

# POPULAR ELECTRONICS

DECEMBER  
1957

35  
CENTS

## Build "Throbbing" Vibrato

(see p. 41)

- Tricks of Tape Splicing
- Eliminate Fluorescent Buzz
- Electronic Christmas Bells
- Update Your FM-3 Tuner



E-28-13747A-19  
LOUIS HOFFART  
8109 WINDWARD  
CLEVELAND OHIO



NC-66 is shown with RDF-66 Direction Finder Accessory



## PORTABLE RECEIVER

for home and away—indoors and outdoors



NC-66

**WORLD'S MOST VERSATILE RECEIVER!** . . . a ham receiver, a 3-way portable, a marine receiver, and an SWL receiver.

For home and away—indoors and out.

National's new NC-66 offers you AC/DC-battery operation, five-band coverage from 150 kc to 23 mc, electrical bandsread with logging scale, plus a fixed-tuned CW oscillator. Housed in a handsome, rugged metal cabinet with a carrying handle, National quality is evident throughout this great new portable. You'll find it attractively functional with a long "Full-Vue" slide rule dial, a quality 5" PM speaker, and a phone jack. It also has *two* antennas: whip and loop stick.

For boat owners a special marine band from 150 kc to 400 kc covers maritime DF beacon service. And, of course, CD positions are clearly marked.

## FEATURES:

- ★ Continuous coverage of DF beacons, AM broadcast, amateur and world-wide shortwave bands. 150-400 kc, .5 to 23 mc.
- ★ Operates on 115 volt AC or DC or self-contained batteries, or 220 volt AC with accessory adaptor.
- ★ Full electrical bandsread.
- ★ Provisions for external direction finder for marine use.
- ★ Salt spray tested.
- ★ Built-in ferrite loop antenna for DF and BC bands.
- ★ Built-in whip antenna for shortwave bands.
- ★ Receives voice or code. Has CW oscillator; and provision for phones.
- ★ "Full-Vue" slide-rule dial with easy-to-read scale. Amateur and principal shortwave bands as well as CD positions clearly marked.
- ★ Logging scale provided.
- ★ Complete with built-in speaker.
- ★ Separate switch for stand-by operation.
- ★ Handsome, modern styling: two-tone metal cabinet, chrome trim, with carrying handle, and enclosed back.

### \*BAND

### COVERAGE

DF	150-400 KC
BC	.50-1.4 MC
1	1.40-4.05 MC
2	4.0-11.4 MC
3	11.0-23 MC

**TUNING SYSTEM:** Separate general coverage and bandsread tuning capacitors connected in parallel on all bands. Three gang capacitors tune antenna, RF and oscillator circuits. Bandsread knob can be used as a vernier on all frequencies.

**AUDIO SYSTEM:** Two-stage audio amplifier with 3V4 output tube. Has speaker and phone output jack.

**CONTROLS:** Main tuning; bandsread; volume control; band selector switch; AM-CW switch; stand-by-off—receive switch.

### TUBE COMPLEMENT:

RF	1U4	Audio output	3V4
Converter	1L6	Rectifier	Selenium
CW on-IF Amp.	1U4		
2d Det. — AVC — 1st audio	1U5		

### OTHER SPECIFICATIONS:

Antenna input: 50-300 ohms, unbalanced.

Size: 12-5/16" wide x 9-11/16" high x 10" deep (overall).

Finish: two-tone gray.

Shipping weight: 16 lbs. less batteries.

Optional accessories: RDF-66 Loop, 220V. adaptor.

**Only \$12.95\* down**

Up to 20 months to pay at most Receiver Distributors.

\*Suggested Price: \$129.95\*\*

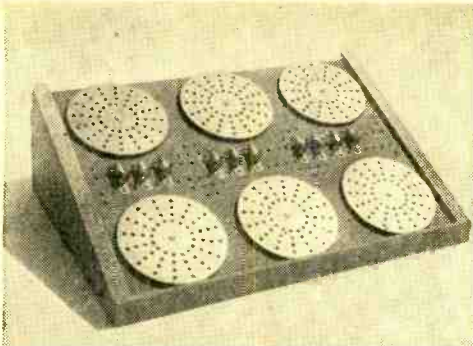
RDF-66 Direction Finder Accessory available at additional cost

\*\*Prices slightly higher west of Rockies and outside U. S. A.





# New! A MACHINE THAT COMPOSES MUSIC



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Cover photo by Dan Rubin  
Equipment courtesy of Danelectro (electronic guitar),  
Harvey Radio (amplifier) and Electronic Workshop (speaker)

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December, 1957

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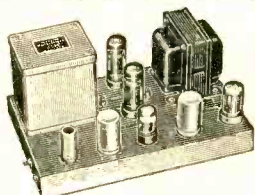
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"... one of the best-performing amplifiers extant; obviously an excellent buy." AUDIOCRAFT Kit Report, July 1957, on the

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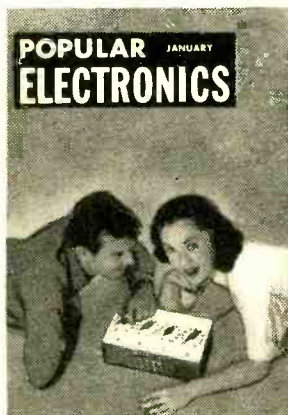
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## COMING NEXT MONTH (JANUARY)



**(ON SALE DECEMBER 19)**

Our January cover shows two of our favorite readers playing a game of "Nim." This is the contest where two players attempt to outwit one another by picking up matchsticks from four piles, the object being not to be left with the last one. Of course, we're doing it electronically—and showing you how the binary coding system used in gigantic computers can be put to practical application.

There are many other construction projects in the January issue, with some interesting ones on hi-fi. You'll like the anti-phase amplifier and the article on adding a tuning meter. Oh, yes, Kohler will be back!

## IN THIS MONTH'S

## RADIO & TV NEWS

**(DECEMBER)**

Electronic Fencing "Touche" Indicator

Antenna Applications in Two-Way Radio Systems

Stereo Balance and Gain Control

New Hi-Fi Reluctance Phono Cartridge

Three TV Antennas on One Lead

Wide-Range Crystal Marker Generator



# triple news from triplett



BUREAU OF STANDARDS ADVERTISING

## 1st news: Triplett Model 10 Clamp-On Adapter

Just plug into any Triplett Model 310 Miniature VOM it becomes an AC clamp-on ammeter to measure AC amperes without cutting or opening current carrying wires. The split transformer yoke opens at the touch of a lever to fit around a single conductor or bus-bar for direct readings of AC amperes from 3 to 300 in 6 steps. Model 10 \$14.50 net.

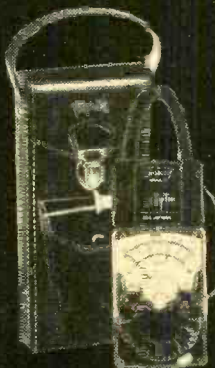
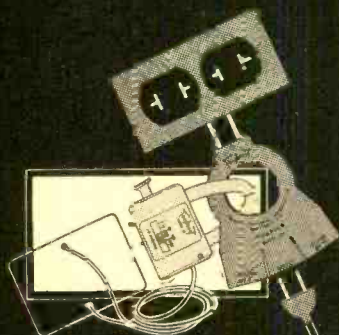
The Model 10 can be separated from the Model 310 as shown in the drawing at left by No. 311 lead attachment. This permits readings in difficult locations. No. 311 leads \$1.90 net.

## 2nd news: Triplett Model 101 Line Separator

Serves to plug in at outlet to divide 2 conductor cords for clamp-on measuring. Makes accurate, rapid testing of radio and TV sets, phonographs, appliances, motors, etc. possible without opening or splitting double conductors. Also serves to increase ammeter sensitivity 10X and 20X, if desirable, for easier reading. Model 101 \$5.50 net.

3rd news: All four parts are available conveniently packaged in one handy, durable, high-quality carrying case. This complete package is known as Triplett Model 100 and is priced at \$61.90 net.

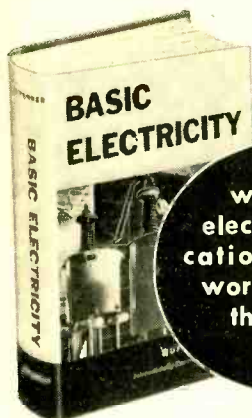
Model 100 consists of Model 310 VOM, Model 10 Clamp-On Adapter, Model 101 Line Separator, No. 311 leads and carrying case with provision for all parts.



53 years of experience

In addition, to use with the Model 310, the Model 10 Adapter also can be used as a Clamp-On Ammeter with any Volt-Ohm-Milliammeter having a 3 AC volt scale at 5000 Ohms per volt such as Triplett Models 630, 630-A, 630-NA, 631, etc., by employing Triplett No. 611 leads \$1.90 net.

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## TOPS FOR BEGINNERS . . .

*The ideal "refresher" course for experienced servicemen!*

Think how often you've been "stumped" by a technical talk, text book or by some complicated equipment . . . simply because you're not too clear about the principles involved. Think of the troubles you may have had with basic electrical factors such as reactance, phase relations, impedance, etc. for the same reason.

And think of the future too! BASIC ELECTRICITY by Rufus Turner brings you truly top notch training for profitable industrial work where it's impossible to say just where electricity ends and electronics begins.

Starting with a clear explanation of fundamentals, the book progresses to every phase of electrical and electromagnetic theory and operation. Included are dozens of typical electrical problems and their solutions. Each chapter ends with a Self-Test review of all the main points. Essential elements such as motors, generators, batteries, polyphase, etc., often neglected by ordinary electronic books, are fully covered. Everything is explained clearly as A-B-C by text and over 300 clear illustrations.

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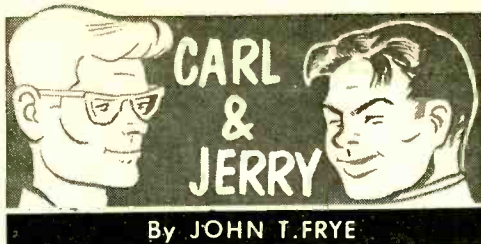
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## Santa Knows All

CARL AND JERRY were standing with the manager of Carlton's Department Store watching Santa Claus talk to the children. Santa sat back in a curtained recess on a throne of artificial ice and snow, and the children came up to him one at a time to sit on his knee and tell him what they hoped to find under their trees on Christmas morning.

"Watch this one," said Mr. Bixby, the store manager, with a smile of anticipation as a pretty little dark-haired, hazel-eyed girl tiptoed cautiously toward Old Santa.

"Well, well," Santa boomed, scooping up the little girl and placing her firmly on his broad knee, "if it isn't little Carol! Aren't you the pretty one today! I've been thinking about you, and I know exactly what you want: a big new doll just like the one you saw out there in the window. Somehow I've got a feeling you're going to find that cuddly doll right in front of your tree Christmas morning . . . but, Carol, you must promise me something."

"Oh, I will, Santa, I will!" the wide-eyed little girl said fervently.

"Well, you mustn't hit your brother over the head with this doll and break it as you did your other one," Santa said with a twinkle in his blue eyes.

"I won't, Santa Claus; honest I won't," Carol promised as Santa set her back on her feet.

"And, Carol," Santa called as she was leaving, "you can tell your pretty mother for me that I'm glad she likes my voice."

Carol and a flustered, bewildered-looking mother made a quick exit from the store as Mr. Bixby turned chuckling to the boys.

"THEY JUST can't figure it out," he said. "When you boys first suggested the idea to me, I never imagined it would work so well. And it is actually so simple. With that hearing-aid earphone concealed by his whiskers, no one would ever suspect Santa was listening on a little transistorized receiver. By the way, that miniature transistorized wireless phono transmitter is camouflaged so well even I can't locate it. Just where is it?"

"It's hidden inside that railing just at

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## Carl & Jerry (Continued from page 8)

the point where each child waits his or her turn to talk to Santa," Carl explained. "As the parents coach their kids or chat with the other parents, the mike picks up wonderful clues for old St. Nick regarding Christmas wishes, past behavior, and so on."

"The word is spreading like wildfire," Mr. Bixby chortled, "that Carlton's Santa Claus is the only real one. He knows everything. In fact, boys, I'm so pleased that I'm going to give you a little bonus. Our agreement was that you were to receive fifty dollars for building and renting us the equipment. Well, here's thirty-five dollars for you, Jerry; and here's the same amount for you, Carl. I'm not even going to wait until we're through with the equipment. You boys may want to do a little shopping of your own with that money before Christmas Eve."

"Man," Carl exclaimed, after they had expressed their thanks and Mr. Bixby had left, "now we can buy that combination tube and transistor tester we've been wanting!"

Before Jerry could answer, Santa Claus rose from his throne and announced he had to go and feed his reindeer but would be back in half an hour. A curtain was drawn

across his alcove, and he disappeared from sight. An instant later, though, Jerry saw him beckoning from the open door of a storage room.

"I was wondering if you boys could turn up the volume on that receiver a bit while I'm out to lunch," he suggested. "The store is getting noisier, and it's a little hard to catch what the children say at times. Just boop it up a trifle, please."

CARL AND JERRY proceeded to the curtained-off alcove; and Jerry picked up the receiver, placed the earphone in his ear, and reached into his pocket for a screwdriver with which to adjust the volume. Suddenly he paused and started listening intently. Then he walked over and parted the curtain a little so that he could see the spot where the hidden transmitter was located. Carl, looking over Jerry's shoulder, saw a little boy of four or five leaning back against the railing while another boy of ten or eleven, obviously a brother, knelt in front of him talking earnestly. Jerry removed the earphone from his ear and turned up the volume of the receiver so that Carl could hear the conversation between the two boys out in the store.

"But, Timmy," the older was saying, "we  
(Continued on page 14)

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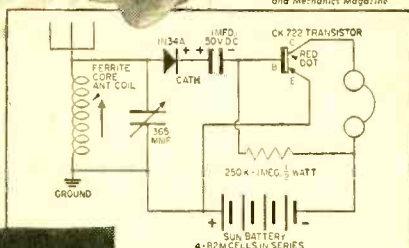
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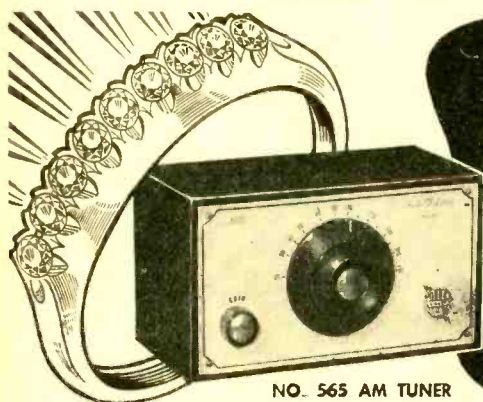
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## Carl & Jerry (Continued from page 10)

ought not wait for Santa to come back. The folks will be worried about us. Anyway, I don't think you should ask Santa Claus to bring you that electric train. You don't understand, but seventy-five dollars is an awful lot of money. What with Dad being sick for so long and everything, maybe we shouldn't expect too much for Christmas this year."

"Why, Ronnie?" the little tow-headed youngster asked. "You think Santa only brings presents that cost a lot to little boys with rich parents? If that's so, what's the use of being Santa? That's not the way it is. Santa Claus can do anything. When I tell him I want the train so Daddy and I can play with it together and Daddy will forget how bad he feels, I just know I'll get it. When Daddy was a little boy, he wanted an electric train more than anything, but he never got one. Don't you see that I've just got to stay and explain this to Santa?"

Little Timmy stood up straight, and for the first time the boys saw the crutches under his arms and caught the glint of metal braces on his slender legs.

Carl smiled wryly as he answered the question in Jerry's eyes. "Bye-bye tube and transistor tester," he chanted softly.

"I knew you'd be soft-hearted and soft-



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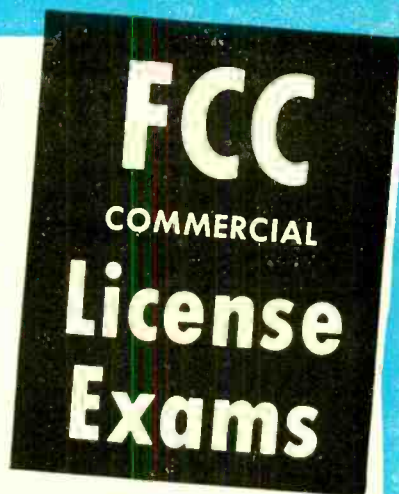
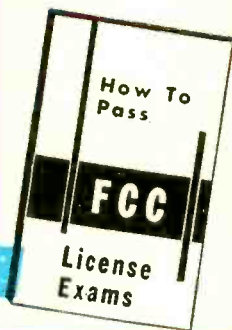


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## Carl & Jerry (Continued from page 14)

headed enough to say that," Jerry exclaimed, digging an affectionate elbow into the ribs of his lanky friend. "Let's go hunt up Mr. Bixby and buy that train right away. Then we must brief Santa a little. Finally we'll follow the kids home and see where they live. It must be close because the little fellow couldn't walk too far."

**T**HE BOYS found Mr. Bixby talking with Santa Claus, who was delicately plying a toothpick through his whiskers in a most mortal manner. Constantly interrupting each other, the boys explained to the store manager what they wanted to do.

Now Mr. Bixby had not become the head of Carlton's Department Store by being a sentimentalist, but even he was not immune to the Christmas spirit, and there was something about the impetuous way the two boys responded to the appeal of little Timmy that touched him.

"I've an idea, boys," he said. "The store and its employees build up a fund every Christmas to help needy cases. How would it be if you two kept the money that you've earned and let us take care of this for you?"

