reports go to P.O. Box 192, Monrovia. (*149, 303, 433*)

Nicaragua—YNMS, *R. Philips,* Leon, 7660 kc., has been noted as early as 1800 and as late as 2245 with Latin American records, frequent commercials, and many Spanish anmts; the power here is only 250 watts. YNCA, *R. Atlantico,* Bluefields, 7753 kc., is being tuned from 1955 with typical area music and Spanish anmts; 150 watts power. Both of these stations may require extremely careful tuning. (*61, 226*)

Nigeria—Lagos, 4986 kc., signs on at 0000 with African chanting. The signal is good but static makes it rough to copy. (*149*)

Pakistan—Karachi's 15,335-kc. outlet is heard well in the 1930-2015 xmsn to South and Southeast Asia. English news and Oriental songs make up the program. (*226*)

SHORT-WAVE ABBREVIATIONS

anmt—Announcement
c.w. QRM—Morse code interference
Eng.—English
ID—Identification
IS—Interval signal
kc.—Kilocycles
kw.—Kilowatts
N.A.—North America
R.—Radio
s/off—Sign-off
s/on—Sign-on
xmsn—Transmission from station
xmtr—Transmitter used by station

Philippines—The Far East Broadcasting Co., Manila, is testing a new 50-kw. xmtr on 11,920 kc. The times are not known but DX'ers should tune between 1700-1900 and 0000-1200. Reports go to Box 2041, Manila. The FEBC carries a mailbag session on Wednesdays at 1015 on 15,300 and 17,800 kc. (*SW, 61*)

Portuguese China—*R. Vila Verde,* Macau, is reported to have returned to the air on 17,785 kc. with 300 watts and a xmsn in Eng., Portuguese, and Chinese at 0730-1000. DX'ers, par-

ticularly on the West Coast, should watch for this rare catch! (*7, 61, 192*)

South Vietnam—3WT—, *Radio VTVN*, Saigon, 7265 kc., has Eng. news at 0900. (*7*)

Spain—*Voice of Spain*, Madrid, is being widely heard on 9363 kc. (and on 6130 kc. in Eastern areas) at 2215-2300, 2315-0000 and 0015-0100, with Eng. news following the s/on. (*DB, WD, AT, 408*)

Sweden—*R. Sweden*, Stockholm, is now broadcasting to Eastern N.A. at 0900 on 17,840 kc. and at 2045 on 11,810 kc., and to Western states at 2215 on 11,810 kc. (*AA, LL, RL, 226*)

Switzerland—Berne is scheduled to Eastern N.A. at 2030-2215 on 11,865, 6165, and 9535 kc. and to Western states at 2315-0000 on 9535, 15,305, and 11,865 kc. The mailbag is broadcast on the last Sunday of each month, the DX program on the first Friday. Berne has been using 15,320 kc. in place of 15,305 kc. in the service to Brazil, opening at 1800. (*BB, LC, KJ, DL, JM, CP, 403, 466*)

Tahiti—*R. Tahiti*, Papeete, is now on 11,825 kc. at 1700-1800 on weekdays, 1500-1800 Sundays, in language xmsns (Tahitian and possibly French). This has not been heard as yet. The 6135-kc. outlet still comes through well from 0000 s/on in French with an Eng. newscast at 0230. (*JT, 61, 353*)

Tangier—*IBRA Radio*, 11,515 kc., is noted at 1615-1645 with Eng. religious programs and at 1645-1700 in Arabic. *R. Inter-Africa* fol-

SHORT-WAVE CONTRIBUTORS

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A Middle Eastern Correspondent (*MEC*)

lows at 1705-1735 with music and anmts in Arabic, Eng., French, German, Swedish. (*AM*)

Turkey—*R. Ankara*, TAT, 9515 kc., is tuned at 1800-1900 in Eng. with news, talks, and music. (*DB, NJ, OS*)

USA—The *Voice of America*'s seaborne relay station on the U.S.C.G. Cutter "Courier" is noted on 9530 kc. at 2200-2330; all Eng. except at 2245-2300 in Arabic. This station is located at the Isle of Rhodes. (*AM, RT, 226*)

