POPULAR ELECTRONICS

NOVEMBER 1956

35 CENTS

8 New Construction Projects

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Transistorized Timer... R/C Triplex... Receiver... Phono Player

Here it is!

the All-New

HAMMARLUND HQ-100

COMMUNICATIONS RECEIVER

Keep up with the world—listen to radio programs from all countries—listen to the amateurs, ships, and many other interesting conversations. The whole wide world can be received like domestic stations on the brand-new Hammerlund HQ-100.

Variable selectivity permits you clear reception of even the most remote stations. Electrical bandspread tuning provides extra-accurate tuning in those crowded spots on the dial.

Many new and exciting features have been built into the new HQ-100. An amazing Auto-Response circuit automatically sets the audio characteristics for the very best performance on either communications or high-fidelity music.

This is not a reworked broadcast receiver, but a thoroughbred communications instrument made by the leading manufacturer of such receivers. See it and try it at your Hammarlund dealer.

Complete technical information and name of nearest dealer on request.

Ask for bulletin P-11

only $169.00

(Without Speaker)

*Telechron automatic clock-timer switch for warm-up operation, $10. extra

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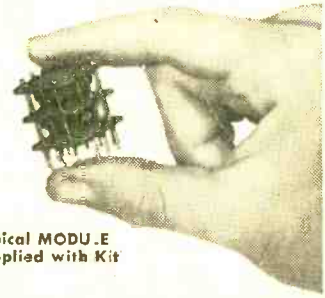
460 West 34th Street, New York 1, N. Y.

BUILD THIS NEW FABULOUS

MODULAR RADIO



Typical MODU.E Supplied with Kit

Modular Construction eliminates use of individual resistors, capacitors and wiring.

ONLY $17.50

Complete Kit with Tubes, Loudspeaker and Ivory Molded Cabinet

Assemble this sensitive AC-DC Table Model Super Heterodyne Radio Receiver in less than ½ hour

NO WIRING
NO SPECIAL TOOLS
ONLY A SOLDERING IRON REQUIRED

In years to come, every radio, TV receiver, test instrument — in fact, every electronic device — will be modular constructed.

Be among the first to assemble a modular radio-broadcast receiver!

Supplied with easy-to-follow step-by-step instructions.

You have read about the Navy's 'Project Tinkertoy.' You have heard about 'Module' construction in military electronic applications.

This remarkable new pre-fab technique is now available to you — for the first time — in the first civilian product to feature *both:* PRINTED CIRCUITRY and MODULAR COMPONENTS.

Here is an exciting opportunity to work with one of the latest developments in modern electronics and learn about the new, fabulous module technique.

ACT NOW!

Send your check or money order . . . today!
10% required on C.O.D.
Use this convenient order form

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21-28 45th Road, L.I.C. 1, N.Y.

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I enclose ☐ check; ☐ money order in the sum of $.....
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☐ As 10% deposit for C.O.D — I pay all charges.

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POPULAR ELECTRONICS

CONTENTS

FEATURE Articles and Electronic Developments

ELECTRONIC Build-It-Yourself Projects

AUDIO and Hi-Fi Features

Miscellaneous Electronic News

(Also see page 6 for DEPARTMENTS)

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NOVEMBER 1956

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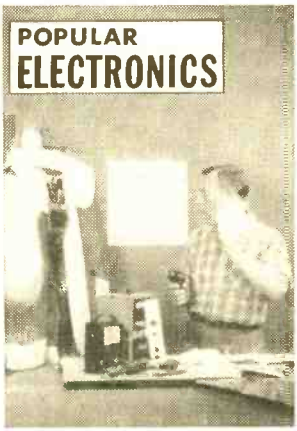
DEPARTMENTS

COMING NEXT MONTH (DECEMBER)



(ON SALE NOVEMBER 20)

In accordance with our annual Christmas custom, there will be several projects for both adults and children: "A Child's Radio," "Electronic Tiddly-Winks," "Electronic Roulette," and "Electronic Harmonica." Also look for construction details on the "Economy" audio signal generator and a simple converter for long-wave DX'ing.

Other assorted subjects include: how the effect of an atomic bomb on huge population centers is "tested" with an elaborate computing system; the electronic "composer" and the two-ton monster that plays every imaginable musical instrument; how to listen to police calls; the purpose of a loudness control in hi-fi amplifiers.

IN THIS MONTH'S

RADIO & TELEVISION NEWS

(NOVEMBER)

The "Distributed Port" Loudspeaker Enclosure

All-Transistor Hi-Fi Amplifier

An Air Raid Alarm for Home Receivers

How to Choose a Tape

The "Electro-Tach"—An Electronic Tachometer

LOOKING FOR JOB SECURITY AND SUCCESS?

LET MY STUDENTS AND GRADUATES TELL YOU

ABOUT MY TRAINING—

$60 A WEEK IN SPARE TIME

I have the skill and know-how to do the work I love best and to enjoy better things in life, thanks to RTTA. I am working at TV servicing and making $60 a week sparetime.

Harold Gimlen, Flint, Mich.

AIRCRAFT INSPECTOR

With RTTA training and through repairing radios and televisions for the right people at the right price, I was able to make the right contacts. I am now an Inspector for Douglas Aircraft at about $125 a week.

Hugh Maddox, Los Angeles, Calif.

ELECTRICAL TESTER

RTTA training has helped me understand TV and many variations of simple circuits. The course covers all subjects very clearly. I am now an Electrical Tester for Western Electric Co. at $83.42 a week.

Raymond Lapan, Burlington, N. C.

HAS OWN BUSINESS

I have a shop at home and have been working on radio and TV after working hours of my regular job. I average $50 a week for this part time work. RTTA training helped me in making extra money and giving me experience in the electronic field.

Richard Hennis, Little Rock, Ark.

SERVICE MANAGER

I manage two radio and television shops, one here and one in Pompano Beach. RTTA training increased my knowledge of TV circuits and showed me new, quicker methods of repairing. Lessons as presented are very concise and clear.

William Phillips, Fort Lauderdale, Fla.

REPAIRED EVERY SET

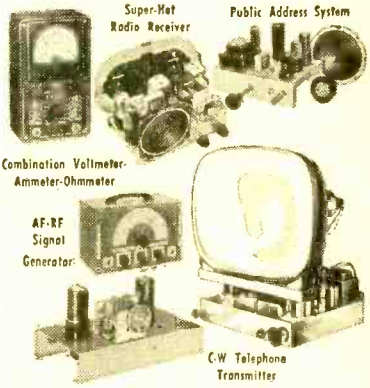
RTTA training helped me to understand TV more thoroughly. I have repaired every set that I was called on to repair.

Andrew Busi, Jr., Iselin, Pa.

L. C. Lane, B.S., M.A. President, Radio-Television Training Association. Executive Director, Pierce School of Radio & Television.

—ABOUT MY EQUIPMENT

YOU GET ALL THIS EQUIPMENT



". . . a money making little gem."

I have completed kit #6 and was amazed at how it works. I showed it to a friend of mine and he asked me to set it up for one of the picnics his social club was having. That sure is a money making little gem.

John Fernandez, Fresno, Calif.

"We get excellent pictures . . ."

I would like to compliment you on an excellent and complete course. We get excellent pictures on my TV set from WSYR (Syracuse, N.Y.), approximately 110 air miles away. The set is working good and I have had to replace only three tubes since I assembled it two years ago.

Larry H. Stafford, Kingston, Ont., Canada

". . . very good reception . . ."

I have really enjoyed the course and have come a long way in TV servicing. I am getting very good reception on my TV station considering that the nearest VHF station is 120 miles.

J. W. Hanlon, Jr., Henderson, Texas

YOU, TOO, CAN GET A BETTER-PAYING JOB IN THE EVER-EXPANDING RADIO-TELEVISION-ELECTRONICS FIELD

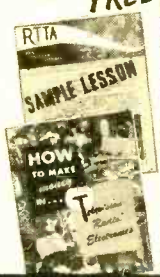
Why limit yourself and your earnings because of your lack of training. Learn AT HOME in your SPARE TIME to be an electronic technician, television repairman, or studio technician. You don't need any experience whatsoever.

After you finish my Radio-FM Television Course or FM-Television Course you can have, if you want it, two weeks of laboratory training at my associate resident school in New York City—AT NO EXTRA COST.

If you have had previous radio and television experience you can take my practical TV Studio Technician Course to qualify for a good-paying job in a TV studio.

Write to me today and let me show you how you can begin now to put yourself on the road to a better future.

YOU GET THESE **FREE**



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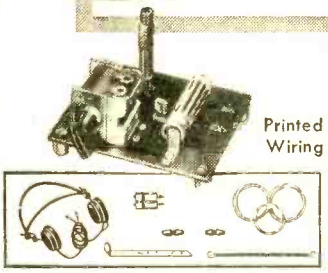


Printed Wiring

Fascinating knight-kit TRANSISTOR RADIO KIT

Model S-765 only $4.35 Experiment with the marvel of transistors! Printed circuit mounting board simplifies assembling. Just mount components, solder a few connections and enjoy excellent AM broadcast reception. Compact; fits in palm of your hand; operates from single penlight cell that lasts for months. Complete with all parts, transistor and penlight cell. Easy to assemble. Shpg. wt., 2 lbs.

Model S-765. Net only **$4.35**

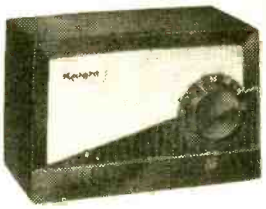
S-266. Accessory kit; 4000 ohm double headphones and all parts for outdoor antenna. Net..... **$3.15**

knight-kit "SPACE-SPANNER" BANDSWITCHING RECEIVER KIT

Model S-243 only $15.95 All-new 2-band receiver, easy to build—a great value. Bandswitch selects thrilling short wave, including amateur, aircraft, police and marine radio (6 to 18 mc), and standard broadcast. Highly sensitive regenerative circuit. Has 4" PM speaker and beam-power output for strong volume. Kit includes calibrated panel, punched chassis, all parts and tubes (less cabinet). Easy to build. 7 x 10½ x 6"; for 110-120 v. 50-60 cycle AC or DC. Shpg. wt., 4½ lbs.

Model S-243. Net only **$15.95**

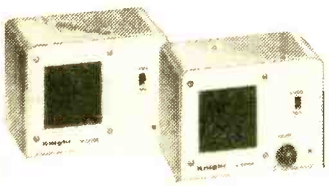
S-247. Matching cabinet for above **$2.90**



knight-kit "RANGER II" AC-DC SUPERHET RADIO KIT

Model S-735 only $17.25 Build this top quality table model radio at low cost! Tunes full AM broadcast, 540 to 1680 kc (includes police calls). Features Alnico PM dynamic speaker; automatic volume control; sensitive Superhet circuit; handsome plastic cabinet. Easy, step-by-step assembly. Complete with punched chassis, all parts and tubes, speaker and smartly styled bakelite cabinet (6 x 9 x 5"). For AC or DC. Shpg. wt., 8 lbs.

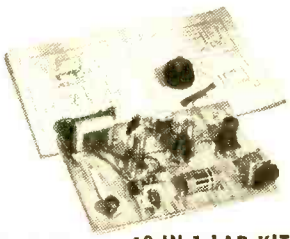
Model S-735. Net only..... **$17.25**



knight-kit TWO-WAY INTERCOM SYSTEM KIT

Model S-295 only $14.75 Easy to build—ideal for home or office. Consists of Master and Remote unit, each with press-to-talk switch. Remote can be left "open" for distant answering or baby-sitting. In "closed" position, Remote remains private, but can be called and can originate calls. High-gain 2-stage amplifier and 4" PM speakers. With tubes and 50-ft. cable. (Up to 200-ft. may be added.) Each unit 4¾ x 6½ x 4⅜"; antique white finish. For AC or DC. Easy to assemble. 7 lbs.

S-295. Net only..... **$14.75**



knight-kit 10-IN-1 LAB KIT

Model S-265 only $12.65 Instructive, fascinating! Enables you to build any one of 10 circuits: Broadcast receiver for headphone reception; Phono Oscillator to play records through any radio; Phono Amplifier; Code Practice Oscillator; Signal Tracer; Electronic Timer; Relay, etc. Includes tubes, all parts, instructions (less photo-tube and socket, and headphone). Ready to build. For 110-120 v., 50-60 cy. AC. 10 lbs.

Model S-265. Net only **$12.65**

J-112. Headphone for above.... **$1.05**

C-100. Antenna Kit for above... **$1.05**

IDEAL KIT FOR THE HAM

Model S-255 only $43.75

knight-kit 50-WATT CW TRANSMITTER KIT

Compact, value-packed, low-power rig. 50 watts input to 807; 6AG7 oscillator takes crystal or VFO; bandswitching covers 80, 40, 20, 15, 11-10 meters; pi matching network eliminates separate antenna tuner; clean cathode keying of oscillator and final; excellent TVI suppression; meter reads plate or grid of final. With all parts, tubes, wire, solder and instructions (less key and crystal). 8¼ x 11¼ x 8¾". 18 lbs.

Model S-255. Net only. **$43.75**

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VTVM KIT
with printed circuit board
Model F-125
only **$24.95**

Easy to build. Reads peak-to-peak. 1% resistors. Balanced-bridge push-pull circuit; 4½" meter, 200 microamp. Ranges: AC peak-to-peak volts, 0-4-14-40-140-400-1400-4000; AC rms v. and DC v., 0-1.5-5-15-50-150-500-1500; ohms, 0-1000-10K-100K, 1-10-100-1000 megs; db scale, −10 to +5. Zero-center scale; direct-reading db scale; polarity reversing switch. Ready to build. 7¾ x 5¼ x 4⅛". 6 lbs.

Model F-125. Net only..... **$24.95**
F-125. High Voltage Probe..... $4.75
F-127. High Frequency Probe... $3.45

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20,000 OHM/VOLT VOM KIT
Model F-140
only **$29.50**

Low cost 32-range VOM. Features 4½" 50-microampere meter; 1% precision multipliers; 2% accuracy full-scale deflection. Ranges: AC, DC and output volts, 0-2.5-10-50-250-1000-5000; Resistance, 0-2000-200,000 ohms and 0-20 meg; DC ma, 0.1-10-100; DC amps, 0-1-10; Decibels, −30 to +63 (6 ranges). Black bakelite case, 6¾ x 5¼ x 3¾". Ready to build. 5 lbs.

Model F-140. Net only..... **$29.50**

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'IN CIRCUIT" CAPACITY CHECKER KIT
Model F-119 only **$12.50**

Remarkable unit checks capacitors while they're still wired in the circuit! All you do is press a button—and the "magic eye" shows opens and shorts. Tests opens and shorts on capacitors of 20 mmf or greater, even if in parallel with a resistance as low as 50 ohms. Complete; ready to build. 5 lbs.

Model F-119. Net only..... **$12.50**

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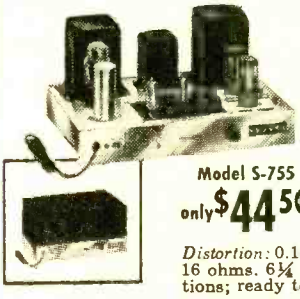
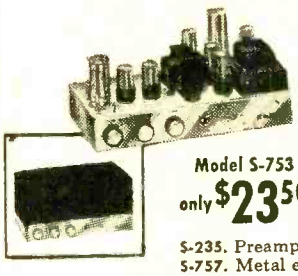


knight-kit LINEAR-DELUXE BASIC 25-WATT HI-FI AMPLIFIER KIT

Model S-755
only **$44.50**

Custom quality at very low cost. For use with any tuner or preamp with full set of controls. Deluxe features: Chrome-plated chassis; potted transformers and chokes; printed circuit wiring board; balance and damping controls. *Output:* 25 watts. *Response:* +0.5 db, 10 to 120,000 cps at 20 watts. *Distortion:* 0.15% at 25 watts. *Speaker Outputs:* 4, 8 and 16 ohms. 6¼ x 14 x 9". With all parts, tubes, instructions; ready to build. Shpg. wt., 27 lbs.

Model S-755. Net only..... **$44.50**
S-759. Metal enclosure for above; black finish.... $4.25

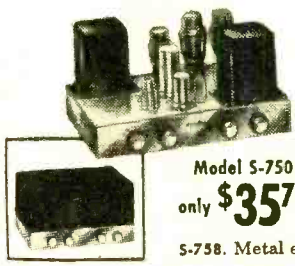


knight-kit 10-WATT ECONOMY HI-FI AMPLIFIER KIT

Model S-753
only **$23.50**

True Hi-Fi at lowest cost. Only 0.5 volt drives amplifier to full 10 watts output! *Response:* +1 db, 30 to 20,000 cps at 10 watts. *Distortion:* less than 0.5% at 10 watts. Chrome-plated chassis is punched for preamp kit listed below. Matches 8-ohm speakers. With tubes, all parts, easy instructions. 7 x 13 x 6" Shpg. wt., 14 lbs.

Model S-753. Net only..... **$23.50**
S-235. Preamp kit (for magnetic cartridges)..... $3.10
S-757. Metal enclosure for above; black finish.... $3.95



knight-kit 20-WATT LOW COST HI-FI AMPLIFIER KIT

Model S-750
only **$35.75**

Delivers deluxe Hi-Fi sound. Includes built-in preamp; inputs for magnetic cartridges, etc.; record compensator; bass and treble controls, etc. *Response:* +1 db, 20-20,000 cps at 20 watts. *Speaker Outputs:* 4, 8, 16 and 500 ohms. Chrome-plated chassis, 7½ x 13 x 8¾". With all parts, tubes and easy instructions. 23 lbs.

Model S-750. Net only..... **$35.75**
S-758. Metal enclosure for above; black finish.... $4.15

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ALLIED RADIO

OUR 36th YEAR

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Quantity	Description	Model	Price

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☐ Send me your FREE 1957 ALLIED 356-Page Catalog.

Name_____

Address_____

City_____ Zone____ State_____

By JOHN T. FRYE

Eeeeelectricity!

CARL WAS JUST ARRIVING home after spending a short week-end vacation with an aunt and uncle in Chicago. He burst in the front door; yelled "Hi, Dad"; planted an awkward kiss on the bridge of his mother's nose; and sailed right on out the back door, across the yards, and into the basement laboratory of his neighbor and best friend, Jerry Bishop.

Jerry was there all right, and he was just as glad to see his pal as Carl was to see him; but it was against the Code of Boyhood to show their feelings. Jerry hardly looked up as he grunted a greeting. To tell the truth, though, he was pretty busy trying to strap a squirming, wriggling *something* into the concave side of a short section of gutter trough. It kept slithering through the rubber gloves he was wearing.

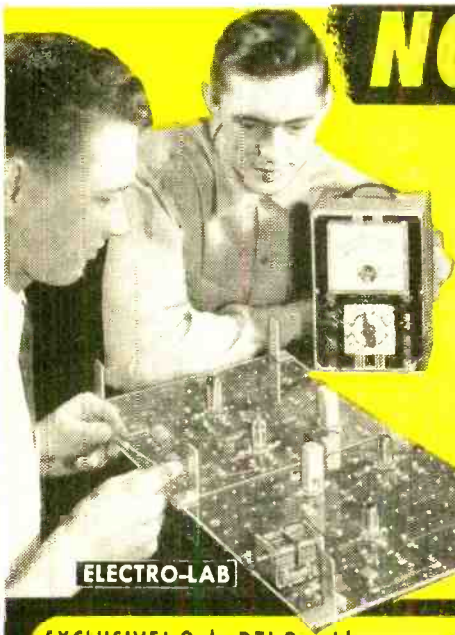
"Holy cow, Jer, what is that thing?" Carl demanded. "Is it a snake?"

"Of course not, stupid. It's an eel that my uncle in the Navy sent me from South America. I want to make some tests on it. Put on that other pair of rubber gloves and help me fasten it in this trough."

"Not on your life!" Carl said emphatically as he backed toward the door. "I wouldn't touch that snaky-looking thing with a ten-foot pole, let alone my hands. Why on earth would your uncle send you something like that? Has he sprung his hatch?"

"Certainly not. This is not just an ordinary eel. In fact, it's not really an eel at all. Strictly speaking, it's an electric fish. My uncle says if I'm going to be an electronics engineer I should know about all forms of electricity; and electric fishes have been stirring electrons for thousands of years. Pictures of them appear in Egyptian tombs and they are mentioned in Aristotle's *Historia Animalium*. In addition to this so-called electric eel, there are five other fishes with shocking power: the torpedo or electric ray, the electric catfish, the star-gazer, the numb-fish, and the elephant-snout fish."

"NEVER MIND the lecture, Professor," Carl said impatiently. "Just tell me



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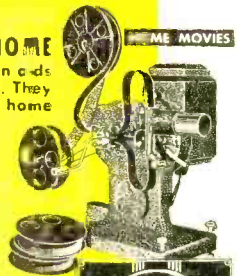
FASTER and EASIER with the aid of

DTI EXCLUSIVE TRAINING FEATURES

EXCLUSIVE! Only DTI Provides Visual Aid Motion Pictures AT HOME

One of the most helpful . . . most modern aids to learning, is motion pictures AT HOME. They are an important part of your DeVry home training. Through the magic of films, you see electricity in action, you see electrons on the march . . . the hidden actions "inside" of a circuit . . . and other important principles of electricity and electronics. DeVry loans you a special movie projector and a series of highly instructive movie films that enable you to see these principles quickly . . . easily . . . and in a much shorter time than by reading alone.



EXCLUSIVE! The Unique ELECTRO-LAB* (above) Provides Needed Practical Experience

To make real progress, you need practical experience. That's the reason you get and KEEP the recently-developed DeVry Electro-Lab. Using its transparent base, you see each circuit top and bottom; you follow special diagrams—quickly attached and detached. You use quick-operating spring clip connectors that cut time-consuming soldering to a minimum. You build circuits faster . . . learn more thoroughly.

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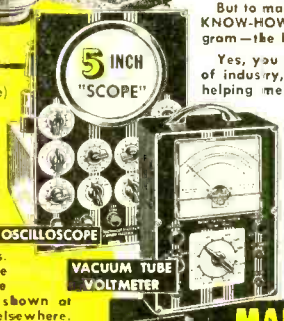

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1021A DTI's training is available in Canada.

Carl & Jerry (*Continued from page* 10)

what you are trying to do with old Squirmy there."

"I want to strap him in this rubber-lined trough so I can find out something about the electric charge he emits. The rubber lining will prevent his being short-circuited by the metal trough. When I get him fastened down, I'll slide these little tin-foil strips underneath his body at different points to pick off the charge he emits. Then, by using the 'scope and the VTVM, I'll know if he has a.c. or d.c. wiring and how much voltage he puts out."

"You mean you don't have any idea what to expect? And are you wearing those rubber gloves because you don't want to touch the slimy thing or because you're afraid of being shocked?"

"To answer the last first, I'm wearing them cause I don't want to be shocked. A full-grown electric eel can put out a jolting five-hundred volts that can stun a horse or paralyze a man. Since eight feet is about as long as they get, and since this one is nearly five feet long, I'd guess he was full grown. He acts fully charged, too. An adult eel that puts out only three hundred volts is either sick or simply not letting himself go. Even a baby eel can deliver around 120 volts—as much voltage as there is in the a.c. house line."

"How do you know all this? You been boning up at the library?"

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. . . Jerry was trying to strap a squirming, wriggling something into the short section of gutter trough, but it kept slithering through his rubber gloves . . .

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Carl & Jerry (*Continued from page* 12)

from a story that appeared in the June-July, 1956, edition of a storage battery house organ called *Exide Topics* that my uncle sent me. What I want to do right now is to double-check on some of the statements in that story."

"Looks like you've got Old Squirmy pretty well trussed up; so let's start double-checking," Carl suggested.

"Okay," Jerry agreed. "First let's see if this eel is a.c. or d.c. According to the eel experts, the electrical discharge he puts out is a series of rapid direct-current discharges in the form of short-duration pulses sent out at a rate of about four hundred per second. But these pulses are of such short duration, about two-thousandths of a second, that the actual wattage output of an adult electric eel is only about forty watts."

"THEN SUPPOSE we hook Buster here to a forty-watt bulb," Carl suggested.

"He's no good for lighting bulbs," Jerry explained. "Those pulses are too short to overcome the thermal lag of an incandescent bulb filament. Voltage has to be applied to such a filament for about one-fiftieth of a second before it begins to glow, and one of these pulses only lasts about one-tenth that long. But he could light a neon bulb, and I'm sure he'll make some interesting traces on our 'scope. I've got an idea about how to check his polarity, too. We'll simply run his output into this 0.5-microfarad capacitor and let him charge it up with his pulsating voltage. Then our VTVM connected across it will show his peak voltage and polarity."

As he talked, Jerry slipped one tin-foil electrode beneath the tail of the eel and another beneath the center of his body. Leads from the electrodes went to the capacitor, and the VTVM was connected to read the voltage charging this capacitor.

"Three-hundred-and-fifty volts!" Carl announced; "and the way the pointer swings proves that Old Squirmy's tail is the negative pole of his battery and the front part of him is the positive pole."

"Watch the meter while I slide this front electrode back and forth," Jerry suggested. "I want to find where the front end of his generator actually is."

This method soon showed that the maximum voltage, four hundred and eighty volts, was obtained when the negative electrode was at the eel's tail and the positive electrode was at a point about a foot back from his head.

"That squares with what the books say,"

(*Continued on page* 18)

CARL E. SMITH, E. E.
President

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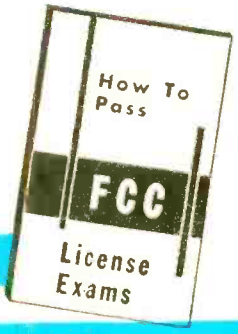

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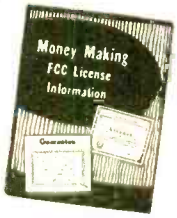

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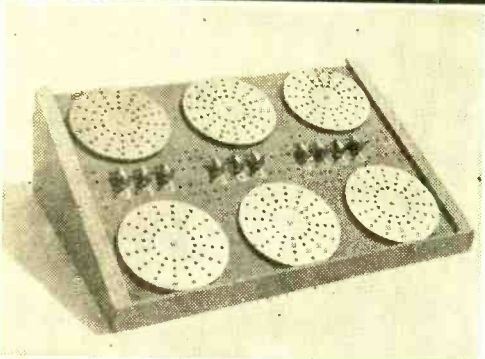

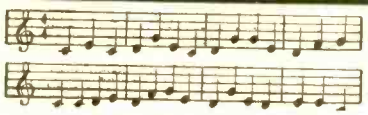

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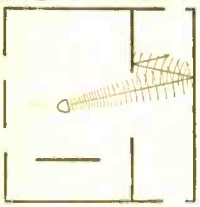

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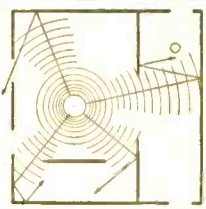

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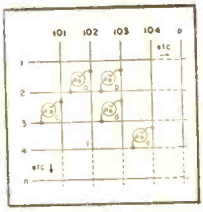

SECTION OF MATRIX Diagram of a Neon Tube Digital Storage Unit.

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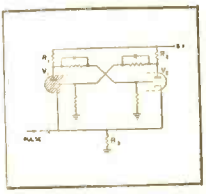
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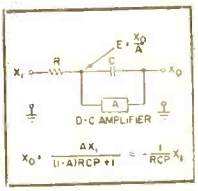

Block diagram for a simple integrating circuit.

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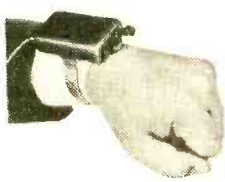

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Carl & Jerry (*Continued from page* 14)

Jerry reported. "According to them, all of the critter's vital organs are in the front fifth of his body, and the rest is made up of 'electric tissue.'"

"Whatever that is."

"It's a flabby whitish jelly composed of 92% water. This stuff is organized into three pairs of electric organs. The eel can use one pair for a major discharge, one pair for a medium-size whammy, and the third pair for a small shock. Each organ is made up of smaller units separated by another kind of tissue that acts like the insulating separators in a storage battery. The electricity is actually produced in these smaller units. Each one produces about one-tenth of a volt. Somehow, in some way, the creature is able to connect these units in series to produce the high voltage discharges. But how he can throw thousands of 'switches' on and off several hundred times a second in perfect unison is still a mystery."

JERRY CONNECTED the leads from the electrodes to the horizontal input terminals of his 'scope and adjusted the linear sweep until he had two of the voltage spikes visible on the screen. Since the frequency of the eel's output was irregular, this pattern was not easy to hold, but a sweep frequency of around 200 cycles per second displayed two complete pulses. Once again this proved the books were right when they said that the eel put out about 400 discharges per second.

"For the rest of our experimenting," Jerry mused, "we should have the eel swimming freely about. Wonder where we can manage that? He's too big for a washtub."

Jerry and Carl looked deep into each other's eyes and saw the same thought. "Okay," Jerry said, "but you'll have to go ahead and make sure the coast is clear. Mom is deathly afraid of this thing, and if she saw us sneaking it into the bathroom, she would never set foot in there again."

Jerry gathered Old Squirmy, still strapped to the length of gutter trough, under his arm and cautiously followed Carl up the basement stairs. Jerry's mother, fortunately, was busy talking on the telephone and never noticed the boys tiptoeing past the door on their way to the second floor. Safely inside the bathroom, Carl started quietly filling the tub with water while Jerry made another trip to the laboratory for other equipment he wanted. When the tub was two-thirds full, the eel was released inside it. He seemed to enjoy his freedom and went slithering around on

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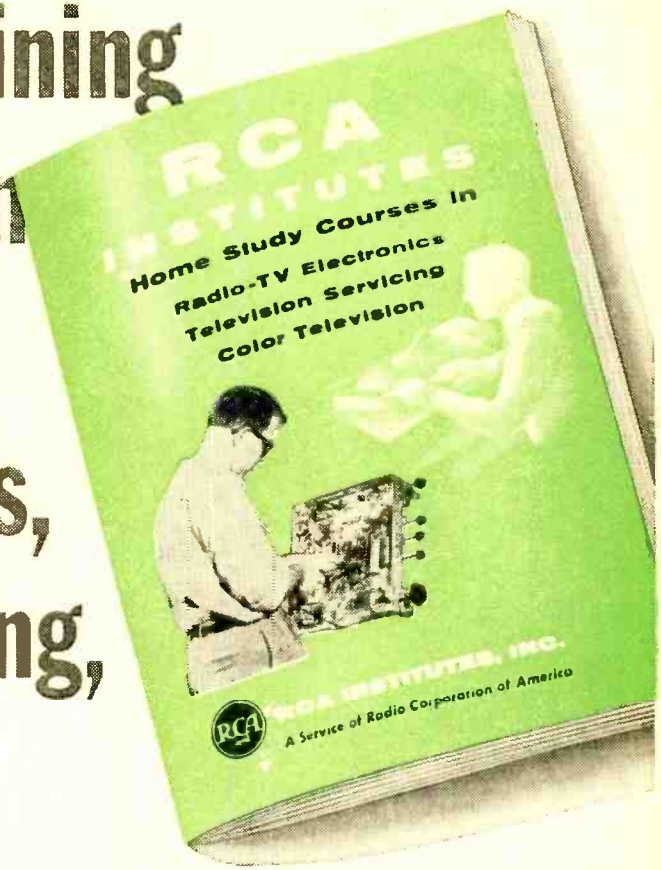

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Carl & Jerry (*Continued from page* 18)

the bottom of the tub in graceful coils. Jerry separated the earpieces of a pair of headphones and handed one to Carl.

"Listen!" he said, as he dipped the metal-tipped ends of the headphone cord in the water. Clearly heard in the phones was a static-like noise. When the eel was quiet, this noise subsided; but as soon as it started to move, the noise returned.

"Any time he is moving," Jerry explained, "the electric eel gives off a series of weak discharges. These serve two purposes: first, they warn enemies to keep their distance; and secondly, they form a kind of radar that enables the eel—which is virtually blind when it is adult—to seek out its prey."

"WAIT A MINUTE!" Carl interrupted. "I'm not so dumb that I don't know a radar system consists of a receiver as well as a transmitter. I'll admit Old Squirmy has a dan-dan-dandy low-frequency transmitter; but where's his receiver?"

"He's got one all right, according to the books," Jerry replied. When one eel in a tank discharges, all the other eels come to the spot, apparently to horn in on the result. Obviously they know when one of their fellows is trying to stun something and can judge very nicely where the current is coming from. But now let's see if we can prove this with the eel-caller I've built up. It's a blocking oscillator that produces sharp spikes of voltage over a frequency range which is adjustable from about 500 to 2000 cycles per second. The output of the oscillator drives an output tube so as to produce pulses of very respectable amplitude across these two electrodes. Let's place the electrodes in the water at this end of the tub and see if we can sweet-talk him into coming over."

Carl did as he was told, and Jerry began varying the frequency of the blocking oscillator. As a certain frequency was reached, the eel on the bottom of the tub began to stir and swim directly to the electrodes. When they were transferred to the opposite end of the tub, he immediately moved toward them.

"Old Squirmy's receiving frequency seems to be around 800 cycles per second," Jerry announced.

"Say! That thing really puts the come-hither on him," Carl said enthusiastically. "We ought to patent it."

"We're a little too late," Jerry told him. "Eel hunters in South America are already using earphones to locate electric fish and then are employing eel-callers something like this one to lure them into

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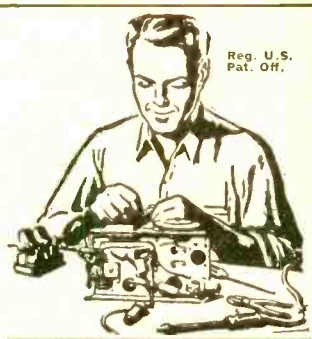

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Here is an excerpt from a letter that we received from Loren DePriest, 1496 4th St., Mansfield, Ohio: "I have spent many pleasant hours in constructing the radios from the schematics in your book, and have learned a great deal from them. Being as I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

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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 question 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 quicky. The Troubleshooting Tester that comes with the Kit is really swell, and finds the trouble if there is any to be found."

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Carl & Jerry *(Continued from page 20)*

their traps. But to get back to his built-in radar, by means of it the electric eel can move straight toward his prey and can detect a variation of just a few inches. What's more, he can tell instantly if his prey is moving and can make allowances for that movement."

"YOU KNOW," Carl mused, "that's all pretty wonderful when you stop to think about it. Here we think of electricity itself as being quite modern, but that ugly creature resting there on the bottom of the tub and his ancestors have been using electricity for thousands of years. What's more, they've been using it in ways that we think of as being ultra-modern. Since electric eels talk to each other by means of their electric discharges, we must admit that they are equipped with wireless telephones. Those same discharges are employed as a compact, efficient, and highly effective weapon to secure food and to combat enemies. Finally, the lowly eel has been quietly using radar—which we did not discover until the last war—for countless centuries. It kind of makes you wonder if man—in spite of all his scientific development and progress—is so doggone smart as he thinks he is, doesn't it?"

"It certainly does," Jerry agreed, "and I think my uncle had something like that in mind when he sent me the eel and told me to study it. When we work with electricity that is man-produced by batteries and generators and so on, we sort of take it for granted and forget how magic it really is, but when you see electricity being generated within the living tissue of a live creature such as this, all the wonder and mystery of it sweeps over you, and you are glad that you intend to make a lifetime study of it." —30—

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LETTERS FROM OUR READERS

Wanted: Parabolic Dishes

■ I am looking for a parabolic dish or horn to be used with a speaker or microphone similar to those used on sound trucks. I used to be able to get them for about $10, but now have no luck. Have any of your readers seen some in other cities?

FRANCIS FOSSA
Nashua, N. H.

The editors of POP'tronics are also scouting around for one of those war surplus dishes. Carl and Jerry located one for their May 1956 story installment, but they're not telling anyone where they found it. How about it, guys, have you seen or heard of any parabolic dishes lately?

Must Meet FCC Standards

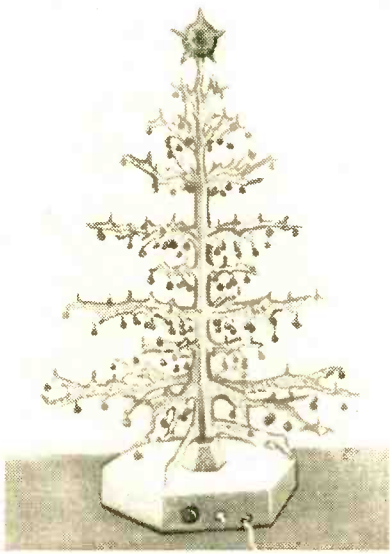
■ I would like to obtain a diagram to build a transceiver such as the Vocaline (June and August issues) Citizens band Model JRC-400.

(name withheld)

We cannot stress too strongly that all radio transmitters used for two-way voice communications must meet FCC standards. In the case of radio amateurs, we are sure you are aware that they must pass strict examinations. Citizens band equipment must be approved by the FCC laboratories—constructing your own is impractical.

Twinkling Xmas Tree

■ In your December 1954 issue, you featured a twinkling tree which interested me greatly. I constructed one from plastic in six sections. It is 30"



high. The neon bulbs are cemented in notches filed in the upper edges of the limbs. All wires are carried to the base of the tree where war-surplus

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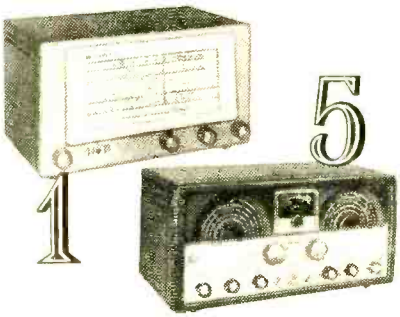

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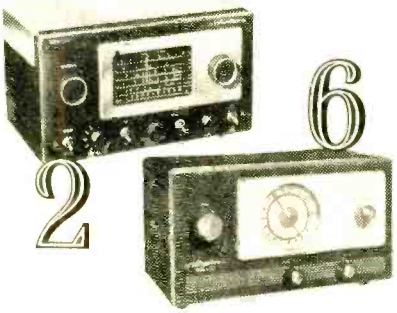

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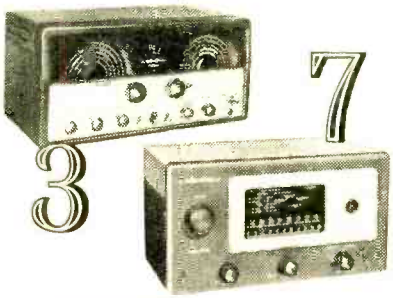

model S-85, S-86 $119.95

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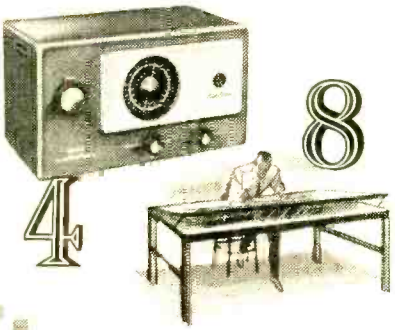

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model S-102, S-106 $59.95

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model SX-104, SX-105 $89.95

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Letters (*Continued from page 26*)

0.5-μfd. capacitors are employed to control the twinkling frequency.

R. J. Norton
Everett, Wash.

Many thanks for remembering to send in the photo of your Xmas tree. Other readers interested in duplicating this tree can obtain the plans from our back issue department. Each back issue costs only 30 cents.

Comments on August/September

■ Thanks for the story in your August issue on tape correspondence. This QSL card is my own

idea. How do you like it? I am using a DeJur model TK820, dual speed, and a Shure 51 microphone.

Art Rubin
355 Summit Ave.
Cedarhurst, N. Y.

■ Your August issue was one of the best yet. I particularly liked the article on memory devices.

O. Relling
Oceanside, N. Y.

Many thanks, Otto, for your note. Readers that missed the August issue will soon see the memory device article reprinted in SCIENCE DIGEST.

■ Just finished the series by Lou Garner on printed circuits. It was excellent! Please continue the series with more on methods using silk screens and photographic techniques.

John York
Fishkill, N. Y.

■ Congratulations on McIntyre's dual control system in your September issue (page 63). It was just the thing I was looking for. I appreciated the well-written description.

Lee Aurick, W1RDV
Hartford, Conn.

■ Specifically liked the issue devoted to electrets (August, page 85).

Doug Mosher
Portland, Ore.

More Help for Mr. Grenier

■ To make faded tube numbers reappear (see request by Gerard Grenier, August issue, page 28), I would suggest melting some black carbon with candle wax, then pouring it over the spot on the

(*Continued on page 32*)

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

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

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How to gain career success in the tremendous electronics industries. It pinpoints opportunities which exist. By 1960, the electronics industries will do no less than $15 billion worth of business per year, not counting military orders. Take TV for example: There are about 34,000,000 TV sets and over 425 TV stations on the air. Color TV is pushing ahead furiously. There is but one field of maximum opportunity in this electronic age.

CREI TRAINS YOU IN MINIMUM TIME AT HOME

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

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

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If discharged after June 27, 1950, let new GI Bill of Rights help you get resident instruction. Check coupon for full data.

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Street .....

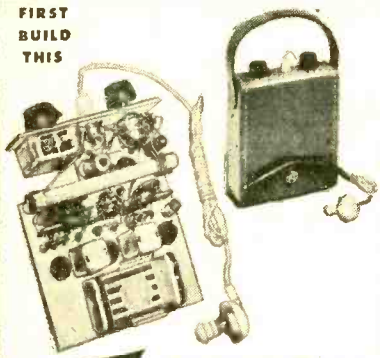
City ..... Zone ..... State .....

Check: ☐ Home Study ☐ Residence School ☐ Korean Veteran

Lafayettes

4 AND 6 TRANSISTOR SUPERHET KITS POCKET AND HOME RADIOS FOR SPEAKER AND EARPHONE OPERATION

FIRST BUILD THIS



THEN BUILD THIS **19.95**

POCKET SIZE: 4"L x 3-5/16"W x 1"D BUILT-IN ANTENNA! REQUIRES NO EXTERNAL ANTENNA OR GROUND!

Lafayette engineers have designed this fascinating 4-transistor superhet receiver kit in a unique and interesting form. It is, by itself, a completely self-contained, pocket sized personal portable set which operates a miniature earpiece so only you can hear; by plugging into the KT-96 kit listed below, it is instantly converted to a full 6-transistor home radio, complete with speaker for the entire family to enjoy. The set is completely subminiaturized and utilizes the new, radically different Argonne "Poly-Vari-Con" ultra miniature 2-gang variable condenser. You will be delighted with the truly subminiature parts, from the variable which measures only 1-1/16" square x 3/8" deep, to the tiny I.F.'s and electrolytics. The chassis measures only 4" L x 3-5/16" W x 1" D. You'll be amazed at its performance. Circuit features use of 4 transistors (2 high frequency and 2 audio type) plus a germanium diode, 2 I.F. stages and built-in high gain ferrite core and antenna. The result is a sensitive, stable and selective set covering the entire broadcast band. Requires no outside antenna or ground connection. The kit is furnished complete with transistors and all parts, including battery and chassis already drilled and punched. The earpiece and carrying case are accessory items, not supplied. All necessary pictorial and circuit diagrams are furnished with simple, easy-to-follow instructions. Shpg. wt., 2 lbs.

KT-94 Kit ..... Net **19.95**

MS-311 LEATHER CARRYING CASE ..... Net **1.95**

MS-260 Super power dynamic earpiece ..... Net **3.95**

MS-278 Economy earpiece ..... Net **1.95**

11.50

2-TRANSISTOR CLASS B PUSH PULL OUTPUT STAGE KIT WITH SPEAKER SELF-CONTAINED IN BEAUTIFUL PLASTIC CASE.