Carl and Jerry exchanged glances, and

then Carl spoke up for both of the boys:

"We appreciate the offer, Mr. Bixby, but if you don't mind we'd like to do it ourselves. You see, up to now Jerry and I have almost always been on the receiving end of things. Everyone has done things for us. I guess it's about time we started trying to do a little something for others. It makes us feel sort of grown-up and good inside."

"Okay, okay!" Mr. Bixby said hurriedly, clearing his throat; "but you mustn't be selfish about this. Let us help a little, too. The store will sell you the train at our cost price, and that'll leave enough over to buy a nice present for Ronnie."

The boys quickly agreed to this proposal, and Santa took his place on the throne. The curtain was pulled back, and Timmy started toward him at once, swinging through his crutches.

**"A**S I LIVE AND BREATHE and harness my reindeers, if it isn't my little friend, Timmy!" old Santa exclaimed, carefully gathering up the little boy. "I've been watching for you because I know just what you want."

"Really, Santa?" the little curly-headed blond boy asked, his blue eyes open wide.

"Unless my elves have been telling me

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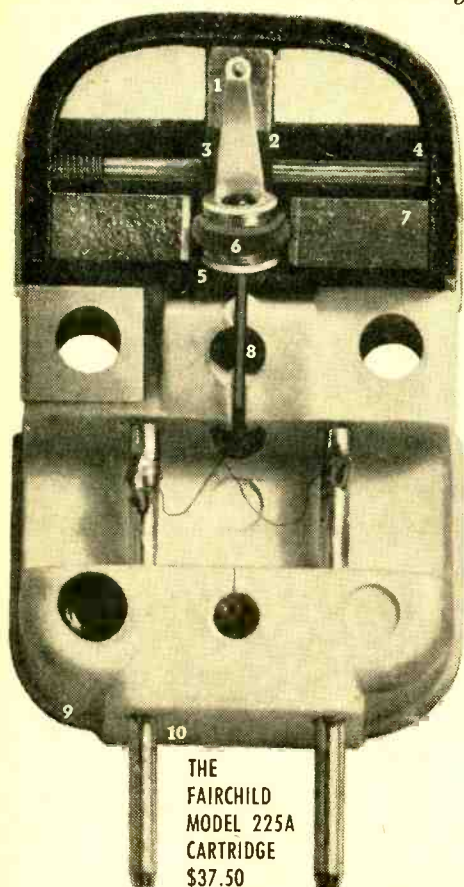
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1 Precision ground diamond stylus fitted to stylus arm. 2 Center beam support insures precise placement of stylus arm. 3 Special alloy aluminum stylus arm—low moving mass provides improved tracking. 4 Micradjust Screw—permits exact factory setting of damping, assures uniform flux gap and proper centering of stylus arm. 5 Moving coil wound on nylon bobbin with triple gold plated wire. 6 Special composition silicone rubber damping ring. 7 Alnico V magnet for greatest energy product has special alloy flux return path for maximum sensitivity. 8 Mylar vane anchors coil. Flexure pivot construction provides extreme freedom of motion. 9 Rubber impregnated molded base impervious to moisture absorption. 10 Gold plated terminal lugs.

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"In the Groove"  
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## Carl & Jerry (Continued from page 16)

wrong, it's an electric train; and I can just see you and your daddy playing with it under the tree on Christmas morning," Santa said dreamily, with his eyes closed.

"You hear that, Ronnie; you hear that?" Timmy shouted, bouncing up and down on Santa's lap in excitement.

"And," Santa continued, "I wonder how Ronnie would like a fine transistor radio kit that he and his daddy could put together?"

The boys could see Ronnie nodding his head up and down so vigorously that his sock cap slid down over his eyes. For the moment, all the sophisticated cynicism of late childhood had deserted him.

Timmy was so excited he could not sit still; so Santa carefully set him on his feet and watched him and Ronnie making their way down the aisle. If you watched very, very closely, you could have caught a secret sign of mutual approval, made by circled thumb and forefinger, being exchanged by Mr. Bixby in the balcony, Santa Claus, and two boys who casually followed Ronnie and Timmy through the crowded store.

One of the boys was short and plump and dark, the other with glasses was tall and blond and athletic; but on the face of each was exactly the same happy, contented, "Christmassy" smile.

-30-



... "You hear that, Ronnie; you hear that?" Timmy shouted, bouncing up and down on Santa's lap ...

Always say you saw it in—POPULAR ELECTRONICS



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This is typical of the high-level opportunities available to CREI-trained men:

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

### **YOU NEED ADVANCED TRAINING**

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

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"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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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. Electronics is the ONE field of maximum opportunity in this electronic age.

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

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☐ Aeronautical Electronic Engineering Technology **Z**  
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City . . .

Zone . . .

State . . .

Check: ☐ Home Study

☐ Residence School

☐ Korean Veteran



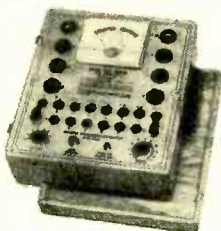


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#### NEW! EMC Model 301 Speedi Tube Tester

Precision crafted for checking tubes in seconds. Only 2 settings to make. Checks for shorts, leakages, and quality. Over 375 tubes now listed, including 024 tube. New listings available. Saves precious time and quickly pays for itself. Also available with 7½" meter.



Model 301P, illustrated with 4½" plastic front meter, in oak carrying case, \$47.50; In Kit Form, \$33.20.  
Model 301C, Sloping Counter Case, \$46.50; Kit, \$32.60.  
Model PTA, Picture Tube Adaptor (to check and rejuvenate picture tubes).....\$4.50

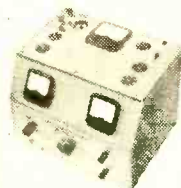


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PE-12

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## LETTERS FROM OUR READERS

### Out of Luck

■ Can you give me addresses of companies that want wireless operators? I'd like to join the U. S. Merchant Marine as a wireless operator. I am 18 years old, a Dutchman, and hold a second class ticket.

R. VAN DEN BERG  
Singapore, Malaya

*In order to work on an American ship, you would require a Federal Communications Commission ticket. Only U. S. citizens—with very rare exceptions—can get such a ticket. That goes for airlines, too.*

■ Is it possible to make a transistor metal locator cheaply?

PHILIP SHAW, JR.  
Redondo Beach, Calif.

*Not only would it be more expensive to do so but you would probably sacrifice sensitivity as well because of oscillator power requirements.*

### Can We Help?

■ In a recent issue you described some of the possible uses of an electronic paging system. You also mentioned a company called "Page Boy, Inc." This kind of a system seems to have possibilities in the Naval shipyard in which I am now serving, and I would be very grateful if you could give me the names and addresses of some of the companies that make the equipment.

PETER COSSETTE  
Cmdr. R.C.N.  
Victoria, B. C.

*Two of the manufacturers of this equipment are:*

Page Boy, Inc.	Stromberg-Carlson
1724 E. 12th St.	1710 University Ave.
Brooklyn, N. Y.	Rochester, N. Y.

■ On page 92 of the October issue you mention a "Bambinophon." Who sells it?

G. JENTZEN  
Washington 10, D.C.

■ I saw your article about the "Bambinophon" and was wondering if it was for sale in this country.

VERNE ARMSTRONG  
Raymond, Minn.

■ Saw the story on the transistor tape recorder for the small fry. Where can I get it?

MICHAEL AXELROD  
Uniontown, Pa.

*As far as we know, the "Bambinophon" recorder is available only from:*

Dr. Windhaus & Co.  
35 Graf Adolph Str.  
Dusseldorf, Germany

■ In the August issue you describe a Metz portable

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# Do you like to experiment ... to build ... to create?

## Then there's an excellent future for YOU in **ELECTRONICS - RADIO - TV**

No experience necessary. Central's complete, approved training will qualify YOU for high-pay Electronic career in shortest possible time ... at minimum cost. Practical "Progressive Plan" prepares you in-a-hurry for basic Electronic

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Kenneth S. Graycraft  
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Since 1931, Central has trained over 50,000 young men and women. Graduates are periodically interviewed and employed by many of America's foremost industrial giants. Just look at the outstanding positions held by these recent Central graduates:



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I. B. M. Corporation



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QUALITY ASSURANCE  
Atomic Energy Commission



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Boeing Airplane Company



Clayton P. Kiper  
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Remington Rand Univac

### Two Quick Ways to Train

**1 HOME STUDY**—Train in your spare time ... without giving up present occupation. Build—keep powerful Radio Receiver, Multi-Tester, TV-Oscilloscope with 5-inch Cathode Ray Tube. Experiment with Transistors—other new electronic equipment. Full preparation for First and Second Class FCC Licenses. Easy, step-by-step instructions. Transfer to resident training after preliminary home study if you desire. Inspected and **ACCREDITED** by the National Home Study Council.

**2 RESIDENT**—Regularly scheduled classes for full time students. Outstanding technical facilities ... staff of highly competent electronic instructors. Over 21 classrooms and laboratories plus modern TV broadcast studio. Courses in Radio-TV Servicing, Broadcasting, Electronic Engineering Technology. "Electronics, Radio, and Television Technology" course **ACCREDITED** by Engineers' Council for Professional Development as engineering technician program. Graduates receive "Associate of Science" degree—recognized as proof of top-level training. Housing assistance. Part time employment available.

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Tell me more about how Central training can qualify ME for high-pay career in Electronics. Check field(s) of interest below if you wish.

- ☐ RADIO
- ☐ TELEVISION
- ☐ COLOR TV
- ☐ ELECTRONICS
- ☐ GUIDED MISSILE
- ☐ ATOMIC ENERGY
- ☐ OTHER \_\_\_\_\_

- ☐ RADAR
- ☐ AUTOMATION
- ☐ SEISMOGRAPH SURVEY
- ☐ AIR TRAFFIC CONTROL
- ☐ NAVIGATION
- ☐ TECHNICAL WRITING

- ☐ TECHNICAL DRAFTING
- ☐ AIRCRAFT MANUFACTURE
- ☐ COMMERCIAL AVIATION
- ☐ U.S. CIVIL SERVICE
- ☐ U.S. ARMED FORCES
- ☐ YOUR OWN BUSINESS

**CHECK ONE:** ☐ RESIDENT TRAINING ☐ HOME STUDY



C. I. FOSTER  
President

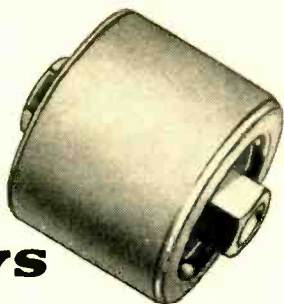
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**VETERANS:** Central offers courses approved under G.I. Bill.  
If Korean Vet., give approx. discharge date \_\_\_\_\_

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## 4 Ways Better

- 60 to 90% smaller
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You don't have to take our word for it. Here's what a satisfied user has to say — "We have found that Centralab capacitors are a 'must' in high-power r-f work. They are the only ones whose internal inductance is low enough to do the job."

They're ideal for stationary and mobile transmitters, tuned tank circuits, antenna circuits, and other applications where high-voltage, high-frequency circuits are required.

CRL capacitors have extremely low pf (down to .1%) and inductance. Retrace characteristics are stable. Their "double cup" design provides greater strength and long leakage paths... prevents arcing.

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Get your CRL Series 850 ceramic transmitting capacitors from your Centralab distributor. They're shown on page 39 of Catalog 30. If you don't have a copy, ask your distributor for one, or write direct to Centralab.

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D-4658

## Letters

(Continued from page 20)

radio. Where would I be able to get one of these?

LEIGH IERLAU  
Atlanta 9, Ga.

The manufacturer is:

Metz Apparatefabrik  
Fuerth/Bayern, Germany

■ While glancing through your July 1956 issue, I noticed an article called "Closed-Circuit Television—New Communications Tool." In it you mention a system called "Visicall." Could I have the name and the address of the manufacturer?

H. D. LESHER  
Vegas Video Sales Service  
Las Vegas, Nev.

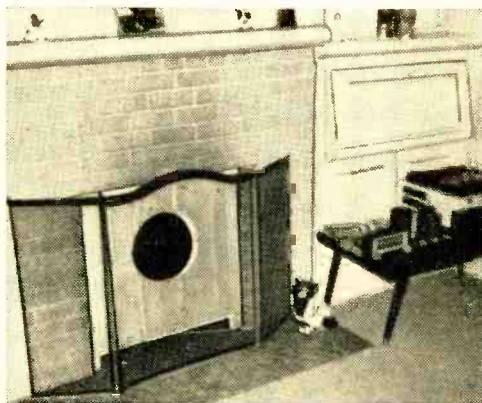
The manufacturer is:

Sperti Faraday, Inc.  
Adrian, Mich.

## Dep't. of Conflagration?

■ The photo shows a "horn" built into my fireplace. When I don't use the fireplace for heat, I use it for hi-fi. Santa can use the door.

I find it gives amazing results, costs very little, and you can even use the fireplace screen for grille cloth. Please note that the flue should be plugged



with newspapers. But be sure to unplug it when you light it up—the fireplace, that is.

HOWARD L. WILBUR  
San Diego, Calif.

*Sounds like a spark-ling good idea.*

## Pats On The Back

■ In the September issue I read and enjoyed the article "Radio Keeps You in Touch." I took special interest in the section on mobile radios. I would like to have one of these units in my car but have one question: how would you go about getting service if you were to leave the vicinity where you originally had the equipment installed?

J. F. RICHMOND  
Joppa, Maryland

*If you are talking about phone company installations, you would have to get a new installation from your phone company if you moved out of a particular area.*

■ Could you please transmit to me all relevant in-

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**Model 301 PROFESSIONAL  
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Each speed variable!  
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—Professional performance,  
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## Letters

(Continued from page 22)

formation on the well-modulated girl on the June cover of POPULAR ELECTRONICS. It is impedance that I know so that I will be able to reactance. All details received will be kept in strictest fidelity by yours truly.

ANDREW NAGY  
Hamilton, Ontario

*All data on this device represents a well-modulated trade secret.*

### The Women Again

■ In the August magazine, Dave Kavanaugh wanted to know if women did not read POP'tronics. I don't know about "the women," but I read every issue from "kiver to kiver." I'm also a charter member and have every issue that has been published. I only wish you would publish it more often and put more in it to help hams pass their exams for the various licenses.

RUBY H. LYERLY, KØGKV  
St. Louis, Mo.

■ In answer to reader Dave Kavanaugh's letter, women do read P.E.; at least this one does. I like your column for the Novice Hams.

CAROLYN THOMPSON  
Marblehead, Mass.

■ I will join Margaret Le Fevre (October issue) as another of your estimated 3-4% feminine readers. My husband and I first heard of POP'

tronics a year ago and subscribed immediately. I first read *Carl & Jerry, Short-Wave Report*, and *Among the Novice Hams*; then any other articles I can understand. Herb Brier's current series of lessons is exactly what I need as I have had difficulty finding textbooks simple enough for a beginner to understand.

RUTH S. CONGRAM, KN9JCN  
Monticello, Ind.

*The girls are swamping us. Any more questions about women?*

### Back Issues

■ I am trying to locate a copy of the May 1955 issue. It is not available from your Circulation Department and I have been wondering whether any of your readers could supply me with this issue. I am willing to pay any reasonable price, including postage.

CHARLES DUNLOP  
1902 Sheridan Road  
Evanston, Ill.

*These are the issues that are currently out of circulation:*

May 1955	December 1956
June 1955	February 1957

### Some More Assists

■ I have just read "Radio Keeps You In Touch" in the September issue and enjoyed it very much. For some time our office has been interested in obtaining a communication system for use between

## New Transcription-Type Tone Arm Makes Collaro World's First True High Fidelity Changer



FREE: Colorful new catalog, containing guide on building record library plus complete Collaro line.

From Collaro Ltd., world's largest manufacturer of record playing equipment — comes the most significant development in years — the exclusive new transcription-type tone arm, which transforms the conventional record changer into a TRANSCRIPTION CHANGER, with features of the finest professional equipment.

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In its superb performance, the new Collaro Continental, Model TC-540, meets the rigid requirements for high fidelity equipment, offering professional quality at a record changer price. The Continental is \$46.50. Other Collaro changers are priced from \$37.50 up. (Prices slightly higher west of Mississippi.)

ROCKBAR

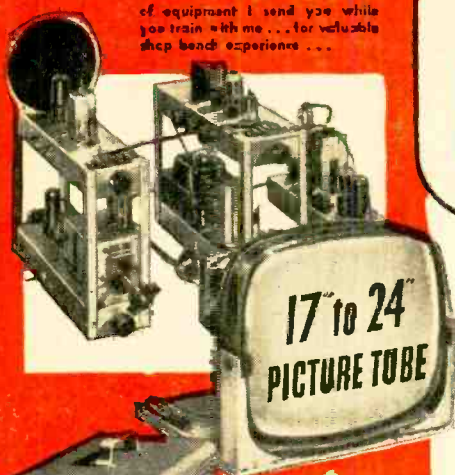
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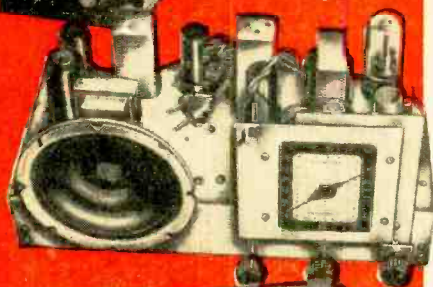


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**NEWEST  
DEVELOPMENTS**

Your training covers U H F, Color Television, F. M., Oscilloscope Servicing, High Fidelity Sound and Transistors.