Clandestine—*Sawt Al-misr Hurrah (Voice of Free Egypt)*, 9490 kc., has been heard well at 0020-0100 in Arabic with speeches and Arabian music. (*OS*)

Unidentified—Heard at 2335-0000 on 5986 kc., this one is in Arabic with talks, chanting and instrumental music. The ID sounded like *Huna Sah*. Off at 0001. (*61*)

Service Radio, 3456 kc., was heard at 0150-0155 with time signals and chanting, possibly in French. (*465*)

An Arabic station on 8820 kc., opening with a trumpet IS at 2355, went into Arabic at 2257, chanting at 2259. Some anmts have been noted which relate the station to Egypt or Tunisia although this is unconfirmed. (*286*) —30—

Among the Novice Hams

(*Continued from page* 83)

signal is strong enough to overcome most static and background hash. For comparison, an S2 to S3 signal is weak but readable if you concentrate on it and the QRM is low.

On a reasonably sensitive amateur receiver, S6 represents about 12 microvolts or seven-billionths of a watt of signal at the receiver antenna terminals. (Many receivers, however, will register S8 or more for a signal of this strength.) S-meters are calibrated in "db over S9" to prevent running out of S-units.

Inflated S-meter readings make the transmitting operator proud that his mighty 6L6 has so much sock. At the same time, the receiving operator is happy that his receiver pulls in such a puny signal so well. This is a perfect double example of ignorance being bliss.

High Power vs. Low Power. From the previous figures, it is obvious that increasing signal strength by raising transmitter power above about 50 watts becomes a slow and increasingly expensive process. This fact is quite discouraging to the high-power man but helpful to the milliwatt man.

On the other hand, there is little reason for less than 15-watts input to a transmitter operated from a.c. power lines. Since low-power transmitters use standard receiver parts almost exclusively, and a one-watter

requires just about as many parts as a 15-watter, the cost is about the same for either. By reducing power below about 15 watts, you handicap yourself unnecessarily.

Of course, the picture is different for battery-operated and/or transistorized transmitters. In the former, even a few watts of power represents quite a drain on the batteries. In the latter, presently available r.f. transistors will handle only very limited amounts of power. In either event, low power is a necessity, not a choice.

Although we have been comparing low-power transmitters with 1000-watt ones, most General Class amateurs use transmitters in the 75- to 250-watt class, such as the Heath DX-100, Johnson Ranger, Viking II, etc. Consequently, the average Novice power is not as much below the General Class level as might at first appear.

Further equalizing things, "Generals" seldom operate in the Novice bands, except to work Novices; therefore Novices usually compete with one another. The importance of this is not so much that the average General Class amateur runs higher power than Novices, but that he usually has a better antenna system, because he has learned by experience that improving his antenna adds S-units to his reports faster than raising transmitter power.

Most important of all, propagation conditions vary from hour to hour and from day to day. When conditions favor one area for working into another, a few watts might overwhelm a kw. from a different area. You are the only station operating from your shack; so you are the only one who can take advantage of the golden opportunity when conditions are ripe.

Choosing Your Transmitter. In view of the above, you can see that power is not the only criterion. Quality of components, ease of operation, built-in preventive measures against harmonics and other spurious radiations, and other features, must all be considered. If other qualities are equal, select the most powerful transmitter available—not over 75 watts for Novice work—but do *not* sacrifice other features for a few watts more power.

Remember, under ideal conditions, not even an expert can detect the effects of less than a 20% power change by ear. And a two-to-one change in power looks much more impressive at the transmitter end than it sounds in the other fellow's loudspeaker.

News and Views

Ron, KN8KPJ, uses a National NC-98 receiver, a Heathkit DX-20, and a 40-meter dipole. He has worked 23 states, with 18 confirmed, and QSL's 100%. Although he uses both 40 and 15 meters, he much prefers the former. Ron took his Technician Class examination recently and got several questions on Class A amplifiers that he could answer as a result of the discussion of them in *Among The Novice Hams*. He offers to help anyone with Novice code and theory and would like a little help himself on General theory . . . **Mike, K7CLS,** offers to sked anyone needing Utah for WAS. As a Novice, Mike worked 41 states and three countries. Thirty of the states were worked on 80 meters running 12 watts to a 6AG7-6L6 transmitter. Now Mike has a General and 43 states. Since the power company removed his 80-meter antenna from its pole, he feeds his new Heathkit DX-40 into a 40-meter dipole on 40 and 15 meters. Mike has tried phone but prefers c.w.