• CONVERTS 4-TRANSISTOR KIT INTO A 6-TRANSISTOR HOME RADIO WITH SPEAKER

Add a completely transistorized push-pull audio stage to your 4 transistor receiver. Complete stage including speaker and case measures only 3" H x 2¾" W x 1¾" D. Plugs right into 4 transistor kit above. Converts your 4 transistor set to a 6 transistor plus diodes superhet receiver. Performance equal or superior to commercially wired sets selling at more than twice the price. Kit includes 2 transistors, 2 transformers, 2½" PM speaker, pre-punched chassis, speaker case to hold entire stage, battery, hardware, instructions and diagrams. Shpg. wt., 1 lb.

KT-96 ..... Net **11.50**

FM-AM TUNER KIT

34.95

Basic FM-AM Tuner having outstanding specifications and delivering astonishing performance — all at a budget price in easily assembled kit form.

- **AFC DEFEAT CIRCUIT WITH FRONT PANEL CONTROL**
- **FOSTER-SEELEY DISCRIMINATOR CIRCUIT**
- **GROUNDED GRID TRIODE AMPLIFIER**
- **20-20,000 CPS RESPONSE**

Choose this 7 tube compact high-fidelity FM-AM tuner whose characteristic features are found in units costing many times as much, and whose performance is unheard of at this low price. There are two front panel controls, a function control for AM, FM, PHONO, TV and a tuning/AFC defeat control. Features Armstronf FM circuit with limiter and Foster-Seeley discriminator. Simplified tuning with slide-rule dial and flywheel counterweighted mechanism, high impedance phono input and high impedance audio output.

SPECIFICATIONS

FREQUENCY RANGE: FM 88-108MC, AM, 530-1650 KC. **ANTENNA INPUT:** FM, 300 ohms, AM Ferrite loopstick and high impedance external antenna. **DISTORTION:** Less than 1% at rated output. **FREQUENCY RESPONSE:** FM, +, .5 db 20 to 20,000 cps, AM ± 3 db 20 to 5000 cps. **SENSITIVITY:** FM, 5 UV for 30 db quieting, AM, Loop sensitivity 80 UV/meter. **SELECTIVITY:** FM, 200 KC bandwidth, 6 db down; 375 KC FM discriminator peak to peak separation, AM, 8 KC bandwith, 6 db down. **IMAGE REJECTION:** 30 db minimum. **HUM LEVEL:** 60 db below 100% modulation. **TUBE COMPLEMENT:** 2-12AT7, 1-6BE6, 1-BA6, 2-6AU6, 1-6AL5 plus selenium rectifier. **SIZE:** 6¼" high x 9⅝" wide x 9½" deep (excluding knobs). **CONSUMPTION:** 30 watts. For 110-120V 60 cycles AC. Attractive etched copper-plated and lacquered finish. Less metal case. Shpg. wt., 9 lbs.

KT-100 ..... NET **34.95**

ML-100....Metal cage for above, Shpg. wt., 3 lbs. **5.00**

LAFAYETTE SIGNAL GENERATOR

COMPLETELY WIRED AND TESTED! ACCURACY AND QUALITY GUARANTEED!

22.50

- **FREQUENCY 120KC to 260MC!**
- **120KC to 120MC ON FUNDAMENTALS!**
- **30 DAY TRIAL PERIOD! FULL REFUND IF YOU ARE NOT SATISFIED FOR ANY REASON**

Completely wired and tested instrument. Do not confuse with kits sold in the same price range. Has the quality and accuracy of instruments selling for 3 to 4 times as much. Six overlapping ranges — 120KC to 320KC, 320KC to 1000KC, 1MC to 3.2MC, 3.2MC to 11MC, 11MC to 38MC, 37MC to 130MC — all on fundamentals — calibrated harmonics from 120MC to 260MC. Switch between internal modulation at 400 cps or any external source at other frequencies. 400 cps signal can be used separately. Outputs are unmodulated RF, modulated RF and 400 cps audio. RF output is in excess of 100,000 micro volts. Jacks are provided for high or low RF output.

Highly stable special circuit design. Fine adjust RF control. AF output 2-3 volts, input 4 volts, across 1 megohm. 5 inch etched dial plate — protected by clear plastic bezel. Common AF terminals for EXT-MOD input and INT-AF output eliminates need for special connectors. Gray metal case — carrying handle — complete with leads, line cord and plug. For 105-125V, 50-60 cycle A.C. Shpg. wt., 8 lbs.

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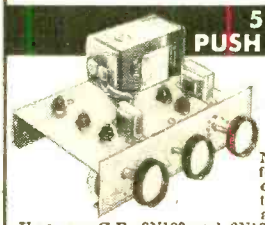
3 TRANSISTOR HI-FI PREAMPLIFIER KIT

New Lafayette Hi-Fi Pream Kit using new GE 2N190 quality audio transistors. Separate Volume, Bass and Treble controls. Frequency response 20-20,000 cps. Three phono and microphone. Provides low-noice, stable preamplification without hum and microphonics. Complete with all parts transistors, pre-punched chassis, battery and detailed step-by-step instructions. Size 4⅛" x 3¾" x 1½". Shpg. wt., 2 lbs.

KT-117 —Complete Kit.....Net **18.45**



5 TRANSISTOR PUSH PULL AMPLIFIER KIT

- ¾ WATT, CLASS B, PUSH-PULL OUTPUT
- CRYSTAL AND MAGNETIC INPUT
- SEPARATE BASS AND TREBLE CONTROLS

New 5 transistor audio amplifier for phonos—microphones—tuners—etc. Excellent for the experimenter—student—or any one desiring a good transistorized amplifier. Uses new G.E. 2N189 and 2N186A transistor. Inverse feed back for reduction of distortion. Transformer coupled driver and output stages. Complete with punched chassis, knobs, transistors, all parts and detailed instructions and diagrams.

KT-104—3.2 ohm output.....Net **22.95**
KT-105—8 ohm output.....Net **22.95**

TRANSISTOR CODE PRACTICE OSCILLATOR KIT

For those interested in mastering the International code, an audio tone oscillator is essential. The circuit of this transistorized feedback oscillator has the simplicity of the neon glow, the signal strength of the vacuum tube, and requires only two penlite cells for weeks of service. It may be used for solo practice, or two may send and receive with the same unit. Kit comes complete with Transistor, Telegraph Key, Resistors, Condensers, Masonite Board, etc., and Schematic Diagram.

KT-72 .....Net **2.99**
Cannon EC1—Single Headset .....Net **1.13**

2 TRANSISTOR POCKET RADIO KIT

Packed into a 2½"x3½"x1¼" plastic case. This Two Transistor plus crystal diode radio kit offers many surprises, utilizing a regenerative detector circuit with transformer coupled audio stage, gives you high gain and excellent selectivity. Pulls in distant stations with ease with more than ample earphone volume. Kit comes complete with two transistors, crystal diode, loopstick, Argonne transistor audio transformer, resistors, condensers, plastic case, etc. Including schematic and instructions.

KT-68A Complete Kit less earphones. Net **10.95**
MS-260 New Super Power Dynamic Earphone, ideal for Transistor Circuit imp. 8000 ohm, D.C. 2000 ohm **3.95**

NEW POCKET AC-DC VOM MULTITESTER
2,000 ohm per Volt on AC & DC

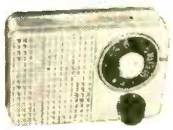
- **Completely wired — Not a kit**

Accurate VOM with a sensitivity of 2000 ohms per volt on both AC and DC. Single selector switch. 3" 160 amp. meter. Scales: DC Volts: 0-10-50-500-1000; AC Volts: 0-10-50-500-1000; Ohms: 0-10K, 0-1 Meg; DC Current: 500 ua and 500 ma; Decibel: —20 to +22, +20 to 36; Capacity: 250 mmf to .2 mfd and .005 to 1 mfd. Heavy plastic panel, metal bottom. 4¼" x 3½" x 1⅝". With batteries and test leads. Shpg. wt. 4 lbs.

RW-27A **8.95**

NEW! Mail Order Center ------->

3 TRANSISTOR SUPERHET POCKET RADIO KIT



- A TRUE POCKET SUPERHET RECEIVER-NO EXTERNAL ANTENNA!
- NO EXTERNAL GROUND!

A remarkable sensitive, super-selective pocket superhet receiver with astonishing performance over the complete broadcast band. Uses 2 high-frequency and one audio transistor plus efficient diode detector and features 2 specially matched IF transformers for maximum power transfer. The components are housed in a professional looking beige plastic case. The receiver's appearance enhanced by attractive maroon and silver station dial. Sensitive built-in ferrite antenna eliminates need for external antenna. A designer's dream in a true pocket superhet receiver! Complete with all parts, transistors battery, case, dial and easy to follow step-by-step instructions. 4⅛"x2⅝"x1-1/16". Shpg. wt., 1 lb.

KT-116 —Complete Kit, less earphone.....Net **16.95**
MS-260—Super Power Dynamic Earphone.....Net **3.95**

1 AND 2 TRANSISTOR POCKET RADIO KITS

ONE TRANSISTOR POCKET RADIO KIT—KT-97

- IDEAL FOR STUDENTS, HOBBYISTS AND EXPERIMENTERS
- PRE-PUNCHED CHASSIS FOR ADVANCEMENT TO 2 TRANSISTOR KIT

Ideal, low-cost transistor pocket radio kit. Super-selective ferrite loop antenna permits good reception up to 50 mile radius with approx. 50 ft. antenna and good ground. Provisions for advancement to 2 transistor receiver. Complete Kit with simple detailed instructions. 3⅝" x 2⅝" x 1". Shpg. wt., 1 lb.

KT-97—Complete, less earphones..Net 4.50

TWO TRANSISTOR POCKET RADIO KIT—KT-98

Contains all KT-97 components plus additional R-C coupled transistor stage for increased sensitivity and output. Complete with instructions. Shpg. wt., 1 lb.

KT-98 —Complete 2 Transistor Kit, less earphone.....Net **5.95**
MS-111—Crystal earphone for KT-97 and KT-98.....Net **1.49**
MS-260—Super power dynamic earphone.....Net **3.95**

20,000 OHM PER VOLT MULTITESTER SEMI KIT

A new kind of kit—the difficult work is already done—you wire in only a few multipliers and mount the battery holder to complete the unit. A fine high sensitivity (20,000 ohms per volt DC —5000 ohms per volt AC) instrument employing a 3" 40 microamp movement. Has 4 DC voltage, 4 AC voltage, 2 DC current, 3 resistance and 2 db ranges. Complete with test leads and detailed instructions. Size 3⅝" x 4⅝" x 1⅝". Shpg. wt., 3 lbs.

KT-20—Kit .....Net **11.95**

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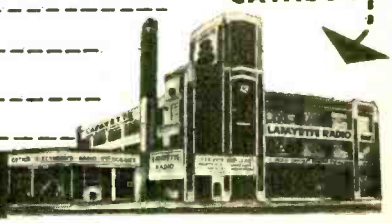


CUT OUT AND MAIL TODAY!

Letters (*Continued from page* 28)

tube where you think the numbers were originally positioned. Let the black wax cool, and after a short time heat the tube to melt the wax. Once the lump of wax is removed, rub the tube briskly—the numbers should suddenly reappear. Do this a few times, as the numbers will soon fade out again.

PHILIP HOFF
McKees, Pa.

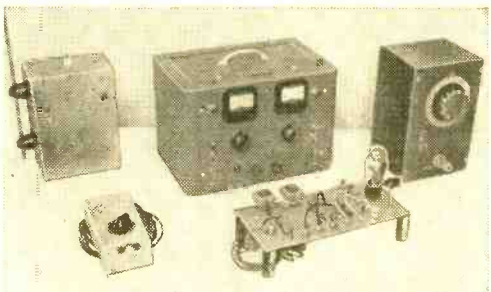
■ Best method is to apply full strength household ammonia to the tube. This will generally bring the numbers up.

F. R. COLEMAN
Victory, W. Va.

Once again, many thanks to all readers suggesting ideas on how to bring up invisible tube numbers. Other methods were printed on page 30 of the October issue.

Building P.E. Projects

■ This photo shows most of the construction projects that I have built from the pages of P.E. I had a real "ball" building them. There are eight in all, counting the extra metal locator, field strength meter, and R/C battery rejuvenator that



are not shown. In the photo (from left to right) are the Lorenz transmitter, headphone adapter, battery eliminator, thyratron experiments and metal locator.

DON BOGGS
Manhattan Beach, Calif.

Medium-Wave DX

■ I have been reading the letters about long-wave DX and thought some readers might be interested in medium-wave (broadcast-band) DX. Some of my best loggings include: LRA, PAR, CBI38, BED2, CMBZ, WNEW, WWVA, WINS, WCAU, CMQ, PRE8, and WMGM.

I use an Eddystone 740 receiver and a 33′ antenna. I would like to hear from other readers about their DX.

EDDIE W. BURY
81 Pyenot Hall Lane
Cleckheaton, Yorkshire
England

Thank you, Eddie, for your interesting letter. Although POP'tronics does not publish a column on medium-wave DX, we do recommend that you contact the Newark News Radio Club, 215 Market St., Newark 1, N. J., about its bulletins on broadcast-band (as we call it in the states) DX. —30—

QUALITY INSTRUMENTS BY EMC

Save More . . . Service Better

A COMPLETE "ECONOMY-LINE" WITH HIGH-PRICED FEATURES.

Advanced production techniques and extensive quality controls assure you of a high quality, reliable instrument at the lowest possible price . . . compare and you'll agree — it's smart to buy EMC.

VOLOMETER — EMC Model 102

Durable molded bakelite case, pocket size. Features 800 micro amperes D'arsonval-type meter, 3½ inch plastic meter, accurate to within 2%. Three AC current ranges — and the same zero adjustment for both resistance ranges.

$14.90 wired & tested $12.50 kit form

VOLOMETER — EMC Model 104

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MUTUAL CONDUCTANCE TUBE TESTER — EMC Model 206 P

One of the finest pieces of tube testing equipment at a price comparing favorably with emission-type testers. This completely flexible model using lever-type switches offers extremely accurate results with ease of operation.

$83.50 (hand rubbed carrying case)

TUBE TESTER and REJUVENATOR — EMC Model 209

Miniaturized instrument gives fast, absolutely accurate checks for tube quality, shorts, leakages, continuity, and opens on all modern and future tubes . . . uses standard emission test for quick readings on modern, 3½" plastic meter. $38.50 in hand rubbed carrying case.

$35.90 (hammertone metal case)
$25.90 kit form

VACUUM TUBE VOLTMETER — EMC Model 106

Specially designed for field alignment of TV and radio sets. Uses 1% precision resistors for voltage multipliers. 5 db ranges. Full scale deflection of 1½ volts for both AC-DC volts. Housed in compact portable bakelite case. Size 4¼" x 5¼" x 2⅞". Net weight 3 lbs.

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VOLT-OHM-CAPACITY METER — EMC Model 107

Directly measures capacity, resistance and complex waveforms peak to peak. Some of the high quality features at no extra cost are: expanded scale cannot burn out . . . measures 50 mmfd to 5000 mfd . . . inductance from 1.4 henries to 140,000 henries in 4 ranges . . . 1% multipliers for voltage capacity and resistance measurements.

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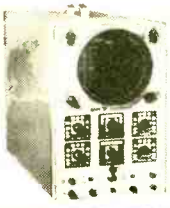

WIDE BAND OSCILLOSCOPE FOR COLOR AND MONOCHROME TV
EMC Model 601

EMC Model 601 oscilloscope gives you the highest quality features ever found in this price field. Exclusive features: full 5 mc bandwidth for color TV servicing — push-pull vertical amplifier, .02 volt per inch sensitivity — 5 UP1-5" scope tube — 60 cycle phasing control — DC positioning controls eliminates overshooting and bounce — built-in peak-to-peak calibration reference — 2-step compensated attenuator input — multivibrator sweep, from 15 cycles to over 75 kilocycles.

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Write today for FREE illustrated catalog and technical information on the EMC economy line.

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The popular 700 has three extra features — bar generator for TV adjustment with a variable number of bars available for horizontal or vertical alignment. Complete coverage from 18 cycles to 108 megacycles on fundamentals.

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Yes, send me a complete catalog of all EMC Instruments plus full information about the EMC "Profit" Plan for jobbers. PJ-9

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10 new popular replacement variables from one to five gang. Ship. wt. 9 lbs.

C. KIT Midget Variables

$2.99

Includes 10 assd. variables such as 100 mmfd. BUD MC1265 31 plate (reg. net $2.45), 243 mmfd. dual 33 mmfd, also 3, 15, 35, 50 and 100 mmfd. All midline types. Ship. wt. 3 lbs.

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50 popular sizes including plastic and metal encased from .001 mfd. to 1 mfd. 600 V. and cathode by pass types. Poular brands, no freak types or sizes. Ship. wt. 3 lbs.

E. KIT Tube Sockets

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829, 832, Steatite, XU-4 Pin, Acorn, miniature, octal, loctal, wafer, and molded types. A whale of a buy. 50 in all. Ship. wt. 3 lbs.

F. KIT Radio Knobs 100

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100 various knobs for radio & television. Push on, set screw, pointer, audio, red, brown, black and white. All for reg. ¼" shaft. Ship. wt. 3 lbs.

G. KIT Wafer Switches

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50 pcs. Includes aircraft strain, antenna, feed thru, stand off, and mounting types. All low loss. Ship. wt. 6 lbs.

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Contains 25 ass'd. IF, RF, OSC, antenna, and a $5.75 Meissner wave trapper. Ship. wt. 4 lbs.

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25 ass'd. bathtub by pass condensers for that rugged service construction. Ship. wt. 5 lbs.

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Assorted. Many for ham bands. Ship. wt. 3 lbs.

T. KIT Carbon Brushes

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Over 100 assorted new dynamotor and motor brushes, most with spring & bronze lead. Ship. wt. 3 lbs.

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Save money and give the gift that will keep any radio man busy for hours going thru this treasure house of parts that will be the envy of his fellows. Over a $1,000 inventory. Remember, this is all picked, useful, new merchandise. All sold to satisfy or money refunded.

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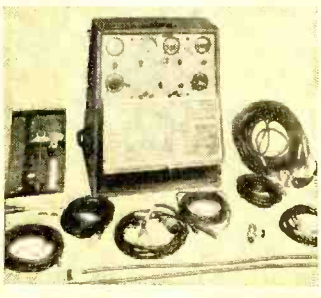

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Tube Checker . . . Dynamic Mutual Cond. $22.50 ea.

Here is a real buy on a portable dynamic mutual conductance tube checker built for the Signal Corp. by leading mfgrs. Checks most of latest tubes including TV types. Some defect is in all but can be easily repaired by the radio man, sometimes only a tube needs replacement. Ship. wt. 18 lbs.

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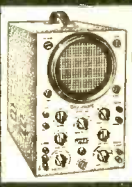

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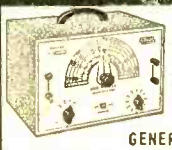

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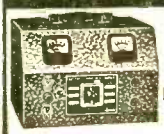

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Politics and pure reason mix in computer guesswork on national elections

Lowell Thomas (above) and Charles Collingswood (left) take tips from Univac in following the progress of the election.

By HERBERT REID

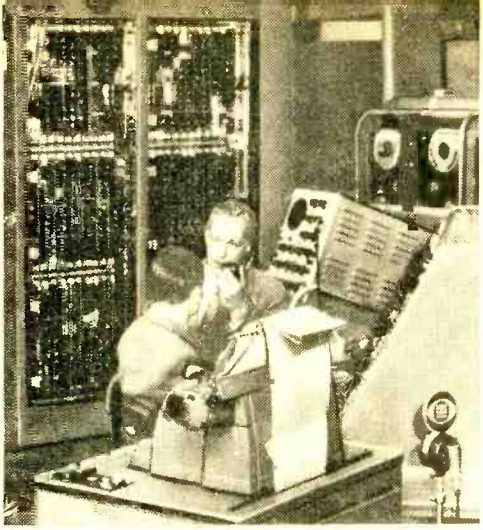
Electronic Election Bet

DWIGHT EISENHOWER and Adlai Stevenson won't be the stars of the show when TV covers the election. At the moment of decision, CBS cameras turn their backs on personalities, parties, and passions. Instead, Univac, Remington Rand's giant electronic computer, swings into focus. With its blinking lights and shining dials, this computer out-sparkles even the flashiest politico. But, unlike the candidates and their drum-beaters, Univac never raises its voice. The even-tempered humming of its circuits and the logical nature of its innards bespeak the very opposite of politics: pure reason.

For all its rationality, Univac won't throw a wet blanket of cool mathematics over the excitement of election night. On the contrary, with the whole nation figuring the odds of the race, Univac gets into the act as champion guesser of them all.

Hindsight for the Future. If you are planning to wager some last-minute election bets, better take a tip from Univac, no matter what your own "expert" notions may be. CBS learned this the hard way on election day in 1952. At 8:30 P.M., November 4, less than two hours after the first poll closed, the computer had predicted an Eisenhower landslide. At that time, only three million returns were in from scattered Eastern states. No returns at all had been received from 21 states. Univac had to rely solely on historical information in those cases. But the machine wrote: "100:1 in favor of Eisenhower."

Everybody had been expecting a close race. The scientists masterminding the



Latest election forecast rolls out of automatic typewriter. Rack in rear does the reckoning.

computer were doubtful of their own robot. They threw out the prediction, not daring to put it on the air. They thought something was wrong with the setting of the machine. There was a mad scramble, after which they proceeded to feed Univac a series of cautious "correction factors" to lessen the assumed chances of Eisenhower carrying Southern states. Despite this, Univac still stuck to Eisenhower, but reduced the odds to 6 to 5.

By midnight, evidence had piled up showing that Univac's first prediction had been amazingly accurate. And the final tally of electoral votes brought complete vindication. Univac had said, on the basis of a relative handful of returns, that Eisenhower would get 438 electoral votes and Stevenson would get 93. The actual result was 442 to 89.

Had Univac been human, it probably would have spelled out as a final message: "I told you so!" Univac wasn't psychic. But primed with past election results, the machine had at its electronic fingertips more political data than any human brain could scan and digest. Thanks to this storehouse of facts and the fast sifting of information, the machine's agile hindsight outsmarted the foresight of the prognosticators.

History and Math. This trick of "looking backward" into the future is not at all unique. In fact, it is the basis of all science, which always assumes that the future will shape up as a logical outgrowth of the past. Thus, past experience becomes the raw material for future theory, and hindsight forms the basis of prediction.

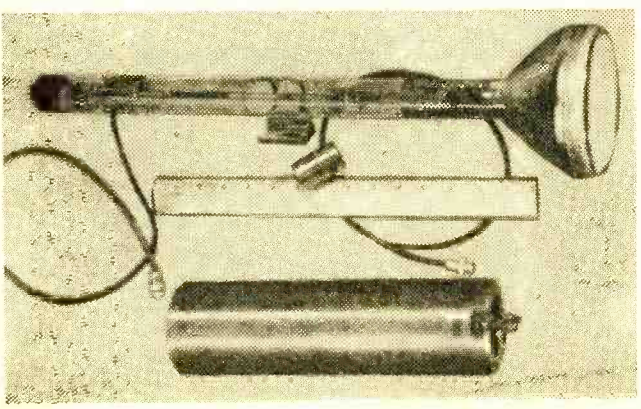
Yet history and experience in themselves are not enough. The trick lies in knowing how to interpret the historical information. This is something no computer can do for itself. Like all so-called electronic brains, it hasn't really got an ounce of intelligence. It is merely an oversize gadget —blind, dumb, senseless and inert. What makes it work is the mind of its human masters, who have fed it in advance mathematical instructions as to how to deal with the numbers from the polls, and who,

(*Continued on page* 113)

Simplified Radar to Use "Wamoscope"

RADIO ENGINEERS attending the Western Electronic Show in Los Angeles recently were amazed to hear of a single-tube radar set. Developed by Sylvania Electric Products, Inc., for the U.S. Navy, the radar has been dubbed the "wamoscope." Literally interpreted, "wamoscope" means "wave-modulated oscilloscope." Microwave radar signals can be fed directly into the tube where—in a single glass envelope—they are amplified, detected, and finally displayed on a fluorescent screen.

Secret of the "wamoscope's" unusual ability is the traveling-wave focusing principle. (The focusing solenoid is shown in the photo as the metal cylinder.) The "wamoscope" can be designed for any u.h.f. band and with any size cathode-ray screen. Although the first one is reserved for the military, radio engineers are planning on possible applications in miniaturized commercial and industrial closed-circuit TV systems.



First "wamoscope" measures just under two feet, but contains complete radar reception system for direct signal display on cathode-ray screen on end of tube.

SEE WHO'S ON THE PHONE

SOON YOU WILL SEE as well as hear your partner in a telephone conversation. Practical two-way transmission of pictures along with the voice over ordinary telephone lines from coast to coast was recently demonstrated by Bell Telephone Laboratories. Head and shoulders of the callers appeared clear and recognizable on small TV attachments to ordinary telephone sets.

Unlike conventional video transmission channels, the new "picture-phone" uses a narrow frequency band, making it possible to send pictures over regular telephone wires rather than expensive coaxial cable. Because of such limitations, only two "frames" per second are transmitted. This suffices, however, since only the portrait of the caller is shown and there is no need for fast action on the screen.

Furthermore, the raster of the small tube requires only 40 lines for good picture definition. By such means, the video bandwidth was reduced to 600 cps (as compared to 4 megacycles on regular TV). This 600-cycle band travels over the telephone wires exactly like a voice signal, needing no special video lines or amplifiers. It is because of the drastic reduction in bandwidth that the picture-phone appears practical for general use in the not-too-distant future. Both local and long-distance service is planned.

Though transmission of spoken words remains the prime rational aspect of telephony, millions of people rely emotionally on the telephone for its power of making physically distant people seem close. The addition of sight to sound will vastly enhance this psychological by-product of direct message transmission.

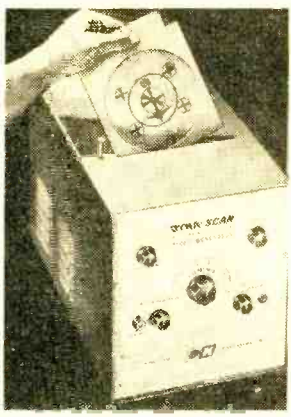
Even the occasional need for privacy was foreseen by Bell engineers. If you have to answer the phone after running out of the shower, you can just switch off the video so that you can see your caller but he can't see you. —30—

New "picture-phone" (above) displays caller on screen of small TV tube. The camera behind the phone completes the two-way setup. Shown below is the first practical picture-phone which operated in Germany twenty years ago. However, Hitler's military needs halted this promising development.

Picture tube, camera and controls are combined in this experimental model. Camera lens is visible above tube screen.

Unique Video Generator

ANY VISUAL PATTERN, picture, or printed message can be reproduced on a television set using the "Dyna-Scan" video generator. This flying spot scanner produces a fully modulated r.f. carrier containing synchronizing pulses and complete video information to drive a standard TV receiver. It can be used with a single set or any number of sets, or fed into a master antenna system. By inserting a slide transparency in the device, test patterns, messages, etc., printed on the slide will be shown on the TV set to which the unit is connected. Net price of Dyna-Scan is about $200. For further information, contact the manufacturer, B & K Mfg. Co., 3731 N. Southport Ave., Chicago 13, Ill.



TV Turned Traffic Cop

REGULATING THE FLOW of truck traffic in and out of Zenith Radio Corp.'s main plant in Chicago is a company-installed closed-circuit TV system. Photo at left shows a plant guard coordinating truck movements with the aid of the traffic picture displayed on his TV screen. The TV camera which picks up the action is located at a strategic spot along the two-lane ramp leading to the plant.

Before the use of TV, a steady procession of trucks throughout the day presented problems of delay and stack-ups. With the new system, one man stationed at a single control point can regulate traffic safely and easily. Waiting time is reduced, all trucks move faster, and the guard need never leave his seat. The TV screen he uses is housed in a master panel along with controls for electrically operated ramp doors and gates. A two-way voice communications system permits the guard and the driver of a truck to exchange traffic and check-out information. The driver's microphone is mounted in the plant wall near the waiting truck.

Live TV to S.A.?

LIVE TELEVISION broadcasting from the United States as far south as Venezuela is entirely possible, according to Dr. Allen B. Du Mont, chairman of the Du Mont Laboratories, Inc., Clifton, N. J. On a recent trip to the Caribbean area and South America, Dr. Du Mont noted that local reception was as good as reception in the United States, and that there appears to be an eager audience for U. S. telecasts. Such programs could reach Venezuela by use of "forward scatter" facilities between Florida and Cuba. Dr. Du Mont suggests the installation of a receiving station and beam transmitter atop a 9000-foot mountain in Haiti to relay signals directly into the South American area.

Electronic Alarm Guards Pool

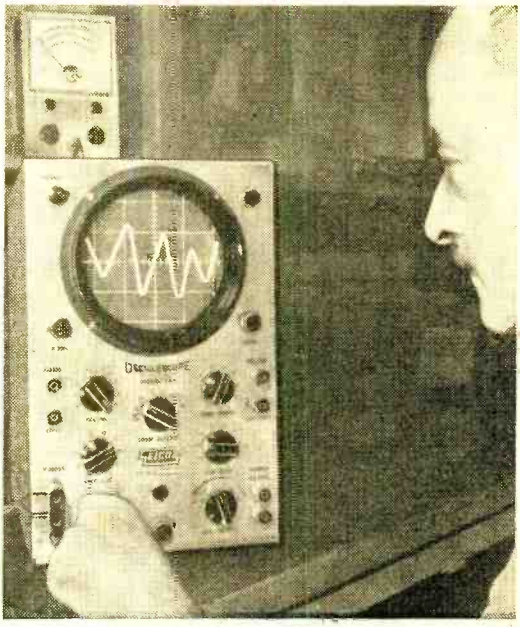
GUARDING against accidents as well as trespassers in this swimming pool is an electronic alarm system known as "Pool Guard." The system, activated by a body entering the water, sounds a loud warning bell. It requires no outside electrical connections, being operated on two low-voltage batteries.

A sensing device in the water responds to the displacement of water when an unwanted body enters the pool. The control unit, containing an "ON-OFF" switch, may be located at the pool or remotely. With the switch "OFF," the alarm system is deactivated, and the pool may be used normally. Pool Guard is made by Supertron Corp., Los Angeles 65, Calif.

The oscilloscope, the most versatile of all measuring devices, enables man to perceive facts of nature to which his own senses are blind. It is today's foremost instrument of basic research and applied technology.

By H. H. FANTEL
Associate Editor

Past and present blend in a single moment in new cathode-ray display



Tricked-up Cathode Rays Are "On the Beam"

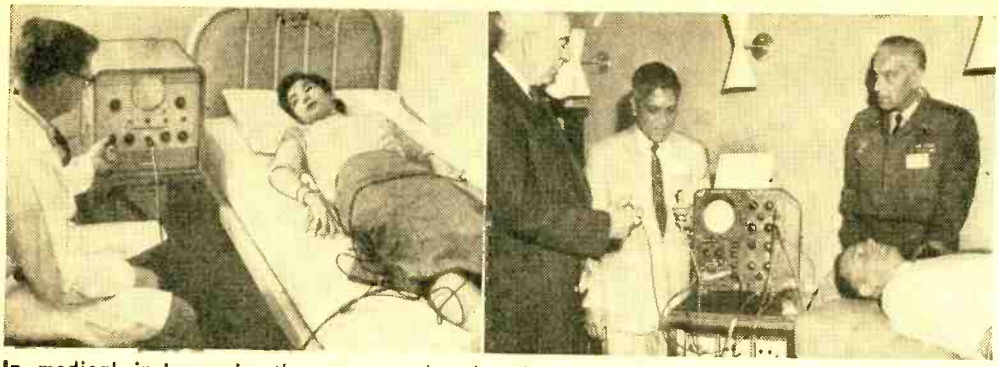
AS AN "OLD DOG" that has been the pet of physicists ever since the early days of electronics, the cathode ray is lately learning an amazing number of new tricks. Instead of just dancing about on an oscilloscope or putting on TV shows in your home, the cathode ray has taken some memory training and also learned to write. But before showing off these latest frills, let's look at the basic function of the cathode-ray tube.

In its most familiar form, the cathode-ray tube acts as the "picture tube" in television sets. Electrons shoot out in a narrow beam from the "electron gun" in the neck of the tube. They hit a phosphor screen, which lights up under their impact. On the way between the electron gun and the tube screen, the beam is bent—or "deflected"—by electromagnetic fields set up by coils around the tube neck. Another way of deflecting the beam is to employ capacitor plates within the tube, which bend the beam by setting up electrostatic fields along its path. These deflections guide the beam across the tube face so that the "picture" appearing on the tube face represents the electric signal fed to the tube.

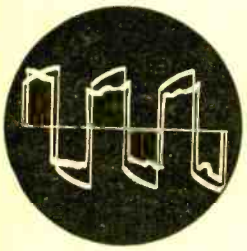
In oscilloscopes, the cathode-ray tube acts as a measuring device. It indicates anything that can be expressed as an electric voltage. Factors and forces like pressure, tension, temperature, distance, speed, and weight, can be converted into electrical terms and gaged accurately by the beam pattern on the face of the cathode-ray tube. The measuring range is virtually unlimited, since the scale of representation can be varied from zero to a very high value by switching resistors of different sizes into the circuit. A half-inch line on the tube face might mean a little or a lot. Assuming you are measuring weight, that half-inch line might represent a ton or a grain, depending on the scale selected. This extreme variability of range makes the oscilloscope the most versatile of all measuring instruments.

The Instant Image. Speed is another asset of the cathode ray. No need waiting for a swinging pointer to come to rest; no chance for the pointer to lag behind the signal. For the "pointer" in a cathode-ray tube is a beam of free electrons, capable of moving at almost the speed of light. Since there is nothing faster, the beam can theoretically keep up with even the most rapid events. In actual practice, the time constants in the deflection circuit dictate a speed limit somewhat below the beam's unbeatable record. But for most practical purposes, the beam keeps a comfortable speed margin on almost anything it has to tackle.

But speed is only half the story. Weight, or rather the lack of it, makes up the rest,



In medical instruments, the memory-endowed cathode-ray tube retains traces of past heartbeats to compare successive heart contractions. The functioning of other organs can be similarly checked.



Two traces occurring one after the other are presented simultaneously for comparison on Memotron.

since electrons are virtually weightless. The beam has practically no inertia. It can shuttle back and forth through intricate patterns at breakneck speed without "going off" at the curve. This fast and accurate shuttling enables the beam to trace high-speed oscillations in their rapid rise and fall, showing them as the familiar waveform patterns.

With all these advantages, it is no wonder that the cathode ray became the universal measuring tool of nearly every science. Yet in all its countless jobs, the cathode ray suffered from one major disability. It could display information about any occurrence only during the instant that the event actually happened. It presented data from moment to moment without being able to compare the things happening *"now"* with the things that had happened *"before."* It took no account of the past. In other words, it had no memory. The past was always lost.

The Past Regained. Now the cathode ray—which as Man's lightest and speediest tool has helped him master mass and space—also enters the dimension of time. The Memotron, developed by Hughes Products, is a new cathode-ray tube with the ability to "store" information of past events so that they can be compared with later data. Both past and present show simultaneously on the screen of the tube.

The image on the tube face lasts until it is intentionally "erased." This is particularly convenient for the study of transients, i.e., unique occurrences which happen very quickly and only once. A timing pulse in radar, a critical moment in music (e.g., the beat of a kettledrum), the current surge in starting a motor . . . all these are typical transients. The Memotron "holds" them permanently for thorough study. Tracings of events occurring at different times can be "stacked" on the tube for comparison at a single glance.

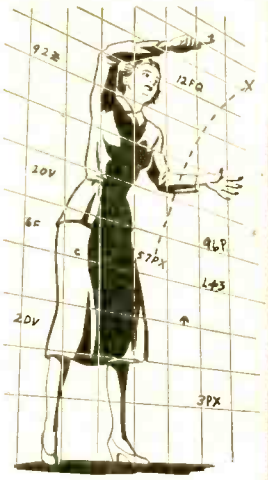
Hughes engineers went even a step further. Instead of simply "remembering" light curves against a dark background, as does the Memotron, their new Tonotron tube "remembers" whole pictures in all their various shades of grey. What's more, the amount of contrast is variable so that the halftones can be adjusted for best picture quality.

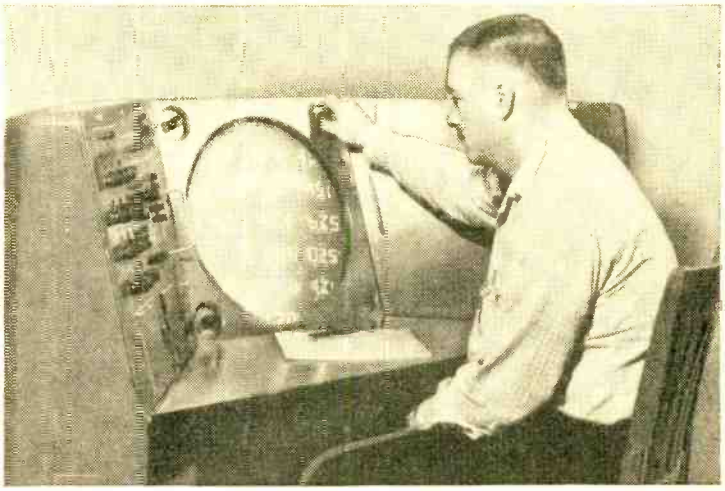
The length of time for which the picture is retained on the screen after being flashed on by the scanning ray is called the "persistence" of the image. The Tonotron features variable persistence, adjustable on the control panel. This, in addition to an accurately shaded presentation of the grey scale, assures "high fidelity" in picture reproduction.

Frozen Action. One Tonotron application is in the form of a TV tube capable of "freezing" the picture. Earlier this year, such a tube was demonstrated by the Institute of Radio Engineers in New York. Mounted side-by-side with a conventional TV receiver and tuned to the same channel, the Tonotron TV tube allowed viewers to push a button and "stop the action" while the program on the regular tube went ahead.

Yet the greatest need for the Tonotron and the new tube's immediate chance to

The Tonotron, newest cathode-ray tube, retains complete images with halftone shading for variable time periods. It "freezes" action on TV picture at right while show continues on regular tube.





Air traffic patterns are marked in conventional way on transparent board by girl above. But to keep up with today's faster planes and denser traffic, human reactions proved too slow and human error too much of a risk. The "writing tube" (above, right) now takes over the job, marking the planes' positions as fast as radar can track them. This device, a recent development of the Boston Electronics Division of American Machine & Foundry Co., will contribute to greater air safety.

prove its usefulness lie in airborne radar. "With this tube, a pilot need not take his eyes from the control and peer into a hood to see a radar presentation," says Dr. A. V. Haeff of Hughes Aircraft Co. "The picture is so bright that he can see it at a glance, night and day, and he gets a continuous picture rather than fleeting blips. He controls the time it takes the picture to fade, holding it brilliant for as long as needed, or erasing it at will. Radar gives the pilot an electronic 'map' of the air around him, showing any storms or obstacles ahead. He will clearly see mountains and the ground below him even through blinding weather. With its ability to hold the picture and to

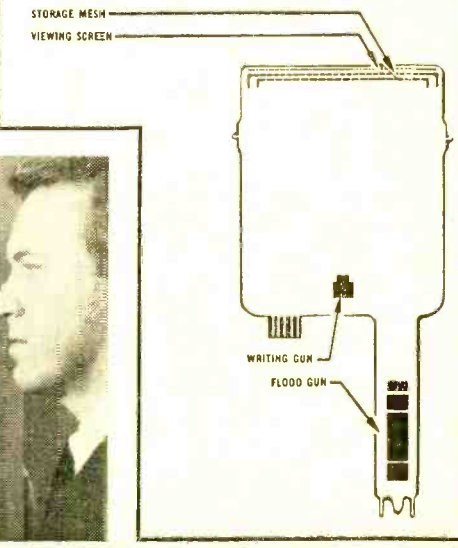
(*Continued on page* 116)

HOW IT WORKS

The "memory" of a cathode-ray tube is based on the well-known fact that a capacitor is capable of storing electric charges. Just behind the viewing screen on the tube is a fine wire mesh coated with a dielectric, which acts as a negatively charged capacitor. This capacitor-type storage mesh is usually flooded with a gentle stream of slow electrons sprayed on by a special "flood gun." But because of its negative charge, the storage mesh bars the path of these electrons. They never reach the screen and the tube stays dark.

Yet when a signal is to be recorded, the high-velocity, sharply focused beam from the regular electron gun smashes through the barrier of the storage mesh and disrupts its negative charge. This makes an electronically transparent "cutout" for the slow electron stream from the flood gun. Now the electrons can travel through the mesh and the tube screen lights up in the patterns "cut out" by the writing beam. The steady electron flow from the flood gun then keeps these areas lit. And the pattern is thus "remembered."

To erase, a positive voltage is pulsed over the whole storage mesh, equalizing all the charges and obliterating the stored pattern.



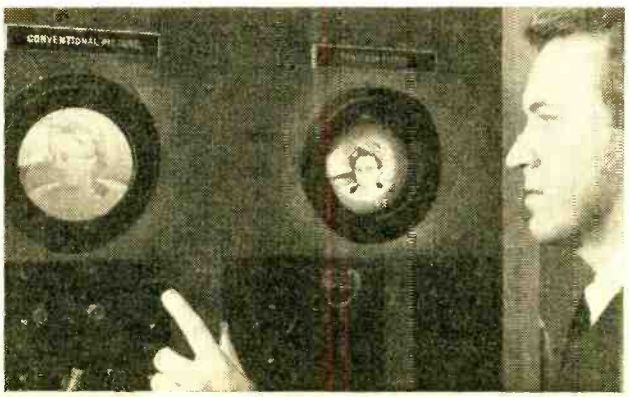


Chart Dials TV Troubles

DEFECTS in television reception that are caused by faulty tubes or adjustments are described and illustrated on a large circular chart, a portion of which is shown at right. When the chart's dial is turned to the difficulty encountered, a slide-rule index pin-points the adjustments to be made and the tube or tubes that may need replacing. Known as the "TV Tube Trouble Shooter," the chart is available for $1.00 from Maple Enterprise, Box 42, Dept. 100, Hillside, N. J.

Video Rig Checks Freight

FREIGHT CARS entering Southern Railway's Citico yard, Chattanooga, Tenn., have their pictures taken by RCA closed-circuit TV system to speed sorting of cars for classification and switching to trains. Cameras, installed at yard entrances, enable clerk in office (photo below) two miles away to "see" and record action. Intercom system adds to rig's versatility.

Fast/Slow TV Scanner

A COMPATIBLE system for combining fast-scan and slow-scan television economically has been announced by General Electric Co., Syracuse, N. Y. The system changes fast TV (30 pictures per second) to slow TV (one picture every 4 or 5 seconds) by means of an electronic converter.

Fast TV is the kind used by broadcasting stations and is what you see on your home receiver. The slower scan, while not providing fine detail and unsuitable for action scenes, is considered adequate for many industrial applications, particularly when there is no motion involved. What's more, slow TV can be sent over modified telephone lines and is therefore a much cheaper method than fast TV which requires coaxial cables.

The new G.E. converter, still in its laboratory developmental stage, will permit industrial television users to take advantage of the good features of both scanning methods within one closed circuit system.

Computer Speeds Supplies

A GIANT computer (IBM 705) has been installed as the electronic brain for the Army Signal Corps computer-communications system for signal supply management

at the Army Signal Supply Agency in Philadelphia. Designed by International Business Machines Corp., it is a key element of the data processing network that provides high-speed control of global logistical operations of signal supplies.

Operating with the speed of light, the computer can make 30,000 decisions per second, 8400 additions or 1200 multiplications per second. It can process 8000 tabulating machine cards a minute—thousands of times faster than this can be done by manual operation. The IBM 705 is expected to effect a major saving in the cost of supply control and management.