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The coupon below brings you my big new catalog plus an actual sample Sprayberry Lesson. I invite you to read the facts... to see that I actually illustrate every item in my training. With the facts in your hands, you will be able to decide. No salesman will call on you. The coupon places you under no obligation. Mail it now, today, and get ready for your place in Radio-Television.

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City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# Complete ELECTRONICS COURSE with TRAINING AID KITS

● **THIS NEW PROGRAM** designed by MacFarlane Industries will enable the novice or advanced student in electronics to develop the highest levels of capability in the applications of practical electronics. Although MacFarlane Industries courses are not intended as a substitute for university, college, or vocational training, the courses and kits provided can be a useful influence in an individual's career in electronics. This particular program is the key to a far more complete and satisfying education than mere formal educational institutions.

The philosophy governing this program is based on the ability of students to arouse and stimulate their interest to the point that the usual drudgery, difficulty and consequent boredom which often attend training efforts are eliminated. Results indicate that a dynamic, alert and vitally creative individual emerges.

## METHODS OF TRAINING

All text materials, experiment kits, etc. are produced on automatic electronically controlled equipment. Problem games and examinations



are all electronically evaluated. In order that each individual gets full opportunity to examine and develop skill in the operation of specialized instruments, an electronic com-

puter schedules shipment of kits and instruments to correlate with the study pace of each individual, thus even though groups begin their effort simultaneously there is no requirement to either rush your studies or to be delayed by others.



SEND TODAY FOR

## INFORMATION ON TRAINING AID KITS

**MACFARLANE INDUSTRIES EDUCATIONAL DIVISION**  
P.O. Box 33 • Redondo Beach, California

Please send me free, complete information on Training Aid Kits.

NAME \_\_\_\_\_ AGE \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

## Letters

(Continued from page 24)

office and automobiles. If possible I would like to obtain the addresses of companies that manufacture equipment of this type. Class A Citizens' Band radios sound promising and should be adequate.

L. A. PARKS, JR.  
Parks Realty Co.  
Statesville, N. C.

*Manufacturers of this type of equipment are:*

<i>Motorola</i>	<i>General Electric</i>
<i>4501 W. Augusta Blvd.</i>	<i>Electronics Park</i>
<i>Chicago 51, Ill.</i>	<i>Syracuse, N. Y.</i>
<i>Radio Corporation of America</i>	
<i>Camden, N. J.</i>	

■ You list radios for the Citizens' Band. Could you tell me who sells them?

HAROLD B. COMER  
Elkton, Va.

*For Class B:*

*Vocaline*  
*Coulter St.*  
*Old Saybrook, Conn.*

*and perhaps:*

*Cletron, Inc.*  
*Cleveland 3, Ohio*

## More on the "VHF Ear"

■ I built the "VHF Ear" (July '57). It works quite well with the 16" piece of stiff copper wire but I was wondering if a longer antenna would bring in a better signal?

DAVID GETCHELL  
Rockville, Conn.

*No, it would not. The 16" wire is resonant. You would lose sensitivity with a larger antenna.*

■ I took a vacation in Texas this year and flew via American Airlines. I really had fun with the "VHF Ear" except when my wife was nagging me: "Let me hear" . . . "I want to listen" . . . The reception was perfect. We landed in El Paso and had a four-hour layover. It really went fast because we were listening on the "Ear."

ROBERT G. ERICSON  
San Diego, Calif.

*The "Ear" is one of our most popular projects. Everyone seems to be building it.*

-30-

## Out of Tune

**Meter Your Enlarger Exposures** (October, 1957, page 77): Referring to the schematic and pictorial on page 78, the lead from switch S2 should be connected to pin #1 of the OA2 tube, not to pin #5. This change is necessary to "isolate" PC1 during the first step of the calibration procedure. Pins #1 and #5 are joined internally in the OA2 tube by a jumper, so that removing tube opens circuit.

-30-



# AT LAST!

## RADIO-TV and ELECTRONICS TRAINING

### .... AT A PRICE YOU CAN AFFORD!

**\*21 INCH**  
Receiver Kit included

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

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

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

**We Want 100 More Shops for 1957**

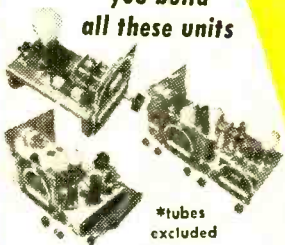
This 35 year old training organization — called RTS, that's Radio-Television Training School — wants to establish a string of Radio-TV Repair Shops in principal cities throughout the U. S. So far, 36 such shops are **NOW IN BUSINESS AND PROSPERING.** We are signing contracts with ambitious men to become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

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

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

**COMPLETE  
COLOR  
INSTRUCTION  
INCLUDED**

**you build  
all these units**



\*tubes  
excluded

### RADIO-TELEVISION TRAINING SCHOOL

5100 S. VERMONT AVENUE  
LOS ANGELES 37, CALIFORNIA

Est. 1922



**ACT  
NOW!**

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

**We supply and finance your equipment**

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

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



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

**ALL  
THESE  
FREE!**



**CUT OUT AND MAIL — TODAY!**

### RADIO-TELEVISION TRAINING SCHOOL

5100 S. Vermont Avenue, Dept. PE 127  
Los Angeles 37, California

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

☐ Radio-Television ☐ Industrial Electronics (Automation)

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

City & State \_\_\_\_\_  
300

# POP'tronics

## BOOKSHELF

Five of the country's largest electronic parts supply houses this month announced the publication of their 1958 catalogs. Free for the asking, several of these catalogs feature special components and kits unavailable elsewhere.

*Allied Radio* (100 N. Western Ave., Chicago 80, Ill.) has a complete line of kits designed for the do-it-yourself enthusiast, including test equipment and hi-fi gear. The Knight label, which is Allied's own, has been appearing on well-constructed kits for many years and the new line continues the tradition of high quality at low cost.

*Burstein-Applebee* (1012-14 McGee St., Kansas City 6, Mo.) presents a fine selection of standard tools and household appliances at discount prices in their catalog, in addition to standard electronic components. The bargain hunter will do well

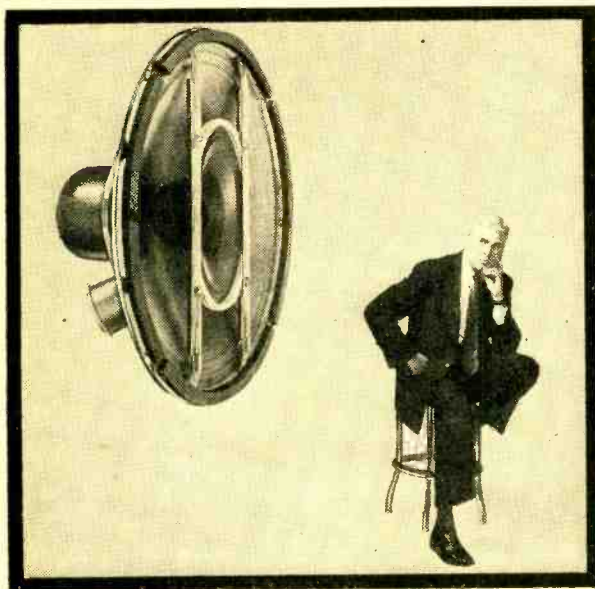
to look over B-A's "special purchase" items starting on page 132.

*Lafayette Radio* (165-08 Liberty Ave., Jamaica 33, N. Y.) features many exclusive imports in the electronic and photographic area. In addition, there are Lafayette's own high-fidelity components, available in both kit and factory-wired form. And of course, there's a special section devoted to transistor kits and components for the POP'tronics readers with that particular passion.

*Newark* (223 W. Madison St., Chicago 6, Ill. and 4736 W. Century Blvd., Inglewood, Calif.) stands ready to serve our West Coast readers with a full line of components for the hobbyist and industrial user. A number of specialty manufacturers and products are listed.

*Radio Shack* (167 Washington St., Boston 8, Mass.), has a well organized catalog featuring industrial, servicing and high fidelity components. Radio Shack's own line of hi-fi is featured under the "Realistic" label. Check their little 10-watt amplifier and speaker as an ultra-economical system for the newcomer to audio.

All in all, our distributors are doing a fine job in presenting not only the standard brand electronic merchandise but many special items worth serious consideration by the wise shopper. —30—



NEW SONOTONE CA-12 12" CO-AXIAL LOUDSPEAKER

**The price  
will be music to  
your ears, too!**

40-14,000 cycles—elliptical cone tweeter—complete dividing network. And the price...\$19.50. That's right, \$19.50. Yet it outperforms speakers selling at three times the price. Interested? Listen to the CA-12 and be convinced.

Ask your dealer for a demonstration, or send your name and address for full details.

Electronic Applications Division  
**SONOTONE® CORPORATION**  
Dept. LG-127, ELMSFORD, N. Y.

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_  
LG-127



# Build 16 RADIO CIRCUITS AT HOME

with the New Deluxe 1958 PROGRESSIVE RADIO "EDU-KIT" only \$22.95

## A Practical Home Radio Course

### Now Includes

- ★ TRANSMITTER
- ★ SIGNAL TRACER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR
- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ Excellent Background for TV
- ★ School Inquiries Invited
- ★ Attractively Gift Packed

## WHAT THE "EDU-KIT" OFFERS YOU

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

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

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

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

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

## THE KIT FOR EVERYONE

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

ages and backgrounds have successfully used the "Edu-Kit" in more than 75 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

## PROGRESSIVE TEACHING METHOD

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

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

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

## THE "EDU-KIT" IS COMPLETE

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

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

## PRINTED CIRCUITRY

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

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



Reg. U.S.  
Pat. Off.

## FREE EXTRAS

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

## SERVICING LESSONS

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

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

Robert L. Shuff, 1334 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Troubleshooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

## UNCONDITIONAL MONEY-BACK GUARANTEE

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

- ☐ Send "Edu-Kit" Postpaid. I enclose full payment of \$22.95.
- ☐ Send "Edu-Kit" C.O.D. I will pay \$22.95 plus postage.
- ☐ Send me FREE additional information describing "Edu-Kit."

Name .....

Address .....

## PROGRESSIVE "EDU-KITS" INC.

497 Union Ave., Dept. 539D, Brooklyn 11, N. Y.

**BUILD  
THE  
BEST!**

## BUILD ALLIED knight®-kits

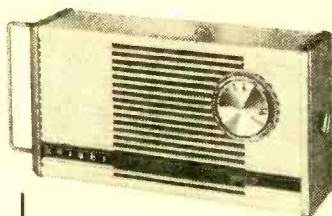
the finest electronic equipment in money-saving kit form



### knight-kit "Trans-Midge" Transistor Receiver Kit

**Model Y-767**  
**\$245**  
Tiny, cigarette-pack-size 1-transistor radio kit—fascinating to build. Covers the local AM broadcast band with exceptional sensitivity and selectivity. Features: ferrite core tuned coil; low-drain transistor operating for months from single penlight cell; handsome plastic case. Complete with all parts, transistor, battery and easy-to-follow instructions. (External antenna required.) A wonderful value. Shpg. wt., 8 oz.

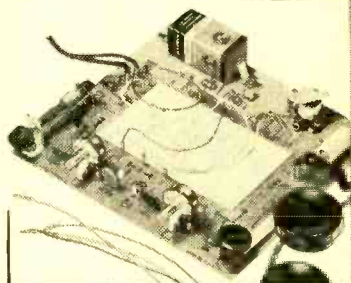
**Model Y-767.** Net only..... **\$245**  
**J-149.** Headphones. 1 1/4 lbs. ... **\$2.15**  
**C-100.** Antenna Kit. 1 1/2 lbs. ... **\$1.03**



### knight-kit 5-Transistor Superhet Portable Radio Kit

**Model Y-766**  
**\$2995**  
Handsome, easy-to-build personal portable with every ultra-modern design feature: 5 transistors (up to 200 hours playing time from 9v. battery supplied); printed circuit for easy building; big 3 1/2" speaker; push-pull audio output; built-in ferrite loopstick antenna. Sensitive reception of AM broadcast band with exceptional tone. In ultra-smart high-impact ivory plastic case with handsome gold trim; size only 7 1/2 x 3 3/4 x 1 3/4". With all parts, transistors, battery and instructions. Shpg. wt., 2 lbs.

**Model Y-766.** Net only..... **\$2995**



### knight-kit 10-Circuit Transistor Lab Kit

**Model Y-299**  
**\$1575**  
Sensational transistor hobby kit! Assemble the basic parts once, then complete project after project (10 in all), just by plugging leads into proper jacks on printed-circuit board—no wiring changes needed. Make the following: AM radio; amplifier; wireless oscillator; code practice oscillator; electronic timer, switch or flasher; voice-operated, capacity-operated or photoelectric relays. Includes all parts, 2 transistors, battery, headphones, instructions for each project. Shpg. wt., 3 lbs.

**Model Y-299.** Net only..... **\$1575**



### knight-kit 2-Transistor Pocket Radio Receiver Kit

It's fun to build this pocket-size two-transistor radio—enjoy loud, clear local broadcast-band reception wherever you go! Completely self-contained with built-in ferrite loopstick antenna—no external antenna needed. Extremely efficient reflex type 2-transistor circuit actually does the work of 3 transistors! Printed circuit board reduces building time to about one hour. Has air-dielectric variable capacitor for easy, accurate station tuning. Operates for months and months on long-life alkaline battery supplied. Sensitive miniature earpiece provides remarkably fine tone. Complete with all parts, including plastic-impregnated case, earpiece, battery and transistors. 4 x 3 3/4 x 1 3/4". Shpg. wt., 1 1/2 lbs.

**Model Y-262.** Net only..... **\$1465**

SEE DOZENS OF OTHER GREAT knight-kits IN THE BIG 404-PAGE ALLIED 1958 CATALOG



**FREE** Send for it

Get our 404-page 1958 Catalog featuring more than 50 ALLIED KNIGHT-KITS: Hi-Fi, Hobbyist, Instrument and Amateur Kits. Send for it now.



"RANGER" SUPERHET  
BROADCAST RECEIVER  
KIT. Y-735 **\$17.25**



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SW RECEIVER KIT  
Y-740 **\$11.95**



"10-IN-ONE"  
ELECTRONIC LAB KIT  
Y-265 **\$12.65**



TRANSISTOR RADIO  
RECEIVER KIT  
Y-765 **\$3.95**

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# GET THE MOST FOR YOUR MONEY IN **ALLIED** knight-kits

**EASIER TO BUILD** because KNIGHT-KIT "Step-and-Chek" instructions are marvels of simplicity—so easy to follow!

**LOWEST COST** because ALLIED'S giant buying power brings you biggest savings. Save most with KNIGHT-KITS!

**LATEST DESIGN**—each ALLIED KNIGHT-KIT incorporates the very latest circuitry for top-quality performance!



## knight-kit Transistorized Code Practice Oscillator Kit

Model Y-239

**\$3<sup>95</sup>**

Advanced-design code practice oscillator—ideal for beginners learning the code. Uses transistor circuit—operates for months from a single penlight battery. Has clear, crisp tone of approximately 500 cycles. Includes jacks for headphone tips; screw terminals for key. Compact black bakelite case with aluminum panel, only 2 3/4 x 3 3/4 x 1 1/2". Complete with all parts, transistor, battery and step-by-step instructions for quick, easy assembly. (Less earphones and key.) A fine code practice kit at very low price. Shpg. wt., 1 lb.

Model Y-239. Net only.....**\$3<sup>95</sup>**

## knight-kit Photo-Electronic Relay Kit

Model Y-702

**\$13<sup>50</sup>**

Advanced-design, ultra-sensitive photo-electronic relay—build it yourself and save! Covers 250-ft. with white light; 125-ft. with "unseen" (red filter) light (made available in Light Source Kit listed below). Ideal as announcer, counter, burglar alarm (can be set to ring bell continuously when beam is broken). Hundreds of uses. SPST relay contacts. 6.3v. terminals provide power for accessories. 105-120 v. 50-60 cy. AC use. 6 lbs.

Model Y-702. Relay Kit. Net. **\$13<sup>50</sup>**

Model Y-703. Light Source Kit. With long-life sealed beam bulb and red filter. Shpg. wt., 3 1/2 lbs. Net. **\$6<sup>75</sup>**

## knight-kit 2-Way Intercom System Kit

Model Y-295

**\$14<sup>75</sup>**

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 switchless answering and baby-sitting. In "closed" position, Remote is private", but can be called and can originate calls. High-gain 2-stage amplifier and 4" PM speakers. Delivers full volume from only a whisper. With tubes and 50-ft. cable (up to 200 ft. may be added). Antique white finish. Size each unit, 4 3/4 x 6 1/2 x 4 3/4". For 110-120 v. AC or DC. Shpg. wt., 8 lbs.

Model Y-295. Net only.....**\$14<sup>75</sup>**

## knight-kit "Space-Scanner" Bandswitching Receiver Kit

Model Y-243

**\$15<sup>95</sup>**

Thrilling 2-band receiver, easy to build, fun to operate—a terrific value. Bandswitch selects exciting short wave, including foreign broadcast, amateur, aircraft, police and marine radio (6.5 to 17 mc), and standard broadcast. Features highly sensitive regenerative circuit. Includes built-in 4" PM speaker and beam-power output for strong volume. Headphone connectors are available for private listening; switch cuts out speaker. Kit includes calibrated panel, punched chassis, all parts and tubes (less cabinet). Easy to build from step-by-step instruction manual. 7 x 10 x 6". For 110-120 volt, 50-60 cycle AC or DC. Shpg. wt., 5 lbs.