Jack, KN1GCS, will probably be surprised to see a report on his station so long after he made it. In three months, Jack's WRL Globe Chief transmitter, running 50 to 75 watts, and his Hallicrafters SX-71 receiver racked up 224 contacts and 38 states confirmed. He uses a "Demi-Quad" antenna built from an article in POPULAR ELECTRONICS—presumably for 15 meters—and recommends it highly. . . . **Pete, KN4VNK,** reports that he received 400 letters as a result of his offer of a free Novice code course in the June "News and Views!" To spare Pete from another siege of writer's cramp—the essential point of the system is to learn the code by *sound*, instead of by *sight*. Your tutor sends a letter in code, telling you what the letter is, as you write it down. Example: The tutor sends "dit dah," and says "A." You write down "A." After sending the letter and announcing what it is several times, he sends only the dit-dah's as you write down the corresponding letter. He introduces another letter in the same manner, then alternately sends each one, as you *always* write down the letter the sounds represent. This method is the one employed in most modern code courses and is far superior to trying to use a printed chart and memorizing the code by sight. The disadvantage to it is that you need an experienced teacher or a recorded code course of some kind to get started with the code on the right foot.

Jerry, K4TIG, was very busy when he was a Novice. In 5½ months, he made exactly 600 contacts in 48 states, 45 confirmed, and contacted 34 countries in all continents. Thirty of his countries came in during his last seven weeks as a Novice. He rates Australia (VK) as his best DX. The equipment at KN4TIG included a Hammarlund HQ-140XA, a Heathkit AT-1 transmitter with a home-built am-

plifier, and a DX-40. His antennas were an 80′ "long wire," 300′ "long wire," and 40-meter folded dipole. As a "General," Jerry has now added four more countries to his total. . . . **Sanford, KN5QHS,** made 175 contacts in 20 states, all confirmed, in 2½ months as a Novice. At present, he is waiting for his General ticket to come through and planning on a new Heath DX-100 transmitter. San offers to sked anyone needing an Arkansas. He QSL's 100%. . . . **Slim, KNØPFF,** keeps the ionosphere stirred up on 40 and 15 meters with a DX-40 feeding either a "Hy-Gain" vertical antenna or a 40-meter dipole. He strains the incoming signals through a Hallicrafters S-53A receiver, and in four months, he has worked 35 states—with cards from 34—and Italy and Puerto Rico.

Tom, KNØPDI, started his Novice career on 40 and 15 meters. Then he put up an antenna for 80 meters and has just about deserted 40 and 15. He says that while it is great to work DX on the other bands, it is just as much fun to work fellows in your own area and get to know them. Tom is one of those fairly rare hams who have the courage to build a receiver; his is an 11-tube affair. He transmits on a DX-20, and his states-worked total is 30 in six months. Tom thinks the best compliment a ham can receive is "You have a beautiful 'fist'," and that this is far more important than a 599 report. He needs a little help with General Class theory. . . . **Bob, K2ZSQ,** and his father, **"Red," K2ZSP,** got their Novice licenses together. Bob now has his "General." Red has his Technician license, and is about ready for his General examination. He worked five states in two weeks on 6 meters. Bob is also on "6" with a home-brew 35-watter feeding a 5-element beam, 25′ high, and he receives on an NC-183. Bob is activities manager of the Rahway High School Radio Club and is willing to help anyone become a ham. He also reported on: K2HHT, and his 10-year-old brother, KN2SNG; KN2REH; KN2KSL; WV2AUV; WV2BII; K2DQU, and K2QNI. They are all members of the RHSRC, who work every band from 2 to 80 meters.