The "Tirade Terminator"

an Instant Heating Intercom

By HARVEY POLLACK

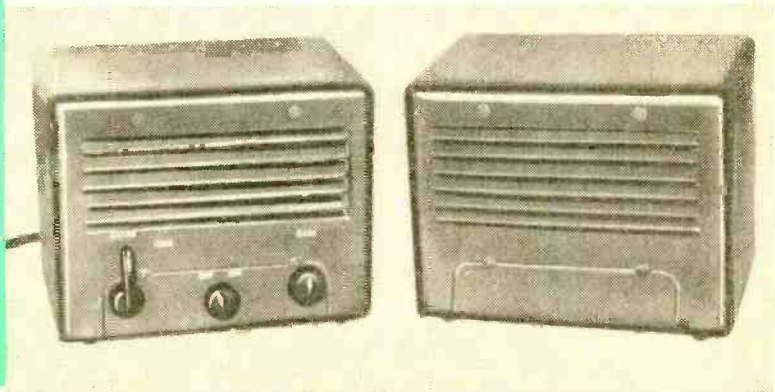
UNLESS YOU LIVE in a very unusual household, you must have had more than one exasperating session with an irate wife or mother on the subject of time wasted in the workshop building useless gadgets. Here's a warranted method of putting an end to those dispiriting gripe sessions. Build something for *her* exclusive use and convenience!

As a protective device and step-saver, an instant-heating (no warm-up time) intercom between the kitchen and the front door will permit her to find out who is ringing the bell without approaching the door itself; undesirable callers can be sent on their way through the medium of a two-way conversation right from the kitchen sink!

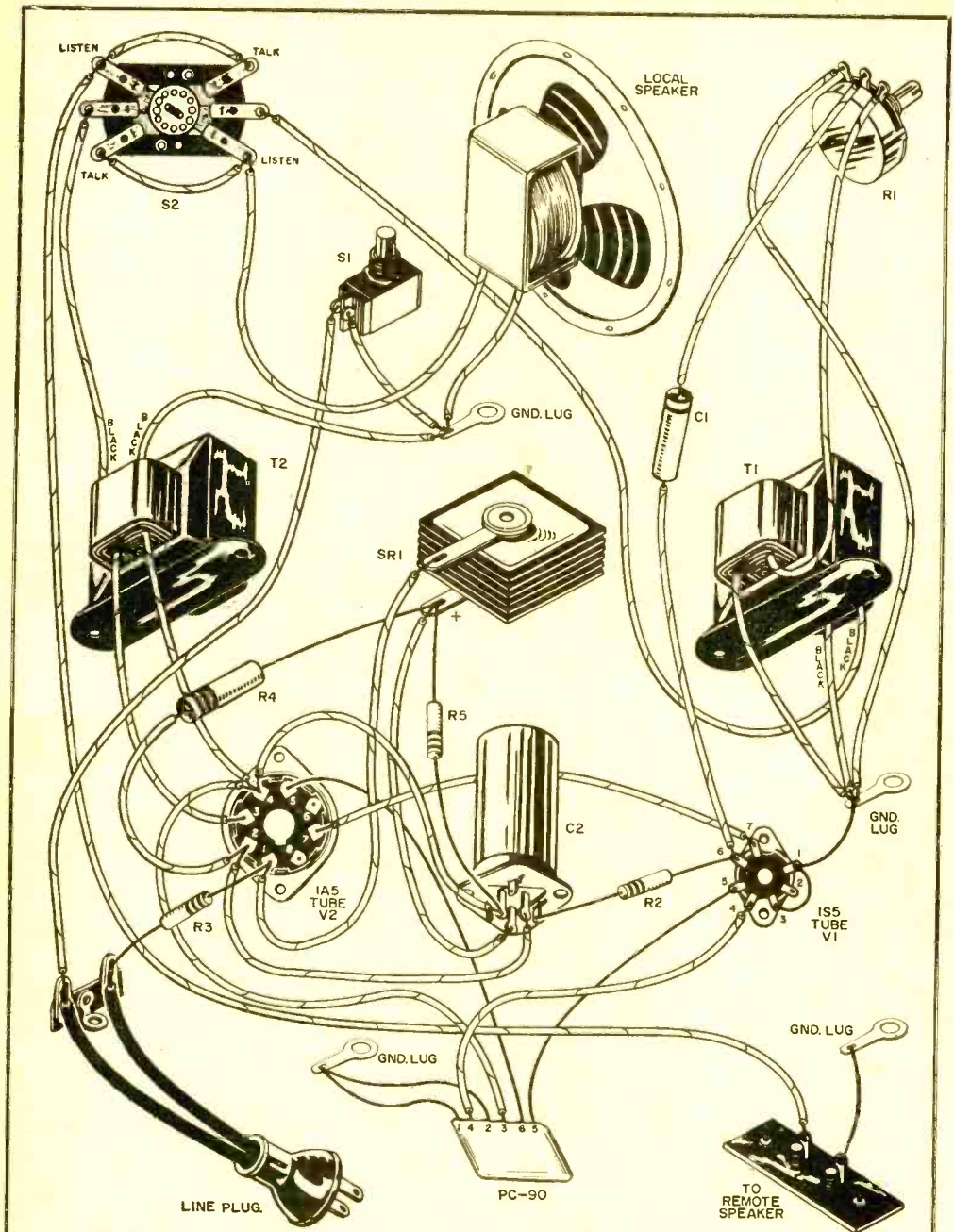
Ordinary office intercoms are not satisfactory for home use. Generally, they use tubes that have a 15 to 30 second warm-up time. To avoid this waiting period, such units are usually left running all day long —an unnecessary extravagance for the average apartment-dweller or home-owner. The intercom described in this article eliminates the need for a warm-up interval by using battery-type tubes arranged for 117-volt a.c. operation.

Construction. The plastic cabinet is supplied without holes for the controls in the front panel so that it may be used as either the master unit or the remote speaker housing. Three ⅜" holes should be drilled in the desired locations before doing anything else; they can be used as templates for locating the control openings in the front apron of the little chassis.

Mount the major parts on the top of the chassis (see the photo on page 50). Se-



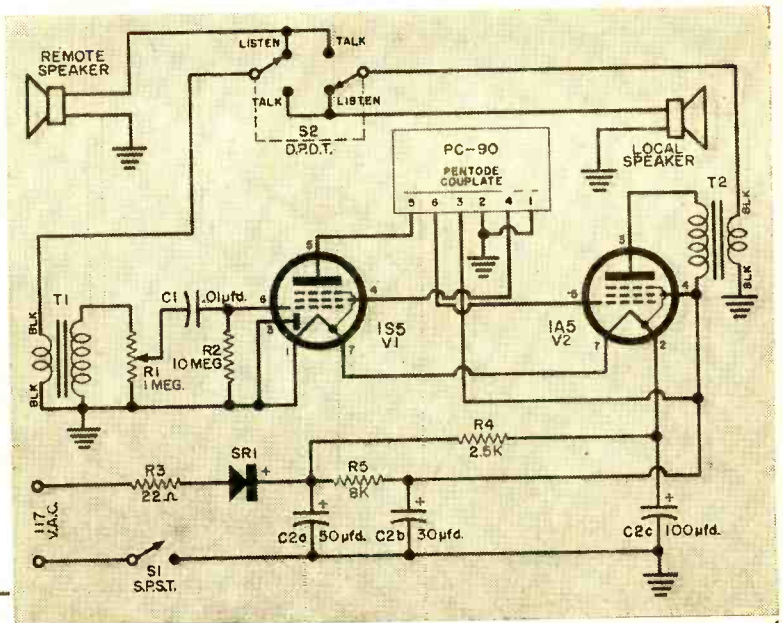
Plastic cabinet comes without holes for controls drilled in front panel; it can serve either as master unit or remote speaker housing. Trimming the cabinet with decals will make intercom look like expensive commercial unit. Waterproof housing may be used for remote out-of-doors unit (see above).



Hook up the components of the "Tirade Terminator" as shown in this pictorial diagram.

cure the gain control (*R1*), the canopy-type switch (*S1*), and the *TALK-LISTEN* selector switch (*S2*) to the front apron. Do not cut the shafts short as yet; this can be reserved for last once you are quite sure that everything fits properly.

Plan your layout so that input transformer *T1* is physically close to *R1* and pentode amplifier *V1*. Since connections between these parts are high impedance paths, they are quite subject to hum pick-up and feedback unless made as short and direct as possible. Except for this grid circuit, the remainder of the wiring is not particularly critical. However, delicate filaments combined with high-gain amplifiers are subject to 60-cycle hum unless carefully handled. If the hum is excessive, it



Wiring diagram for instant-heating intercom. The "Tirade Terminator" eliminates need for a warm-up interval by using battery-type tubes arranged for 117-volt a.c. operation — making it particularly suitable for home use. Only the wiring for the grid circuit is critical. The pentode Couplate (PC-90) should be installed after all other wiring is completed.

PARTS LIST

C1—0.01-μfd., 400-volt paper tubular capacitor
C2a/C2b/C2c—Filter block capacitor, 50-30-100 μfd., 150-150-25 volt, Twist-lok type in can (Sprague TVL-3427)
R1—1.0-meg. volume control potentiometer, audio taper (Mallory U-53, Midgetrol)
R2—10-megohm, ½-watt resistor
R3—22-ohm, ½-watt resistor
R4—2500-ohm, 10-watt resistor (Sprague Kool-ohm Type 10KT)
R5—8000-ohm, 1-watt resistor
S1—S.p.s.t. switch, rotary canopy type with long shaft
S2—D.p.d.t. TALK-LISTEN switch, spring return (Centralab Type 1464)
SR1—65-ma. selenium rectifier (Sarkes-Tarzian Model 65)
T1—Intercom input transformer, primary 4 ohms to secondary 25,000 ohms (Stancor Type A-4744)
T2—Output transformer, 25,000-ohm load to 4-ohm voice coil (Stancor Type A-3327)
V1—1S5 tube
V2—1A5 tube
PC-90—Pentode-type Couplate (Centralab)
SPEAKERS—4"-diameter, 4-ohm voice coil PM speakers (Lafayette SK-25)
1—Miniature 7-pin socket, top mounting with shield saddle
1—Octal socket, 1" mounting hole, bottom mounting
1—Shield for 1S5 tube
1—3" x 6⅛" x 1¼" chassis (ICA 29080)
1—Intercom cabinet, brown plastic (Available from Lafayette Radio, 100 Sixth Ave., New York, N. Y.)
1—Cabinet for remote speaker (outdoor use—ICA 3988; indoor use—Lafayette unit above)
1—Insulated terminal board, two terminals, for remote speaker leads
1—Line cord and plug for 117-volt a.c. line, Elmenco fuse plug, with two 1-amp. fuses
Misc. rubber grommets, solder lugs, hardware, hookup wire, line cord for remote speaker

usually means one of three things: poor grounds, defective filament filtering capacitor (*C2c*), or excessively long grid leads in the 1A5 circuit.

All wiring should be completed before the pentode Couplate (PC-90) is installed. This is a printed electronic circuit which replaces three capacitors and three resistors. It is a terrific space-saver and is quite inexpensive. Wire it in last, covering those leads which might touch each other with short lengths of "spaghetti" tubing.

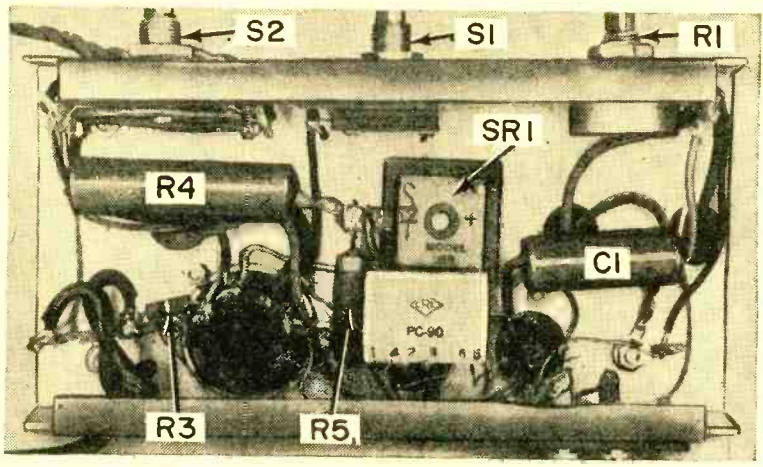
Testing and Installation. Preliminary tests are always performed with the a.c. plug disconnected from the power line. These tests do not guarantee that the circuit wiring is correct in all details; they are intended merely as protective measures to avoid damaging tubes or other compo-

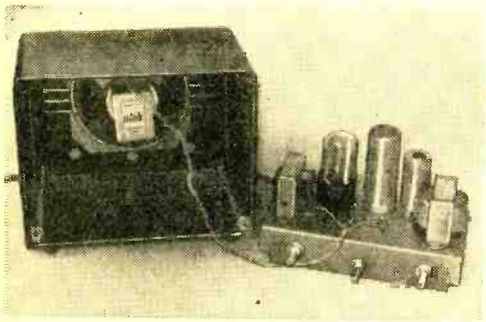
HOW IT WORKS

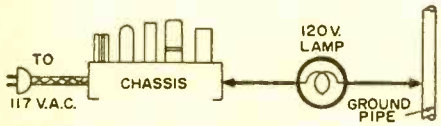
A permanent magnet dynamic speaker may be used as either a microphone or an audio reproducer. On the *TALK* position of the switch, the local speaker is connected to the input transformer (*T1*) and serves as a microphone. Varying acoustic pressure applied to the speaker cone by sound waves induces a tiny audio voltage in the voice coil. This voltage is stepped up by the high secondary-to-primary turns ratio of *T1*, further amplified by pentode *V1*, and the signal fed to the grid of the output tube where it is converted to audio power. The remote speaker is activated by the output tube via the selector switch. In the *LISTEN* position, the speaker functions are reversed, the local speaker now doing the reproducing and the remote speaker acting as a microphone.

Use of battery-type tubes is made possible by rectifying the a.c. from the 117-volt power lines and then by filtering it in *C2a*, *C2b*, and *R5*. *R4* is the filament dropping resistor which insures that a maximum of only 0.05 ampere will flow through the series filaments. The remainder of the circuit is straightforward. To save considerable space, a printed circuit Couplate is used between *V1* and *V2*.

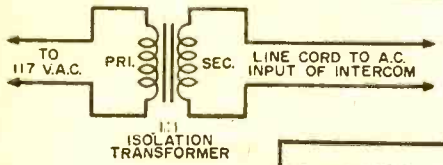
Parts are mounted as shown in photos at right (under-chassis view) and below. If you fit a small piece of plywood tightly into slots near bottom of cabinet, the chassis can rest on this base. A small plywood lip glued to the back of the wood will prevent chassis from sliding, thus holding it securely in place without use of metal screws anywhere.







Establishing the chassis at house-ground potential. If lamp lights when intercom is turned on, plug must be reversed. When chassis is at house-ground potential, lamp will be out.



To eliminate any chance of shock, an isolating transformer having a 1:1 turns ratio could be connected as shown between the line and the a.c. input to the intercom — making precautions in text unnecessary.

Chart at right lists preliminary circuit tests that must be made before using intercom.

nents when power is first applied. (See chart below).

When the requirements of the tests have been satisfied, power may be applied with both speakers connected. *It must be remembered that the chassis is at the potential of one of the legs of the a.c. line.* The following precautions *must* be observed to avoid possible electrical shock and blown fuses.

Connect a 117-volt incandescent lamp (any wattage will do) from the chassis to a ground pipe or other ground point; often the screw which holds the wall outlet plate to the wall box is grounded and will serve the purpose. Turn the intercom on and then insert its line cord plug into the wall receptacle.

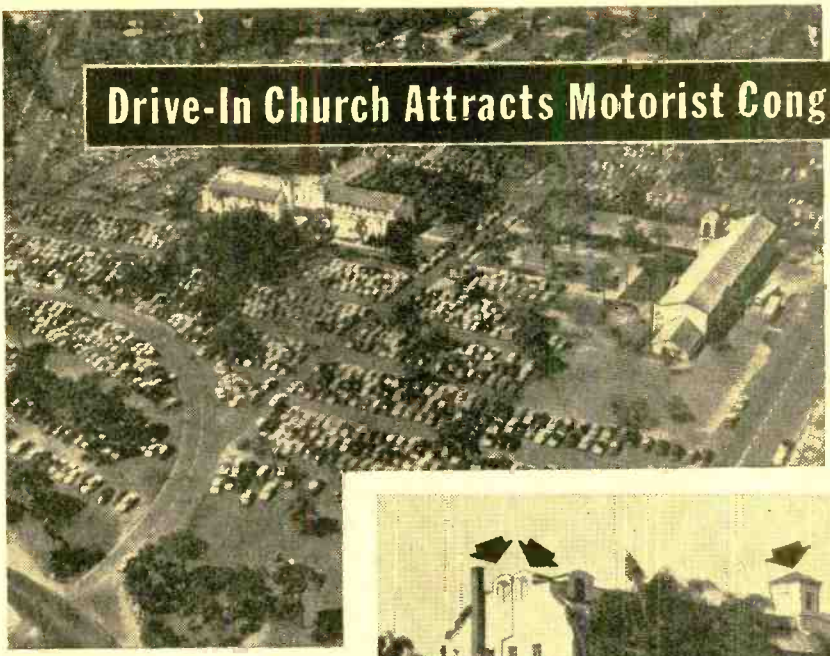
If the lamp lights, the a.c. plug is in the wrong way and must be reversed; reversal should cause the lamp to go out, indicating that the chassis is now at house-ground potential. If the lamp does not light, reverse the plug to make sure it does light when the plug is in the wrong way. This is the only means of establishing that the ground point you are using is *really* at house-ground potential.

Once this is ascertained, the plug should be reversed so that the lamp is extin-

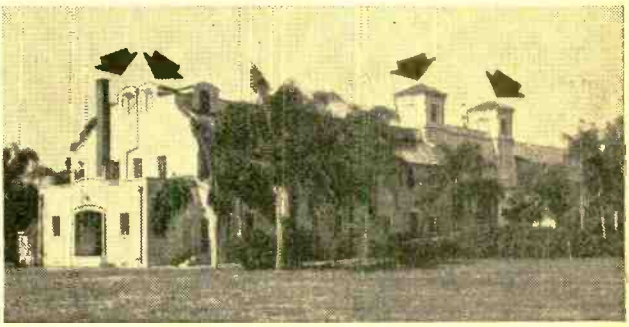
(*Continued on page* 131)

SECTION TESTED	OHMMETER CONNECTIONS From	To	APPROX. READING SHOULD BE:
Filament circuit	Plus end of selenium rectifier SR1	Chassis	2500 ohms
Plate and screen circuits	Pin #4 of V2	Chassis	3300 ohms
TALK-LISTEN switch circuit. (Switch first on LISTEN, then on TALK)	Ungrounded remote speaker terminal screw on output terminal board	Ungrounded voice coil lug on local speaker	10 ohms for either switch position
A.c. input circuit (S1 off)	One prong of a.c. plug	Other prong of a.c. plug	Infinite

Drive-In Church Attracts Motorist Congregation



Aerial view (left) of drive-in church shows worshippers in parked cars during Palm Sunday services. Below, arrows indicate where four speakers are installed on main building.

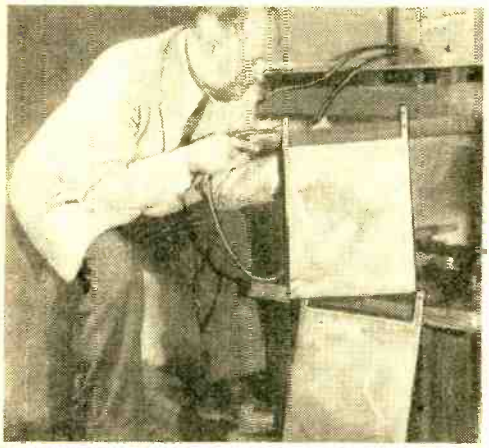


PULPIT eloquence, aided by a unique public address system, has turned an acknowledged "white elephant" into a highly successful religious edifice that boasts congregations of as many as 10,000 people and a fame which is spreading over the world. Known as the Pasadena Community Drive-In Church, it consists of an aggregation of buildings and lush green ground located seven miles outside of St. Petersburg, Florida, and has built its present attendance from little more than a handful of worshippers.

Motivating force behind the drive-in church is dynamic, sparse-framed Pastor J. Wallace Hamilton, D.D. The p.a. system was installed by Altec Service Company whose problem—in addition to the indoor setups—was to cover 18 acres of outdoor area. A room high above the chancel was fitted with a control console, tape recorders, patch panel, amplifiers, and monitor speakers. Microphones and reproducing speakers are located at strategic spots within the church and about the grounds. The patch panel handles 24 circuits. Eight Altec "Voice of the Theatre" speaker systems serve to distribute the sound. Electrically operated windows and curtains, acoustical treatment of rooms, Hammond organ, concert grand piano, and a team of 60 ushers—in addition to Dr. Hamilton's personal staff of seven—complete the picture of this unique drive-in church. —30—

Control room (above), placed behind window affording view of parking area, shows professional sound setup used.

Rev. J. Wallace Hamilton, D.D., in his study at left, has successfully applied electronics to religion in this famed drive-in church.



Good-Bye Barnacles

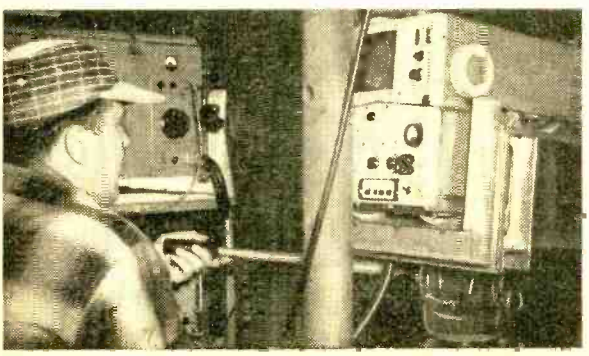
AN INVENTOR has developed an "electronic coating" for ship hulls with which he expects to eliminate the costly twin foes of the shipping industry—corrosion and barnacles. By electronic means, the ship's plates are polarized, causing a thin, flint-hard protective coating of minerals from the sea to form on the hull. This makes the ship very uninviting to plant and animal life and also keeps away rust and corrosion. Inventor Henry Burkey claims that the coating will save millions of dollars yearly by eliminating the need for scraping and painting hulls. At left, Burkey inspects test plates after submersion in raw sea water.

Gas with a Kick

A NEW TYPE of long-life dry battery is now under development at the Union Carbide and Carbon Co. Unlike conventional batteries, which use metals as their active chemical agent, these new cells (right) are energized by gases acting on a caustic paste. They will furnish uninterrupted power as long as oxygen or hydrogen are fed into them. Their first job may be as a power source for submarines.

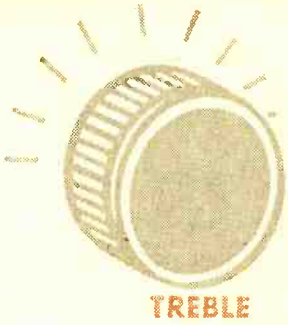
Bell Shakes Them Up

VIBRATION TESTS for electronic components of ballistic missiles are made at Bell Telephone Laboratories. In the photo at left is equipment being subjected to severe test "punishment"—shock, vibration, and extreme temperatures. Electronic components intended for use in the intercontinental missiles Atlas and Titan must be inured to such rigors to endure rocket flight.



TV Peeks from Sky

WITHIN THE CABIN of a helicopter, an engineer pans the camera of a new airborne TV system developed by Philco Corp. for the U. S. Navy. From aloft, the TV transmitter scans amphibian landings and other ship-to-shore movement, relaying the information to remote command posts. Excellent pictures were obtained more than 50 miles away even before sunrise.



The Hi-Fi Boost

By LEON FIELDS

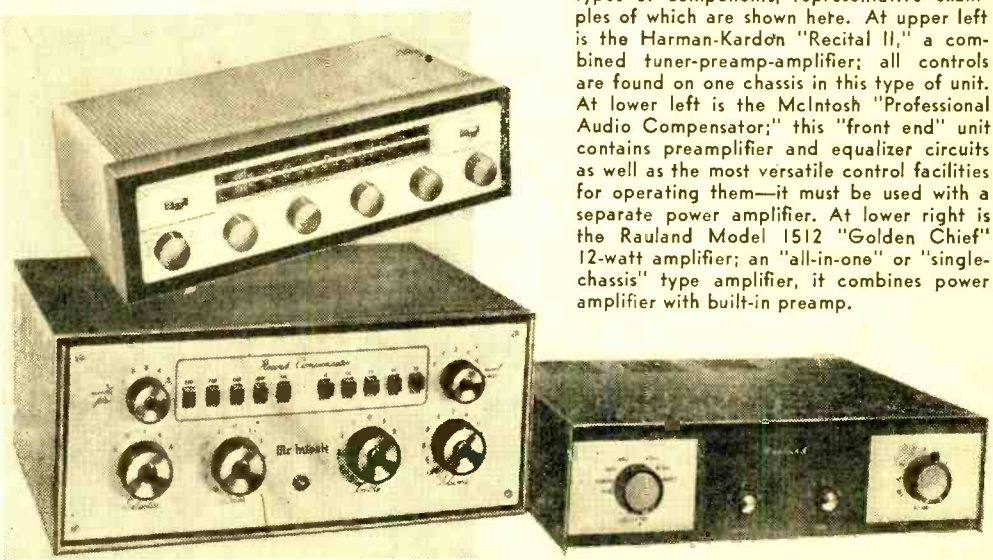
Tone controls permit matching the output of your hi-fi rig to room acoustics as well as to your own listening tastes

ANYONE WHO HAS ever read a set of specifications describing a hi-fi amplifier has, at one time or another, done a double-take when confronted with the following typical statements: (1) the amplifier is flat from 20 cps to 30,000 cps ±0.1 db, and (2) separate bass and treble controls provide as much as 20 db of boost or attenuation at low and high frequencies respectively.

"Why," inquires the hi-fi'er, "does the manufacturer go to such lengths to achieve uniform amplifier response, only to allow the 'uneducated' customer to upset it by the use of tone controls? Aren't we defeating the whole concept of high fidelity by incorporating these 'continuously variable amplitude-distorting' knobs?"

The question is a legitimate one and must be answered. After all, high fidelity does mean "faithfulness of reproduction," and it is highly doubtful that the first bassoon player of the Philharmonic Symphony has a "bass-boost" knob on his instrument. Your amplifier does have one, and a treble control as well. And they're designed for your use. More than mere gadgets, they can serve you well in increasing your hi-fi enjoyment.

"Mellow Like a Cello." The history and development of tone controls parallels the changing public taste for reproduced music. It also follows the fidelity and flexibility of music that is broadcast and recorded. Early "tone controls" in the better



Separate treble and bass tone controls are standard items on hi-fi equipment and are indispensable to maximum enjoyment of hi-fi listening. They may be found on any of three types of components, representative examples of which are shown here. At upper left is the Harman-Kardon "Recital II," a combined tuner-preamp-amplifier; all controls are found on one chassis in this type of unit. At lower left is the McIntosh "Professional Audio Compensator;" this "front end" unit contains preamplifier and equalizer circuits as well as the most versatile control facilities for operating them—it must be used with a separate power amplifier. At lower right is the Rauland Model 1512 "Golden Chief" 12-watt amplifier; an "all-in-one" or "single-chassis" type amplifier, it combines power amplifier with built-in preamp.

. . . Given a pair of such controls, the listener becomes a virtual conductor of his own orchestra . . .

console radios consisted generally of a simple treble-cut adjustment, shown in the first of the four schematic diagrams on page 55.

Turning the control knob of such a circuit may give the illusion of scaling from the depths of bass to the heights of treble, but to the ear trained to appreciate live music or initiated in the wide range afforded by hi-fi reproduction, such a "tone control" is practically worthless. At its best, it provides a limited kind of treble attenuation—and absolutely no bass boost. Used originally in radio receivers that were decidedly "un-hi-fi," its action was inherently limited to the relatively thin audio produced by such sets. Cutting the highs is not a real way of getting better bass.

Nevertheless, such a control could often be used to bring into balance the over-all audio spectrum. This balance, often disregarded in the broadcast studio and completely unstandardized in the record industry until recent years, had to be achieved somehow in the home listening situation. Then, too, up to the advent of hi-fi, a great many people preferred so-called "mellow music."

Muted trombones and alto saxophones seemed to have had the most say in pre-war popular music. And in "classical" music, cellos whose overtones were clipped off and tympani with an anonymous thud but no "bite" filled the air in the homes of serious music lovers. An entire generation was weaned on this kind of listening, whose "hangover" effect is still evident in the opinion expressed now and then by newcomers to hi-fi that "it sounds too shrill." As a matter of fact, discounting those who had the opportunity to attend live concerts, relatively few "music lovers"—even those with extensive record collections—ever really knew what a live violin sounded like before the advent of hi-fi.

In such a reproducing and listening context, the simple treble-cut control had a justifiable, if not spectacular, role. There is still valid reason for its use in low-priced AM receivers and in applications where voice communication is the main thing. Despite recent advances in AM broadcasting, this type of transmission is still subject to static interference, especially in remote areas and during electrical storms. Most of the static heard is contained in the high-frequency portion of the audible spectrum. Since AM broadcasting is generally limited to a tonal range well below 10,000 cycles, it would seem pointless to run a sound system "wide-open" only to allow annoying noise and static to get through with no particular improvement in program content.

A second justification for treble cut lies in the fact that tastes in living room decor differ considerably. A relatively bare-walled, hard-floored "live" room seems to have more treble bouncing around than does a thickly carpeted, heavily draped room. In the former, the treble tones may sound too exaggerated despite the fact that the electronic system itself has perfectly flat response. In such a situation, cutting the treble by means of a convenient control would certainly be apropos. Circuit (A) shown on the next page might do the trick very nicely.

Why Bass Boost? FM broadcasting and LP records and the better equipment to go along with these recent program sources have brought the highs into the living room—sometimes with a vengeance. Usually, a hi-fi enthusiast passes through two initial stages upon being exposed to the new medium. First, he may be impressed by the presence of high frequencies in the reproduced sound. Violins, flutes, piccolos and brass choirs take on a new crispness and clarity of tone. Certain notes, like those struck on the triangle, may be heard for the first time. Everything is articulated more clearly and distinctly. The highs have been discovered!

Some time later, the listener reaches a more advanced state of aural sophistication in which he realizes that something is wrong—the bass tones aren't all there! After checking all the components of the system and re-reading their specifications, the listener concludes that either the components manufacturers are making overly

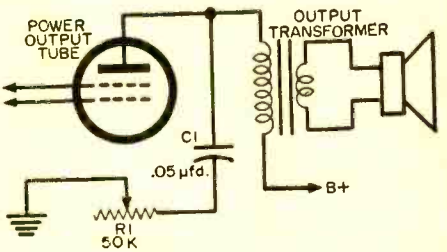
extravagant claims or that he, the listener, isn't hearing right.

In this case, the latter conclusion happens to be true. He *isn't* hearing right! It's a fact that human hearing does not respond uniformly to all tones at all levels. To put it another way: if you listen to a live concert, your ears respond in a certain manner to all the sound heard. If you play a recording of that concert in your living room at reduced volume, the low tones will seem to be reduced *more* than the middle and high frequency tones.

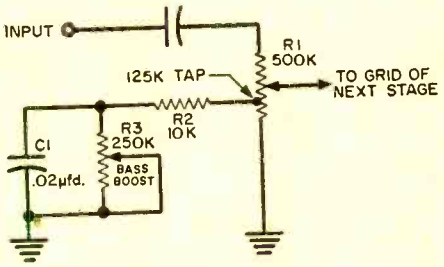
To restore the music to its relative tonal balance, some form of compensation must be used. A very simple type of "bass boost" control for this purpose is shown in the schematic (B) at the right. At high settings of the volume control (where we are closer to the original "loudness level" of the live sound), the circuit provides no bass boost action. As the volume control is lowered, the circuit may be used to increase the level of bass tones.

Knobs and More Knobs. Often, in listening situations, tone control may be required which has the opposite effect of that just discussed. We might need a means of reducing bass and boosting treble. Bass attenuation may be desirable, for example, in a multiple speaker system in which the woofer is more efficient than the other elements of the system. Treble boost, on the other hand, might be needed to some degree because at the extreme high end of the audible spectrum human hearing undergoes somewhat the same deterioration that is experienced with low frequencies at subdued listening levels (though to a lesser degree as a rule). Treble boost might also be required to add highs for tonal balance in a relatively "dead" room. This, of course, is largely a

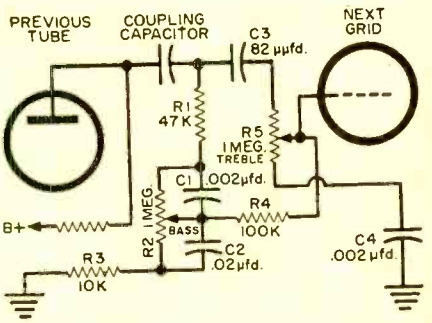
(*Continued on page* 126)



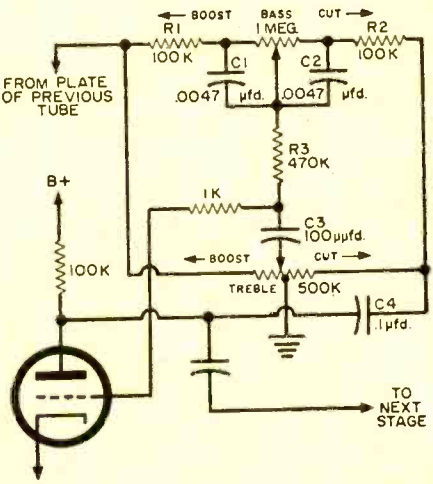
(A) Simple treble attenuation circuit.



(B) Simple type of bass boost circuit.



(C) Popular type of treble and bass controls.



(D) Feedback tone controls (Baxandall system).

Schematics of the basic types of tone control circuits in use today are shown at right. Many feel that types (A) and (B) are not versatile enough to be labeled as "hi-fi." Types (C) and (D), however, provide the required range and flexibility of adjustment expected in good audio equipment. Type (C) has been used very widely in modern equipment, although it is gradually being superseded by the Baxandall circuit shown in (D). A study of the wiring schematic of a particular preamplifier (or tuner, if it contains a built-in preamp) will help you identify the type of tone control circuit used in that component. Such identification can tell you just what you have in your present preamp and also serve as a guide to future purchases. Explanations of how these circuits operate are included in the text; for a comparison of the ranges of control available in types (C) and (D), see graphs on page 126.

Capacitor Duo-Decades for the Experimenter

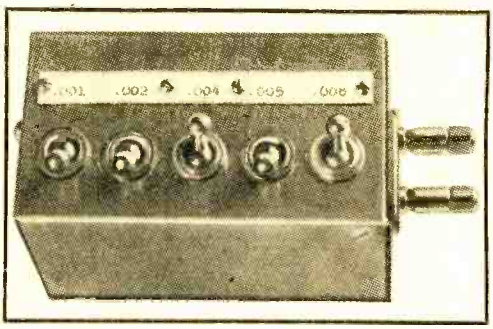
THE DIGITS "1," "2," "4," "5," and "8" can be added in various combinations to obtain all sums from 1 to 20 inclusive. For instance, the sum of 8, 5, 4, 2 and 1 is 20, and the sum of 8, 2 and 1 is 11. The author has adapted this interesting fact to the making of miniature capacitor duo-decades. (See table at right for a set of such digit combinations.)

A single duo-decade requires only five fixed capacitors and five s.p.s.t. toggle switches. The unit shown in the photos contains one each of 0.001-, 0.002-, 0.004-, 0.005- and 0.008-μfd. (actually 0.0082-μfd.) 5% tolerance, silver-mica capacitors. It covers the range from 0.001 μfd. to 0.02 μfd. in 20 steps of 0.001 μfd.

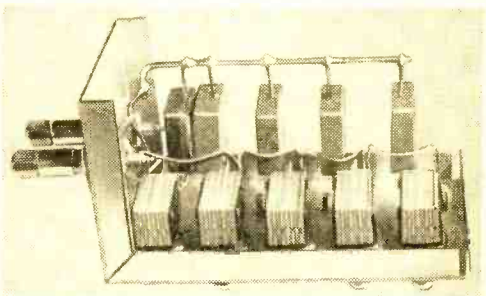
Other duo-decades may be made starting at 0.0001 μfd. and 0.01 μfd. Three such miniature units would use only 15 capacitors altogether, yet they would cover the entire range from 100 μμfd. to 200,000 μμfd. (0.0001 μfd. to 0.2 μfd.) and provide some 2000 different values of capacitance!

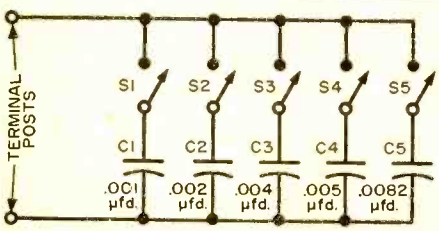
Accuracy of each duo-decade depends upon the accuracy of the capacitors used in it. Since only five capacitors are required per unit, a high order of accuracy can be obtained at reasonable cost. Most experimenters will find that an accuracy of 5% is sufficient for a large majority of applications.

Construction. The duo-decade is built in an LMB Type EL422 flangelock chassis box measuring 2¼" x 2¼" x 4". All switches, capacitors, and the terminal posts



Number:	Sum of:	Number:	Sum of:
1	1	11	8,2,1
2	2	12	8,4
3	2,1	13	8,5
4	4	14	8,5,1
5	5	15	8,5,2
6	4,2	16	8,5,2,1
7	5,2	17	8,5,4
8	8	18	8,5,4,1
9	5,4	19	8,5,4,2
10	8,2	20	8,5,4,2,1





C1—0.001-μfd. silver mica capacitor
C2—0.002-μfd. silver mica capacitor
C3—0.004-μfd. silver mica capacitor
C4—0.005-μfd. silver mica capacitor
C5—0.0082-μfd. silver mica capacitor
S1, S2, S3, S4, S5—S.p.s.t. toggle switches
1—2¼" x 2¼" x 4" aluminum box (LMB No. EL422 or equal)
1—Binding post terminal strip (National FWH or equal)
1—Length of No. 20 bare, tinned, copper wire
1—Short length of heavy busbar wire
Note: C1, C2, C3, C4, C5 may have other values in companion duo-decades. See text for details.

Diagram and parts list for a single duo-decade.

are mounted on the L-section of the box. The mating section merely serves as a protective cover and shield.

Make a label for the switches, bearing the values of the five capacitors contained in the box, out of a strip of thin, white card stock, using hand-lettering or a typewriter. This label is attached to the top of the box with four *4-40* screws.

Solder a length of No. 20 bare, tinned, copper wire to one lug of each of the five switches and then to the solder lug under one of the two terminal posts. Then solder a short length of heavy busbar wire to the lug under the other terminal post. This heavy wire runs almost to the end of the box. One wire lead of each of the capacitors is looped once around and soldered to the busbar, and the other lead of each capacitor is soldered to the second terminal on its own respective toggle switch.

—Frank H. Tooker

Transistor Topics

By LOU GARNER

NOVEMBER should be an exciting month, what with a presidential election and the Thanksgiving and Christmas holidays not too far away. Exciting things are happening in the electronics field, too . . . most of the mail order parts distributors have released their new catalogs, color TV is booming, and, in our "pet" field, there are new types of transistors, transistor components, and transistorized equipment. If you haven't visited your new car dealers yet, don't forget to "give a listen" to the recently developed *hybrid* (tube and transistor) auto receivers.

I don't honestly know whether the average reader of this column is an old-timer or a youngster as far as transistors are concerned . . . but I rather feel that many of you are "new-comers." As an old-timer myself, I'd like to reminisce a little . . . back to about the beginning of 1953. There was great news then . . . Raytheon had just introduced a new *low-cost* transistor, a *p-n-p* junction triode selling for the "give-away" price of merely $7.50 . . . Type number CK722! And it was a real bargain at that price, for, prior to the release of the CK722, the *cheapest* transistor sold for about $18.00, with many types selling for $50.00 to $100.00.

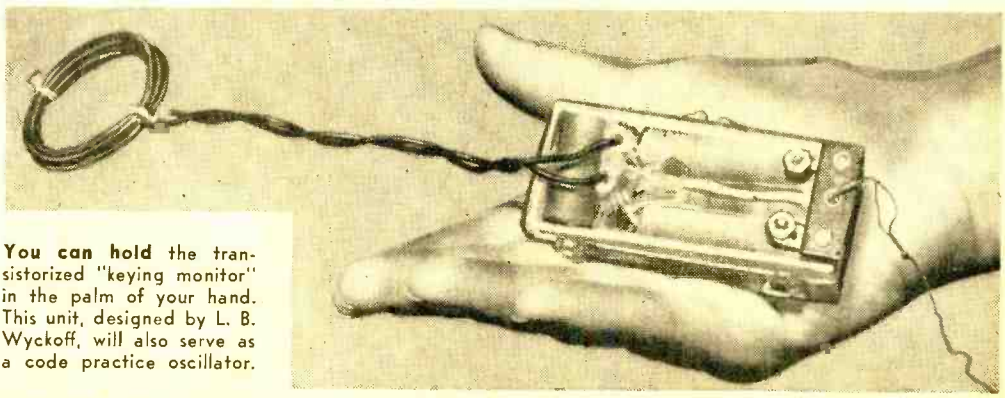
There were relatively few miniature components available in those days, and it was not unusual for an enthusiastic experimenter to assemble a two-transistor "pocket" radio which could barely be squeezed into an overcoat pocket. Few construction projects required more than two transistors . . . the vast majority used only one!

But, as the expression goes, "time marches on" . . . and things change. Today, relatively few transistors sell for more than $5.00, and two popular experimenter types sell for less than one buck! Raytheon's famous CK722 and G.E.'s popular 2N107 both *net* for only 99 cents. And there are a couple of r.f. transistors available for less than $2.00 . . . Raytheon's CK768, a *p-n-p* unit selling for $1.50, and G.E.'s *n-p-n* 2N170 which nets for $1.45. At these prices, most experimenters don't hesitate to tackle four to six transistor projects at a time.

Looking to the future, your columnist fully expects to see the day when transistors sell for appreciably less than that other amplifying device . . . *you know what!*

Reader's Circuit. The old mail box informs us that radio receiver projects are by far the most popular with home builders and experimenters. Because of this, we have featured simple receiver circuits for the past few months. But we know there are many transistor experimenters who are interested in other applications . . . . audio circuits, ham work, test gear, etc. So this month we are departing from usual custom and including a circuit for a "transistorized keying monitor"—a gadget every ham and c.w. operator should find interesting.

Basically, a keying monitor is intended to permit a radiotelegraph operator to hear

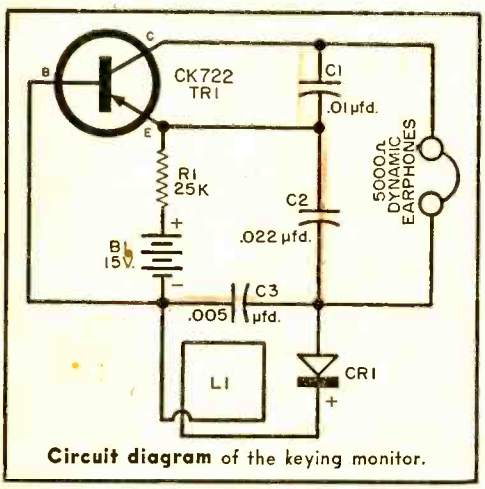


You can hold the transistorized "keying monitor" in the palm of your hand. This unit, designed by L. B. Wyckoff, will also serve as a code practice oscillator.

himself "on the air." Hearing his own transmissions enables the operator to send cleaner, better code, and this, in turn, helps the fellow at the other end who has to copy the signals. L. B. Wyckoff submitted the circuit shown, and assembled the model illustrated.