Model Y-243. Net only.....**\$15<sup>95</sup>**

Y-247. Matching cabinet for above.....**\$2<sup>90</sup>**



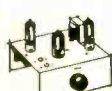
## HOBBYISTS! YOU GET THE WIDEST CHOICE IN ALLIED knight-kits—MOST FUN TO BUILD!



"6-IN-ONE"  
ELECTRONIC LAB KIT  
Y-770 **\$8.45**



CRYSTAL SET  
HOBBY KIT  
Y-261 **\$2.15**



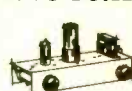
WIRELESS  
BROADCASTER KIT  
Y-705 **\$9.50**



PHONO OSCILLATOR KIT  
Y-760 **\$5.85**



ELECTRONIC  
PHOTOFASH KIT  
Y-244 **\$28.50**



PHONO AMPLIFIER KIT  
Y-790 **\$9.45**

**EASY TERMS AVAILABLE**

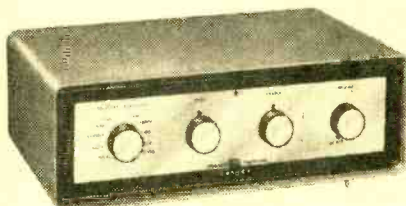
All Prices Net F.O.B. Chicago

**MORE knight-kits ON  
FOLLOWING PAGES**

**Hi-Fi**  
everyone  
can  
afford

## Sensational All-New ALLIED knight-kit HI-FI Equipment

World's Finest • Custom Styled • Easiest to Build • Money-Saving



- All-New Custom Styling
- Exclusive Printed Circuit Switch
- 8 Inputs for Every Signal Source
- Full 18-Watts with Superb Specifications

### knight-kit Complete 18-Watt Hi-Fi Amplifier Kit

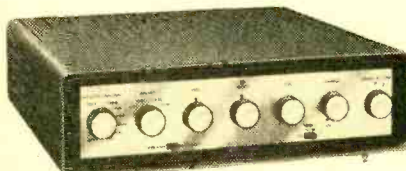
Model  
Y-786

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

Only \$3.99  
down

Here is a custom-styled, easy-to-build complete Hi-Fi amplifier at unbeatable low cost. Features 8 inputs for every possible signal source, including NARTB equalized tape head input. Delivers full 18 watts output at only .5% distortion; uses new RCA 6973 hi-fi output tubes; frequency response,  $\pm 1$  db, 20-30,000 cps; tape head and magnetic cartridge sensitivity, 5 mv for 18 watts output; hum and noise level better than 60 db below 18 watts; output taps for 4, 8 or 16 ohm speakers. Separate bass and treble controls; full record equalization. Simplest assembly is made possible through use of exclusive printed circuit switch and two printed circuit boards—no critical wiring to do. With beautifully styled custom cabinet; 4 x 13 x 8". Complete with cabinet, tubes, step-by-step instructions. Shpg. wt., 15 lbs.

Model Y-786. 18-Watt Hi-Fi Amplifier Kit. Net only..... **\$39<sup>95</sup>**



- New Printed Circuit Switches
- Three Printed Circuit Boards
- 8 Inputs • Full Equalization
- Full 30 Watts • Custom Cabinet

### knight-kit Complete 30-Watt Hi-Fi Amplifier Kit

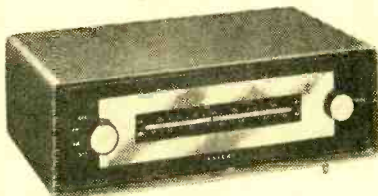
Model  
Y-762

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Model Y-762. 30-Watt Hi-Fi Amplifier Kit. Net only..... **\$76<sup>95</sup>**



- Latest Printed Circuit Design
- Flywheel Tuning • Built-in AFC
- High Sensitivity • Hi-Fi Response
- Advanced Custom Styling

### knight-kit FM-AM Hi-Fi Tuner Kit

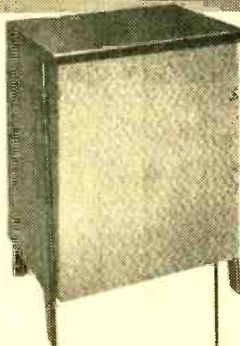
Model  
Y-787

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The best-looking, best-performing FM-AM tuner your money can buy! Covers full AM broadcast and 88 to 108 mc FM. Sensitivity is 2.5 microvolts for 20 db of quieting on FM; 3 microvolts for 10 db signal-to-noise ratio on AM. Features include: Inertia Flywheel Tuning for easy, accurate tuning; Automatic Frequency Control (plus AFC disabling) to "lock-in" FM stations; printed circuit board for time-saving, error-proof assembly; pre-aligned RF and IF coils; tuned RF stage on FM; drift-compensated oscillator; neon glow tuning pointer; cathode follower output; two output jacks—one for recorder, one for amplifier; built-in AM ferrite antenna. Ideal for use with KNIGHT-KIT amplifiers above. Includes handsome, custom-styled case, 4 x 13 x 8". Ready for easy assembly. Shpg. wt., 12 lbs.

Model Y-787. FM-AM Hi-Fi Tuner Kit. Net only..... **\$49<sup>95</sup>**

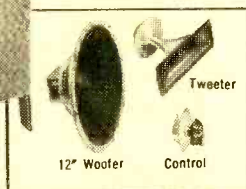


### knight-kit 2-Way "Ducted Port" Complete Speaker System Kit

Model Y-789

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**BIG SAVINGS**—assemble your own quality KNIGHT-KIT 2-Way Speaker System—it's easy! Cabinet is pre-finished—you just assemble 7 pieces, mount the speaker components and enjoy rich Hi-Fi sound. Special Jensen-engineered baffle features "ducted port" construction to enhance bass response. Kit includes Jensen 12" woofer and compression-type tweeter; genuine L-pad control permits adjustment of tweeter for best tonal balance. Impedance, 16 ohms. Assembled unit delivers frequency response of 45-14,000 cps. Enclosure measures 26 x 19 x 14". Kit includes everything required for easy assembly. Specify blonde or mahogany finish when ordering. Shpg. wt., 33 lbs.

Model Y-789. 2-Way Speaker System Kit.

Net only ..... **\$49<sup>95</sup>**

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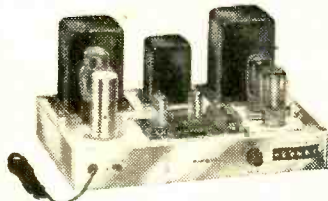


Model  
Y-754  
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Sensational Hi-Fi design at new low cost! Features precise record equalization guaranteed within 1/2 db of recommended accuracy! Exclusive new printed-circuit switches and 2 printed-circuit boards for easy, error-free assembly; built-in power supply; response,  $\pm 0.5$  db, 10-50,000 cps; 8 inputs (including Tape Head); separate Bass and Treble controls; separate Level and Loudness controls; Rumble Filter switch; DC on all tube filaments; cathode follower output. Beautiful custom-styled case, 4 x 13 x 8". Complete with case. Shpg. wt., 12 1/2 lbs.

Model Y-754. Preamplifier Kit. Net only. .... **\$39<sup>95</sup>**



Model  
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Model Y-755. 25-Watt Amplifier Kit. Net only... **\$44<sup>50</sup>**

Y-759. Metal cover for above. Wt., 3 lbs. .... **\$4.25**



Model  
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### knight-kit Hi-Fi FM Tuner Kit

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Model Y-751. Hi-Fi FM Tuner Kit. Net only. .... **\$38<sup>95</sup>**

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Printed circuit board for easy wiring. Easy-to-read 4 1/2" meter; 200 ua movement. Zero-center scale, direct-reading db scale. Polarity reversing switch. Response, 30 cycles to 3 mc. Input resistance, 11 megs. Ranges: AC peak-to-peak v., 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. 7 3/4 x 5 1/4 x 4 3/4". Shpg. wt., 7 lbs.

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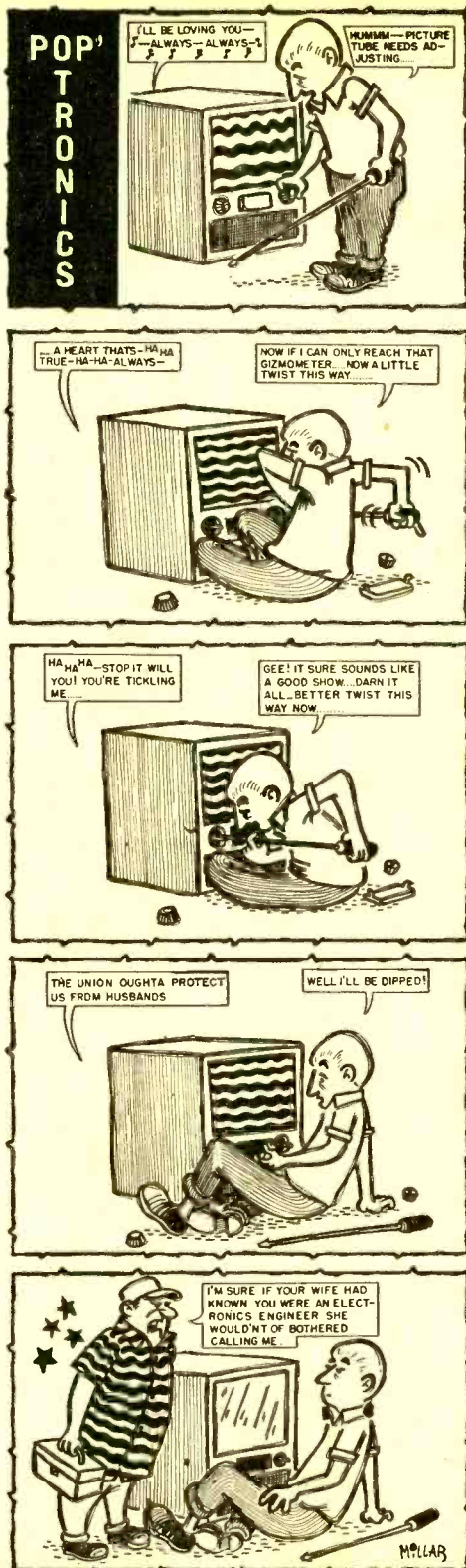
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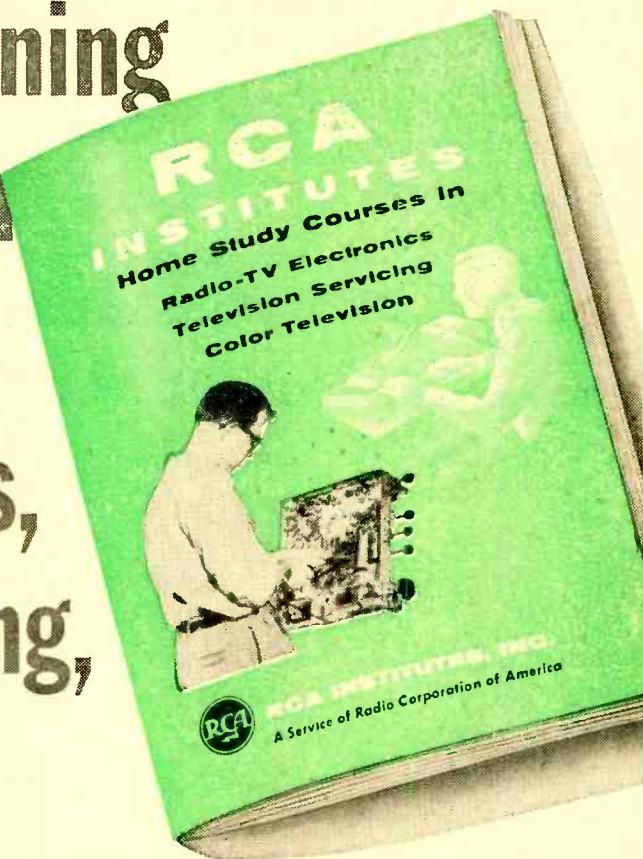
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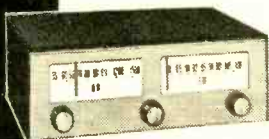
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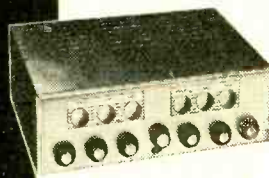
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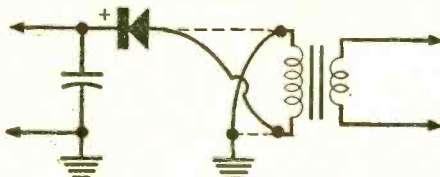
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# TIPS and TECHNIQUES

## ANOTHER HUM CURE

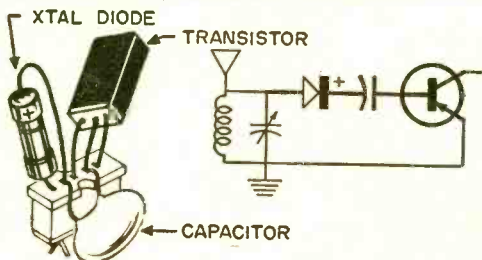
If hum develops in a regenerative receiver or preamplifier which uses a transformer-powered selenium B+ supply, it can sometimes be cured simply by reversing the transformer's high-voltage secondary



leads. The dashed lines in the schematic indicate the original wiring. The lead which previously went to the chassis terminal, and the lead which went to the rectifier connected to chassis. —F. H. T.

## SIMPLIFIED SUBMINIATURE WIRING

Transistor circuit wiring can be kept to a minimum by using the insert contacts of



subminiature sockets as clips. Temperature-sensitive components can be quickly and securely joined without heat, solder or the risk of damage. —W. P.

## CRAYONS FOR COLOR CODING

You can prevent mix-ups in wiring when only plain or single-color radio hookup wire is at hand. Color-code your wire by rubbing it with ordinary wax crayon. A small box of crayons contains eight or more colors. If still more are needed, use two colors on the same wire. —K.M.

## NOVEL SPEAKER REPAIR

In the course of normal handling, speakers with aluminum high-frequency caps may develop minor dents in their delicate



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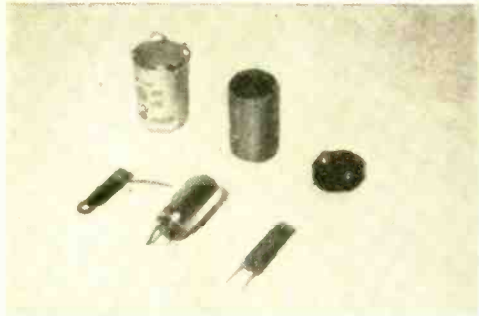
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diaphragms. A dent can be removed without major effort by using the sticky end of a Band-Aid. Press the adhesive gently to the "wound," then pull it out. —D.L.S.

## EXPERIMENTAL PARTS FROM STARTERS

Need a neon-glow lamp and some other parts for experiments? Then save those plug-in starter switches that are used with



fluorescent lamps. Each starter contains a neon-glow lamp, a thermo-switch, and a small paper capacitor. The outside aluminum housing and inside insulating sleeve also have many uses. —J.A.C.

## BLOCK STRAIGHTENS BENT LEADS

To straighten the bent pigtail leads of capacitors or resistors, lay the wire lead

on the edge of a flat surface and roll a flat block of hardwood over it with moderate pressure. This trick is handy for wires to



be used in circuits at very high frequencies where bends add inductance. —J.A.C.

## STRANDED WIRE INSTALLATION

Because individual strands have a tendency to separate, many experimenters avoid the use of stranded wire. The military services, however, prefer stranded to solid hookup wire because of stranded wire's greater flexibility and resistance to vibration. For special jobs, you can do a neat wiring job by following their procedure.

(Continued on page 109)

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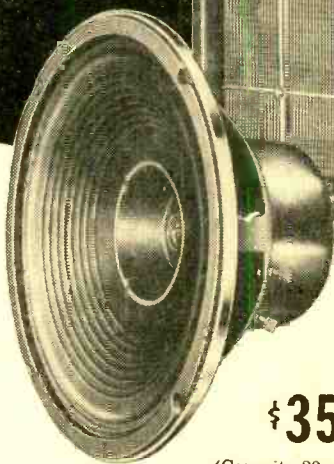
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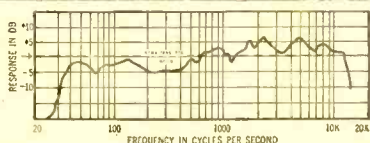
The famous Electro-Voice SP12B RADAX coaxial speaker *economically* delivers the smoothest, widest range available in any loudspeaker in its price class. This is paralleled by its superb efficiency, which means full, distortion-free sound with *less* power from the amplifier. When these qualities are combined with the wide polar distribution afforded by the second RADAX cone element, you have fine listening pleasure—



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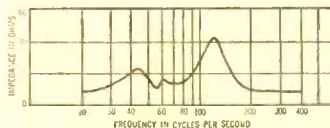
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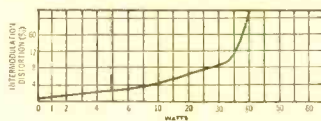
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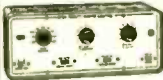
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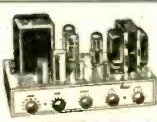


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# Build Your Own Vibrato

**I**F YOU OWN an electronic musical instrument or a conventional instrument equipped with a pickup, chances are that the vibrato described in this article is just what you've always wanted.

A vibrato is a device which continuously and automatically varies the amplitude of the music at a low rate of speed, usually somewhere in the range of 6 to 15 times per second. For instance, it is a vibrato which produces the soul-stirring throbbing, especially in the bass notes, of a pipe organ.

**Construction.** Layout and wiring are not especially critical. For convenience a turret socket was used to mount the oscillator tube, *V1*, and its components, but a standard socket and tie points will do as well.