Steve, K6TAY, uses the theory discussions in *Among The Novice Hams* in helping Novices in his area. He operates 10, 15, and 20 meters, phone and c.w., with a DX-100 and a Hallicrafters S-85 receiver, and offers to sked anyone needing California. Steve should have his new five-element tri-band beam going by the time you read this. . . . **Dave, KN8JXT,** worked 13 states and Canada on 80 meters in his first two weeks on the air with a WRL Globe Chief 90A running 75 watts and a Hammarlund HQ-100 receiver. His antennas are 80- and 40-meter doublets, and an "all-band" vertical. Dave will schedule anyone and will help prospective Novices. . . . **Dick, KN1GCX,** in Vermont, has worked 25 states, 23 confirmed. He usually works 40 meters but drops to 15 meters at times.

Bob, K1CVH, took three passes at the General Class written examination before he conquered it, but, as his 25-wpm code certificate indicates, he had no trouble with the code. His Novice record was 48 states (one didn't

QSL) and 29 countries. Bob's equipment includes a Globe Chief 90A (75 watts as a Novice, 90 watts now) which feeds a 40-meter "zepp" antenna, and a Gotham vertical for 10, 15, and 20 meters. . . . **Mike, KN4TBN,** operates on 3715 kc. with a Heathkit DX-35 feeding a doublet and receives on a Hallicrafters S-38D excited from a 4' receiving antenna. In six months, Mike has made 335 contacts in 25 states. He will help others get their Novice licenses.

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Until next month, when I hope you and your picture are in these pages . . . a Merry Christmas to you all. 73,

Herb, W9EGQ

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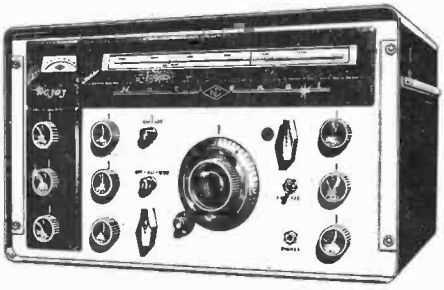

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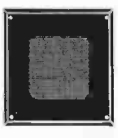

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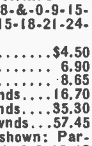

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TAPE Recorders, Hi-Fi components, tapes. Unusual Values. Free Catalog. Dressner, 60-02F, 174 St., Flushing 65, N. Y.

RECORDERS, Hi-Fi. Free wholesale catalogue. Carston, 215-P, East 88 St., N.Y.C. 28.

HIGHEST Trade-In Allowances Toward Ampex, Concertone, Crown, Ferrograph, Presto, Pentron, Components. Accessories. Catalog. Boynton Studio, 10-PE Pennsylvania, Tuckahoe, N. Y.

RECORDERS, Tape Decks, Stereo Tapes, Accessories, Excellent Values, Catalogue. EFSCO, 270E Concord, West Hempstead, N. Y.

PLASTICS

NEW Liquid Casting Plastic clear, colors. Embed real flowers, minerals, biological specimens, delicate instruments, electronic parts. Also cold-setting resin and fiberglass for laminating, casting, molding, coating. Manual 25¢. Castolite, Dept. P-125, Woodstock, Illinois.

EMPLOYMENT INFORMATION

JOBS—High Pay; USA, So. America, The Islands. All trades. Many companies pay fare. Write Dept. 71N, National Employment Information, 1020 Broad, Newark, N. J.

EARN Big Money. Be a Success. Tremendous Opportunities. Don't dream of success. Be one. Grasp your opportunity now by sending $1.00 for U.S.A. Overseas Job List and Guide Book aiding you to get the job you want. Future Unlimited, 222 West 33 Street, New York City 1.

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FREE! Blackhawk's big sale catalog 8mm., 16mm. movies, 2"x2" color slides. Biggest selection anywhere! Projectors, cameras, supplies—big discounts! Get free, every three weeks, 12-page newspaper size bargain list! Blackhawk Films, Davenport 24, Iowa.

LEATHERCRAFT

FREE "Do-It-Yourself" Leathercraft Catalog. Tandy Leather Company, Box 791—J27, Fort Worth, Texas.

HIGH FIDELITY

DISGUSTED with "Hi" Hi-Fi Prices? Unusual Discounts on your High Fidelity Requirements. Write Key Electronics, 120 Liberty St., New York 6, N. Y. EVergreen 4-6071.