Referring to the schematic diagram, a single CK722 *p-n-p* transistor is connected in a modified "Colpitts-type" audio oscillator. Frequency of operation is established by a tuned circuit made up of the earphone's inductance and capacitors *C1* and *C2*, in series. The ratio of these two capacitors determines the amount of feedback supplied to initiate and sustain oscillation. Operating power is supplied partially by a small penlite cell and partially by rectified r.f. energy, picked up by loop *L1*, rectified by the crystal diode, and filtered by *C3*. According to Wyckoff, the battery's current drain is so small that its useful operating life approximates its normal shelf life; hence no "on-off" switch is needed.

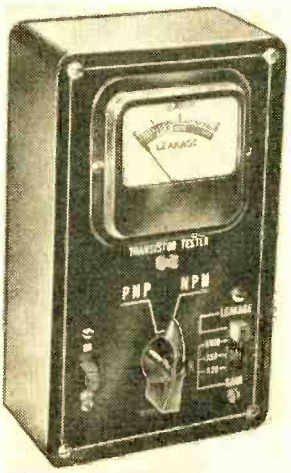
Construction is simple and straightforward, with neither layout nor lead dress critical. Wyckoff assembled the model pictured in a plastic box measuring 2½" x 1" x ¾". Capacitors *C1, C2* and *C3* may be either paper or ceramic units; *R1* is a half-watt carbon resistor; almost any crystal diode may be used . . . the CK705 or 1N34A will probably be the choice of most builders. The pickup coil, *L1*, consists of approximately five turns of hookup wire, wound in a 2"-diameter loop and secured with string or lacing twine . . . you can use Scotch tape for this job if you wish. A high-impedance (5000-ohm) *dynamic* earphone should be used . . . crystal earphones will *not* work in this circuit.



Circuit diagram of the keying monitor.

The completed gadget may be used as either a *code practice oscillator* or a *keying monitor*. To use it as an oscillator, replace *L1* with another penlite cell, connected in series with your hand key, and with the negative terminal on the "diode" side. To use it as a monitor, place the pickup coil, *L1*, near the tank coil of your transmitter. Exact placement is not too critical, but will vary with the size of your rig. With low- and medium-powered rigs, the pickup coil may have to be within a few inches of the "tank" . . . with higher power rigs, it may be placed several inches—or even a foot or more—away.

Tickler File. Again, we "tickle" your memories about items mentioned in previous columns . . . items we feel to be of special interest to you:



Lafayette's new transistor checker available in kit form.

(1) Sylvania's new transistor kit (six transistors and a crystal diode) can be obtained from your regular distributor.

(2) Lafayette's new *transistor checker* kit . . . write to Lafayette Radio, 100 Sixth Ave., New York 13, N. Y., for price data and specifications.

(3) G.E.'s new *tetrode* transistor . . . there is no price data yet, but units will be available for *operation up to 120 megacycles!*

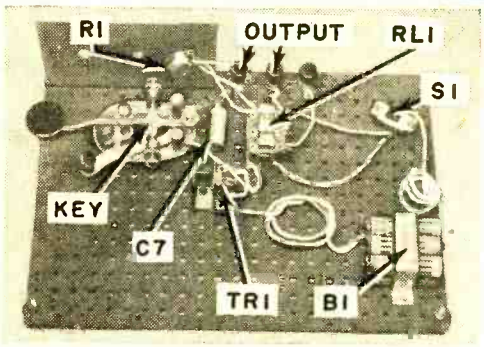
Hot News! We always devote space to tips about new products, but this month we have some news which we feel deserves special mention . . . *CBS-Hytron* has announced two new *power* transistors, designed and priced especially for experimenters. These two units, capable of outputs in the watts, should be available from your local distributor before too long. Type numbers are 2N256 and 2N257, for the 15-volt and 30-volt units, respectively. Selling price will be around $2.50 to $3.50, according to present plans. At these prices, the 2N256 and 2N257 will sell *for less than half* as much as other "high power" transistors, representing a major price break.

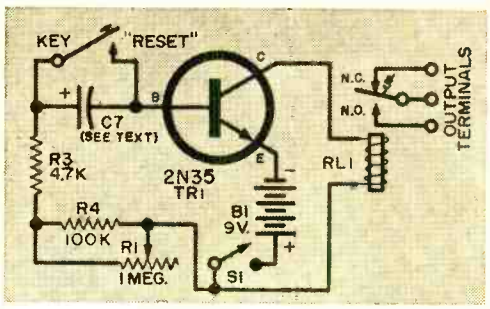
Product News. In addition to the "red hot" news tip mentioned above, we have quite a few items from other manufacturers and suppliers.

(*Continued on page* 118)

Transtopic Experiment No. 12

Electronic Timer





THIS is another experiment in the series that started in the March, 1956 issue. The last experiment, No. 11, appeared on page 63 of the October issue.

Wiring hints and parts lists were included in the March issue. Further information on the components and chassis may also be found in that issue. This is Project No. 12 and concerns the construction of a simple electronic timer.

When the timer is assembled according to the circuit shown in the wiring schematic, it may be used for a variety of applications. If you're a photographic fan, you can control your enlarger or printing box with it. In chemistry, it might be used to control a small heater or an electric stirrer. The only precautions you need observe in assembling the unit are to double-check the polarities of the battery and electrolytic capacitor, *C7*, and to make sure a good-quality electrolytic capacitor is employed.

With the wiring completed, the relay should pull in and should hold in for a short period of time, finally dropping out. Afterwards, closing the "RESET" switch (hand key) and releasing it should cause the relay to pull in again, and to hold in for a period of time determined by the setting of *R1*, again finally dropping out. The relay's "OUTPUT TERMINALS" are used as a simple switch to control the circuit being timed.

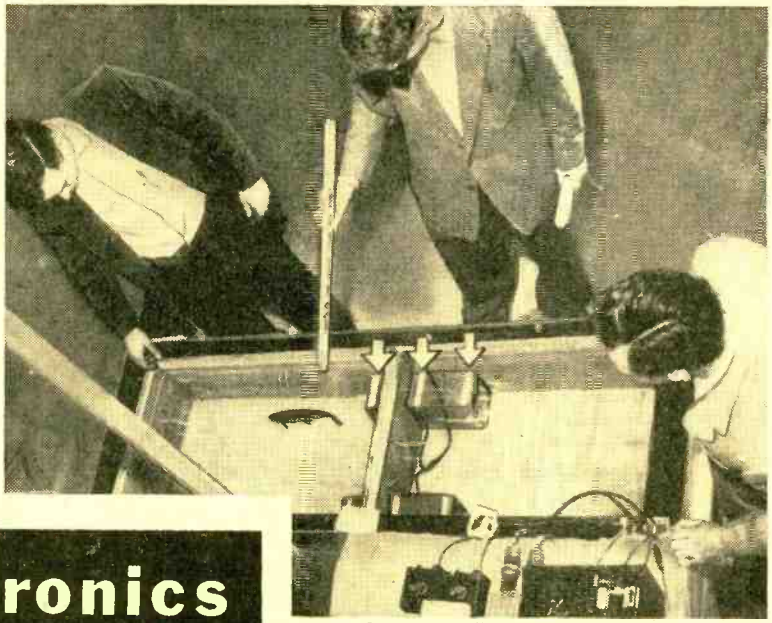
Timing range depends on the adjustment of the relay, the setting of *R1*, and on the size of capacitor *C7*. A 25-μfd. capacitor provides a range of from approximately 1 to 3 seconds to a maximum of from 5 to 12 seconds. If this capacitor is a 100-μfd. unit, the minimum will be 5-8 seconds, the maximum 25-45 seconds.

When the power switch *S1* is first closed, there is a rush of current through the *R1-R4* parallel combination, through *R3* and through the base-emitter circuit of *TR1*, charging *C7*. This flow of base-emitter current closes *RL1*. The relay then holds closed as long as sufficient collector current flows.

As *C7* is charged, the current flow in this circuit gradually drops. Since collector current also drops, *RL1* drops out. The time required to charge *C7* depends on the *RC* time constant of the circuit. Closing the "RESET" switch discharges the capacitor, permitting the timing cycle to be repeated.

For a given transistor, and assuming *C7* to be fixed, the minimum timing period is determined by *R3*, whose value is chosen to keep the base-emitter current within a safe value as *C7* is shorted by the "RESET" switch. The maximum timing period is determined by the total resistance in the circuit.

—Louis E. Garner, Jr.

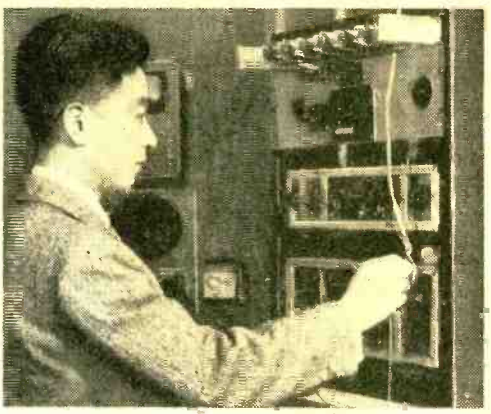


Number of fish, size, and direction of travel are determined by electronic counter. In display model (right), trout in tank has just passed through tunnel, has been detected. The detector circuit can operate a camera which will photograph fish so as to identify species. Below, right, a technician tests the firing mechanism of the counter.

Above photo, "The Oregonian," by Rollie Dobson
All others, Fish and Wildlife Service

Electronics on the Fishways

By MARGARET MAGNA



ELECTRIC FENCES protect spawning salmon from Kodiak bears! Fish take their own pictures by means of electronic counters! Sonic trackers chart reactions to various types of fishways! Electrical weirs jolt life out of sea lampreys! And underwater telemeters indicate net depths for "mid-water" trawling!

All of these devices—and many others—are being utilized by the Fish and Wildlife Service, U. S. Department of the Interior, in fishery research and management. Electrical screens protect fish at power-plant intakes. Shockers temporarily "knock them out" to determine population figures. Fish are spotted for harvesting with special finders developed by electronic specialists. With the help of underwater TV, biologists determine methods of saving small fish from destruction. In other words, electronics is playing an increasingly active role on the fishways—the watery roads on which fish travel.

Fish Count Themselves. Created by the Fish and Wildlife Service, the electronic counter is fully automatic. It counts the fish and indicates their size and direction of travel. Through the medium of an underwater camera, it can also identify the species; in effect, enabling the fish to photograph themselves.

The basic element of the counter is a detector which, utilizing the difference in conductivity between fish and water, passes a signal when a fish is between its electrodes. This signal may be used to trip an electric tally, flash a light, ring a bell, etc. Arrangement of the electrodes in tunnels determines the minimum size of fish that can be counted.

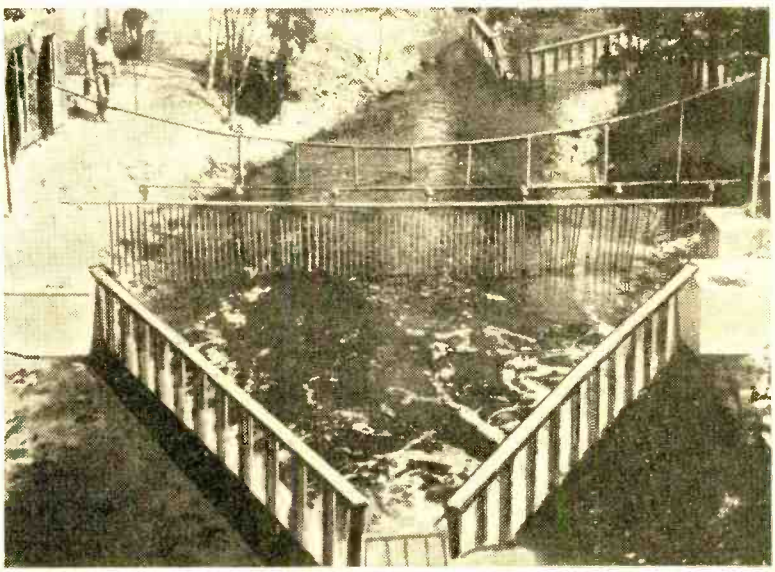
Signals from two detectors can be used to actuate a logic device, which indicates the number of completed upstream and downstream passages on separate dials. It rejects all passages that are incomplete. The output of the logic device will also

operate automatic devices when a predetermined number of fish has passed, such as gates at hatchery holding ponds, thus preventing overcrowding.

Tunnels can be made of transparent, opaque or pigmented materials. Or detectors may be used with troughs, weirs, posts in stream beds, etc., if tunnels are not desirable. The system will work at any depth and in murky water, where visual observation is impossible.

At present, the chief value of the electronic fish counter is in testing effectiveness of the fishways and registering the number of salmon heading for spawning grounds. Continuance of a salmon fishery depends to a great extent upon whether or not a sufficient number of adult fish reach the spawning areas. A fish counting laboratory is now in operation at Ballard Locks, near Seattle, Wash., and indications are that this device, when fully developed, will be used in many parts of the country where fish runs are important.

Underwater TV housing being mounted on sled (above) prior to use at Coral Gables, Fla. The camera within the housing scrutinizes fishing gear while it is in operation.



Electrical weir at Carp Creek, Mich. (left) is located between two mechanical weirs used in checking the effectiveness of this barrier. Lampreys, which prey on smaller fish, are killed by its charged electrodes as they attempt to pass through on their way to spawning grounds.

Sonic Tracker. A capsule about two-and-a-half inches long and less than one inch in diameter, the sonic tracker is fastened to the back of a salmon just to the rear of the dorsal fin. It contains a 15-volt battery and small transmitting apparatus capable of sending signals for 10 to 100 hours. This "tattle-tale" electronic device will flash every twist and turn of the fish to a recording instrument on land or in a boat.

Under ideal conditions, the signals from the tracker may be detected as far away as 2000 feet. A fish carrying the capsule can be tracked and its position pinpointed for about 800 feet in clear, still water, and for about 100 feet in rough, turbulent streams. Movements of as many as ten fish can be traced simultaneously using transmitters with different frequencies.

Initial studies of the sonic tracker—one of the newest of the electronic devices—are being made at Bonneville Dam on the Columbia River. By investigating the passage of salmon through several types of fishways, technicians hope to be able to determine the most effective fish ladder design. Although the tracker is being applied particularly to salmon studies, it can be used on other species as well.

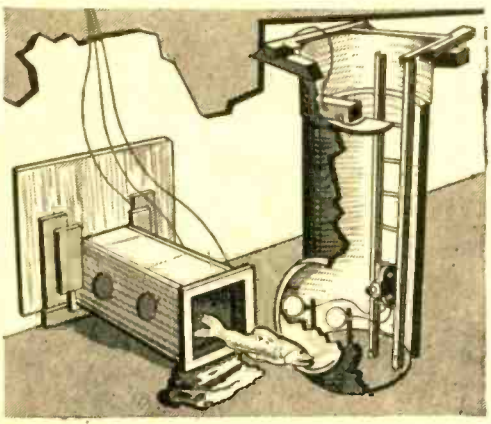
Telemetering and TV. The underwater telemeter will indicate the exact distance of a trawl or net below the surface of the water. As a means of discovering the fishery values of the mid-water ocean area, it is expected to increase the efficiency of commercial fishing considerably. Compar-

Fish are shocked into temporary unconsciousness by biologists in West Gallatin River, Montana. The men at left and right hold insulated handles to probes that pass shocking current through stream.

atively little mid-water fishing has been done by American fishermen, who have heretofore concentrated on surface and bottom fishing.

Underwater television tells the Fish and Wildlife Service more about fish in their regular habitat and more about what can be done to make fishing gear efficient and effective. The Service has two such units: one at the Gear Research Laboratory at Coral Gables, Florida, where a camera scrutinizes gear while it is actually in operation; the other at the Fishery Laboratory at Woods Hole, Mass.

At Woods Hole, biologists are more concerned with the effect of fishing gear on fish which are too small for market, rather than with efficiency of commercial gear. Looking for methods of saving such fish from destruction, they are studying the sizes of fish which can escape through the trawl meshes, and the manner of escape, as well as behavior within the net. These biologists are also making various studies of the ocean bottom and the small marine animals which inhabit the bottom and serve as fish food.



Pictorial drawing shows the photographic fish counting setup at Ballard Locks, Seattle, Wash.

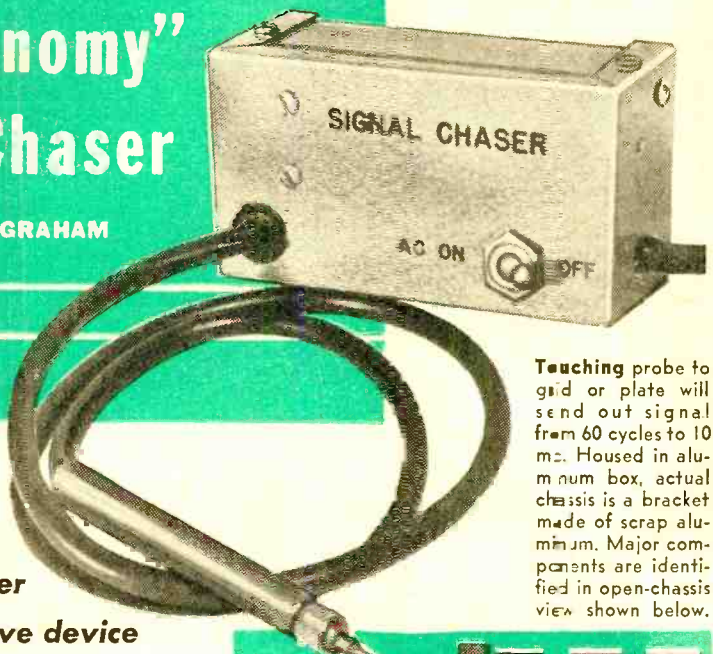
Electrical Weirs. Since the power turbine and some of the big irrigation diversions offer a major threat to young fish, considerable research is being done on mechanical and electrical methods of meeting this problem. Numerous screening techniques have been tried. In small experimental streams, such devices have been about 95% successful in guiding the fish into the desired places. Testing is now being done on large streams. Two methods have been used, one based on the fact that fish are attracted to the positive pole, the other based on the principle of repulsion by an electrical field.

The sea lamprey weir is an electrical barrier placed across a stream used by the lamprey for spawning. Its charged electrodes kill any sea lampreys attempting to pass through. Such weirs are installed in tributary streams of the Great Lakes. The sea lamprey, which entered the upper Great Lakes about 20 years ago, destroyed the lake trout fishery of Lake Michigan and Lake Huron, and has now appeared in Lake Superior. Its control is a major objective of the Fish and Wildlife Service at the present time.

For about three years, the electric fence has successfully kept the big Kodiak bears away from critical sections of salmon streams. The electric shocker, which has also been utilized for some time in making fish population studies, is now effective in soft water, thereby extending the range of its usefulness. By and large, it might be said that the role of electronics on the fishways is to protect fish from harm until such time as they become useful to man, at which point it abdicates in favor of the electric stove. —30—

The "Economy" Signal Chaser

By RICHARD GRAHAM



Touching probe to grid or plate will send out signal from 60 cycles to 10 mc. Housed in aluminum box, actual chassis is a bracket made of scrap aluminum. Major components are identified in open-chassis view shown below.

Track down trouble in your receiver or amplifier with this inexpensive device

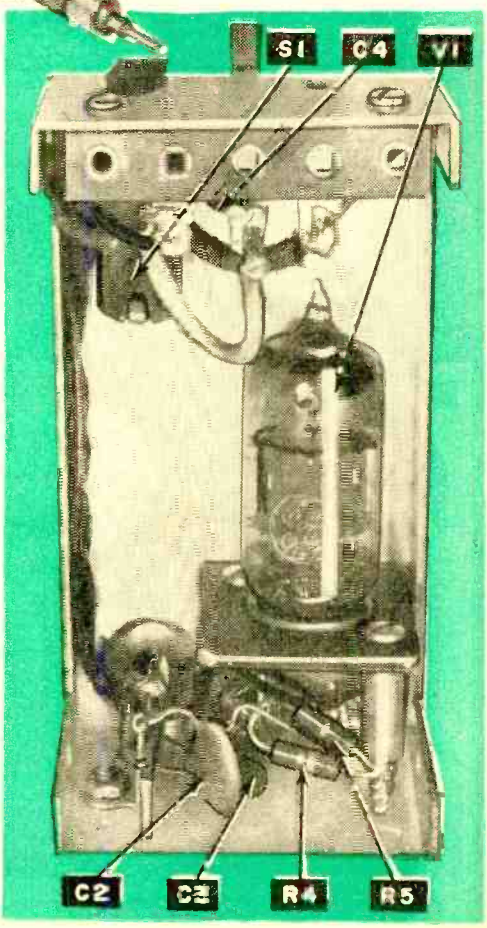
HOW TO DIAGNOSE a receiver failure is a problem that is practically as old as radio itself. Yet to the novice in the radio game, the problem is as acute as ever, for it often means many hours of head-scratching and experimenting before the trouble is found. For some, this state of affairs is due to the lack of proper test equipment to help point the way.

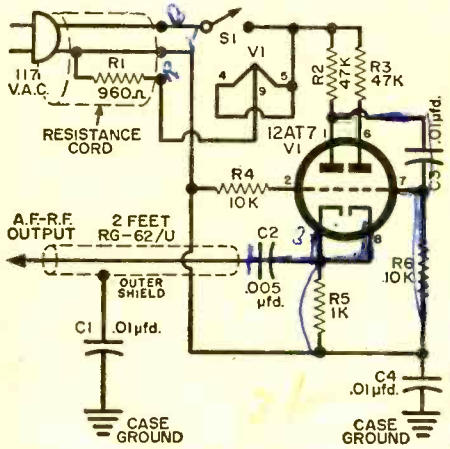
Somehow, the term "test equipment" conjures up visions of an elaborate test-bench loaded with scopes, meters, signal generators, etc. All of these items are valuable aids to successful servicing although basically they can do no more than the simple device described in this article to help you find what happened to the signal.

The device is called a "Signal Chaser" because it sends out a modulated signal over the entire audio and radio spectrum from 60 cycles to over 10 megacycles. It can be used for tracking down component and stage failures in audio amplifiers, preamplifiers, and speakers, as well as in any r.f. or i.f. stage of a radio receiver.

Simple to construct, the Signal Chaser uses only one tube, requires no d.c. power supply, and does not need alignment or adjustment to be put into operation. It is housed in a 2" x 4" x 1½" aluminum box.

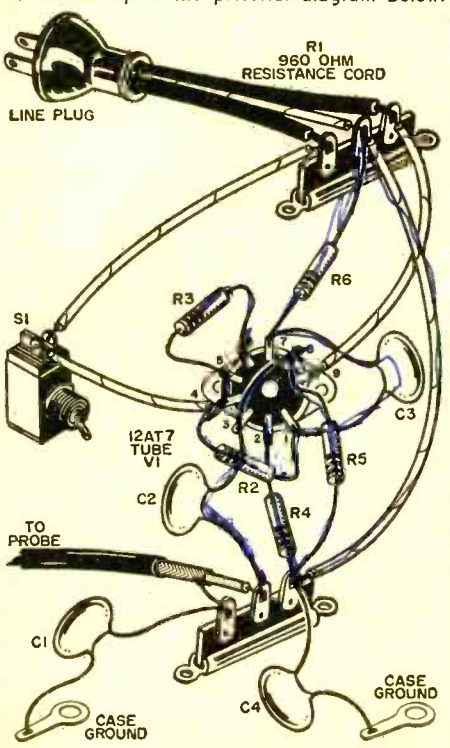
The actual chassis is a bracket formed from a 2" x 1¼" piece of scrap aluminum. A ½-inch lip is bent up on the two-inch





C1, C3, C4—0.01-μfd., 600-volt disc ceramic capacitor
C2—0.005-μfd., 600-volt disc ceramic capacitor
R1—960-ohm resistance line cord
R2, R3—47,000-ohm, ½-watt resistor
R4, R6—10,000-ohm, ½-watt resistor
R5—1000-ohm, ½-watt resistor
S1—S.p.s.t. toggle switch
V1—12AT7 tube

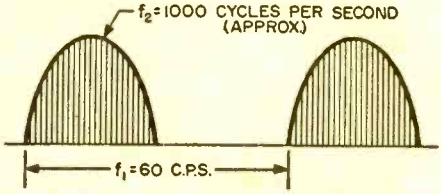
Diagrams and parts list for the "Economy" Signal Chaser. It is important that the output leads of the resistance line cord, which provides the filament voltage, be connected as shown in the schematic diagram above so that the filament will light and the tube will not burn out. You can see how the various parts are hooked up in the pictorial diagram below.



HOW IT WORKS

This circuit is basically a free-running cathode-coupled multivibrator with 60-cycle a.c. voltage applied to the plates. The multivibrator will operate only when the plate supply is positive with respect to the cathode. Frequency of the multivibrator is approximately 1000 cycles; however, it can be varied by the amplitude of the applied a.c. plate voltage (reduce or increase values of *R2* and *R3*).

Multivibrator output is interrupted at the power line frequency of 60 times per second. The resultant waveform has fundamental frequencies of 60 and 1000 cycles, both of which are extremely rich in harmonics. The 60-cycle modulation of the 1000-



cycle fundamental results in a signal every 60 cycles from 60 cycles to over 10 megacycles.

The output is taken from the common cathodes of the twin triode. Coupling and/or a.c. isolation are provided by capacitors *C1, C3,* and *C4*. A good grade of coaxial cable is necessary since the capacity of the cable will determine the output at the higher radio frequencies.

dimension. The 9-pin socket and two small stand-off insulators are mounted on this chassis, which can be assembled and wired before it is mounted permanently in the aluminum box.

Output from the Signal Chaser is fed through a capacitor (*C2*) and a 2′ length of RG-62/U coaxial cable. If RG-62/U cable is not available, the second-best choice is RG-59/U. The cable ends in a standard meter test probe. Only the inner conductor of the coaxial cable is connected to the probe test point. The outer braid shield should extend down the probe handle to within approximately one-half inch of the tip. Details of the probe construction are clearly illustrated at the top of the following page.

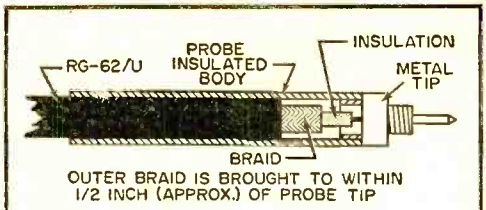
In the interest of simplicity, the Signal Chaser is operated directly from the 117-volt a.c. power line. Therefore, it is necessary to isolate the output coaxial cable lead and the aluminum case of the Signal Chaser from the power line. This precaution must be taken to eliminate a dangerous shock hazard, particularly if the Signal Chaser is to be used to service a.c./d.c. sets where the chassis is commonly connected to one side of the power line. For this reason, the coaxial shield is connected to the case through 0.01-μfd. capacitor *C3*, and one side of the line is connected to the case through capacitor *C4*.

A resistance line cord is used to provide the filament voltage for the 12AT7. This type of line cord has three output leads on

the end. Make sure that the wires are connected as shown in the diagram. Otherwise, either the filament won't light or the tube will be burned out. An ohmmeter will help sort these wires if they are not coded clearly.

The basic procedure when using the Signal Chaser is to follow the signal path through the receiver in reverse. For example, in the typical receiver, the Signal Chaser probe can be placed on the grid of the audio output stage. If all is functioning correctly, a loud buzzing sound will be heard from the speaker. The probe can be placed on the plate and then the grid of the first audio stage in the receiver. If the loud buzzing sound is heard, all is well, and the probe can be placed on the grids, plates, and diode of the preceding detector, i.f., and r.f. stages.

Continue this procedure until the point is found where the loud buzzing sound cannot be heard. This, then, is the point at which the signal path is broken. A closer visual inspection and perhaps a few measurements with a voltmeter will most likely enable you to locate the specific difficulty.

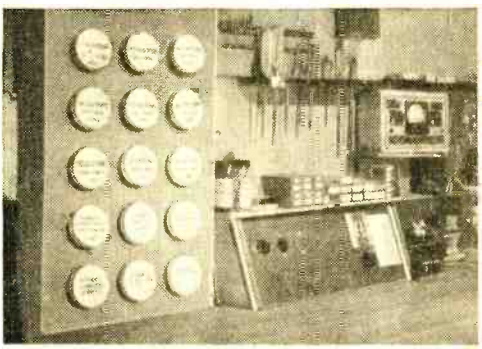


Construction details of the standard meter test probe. Only the inner conductor of the coaxial cable is connected to the test point.

This method of servicing radio and audio equipment is known as the signal substitution method and is described in detail in many books on radio-TV servicing techniques. —30—

Storing Small Components in the Workshop

STORING of parts and accessories is a major problem in the home workshop. Most electronic parts are small and delicate, requiring separation and protection from breakage. Small glass jars are readily available, and are ideal for storage purposes—but how and where should you store them? Illustrated here is one of the most satisfactory methods yet developed.



Construction is self-explanatory, and the dimensions are tailored to suit the number and size of jars to be used. The holes can be cut with a carpenter's expansion bit and should be just large enough to let the jar slope slightly backwards when inserted. The jars are supported at the back of the board by strips cut to size from ½" x 1" molding, available in all lumber yards for a few cents a foot.

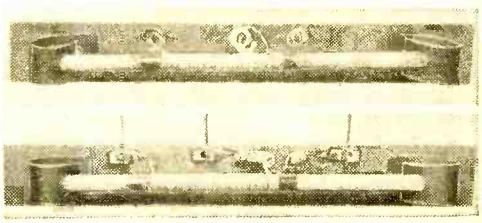
An additional bonus afforded by this system is that the contents of each jar can be printed directly on the cover for easy identification. —*Robert B. Kuehn*

Handy Connections for Ferrite-Rod Loop Antennas

WHEN EXPERIMENTING with ferrite-rod transistor loop antennas, such as the Miller #2000 shown in the photo, it isn't very hard to break off the pigtail leads. Experimenters can avoid this danger by mounting three small Fahnestock clips on the insulating strip base, and soldering the pigtail leads directly to the small lugs on the clips.

Drill three 1/16"-diameter holes in the strip at the approximate positions shown in the photo, and mount three #15 Fahnestock clips using 1/16"-diameter round-head machine screws ¼" long with hexagon nuts to fit. After mounting the clips, snip off the excess ends on the screws so they won't interfere with the levers on the clips. Do not snip off the excess wire on the pigtail leads, but coil them up and then solder the tinned ends into the eyes of the small lugs on the clips.

Now you can experiment to your heart's content without danger of breaking off the wire leads. —*Art Trauffer*

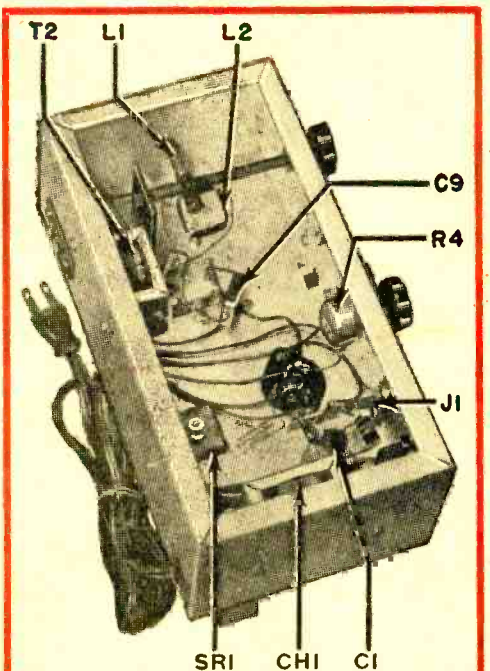


Long-Wave DX'er a Single-Tube Receiver

AN OFTEN UNTAPPED source of radio signals for code practice lies in what is known as the long-wave region above the broadcast band. This is a sort of "never-never land" where few experimenters ever tune. Perhaps it is because this area has no voice signals but instead is populated only with c.w. and m.c.w. signals that it has so little interest for the average person—but it's a gold mine for anyone who wants to learn the code.*

Receivers for use in this part of the radio spectrum are not too easy to find. Most, if not all, of those available in surplus are quite big, heavy contraptions with power requirements other than 117-volt, 60-cycle, a.c. If you're interested in tuning here, you are better off building your own converter or receiver. Elaborate, expensive equipment isn't at all essential, especially for code-practice purposes. Many long-wave stations use very high power, so even a simple, one-tube receiver—such as the "Long-Wave DX'er"—can do a good job.

Construction. Looking at the front-view photo of the receiver, the knob to the left of the tuning dial is the regeneration control. The one on the right varies *R4*, the volume control potentiometer. To the right of the volume control is the phone jack, *J1*, and to the right again, the power "on-off" switch *S1*. The tuning dial is of the vernier type for easy tuning. It is mounted on a small strip of sheet aluminum.



Under-chassis view of "Long-Wave DX'er" indicates placement of its major components.

The heart of any receiver is its "front end." In this particular receiver, it narrows down to the tuning capacitor gang, *C4/C5*, and its coil, *L1*. A large maximum capacitance is necessary and is obtained by paralleling the two sections of a dual 420-$\mu\mu$fd. variable capacitor.

Several different coils were tried at *L1*, but none were as sensitive as the Miller X-121-A specified in the parts list. Although this particular coil requires a fair amount of modification (as described below) before it can be used in the circuit, such modification is not difficult. The coil, as purchased, is enclosed in a $\frac{3}{4}$" x $\frac{3}{4}$" x 2" shield can. Since the can will not be used, it should be removed.

First, lift up the two little metal tabs on the underside of the shield. Straighten them up until they are flush with the sides of the can. Then, using a tiny screwdriver, pry out the little Bakelite terminal board and the coil. Do this carefully. Lift a little on one side, then another—working around the four sides of the Bakelite piece until it is free of the shield. The powdered iron core will remain in the can. Directions for removing it will be given shortly.

Study the lead arrangement on the coil. The lead nearest the terminal board is the ground point; slightly above it is a double lead that is the antenna tap. The lead furthest from the terminal board is the grid end of the coil. When you can recognize where these leads are to be connected just by looking at the coil, carefully unsolder the three leads from their solder lugs, drill out the eyelet in the center of the terminal

* A feature article on long-wave DX stations appeared in the October issue on page 51. This article described the stations that can be heard, the frequencies in use, and how DX stations may be verified.

By FRANK H. TOOKER

Want to learn c.w.? The long-wave region above the broadcast band is ideal for code practice, and the sensitive little receiver described in this article is simple to put together.

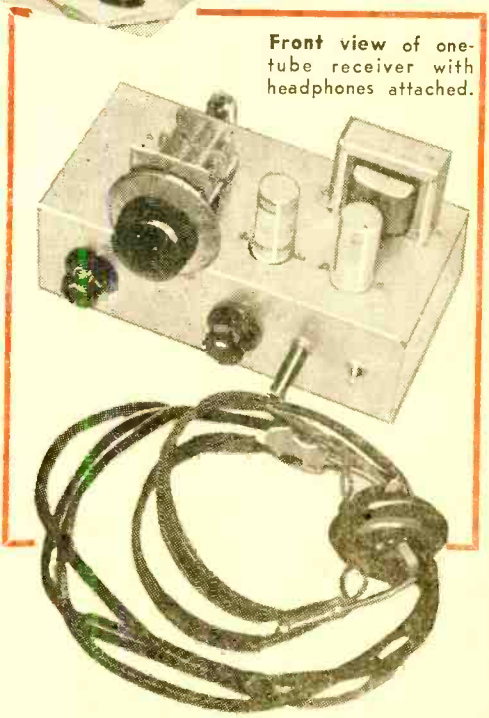
Cover photo by Maynard Frank Wolfe

board, and remove the terminal board and the remains of the eyelet from the coil form. Remove 225 turns from the *grid end* of the coil, and snip off the wire about four inches from the coil form. Solder a 3" length of insulated wire to the antenna tap lead; then solder a 2" length of the same wire to the ground lead. Insulate these soldered connections and anchor them to the coil with small pieces of plastic insulating tape.

The powdered iron core is secured to the top of the shield can with an eyelet and a small nut. Remove the nut and file away the eyelet. Be careful not to damage the threads on the small projecting brass rod in the center, for these will be used with the nut to secure the core and the coil to the side of the chassis in your receiver. When the eyelet is filed away, a light tap on the end of the threaded rod will drop the core out of the can.

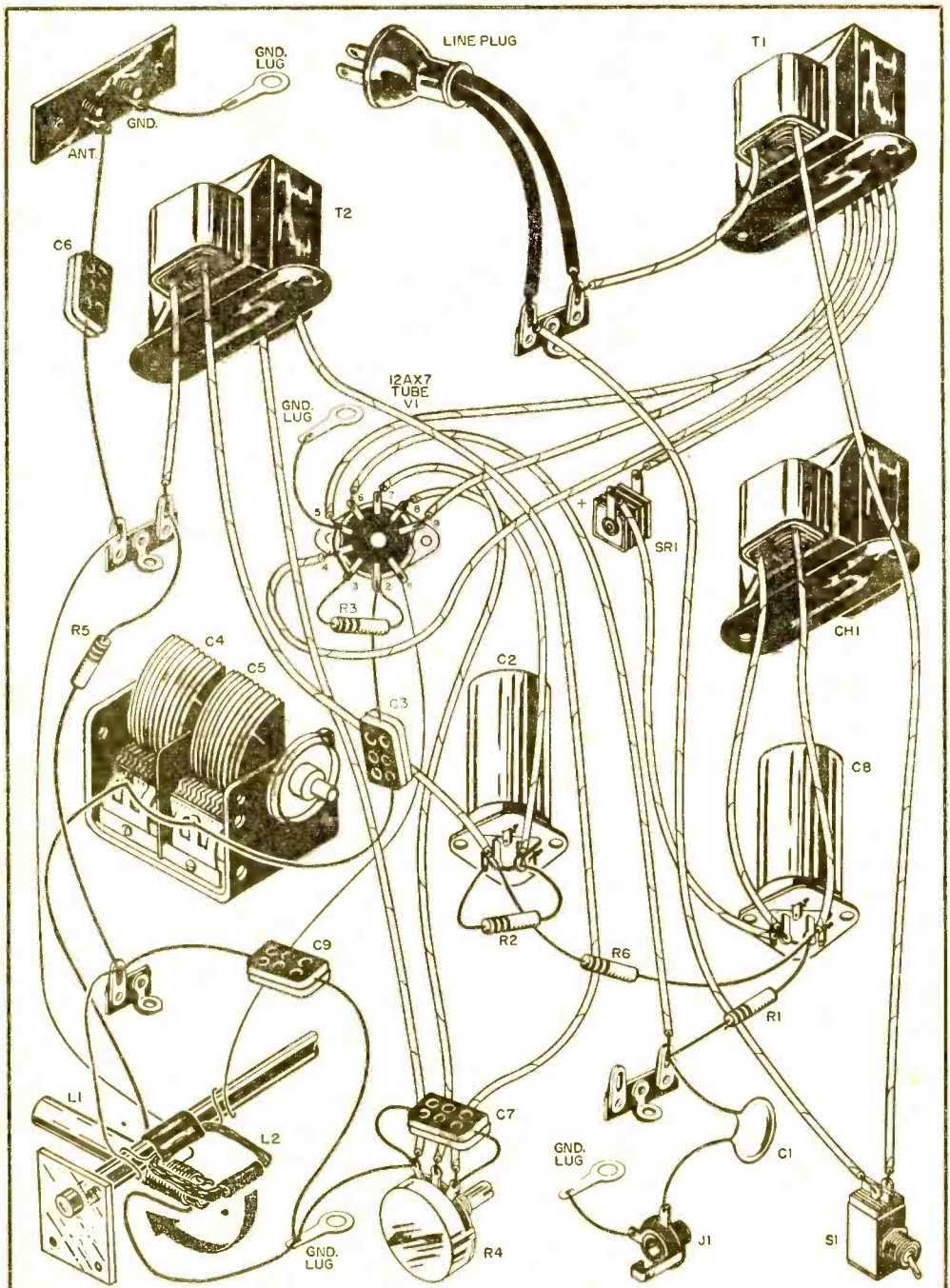
The tickler is a ¾"-square coil. It consists of 25 turns of No. 28 enameled wire, and is made by scramble-winding the wire on the Miller shield can. Wind the coil over as narrow an area as possible. Slip it off the can and wrap the coil snugly with plastic insulating tape.

To make the tickler adjustable in the receiver, it is mounted against the side of a short length of ¼"-diameter fiber rod. Prepare a place for the coil on the rod by filing a small flat on one side of the rod. Note that the tickler is located over the tuning coil. Spacing between the two coils is such that the tuning coil will be centered in the tickler when the latter is swung down over the tuning coil. You don't have to be especially precise about the coupling between the two coils.



Front view of one-tube receiver with headphones attached.

Normal adjustment of the tickler has little, if any, effect on the tuning of the receiver. Mount the tickler coil on the rod by spreading a generous dab of polystyrene



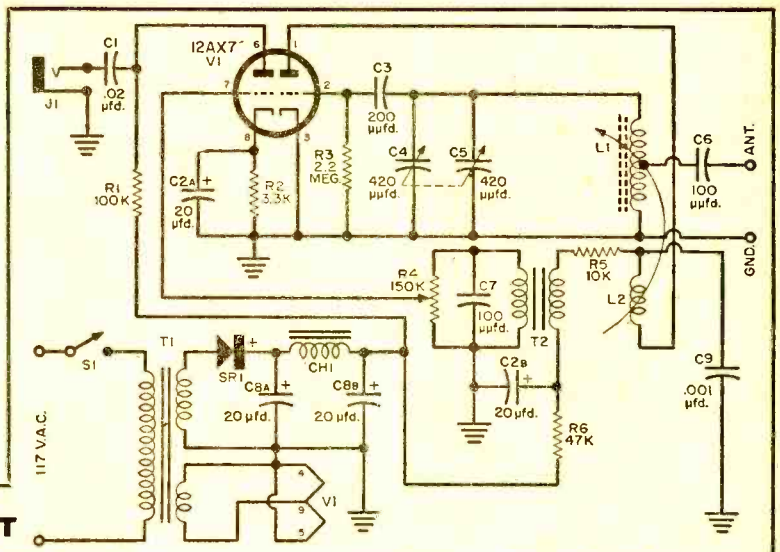
HOW IT WORKS

This is a regenerative receiver with positive feedback in the detector obtained through a plate tickler coil (*L2*). Regeneration is controlled by physically varying the position of the tickler with respect to the tuning coil, *L1*.

One half of a twin-triode tube serves as the detector. The other half operates as a transformer-coupled audio amplifier. Resistor *R5*, capacitors *C2b* and *C9*, as well as the capacitance between the transformer windings and ground, act as filters generally to eliminate "fringe howl."

Antenna coupling capacitor *C6* depends to a certain extent upon the length and height of your antenna. The value shown (100 $\mu\mu$fd.) is about right for a 35′ to 50′ antenna, 20 to 30 feet above ground. Too large a capacitor here will reduce the tuning range and may adversely affect regeneration. The receiver tunes from 100 to 400 kc. and is designed for headphone reception only. It is complete with its own transformer-type power supply.

Wire the "Long-Wave DX'er" as shown in schematic diagram at right. Complete details for modification of coil L1 are given in text. Components should be hooked up as illustrated in pictorial diagram at left.