Miniature coaxial jacks, of the type found on most hi-fi amplifiers, were used at *J1* and *J2* for the output and input con-

December, 1957

*Make like Elvis  
with an "electronic"  
throbbing guitar*

**By FRANK H. TOOKER**

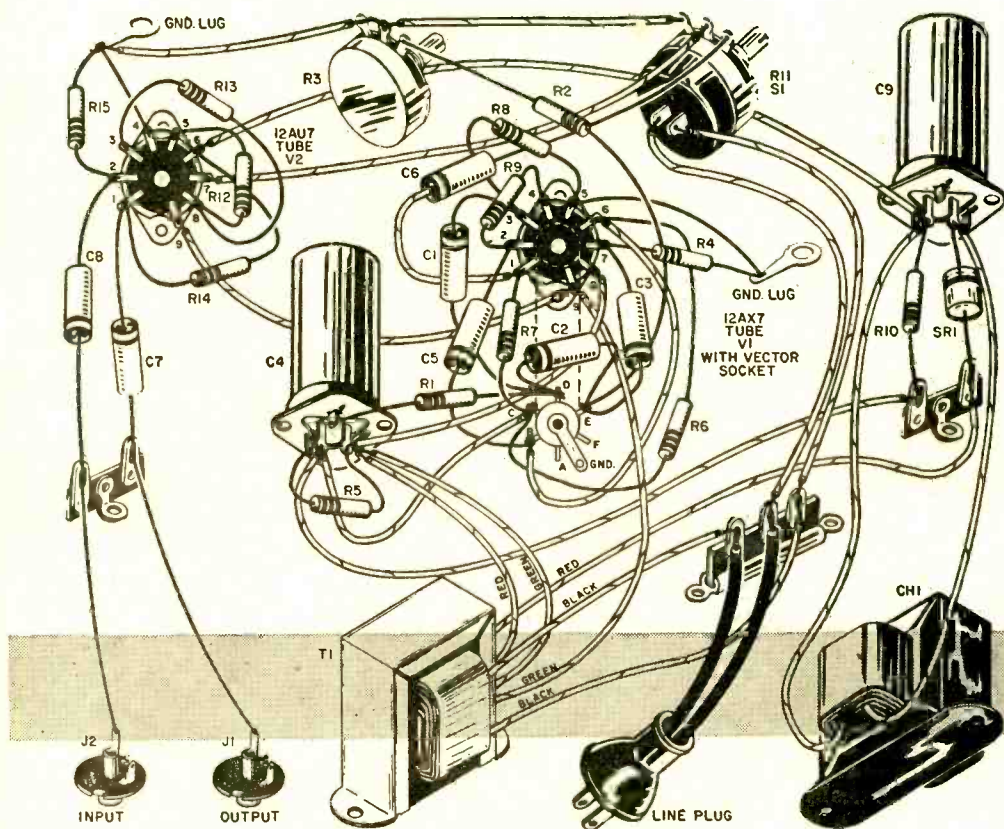
nections, respectively. If your setup requires something different, any conventional type of jack may be employed.

Keep the power supply components well separated from the oscillator and modulator components, to prevent hum pickup—and orient the tube sockets for reasonably short lead connections. Make sure that the 6.3-volt heater leads are dressed snugly against the chassis and that they are well separated from grid terminals and leads.

A miniature amplifier foundation (Bud No. CA-1754) was used for a chassis (any other setup of suitable size can be substituted).

The Bud chassis measures 5" x 7" x 2", and its over-all height with the grille cover in place is 6". The finish is black crackle—but if some other color appeals to you, it's a simple matter to go over the chassis with a couple of coats of plastic spray.

In some instances, it may be possible to mount the vibrato circuit proper on the same chassis with the musical instrument amplifier. This can be done provided that there is room, and that the power transformer in the amplifier can supply the 0.6-ampere additional filament current de-



## PARTS LIST

C1, C2, C3, C5—0.05- $\mu$ f.d., 200-volt, metalized paper capacitor

C4a/C4b—20/20- $\mu$ f.d., 150-volt, dual electrolytic capacitor

C6, C7, C8—0.02- $\mu$ f.d., 200-volt, paper capacitor

C9a/C9b—40/40- $\mu$ f.d., 250-volt, dual electrolytic capacitor

CH1—3.5-henry, 50-ma. filter choke

J1, J2—Miniature phono jack

R1, R4, R7, R8, R10—220,000-ohm,  $\frac{1}{2}$ -watt resistor

R2, R6—100,000-ohm,  $\frac{1}{2}$ -watt resistor

R3—500,000-ohm potentiometer (Rate control)

R5—10,000-ohm,  $\frac{1}{2}$ -watt resistor

R9—3.9-megohm,  $\frac{1}{2}$ -watt resistor

R11—500,000-ohm potentiometer (Depth control)

R12—27,000-ohm,  $\frac{1}{2}$ -watt resistor

R13—560-ohm,  $\frac{1}{2}$ -watt resistor

R14—47,000-ohm,  $\frac{1}{2}$ -watt resistor

R15—470,000-ohm,  $\frac{1}{2}$ -watt resistor

S1—S.p.s.t. switch (on Depth control)

SR1—20-ma., 130-volt selenium rectifier

T1—Miniature power transformer, 125 volts at 15 ma., 6.3 volts at 0.6 amp. (Stancor PS-8415)

V1—Type 12AX7 tube

V2—Type 12AU7A tube

1—Miniature amplifier foundation chassis or equivalent (see text)

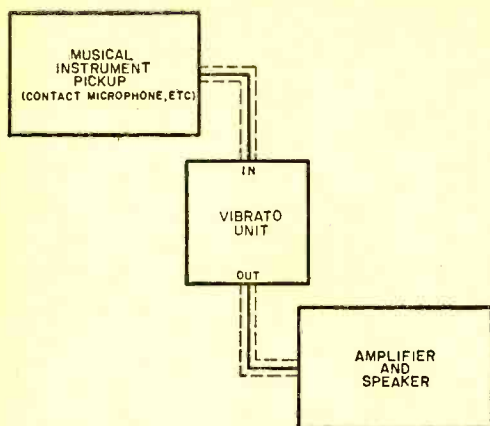
1—Turret-type miniature 9-pin tube socket

1—Miniature 9-pin tube socket

Misc. hardware, grommets, tie points, etc.







**Block diagram** shows correct interconnection of the three basic components of the revised setup. Use shielded microphone cable between units to prevent electrostatic hum pickup. If there seems to be excessive 60-cycle hum present, try reversing line plug of either amplifier or vibrato unit.

manded by the two vibrato circuit tubes. The plate voltage requirement is approximately 175 volts.

**Hooking It Up.** The vibrato is intended to be inserted or connected between the musical instrument and its amplifier. All you have to do to use it is unplug your musical instrument from its amplifier and plug it into the *input* jack of the vibrato. Then connect a jumper cable of convenient length between the *output* jack of the vibrato and the *input* jack of the amplifier.

The *Rate* control determines the rate or frequency of the vibrato effect, i.e., the

### HOW IT WORKS

The schematic shows that the vibrato consists of two parts: (1) a very low frequency audio oscillator, and (2) a modulator. The low-frequency oscillator is of the phase-shift type which uses resistors and capacitors  $C1$ ,  $C2$ ,  $C3$ ,  $R1$ ,  $R2$  plus  $R3$ , and  $R4$  in three RC sections to obtain feedback in the proper phase to produce oscillations. The rate or speed of the vibrato, i.e., the frequency of the oscillator, is determined by the resistance and the capacitance used in the RC sections. Thus,  $R3$  is the *Rate* or speed control of the vibrato.

V1's second triode section serves a dual purpose: (1) it provides a low source impedance for the RC feedback loop (taken from the cathode), and (2) it acts as a buffer to isolate the oscillator from the connection to the modulator (taken from the plate).

The low-frequency oscillator signal is fed through the gain or *Depth* control,  $R11$ , to the control grid of one section of the twin-triode modulator, V2. At the same time, the output signal from the musical instrument is fed through to the control grid of the second section. The two signals mix in V2, with the result that the gain or amplification of the musical signal is made to increase and decrease, smoothly and periodically, at the rate of the low-frequency oscillations. Output from the modulator is taken through C7 and coupled to the input of the musical instrument's conventional amplifier.

Plate current demand is very small, so a miniature power transformer, T1, and a miniature selenium rectifier, SR1, more than meet the requirement.

speed at which the rise and fall in amplitude occurs. Proper setting of this control depends upon the type of instrument with which the vibrato is used and the type of music being played. Component values given in the parts list permit the unit to be adjusted over the most useful range of speeds.

The *Depth* or vibrato-frequency gain control determines the amplitude of the

### POSSIBLE TROUBLES AND CURES

**No Vibrato Effect:** Check all wiring for errors. Make sure input and output plugs are making good contact in the jacks. Look for faulty components. Check the tubes. Make sure the 12AX7 tube is in the oscillator socket, the 12AU7 in the modulator socket, and not vice-versa. Check interconnecting cables for a poor solder joint or broken wire.

**Distortion:** Most, if not all, vibratos cause a certain amount of distortion. However, the effect should not be objectionable. Reduce the setting of the *Depth* control slightly to see if it improves the condition. If so, check the musical signal voltage at the input to the modulator. An input greater than 0.7 volt r.m.s. may cause distortion. Check the value of components around the modulator. Look for a possible defective component. And check the modulator tube.

**Thumping in Speaker:** A thumping noise at the vibrato rate may be due to low frequencies pulling the voice coil or cone out of linearity. This isn't likely to happen unless you have an amplifier with exceptionally heavy bass response. A high-pass filter cutting off at about 100 cycles inserted between the vibrato and the amplifier may be necessary in such cases if all else fails.

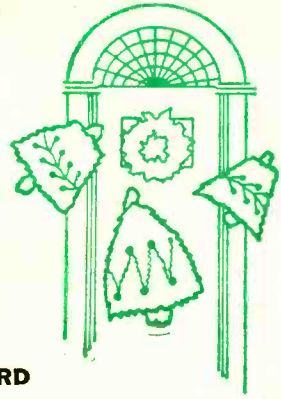
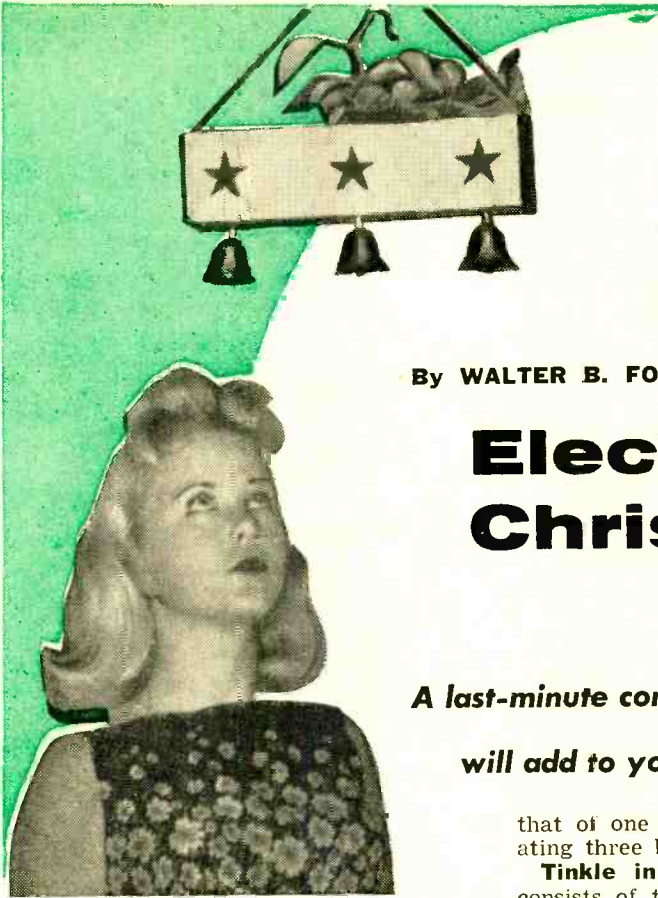
**Hum:** Hum can come from a variety of sources such as a poor layout of components, excessively long leads or poor lead dress, a defective modulator tube, faulty filter choke or capacitors, unshielded interconnecting cables or cables with the shield ungrounded to chassis, using the unit close to power wiring carrying heavy a.c. currents, etc. All of these possible troubles can be easily corrected.

vibrato effect. The more this control is advanced, the more pronounced the vibrato effect becomes. Proper setting depends upon the strength of the musical signal fed to the modulator as well as on the type of instrument and the selection being played.\*

Probably the best method is to adjust the *Rate* and *Depth* controls for the most pleasing effect. You can get some idea as to proper settings by listening to recordings in which a vibrato is used. Many beginners tend to use too much vibrato, or to use it too frequently. Much can be learned by listening to professionals. —30—

\* Maximum musical signal voltage should not be greater than approximately 0.7 volt, to prevent overloading the unit. Optimum operation occurs with a musical signal input from the contact microphone between 0.5 and 0.7 volt.





By WALTER B. FORD

# Electronic Christmas Bells

*A last-minute construction job that will add to your yuletide cheer*

SO YOU'VE got the lights strung on the tree, and the yuletide decorations in the windows, and just about everything else you can think of is in place to add to your Christmas cheer, but you're still not satisfied. You want something a little different from your next-door neighbor's.

Ah, well, if you're really determined, POP'tronics, in the spirit of Christmas giving, offers this inexpensive little tinkler for you to build in a few hours of your spare time before the holiday rolls upon you. You'll be surprised at the excitement it will cause—particularly if you hang a bit of mistletoe from it as a lure for the gals.

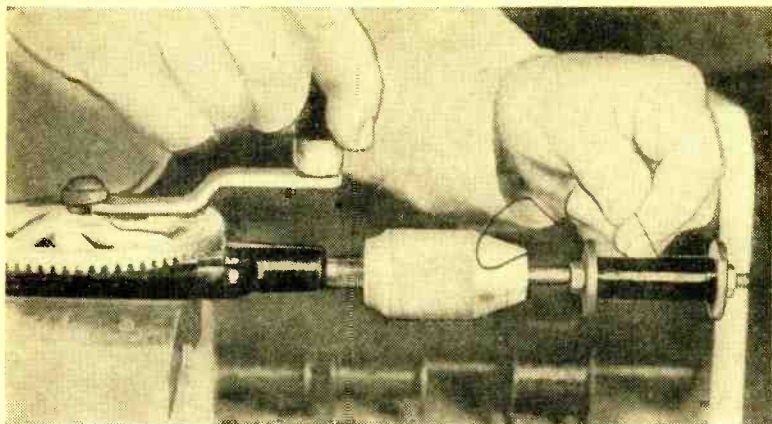
While the unit contains three bells, you may use more or less, as you desire. Note that separate transformers are used for each bell, rather than a single transformer. Since it is best to break the circuit in the primary to prevent TV interference and also to have each bell operate independently, a flasher button and a separate transformer are the best combination. And, fortunately, there are suitable transformers available which may be purchased in lots of three at a price comparable to

that of one transformer capable of operating three bells.

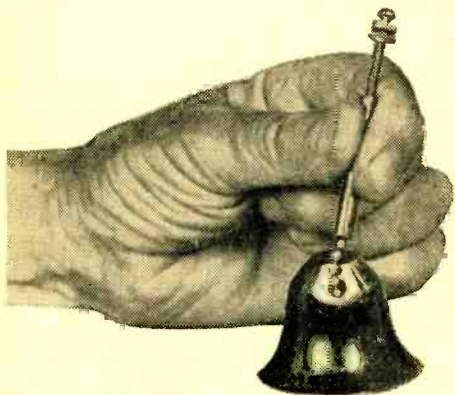
**Tinkle in Oscillation.** The bell unit consists of three solenoids in which steel plungers attached to bell clappers move up and down, causing the clappers to hit the sides of the bells. Due to the action of the flasher buttons in the primary circuit of the transformers when the circuit is closed, the plungers oscillate up and down several times before coming to rest. This action produces a very pleasing tinkling.

Each solenoid is wound on a form 2" long with an inside diameter of about  $\frac{1}{4}$ ", as shown on page 47. Cardboard, plastic, fiber, or other insulating material may be used for the form. Or a piece of  $\frac{3}{8}$ " wood dowel with the center drilled out may be used for the tube through which the plunger operates. Wind each solenoid with 18 layers of No. 26 insulated magnet wire. If a lathe is not available for winding the coils, a hand drill placed in a vise will make a very satisfactory substitute. The plunger consists of a piece of soft steel rod, drilled and tapped for a 6-32 machine screw to a depth of  $\frac{1}{2}$ ".

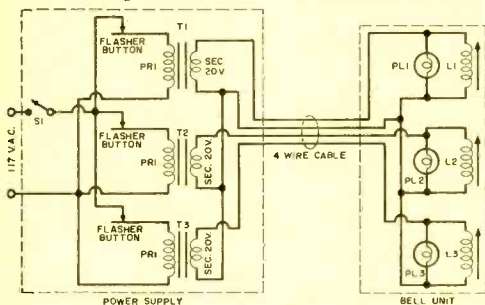
The bells are mounted on a wood base, 2" wide and 12" long. These bells are the type usually sold in dime stores. They have a diameter of 2" and a height of  $1\frac{1}{2}$ ". There are other bells which may be used



If you don't have a lathe for winding solenoids, you can do a good job with a hand drill placed in a vise. See text for the proper coil size.



See how the hole drilled near top of bell (above) allows the clapper chain to move with little friction. Wiring details for tinkler are given below.