SPEAKER System. Superb Hi-Fi performance from low-cost speakers and attractive, easy-to-build enclosure. Complete step-by-step instructions. Send $2.00 today. M-H Laboratories, Box 25, Goleta, California.

CORRESPONDENCE COURSES

COMPLETE Correspondence Course in Radio, TV, & Electronics. Only 12 sections. Includes 1st Class License Prep. Very low rates. Ascot School of Electronics, Box 29092, Los Angeles 29, Calif.

INSTRUCTION

LEARN While Asleep! Exciting details free. Research Association, Box 24-FF, Olympia, Washington.

LEARN Code Easily! Use Kord-All's Elementary course. 12" microgroove record, $3.50 postpaid. Kord-All, Box 444, Warren, Ohio.

NAVY Electronics training course, one of the finest compiled, is available to the public. Excellent electronics instruction for beginners. Designed especially for self-study. Used in training Navy Electronics technicians. 512 pages. 280 diagrams and illustrations. 16 thorough quizzes with answers. This is a high quality course, containing excellent writing, artwork and printing. An outstanding bargain made possible by U. S. Government Printing and Price Control. For your copy send $2.00 to: New England Book Distributors, Box 311, Watertown, Connecticut.

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ELECTRIC Pencil: Engraves all Metals $2.00. Deyer Mfg., 10511-P Springfield, Chicago 43.

TECHNICAL INSTITUTES

ELECTRONIC And Aeronautical Engineering Technology. Two-Year Courses. Bachelor of Science Degree in three years. Northrop Institute in Southern California prepares you for highly paid positions in Aviation and Electronic industries. Employment assistance during school and after graduation. Approved for Veterans. Write for free catalog. Northrup Aeronautical Institute, 1179 Arbor Vitae, Inglewood 1, California.

MISCELLANEOUS

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

"WINEMAKING; Beer, Ale Brewing." Illustrated. $2.00. Eaton Books, Box 1242-C, Santa Rosa, California.

PHONOGRAPH Records cheap, postpaid. Catalogue. Paramount, Box 242-R, Williamsport, Penna.

NEW Organ Builders Manual—Guide to assembling your own electronic organ. 123 pages, profusely illustrated. $2.00 postpaid. Electronic Organ Arts! Box 41084, Los Angeles, Calif.

SHIPPED ON APPROVAL

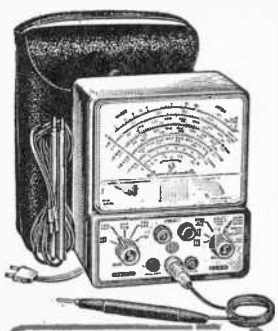
NO MONEY WITH ORDER — NO C.O.D.

Superior's New Model 77

VACUUM TUBE VOLTMETER

WITH NEW 6" FULL-VIEW METER

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



Model 77—Vacuum Tube Voltmeter—
Total Price $42.50
Terms: $12.50 after 10 day trial, then $6.00 per month for 5 months

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

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

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

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

SPECIFICATIONS

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

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

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

Model 79—Super-Meter
Total Price $38.50
Terms: $8.50 after 10 day trial, then $6.00 per month for 5 months.

Superior's New Model 79

SUPER-METER

WITH NEW 6" FULL-VIEW METER

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

The model 79 represents 20 years of continuous experience in the design and production of SUPERMETERS, an exclusive SICO development. It includes not only every circuit improvement perfected in 20 years of specialization but, in addition includes those services which are "musts" for properly servicing the ever-increasing number of new components used in all phases of today's electronic production.

Specifications

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

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

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

Comes complete with operating instructions and test leads. Use it on the bench and on calls. Streamlined carrying case included, accommodates tester, instruction book and test leads. .....Only $38.50 Net

USE APPROVAL FORM ON NEXT PAGE ▶

We invite you to try before you buy any of the models described on this and the following pages. 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, INC. Dept. D-538 3849 Tenth Avenue, New York 34, N. Y.