PARTS LIST

C1—0.02-μfd. ceramic capacitor
C2a/C2b—20/20 μfd., 150-volt, can-type, dual electrolytic capacitor
C3—200-μμfd. mica capacitor
C4, C5—420/420 μμfd. dual variable capacitor
C6, C7—100-μμfd. mica capacitor
C8a/C8b—20/20 μfd., 250-volt, can-type, dual electrolytic capacitor
C9—0.001-μfd. mica capacitor
CH1—8.5-henry, 50-ma. filter choke
J1—Open-circuit phone jack
L1—Tuning coil (Miller Type X-121-A modified) —see text
L2—¾"-square tickler coil, 25 turns of No. 28 enameled wire (see text)
R1—100,000-ohm, ½-watt composition resistor
R2—3300-ohm, ½-watt composition resistor
R3—2.2-megohm, ½-watt composition resistor
R4—150,000-ohm volume control potentiometer
R5—10,000-ohm, ½-watt composition resistor
R6—47,000-ohm, 2-watt composition resistor
S1—S.p.s.t. toggle switch
SR1—65-ma., 130-volt selenium rectifier
T1—Power transformer; 125 volts, ½-wave, at 50 ma.; 6.3 volts at 2 amperes (Stancor PA8421)—a smaller unit may be used here if desired
T2—Single-plate to single-grid audio transformer, 3:1 step-up ratio
V1—Type 12AX7 tube
1—10" x 5" x 3" aluminum chassis

cement or plastic household cement along the flat. Then, hold one side of the coil against the flat and wrap a layer or two of plastic insulating tape snugly around this side of the coil and the rod.

The end of the tickler rod that is inside the chassis is supported by a strip of ⅛"-thick Bakelite. A ¼"-diameter hole is drilled through one end of the strip at the appropriate height to accommodate the rod. The other end of the strip is secured to the underside of the chassis deck by means of a small L-bracket. Sufficient friction to make the rod (and the tickler coil) stay put in any position to which it is adjusted is obtained by passing the knob end of the rod through a ¼"-i.d. rubber grommet.

Make a little spring in each of the two tickler leads by winding a couple of turns around the fiber rod on each side of the coil—and, when the leads are soldered into the circuit, leave enough slack so that the tickler can be rotated through 180°. In normal use of the receiver, the tickler adjustment will not be likely to require more than about 20° of rotation, so there is little danger of the leads fouling or breaking if the aforementioned procedure is followed. Mount the powdered iron core on the inside of the left panel of the chassis and slip the tuning coil, *L1*, over it *with the grid end of the coil toward the left panel of the chassis on which the core is mounted*. The tickler should be nearest the ground end of the tuning coil where it will have the least adverse capacitance coupling effect.

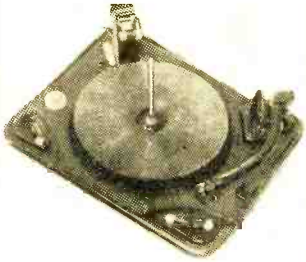
Mount the power transformer, *T1*, in the rear corner and the filter choke, *CH1*, below deck. Filter capacitor *C8* is just in front of the power transformer, while rectifier *SR1* is mounted on a long screw which also holds one end of the transformer.

Orient the tube socket so that the twisted heater leads will not have to cross or come near the detector grid lead. All ground leads in the power supply section go to the can solder lugs on filter capacitor *C8;* this capacitor is mounted on a metal plate. Audio transformer *T2* is located below the tube socket on the rear panel of the chassis; mount this after the socket wiring is completed. A two-terminal strip

(*Continued on page* 112)

what's new in hi-fi

GARRARD SALES CORP.
80 Shore Rd.
Port Washington, N. Y.



Record changer, Model RC-88, is improved version of Garrard RC-80. Unit plays at three speeds automatically or manually, as desired. Motor is 4-pole, shaded induction type. Weighted turntable, 1" high, turns on ball bearings, and is covered with rubber mat. Wow and rumble are said to be negligible. Tone arm, made of aluminum, uses plug-in shell which accepts most pickups. Stylus pressure and pickup height adjustments are provided. Unit is supplied with two spindles; mounting base is extra.

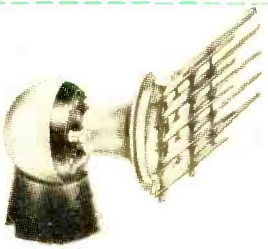
LINTHROP MFG. CO.
433 West Fulton
Grand Rapids, Mich.

Two-way speaker system (8" woofer and 3½" tweeter) is housed in compact attractive enclosure. The "Linthrop" speaker may be used as a reproducer in a modest hi-fi system, as an extension speaker for another room, or as an auxiliary speaker for stereophonic setups or to improve TV sound. Two leads connect unit to any amplifier. Net price, $23.95.

HARMAN-KARDON, INC.
520 Main St.
Westbury, Long Island,
N. Y.

Forty-watt amplifier includes built-in preamp and full audio controls for hi-fi systems. Controls provide for program selection, equalization of tape and records, loudness, treble, bass, rumble filter, speaker damping, and speaker selection. The "Trend II" (Model A-1040) uses four 12AB5 tubes in a high-efficiency, low-power drain circuit. Net price, $125.00.

LAFAYETTE RADIO
100 Sixth Ave.
New York 13, N. Y.

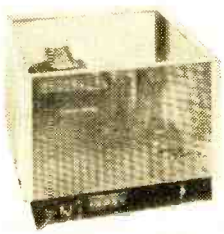


Tweeter (Lafayette "HW-7") features louvered "acoustic lens" for uniform dispersion of highs. Lens is detachable for panel mounting, and a separate base for mounting the tweeter externally is also available. The aluminum voice coil has an impedance of 16 ohms. Power rating is 25 watts. This tweeter is designed to take over at 2000 cycles. Net price, $14.95.

HEATH COMPANY
Benton Harbor 5, Mich.

AM tuner (Heathkit Model BC-1) may be built from kit containing all parts and instructions. Designed for use in hi-fi systems, it provides broad bandwidth with good sensitivity and selectivity. Set features built-in power supply and cathode-follower output, uses five tubes. Net price of $24.50 includes cabinet.

REGENCY DIVISION,
I.D.E.A., INC.
7900 Pendelton Pike
Indianapolis 26, Ind.



Fifty-watt power amplifier, built from Regency HF-50K kit, provides enough reserve power to drive low efficiency, wide-range speaker systems. Response at 50 watts has less than 1% harmonic distortion from 20 to 20,000 cps. Multiple negative feedback circuits assure high damping. Step-by-step instructions are said to permit complete assembly in four hours. Amplifier must be used with audio "front end," or tuner having audio controls. Net, $74.50.

Sound Impressions

IN OUR platter-spinning this month, we came across several new ones that point up the natural affinity of woodwinds for the phonograph. Flute, oboe, clarinet and bassoon emerge from the loudspeaker with such lifelike tinge that the hi-fi listener finds it easy to forget all about his equipment and simply enjoy the music.

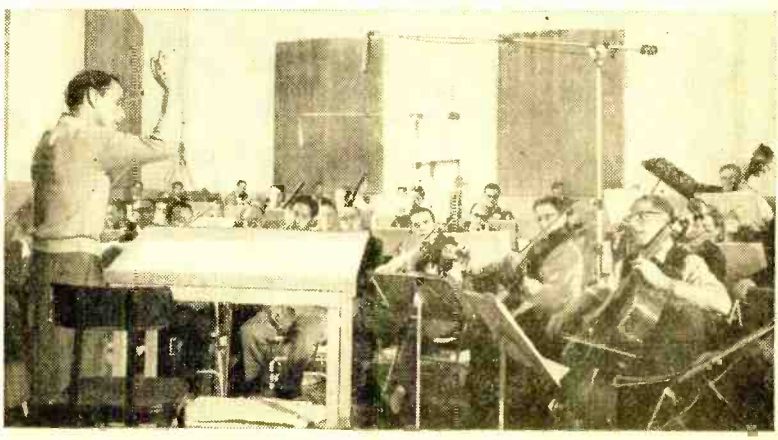
The husky, reedy sound of woodwinds is particularly easy on the foibles of electronic equipment. They sound good on medium-fi as well as on hi-fi because their overtone pattern does not get too badly twisted by a few jags in the frequency response or other minor distortions in amplifier and speaker. Besides, woodwinds don't produce sharp transients (bangs like in piano or percussion) that throw slightly ramshackle rigs into a jangling frenzy on every beat. Even on a less-than-perfect system, stylus, speaker and transformers can comfortably follow the waveforms of woodwind sound without getting rattled. Blended with orchestra, they add tangy spice or smooth sauce to the musical serving.

Unlike many other instruments, woodwinds sound fine even at low volume, which puts less strain on both your output tubes and your neighbors. Despite the absence of sheer decibel power, woodwinds create an amazing palette of tonal colors from acerbic snarls to silk sonorities.

Music in the Winds. The freshest wind to blow out of these woods is stirred up by Alec Wilder on Columbia CL-884. Wilder, one of America's most gifted young composers, reportedly was kicked out of the Eastman School of Music at Rochester for what appears to be an extreme case of irrepressible high spirits, which compelled him to perpetrate all sorts of antics and spoofs. His good-natured practical jokes were always done with grand aplomb and a sense of style. The same mood of sparkling and imaginative fun pervades these woodwind compositions, variously entitled *Her Old Man Was Suspicious, The Neurotic Goldfish*, etc. The humor is pointed, never broad. The style combines an easy sense of aptness with arch mockery matched to musical craftsmanship. Maybe that's why top-notch musicians like Mitch Miller (oboe) and Julius Baker (flute) especially got together for this recording and gave it all they had—which is plenty. Their own evident pleasure in playing these pieces speaks from every groove. Behind the music there seems to be an inaudible chuckle. That's what makes this record something rather special.

Unusual things also happen on the other side. Here stands none other than Frank Sinatra, but this time he isn't singing. He's conducting an orchestra in more Wilder music, and doing a fine job of it. Frank accidentally came across these pieces when the composer and the music were quite unknown. He was so taken by a group of flowing, lyrical numbers for solo woodwinds and strings that he talked Columbia Records into letting him conduct them. The result is a deft blend of impressionism and pops: music to relax you

(*Continued on page* 105)



Frank Sinatra now makes his debut as a "classical" conductor in music by Wilder for solo woodwinds and string orchestra. He interprets this distinctively American music with conviction and finesse.

Robot Helicopter

FLOWN ALOFT by a technician operating a radio-control setup from the ground is the "robot" helicopter above. The ground controller is not a pilot himself; ease of control makes the robot capable of being "flown" by anyone. Inside the helicopter, in addition to the R/C equipment, are facilities for taking still pictures as well as TV pictures and transmitting them to ground observers.

In addition, the robot can lay communications lines, fly a "memory" course fed into a ground control station, and respond to commands transmitted from an airborne control station in a second helicopter. Developed by The Kaman Aircraft Corp., Bloomfield, Conn., the robot is shown in the above photo being demonstrated to U. S. Department of Defense officials at Fort Belvoir, Va.

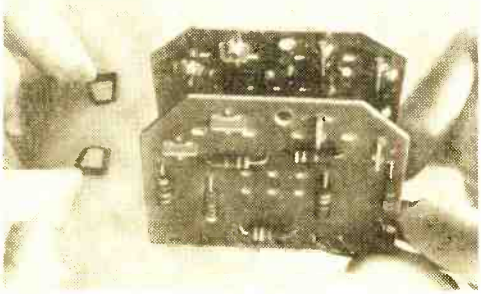
Auto Antenna Replacement

MOTORISTS facing the problem of mischievous people breaking off or pilfering auto radio antenna staffs when a car is not under guard can now solve it in about 60 seconds. The answer is a glistening chrome-plated 3-section replacement auto antenna staff (Model RE-8) which will fit virtually every make of antenna.

The bell-shaped base of the replacement antenna staff merely fits over the old antenna base. A few turns of a special spline wrench, which comes with it, and the new staff is firmly fixed. Model RE-8 is 22" high when it is collapsed; with the three sections extended, the staff stands 56" above the bottom of the base. The unit is made by *Snyder Manufacturing Co.*, Philadelphia, Pa.

Capacitors Use No Leads

A LINE of flat, tapered capacitors, designed specifically for use without leads in printed-circuit wiring boards, has been announced by General Electric's Specialty Electronic Components Department, West Genessee St., Auburn, N. Y. Known as "Wejcaps," the units fit into



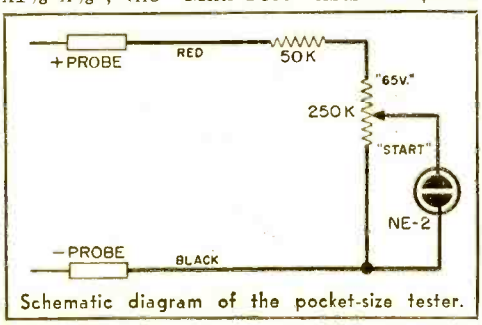
slots in the board and are bonded by dip-soldering. They will be used in TV receiver circuits.

Pocket-Size Tester

UNKNOWN voltages may be measured and circuit continuity checked with the pocket-size test instrument developed by Tele-Matic Industries, Inc., 16 Howard Ave., Brooklyn 21, N. Y. Known as the "Mini-Test," it uses a neon bulb rather than a meter movement for indications. Its range is from 65 to 800 volts.

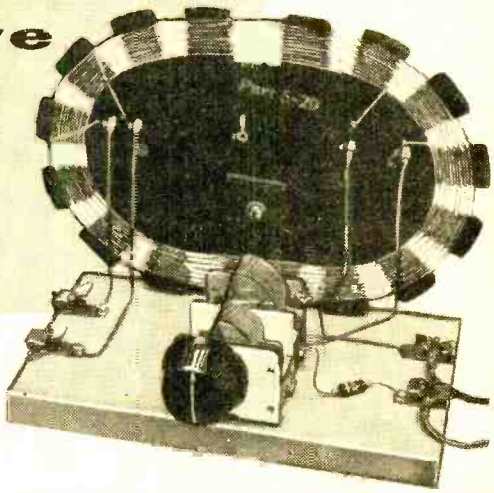
As shown in the diagram below, its action depends on the amount of voltage impressed across the probe terminals. As the knob, controlling the potentiometer, is rotated from "Start" position, more resistance is shunted across the neon bulb until it is impressed with enough (65) volts to glow. The voltage being contacted by the probes may then be read from the knob setting on the outer cover of the "Mini-Test."

To check circuit continuity, an auxiliary lead must be used which—together with one of the probes—is connected to an external voltage source. Measuring 1⅝" x1⅞"x⅝", the "Mini-Test" lists for $2.49.



Schematic diagram of the pocket-size tester.

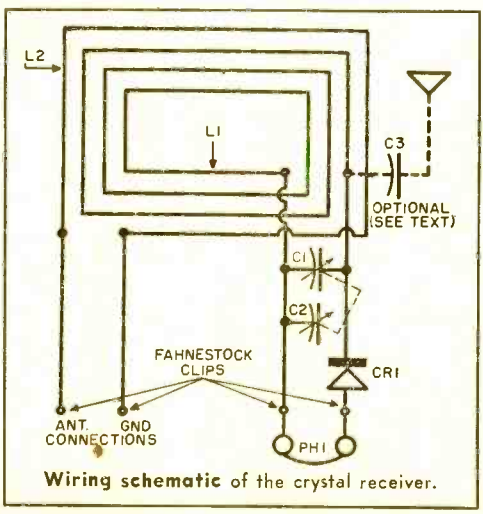
Progressive Crystal Receiver



BEGINNING radio constructors who want to start with a simple crystal receiver would be wise to purchase parts which can be used later on for that inevitable three- or four-tube superhet. For example, if you buy a two-section superhet variable capacitor, you can use the large section for a crystal set and both sections later on for a superhet. Likewise, if you purchase a loop antenna to match the superhet capacitor, you can use the loop as a tuning coil in a crystal set and then use it later on as an antenna for a superhet. You could even use the crystal as a second detector in your superhet.

Almost every radio parts dealer, or radio mail order house, has two-section superhet variable capacitors with matching loop antennas. It would be well to buy a matching oscillator coil at the same time and put it on the shelf for that eventual superhet.

Mount the variable capacitor, loop, and four Fahnestock clips on a wood base 7½" long, 4" wide, and ¾" thick. The loop can be bolted to a 2" x 5" wood upright screw-fastened to the back edge of the wood base. A pair of Fahnestock clips about 1½" apart on the right-hand end of the base are used for the earphones, and another pair on the left end of the base for the antenna and ground connections.



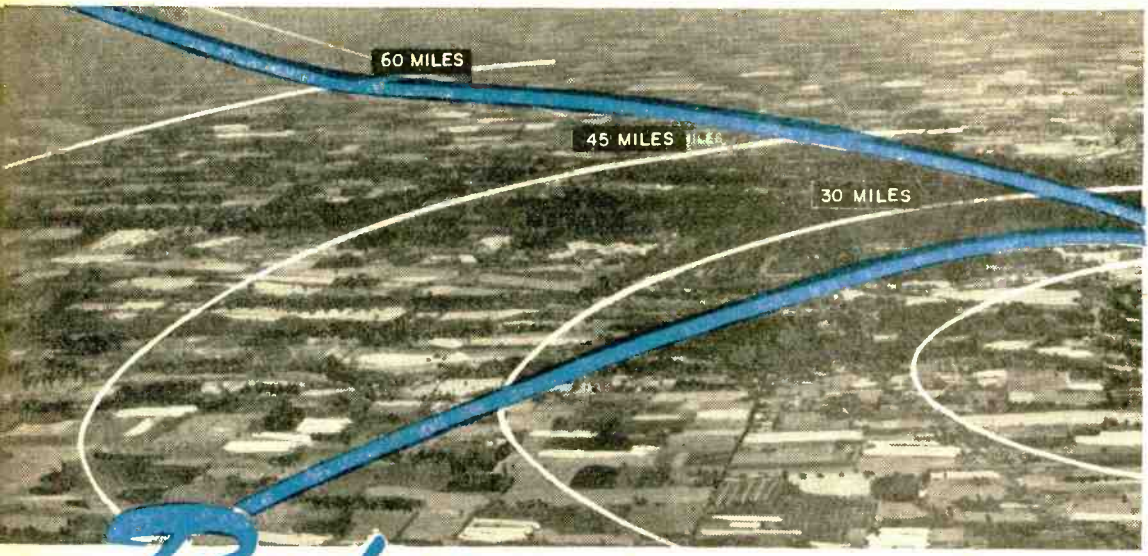
Wiring schematic of the crystal receiver.

The right-hand rear clip is connected directly to the capacitor frame (*rotor*) and from there to the lug on the loop which connects to the inside wire of the large loop winding. One lead of the germanium diode (*crystal detector*) connects to the right-hand front clip, and the other diode lead connects to the stator lug of the large section on the variable capacitor. Now connect the same capacitor lug to the lug on the loop which connects to the outside end of the large loop winding. The two remaining lugs on the loop are for the one-turn external antenna winding; connect these lugs to the remaining two clips on the left-hand end of the base.

If your loop has no external antenna winding, simply wind one turn of hookup wire around the outside of the loop, and fasten wire with cement or coil dope.

With regard to the antenna and ground connections for the crystal set, experiment for best results in your location. In some locations a good antenna is sufficient; in other cases a cold water pipe ground connection will give louder signals. Connecting the antenna directly to the stator lug on the variable capacitor will give strong signals, but poor separation between stations. As shown in the schematic diagram (dotted line), you can connect the antenna to the capacitor stator through a small value of fixed capacitor to improve selectivity. Try several different capacitor values until you find the one that is best for the job.

—Carl Dunant



Radar Tames the Wild Blue Yonder

By SHANE SMITH

THE SKY, once empty and beyond reach, is now a busy thoroughfare. Aviation has shrunk space aloft as well as on the ground. With the planes themselves made safe by today's superb engineering, congestion of the air has become the chief risk of flying.

As the wild, blue yonder grows wilder and more dangerous with fast planes crowding each other for space, the future of flying now depends on electronic aids to air safety.

Volscan, developed jointly by the Cambridge Research Center of the Air Force and the Crosley Corporation, is the latest answer to the urgent problem of air traffic control in the vicinity of busy airports. Combining ordinary radar data, Volscan converts a cloud of randomly arriving aircraft into an orderly, safe procession.

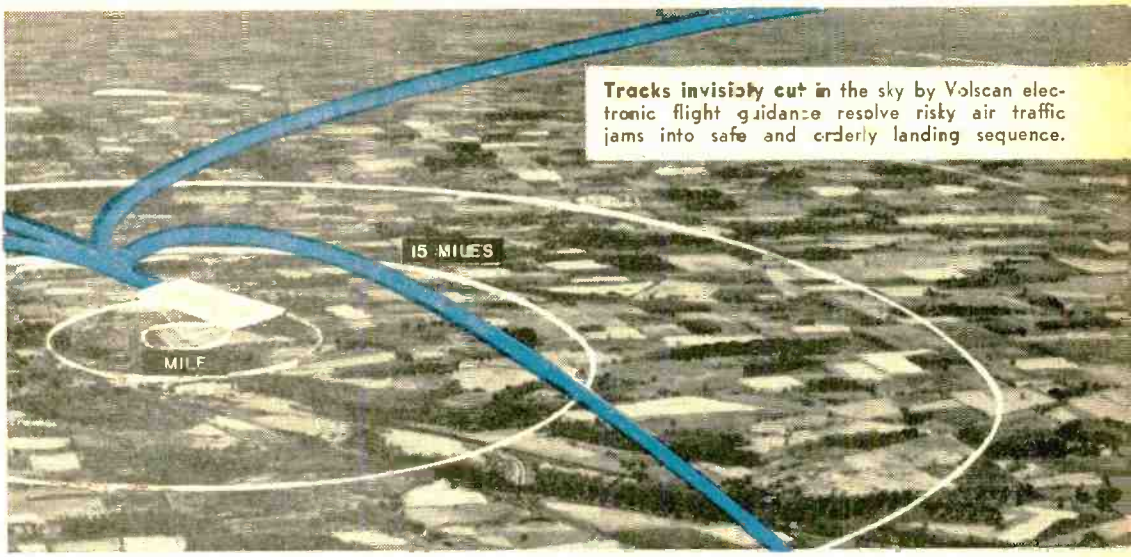
A supersonic jet plane may require as much as 50 miles for its landing approach, with some elbow room at either side. Therefore, an air traffic control system must assign each incoming aircraft a long "block of space" reserved exclusively for its use. Volscan automatically marks this space and follows the aircraft on its assigned path until the Instrument Landing System (ILS) takes over and sets it down on the runway.

Since pilots can't just step on the brake and slow down, the problem is complicated by faster planes overtaking the slower ones. A fast plane coming in later might wind up right on top of a slower plane that had already started its landing approach. Hence, not only the sequence of the incoming aircraft but also their speeds must be taken into account. This adds to the space demand of fast planes and to the score of factors that every minute may tip the balance of life and death at a busy airport.

Volscan keeps all these factors "in mind" at any moment, and automatically parcels out to each plane precisely the air space it needs to keep that fateful balance firmly held down on the safe side. As the airport radar sweeps the sky, each plane in the area appears as a "blip" on the radar screen. The operator marks each newly appearing blip with a light gun, which triggers Volscan's electronic brain into action. The computer then "follows" the plane as the blip moves on the radar screen.

Acting as an electronic traffic manager, the computer has stored within itself the correct answers to every possible landing approach situation that may arise. Since the computer has the answer before the problem actually comes up, it needs only a fraction of a second to pick the correct approach instruction—in effect, to assign a block of space. These instructions are then given to the pilot by radio, or fed directly into the airplane's automatic controls by data-link transmission.

Always on guard against error, Volscan



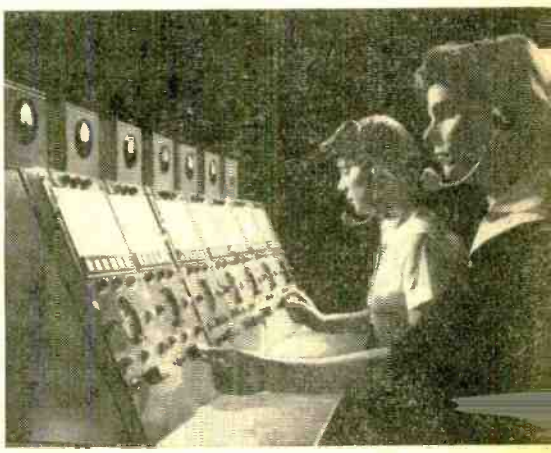
Tracks invisibly cut in the sky by Volscan electronic flight guidance resolve risky air traffic jams into safe and orderly landing sequence.

keeps its unblinking eye on up to 14 planes which it guides simultaneously. If either the human or the automatic pilot takes any plane off the assigned course, the computer immediately compensates for the mistake and issues new instructions for getting the plane back on its track and arrival schedule. It must "touch down" at just the right moment, for the 13 other planes are strung by the computer in a tight but safe landing sequence. The result is maximum use of the available runway facilities, increasing the safe traffic capacity of any airport almost three times.

In this manner, Volscan can handle one landing every 30 seconds, thus reducing the dangerous practice of "stacking" airplanes waiting around an airport for an opportunity to land. Such stacking is discomforting in present-day planes, but for the jets of the not-distant future, it would be disastrous. For jets use almost three times as much fuel at approach altitude as they do at cruising altitude. While awaiting their landing clearance, they might exhaust their fuel reserve.

Volscan and the whole problem of air traffic control point up those ironic twists by which history bedevils human effort. Fifty years ago, when Man first transformed himself into a creature of flight, the main idea was to get him off the ground. Now, in the headlong progress of the air age, he seems to have trouble in getting down again. But electronics offers him a safe ladder for his descent. —30—

Giant overhead radar scope (left) displays total air traffic situation. As newly arriving plane enters the monitored air space, an electronic computer co-ordinates its position and progress with every other plane in the area. Operators at right relay instructions to incoming aircraft in terms of azimuth and elevation.



AFTER CLASS

Special Information on Radio, TV, Radar and Nucleonics

WORKING WITH THERMISTORS

WITH TRANSISTORS enjoying the spotlight in current experimental work, we tend to forget that there is another kind of semiconductor material—the thermistor—which is finding wide acceptance in all kinds of electrical jobs.

Just what is a thermistor?

All electrical conductors show a tendency to change electrical resistance as their temperature varies. Some materials such as the alloy "Invar" do this so slightly that they are said to have virtually zero *temperature coefficient of resistance;* metallic oxides used in today's commercial thermistors change resistance abruptly with relatively small temperature variations.

Modern thermistors have large *negative* temperature coefficients. This means that their electrical resistance *drops* sharply when the temperature *rises*. The extent of the change can be predicted quite closely from the thermistor ratings—as you will see.

Forms of Fabrication. The most common physical shapes in which modern thermistors are fabricated are rods, beads, discs, and washers. Each unit starts life as a pasty black mix of several metallic oxides. Rods, discs, and washers are made by first shaping the mix paste as desired and then firing the forms in temperature-controlled ovens. The "cold" resistance of an individual thermistor is governed by the composition of the original mix and by the time-temperature constants in the sintering process. This control permits a range of 5 to 100,000 ohms at 25° C by means of only two different mixes.

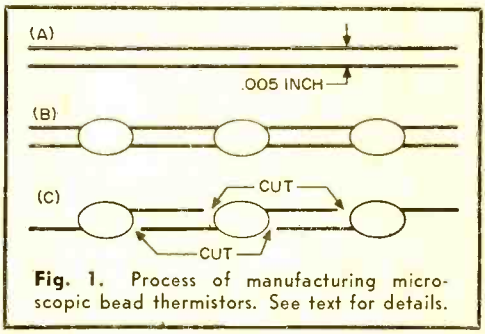
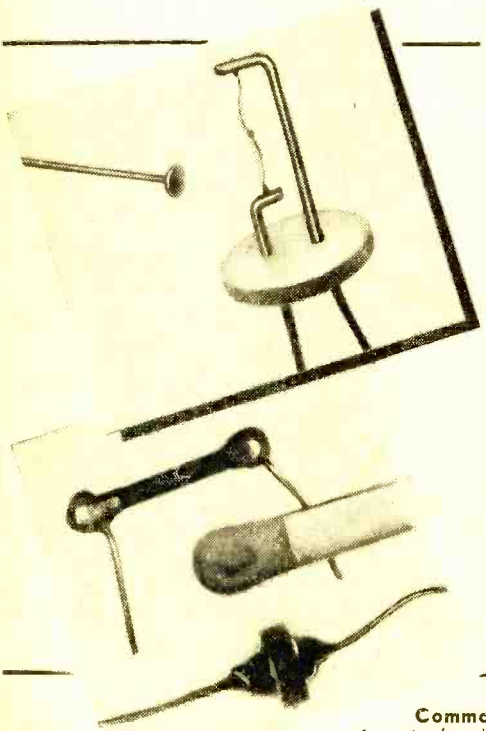


Fig. 1. Process of manufacturing microscopic bead thermistors. See text for details.

Manufacture of microscopic bead thermistors is a fascinating process to watch. (See Fig. 1.) Two extremely fine platinum wires (A) are held taut and parallel to each other on a special frame, the distance between wires being less than .005". Tiny blobs of the mix are then daubed on the wires (B) so that they are bridged by the bead; after drying and shrinking, the strand of beads is sintered and glass-coated. Later, the wires are cut to precise lengths (C) and the units are mounted on holders. Bead thermistors are available in



Common shapes in which thermistors are made. The head of a pin (top) is gigantic compared to tiny bead thermistor (A33 VECO) in center of fine wire. In the bottom square, a 51R2 VECO rod thermistor and a small disc thermistor are contrasted with ordinary paper match-head.

an assortment of values from about 500 ohms to 12 megohms at 25° C.

Varying Temperature. To take advantage of a thermistor's characteristics, its temperature must be made to vary and the resulting change of resistance put to use operating a meter, relay, etc. There are three distinct means by which this is done.

(1) *Ambient temperature changes.* A thermistor will follow the changes in ambient temperature by varying its resistance accordingly. This is the basis of thermometers, fire alarms, and thermostats.

(2) *Self-heating action.* If the current through a thermistor is made large enough, the thermistor temperature will rise, causing the resistance to drop, which in turn allows more current to flow and more heat to be generated. The build-up process continues until the temperature of the thermistor stabilizes at the point where the surrounding medium can carry heat away as fast as it is generated. This action is used in flowmeters, anemometers, liquid level gauges and controllers, and thermal conductivity measurement. The type of medium or its motion causes more or less rapid cooling of the self-heated thermistor, thus setting up the current-change conditions needed for measurement or control.

(3) *Independent heater.* Some special thermistor assemblies are provided with a heating element near the temperature-sensitive bead to permit heating control independently of the main circuit current or ambient temperature. This arrangement is used only in highly specialized industrial applications.

Thermistor Ratings. A sensible approach to thermistor experimentation requires understanding of thermistor ratings and the circuits for which they are best

(*Continued on page* 109)

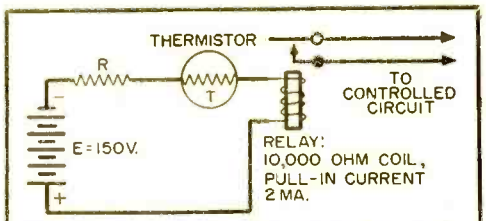


Fig. 2. Basic circuit of thermistor fire alarm.

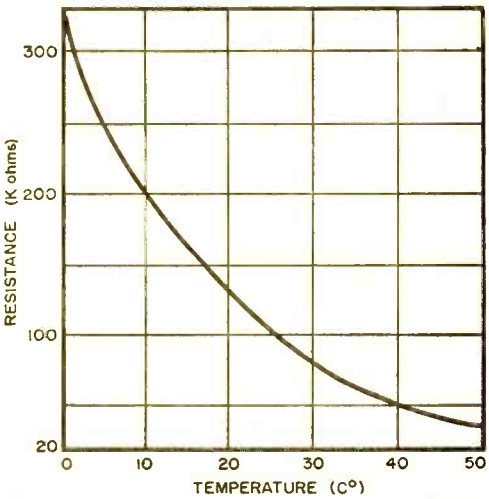


Fig. 3. Resistance-temperature curve for a 51R2.

Victory Engineering Corp.

Probe attachment on thermis-or thermometer at left is being used to measure soil temperature for agricultural control. Inaccessible places are easily reached by a long probe like the one utilized above in measuring air-conditioner vent temperature.

A Beam and Tower for the 15-Meter Novice

By
WILLIAM I. ORR, W6SAI

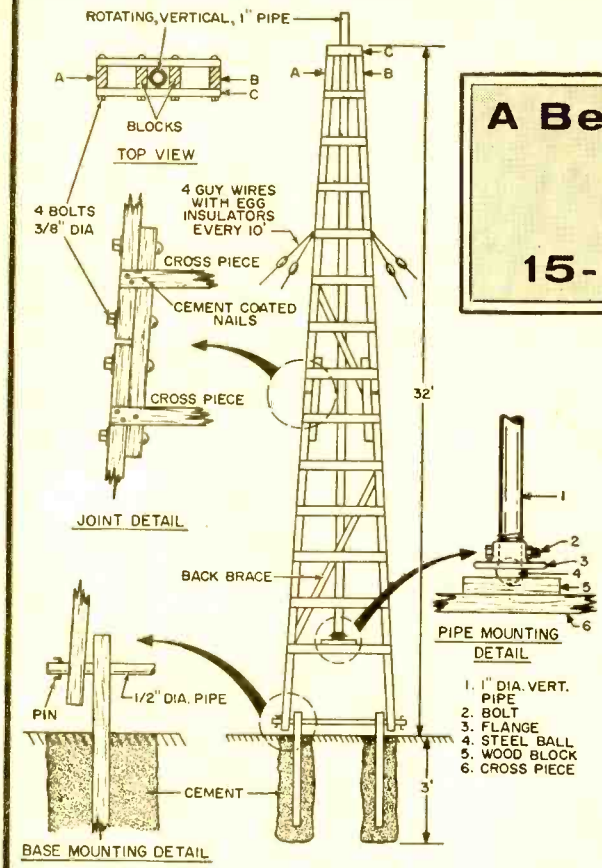


Fig. 1. This inexpensive 32-foot tower can be easily built by the Novice. See Bill of Materials on page 115.

"*WHAT do you think of this DX QSL card?*" asked Jimmy, waving a gaudy red and blue Australian card.

"*Looks real fine,*" I replied. "*Is it in answer to a SWL card that you sent out?*"

"*NO!*" snorted the young Novice. "*This is my first DX card for 15-meter operation! I worked him! I'm in the big league now!*"

"*Well, not exactly, Jimmy! Not with a dipole antenna. You've just been lucky so far. The Novice QRM is getting pretty heavy on 21 megs. You had better start thinking about a beam antenna if you want to be a DX-man.*"

"*That's why I'm here!*" said Jimmy, collapsing into the easy chair next to the operating desk. "*Let's design a good beam antenna and tower that I can put up for about thirty bucks. That's all the money I can scrape up. . . . Golly, a good rotator for the beam will cost that much, I bet.*" An unhappy look clouded Jimmy's face as he voiced this pessimistic thought.

"*All right, pass me a piece of talking paper,*" I ordered. "*I remember a tower and beam antenna design that was used by W6VAT and some of the other DX-chasers. It worked fine, and was very inexpensive to build. It's just the ticket for a 21-mc. Novice antenna. Look here, I'll draw you a sketch of it. . . .*"

A simple and inexpensive 32′ tower can be built from two 20′ "two-by-six" pieces of #1 lumber, as shown in Fig. 1. Each piece of material is cut lengthwise (the lumber yard will do it) to form two "two-by-three" pieces. A 4′ section is cut off the end of each two-by-three, leaving four 16′ pieces to form the legs of the tower. The tower should be flat, built much in the manner of a ladder. Make up each leg with two pieces of lumber, spliced together with a 4′ section. A rigid joint is formed when the legs are drilled and four ⅜" steel bolts are passed through the holes in the leg sections and the splice.

The crosspieces of the tower are made of "one-by-four" lumber. These braces should be spaced about two feet apart, starting about four feet above the ground, and held in place with "sixteen penny" cement-coated nails.

"*Why do you start the crosspieces four feet above the ground?*" asked Jimmy. "*That's to keep the little brats like your younger brother from climbing the tower,*" I replied, with a laugh.

The tower is three and one-half feet wide at the base, tapering to sixteen inches at the top. Splice each side joint and lay the two legs out in the driveway, in correct position. Then, temporarily nail a top and bottom crosspiece in place to steady the legs. After that, nail on the intermediate cross braces. Drive two cement-coated nails through each end of each cross brace.

These cross braces may be cut slightly

longer than necessary, then trimmed up after they are all in place. Use two cross braces at the top and bottom of the tower, one on each side. Check each step carefully, and the tower will remain square and true. Avoid any wood that is split or warped. Finally, turn the tower over and nail the two diagonal braces in place, as shown in Fig. 1, to take the sway out of the tower.

The foundation for the tower is made of two pieces of "four-by-four" creosoted lumber (or redwood) that are sunk vertically in three feet of cement. Foundation holes should be about a foot and a half square. The base hinge is made from a 4' length of ½" water pipe. Drill the legs of the tower and the two mounting posts to pass the pipe, as shown in the drawings.

"How about the rotator?" demanded Jimmy. *"Easy, Junior,"* I said. *"You young squirts are getting soft! You can't afford a rotator. I had a beam antenna for ten years before I had a rotator. I used the Armstrong method of turning it. So can you. After all, you'll find that you only turn the beam occasionally. You won't spin it around too much. There's no reason why you can't rotate the beam by hand."*

Obtain enough 1" (i.d.) water pipe to make a continuous section about 30 feet long. Threaded couplings may be used to make splices, but each coupling should be pinned with a bolt to prevent the couplings from coming undone in a heavy wind.

This pipe is passed down the center of the tower. Starting at the top, and at every fourth cross brace, place wood blocks on each side of the pipe to keep it in position. The blocks form a rough bearing, bracing the pipe but allowing it to turn. Wherever the blocks are used, that cross brace should be bolted to the tower legs with ⅜" steel bolts, as the nails might just loosen in a strong wind. Also bolt the wooden blocks in position.

At the bottom of the tower, the pipe rests on a wooden block attached to the top of the double cross braces. Thread a pipe flange on the base of the pipe, and pin it. Several holes should be drilled in the block, matching the holes in the flange. Finally, boost up the whole pipe an inch or two, and slip an old 1½" ball bearing under it to provide a smooth surface for rotating the pipe. A long bolt is passed through the flange into one of the holes in the block, locking the beam in the chosen direction.

"How do I turn the beam?" asked Jimmy. *"Silly boy! You pull out the bolt, grab the flange, and turn! It's easy!"* I replied.

Brace the tower at the 30' level by two sets of guy wires, running forwards and backwards from the tower, at an angle. The tower can be hinged at the base, and "walked up" into vertical position by three or four fellow hams. When the tower is erect, attach the guy wires to nearby points, and tighten them. A second set of guys could be attached at the 20' level to make the tower even more rigid. When completed, the top of the supporting pipe should project about two feet above the top of the tower to take the beam antenna. As a final step, give the tower a coat or two of gray house paint for protection against the weather.

"The antenna! What kind of an antenna can a poverty-stricken Novice like myself build for a few dollars that will really bore a hole in the band?" demanded Jimmy. *"Well, here it is,"* I replied, reaching for a second sheet of paper.

A two-element, 15-meter parasitic beam will provide about 5 db gain—enough to make the Novice 75-watt transmitter sound like a

(*Continued on page* 114)

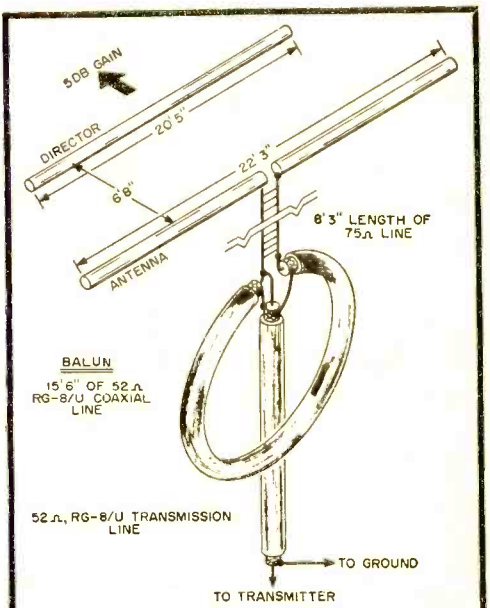


Fig. 2. Electrical diagram of the two-element 15-meter parasitic beam antenna.

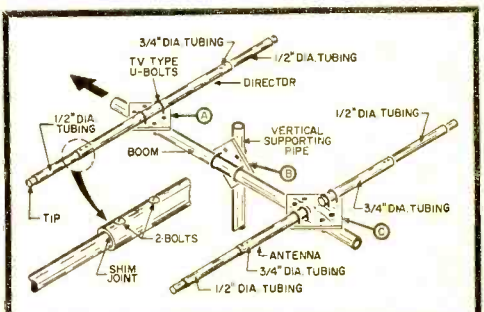
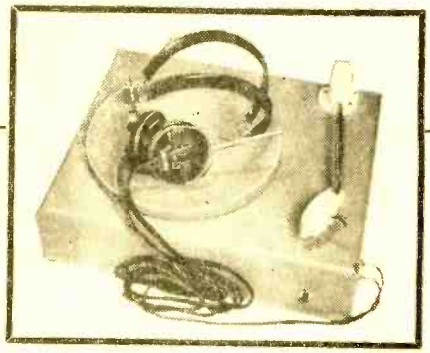


Fig. 3. Antenna assembly. Joints are made with TV-type U-bolts and gusset plates. See Bill of Materials, page 116.

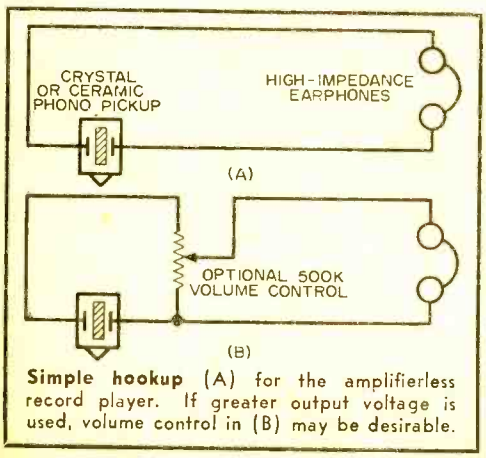
Amplifierless Record Player



WHILE EXPERIMENTING with an old crystal phono cartridge, the author connected a pair of high-impedance magnetic earphones across the terminal lugs on the cartridge, and was pleased to find that the recorded material could be heard with surprising volume and clarity.

There are a number of instances where it might be desirable to dispense with an audio amplifier and speaker. Many public libraries, for instance, are equipped with record players using amplifiers for record-auditioning in their record-loaning departments. Every librarian would welcome a simple record player having improved fidelity, no hum, no tubes to wear out, and consisting of only a turntable with pickup, and a pair of phones. In record shops, the usual row of poorly ventilated booths, with their expensive amplifiers and noisy speakers, could be replaced with a row of turntables with pickups, and earphones.

Measuring 10" x 12" x 3", the author's record-player cabinet was constructed of wood and covered over with Contact adhesive plastic-coated material. You can build a cabinet, buy a ready-made one, or use any suitable record-player cabinet you have on hand. The model utilizes a 33⅓-rpm phono motor that happened to be on hand, but you may want to use a modern 3-speed motor.



Simple hookup (A) for the amplifierless record player. If greater output voltage is used, volume control in (B) may be desirable.

The crystal phono pickup is a Ronette FF2 low-resonance 12" arm containing a Ronette 284-P high-fidelity crystal cartridge. Although the voltage output of the 284-P is relatively low (between .15 and .38 volt) as compared with many crystal cartridges, the earphone volume seems to be entirely satisfactory. Those with below normal hearing, however, will need to use a crystal or ceramic cartridge having a high voltage output. Other high-fidelity crystal or ceramic phono cartridges which may be used are the Sonotone "3" series, the Electro-Voice "80" series, the Shure "Music Lovers Cartridge," etc. Magnetic and dynamic phono cartridges are not suitable for amplifierless earphone listening due to their very low outputs.