### BILL OF MATERIALS

- L1, L2, L3—Solenoid (see text)
- PL1, PL2, PL3—Miniature light socket with 20-volt bulb
- S1—S.p.s.t. toggle switch
- T1, T2, T3—Bell-ringing transformer (Olsen Radio Warehouse, Akron, Ohio)
- 3—Flasher buttons
- 1—Length of 20-gauge, four-conductor cable
- 1—1-lb. spool of No. 26 insulated magnet wire (4 ounces for each coil)
- 3—Small hand bells (see text)
- 3—Pieces of soft steel rod, round,  $\frac{1}{4}$ " diameter,  $1\frac{3}{4}$ " long
- 1—4" light socket chain
- 1—Four-terminal socket (optional)
- 1—Four-terminal plug (optional)
- Misc. wood base, sheet metal, screws, etc.

if the mounting dimensions are varied accordingly.

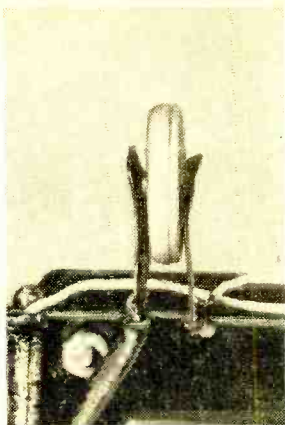
**Preparing the Bells.** Remove the handles and clappers from the bells and drill  $\frac{1}{4}$ " holes through the bells on one side, near the top, so that a piece of light bulb socket chain will pass through hole freely. Before securing the bells to the wood base, drill  $\frac{9}{32}$ " holes through the wood base through which the solenoid plungers will move. These holes should be located so that they will be directly over the  $\frac{1}{4}$ " holes in the bells when the bells are secured to the wood base. Glue the solenoids to the wood base, then secure the bells in position with  $\frac{3}{8}$ " spacers and wood screws. The spacer will allow the necessary space for the plunger to move in and out of the solenoid.

Insert a machine screw on which a nut and washer have been placed in the threaded end of the steel plunger, as shown in the drawing. Solder a piece of light bulb socket chain about 1" long to the opposite end of the plunger. Solder pieces of spring brass in which No. 34 holes have been drilled to the ends of the plungers, so that the clappers may be attached to the ends of the chains. Attach miniature light bulb sockets to the wood base directly in front of the solenoids. Connect the solenoids and sockets according to the wiring diagram.

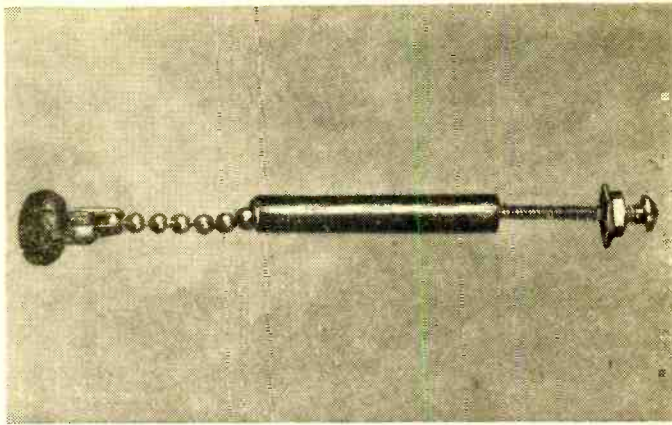
Make a metal housing for the unit with  $\frac{1}{2}$ " holes drilled directly over the plungers. The face of the housing may be made of cardboard through which a suitable greeting, such as "Welcome" or "Merry Christmas," or figures may be cut and illuminated from within by means of colored light bulbs or colored cellophane backing. The unit constructed by the author uses green and red stars with a very pleasing effect.

**The Power Supply.** The power unit consists of 20- or 24-volt transformers and small flasher buttons. All of the trans-



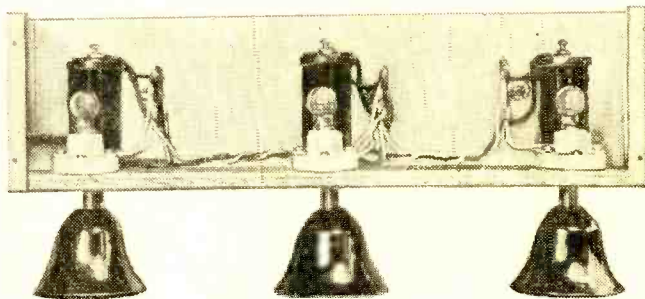


**Side view** of flasher button as it is held between spring brass brackets on one transformer.



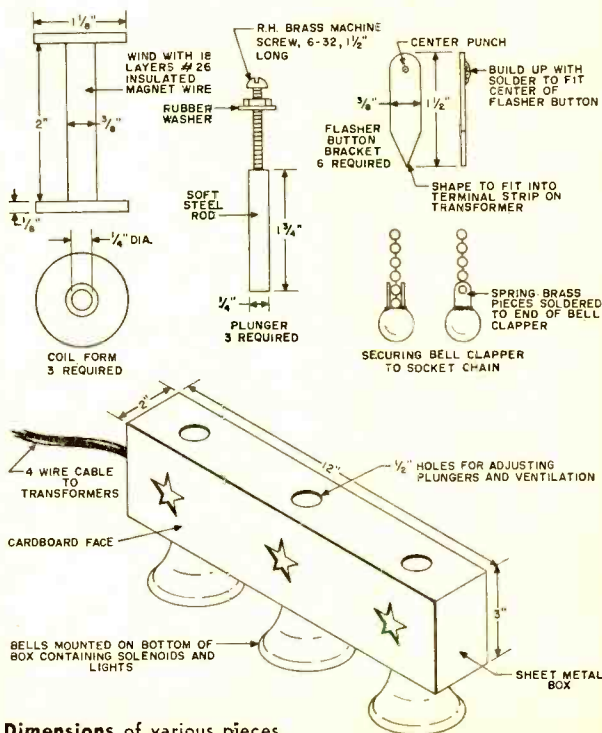
**Completed solenoid plunger** with bell clapper secured to end of chain. Clapper may be removed easily to allow plunger to be inserted into the solenoid. Note how length can be varied by nut and washer.

**Bell unit** with front removed to show solenoids and miniature lights. Terminal strips at right of coils prevent breakage of the solenoid leads.



formers may be controlled by one switch, or each by a separate switch. The flasher buttons are mounted on the transformers by means of three-terminal tie points and spring brass brackets, as shown on the drawing. A four-wire cable completes the circuit to the solenoid unit. A four-wire socket and plug at either end of the cable will provide for more convenient handling of the unit. The power supply should be enclosed for safety.

With the flasher buttons in place and 20-volt lamps in the sockets, the unit is ready for preliminary adjustment. Connect the power supply to 117 volts, a.c., and adjust each plunger and each length of socket chain for the desired sound from the corresponding bell. If you want a different tone from each bell, you can slot the edge of the bell with a hack saw. Adjust the plunger by turning the nut on the machine screw up or down.



**Dimensions of various pieces.**

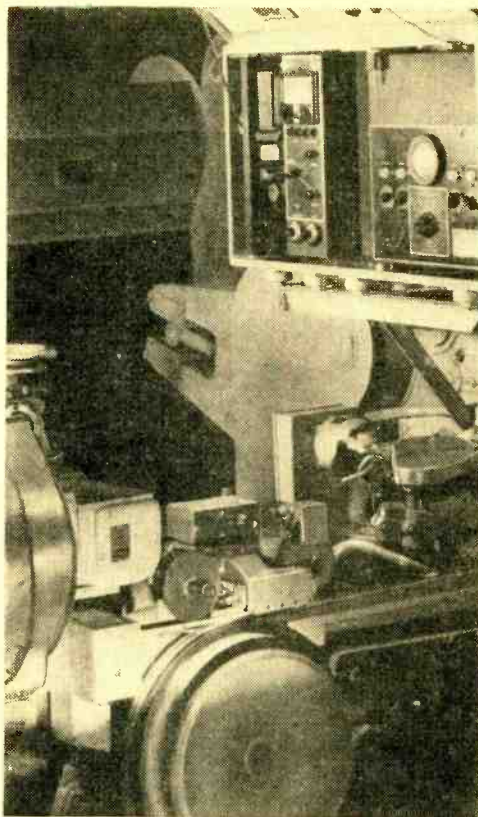
## The Fine ART of MEASUREMENT

**A** NEW ERA has dawned in the fine art of measurement. AccuRay, a device which uses atomic rays as a control, can measure with unheard-of precision any material that goes through a roller or a pipe. This means that metal, paper, rubber, plastic—you name it—can be processed with a fineness that by 1961 will save industry a billion dollars a year. How it works is amazingly simple.

The machine usually consists of two arms. The "hot" arm is mounted beneath the moving material to be gauged, the other above it. In the lower arm is a radioactive isotope pellet, whose rays penetrate the sheet and are detected by a counter in the upper arm. The thickness of the sheet, or tube, determines the amount of radiation getting through.

Let's assume that the process is going along smoothly, and that the sheet is being rolled at precisely the correct thickness. Suddenly, the tension of the rollers changes imperceptibly—a common occurrence—and the thickness is changed by a fraction of an inch. In that instant, the number of rays reaching the counter changes, either up or down, according to whether the sheet is thicker or thinner. In a fraction of a second, the counter flashes a warning to the control to which it's linked, and the rollers are adjusted back to their original tension. This is automatically indicated on a recorder hooked up to the device, so that a permanent record of accuracy is kept.

One of the most publicized uses of AccuRay is in the control of cigarettes. Here the long tube of tobacco-filled paper passes between the jaws of the machine (above). If there is a variance of a fraction of a degree



in the amount of tobacco in the tube, AccuRay rejects it automatically, and has the cigarette machine reset to give the proper weight of the tobacco in the following cigarette tube.

Another important use of the device is in the making of tires. Heretofore it has been difficult to get a precisely balanced tire, since the weight of the rubber as it was being rolled varied by more than the tolerance needed. With AccuRay, this changed—tire rubber is being held to accurate tolerance, and tires are being made both cheaper and better.

—30—

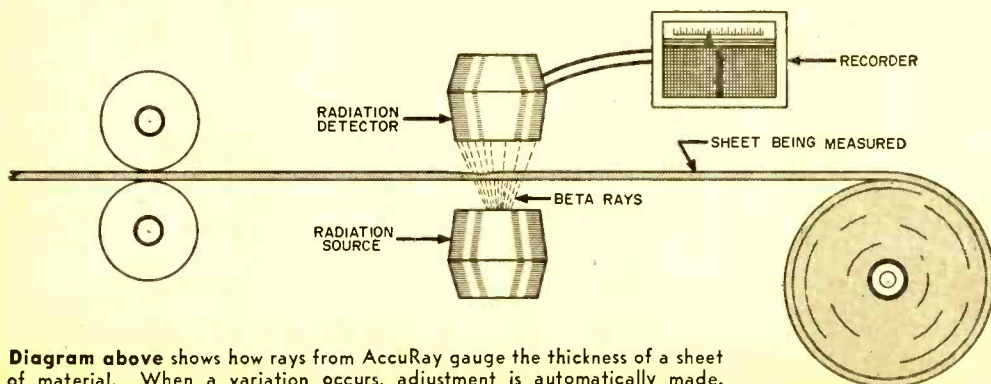


Diagram above shows how rays from AccuRay gauge the thickness of a sheet of material. When a variation occurs, adjustment is automatically made.



# Printed

## Circuits

## Come of Age

By ALLEN LYTEL



**P**RINTED circuits have come of age. Today they are an integral part of almost all electronic equipment. Look at the nearest device: if it has been made in the past year, the chances are that in it you will find printed circuits or components.

Some of the newest uses for printed circuits are in the instrument cluster connections in an auto dashboard (see photo above). Guided missiles have compact, reliable controls which use printed circuits, and so do midget tape recorders, jet planes, hearing aids, electronic organs, and hundreds of other devices.

**The most common** type is an insulating board\* with a pattern of conducting wires (below right). A photo or printing process transfers the design to the copper-clad base and an etching process removes the excess copper, leaving the circuit. In other methods, the conductors are built up on the insulated base. Next step is the placement of components, handled mechanically. In one machine all heads are controlled simultaneously, and as the board is positioned, all the capacitors and resistors are inserted in one operation. In another machine, they are inserted one at a time as the board moves down the line. After the components are inserted, all parts are dip-soldered in place in a single operation.

The use of printed circuits has led to the development of modules. These are complete circuits such as audio amplifiers, cathode followers or pulse generators.

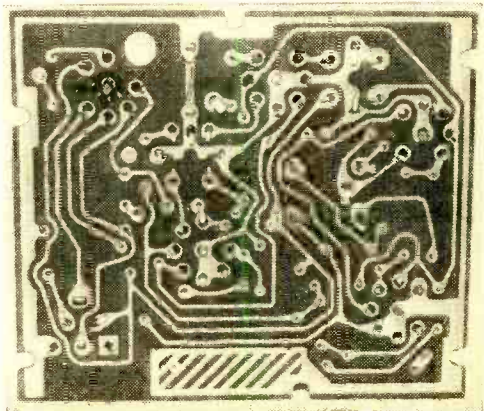
**Modules are built** on a single board as a unit, acting as a standard circuit which can be used in different end products. Figure 1 on the next page shows an experi-

mental TV receiver built of 17 modules which hold 153 of the 195 components (resistors, capacitors, etc.) exclusive of the tuner. Other modular construction is of the type in Fig. 2. These are plug-in boards as used in many computers and industrial controls. Tube and tubeless types with diodes are shown.

These modules can be made up of smaller units. For example, several resistors and capacitors can make up a package—a "super component"—and can be used on a printed-circuit board (Fig. 3). In another way of treating the same situation, the components are encapsulated in phenolic material (Fig. 4).

The newest development is flat Tape Cable (Fig. 5) which eases the task of interconnecting printed wiring (see October issue of POPULAR ELECTRONICS, p. 72).

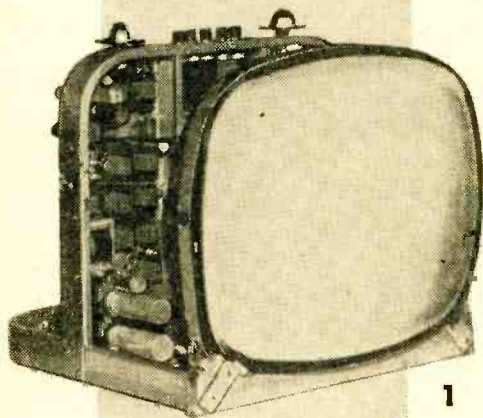
(Figures 1-5 appear on pages 50 and 51)



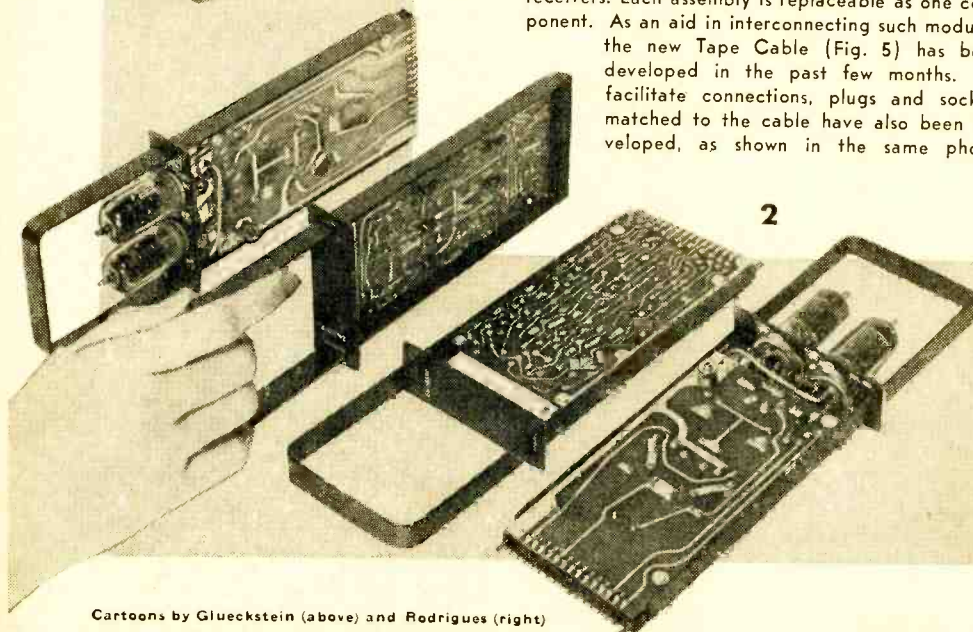
\* See "Simplified Etched Circuits," June, 1957, p. 67.