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before **you buy!** ***then*** **if satisfactory pay in easy, interest free, monthly payments. See coupon below.**

Superior's New Model 82

A truly do-it-yourself type TUBE TESTER

TEST ANY TUBE IN 10 SECONDS FLAT!

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

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

FEATURES:

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

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

Model 82 comes complete, housed in portable, hand-rubbed oak cabinet with removable cover. Only **$36.50 Net**

Model 82—Tube Tester
Total Price $36.50
Terms: $6.50 after 10 day trial, then $6.00 per month for 5 months.

Superior's New Model TD-55
STANDARD TYPE

TUBE TESTER

Speedy, yet efficient operation is accomplished by: 1. Simplification of all switching and controls. 2. 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.

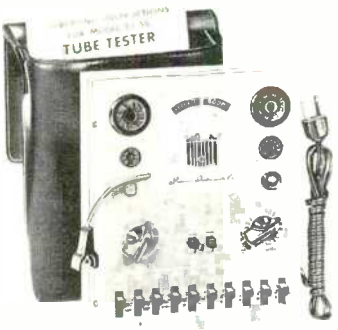
You can't insert a tube in wrong socket
It is impossible to insert the tube in the wrong socket when using the new Model TD-55. Separate sockets are used, one for each type of tube base. If the tube fits in the socket it can be tested.

"Free-point" element switching system
The Model TD-55 incorporates a newly designed element selector switch system which reduces the possibility of obsolescence to an absolute minimum.

Checks for shorts and leakages between all elements
The Model TD-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.

Elemental switches are numbered in strict accordance with R.M.A. Specifications.
The 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

Complete with carrying case **$26.95 Net**



Model TD-55 — Tube Tester
Total Price $26.95
Terms: $6.95 after 10 day trial, then $5.00 per month for 4 months.

We invite you to try before you buy any of the models described on this page, the preceding page and the following pages. 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.

SEE OTHER SIDE

CUT OUT AND MAIL TODAY!

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

- ☐ **Model 77 ..... Total Price $42.50 $12.50 within 10 days. Balance $6.00 monthly for 5 months.**
- ☐ **Model 79 ..... Total Price $38.50 $8.50 within 10 days. Balance $6.00 monthly for 5 months.**
- ☐ **Model 82 ..... Total Price $36.50 $6.50 within 10 days. Balance $6.00 monthly for 5 months.**
- ☐ **Model TD-55 ..... Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.**
- ☐ **Model 76 ..... Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.**
- ☐ **Model TV-50A ..... Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.**

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Address .....

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

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

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NO MONEY WITH ORDER — NO C.O.D.

Model 76—All Purpose Bridge
Total Price $26.95
Terms: $6.95 after 10 day trial, then $5.00 per month for 4 months.

Superior's New Model 76

ALL PURPOSE BRIDGE

IT'S A **CONDENSER BRIDGE**
IT'S A **RESISTANCE BRIDGE**
IT'S A **SIGNAL TRACER**
IT'S A **TV ANTENNA TESTER**

CAPACITY BRIDGE SECTION
4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad, .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. Will also measure the power factor of all condensers from .1 to 1000 Microfarads.

RESISTANCE BRIDGE SECTION
2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms.

SIGNAL TRACER SECTION
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.

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? Locates a break in any TV antenna and measures the location of the break in feet from the set terminals.

Complete with R.F. and A.F. probes and test leads **$26.95 Net**

Model TV50-A—Genometer
Total Price $47.50
Terms: $11.50 after 10 day trial, then $6.00 per month for 6 months.

Superior's New Model TV-50A

GENOMETER
7 Signal Generators in One!

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

This Versatile All-Inclusive **GENERATOR** Provides **ALL** the Outputs for Servicing:
● **A.M. RADIO** ● **F.M. RADIO** ● **AMPLIFIERS** ● **BLACK AND WHITE TV** ● **COLOR TV**

R. F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

MARKER GENERATOR: The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.

DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50A will enable you to adjust for proper color convergence.

CROSS HATCH GENERATOR: The pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

Complete with shielded leads **$47.50 Net**

TRY FOR 10 DAYS

BEFORE you bu
THEN if satisfact

pay in easy, interest free, monthly payments. See coupon inside.

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