Use high-impedance earphones to match the high impedance of the crystal or ceramic cartridge. A crystal headset is the logical choice. The author uses a pair of Brush BA-206 crystal phones. Those who do not wish to invest in a pair of top-quality crystal earphones will find that the little crystal earpiece available from Lafayette Radio, 100 Sixth Ave., New York, N. Y. (Catalog No. MS-111, $1.49 net), is as sensitive as a pair of phones. The frequency response is not nearly as smooth, though, and you'll have to push the earpiece firmly into your ear to get good bass response—which may result in discomfort over long periods of listening. Nevertheless, this little earpiece does a fine job for the money.

—Art Trauffer

THE TRANSMITTING TOWER

Herb S. Brier, W9EGQ

USUALLY when a short-wave communications receiver is mentioned, one immediately thinks of an elaborate, multitube superheterodyne. The reason for this is that the basic superheterodyne circuit is flexible enough to accommodate the many tubes and special circuits required to give the best possible results under unfavorable conditions. It is the basis of the often repeated advice to get the best receiver you can afford for your radio shack. It does not mean, however, that you must have an elaborate superheterodyne receiver to hear short-wave signals. The much simpler regenerative receiver will also bring them in.

In the hands of a skilled operator, the performance of a two- or three-tube regenerative receiver will approach that of a superheterodyne costing several times as much. In addition, its simplicity makes constructing a regenerative receiver (either from "scratch" or from a kit) and learning how to operate it an ideal project for anyone just getting started in radio. Doing so is fun and will quickly develop the skill and knowledge required to tackle a more elaborate project successfully.

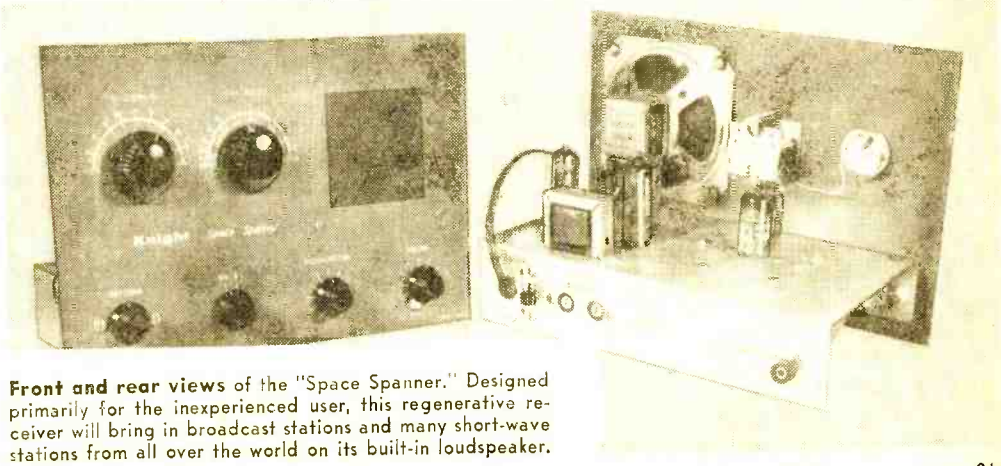
What Is Regeneration? The Knight "Space Spanner" short-wave and broadcast band receiver, available in kit form from Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill., is an example of a modern regenerative receiver. Before discussing it specifically, let's learn a bit about how a regenerative receiver works—with the aid of Fig. 1 on page 83.

To begin, all signals picked up by the receiving antenna are fed into the tuned circuit, consisting of a coil *L1* and a variable capacitor *C2*, via the antenna coupling capacitor *C1*. *L1* and *C2* select the signal and deliver it to the grid of the detector tube, *V1*, via the grid capacitor *C3* and grid resistor *R1*.

In the tube, the desired signal is amplified, and through the influence of *C3* and *R1*, the audio-frequency intelligence it carries is removed from the signal and is delivered to a pair of headphones or to an audio amplifier for further amplification.

Note that the signal from the plate of the detector tube does not go directly to the phones or audio amplifier. Instead, it first flows through the "tickler" coil *L2*, which is wound on the same form as *L1*. In this manner, part of the detector output signal is coupled back into *L1*, from whence it goes through the tube to be amplified again and again. This is *regeneration*.

Each time the signal makes the round trip through the circuit, it naturally becomes stronger. At the same time, the



Front and rear views of the "Space Spanner." Designed primarily for the inexperienced user, this regenerative receiver will bring in broadcast stations and many short-wave stations from all over the world on its built-in loudspeaker.

HELP US OBTAIN OUR HAM LICENSES

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

K1/W1 CALL AREA

Bruce A. Childs, P.O. Box 226, Centerville, Cape Cod, Mass. (Code)
Edward Tanzer, 216 Vine St., Everett, Mass. (Code)
Joel L. Richmond, 2 Hiawatha Road, Mattapan 26, Mass. (Code)

K2/W2 CALL AREA

Joseph Essington (15), Pedricktown Rd., Penns Grove, N. J.
Jose Garcia, 1396 Stebbins Ave., 5-E, Bronx 59, N. Y.
George Stovall, 112-24 Northern Blvd., Corona 68, New York, N. Y.
Joseph Green, 60 Felice Crescent, Hicksville, N. Y.
Stuart Ring, Box 7, Adams, N. Y.
Martin Gucker, 65 E. Tremont Ave., Bronx 53, N. Y. (Code)
Stuart Mount, P.O. Box 62, Clintondale, N. Y. (Code)
Robert Batchelor, 20 McKinley Place, Glen Cove, N. Y.
Ronald Wilensky, 920 E. 17th St., Brooklyn 30, N. Y. (Code)
Bob Freeman (13), 88 Magnolia St., Westbury, N. Y. (Code)
Pete Tedesko (13), 26 Brookside Circle, Bronxville, N. Y. (Code)

K3/W3 CALL AREA

Robert Bair, 169 Craig Drive, Greensburg, Pa.
Robert Himler, 11 W. Madison St., Latrobe, Pa.
Michael W. Vore, 359 Whitfield Road, Catonsville 28, Md.

K4/W4 CALL AREA

Tad Buckland (14), 317 Blowing Rk. Rd., Boone, N. C. (Theory)
Jimmy Cheek (18), 107 Hampton St., Westminster, S. C.
Richard L. Warren (13), 2780 Skyline Drive, Memphis 8, Tenn.
Kip Coffeen, 126 Pinewood Ct., Lynnwood Subdivision, Woodbridge, Va.
Frank Piekarski, 27 Morgantown St., Fairchance, Va.
Don Blanton, 2523 Hale Ave., Louisville, Ky.
Kimp Talley (17), Route 2, Box 48, Henderson, N. C.
Jackie Blackwell, Box 367, Kernersville, N. C.
Mike Fletcher, SWL-42, (18), 300 W. Redbud Dr., Knoxville, Tenn. (Theory)
George Brookhyser (16), Box 157, Sylva, N. C. (Code and theory)

K5/W5 CALL AREA

Jimmy Day, Box 22, Lone Grove, Okla.
Jim Willcox (15), 309 Pinewood, Hot Springs, Ark.
Bobby Larse, VA Hospital, McKinny, Texas.
Ronald E. Alford (14½), 1802 Sullivan St., Pasadena, Texas.
John Kusianovich, P.O. Box 6, Fort Stanton, New Mexico.
Bill Blankenship, Box 306, Cooper, Texas.

K6/W6 CALL AREA

Don Petric, 1710 Malcolm Ave., Los Angeles 24, Calif.
Gary Young, P.O. Box 115, Lockeford, Calif.
Thomas Whiteley (14), 4637 18 St., San Francisco, Calif.
Leslie Stanford Cammer (12), 624 San Pascual, Santa Barbara, Calif.
Fred Capshew, 1928 Chance Ave., Fresno, Calif.
Fred Reher, 12971 7th St., Chino, Calif.
Don Ziegler, 1855 Sonoma Ave., Santa Rosa, Calif.
Philip Saxe (11), 4624 18 St., San Francisco, Calif.
Robert A. Graeber, 456 Milford St., Glendale 3, Calif.
Jim Richman, 737 N. Mansfield, Hollywood 38, Calif.
Thomas Scott (14), 545 Redwood Ave., San Bruno, Calif.
Joe Sharmer (15), 902 Walnut Ave., Santa Cruz, Calif.
Jon Clark (14), 704 Gilroy Drive, Capitola, Calif.
Joseph W. Granville, 1864 Belmont Ave., San Carlos, Calif.
Earl Neoman, P.O. Box 1506, Shapter, Calif. (Code and theory)
Dug Stokes, 636 W. Cypress Ave., Covina, Calif.
Gary Grant, 9588 Upland St., Spring Valley, Calif. (Code)
Floyd L. Herbert, 2399 Ash Ave., Merced, Calif. (Code)

K8/W8 CALL AREA

Don Rees (13½), 706 Gill St., Huntington, W. Va.
Jim Toreson, 38207 Barth, Romulus, Mich.
Lewis Traxler, 535 Kaler Ave., Bucyrus, Ohio.
Bill Newbrough, 351 W. Washington St., Grafton, W. Va. (Theory)
Martin Webb, 717 Maryland Ave., Fairmont, W. Va. (Code)
Jerry Barker, 595 Hagadorn, S. Lyon, Mich. Phone: GE 8-8054. (Code and theory)
Len Behr, 5926 Coplin Ave., Detroit 13, Mich. (Code and theory)
Jeff Bohl (14), 1717 W. Pasadena, Flint 4, Mich. (Code and theory)
Ricky Karash (10), 330 Walworth Dr., Euclid 32, Ohio.
Nicky Swan, P.O. Box 204, Ludington, Mich.
Gary Townsend, 838 Continental, Detroit 15, Mich.
Dennis Beshara, 5555 Stuber Dr., Canton 8, Ohio. (Theory)

K9/W9 CALL AREA

Nick Frato, 6903 So. Anthony, Ft. Wayne, Ind.
Ronald Isaacs (13), 819 N. 6th St., Mt. Vernon, Ill.
William L. Harris, 824 N. 10th St., Lafayette, Ind.
Fred Leadlove (15), 1615 Ohio Ave., E. St. Louis, Ill.
Charles Smith, 302 Sixth Ave., Sterling, Ind.

KO/WO CALL AREA

Roger E. Clark, 246 North 9th Ave., Broken Bow, Nebr.
I. J. Rusand, 702 W. 1 St., Pittsburg, Kansas.
Bob Ball, 1519 Main St., Lexington, Mo.
Dick Anderson, 4234 Raleigh Ave., St. Louis Park, Minn.
Tom Reiter, 1625 Prescott St., Dubuque, Iowa.
Mac Floyd, 117 No. Chautaugua, Wichita, Kansas. (Code)
Dale Kerwood (14), 4560 Wolff St., Denver 12, Colo.
David Bergan, Florence, So. Dakota. (Code, theory and regulations)

VE AND OTHERS

Carl O. Baptiste, Jacamel, Haiti, West Indies.
J. G. Badeau, P.O. Box 378, Station "A," Kitimat, B.C., Canada.
Nicky LeMoine, 608 Argyle Ave., Westmount, Montreal, Que., Canada.
Boris Auguste (VP2LB), I.C.T.A., St. Augustine, Trinidad, B.W.I. (Pen pals)

To help prospective amateurs obtain their Novice licenses, the Radio-Electronics-Television Manufacturers Association offers a set of code records (recorded at a speed of 33⅓ rpm) and a Novice Theory Course for $10.00, postpaid. The complete course or more information on it is available from RETMA, Suite 800, Wyatt Bldg., 777 Fourteenth St., N. W., Washington 5, D. C.

process increases the ability of the receiver to select the desired signal from among other signals. This is because regeneration increases the strength of the desired on-tune signal much more than that of the off-tune signals.

In this circuit, regeneration is controlled by varying the detector plate voltage. However, if the regeneration control is advanced beyond a critical point, so much energy is fed back from the plate of the tube to its grid circuit that the tube breaks into sustained oscillations.

As a result, each time a signal is tuned in, it beats with the signal generated in the tube to produce an audible beat-note (also called a heterodyne, squeal, or whistle) in the phones or loudspeaker. The detector is operated in this manner to receive c.w. code signals. To receive signals carrying voice or music, the regeneration control is normally adjusted to just below the oscillation point.

Knight "Space Spanner." Returning now to the Knight "Space Spanner," this receiver uses a 12AT7 dual-triode tube as a regenerative detector and first audio stage. The 12AT7, in turn, drives a 50C5 output amplifier, which drives a built-in loudspeaker or a pair of phones.

Voltages to operate the receiver are obtained from a self-contained power supply. It utilizes a 35W4 rectifier tube to convert the power line current to the well-filtered direct current required for quiet, hum-free operation of the receiver.

The "Space Spanner" covers the standard broadcast band—545 kc. to 1605 kc.—in one position of its band selector switch and the short-wave range of 6.5 mc. to 17 mc. in the other.* Other panel controls include the main tuning dial, which adjusts the main tuning capacitor, and the "bandspread" dial which controls a small variable capacitor connected in parallel with the main tuning capacitor. This small capacitor permits any small segment of the frequency range covered by the main dial to be spread across the entire bandspread dial scale.

Assembling the kit is made easy by the exceptionally easy-to-follow instruction book included with it. All parts, except hookup wire and solder required to assemble the "Space Spanner" are included in the kit.

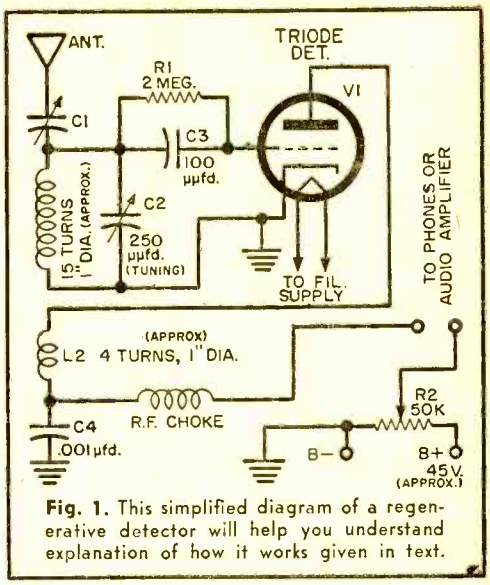


Fig. 1. This simplified diagram of a regenerative detector will help you understand explanation of how it works given in text.

Results and Conclusions. Reception on the broadcast band with the Knight receiver compares favorably with that of the average table model receiver. A 15′ antenna strung across the room will bring in all stations within the normal "service area" with good loudspeaker volume.

On the short-wave band, an antenna 50′ to 75′ long erected as high and clear of buildings and trees as convenient will give loudspeaker volume from the more powerful stations both from the United States and overseas. To receive the weaker ones, however, it is necessary to use headphones. This may be a blessing in disguise. Under unfavorable conditions, signals are always more readable through phones than through a loudspeaker, anyway.

On the basis of its simplicity, perform-

(*Continued on page* 119)

Dave Reddick, KØBIL, Naturita, Colo., has been a ham for a little over a year. He operates his DX-100 transmitter and SX-99 receiver on the 75-meter phone band but will be happy to work anyone who wants a Colorado contact on phone or code.

* Its 6.5-mc. to 17-mc. short-wave coverage is a compromise. But it covers most of the international short-wave broadcast bands and the 7- and 14-mc. amateur bands; therefore, it can be used as a 7-mc. Novice receiver. Strictly as a Novice receiver, it would be better if the coverage was from approximately 3 mc. to 8 mc., so that it would include the 3.5-mc. amateur band. But then most of the international short-wave broadcast bands would be omitted; consequently, the present coverage probably best meets the needs of the greatest number of potential users. Other bands could have been added to the receiver, but this would have increased its complexity and cost more than the intended purpose would warrant.

Singer's voice is blended with orchestral background from record by means of mixer. Result is recorded on tape.

MIXING IT UP

Equipment Courtesy Fisher Radio Corp.

By Richard H. Dubbe

You can combine voice and music "professionally" on one tape

DO YOU WANT your tape recordings to have that final "finish" that makes them sound like professional programs? Use a "mixer"—it will open a new world of fun for you and program flexibility for your tape machine.

Suppose, for instance, you have taped some music by a favorite band. You want to combine this with voice announcements, coming in occasionally over or under the music, to describe who the musicians are, what they're playing, etc.

Or suppose you're creating on tape a drama in sound, consisting of a play with musical background and sound effects. The music must swell up, die down, and relate itself dramatically to the voice parts. Similarly, the loudness of the spoken parts must be separately controlled so that they can be faded in and out.

These are only two situations out of many in which a mixer could prove invaluable. The separate signal sources it accepts, blends, and feeds to the recorder may be from microphones, phono players, TV sound, radio tuners, other tape recorders, or any combination of such sources.

Mixing in the "Pot." To be really useful, a mixer should also be a "fader"—so that it will not only blend independent sound sources but will also permit you to control their relative levels.

The simplest kind of mixer-fader consists of two potentiometer volume controls wired to accept signals from two input jacks and to feed a common signal out of a third jack. A simple circuit for such a device is shown in Fig. 1. It is easy and cheap to build, but it runs the risk of noise and improper impedance matching.

Electronic mixers provide smooth mixing and fading with little insertion loss and with maximum transfer of signal voltage. What's more, using tubes, you can build a very versatile mixer which will accept both high- and low-level signals simultaneously. In other words, the tube provides gain for the weaker signals available from low-level mikes or weak tuners, etc.

Single Triode Mixer. The simplest form of electronic mixer, with a single triode stage, is shown in Fig. 2. Sometimes termed a "parallel mixer," this circuit is useful only for mixing two signals of fairly high voltage level, such as the output from a phono preamp, high-level mike, radio tuner, etc. The series resistors (*R2* and *R4*) prevent the fading controls (*R1* and *R3*) from short-circuiting each other, but at the same time they reduce the voltage level of the incoming signals.

Dual Triode Mixer. An improved version of the single triode mixer is one which uses both halves of the dual triode tube (Fig. 3). Each input channel, with its own level control, feeds the grid of one triode. Any combination of signals—selected by adjusting *R1* and *R2*—is passed through *C2* to the next stage, which should be the low-gain, high-impedance input jack of a tape recorder.

Resistors *R6* and *R7* are needed for isolating the two plates, but they will reduce the output signal voltage. The amount of

reduction depends on the value of the grid resistor used in the following stage. The higher this resistor, the lower the signal loss. Thus, it is essential that the mixed signal be fed to a high-impedance input.

The incoming signals to be mixed should be high-level signals, such as are available from a phono preamp, radio tuner, high-level microphone, TV sound, etc.

Pentode Mixer. If the mixing stage must provide more gain than the triode circuit above can manage, a mixer with pentodes may be used. The circuit in Fig. 4 has been designed to accept a low-level signal in channel 1, and either a low- or high-level signal in channel 2. With the values shown for the components in this circuit, the mixer will have considerable gain. Either channel 1 or channel 2 (with the switch on "LOW") may be used—not only for mixing, but also as a preamp to boost low level signals. Suitable signal sources would be a low-level microphone, a magnetic phono pickup that has not been fed through its own preamp, the signal from a crystal detector tuner, etc.

With the switch in channel 2 on "HIGH," an additional large resistor is thrown into the grid circuit of the bottom 6AU6. This resistive network reduces the strength of an incoming signal to the point where it will not overload the 6AU6. Therefore, it enables you to feed a high-level signal into channel 2. Needless to say, you may feed a low-level signal into channel 1 at the same time. Such an arrangement provides maximum versatility of operation.

R1 and *R2* serve as the level and fading controls for their respective channels. *R8* serves as a "master level control" which

(*Continued on page* 131)

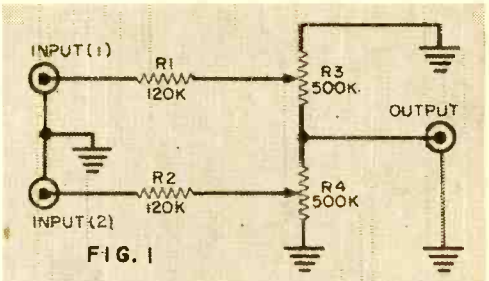


FIG. 1

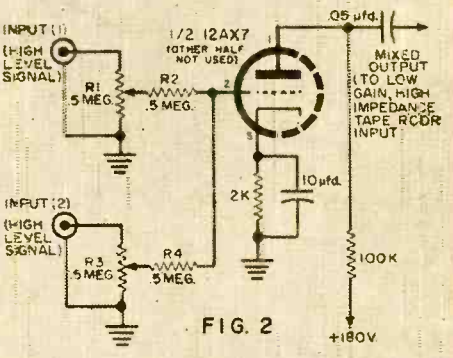


FIG. 2

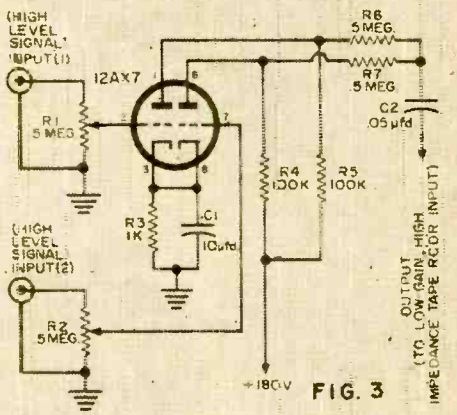


FIG. 3

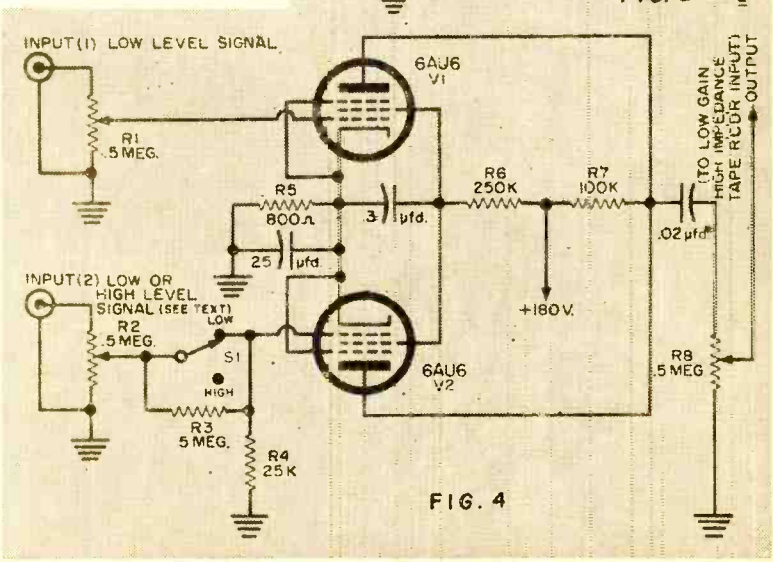


FIG. 4

Figs. 1, 2, 3, and 4 (top to bottom) are schematic diagrams for the four types of mixers discussed. Circuit details are given in text. Construction data for circuit in Fig. 1 appeared in an earlier article in POPULAR ELECTRONICS (July, 1955, page 81).

By CLAUDE McCULLOUGH

R/C Triplex

Three Controls on One Channel

TO THE R/C FAN who has been flying single-channel models, the challenge of multiple controls is an enticing one. The "Triplex" circuit shown here was developed over a period of years and flown in a number of the author's models. "Triplex" provides three controls using any ordinary single-channel R/C receiver. Most "rudder-only" models may be easily modified to carry it.

The basic principle of this method is the use of a pulse system of proportional control. Addition of extra control features is accomplished in an uncomplicated manner. They are simple to maintain and also achieve a degree of "fail-safe" operation.

The R/C transmitter is keyed in the usual pulse method by a mechanical or electronic pulser, in which control stick movements vary the pulse length from no signal at one end of the range to a steady signal at the other. For the author's purposes, the movement of the stick is limited, so it doesn't quite reach the extreme positions. Two push-button switches have been added as shown in Fig. 1. One is a normally closed switch which gives "full off" when depressed; the other is a normally open switch which gives "full on" when depressed.

When the pulsed signal is received by receiver relay *RL1* in Fig. 2, the twin-coil

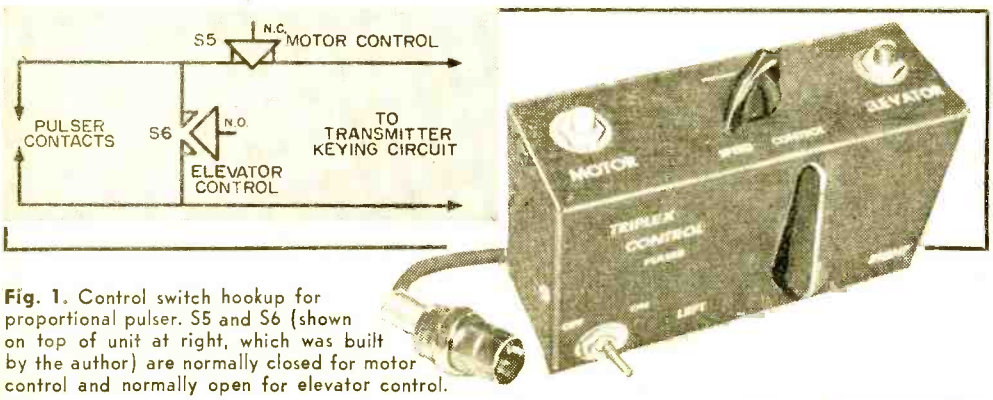


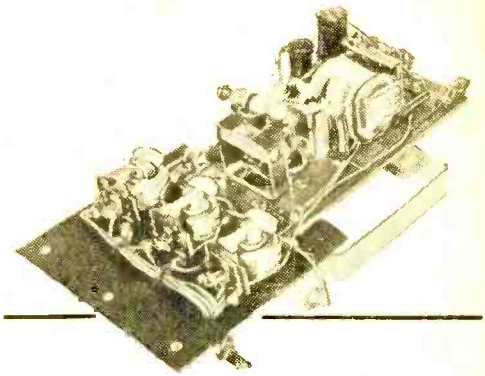
Fig. 1. Control switch hookup for proportional pulser. S5 and S6 (shown on top of unit at right, which was built by the author) are normally closed for motor control and normally open for elevator control.

actuator displaces the rudder in proportion to the pulse rate. At the same time, *RL2* is keyed, which in turn keys *RL3* and *RL4*. Relays *RL3* and *RL4* are delayed for about one-half second by the 50-μfd. capacitors *C1* and *C2*. A pulse rate above 150 pulses per minute will cause relays *RL3* and *RL4* to remain closed.

If a full-off signal of about ¾-second duration is sent via *S5* (Fig. 1), *RL3* opens after a ½-second delay period and keys the motor control escapement. If the motor control is an escapement-operated air-bleed valve, then holding the full-off signal for several seconds will cut the motor. And since the continuity of the actuator is broken, the rudder will be left in neutral position. This prevents the model from a failure in flight due to the interruption of the radio signal in some manner (such as transmitter failure or flying out of range).

Similar action occurs in *RL4* when "full-on" is sent via *S6* in Fig. 1 to operate the elevator escapement. A four-position escapement is used in this case to give half positions. The rudder control will give maneuverability while the elevator is in any position.

When a full-on signal is sent, the rudder again falls to a neutral position after the first ½-second. If you have interfering ra-



The receiving unit is mounted as an extension of the chassis of the McNabb 465-mc. receiver.

PARTS LIST

B1—15-volt hearing-aid battery (Eveready #411 or one-ounce equivalent)—see text for other battery voltages
C1, C2—50-μfd., 25-d.c.w.v. electrolytic capacitor (Aerovox Bantam SRE)
RL1—Receiver relay (part of receiver)
RL2—Neomatic or similar subminiature relay, about 300 ohms
RL3, RL4—Neomatic or similar subminiature relay, 5000 to 10,000 ohms
S1, S2, S3, S4—Miniature slide switches
S5—Push-button switch, normally closed
S6—Push-button switch, normally open

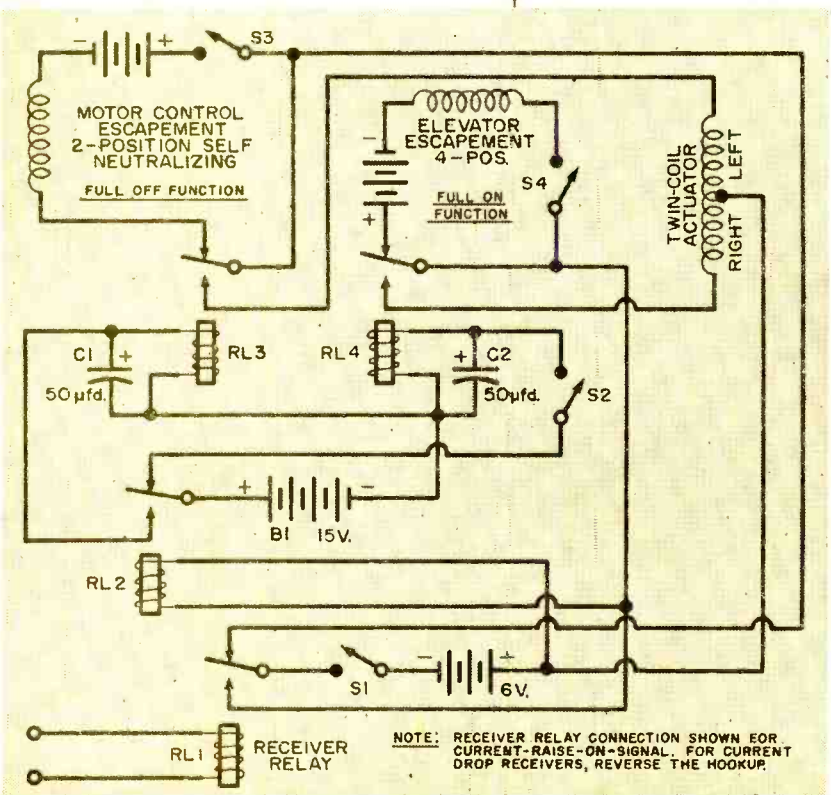


Fig. 2. Schematic diagram of "Triplex" control system. Component values are given in parts list above. See text for details of motor control and elevator escapements, actuator and pulser. Note that all switches are shown open in this diagram; they would be closed for normal operation.

dio signals present, simply switching off the elevator with *S4* will allow you to fly with only rudder and motor control. The single effect of an interfering signal will then be to return the rudder to neutral.

Since the "Triplex" is to be added to your present equipment, the method of mounting and installation is up to you. The photo shows a McNabb Citizenship 465-mc. receiver, with the extra components mounted on a Micarta extension to the chassis.

Any sensitive relay with coils of 5000-10,000 ohms can be used for *RL3* and *RL4* with the delay circuits shown; I used the Neomatic 7250-ohm subminiature type in this original unit. It may be necessary to adjust the value of capacitors *C1* and *C2* and the spring tension of the relays to give the required delay. The keying relay in this circuit is a Neomatic with a 300-ohm coil, employed in conjunction with an actuator using 6 volts through 20-ohm coils. Be certain that the keying relay will close at the lowest voltage used to operate the actuator.

The escapements will determine battery voltage for the elevator and motor controls. Do not employ the same battery for both escapements or tap into the actuator battery. Use a 15-volt Eveready #411 battery or a one-ounce equivalent to power the delay relays. I recommend a twin-coil activator and a fully variable pulser. Since an elevator is a much larger load than a rudder, use a heavy-weight escapement and try balancing the elevator.

All of the components may be purchased from firms which specialize in R/C equipment. —30—

Novel Probe Adds Range to Your VOM

MOST ELECTRONIC experimenters have used the temporary hookup illustrated in Fig. 1 to measure very high resistance values. With an auxiliary B battery and multiplier resistor, the top indication on the ohm scale of a VOM is multiplied ten times. Thus, resistance values up to 200 megohms can be measured provided that values up to 20 megohms could be measured without the external hookup.

While it is very useful to be able to measure high values of resistance, an external hookup is awkward and inconvenient. The obvious need for a compact and convenient ohmmeter multiplier can be met with miniature transistor batteries. Such a probe can be made completely self-contained and as convenient to use as the conventional test lead.

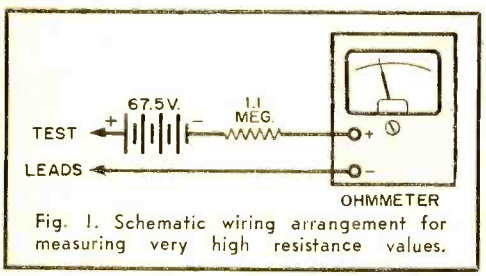


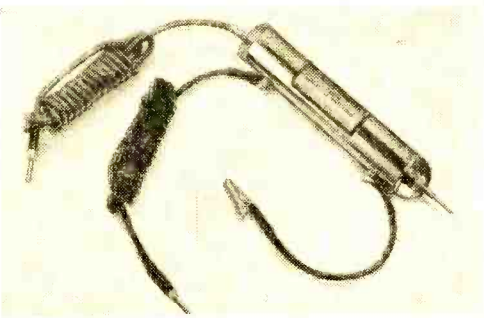
Fig. 1. Schematic wiring arrangement for measuring very high resistance values.

The Futuramic Co. has announced the availability of a high-ohm probe utilizing the arrangement shown in Fig. 1. It can be used with most popular types of VOM's which have a 12-ohm center-scale indication and an R x 10,000 ohm range with an internal 7½-volt ohmmeter battery.

The battery complement of the probe comprises three Mallory Y-15 transistor packs. Because the current drain is very small, battery life is long. However, after extended service, it will be necessary to replace the batteries eventually. This point is reached when it is no longer possible to zero the pointer on the ohmmeter scale by adjustment of the "zero ohms" control of the VOM.

In effect, the high-ohm probe provides an additional range on the ohmmeter. The probe converts the R x 10,000 range to an R x 100,000 range. With the probe plugged into the VOM in place of the conventional test lead, a reading of "10" on the ohmmeter scale indicates a resistance value of 1,000,000 ohms; a reading of "1000" indicates a resistance value of 100 megohms.

The high-ohm probe finds valuable application in radio and television servicing, and in the electrical and industrial-electronic fields. A refrigeration service engineer is often required to test hermetic compressor-motor assemblies for leakage ("grounds"). Although a VTVM can be used directly to measure resistance values



up to 100 megohms (a commonly accepted limit), most technicians prefer a VOM because it requires no source of external power and is simpler to operate. By the use of a high-ohm probe, a valid test of the compressor-motor assembly can be made with a VOM.—*Robert G. Middleton*

A "First" Project—

Putting Together a Clock Radio

By ALLEN C. TRAINER

Combine an old AM receiver with a clock timer as a start in radio

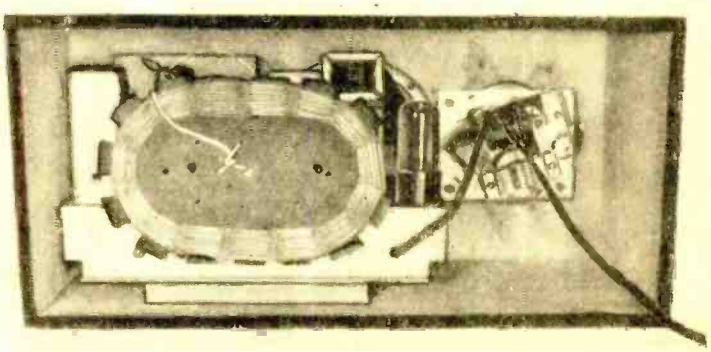
IF YOU FEEL that you don't know enough about electronics to tackle a resistor-and-capacitor project, try this ordinary conversion job. The project just consists of building a box to house an electric clock and AM radio, and of wiring the radio line cord to the clock. Any old table-model radio will do, and a clock timer can be purchased from a number of radio supply mail order houses for approximately four dollars.

Dimensions are not given for the new cabinet, because each dimension depends upon the size of the radio chassis. The easiest way to figure the size is to measure the old cabinet and add sufficient length to one end to include the clock. Then cut the cabinet pieces to size. Be sure to figure the thickness of the top and bottom pieces when determining the over-all height.

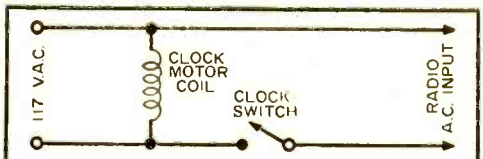
Cut all the pieces to size and make a trial assembly of the parts without fasteners. Now place the radio chassis on the bottom piece and hold the front panel in position, then scribe the outline of the dial assembly and the control shafts. Next, hold the clock in position on the front panel, centering it between the top and bottom, and scribe the outlines of the clock face.

Remove the front panel and cut out the openings with a coping saw. Again place the panel in position and make sure that the dial and shafts, and the clock face, will fit through the openings.

Fasten a grille cloth to the front panel by tacking the cloth near the edges of panel face. In this position, the tacks will be covered by the molding strip. Puncture the cloth in the center of the dial and clock face openings, and make several cuts from the center to the edge. Fold the resulting wedge-shaped pieces into the open-



Clock mounting position and wiring are shown in rear view of completed clock radio at the right. Above, left, is a front view of the new cabinet containing both the electric clock and the original AM radio (above, right).



Schematic diagram for wiring the radio line cord to the electric clock. Simplicity of wiring details makes this an easy job.

ings and tack the material to the back of the panel. This procedure will provide a cloth covering over the edges of the opening. Punch holes for the radio setting control shafts; the knobs will cover the openings.

Assemble the cabinet, using nails, or screws and glue. Always make sure that the radio chassis and clock are properly aligned.

Use finishing nails to fasten the molding strips to the front of the cabinet, and countersink the nails. Fill the nail holes and any cracks in the cabinet with wood putty and sand the whole cabinet. To finish the cabinet, use two coats of clear shellac or some other filler, and a final coat of enamel or paint—choose a color to fit in with the furnishings of the room. It is a good idea to attach rubber feet, or glue felt, to the bottom of the cabinet to prevent scratching or marring other furniture. Suitable rubber feet are available at radio supply houses or hardware stores.

Place the radio chassis and the clock in their mounting positions and check the length of the radio a.c. line cord from the radio chassis to the clock switch contacts and motor coil. Cut the radio line cord and solder one radio lead to one clock switch contact and the other lead to one of the motor coil terminals. Solder a jumper from the remaining switch contact to the remaining motor coil terminal, and solder the line cord wires to the motor coil terminals. Secure the line cord to the inside of the case to relieve the strain on the soldered joints.

Now, plug the line cord into an outlet and see that the clock runs. Turn on the radio, and turn the clock setting knob until the switch contacts close. The radio should operate normally. —30—

The Third Hand You Have Often Wanted

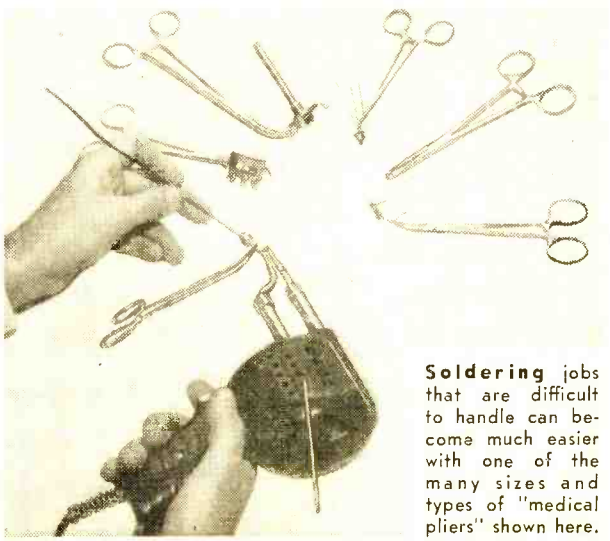
AN UNUSUAL—but indispensable—tool for the electronics worker can be a pair of "pliers" commonly used by a surgeon for clamping off arteries to prevent bleeding. The "forcep hemostat" has been found, by those who have tried it, to be the third hand that you may have often wished you had.

Such hemostats are made of fine surgical stainless steel and are practically indestructible. They are resistant to solder and soldering acids and fluxes. The beautiful feature which makes them shine is the locking device on the handles. Snap these little wonders on a piece of material and they hold it all by themselves. No help wanted!

There are many different sizes and shapes. My experience has proven, however, that the 6¼" straight model is the best size because of its holding power and capacity. The smaller models are a little too delicate and the larger models just a little husky. Model WW-150, shown in upper right-hand corner of photograph with a nut in its jaw, is available from Murray and Baumgartner Surgical Instrument Co., 5 West Chase St., Baltimore, Md., for $4.00, f.o.b. Baltimore.

In use, hold the hemostat in your hand, lay it off the edge of the workbench, or clamp the handles in a bench or drill vise. For the man who employs a soldering gun, it is the answer to that awkward feeling you get when working on small or subminiature parts. Such a portable "vise" is tops for holding two or more wires together when you are soldering in tight spots.

Keep a close watch on visitors when they start fondling your hemostat and you see that faraway gleam in their eyes. They are probably thinking: "Boy, could I use these when I . . ." —*Clyde D. Adams*



Soldering jobs that are difficult to handle can become much easier with one of the many sizes and types of "medical pliers" shown here.

Tuning the Short-Wave Bands

with Hank Bennett

THIS month we are going to forego our usual visit into the listening post of one of our P.E. reporters and, instead, make a short trip to the Island of Haiti and the control room of *Radio Commerce* there. Our guide through the station is engineer Jan-Claude Bance. Mr. Bance, in addition to helping put the signals of *Radio Commerce* onto the air waves, can also be heard operating his own amateur radio station, HH2JC.

Jan-Claude Bance is seated at the controls in one of the studios of Radio Commerce, Haiti.

Radio Commerce operates on three frequencies: 1080 kc. in the broadcast band; 6091 kc. in the 49-meter s.w. band; and 9485 kc. in the 31-meter s.w. band. For the medium-wave outlet, the power is 1000 watts; for the short-wave xmtrs, the power is 7500 watts. The call letters for the various outlets are 4VA (1080 kc.), 4VB (6091 kc.), and 4VC (9485 kc.). Mr. Bance tells us that all equipment has been manufactured by RCA and that the wiring of the station was done by engineer Edouard Gentil, a native of Haiti.

The antenna for m.w. station 4VA is a vertical, 200′ high, with a transmission line of 230 ohms. This xmtr can be heard, with a good signal, without interference, for 200 miles. Your Editor is willing to bet that some of our readers in the southern states could hear 4VA without much trouble, on the nights when the Cubans and other West Indian stations are coming through. The antennas for 4VB and 4VC are both horizontal Delta arrays, 80′ high for 31 meters and 60′ high for the 49-meter outlet.

Radio Commerce can be heard daily as follows: at 0630-2230 on 1080 kc.; at 0630-0930 on 9485 kc.; and at 1700-2230 on 6091 kc. In addition, a program in English is heard Sundays at 1700-1900. Two widely reported and well-heard programs in the English xmsn are "Glimpses of Haiti" at 1800-1830 and "Paris Star Time" at 1830-1900.

Our thanks go to Mr. Bance for the pleasant trip around the station, and to Herb Brier, of the *Transmitting Tower,* for his assistance in preparing this story.

Random Notes. Congratulations are in order for the Universal Radio DX Club for the "New Look" in their club Bulletin. By the same token, Roger Legge and Stewart West, of the Newark News Radio Club, are to be commended for the excellent "Band Survey" that they are writing monthly for the NNRC Bulletin.