"If this works you'll make hearing-aid history —"



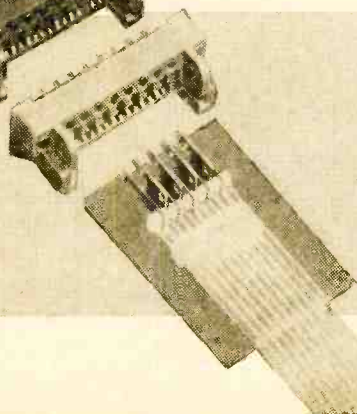
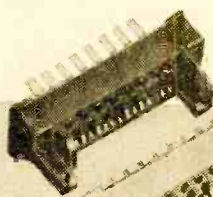
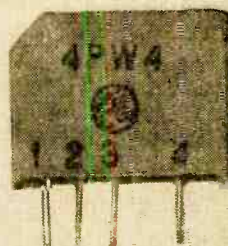
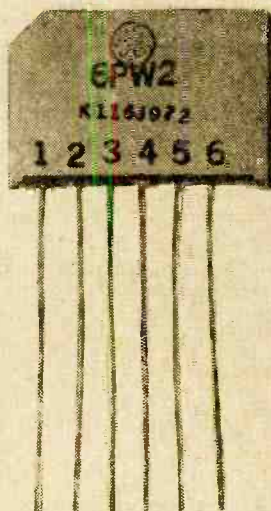
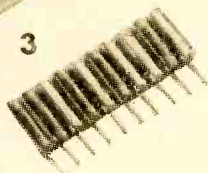
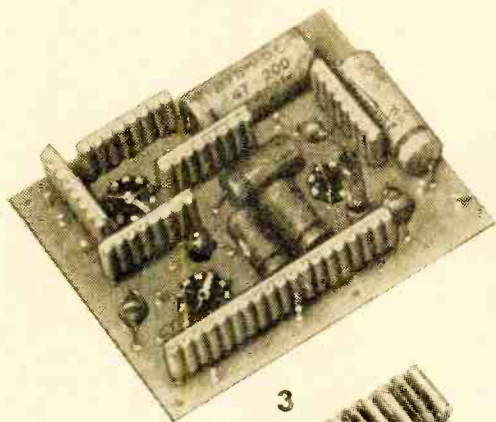
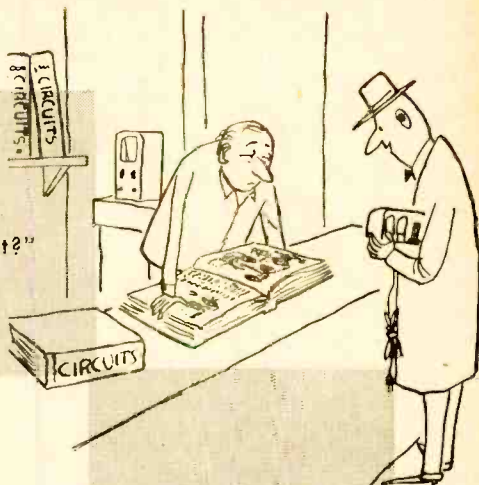
**Outgrowths** of the simple printed circuit shown on the preceding page are the modules on these two pages. An excellent example of modules put to use is in an experimental television receiver (Fig. 1) which has 195 components plus the tuner. Of these, 153 parts are mounted in 17 modules, some of which can be seen in the photo. Industrial control modules are shown in Fig. 2. These are plug-in boards, both tube type and tubeless with diodes. Such modules can be made up of even smaller units—the so-called "super component"—as shown in Figs. 3 and 4 (at right). In Fig. 3, leadless resistors and capacitors are made up into a single pre-wired unit (small photo) which is then mounted on a small printed-circuit board (larger photo). Note how this arrangement saves space. Another way of doing the same thing is shown in Fig. 4. Here groups of components are encapsulated in phenolic cases. Units like this are found in most of today's television receivers. Each assembly is replaceable as one component. As an aid in interconnecting such modules, the new Tape Cable (Fig. 5) has been developed in the past few months. To facilitate connections, plugs and sockets matched to the cable have also been developed, as shown in the same photo.



Cartoons by Glueckstein (above) and Rodrigues (right)



"Those the printed circuits you hear about?"





# Transistor Topics

By LOU GARNER

AND a Merry Christmas to *you* . . . together with the sincere wish that your Christmas Stocking will be brimming full with exactly what *you* would like old St. Nick to bring—be it a new car, new test equipment, or a whole cartload of transistors and miniature components.

In the past few weeks our mail has included a lot of letters asking about high-frequency operation of transistors. There's nothing especially mysterious about transistors at high frequencies. The circuits themselves are quite similar to those used at, say, AM broadcast-band frequencies (550 to 1500 kc.) except, of course, for the values of components in the tuned circuits. But the important thing is to have the proper type of transistor.

**High-Frequency Operation.** Tetrode transistors (see our May 1957 column) may be used up into the hundreds of megacycles. The highest frequency tetrode available at this writing is Texas Instruments' Type 3N25—this is a *p-n-p* unit with a cutoff frequency of 250 mc. General Electric, too, offers a whole series of tetrode transistors—the highest frequency unit is the 3N30, an *n-p-n* transistor with a cutoff frequency of 120 mc. RCA is currently offering the highest frequency *triode* transistor, the 2N384; this is a *p-n-p* unit with cutoff frequency of 100 mc. which may be used as an oscillator up to 250 mc.

In general, r.f. transistors will serve as *amplifiers* up to, or slightly past, their nominal "cutoff frequency" (at which their gain is approximately 70% of that achieved at low frequencies), and as *oscillators* well above cutoff frequency. Take the RCA transistor as an example. With a cutoff frequency of 100 mc., this unit will provide 15 db gain at 50 mc. in a common base amplifier circuit. It provides unity gain at 250 mc.

The lowest priced high-frequency transistor as far as the home experimenter is concerned is probably Philco's Type AO-1 *surface barrier* transistor. With a rated cutoff frequency of 30 mc., the AO-1 is offered at slightly under \$2.00 by leading mail order supply houses.

All of these transistors are suitable for receivers and *low-power* transmitters. Unfortunately, no manufacturer is currently offering medium or "hi" power transistors for use at high r.f. values.

**Readers' Circuit.** One- and two-transistor receiver circuits are extremely popular with home builders. Almost all such circuits featured in past columns have used either detector-amplifier or simple regenerative-detector arrangements. These circuits, at best, have limited sensitivity and, usually, just fair selectivity.

This month, however, we have a most interesting "maximum performance" two-transistor receiver circuit. Submitted by

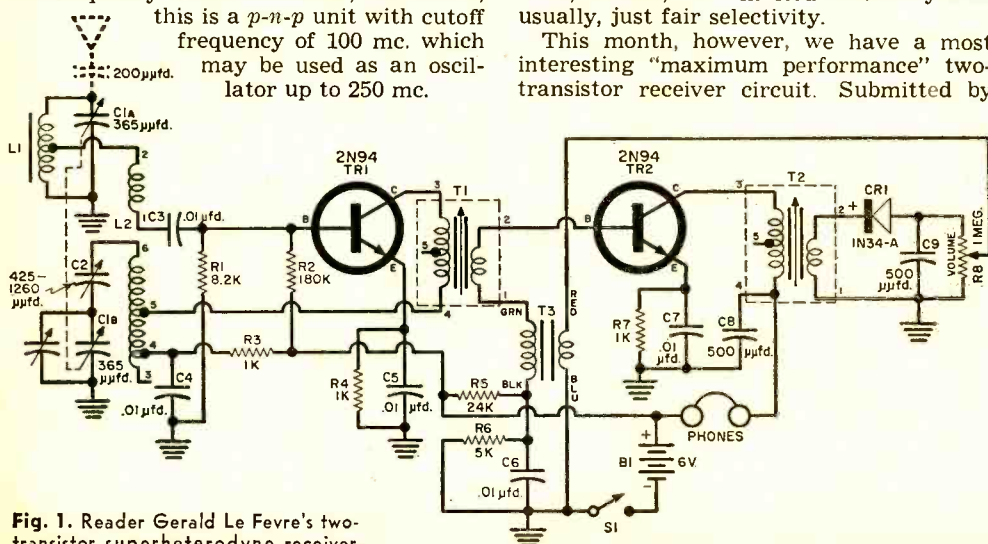


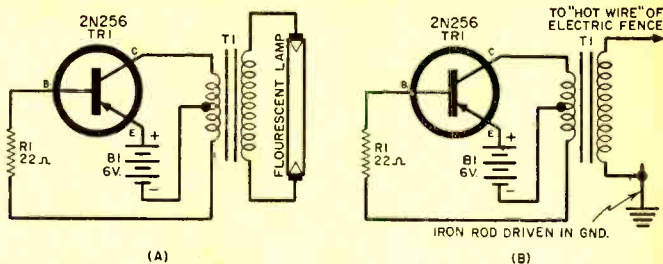
Fig. 1. Reader Gerald Le Fevre's two-transistor superheterodyne receiver.



Gerald Le Fevre, of York Rd., Pavilion, N. Y., as his "favorite," this receiver has a *superheterodyne* circuit. In addition, it uses a reflex arrangement, permitting one transistor to serve both as an i.f. stage and as the audio amplifier. Coils *L1* and *L2* are Miller Types 2000 and 2020 respectively.

Referring to Fig. 1, you will see that a Sylvania Type 2N94 r.f. transistor serves as a combination mixer-local oscillator. The i.f. output signal developed across the primary of transformer *T1* is coupled to the i.f. amplifier stage, a second 2N94. *T1* is a Miller 2041.

The amplified signal then goes from i.f. transformer *T2* (Miller 2042) to a 1N34A diode, which serves as the second detector. The resulting audio signal, appearing across



**Fig. 2.** Two simple uses for a transistorized high-voltage "generator," suggested by reader Charles Rakes: (A) night light; (B) electric fence.

as well. A Miller #2112 two-gang unit serves as tuning capacitor (*C1a/C1b*). All resistors are ½-watt units, while all fixed capacitors may be small disc ceramics or paper tubulars.

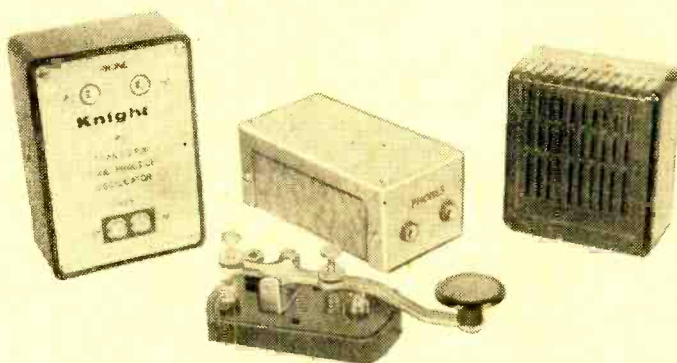
If you assemble one of these receivers, be sure to keep your layout as "clean" as possible, with all signal leads short and direct. Watch the *battery polarity* . . . remember that the 2N94 is an *n-p-n* transistor! Moderate-impedance (2000 to 4000 ohm) magnetic headphones should be used.

You shouldn't need an external antenna for stronger local stations. However, for additional pickup, try connecting an antenna to the "hot" side of the ferrite antenna coil (*L1*) through a 200-μfd. ceramic or mica capacitor.

To align the unit for best operation, use a standard r.f. signal generator. With a modulated r.f. signal, peak the i.f. transformers for maximum output at 455 kc. Adjust the oscillator trimmer capacitor (across *C1b*) for tracking at the high-frequency end of the dial (around 1500 kc.) and the padder capacitor (*C2*) and oscillator "slug" (in *L2*) for tracking at the low-frequency end of the band (about 600 kc.), "rocking" the tuning capacitor as you do so. If an antenna trimmer capacitor is provided (across *C1a*), adjust this for maximum output above 1550 kilocycles.

**High-Voltage "Generator."** Reader Charles Rakes, of 4419 Harrison St., Kansas City, Mo., has submitted a pair of interesting applications for a high-voltage "generator" designed around a low-cost power transistor. Referring to Fig. 2, a CBS-Hytron Type 2N256 power transistor is connected as a modified "Hartley-

(Continued on page 122)



**Transistorized** code practice oscillators are currently available in kit form from, left to right, Knight (Allied Radio), WRL Electronics and Lafayette Radio. See page 122 for details on all of these units.

volume control *R8*, is "reflexed" back to the i.f. stage through audio coupling transformer *T3*. Finally, the amplified audio output signal is applied across a pair of headphones. (*T3* is an Argonne AR-100.)

Base bias for the first stage is supplied by voltage divider *R1-R2*, operating in conjunction with emitter resistor *R4*, bypassed by *C5*. Base bias for the second stage is supplied by voltage divider *R5-R6* and emitter resistor *R7*, bypassed by *C7*. *R6* is bypassed by *C6*; other r.f. bypass capacitors are *C4*, *C8*, and *C9*. Operating power is supplied by a standard 6-volt battery, *B1* (such as a Burgess Type Z4).

Construction should pose no problem for the experimenter who has assembled other simple transistor receivers. Gerald assembled his unit on a 4" x 4" chassis, but suggests that a small Masonite board will serve

# POWER TRANSISTOR *Signal Tracer*



**Internal** and external views of tracer are shown on these two pages. The power transistor (TR4) should have its shell well insulated from chassis ground. The speaker is a special job requiring no output transformer when used with the 2N255 transistor.

**W**ITH the possible exception of a volt-ohm-milliammeter, the signal tracer is perhaps the most useful test instrument in the home workshop. However, a.c.-operated signal tracers have always been handicapped by their sensitivity to 60-cycle pickup. And battery-powered models, using vacuum tubes, have the disadvantages of high-battery drain, tube fragility and low audio output.

The "de luxe" model tracer shown here incorporates four transistors and a self-contained 6-volt battery and has almost 1 watt of audio available at the output of the CBS 2N255 power transistor!

**Construction is simplified** by using a standard aluminum chassis as a cabinet. A small individual subchassis for parts mounting is cut from a scrap piece of aluminum and bolted directly on the speaker. The power transistor is insulated from the

chassis and plugged into a 9-prong miniature socket. All other transistors and parts are soldered directly into place as the circuit is wired.

Spaghetti is placed on the collector and base leads of each transistor to prevent shorts to other components or to the chassis. Parts placement is not particularly critical, but try to keep the input components away from the output circuit.

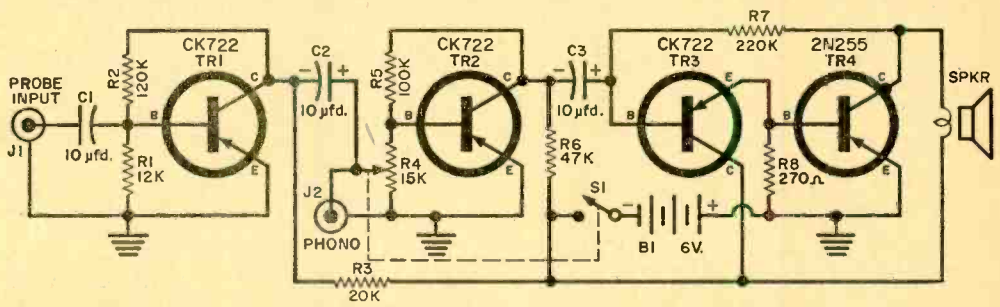
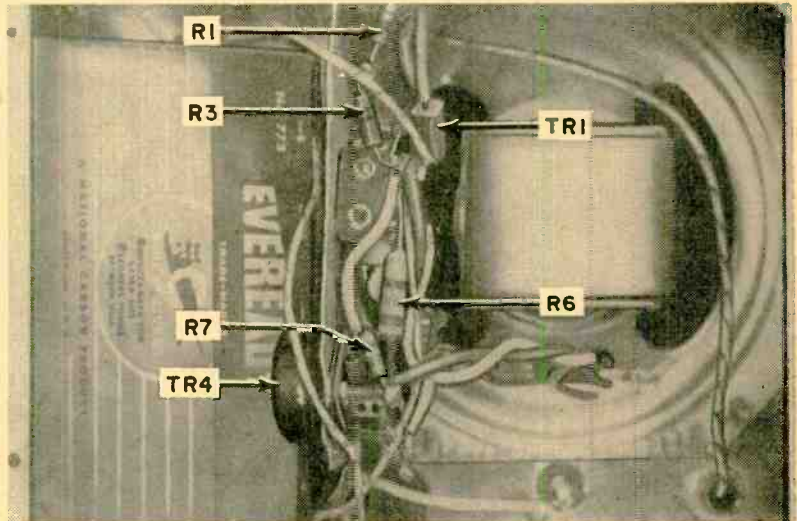
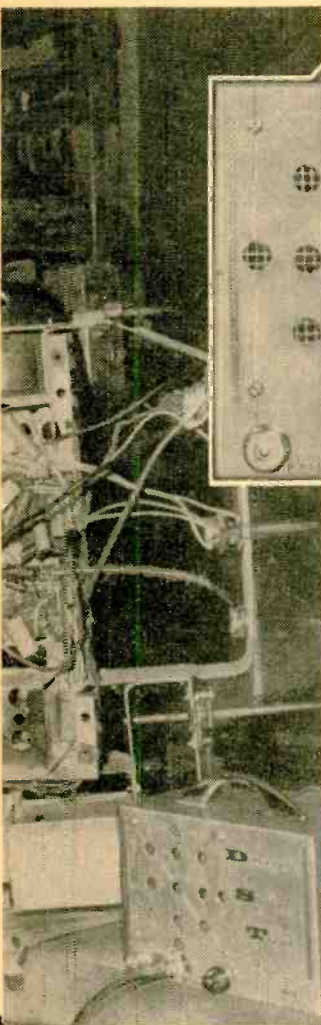
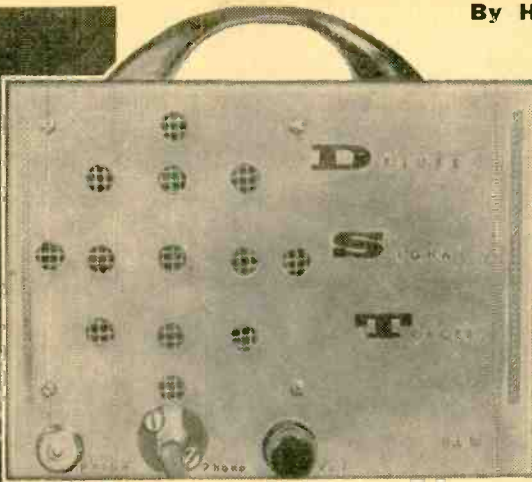
Note that this model tracer has two separate input jacks labeled respectively "phono" and "probe." The "probe" jack (J1) is the input for the r.f. detector lead. This probe contains a crystal diode which demodulates the r.f. signal and allows the transistor audio amplifier to build up the signal to audible level.