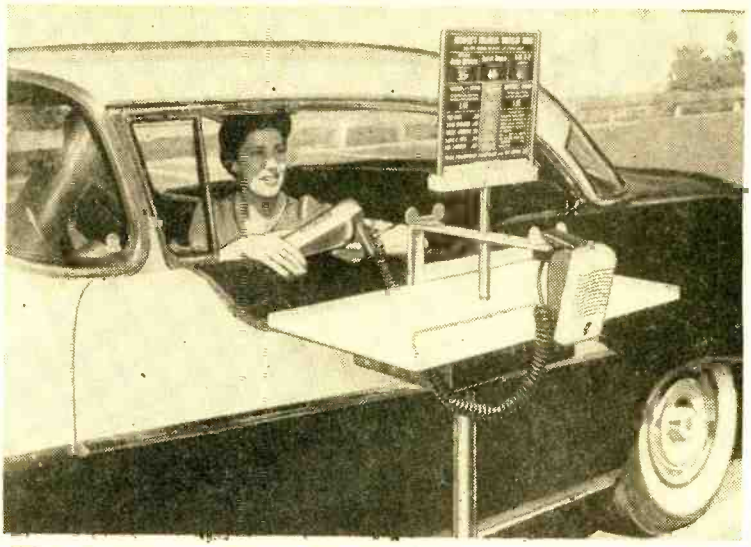
Joel Richmond and Port Baughman wrote in to tell us that *Radio Netherlands,* Hilversum, is offering a pictorial map folder of the Netherlands and a folder entitled "Improving Shortwave Reception" (the latest edition, with more antenna information) to anyone requesting them.

For those who would like to experiment

(*Continued on page* 121)

Joseph Montoya, San Dimas, Calif., listens with a Hammarlund HQ-140X receiver. His antenna is a vertical steel rod, 70 feet off the ground.

Electronics Comes to Drive-In



When the customer places an order for "hamburger with," this robot "car-hop" accepts the order, relays it to the kitchen, and delivers the food.

WHILE a great many of the country's drive-in eateries still follow the conventional pattern of serving their hungry customers by way of attractive "car-hops," in view of the shortage of these girls some restaurant owners have enlisted the aid of electronics.

In the photo at right is a gadget that will accept and relay the order of a customer who is comfortably seated in his or her car on the drive-in lot. All the customer need do is read an illuminated menu, press a button, and place his food order via a two-way speaker system.

The dulcet tone at the other end of the system accepts the order and relays it to the kitchen. When the food is ready, the "glamor-gal" car-hop delivers it.

This electronic gadget does away with the need for an estimated 50% of the fast-stepping females. And when the device isn't in use for placing food requests, it dispenses a steady stream of music from a record player loaded to the gills with the waxings popularly demanded by teen-agers.

True, the intercom hasn't the glamor of a slender figure or a well-turned ankle or a welcoming smile. Nor does it beseech in twinkling soprano: "What'll you have?" But the robot-like efficiency of this electronic car-hop makes up for its lack of more personal attractions. —*Stanley Clark*

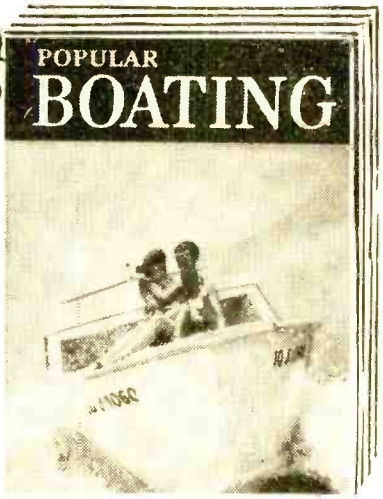
Checking metal parts for proper heat treatment is one of the many duties of the "Metal Monitor." Easy to operate, and requiring no special or technical skill, it is portable and can be moved to the job.

Metal Monitor

THE "Metal Monitor" checks metals without laboratory analysis. It can identify ferrous and non-ferrous metals by comparative testing with known samples, and it sorts mixed metals of unknown character into homogenous groups for further testing. Manufactured by Brush Electronics Company, division of Clevite Corporation, Cleveland, Ohio, it will check stock, parts in process or finished products for many characteristics—hardness, heat treatment, metallurgical structure, uniformity, plating thickness and plating adhesion.

In operation, an electrode (with a self-heating element) is placed in contact with the metal to be tested. Voltage generated by this contact is amplified and transmitted to a meter on the Metal Monitor. The reading is then compared to readings obtained from samples whose compositions and metallurgical characteristics are known. As many as 3000 pieces can be checked in an hour.

You're invited to a Launching!



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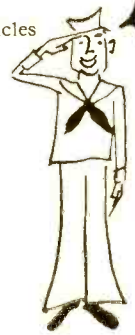
Here are just a few of the exciting articles in POPULAR BOATING's first issue:

- BREAKING THROUGH THE "WATER BARRIER"—America's best-known racing writer, Hank Bowman, describes the perils of high speeds afloat.
- SHOULD YOUR FIRST BOAT BE POWER OR SAIL?—Two top boating writers defend their favorite craft in a hot debate.
- OUTBOARDS UNLIMITED—There's no limit to the fun outbounding offers. Here's how to enjoy it more fully!
- GUY LOMBARDO'S GREATEST BOATING MOMENTS—In this exclusive article, the famed musician and boatman recalls the most thrilling moments in his racing career.
- ANN DAVISON'S NEXT BOATING VENTURE—An exclusive first-hand report by the only woman ever to sail the Atlantic alone!



This first issue is already a complete sellout at many newsstands. For POPULAR BOATING offers readers far more than any other publication in the field . . . yet costs *less*. At regular rates, POPULAR BOATING sells for 35c on newsstands (Special Show Numbers: $1.00) and $4.00 a year by subscription.

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However, as a regular POPULAR ELECTRONICS reader, you can climb aboard POPULAR BOATING for a trial cruise at a not-to-be-repeated introductory rate—8 months for only $2.00. You get the big $1.00 January Boat Show Issue at no extra cost, too! All told, by taking advantage of this offer you save a whopping 42% over established rates.

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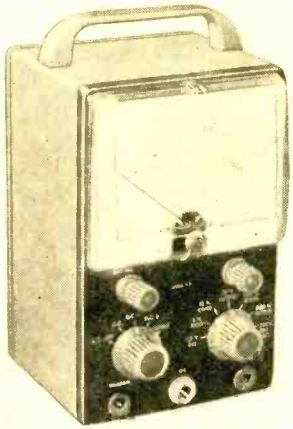

etched circuit vacuum tube

voltmeter kit

MODEL V-7A

$24.50

SHIPPING WT. 7 LBS.

In addition to measuring AC (rms), DC, and resistance, the modern-design V-7A incorporates facilities for peak-to-peak measurements. These are essential in FM and television servicing.

AC (rms) and DC voltage ranges are 1.5, 5, 15, 50, 150, 500, and 1500. Peak-to-peak AC voltage ranges are 4, 14, 40, 140, 400, 1400, at 4,000. Ohmmeter ranges are X1, X10, X100, X1000, X10K, X100K, and X 1 megohm. A db scale is also provided. Polarity reversing switch provided for DC measurements, and zero center operation is within range of the front panel controls. Employs a 200 microampere meter for indication. Input impedance is 11 megohms.

Etched metal, pre-wired circuit boards insure fast, easy assembly and result in reliable operation. Circuit board is 50% thicker for more rugged physical construction. 1% precision resistors used for utmost accuracy.

Heathkit

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MODEL M-1

$14.50

Shpg. Wt. 3 lbs.

The Model M-1 measures AC or DC voltage at 0-10, 30, 300, 1000, and 5000 volts. Measures direct current at 0-10 ma and 0-100 ma. Provides ohmmeter ranges of 0-3000 (30 ohm center scale) and 0-300,000 ohms (3000 ohms center scale). Features a 400 microampere meter for sensitivity of 1000 ohms per volt. Handy and portable. Will fit in your coat pocket, tool box, glove compartment, or desk drawer.

Heathkit **VOM KIT**

20,000 ohms/v. DC and 5,000 ohms/v. AC sensitivity. Ranges (AC and DC) are 0-1.5, 5, 50, 150, 500, 1500, and 5000 v. Direct current ranges are 0-150 ua, 15 ma, 150 ma, 500 ma, and 15 a. Resistance ranges provide center-scale readings of 15, 1500 and 150,000 ohms. DB ranges cover −10 db to +65 db.

Features 4½" 50 ua meter and 1% precision resistors.

MODEL MM-1

$29.50 Shpg. Wt. 6 Lbs.

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BENTON HARBOR 5, MICHIGAN

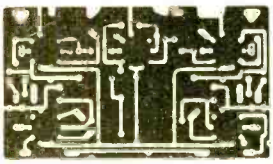
Heathkit 3" oscilloscope kit

ETCHED CIRCUIT

- Push-pull vertical and horizontal amplifiers.
- Light weight and small size for portability.
- Good sensitivity and broad frequency response.
- Etched metal circuit boards for simplified assembly.
- Attractive panel and case styling.

MODEL OL-1

$29.50 Shpg. Wt. 14 Lbs.



This compact little oscilloscope is just the ticket for use in the ham shack or home workshop. Measures only 9½" H. x 6½" W. x 11¾" D. Weighs only 11 pounds.

Employing etched metal circuit boards, the Model OL-1 features vertical response with in ±3 db from 2 cps to 200 kc. Vertical sensitivity is 0.25 volts rms per inch, peak-to-peak, and sweep generator operates from 20 cps to 100,000 cps. Provision for direct RF connection to deflection plates. Incorporates many features not expected at this price level. The 8-tube circuit features a type 3GP1 cathode ray tube.

- Cathode-follower output for isolation.
- No oscillator calibration required.
- Covers 160 kc to 220 mc (including harmonics).

Heathkit signal generator kit

This signal generator covers 160 kc to 110 mc on fundamentals in 5 bands. Calibrated harmonics extend its usefulness up to 220 mc. The output signal is modulated at 400 cps, and the RF output is in excess of 100,000 microvolts. Output controlled by both a continuously variable and a fixed step attenuator. Audio output may be obtained for amplifier testing.

MODEL SG-8

$19.50 Shpg. Wt. 8 Lbs.

This is one of the biggest signal generator bargains available today. The tried and proven Model SG-8 offers all of the outstanding features required for a basic service instrument or for use in experimenting in the home workshop. High quality components and outstanding performance. Easy to build, and no calibration required for ordinary use.

Heathkit grid dip meter kit

This extremely valuable instrument is a convenient signal source for determining the frequency of other signals by the comparison method. Range is from 2 mc to 250 mc. Uses 500 ua meter for indication, and is provided with a sensitivity control and headphone jack. Includes prewound coils and rack. For hams, experimenters, and servicemen.

MODEL GD-1B

$19.50 Shpg. Wt. 4 Lbs.

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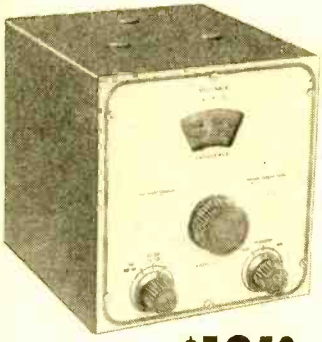
BENTON HARBOR 5, MICHIGAN

Heathkit ANTENNA impedance meter kit

Used in conjunction with a signal source, the Model AM-1 will enable you to measure RF impedance. Valuable in line matching, adjustment of beam and mobile antennas, etc. Will double as a phone monitor or relative field strength indicator. A 100 microampere meter is employed. Covers the impedance range from 0 to 600 ohms. An instrument of many uses for the amateur. Easily pays for itself through the jobs it will perform.

MODEL AM-1

$14.50 Shpg. Wt. 2 Lbs.



Heathkit

vfo

KIT

- ☆ 6AU6 electron-coupled oscillator.
- ☆ OA2 voltage regulator tube for stability.
- ☆ Smooth-acting illuminated dial.
- ☆ Easy to build and attractively styled.

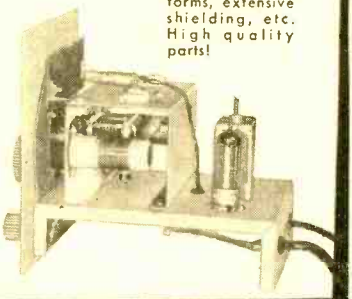
MODEL VF-1 **$19.50***

Shpg. Wt. 7 Lbs.

This variable frequency oscillator covers 160-80-40-15-11 and 10 meters with three basic oscillator frequencies. RF output is better than 10 volts average on fundamentals. Enjoy the convenience and flexibility of VFO operation at no more than the price of crystals. May be powered from a socket on the Heathkit Model AT-1 transmitter, or supplied with power from most transmitters.

Features illuminated and pre-calibrated dial scale. Cable and plug provided to fit crystal socket of any modern transmitter.

Extra features include copper-plated chassis, ceramic coil forms, extensive shielding, etc. High quality parts!



Heathkit CW amateur transmitter kit

SPECIFICATIONS:

RF Amplifier Power Input	25-30 watts
Output Connection	52 ohms
Band Coverage	80, 40, 20, 15, 11, 10 Meters
Tube Complement:	
5U4G	Rectifier
6AG7	Oscillator-Multiplier
6L6	Amplifier-Doubler

This CW transmitter is complete with its own power supply and covers 80, 40, 20, 15, 11, and 10 meters. Incorporates such outstanding features as key-click filter, line filter, copper plated chassis, pre-wound coils, and high quality components. Employs a 6AG7 oscillator, 6L6 final amplifier. Operates up to 30 watts plate power input.

MODEL AT-1 **$29.50***

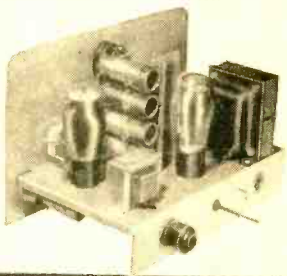
Shpg. Wt. 15 Lbs.

Single-knob band-switching for 80, 40, 20, 15, 11 and 10 meters.

Plate power input 25-30 watts.

Panel meter monitors final grid or plate current.

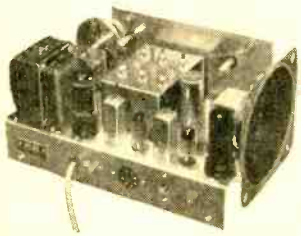
Best dollar-per-watt buy on the market.



Slide-rule dial-electrical band-spread-ham bands marked.

Slug-tuned coils and efficient IF transformers for good sensitivity and selectivity.

Transformer-operated power supply for safety and high efficiency.



Heathkit COMMUNICATIONS TYPE all band receiver kit

$27.95* MODEL AR-3

Shpg. Wt. 12 Lbs.

CABINET: Fabric-covered cabinet available. Includes aluminum panel, speaker grille, and protective rubber feet. Measures 12-1/4" W. x 6-3/4" H. x 7-3/4" D. No. 91-15. Shpg. Wt. 5 Lbs. $4.50.

The Model AR-3 covers from 550 kc to 30 mc on 4 bands. Covers foreign broadcast, radio hams, and other interesting short wave signals.

Features good sensitivity and selectivity. Separate RF and AF gain controls—noise limiter—AGC—VFO, headphone jack—5½" PM speaker and illuminated tuning dial.

SPECIFICATIONS:

Frequency Range	550 kc to 30 mc on four bands
Tube Complement	1—12BE6 oscillator and mixer
	1—12BA6 IF amplifier
	1—12AV6 second detector, AVC, first audio amplifier and reflex BFO
	1—12A6 beam power output
	1—5Y3 full wave rectifier

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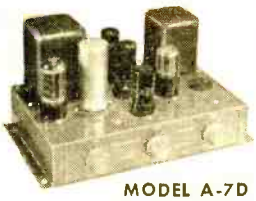
HEATHKIT ECONOMY 7-WATT HIGH FIDELITY



amplifier kit

MODEL A-7D

$16.95 Shpg. Wt.

This is a 7-watt high fidelity amplifier that will produce more than adequate output for normal home installations. Its frequency characteristics are ± 1½ db from 20 to 20,000 cps. Output transformer is tapped to match speakers of 4, 8, or 16 ohms. Separate bass and treble tone controls provided. Features potted transformers, push-pull output, and detailed construction manual for easy assembly.

MODEL A-7E: Provides a preamplifier stage with two switch-selected inputs and RIAA compensation for low-level cartridges. Preamplifier built on same chassis as main amplifier. Model A-7E. Shipping weight 10 lbs. **$18.50.**

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HEATHKIT BROADCAST BAND

receiver kit

MODEL BR-2

Shpg. Wt. 10 Lbs.

$17.50 Less Cabinet

You can build this table model radio and learn about radio circuit and parts during assembly. Complete instructions simplify construction, even for the beginner. Covers 550 to 1600 kc and features miniature tubes, 5½" PM speaker, and built-in antenna.

CABINET: Fabric-covered plywood cabinet as shown. Parts #91-9, shipping wt. 5 lbs. **$4.50**

HEATHKIT HIGH FIDELITY

fm tuner kit

MODEL FM-3

$24.50

Shpg. Wt. 7 Lbs.

Tunes from 88 to 108 megacycles and features sensitivity and selectivity not expected at this price level. Cabinet supplied with the kit. Built-in power supply and a stage of audio to insure adequate output. Easy to build from step-by-step instructions and large pictorial diagrams.

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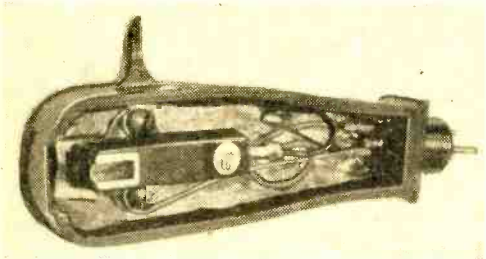
TIPS and TECHNIQUES

HUM IN PHONO PICKUP

Electrostatic hum develops sometimes in a phono system which uses a plastic tone arm and partially unshielded signal lead. Much, if not all, of this hum can be elim-



inated by lining the interior surface of the pickup end of the tone arm with heavy household aluminum foil, and then grounding the foil and the metal case or mounting of the cartridge to the braided shield of the pickup lead. —*F.H.T.*

NEW USE FOR OLD CONSOLE

Television sets and hi-fi equipment have relegated many an old console radio to the attic or junk-heap. With a little work, the cabinets of such sets can be re-done to provide a loudspeaker enclosure with a planter and lamp on top.

To make the planter, cut carefully just below the holes that formerly accommodated the control shafts of the old set. Form a pan of galvanized iron and trim its top edges with copper or brass strips so that it fits snugly into the opened top of the cabinet. In this pan you may install your plants and even the base of a home-designed lamp. And, if the rest of the unused area inside the cabinet is large enough, you can use it for mounting a hi-fi speaker. —*O.W.*

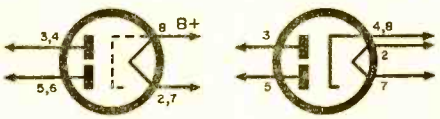
PORTABLE RADIO CHECKS DOORBELL

A portable radio set will pick up the pulses of radio frequency radiated by doorbell wires at the push button. If "hash" is heard in the portable when tuned to a weak station, you'll know that the bell or buzzer is working.

The idea is useful in repair of doorbells. There is no need to have someone upstairs inform the repairman if the bell or buzzer is functioning. The portable radio does the job, making the test for a working bell, buzzer, or door-opener a one-man proposition. —*J.A.McR.*

VERSATILE POWER TUBE SOCKETS

Different types of power tubes may be interchanged without revision in the filament voltage lines if the correct wiring is made at the tube socket. As many as 11 different types may be used on a 5-volt line. Wire together pins 5 and 6 to form one of the plate connections. Wire pins 3 and 4 for the other plate connection. Pin 8 serves as one side of the filament; pins 2 and 7—wired together—serve as the other side. The B-plus



5-VOLT TYPE 6-VOLT TYPE

lead to the filter system must always come off pin 8. A socket wired in this manner will accommodate the following tube types: 5AX4GT, 5AZ4, 5R4GY, 5T4, 5U4G, 5V4G, 5W4, 5X4G, 5Y3G, 5Y4G, and 5Z4.

For 6-volt rectifiers, pin 3 serves as one plate and pin 5 as the other. Pin 2 is one side of the filament and pin 7 the other. Wire pins 4 and 8 together to form the cathode take-off. Such a socket will accommodate tube types: 6AX5GT, 6AX6GT, 6W5G, and 6X5.

In either case, just remember that the rating of the tube used must not be exceeded. —*B.E.*

DO NOT COIL TV LEAD-IN

When installing the flat twin-lead which serves as the lead-in from your TV antenna, there is a great temptation to leave considerable slack at the set to permit moving the TV for service access or changing its location in the room. If such slack is rolled up into a coil, there is apt to be a pronounced reduction in picture brightness—due to the loss of signal strength resulting from coupling effects between the coil turns. A good rule is to leave only enough

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Nothing takes the place of practical experience. As part of N.R.I. Servicing Course you build AC-DC Radio Receiver and Vacuum Tube Voltmeter shown below. Use them to make tests, conduct experiments, get practical experience. All equipment yours to keep.

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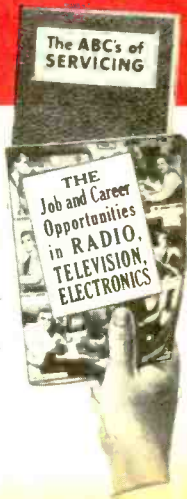

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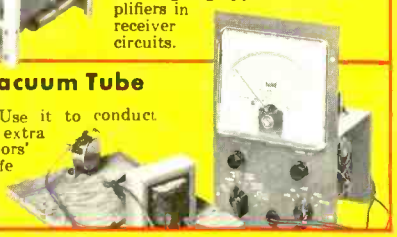

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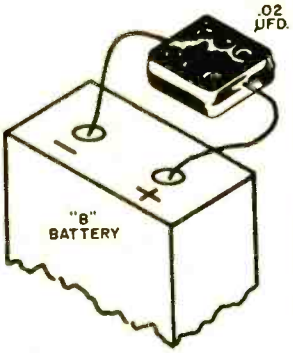
slack to permit moving the set a short distance, allowing the slack to hang uncoiled. If the set is to be relocated elsewhere in the room, it is no problem to splice on enough additional twin-lead as required. —*E.F.C.*

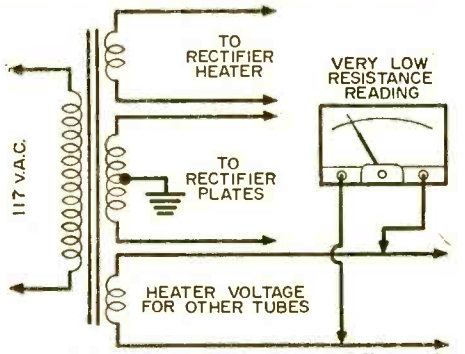
INCREASING B-BATTERY LIFE

A portable, dry-battery radio receiver may oscillate or howl as its batteries age. This condition is often due to the B battery's internal resistance, which increases quite rapidly as the battery nears the end of its useful life. The increased battery resistance permits positive feedback to occur across one or more of the receiver circuits. Frequently, in such cases, you can obtain a few more "howl-less" hours of operation from your receiver by connecting a .02-μfd. mica or ceramic capacitor across the B battery terminals. The same capacitor may work as well if a similar condition develops in a transistor receiver. —*F.H.T.*



DOUBLE-CHECK FILAMENTS

When checking filament circuits with an ohmmeter, don't let the low resistance of the power transformer filament winding mislead you into thinking the winding is shorted. This winding carries the relatively heavy filament or heater current, which may be a couple of amperes, and is therefore made with heavy wire. Also, the step-down ratio from the house 117-volt a.c. line to the low heater voltage requires only a few turns on this winding as compared



to the 117-volt winding. The small number of turns of heavy wire account for the very low resistance—which is often less than 1 ohm. —*E.F.C.*

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TOOLS and GADGETS

HOLE-SAW WITH SLUG-EJECTOR

Up to seven sizes of circular holes can be cut with the "Arco Hole-Saw," which features an automatic "slug-ejector." Powered by any electric drill, drill press, lathe or motor, it is said to cut perfect holes in wood, wallboard, plastics, sheet metal, etc. The exclusive automatic slug-ejector pops

out discs immediately, considerably decreasing working time.

No. 650, which retails at $6.50, cuts 1", 1¼", 1½", 1¾", 2", 2¼" and 2½" holes through any ¾" stock. The seven circular saw blades slip into grooves of tool head and are easily exchanged; a safety lock screw prevents blades from "jumping out." No. 600 ($4.95) cuts 1", 1½", 2" and 2½" holes. (*Arrow Metal Products Co.*, 140 West Broadway, New York 13, N. Y.)

TV BIAS SUPPLY

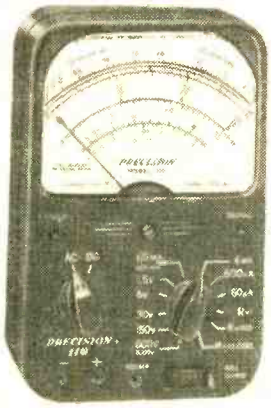
Providing any voltage from 0 to 18, either positive or negative, the "Align-o-Pak" Model BE3 TV bias supply is an im-

proved version of the Model BE2—which provided only 10 volts. The BE3 was designed to include high voltages recommended by some TV manufacturers on

current TV sets and also for some color receivers. (*Service Instruments Co.*, 171 Official Rd., Addison, Ill.)

POCKET-SIZE VOM

Compact enough to fit into a technician's pocket or tube-caddy, the Model 110 VOM combines full-range instrument performance with small-size instrument convenience. This handy 20,000 ohms-per-volt multimeter—which measures only 1 11/16"x3 1/2"x5 3/8"—provides six d.c. and a.c. voltage ranges, five d.c. current and three resistance and six db ranges.



Very flexible voltage measurements are possible due to extra low (1.5 volts, full scale) and extra high (3000 volts, full scale) voltage ranges. Current ranges up to 600 ma. and decibel ranges from −20 to +70 are also available. $32.50, net. (*Precision Apparatus Company, Inc.*, 70-31 84th St., Glendale 27, L. I., N. Y.)

TV AND RADIO TUBE TESTER

Most radio and TV set failures are due to burned-out tubes. The new Teleclear tube tester will automatically check all TV and radio tubes. Operating on 110 volts a.c. or d.c., it is safe, quick and easy to use. Just plug the tube into one of the sockets provided and the neon lamp will indicate its condition instantly.

In addition, this tester performs over 1000 electrical tests. It checks appliances, fuses, light or flash bulbs, wires, motors, resistors, etc. It can also be used to check line or other voltages, as a voltage indicator. Retailing for $2.95, the Teleclear tube tester comes in a shockproof metal case. (*Teleclear Company*, 25 Willett St., New York 2, N. Y.)

—30—

Sound Impressions

(*Continued from page* 71)

but at the same time perk up your ears and wake your mind.

Classical Pipings. Columbia's record of *The Philadelphia Woodwind Quintet* (ML-5093) features flute, oboe, clarinet, bassoon and French horn in pieces specifically written for this combination.

One side contains works by composers of the past (Haydn and Beethoven); the other side is devoted to moderns like Hindemith and Ibert having a resounding romp among the tootling reeds. This lets the listener trace the evolution of woodwind writing from Haydn's simple band style to Ibert's sophisticated tricks and sensuous harmonies and Hindemith's urbane, yet warm and fun-filled modernism. In a sense, this is chamber music—the clever interplay of just a few instruments. But the woodwinds lend it pungency and bounce, far different from the sound of the usual strings.

The playing makes it quite clear why many listeners consider the woodwind section of the Philadelphia orchestra the finest in the world. The fidelity of this record matches the excellence of the performance. Each instrument stands out clearly, yet they all blend as a group. The "presence" is amazing.

Winds also blow at the hi-fi mikes in the jazzy regions of music. *Shifting Winds* by Bob Cooper and Jimmy Giuffre waft over both sonorous sides of Capitol T-6531. Here the reeds stir in a brisk breeze of jazz improvisation but seem at their best in the becalmed interlude on Band 3 of Side 1, called *'Round Midnight*. The recording is as lively and smooth as the music.

An American in Blue. George Gershwin's *Rhapsody in Blue,* and *An American*

RECORDS REVIEWED

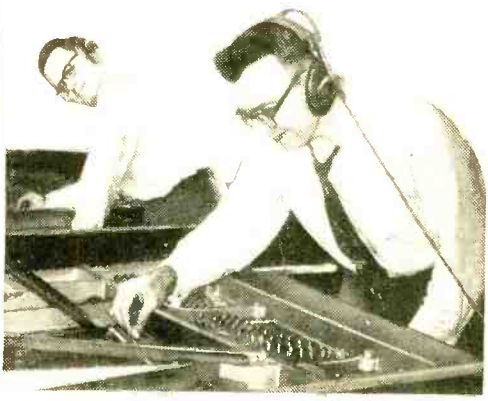
Music of Alec Wilder
Columbia CL-884
Philadelphia Woodwind Quintet
Columbia ML-5093
Shifting Winds
Capitol T-6531
Gershwin: An American in Paris
Rhapsody in Blue
Capitol P-8343
Soundproof
Westminster 6014
Folk Songs of the Old World
Capitol PBR-8345
Delibes: Coppelia
Sylvia
Victor LM-1913
Westminster XWN-18241
Music for Barefoot Ballerinas
Decca DL-8034

in Paris have been recorded so often, and have so much in common, that the listener is apt to blend the two titles into one lazy phrase, such as the heading of this paragraph. Actually, the two compositions are two sides of the same record (Capitol P-8343) and very nearly two sides of the same coin. The "Rhapsody" was the first important American work which used jazz in a full-blown "classical" form.

An American in Paris continued this development. In both works, the composer throws together a rich assortment of melodies, rhythms, and harmonies. Ingenious blends of solo instrument passages with full orchestral choirs produce constantly changing musical patterns — rich in color and irresistible in their rhythm and sweep. From a strictly personal standpoint, the "Rhapsody" represents Gershwin voicing the restless energy — touched with the blues — that was so typical a part of American life in the hip-flask and beaver-coat era. The American then goes abroad and races about Paris — only to wind up with the same restless sadness — or is it nostalgia for the familiar places of his own land? However, even his homesick blues have plenty of bounce, coming from Gershwin's snappy pen.

The performance by Felix Slatkin — conducting the Hollywood Bowl Symphony Orchestra with Leonard Pennario as piano soloist — is truly great. Both sides are breathtaking examples of modern hi-fi recording, with excellent presence and realism. If you like the feeling of the orchestra "coming at you," play this record with your system wide open. Then step back to the far end of the room and hang on!

Searching for Sound. That's exactly what the two gentlemen below are doing. Expert pianists Ferrante and Teicher have discovered new ways of doctoring up instruments to give out bongs, clonks, pings and quivers like nothing on earth—a fact intimated by the flying saucer on the record cover. Old favorites like "Green-



sleeves" take on more spectacular hues and a tonal picture of "Man from Mars" shows the sonic climate of that planet most conducive to hi-fi. Brilliantly played, these tonal phantasies are resoundingly engraved from seventeen microphone channels on *"Soundproof,"* Westminster Record 6014.

Folk Songs á la Carte. A new album of folk songs, recorded by the Roger Wagner Chorale (*Folk Songs of the Old World,* Capitol PBR-8345) samples songs from England, Ireland, Spain, Italy, France, Germany and the Scandinavian countries. Most of the selections are fairly familiar; a few are rarely heard but are certainly worthy of being recorded.

As a selection of representative folk songs "of the old world," the album raises a serious question: why the omission of any selections from the rich and tuneful storehouse of music from the Slavic and Central-European countries? Then too, the slick arrangements, the unnecessary and obtrusive drums and trumpets, the gaudy slides and swoops in the singing, the overtheatrical tricks with tempo . . . all add up to a very un-folksy way of doing folk songs.

As far as simple, down-to-earth folk-singing is concerned, this album definitely missed the boat. Instead, it provides another vehicle – a sort of parade float, pretties up and bedecked with artificial flowers. It will probably take many listeners for a very enjoyable ride, providing they like slick arrangements.

As for the recording itself, it is a brilliant hi-fi job. The ensemble effect of the singing group is amazing. All parts are clearly discernible and yet blend very neatly. The words are understandable, even on first hearing. From a purely vocal standpoint, the effect is gratifying; much range and rich sonic effects are achieved by Roger Wagner as he makes of the folk songs showpieces for demonstrating the mettle of his group and the marvels of hi-fi.

Dancing—Public and Private. Thanks to the spate of musical comedies lately from Broadway and Hollywood, ballet dancing has become a popular art. Unlike other indoor sports, ballet demands physical prowess superior to that involved in most outdoor activities. For most of us, ballet therefore remains a spectator game. Hi-fi fans, who would just as soon listen as look, can now get both of Leon Delibes' top-notch ballets, *Sylvia* and *Coppelia,* served on a single platter. Here is a flood of easy melody to tingle your ears and tickle your toes. For all its charm and delicacy, this is old-fashioned music of solid

beat, ringing harmony, and waltz-time swirls that won't let you sit down.

Victor LM-1913 offers a polished performance by the Boston Symphony under Pierre Monteux, an old and skilled hand with ballet music. He evidently feels this music in his bones and gets the feeling across to the orchestra. The Westminster version (XWN-18241) outshines the Victor with glowing, rich sound — but conductor Adrian Boult seems just a trifle ponderous for this lightweight score. Both records are good . . . their difference gives you a choice between sound and spirit.

From the footlights and the ballet stage, Decca DL 8034 takes us to another kind of dancing. *Music for Barefoot Ballerinas* is a modern jazz-like tone poem for and about would-be dancers. On the jacket, the composer tells for whom he wrote the music.

"The Barefoot Ballerina lives in a small apartment in the city and pinches her dreams of glory between her thumb and her forefinger as she hurries to and from a job, making way stops among a thousand distractions as she goes. . . . But somewhere in her day, the need to break through the routine of her life comes upon her, and she dances by herself, creating that which she may never have learned in a formal lesson, improvising and mimicking. She is without inhibition, usually alone. It is for her that *Music for Barefoot Ballerinas* was primarily composed."

Yet these unpretentious orchestral impressions will please not only the barefoot ballerinas, but hi-fi fans as well, for Larry Elgart's expert saxophone playing is set against a clever orchestral arrangement, ideal for showing off today's sound. —30—

After Class

(*Continued from page 77*)

adapted. Let's see what some of these are.

An arrangement wherein a thermistor is connected in series with a voltage source, a variable or fixed resistance, and a relay makes up a fire alarm or other temperature relay control. The significance of the ratings in the manufacturer's data book are best explained by referring to Fig. 2 (page 77) and the text which follows. Here are the ratings for the 51R2 (tolerances are omitted for simplicity).

R_o @ 25° C.....100,000 ohms
Dissipation constant.2.5 mw. per ° C
Time constant.....20 seconds
R_o @ 0° C/R_o @ 50° C.....9.1

Nominal resistance (R_o). This is the nominal resistance of the thermistor at 25° C (77° F). It is the basis from which all circuit plans start and may be called the

reference value at "room temperature."

Dissipation constant. This refers to self-heating action. To raise the temperature of a 51R2 thermistor from, say, 50° to 51° C, the current flowing in it would have to be increased. The increment would have to be such as to cause 2.5 more milliwatts to be dissipated at the new temperature. Dissipation constants are very dependent upon the type of mounting and the surrounding medium.

Consider a thermistor for which the dissipation constant is specified as 2.5 mw./° C when the thermistor is suspended by its leads in still air. If it is to be used as a thermometer which must have a maximum error of ½° C, then the maximum power in the thermistor must be limited to 1.25 mw. ($2.5 \times ½ = 1.25$). This limitation is required since the thermistor will self-heat by ½° C when subjected to still air environment while the self-heating in moving air or liquid may be negligible.

Time constant. There is a lag between the time that a current increase occurs and the time that the thermistor reaches the final temperature for the new current. The heating and cooling curves are so similar to those which apply to the charging of a capacitor through a resistor that we can use one as an analogy for the other. The *RC* time constant tells us how long it takes a given capacitor to charge to 63% of the full voltage through a specific resistor. Similarly, the thermistor time constant specifies the number of seconds required for the thermistor to attain 63% of the rise in temperature it will undergo as a result of the new current. In the case of the 51R2, the time constant is 20 seconds.

Assume that a 51R2 is self-heated to 30° C and a current increase is initiated which will cause the thermistor temperature to go to 40° C, given sufficient time. It will take the thermistor 20 seconds to cover 6.3° C, i.e., 63% of the 10° C increase. Therefore, at the end of the time constant period of 20 seconds, the 51R2 will have reached a temperature of 30° + 6.3° or 36.3° C.

Essentially, both the dissipation constant and the time constant depend upon how rapidly the thermistor can absorb heat from and liberate heat to its surroundings. Altering the mass of the thermistor affects both; i.e., if the mass is increased, the dissipation constant is increased and a larger time constant results.

Temperature-resistance ratio (R_t @ 0° C/R_t @ 50° C. This ratio provides information related to the resistance variation which may be expected for a given thermistor as its temperature changes. For the 51R2, the resistance at 0° C is 9.1 times

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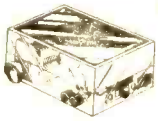

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greater than the resistance at 50° C. This constant is an indication of the sensitivity of the thermistor to ambient temperature variations.

Determining Resistance. Although there are mathematical tools available which enable engineers to determine the resistance of a thermistor at any temperature, the formulas are too complicated to be given here. From a data table supplied by the manufacturer, however, any thermistor may be calibrated by means of a curve such as that of Fig. 3. With it, we can find the resistance of the 51R2 at any temperature between 0° C and 50° C (32° F to 122° F), a very useful range indeed.

As a check, note that the curve shows the resistance of the thermistor to be 100,000 ohms at 25° C, which agrees with the nominal rating R_o given previously. Note also that the resistance at 0° C is 327,000 ohms and that at 50° C it is approximately 36,000 ohms. This verifies the temperature-resistance ratio of 9.1 ($36{,}000 \times 9.1 = 327{,}000$ ohms).

A number of practical thermistor circuits and designs will be presented in *After Class* in a forthcoming issue. Devices using thermistors were described in "Safeguard Your Home with a Thermistor Fire Alarm" (March, 1956, issue of POP'tronics) and "Make Your Own Electronic Thermometer" (April, 1956). Look for an article on a "Thermistor Anemometer" scheduled to appear in the near future. —30—

Long-Wave DX'er

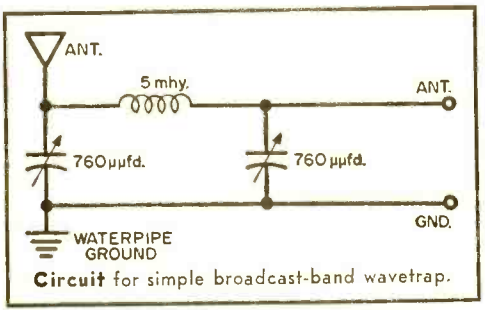
(*Continued from page* 69)

on the back of the chassis accommodates the antenna and ground connections.

Adjustment and Operation. Plug the power cord into a 117-volt a.c. outlet, and plug a set of headphones into the headphone jack. Turn on the power switch. Set the volume control at maximum. A slight hum will be heard for a second or two, and will fade out and become inaudible as the tube comes up to operating temperature.

As soon as the slight hum has disappeared, you may check the regeneration control by rotating it back and forth. A soft "plop" should be heard in the headphones at a setting of the control where the receiver goes into or comes out of oscillation. If the "plop" is not heard at any setting of the regeneration control, turn off the power and reverse the two tickler lead connections.

With the detector oscillating weakly, and the antenna connected, rotate the tuning dial. As soon as you hit upon a station, rotate the tickler coil slightly away from the tuning coil. If you have tuned in a



Circuit for simple broadcast-band wavetrap.

c.w. station, backing off the regeneration control should cause the audio tone to disappear—indicating that the receiver has stopped oscillating. Advancing the control slightly will bring the audio tone back again. Some stations will come in more clearly when the detector is not oscillating—these are modulated c.w. stations. Try to keep the detector barely oscillating when you are tuning for weak stations, for this is its most sensitive condition.

One of the problems you may run into while using this or any other simple receiver on the long waves is picking up a strong nearby broadcast station. Such a station cannot be actually tuned in on the receiver. In fact, it may occupy half the tuning range. The best way to get rid of it is to insert a broadcast-band wavetrap in your antenna lead, a circuit for which is shown in the diagram on this page. Adjust the tuning capacitors in the trap until the broadcast station comes in at the lowest level or not at all. —30—

Electronic Election Bet

(*Continued from page* 40)

unlike the machine, can transmute numbers into meaning.

Political scientists and mathematicians have long known that elections in the United States usually follow certain definite patterns, and that these patterns can be expressed mathematically. But the arithmetic involved is so vast and complex that no human being could work out the equations fast enough to get ahead of the actual vote count. Fast figuring, rather than any political understanding, gives computers a margin over man.

The Fast Shuffle. Within its vast electronic memory (see POPULAR ELECTRONICS, August 1956), Univac stores a complete analysis of voting behavior all the way back to 1928. On election night, these vast stores of historical data are mixed in the Univac with red-hot news pouring in on the press wires and juggled together in the strict order of statistical method. The machine compares the early returns, precinct

by precinct, with the patterns of the past. It weighs in variables, such as splinter trends, Dixiecrats and Independents, constantly checking them against the 15 million items of information stored in its magnetic memory.

In this fast shuffle, the computer completes about 2000 calculations per second. Every time it spots a lead of one party in any given precinct, it goes on to figure out whether the difference is small enough to fall within the limits of chance, or big enough to foretell a significant trend. In other words, it works out the odds by which the candidate with the early lead would go on to win the state.

From the state odds, Univac then switches to compute the presidential odds on the basis of the 531 electoral votes. Mathematically this is done by means of a "531-degree polynomial." By ordinary methods, this calculation takes at least two weeks to complete. Univac clacks out the answer in just six minutes. First it reports the number of states for each candidate, then the electoral and popular votes, and finally the odds in favor of the candidate expected to win. Then it goes on to cover the Congressional contest in the same way, state by state.

Univac's forecast is the best and fastest guess possible within the margin of that proud unpredictability which is part of human nature. Fortunately, our democratic freedom always leaves a loophole through which sheer human mugwumpery may randomly assert itself to the consternation of all machines, political or electronic. —30—

A Beam and Tower

(*Continued from page* 79)

quarter-kilowatt. A simple two-element beam that may be fed with a 52-ohm coaxial transmission line is shown in Fig. 2. The antenna is pretuned for the Novice band, but will operate properly over the entire 21-mc. band. It should be used for reception as well as transmission, since there is a reduction of QRM from the back of the beam.

The antenna element is split in the middle, and fed with a quarter-wave section of 75-ohm balanced transmission line. Connect the bottom of this line to a balancing transformer (balun), and also to the 52-ohm coaxial line going to the transmitter. The purpose of the quarter-wave section and the balun is to match the unbalanced 52-ohm line impedance to the load of 20 ohms presented by the parasitic beam antenna.

Figure 3 shows the antenna assembly. The elements are made of 10' sections of electrician's aluminum conduit, known as "EMT

conduit." This material may be obtained at any electrical supply house. Each element is made of a 10′ piece of ¾″ conduit, and has 5′ tips of ½″ aluminum conduit in each end. An overlap of about six inches at each joint is required. Place a short length of scrap ⅜″ aluminum tubing in each tip to bring the elements to the required length. Each joint should be shimmed with small pieces of aluminum until a tight fit is obtained, then a hole drilled through the joint and a bolt passed through the hole to draw the joint tight. When the antenna element is finished, it is cut in two at the center. Finally, give each element a coat of aluminum paint to prevent rust and corrosion.

Make the supporting boom of the antenna from a 7′ section of steel TV mast, obtainable at any large TV or radio supply house. The director element and antenna are supported on the boom by means of gusset plates cut from ½″-thick plywood. The director plate measures about a foot on a side, and the antenna plate is sixteen inches on a side. Give the plywood plates a good coat of house paint to prevent moisture from creeping in between the surfaces of the wood. Attach the director to the mounting plate by means of two TV-type "U-bolts." Then attach the plate to the boom with the same type of bolts. No electrical connection should be made between the director and the metal boom.

Four U-bolts are required to attach the antenna to its mounting plates. Use two bolts for each half of the element, allowing a 1″ gap between the centers of the two halves. No electrical connection should be made between the halves of the antenna and the supporting boom.

Attach the quarter-wave 75-ohm section to the centers of the antenna by means of bolts passed through holes drilled in the elements. Solder the balun terminals to the bottom of the 75-ohm line, coil up the balun and tape it to the supporting boom of the antenna. The quarter-wave section is allowed to droop beneath the antenna. Make sure that no antenna connections touch the boom of the antenna or the vertical supporting pipe.

As a last step, attach the 52-ohm transmission line, as shown in Fig. 2. The antenna may now be carried up the tower, and attached to the vertical supporting pipe by means of a third gusset plate, made of heavy galvanized iron. This material can be obtained

Bill of Materials for Tower

2—20′ pieces of 2″ x 6″ clear, knot-free #1 Douglas Fir or equivalent lumber—cut each piece lengthwise to form two 2″ x 3″ pieces
7—12′ pieces of 1″ x 4″ clear #1 Douglas Fir or equivalent lumber for cross braces
1—6′ piece of 4″ x 4″ redwood, or "creosoted" lumber for foundation—cut into two 3′ pieces
2—Pounds of "sixteen penny" cement-coated nails
1—1″-i.d. water pipe (enough to make up 30′ of pipe) with couplings and pipe flange
1—4′ length of ½″ water pipe
1—1½″-diameter ball (approx.) from old ball bearing
16—⅜″ iron bolts, 5½″ long, with washers and nuts
Misc. guy wire, egg insulators, paint

Bill of Materials for Antenna

2—10′ lengths of ¾″ electrician's EMT aluminum tubing
2—10′ lengths of ½″ electrician's EMT aluminum tubing
1—10′ length of ⅜″-diameter aluminum tubing—cut into four pieces for element tips
1—7′ section of 1½″-diameter steel TV mast
3—Gusset plates (see A, B, and C in Fig. 3)
14—TV-type U-bolts
1—9′ section of 75-ohm heavy-duty twin lead—cut to 8′6″ and trim each end 1½″ clear (Amphenol 14-023 or equivalent)
1—16′ section of 52-ohm coaxial line—cut to 15′10″, and trim each end 2″ clear (RG-8/U line or equal)
1—52-ohm coaxial line to transmitter (any length)

at any sheet metal shop. Use four U-bolts at this joint, two on the boom, and two on the supporting pipe, making a good electrical connection between the boom and the vertical pipe.

"Heck!" said Jimmy, *"that sounds easy enough. Am I going to have any trouble getting it loaded?"*

"Not particularly," I replied, *"although you should keep in mind that sometimes cutting off a foot or so of the coaxial cable may help if things get rough. If you have any problems, give me a call. And by the way, after you've tested out the beam, let's kick around the idea of a better transmitter for you."* —30—

Tricked-up Cathode Rays

(*Continued from page* 45)

bring out the subtler details, the Tonotron gives the pilot enough time for careful study of what he sees on the screen."

Pictures by Phone. The most revolutionary aspect of the new Tonotron is its ability to receive TV-type pictures over ordinary telephone lines instead of complex and costly broadband channels. It is one of the basic facts of electronics that a fast sequence of signals spreads out over a greater bandwith than a slow sequence of signals. This is the reason why, in radio, a wide r.f. frequency band is required to transmit the fast vibrations of high notes. It also explains why television, where the scanning beam follows very rapid pulses, needs a very broad frequency band of 4 megacycles per channel for clear transmission of these pulses.

Now the Tonotron, with its ability to "hold" the picture, makes it unnecessary for the scanning beam to retrace the picture pattern quite so rapidly. This means that the control pulses don't have to follow one another so closely. Consequently, one can get by with much narrower transmission bandwidth.

Of course, rapid motion is blurred on pictures that are "held" on the tube for relatively long time spans. Despite this limitation, however, the possibility of narrow-band TV transmission over ordinary telephone or radio channels has many potential uses. Navigation charts, weather maps or graphs can be flashed from shore to ship or ground to aircraft by means of already existing voice-radio transmitters and receivers. Most important, early warning radars at distant outposts can transmit a picture of their sky sector over ordinary telephone lines to centrally located defense headquarters. The whole sky area surrounding the North American continent can thus be "drawn together" for observation from a single point.

Writing Rays. Once the cathode ray knew how to remember, it became possible to teach it the alphabet. Realizing that electronic brains are now getting so smart that they might insist on having things put in writing, Stromberg Carlson taught their new cathode-ray tubes how to spell. The result is the Charactron, which writes on its own screen just like human beings write on a blackboard.

The Charactron owes its literacy to a small disc intercepting the electrons as they stream out of the electron gun mounted in the long, slender neck of this huge tube. The center of the disc is perforated with tiny letters, numerals, and other symbols to be written on the tube screen. No letter is larger than 12/1000th of an inch. As the electron beam passes through these perforations, it is shaped into the form of a letter, which is then projected on the screen. The beam is guided by the control signals to pick out the proper letters, one at a time. But since the tube is able to "remember" what letters have come before, it holds the image of the letter sequence until the entire message is spelled out on the screen. When the information is no longer needed, another sweep of electrons, like a sponge on a blackboard, erases the

"Letter disc" is inserted into the neck of the Stromberg-Carlson Charactron. Tiny perforations in disc project alphabet letters on the tube screen.

writing and clears the tube face for the next message.

In fact, the tube was originally designed to replace a sort of "blackboard"; namely, the transparent plotting board on which Air Defense officers mark the location and movement of aircraft. Prior to the invention of the new writing tube, the defense coordinator received information by radar or telephone and then marked the board with grease pencil. But this manual plotting method proved too slow for keeping track of jet planes capable of outrunning their own noise. Besides, the plotting officer had to assimilate information from several sources at once, thus increasing the chance of a fatal human error. The Charactron writing tube replaces the slow and fallible human link in the chain between the source of information and its display.

The cathode ray, nimble servant of a thousand tasks, has extended the range of the human senses and hence of human knowledge further than any other instrument in the history of science. Not even the microscope in the three centuries of its use has contributed so much to so many fields of inquiry. In our time, the cathode ray is perhaps the chief exploratory tool of science. Its probing beacon casts the first light into the waiting darkness beyond the present frontier of knowledge. Now, with memory and the skill of writing added to its traditional accomplishments, the cathode ray is really "on the beam." —30—

Transistor Topics

(*Continued from page* 58)

From Lafayette Radio (100 Sixth Ave., New York 13, N. Y.) comes news of the "world's smallest" *shielded* i.f. transformers. These units measure only ⅜" square by 9/16" high. Catalog numbers are MS-340 for the first and second i.f. units, MS-341 for the third i.f. transformer. An oscillator coil, to match Argonne's famous "Poly-Vari-Con" subminiature variable capacitor, is available as item No. MS-342.

Also from Lafayette comes news of a new four-transistor superhet receiver kit designed for earphone operation—their Catalog No. KT-94. Available as accessories are a leather carrying case (MS-311) and a Class B push-pull audio amplifier and speaker kit (KT-96). The KT-94 and KT-96, together, form a six-transistor loudspeaker-operated receiver.

From J. W. Miller Company, 5917 South Main St., Los Angeles 3, Calif., there has been an announcement of a whole line of transistor coils and i.f. transformers, including six different antenna coils, four i.f. transformers, three oscillator coils, and

two miniature variable capacitors. For details, write and ask for Catalog Sheet No. 2000 5M Fed. 7-56 . . . or check with your regular distributor.

Do you have trouble finding small resistors to match your other subminiature components? You can get a whole "kit" of around ninety (90) subminiature resistors at no more than you'd pay for a couple of transistors from Wholesale Radio Parts Co., Inc., 311 W. Baltimore St., Baltimore 1, Md. These resistors are but a fraction of the size of regular ½-watt units. For full specs, price info, etc., write directly to them and mention this column.

A new technique for the mass production of u.h.f. transistors has been announced by the Philco Corporation. Two new types of transistors, a *micro-alloy transistor* (MAT) and a *surface barrier diffused transistor* (SBDT) are now in engineering development. The MAT transistor is reported to be at least ten times faster than the fastest vacuum tube in electronic computers. The SBDT transistor operates in the 500-mc. range, but will probably find its widest use in the 20 to 200 mc. range.

That's it for now, fellows . . . see you next month.

Lou

The Transmitting Tower

(*Continued from page* 83)

ance, and cost ($13.95), the Knight "Space Spanner" kit is an excellent doorway for anyone who wishes to get started in short-wave radio in easy steps.

As a broadcast receiver, the "Space Spanner" leaves little to be desired; therefore, when it is replaced by a more versatile short-wave receiver, it will still give many hours of service on the broadcast band.

News and Views

Since getting a new DX-35 transmitter and adding a Q-Multiplier to his receiver, **George, K2MBU,** (N.Y.), has brought his states-worked total up to 29 from his home location and up to 20 from his vacation site. . . . **Gary, KN9BNJ,** (Ind.), who for the first six months of his license term had a DX record of seven miles, is now able to work the east coast. . . . **Dave, KN2RSM,** (N.Y.), sticks to 40 meters, where his AT-1 feeds a 100' "long wire" through an AC-1 antenna coupler for a record of 24 states worked, with 16 confirmed. . . . **Gerry** (13), **KNØGPX,** (Minn.), uses a Johnson Adventurer transmitter to feed a 20' folded dipole antenna. His receiver is an SX-71, and he has made 36 contacts in eight states.

Ernie, VE3EGG, (16), (Ontario, Canada), has made 50 contacts in 17 states on 40 meters in the six weeks he has had his license. Ernie

uses a home-built 25-watt transmitter, a ½-wave antenna, and an S-38C receiver. One thing that amazes him is how American Novices can make so many contacts in the crowded Novice bands. . . . **Phil, K5BTW,** (Texas), has graduated from the ten-watter with which he started his ham career to a DX-100, an NC-98 receiver, and a choice of three antennas—a 33′ vertical, a "long wire," and a 3-el, 10-meter beam. His record adds up to 43 states worked, three Canadian provinces, Colombia, and Puerto Rico. . . . **Dick, K4DDB,** after being on 40-meter c.w. exclusively, built a modulator for his AT-1 transmitter and tried 10- and 40-meter phone for a while, but he is back on c.w. again—20 meters this time, where he has recently worked Mexico and several Canadian stations.

In three months of operation, the Knight 50-watt transmitter and the ARC-5 receiver of **Rex, KN4JBJ,** have worked 30 states in all call areas. He is now gunning for Canada and Hawaii. . . . **Bert, WN1IHN,** (Maine), runs 12 watts to a single 6L6 feeding a 60′ length of wire thrown out of the radio shack window. Best DX worked is Georgia and Michigan on 40 meters.

Bernie, KN8BVB, pushes his Globe Scout transmitter to 65 watts input to excite his "Windom" antenna. It took him five days to figure out the proper way to connect his balun coils between the transmitter and the antenna feed line, but then VE3DKQ answered his first *CQ*. . . . **Lou, KN2SZR,** (N.Y.), called for a month after getting on the air without making a single contact because of a poor antenna and insufficient knowledge of how to operate his equipment. In the six months since then, his AT-1 transmitter, AC-1 antenna coupler, and 135′ antenna, plus an old EC-1 receiver (somewhat similar to the present-day S-38 series), have accounted for 15 states.

Helen, W9MXI, one of the first to submit news to the *Transmitting Tower,* is the new president of Chicago YLRL, Inc., and the compiler of an excellently prepared brochure for the information of Chicago YLRL members. . . . Bugs in his equipment prevented **Bill, KN2SLL,** from making many contacts with his Novice license, but he has them ironed out now. Bill sports a 10-wpm code certificate and is waiting for the 15-wpm one to arrive. He is just about ready for his General exam.

Foreign Notes. **Ben Gomboa** (19), Philippine Islands, says reading the *Transmitting Tower* helped him pass the Philippine Commercial Radio Operator examination. He plans to build his own amateur equipment, starting with a one-tube receiver, and has been haunting the Manila radio stores, looking for 80- and 40-meter crystals—without success. . . . In Montevideo, Uruguay, **Jose A. Blanco** has finished building a 14-tube ham receiver and is now working on his 40-watt transmitter. The cost of higher power is prohibitive. He reports that Q-Multipliers are very popular among South American amateurs. . . . **T/Sgt. Wm. Cooper** first heard of amateur radio in the Philippines when he was "phone-patched" to his father in Illinois. Now stationed in Spain, the bug has really bitten, and he is going all out to get his own station.

Boris, VP2LB, started his amateur career using a "guess-timated" power of 15 watts to a

2E26 modulated with a 6N7. When the plate of the 2E26 got red, he reduced the voltage. His modulation transformer was a small power transformer. The antenna was 18' high and the receiver was a Phillips, which worked okay on 40 meters, but always brought in several stations at once. In two months, this lash-up accounted for Puerto Rico, Virgin Islands, Montserrat, Antigua, Barbados, Grenada, Trinidad, Venezuela, British Guiana, and Curacao. Now in Trinidad, Boris is operating at VP4LT until he can get his own station going.

Low-Power Work. Using the "Sandwich Box" transmitter (10 watts) described in P.E. for March, 1956, **Jim, WN3GQT,** has worked 28 states in four weeks on the air using 40 meters. . . . **Dub, W4IHA,** uses the same type of transmitter, which he powers from the "accessory" socket on his AR-3 receiver. In ten weeks, he has worked 50 stations in 18 states, getting many 589/599 reports.

BFO Substitute. **Art Fregau,** (Conn.), reports that by placing an ordinary broadcast receiver on top of the old Sparton "all-band" receiver he uses to SWL, he can receive code signals by carefully tuning the broadcast receiver dial until a harmonic of its oscillator beats with the incoming code signals, to produce audible dots and dashes instead of just "thumps" from the loudspeaker.

Help Offered. **Gerry Parker** (13), **KNØGPX,** Barnesville, Minn., **M. F. "Skip" Nelson, W2ESQ,** 21 Knollwood Ave., Madison, N.J., and **Nathan J. Schulman** (19), 78 Atkins Ave., Brooklyn 8, N.Y., offer to help prospective amateurs qualify for their licenses.

Addresses of "News and Views" Contributors: **K2MBU,** Saw Mill R. Rd., Yonkers, N.Y.; **VE3EGG,** 64 Barrie St., Galt, Ontario, Canada; **K5BTW,** 3134 Harlandale Ave., Dallas 16, Texas; **K4DDB,** 1664 Spring Hill Ave., Mobile, Ala.; **KN4JBJ,** 403 East College St., Griffin, Ga.; **KN8BVB,** 351 Willaman St., North Canton, Ohio; **KN2SZR,** 11 Ford Hill, Deposit, N.Y.; **WN1IHN,** Park St., Lisbon, Me.; **KN2SLL,** Rt. 2, Box 216, Farmingdale, N.J.; **Ben Gamboa,** Calapan, Or. Mindoro, Philippines; **Jose A. Blanco,** C/O U.S. Rubber International Corp., Cerro Largo #766-68, Montevideo, Uruguay, S.A.; **VP2LB,** I.C.T.A., St. Augustine, Trinidad, B.W.I.; **WN3GQT,** Box 399, Aliquippa, Pa.

Until next month, 73,

Herb, W9EGQ

Tuning the Short-Wave Bands

(*Continued from page* 91)

on the ultra-high frequencies, the space satellites to be sent aloft next year to travel around the earth will be equipped with transmitters of about 10-milliwatt power operating on 108,000 mc. Our thanks to Stewart West for this information.

Current Reports

Here is a resume of the latest reports received by your Editor. Our apologies to all who do not find their reports printed. Please understand that our mail is very heavy and the column just a certain length. Please continue sending reports in, and sooner or later

yours will appear. All times listed are Eastern Standard, using the 24-hour system.

Australia—One of the lesser-heard stations is VLW9, a regional domestic station in Perth. This one can be heard on 9610 kc. with Eng. at 0845-1030 s/off. Music, popular and classical, and variety programs are featured. (*BV*)

Belgian Congo—*Radio Congo Belge*, Leopoldville, 9380 kc., usually has a good signal with popular and variety music at 0020-0100. News in French follows the ID at 0100. (*BV*)

Bolivia—CP5, *Radio Illimani*, La Paz, is now heard on 9555 kc. from 0600 s/on until 0700 fade-out. It is also on at 1900-2200 but heavy QRM usually mars reception. (*RL, DX*)

Brazil—*Radio Ministerio da Eduacacao* is again active on 17,875 kc. and can be heard after Cologne goes off at 0800. It apparently does not operate during the evening. *Radio Nove de Julho*, Sao Paulo, is a new station on 11,855 kc. and is noted at 1900-2100 with programs in Portuguese. (*RL*)

Two other new stations are *Radio Capacabana*, 4960A kc., with a program in German at 1700-1730, and *Radio Alanguara* on 5035 kc. No other details on either as yet. (*DX*)

Canada—Readers will recall that the Canadian heard a few months ago on 7920 kc. turned out to be the sixth harmonic of the m.w. station on 1320 kc. Another sixth harmonic is currently noted on 7320 kc. The engineer of CKCW, 1220 kc., is asking for reports in hopes of eliminating this harmonic. Reports should go to CKCW, Moncton Broadcasting Ltd., Knights of Pythias Building, Moncton, New Brunswick, Canada. (*PM and others*)

Canary Islands—*Radio Atlantico*, Las Palmas, 9490V kc., has popular and dance music at 1700-1900. Announcements are in English and Spanish; reports are welcomed. (*PB*)

Ceylon—Colombo is operating on two new outlets in the VOA Service, on 17,800 kc. at 1230-1600 to Africa, replacing 17,845 kc., and on 11,835 kc. at 1400-1600 with "Music USA," replacing 11,875 kc. (*RL*)

Costa Rica—T1FC, *The Lighthouse of the Caribbean*, San Jose, is often readable from 0700 to 0000, but peak signal is around 2300-0000 when they present religious programs in English. They operate on 9645 and 6037 kc. (*TZ, CH, RS*)

Denmark—OZF, *The Voice of Denmark*, 9520 kc., Copenhagen, has English to N.A. at 2100-2130, repeated at 2230-2300. The half-hour preceding each xmsn is in Danish to Danish listeners in N.A. The DX program can be heard Tuesdays at 2115 and 2245. This program is prepared by the *World Radio Handbook*. (*SD, AF, NS*)

Ecuador—HCJB, Quito, operates on 11,915, 15,115, and 9745 kc. Monday is a silent day. Station slogans are *Call of the Andes* and *Heralding Christ Jesus Blessings*. They carry English programs, mostly of religious nature, from 2100 to 0000. In this, their 25th anniversary, they are using their new 50-kw. xmtrs. The station sends a nice picture of the entire staff. (*CM, MG, TW, LW, MA*)

New s.w. stations in Ecuador include: HC-3RM, *Radio Cultura Machella*, Machella, 4845 kc., 250 watts, and HC5JC, *La Voz de San Sedo* (?), 3380 kc., 220 watts. Stations that

have returned to the air are HC2ET, *Radio El Telegrapho*, 4825 kc., 250 watts, and HC2DC, *Radio Senit*, 6150 kc., 250 watts. (*DX*)

England—The Overseas Service of the BBC, London (NOT the General Overseas Service), is heard in a daily broadcast of recorded music announced in English at 2215-2245 on 3975A kc. Other channels in dual are 17,715, 15,447, 11,700, and 9625 kc. The 3975-kc. channel is well heard despite QRM from the 75-meter amateur phone stations. The BBC is on 17,700 kc., replacing both 15,310 kc. for the N.A. Service between 1000-1600, and 17,810 kc. for the General Overseas Service to N.A. at 1600-1930. (*SW*)

French Cameroons—*Radio Douala*, a new outlet on 9900 kc., can be tuned at 1300-1400,

SHORT-WAVE ABBREVIATIONS

A—Approximate frequency
BBC—British Broadcasting Corp.
Eng.—English language transmission
ID—Identify, identification
IS—Interval signal between transmissions
kc.—Kilocyle
L-A—Latin-America(n)
mc.—Megacycle
m.w.—Medium wave
N.A.—North America(n)
QRM—Interference from other stations
s.w.—Short-wave
s/off—Sign-off of station
s/on—Sign-on of station
xmsn—Transmission from station
xmtr—Transmitter used by station
V—Frequency varies
VOA—Voice of America

with news at 1300-1310. Reports go to *Radiodiffusion du Cameroons*, Yaounde. (*DX*)

French Equatorial Africa—*Radio Brazzaville*, 11,970 kc., has an English period to North and South America at 1835-1900, parallel with 9625 kc. A "Mail Bag" and listener's request program can also be noted at 0650, but this is not beamed to N.A. (*DC, TW, KM, JM*)

Goa—English programs are broadcast by *Radio Goa* at 0130-0800 and 1000-1130 on 4890, 7071, and 9610 kc., according to a letter received from the station. The power for 4890 kc. is 5000 watts. (*WRH*)

Gold Coast—ZOY, Accra, can be heard nightly at 0055 s/on with a woman giving the schedule. They relay BBC news at 0100. (*DX*)

Guatemala—*Radio Universal*, 6208A kc., is heard at 0000-0035 with a musical program and ID of *Radio Universal en Guatemala*. This one verified with a letter but didn't list the frequency. The call is TGHC and it relays m.w. station TGHB. (*PM*)

New stations in Guatemala include: *Radio Programas de Guatemala*, TGZB, 3355 kc., 90 watts; TGZA, 6160 kc., 250 watts; *Radio Victoria*, TGLA, 5970 kc., 100 watts; and TGLAB, 4900 kc., 200 watts. (*DX*)

Hong Kong—*Radio Hong Kong*, 3940 kc., is heard at 0830-0900 with fair-to-good signals in Chinese. At times they may have cricket matches in Chinese. (*GN*)

Indonesia—*The Voice of Indonesia*, Djakarta, is heard on YDF6, 9710 kc., with a xmsn in English at 0930-1030. The program is made up of news, topical talks, and good music. They identify often throughout the English session. (*BV*)

Jamaica—*Radio Jamaica*, Kingston, can be noted on 4950 kc. mornings around 0600-s/on

to 0700 and evenings at 1730-2215. All xmsns are in English; news is heard at 2200-2205. (*MP, NS*)

Kashmir—*Radio Kashmir* is presently operating from Srinagar at 2100-2300 and 0230-0330 on 7270 kc., and at 0730-1230 on 6110 kc. This is a good catch for anyone. (*WRH*)

Lebanon—The Lebanese Army Signal Corps operates a station on 6500 kc. with 350 watts. It is scheduled at 0930-1100 on Tuesday and Saturday only and relays other programs of Army station. Further details requested. (*DX*)

Luxembourg—*Radio Luxembourg*, Junglinster, is currently constructing new short-wave facilities to be heard all over world. (*CM*)

Malaya—All stations of the British Far Eastern Broadcasting Service are now identifying as *Singapore BBC Far Eastern Station*. (*DX*)

Mexico—XEXE, Leon, formerly at Mexico City, is again in use on 11,900 kc. It operates at 0645-0100 in parallel with XEXG, 6065 kc., relaying m.w. XEX. (*RL*)

XEOI, *Radio Mil*, 6010 kc., Mexico City, transmits programs evenings for Southwest USA, Central and South America. They feature United States pop records with Spanish commentary. Their address is Fomento de Radio S.A., Ayuntamiento 101, Mexico City. XEHH, *La Voz Potisina*, Mexico City, is a good one for L-A music during most of the day on 11,880 kc., evenings on 11,880 kc., as is companion station. XERH, 1500 kc. (*JC*)

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John Beaver (*BV*), Pueblo, Colo.
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L. Richard Woodyatt (*LW*), Scranton, Pa.
Ted Zagrodnick (*TZ*), Johnstown, Pa.
World Radio Handbook (*WRH*)

Mozambique—*Radio Clube de Mozambique* is being widely reported. It can be tuned on 15,085 kc. around 1500-1515 in a test xmsn of news and music with a gong before each ID. This xmsn is reported parallel with 17,795 kc. to Europe. Reports go to Box 594, Lourenco Marques. (*SW*)

CR7BE is noted on 11,984 kc. at 0030-0100 s/off with Portuguese language and popular

music. ID is *Aqui Radio Clube de Mozambique.* (*BV*)

The outlet on 4920 kc. can be heard in English around 2310-2320 but this might be difficult due to QRM. (*JD*)

Netherlands—*Radio Nederland*, Hilversum, presents a program called "Mail Bag" on Sundays at 2245-2300 on 9590 kc. They invite reception reports, comments, and record requests. Reports go to Mr. Edward Startz, P.O. Box 136, Hilversum. (*RJ, TW*)

New Zealand—*Radio New Zealand* has moved from 15,220 kc. to 15,110 kc. for its Australian beam at 2300-0115 s/off, dual to 15,280 kc., to the Pacific Isles. The DX program gave the schedule at 1905-0115 on 15,110 kc. and at 1500-1900 on 15,220 kc. (*SW, BV*)

Other outlets on 6080 and 9540 kc. can be noted 0100-0445 s/off with news, music, and talks. (*RB*)

Pakistan—*Radio Pakistan* can be heard on 21,580 kc. at 1330-1400 in English, with recorded music, to Turkey, and on 15,400 kc. at 1940-2000 with native music. (*DS, MG*)

Peru—OAX4T, *Radio Nacional del Peru*, 9562 kc., Lima, is often heard evenings around 2130 with excellent musical programs and announcements in Spanish. (*BW*)

New stations operating are: OAX1D, *Radio Chiclayo*, Chiclayo, 3380 kc.; OBX4Z, *Radio Lux*, Lima, 6115 kc.; and OAX8E, *Radio Loreto*, Iquitos, 6250 kc. (*RL*)

Portugal—Lisbon has resumed use of 21,495 kc. and is heard at 0600-0800 in dual with 17,895 and 21,700 kc. A new channel is 15,100 kc., heard at 1700-2030. The 15,380-kc. channel has apparently been dropped. The 17,895-kc. outlet can also be tuned in English at 1200-1245, in Portuguese after 1745. (*RL, BV*)

Spain—*Radio Mediterraneo*, Valencia, 6995 kc., has been heard again at fair level at 1800-1830 s/off with programs of Spanish music. Identity is *Transmite Radio Mediterraneo de la Sociedad Espanola de Radiodifusion*. Closes with *Viva Franco, Arriba Espana* and the Spanish National Anthem. (*PM*)

Switzerland—HER4, Berne, 9590 kc., is often heard, dual with HER3, 6165 kc., and HER5, 11,865 kc., in English at 2320-0000 with discussions, news, and musical programs. This is in N.A. Service. (*BB and many others*)

Tahiti—*Radio Tahiti*, Papeete, 6135 kc., can be heard in French and native languages at 2350-0030. English segment was changed from 0245-0300 to 0230-0245. (*BW, JG*)

Tangier—*Radio Tangier International*, not to be confused with WTAN, is testing at various times during the day with English and Danish announcements. It can be noted at 1730-1740 and 1800-1810. Test xmsns usually last about ten minutes. An announcement stated that a service in Danish probably would be started soon. Reports go to 33 Goya Street, Tangier, North Africa. (*SW, PM, HG*)

Union of South Africa—Johannesburg, 25,880 kc., is operating at 0730-0845 Monday to Friday in English and Afrikaans. It has also been noted at 1230-1345. The 3290-kc. outlet carries English at 1300-1600, Afrikaans at the same time on 3380 kc. (*DX, MO*)

—30—

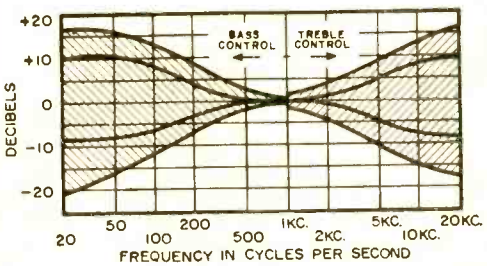
The Hi-Fi Boost

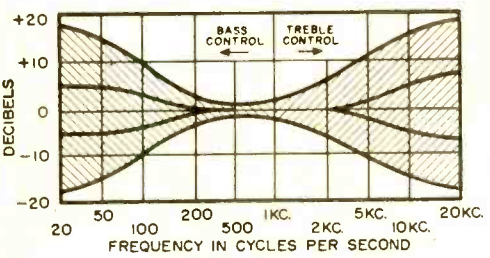
(*Continued from page 55*)

matter of personal preference, the kind of thing that could require different control settings to suit different moods as well as room acoustics.

Then, too, components other than the amplifier may not have perfectly flat responses. It is by no means an insult to a phono pickup to say that it is "down 3 db at 15,000 cps." Neither can a speaker be deemed inferior because its response curve "drops several db below 50 cycles." A small amount of treble and bass boost respectively can restore the entire system to virtually flat response.

Offhand, it would seem that two more knobs would be required, winding up with a total of four tone controls: bass boost, bass cut, treble boost, and treble cut. Thanks to the ingenuity of hi-fi designers, the number of controls has been held to two—which provide all the tonal adjustment required. "Continuously variable" controls—one for bass cut and boost, the other for treble cut and boost—are now the rule in hi-fi amplifiers. Because of the wide range these controls cover, as well as the many intermediate settings and combinations of settings they provide, they are





Ranges of control available with the circuits shown in (C) and (D) on page 55 are shown respectively in the two graphs above. Shaded areas indicate total range. Any combination of values between outer lines is possible. Note that the bottom graph shows that the point in the frequency spectrum, where tonal boost or cut begins, can be varied as well as the actual amount of boost or cut. For this reason, the circuit—the Baxandall system—is generally rated as best for hi-fi.

generally called "universal" tone controls.

One very widely used type is shown in the schematic (C) on page 55. The first graph on page 126 is the range of control available with this circuit. Given a pair of such controls, the listener becomes a virtual conductor of his own orchestra, and can add such coloration and emphasis (or de-emphasis) as he deems necessary for over-all tonal balance. As is true of less notable conductors, however, some audiophiles insist on overdoing it.

Generally accepted procedure for correct use of tone controls is to start by leaving them in the "flat" or uniform response position. This is usually the center position on the knob. As the listener becomes more perceptive, and more sensitive to the peculiar aspects of his own listening area, he may find that moderate amounts of boost or cut may be used until the system sounds "just right." Cranking up both treble and bass controls as far as they will go proves nothing about the fidelity of the system and generally results in jarred nerves.

Baxandall Tone Controls. While great flexibility and range of control is afforded by the system just described, it has what many consider a slight drawback. The point in the frequency spectrum at which boost or attenuation begins is always approximately the same, about 800 cps. Thus, if 6 to 8 db of boost is really needed at 50 cycles to bring a particular speaker system into line, it can only be achieved by including about 3 db of boost at 300 cps. But no boost at all is really desired at 300 cps—it would lend a boomy quality to the sound, particularly to male voices.

This difficulty is overcome by a recent type of universal tone control system which uses feedback. The basic schematic for this system is shown in diagram (D) on page 55; its range of control is shown in the second graph on page 126. Both boost and attenuation, as well as the point at which these effects begin, are made completely variable, depending on the control setting. For this reason, it is known as a "variable crossover" tone control, as well as by the name of its designer, P. J. Baxandall. This type of control system is considered by many to provide more pleasing results and flexibility. As a result, it has gained favor with many manufacturers in recent years.

The diagrams on page 55 and the two graphs (left) should help in identifying tone control circuits in amplifiers. To assess fully the merits of each system, the prospective buyer should try the action and listen to the results of the various systems. Don't ignore tone controls and the importance of using them correctly. They can pay off in years of pleasurable listening. —30—

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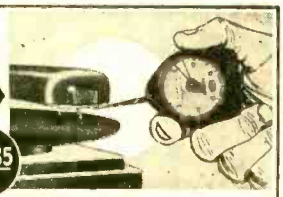

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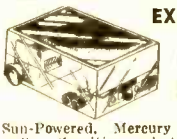

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PLASTIC repair kit will repair most broken or cracked radio cases, dials, knobs etc. $3.00 prepaid. Free information. Raythor Co., Box 264A, Station B, Toledo, Ohio.

ELECTRONIC Brains. Complete Kits. Home-Study Courses. Electric Slide Rule $14.50. Computer Plans: Miniature—$1.—, Analog—$3.—, Digital $3.—. 50 Assorted Diagrams For Experimenters, $2.—. EBE, 1015 Atkin Ave., Salt Lake City 6, Utah.

TRANSISTOR Kits. Amazing Portable one tube FM & TV receiver. Free data. Altronics P. O. Box 32, Normandy Branch, St. Louis 21, Mo.

PANEL Meters, Transformers, Tubes, Crystals. Free List. Rijor Products Co., Box 81, Rego Park, N. Y.

WALKIE-TALKIE chassis only $6.50. Illustrated in this issue. See index on last page. Springfield Interprises, Box 54-E 11, Springfield Gardens 13, N. Y.

TWO Transistor Pocket Radio Kit $11.95. Free Literature. Highland Electric, Box 553E, Pasadena, Calif.

TELEPHONE Transmitter. Hand set type. Suitable for inter-house phones, speakers or any communication purpose. Delivered two for $1.00. No C.O.D.'s. Telephones, Dept. C-529, 1760 Lunt, Chicago 26.

SALE—100 ass't resistors, 10 ohms-4.7 meg., ½-1 watt $1.00. 100 ass't capacitors .5-1000mmf $1.00. L & W Products, P. O. Box 266, Taunton, Mass.

WALKIE-TALKIE plans, constructional details. Inexpensive, simple, compact. 50¢ Fabco Electronics, 7400 Jackson Pk., Birmingham, Mich.

WANTED

CYLINDER and old disc phonographs. Edison, Conqueror, Idelia, and Oratorio models. Berliner Gramophones and Zono-o-phones, Columbia cylinder Graphophones, and Coin-operated cylinder Phonos. Want old catalogues and literature on early phonos prior to 1919. Will pay cash or trade late hi-fi components. POPULAR ELECTRONICS, Box 50.

TUBES and equipment bought, sold and exchanged. For action and a fair deal write B. F. Gensler, W2LNI, 56 Crosby St., N. Y., 12N, N. Y.

SELL Your Way To Wealth! Wanted—Surplus Military And Commercial Aircraft Electronics: BC-788, I-152, ARN-7, ARC-1, ARC-3, transmitters, receivers, test equipment, etc.! Wanted—Electronic Tubes: Broadcast, transmitting, receiving, Magnetrons, Klystrons, miniature, sub-miniature, ruggedized, etc.! Top Prices Paid! For Fattest Checks—Sell to Rex! Write or phone description for immediate action. P. E. Sanett, W6REX, 1524 S. Edris Drive, Los Angeles 35, Calif. Phones: REpublic 5-0215, CRestview 1-3856.

EMPLOYMENT INFORMATION

JOBS—High Pay. South America, the Islands, USA, foreign countries. All trades. Clerical, labor, engineers, drivers, others. Women also. Fare paid. Application forms. For information. Write Section 92B, National Employment Information, 1020 Broad, Newark, N. J.

INVENTIONS WANTED

INVENTIONS wanted. Patented; unpatented. Global Marketing Service, 2420 77th, Oakland 5, Calif.

TAPE RECORDERS

RECORDERS, Tape, Hi-Fi. Wholesale Prices. Catalogue. Kerstin, 215 E. 88 St., N. Y. C. 28.

PRE-RECORDED Tapes, Low price recording tape, Accessories, Catalog, Efsco Sales, 270-A Concord Avenue, West Hempstead, N. Y.

TAPE Recorders. Tape. Unusual Values. Free Catalog. Dressner, 69-02F, 174 St., Flushing 65, N. Y.

TAPE Recorders, surplus, $244.50 Webcor, brand new, scarred, for $146.50; Telectrosonic for $64.50; Wilcox-Gay cost $165.00, used, like new for $75.00; Used Eicor good shape for $59.50; Several P. A. System bargains. Geo. F. Bischof, Fort Worth 4, Texas.

WHOLESALE! Recorders. Tapes. Phonographs. Radios. Catalogue 10¢. Towers — 155, Philadelphia 5.

BUSINESS OPPORTUNITIES

TO $100.00 Weekly. Sparetime, Home Operated Mail-order Business, Successful "Beginner's" Plan. Everything Supplied. Lynn, 10420-E National, Los Angeles 34.

VENDING Machines—No Selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, Dept. 12, 715 Ensor St., Baltimore 2, Md.

PLATE Baby Shoes, jewelry, gifts, bronze and colored pearl. Free booklet. Thompson, 11029 South Vermont, Los Angeles 44, Calif.

BUY Wholesale! Resell at big profits. Brand name merchandise — Appliances, cookware, housewares, watches, jewelry, dry goods, clothing, sporting goods, toys gifts, etc. Free 1957 color catalog listing over 1001 items with confidential cost sheet. Merit Home Products, Dept. PE 11, 107 Manhattan Ave., Brooklyn 6, N. Y.

$150 WEEK—easy! Start home Venetian Blind Laundry. Revealing book free. E. O. Co., 101 So. 44th, Philadelphia 4, Penna.

FREE Booklet "Money-Making Facts" tells mechanically-inclined men how to start sparetime business at home. Lee Foley Company, Columbia Heights, Minnesota.

HUGE Monster Mail, 25¢ — William Greener, Box 306-L, Burley, Idaho.

SELL Rubber Stamps—Printing. Catalogs free. Jos. Abernathy, Barnesville, Ga.

INSTRUCTION

ENGINEERING Degrees earned by home study. Residential Courses also available. American College of Engineering, Box 27724-D, Hollywood 27, California.

BECOME Tax Consultant. Graduates earn $3,000 every tax season preparing returns evenings. State approved. Union Institute, 68 Hudson, Hoboken 3P, N. J.

RECORDS

PHONOGRAPH Records Cheap. Catalogue. Paramount, TD—313 East Market, Wilkes-Barre, Penna.

MISCELLANEOUS

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

BECOME a Radio Amateur. Free Information on how to pass Code and Theory FCC examinations. American Electronics, 1203E Bryant Ave., New York 59.

GUARANTEED 100 Double Edge Blades. Finest Quality—$1.00. United. Box 7, Corona 68, N. Y.

COMPLETE Pocket Printer, Pad, Handy Carrying Case. Three Lines $1.00—500 Distinctive Useful Gummed Name & Address Labels $1.00—United, Box 7, Corona 68, N. Y.

The "Tirade Terminator"

(*Continued from page* 50)

guished and left that way throughout tests and installation. In the final installation, mark the plug and the receptacle with paint or crayon to insure that the plug, if inadvertently removed, will be replaced properly.

When the foregoing instructions for establishing the chassis at house-ground potential are followed to the letter, there is absolutely no danger of a.c. shock from the lines. For those who do not wish to perform these checks, it is suggested that an isolation transformer be inserted between the a.c. input to the intercom and the line. It should be remembered, however, that the use of a transformer carrying a.c. introduces the possibility of hum pickup in the high-gain stage of the intercom, so provision should be made for mounting it at a distance from the 1A5, preferably at the far end of the a.c. cable.

Any 117-volt lamp cord may be used between the master unit and the remote speaker. Use a weatherproof housing outdoors and the plastic cabinet indoors, as shown in the photographs, for the remote speaker. —30—

Mixing It Up

(*Continued from page* 85)

may be used to set the over-all level of the mixed signal as it emerges from the mixer and enters the tape recorder.

Commercially Available Mixers. For those who want to have—but not build—their own mixers, there are several fine units on the market. They range from Switchcraft's modest little "Mini-Mix" to the elaborate, studio-type facilities found on such recorders as the Ampex 601. A neat two-channel mixer-fader, which may also be used as a preamp on one channel, is made by Fisher; a four-channel mixer is produced by Pentron. Some of the newer, high-quality preamp-control units for hi-fi systems have mixing facilities built in. For specific information regarding such units, contact the manufacturers or your local parts or hi-fi dealer.

The mixer you choose to build or buy should be the one that meets your needs as regards the type of signals to be fed into it, the number of different channels required, the degree of gain needed, and the audio quality expected from it in terms of the tapes you're recording. Whatever your choice, the mixer will bring a touch of the professional studio into your home and help you produce better recordings. —30—

ADVERTISER'S INDEX

Superior's New Model 770-A

The FIRST Pocket-Sized

VOLT-OHM MILLIAMMETER

USING THE NEW "FULL-VIEW" METER

71% MORE SCALE AREA!!

Yes, although our new FULL-VIEW D'Arsonval type meter occupies exactly the same space used by the older standard 2½". Meters, its provides 71% more scale area. As a result, all calibrations are printed in large easy-to-read type and for the first time it is now possible to obtain *measurements instead of approximations* on a popular priced pocket-sized V.O.M.

FEATURES

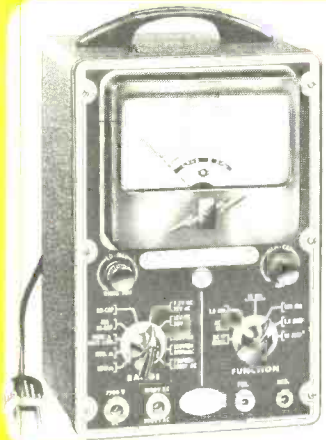
- ★ Compact—measures 3⅛" x 5⅞" x 2¼"
- ★ Uses "Full View" 2% accurate, 850 Microampere D'Arsonval type meter
- ★ Housed in round-cornered, molded case
- ★ Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use.

Specifications

6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 volts.
6 D.C. VOLTAGE RANGES: 0-7.5/15/75/150/750/1500 volts
2 RESISTANCE RANGES: 0-10,000 Ohms, 0-1 Megohm.
3 D.C CURRENT RANGES: 0-15/150 Ma., 0-1.5 Amps
3 DECIBEL RANGES: —6 db to + 18 bd, — 14 db to + 38 db, + 34 db to + 58 db.

The Model 770-A comes complete with self-contained batteries, test leads and all operating instructions.

$15.85



Superior's New Model 670-A

SUPER-METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

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

ADDED FEATURE:
Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

$28.40

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

We invite you to try before you buy any of the models described on this and the following page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

SEE OTHER SIDE

CUT OUT AND MAIL TODAY!

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-287, 3849 Tenth Avenue, New York 34, N.Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payments when due, the full unpaid balance shall become immediately due and payable.

☐ Model TV-11 . . . Total Price $47.50. $11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ Model TC-55 . . . Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.

☐ Model 670-A . . . Total Price $28.40 $7.40 within 10 days. Balance $3.50 monthly for 6 months

☐ Model 770-A . . . Total Price $15.85. $3.85 within 10 days. Balance $4.00 monthly for 3 months

Name _____

Address _____

City _____ Zone ____ State _____

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

Superior's New Model TC-55

Streamlined TUBE TESTER

FOR

The Experimenter or Part-time Serviceman, who has delayed purchasing a higher priced Tube Tester.
The Professional Serviceman, who needs an extra Tube Tester for outside calls.
The busy TV Service Organization, which needs extra Tube Testers for its field men.

• **You can't insert a tube in wrong socket.** Separate sockets are used, one for each type of tube base. • **"Free-point" element switching system** Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or even the "top-cap". • **Checks for shorts and leakages between all elements.** Provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals. Continuity between various sections is individually indicated. • **Elemental switches are numbered in strict accordance with R.M.A. specification.** The 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system.

Speedy, yet efficient operation is accomplished by: Elimination of old style sockets used for testing obsolete tubes (26, 27, 57, 59, etc.) and providing sockets and circuits for efficiently testing the new Noval and Sub-Minar types.

Model TC-55 comes complete with operating instructions and charts and streamlined carrying case.

$26.95

Superior's new Model TV-11

Standard Professional TUBE TESTER

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.

★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.

★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

★ Free-moving built-in roll chart provides complete data for all tubes.

★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.

★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

The model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

$47.50

EXTRA SERVICE — The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

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NO MONEY WITH ORDER — NO C. O. D.

FIRST CLASS
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New York, N. Y.

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No Postage Stamp Necessary if Mailed in the U. S.

POSTAGE WILL BE PAID BY —

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3849 TENTH AVENUE
NEW YORK 34, N. Y.

We invite you to try before you buy any of the models described on this and the preceding page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate. (See other side for time-payment schedule details.)

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!