When testing in audio stages where less gain is required, use the "phono" jack input. This jack (J2) is fed by a shielded



By HOMER L. DAVIDSON

*Transistorized tracer  
avoids noise problems  
of most older models*



#### PARTS LIST

- |  |   |
|--|---|
| B1—6-volt midget battery (RCA VS068)                           | R6—47,000-ohm, 1/2-watt carbon resistor                         |
| C1, C2, C3—10-µfd., 50-volt elec. capacitor                    | R7—220,000-ohm, 1/2-watt carbon resistor                        |
| J1—Chassis-mounting microphone connector<br>(Amphenol 75-PC1M) | R8—270,000-ohm, 1/2-watt carbon resistor                        |
| J2—Phono jack (RCA type)                                       | S1—S.p.s.t. switch (on R4)                                      |
| R1—12,000-ohm, 1/2-watt carbon resistor                        | TR1, TR2, TR3—CK722 transistor (Raytheon)                       |
| R2—120,000-ohm, 1/2-watt carbon resistor                       | TR4—2N255 transistor (CBS)                                      |
| R3—20,000-ohm, 1/2-watt carbon resistor                        | Spkr.—4" PM speaker, 45-ohm voice coil                          |
| R4—15,000-ohm volume control                                   | (Operadio—DuKane Corp., St. Charles, Ill.)                      |
| R5—100,000-ohm, 1/2-watt carbon resistor                       | 1—7" x 5" x 3" aluminum chassis with back<br>plate (Bud AC-429) |

## HOW IT WORKS

Signal tracing is a "dynamic" test in that the equipment under test is in operation and has a signal going through it. The tracer is used to follow the path of the signal from input to output. The signal in the case of a broadcast receiver is a tuned-in station or an r.f. oscillator. For amplifier tracing, you can use an audio oscillator or phono player as a signal source.

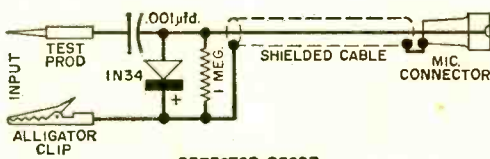
The input signal is coupled to the base of the first audio stage by a 10- $\mu$ fd. capacitor ( $C1$ ). The collector of  $TR1$  is coupled to the base of the second audio stage through a 15,000-ohm volume control,  $R4$ . A phono jack ( $J2$ ) installed at this point enables pickup from a crystal phono pickup head.

A 270-ohm resistor ( $R8$ ) is used as an emitter load resistor, common to both  $TR3$  and the output stage,  $TR4$ . The collector of  $TR3$  is tied directly to the 6-volt power supply. As the output impedance of a 2N255 transistor is approximately 48 ohms, a 45-ohm voice coil speaker provides the proper collector load.

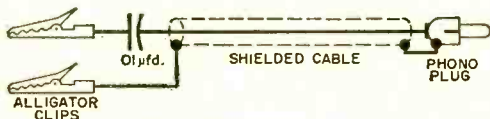
cable terminated on one end by a standard type phono plug and on the other by an isolating capacitor. For audio applications, such as crystal phono cartridge testing or hi-fi amplifier servicing, this input is best.

**Using the tracer** for trouble-shooting is simplicity itself. First turn the radio receiver on and tune it to a strong local station. Connect the signal tracer's ground lead to the receiver's chassis or "ground." Then turn the signal tracer on, adjusting gain control  $R4$  for full volume. Starting at

the receiver's antenna, the probe may be touched to the "input" and "output" of each stage to check individual stage operation. If the program is heard at one stage but not at another, check the circuit between. Defective radios, hi-fi amplifiers, p.a. sys-



DETECTOR PROBE



AUDIO PROBE

**These special probes** should have all elements well shielded. The detector probe components can be built into a small tube shield. All capacitors should be 600-volt miniatures. Thin-lapel microphone-type cable can be used for utmost flexibility.

tems, TV receivers and intercom circuits should present no problems for this little transistorized signal tracer.

-30-

## CROSSWORD PUZZLE

By Arthur L. Branch

### ACROSS

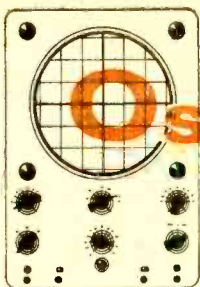
- 1 Multiple of the fundamental frequency.
- 9 Types of tubes used as detectors.
- 11 Rectifier output current: Abbr.
- 13 To make a curve (graphically).
- 14 Chemical symbol for cobalt.
- 15 Resistance unit.
- 17 Suffix denoting one who does.
- 18 Unit of time: Abbr.
- 19 Exclamation.
- 21 Charge developed in a vacuum tube.
- 24 A short circuit may be caused by a \_\_\_\_\_ in the wires.
- 26 Sick.
- 27 Middle Eastern country: Abbr.
- 28 Chapter: Abbr.
- 30 Snake-like fish.
- 32 The: Fr.
- 33 Effective a.c. voltage equals \_\_\_\_\_ - mean - square voltage.
- 35 Continent: Abbr.
- 36 Kind of bird.
- 38 Devices used to pick up radio signals.

### DOWN

- 2 Public notice.
- 3 Tear.
- 4 A burrowing animal.
- 5 Scents.
- 6 Total profit.
- 7 Exists.
- 8 Fuss.
- 10 Part of a transformer.
- 12 Stored electrical energy.
- 14 Periodic changes in current values.
- 16 Conductance unit.
- 20 Like.
- 22 The correct formula for inductive reactance is:  $X_L = 2\pi FL$ .
- 23 Beverage.
- 24 Device used to convert chemical energy into electrical energy.
- 25 Mark with a scribe.
- 29 Part of a loudspeaker.
- 31 Relation of the current to the voltage in an inductive circuit.
- 33 Rodent.
- 34 2000 pounds.
- 36 Practical nurse: Abbr.
- 37 Cathode-ray tube's pin connection: Abbr.

(See page 117 for solution)





# Oscilloscope Traces

## Radio-Frequency Measurements

*Wherever signals go "on the air," these tests will  
tell you their nature*

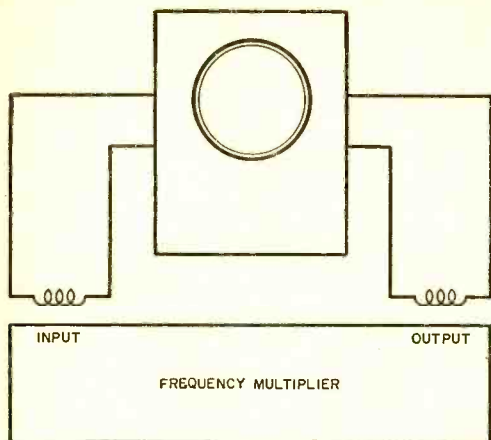
By HOWARD BURGESS

**W**HENEVER some science fiction movie or TV show is intended to appear "ultra-scientific," or when a sponsor wants to clinch his sales pitch with some phony-technical display, chances are that an oscilloscope will be shown with a modulated wave pattern jumping around on the screen. Such 'scope traces are, as it were, the popular image of scientific work.

Perhaps this particular trace has gained its popularity because it is so useful. It can be immensely valuable to anyone working with a modulated carrier. The carrier need not be one of a high power transmitter. It can originate from a wireless record player, a service-man's signal

**Checking the carrier frequency of a portable transmitter by the techniques described here will assure its proper functioning when it is taken into the field.**



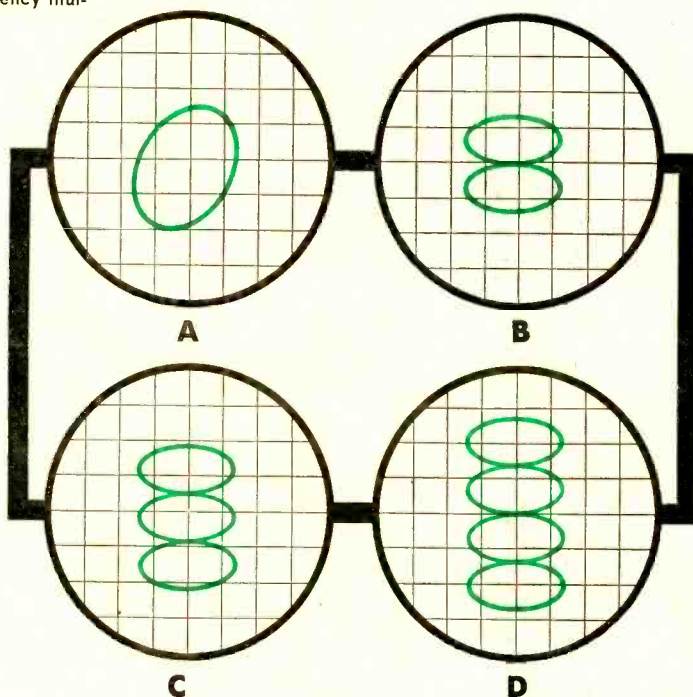


**Fig. 1.** The oscilloscope is coupled to the input and output of a frequency multiplier stage in order to check its operation.

traces can be obtained to well over one hundred megacycles.

One use of the oscilloscope which generally requires this type of connection is the checking of frequency multipliers in transmitters. Many of the modern transmitters, both amateur and commercial, have one or more frequency multiplier stages following the crystal oscillator. If the output of the transmitter is to be on the correct frequency, each multiplier stage must increase the frequency by the desired number of times.

**Counting Loops.** The output frequency of each stage can be checked with a good calibrated wavemeter if one is available. A double-check, and in many cases a better test, can be made with an oscilloscope. This method makes use of the Lissajous



**Fig. 2.** Scope patterns created by an r.f. stage in the hookup described in Fig. 1: (a) without frequency multiplication; (b) with frequency doubling; (c) with frequency tripling; (d) with frequency quadrupling. These patterns provide a quick check for frequency multiplier stages.

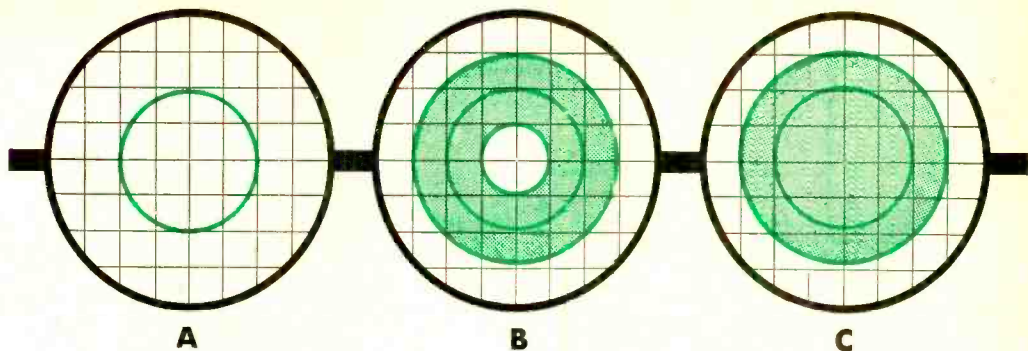
generator, a transmitter for opening garage doors or controlling models, or a ham transmitter.

**Direct Connection.** Very few amateurs own an oscilloscope with an internal amplifier able to pass the higher radio frequencies. However, in most cases this problem can be solved by feeding the r.f. signals directly to the deflection plates of the oscilloscope cathode-ray tube. Most oscilloscopes have these connections brought out to a small terminal board in the rear of the 'scope's cabinet. With the signal fed directly to the cathode-ray tube,

pattern which is formed when two signals of different frequencies are applied to the vertical and horizontal plates of the tube. (See *POPULAR ELECTRONICS*, March, 1957, page 63.) If one set of deflection plates is coupled to the input of the multiplier stage under test and the other set of deflection plates is coupled to the output of the same stage (Fig. 1), the pattern formed will indicate the number of frequency multiplications taking place in the stage.

The pattern most likely to be formed will be found among those shown in Fig. 2. They range from a multiplication factor of





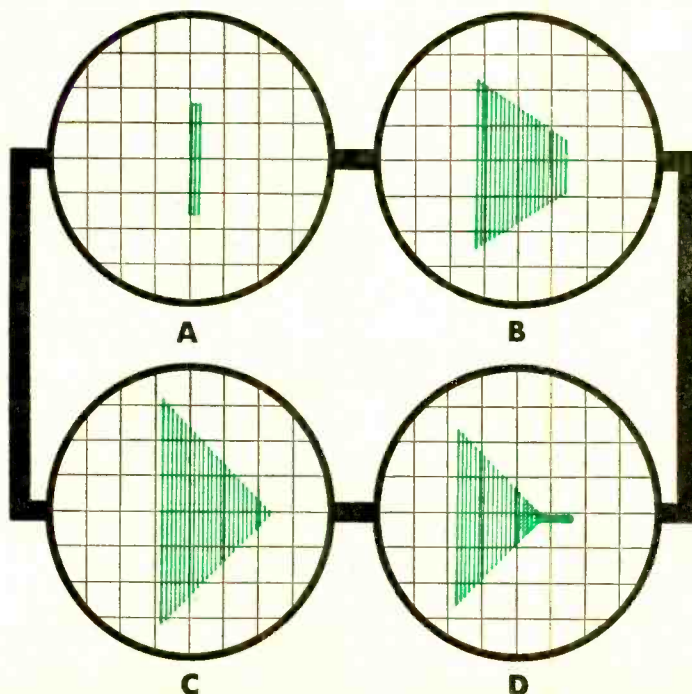
**Fig. 3.** The circular patterns produced by r.f. on the 'scope screen are shown here for three different cases: (a) no modulation; (b) 50% modulation, and (c) 100% modulation of the carrier frequency.

1 (shown at A) to factor of 4 (at D). For those who are not familiar with this type of trace, examination of the figure will show that the multiplication factor is found by dividing the number of loops in the width of a pattern into the number of loops in its height. All of these patterns are one loop wide. In many cases the loops will not be as rounded and clear-cut as shown here; however, it is the *number* of loops and not the *shape* that matters in this case.

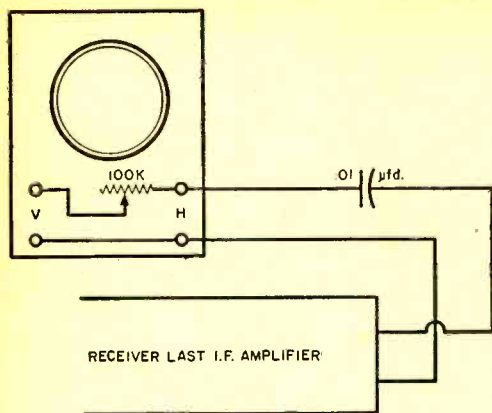
**Modulation Check.** Anyone that works with electronic equipment for any length of time sooner or later finds himself con-

fronted with modulation problems. Even the experimenter who is not a licensed amateur would like to be able to check the modulation of stations that he hears. If precise checking isn't necessary, the simple test to be described will be adequate. The setup in Fig. 5 will usually do the job.

The horizontal input to the 'scope is coupled to the plate of the last i.f. amplifier of the receiver through a small blocking capacitor. This added load will probably require a slight amount of retuning of the last i.f. transformer. The sweep generator in the 'scope must be turned off. Now connect the vertical input to the horizontal in-



**Fig. 4.** The trapezoidal pattern of r.f. as it appears with: (a) no modulation, (b) 50% modulation, (c) 100% modulation, and (d) overmodulation of the carrier frequency.



**Fig. 5.** This simple circuit will usually produce a circular pattern at an i.f. frequency.

put through a 100,000-ohm potentiometer. Then, with a good strong signal tuned in on the receiver, adjust the vertical and horizontal gain controls of the 'scope and the variable resistor until a circle is produced on the screen.

**Circle Check Pattern.** If the signal is not being modulated, the circle will be a sharp, well-defined pattern. As soon as modulation is applied to the carrier, the circle will alternately expand and contract to form a pattern similar to a doughnut. As the percentage of modulation is increased, the hole in the center will gradually close until it is completely closed at 100% modulation. If more than 100% modulation is present, a bright dot will form in the middle. The circle should move out the same distance that it moves in toward the center.

**Caution:** Before alienating your transmitting friends by criticizing the signal they send out, make sure that the receiver you used for this test is in good condition. A properly modulated wave, upon passing

through a poorly adjusted receiver, can appear either over-modulated or under-modulated.

This system can also be used to check the output of signal generators which are operating on frequencies too high to be fed directly into the oscilloscope. Phono oscillators and similar gadgets can be checked for percentage of modulation in the same manner. The oscillator is tuned in on the broadcast receiver and the 'scope connected to the i.f. system of the receiver as outlined above.

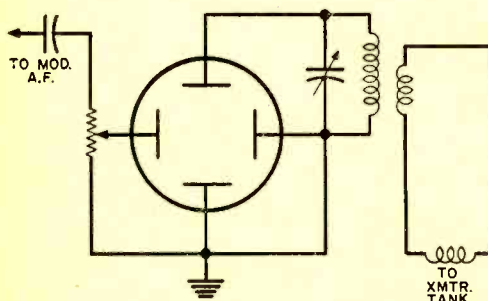
**Trapezoid Check Pattern.** Another modulation pattern which is formed in a manner similar to the circular trace is that of the trapezoidal figure. This type of measurement requires a direct power take-off from the transmitter tank and a sample of the audio used to modulate the transmitter. Because of this, it is not suitable for measuring the modulation of distant stations. The circular pattern serves that purpose.

However, for continuous monitoring of a transmitter, the trapezoidal pattern is the simplest to obtain since it requires no amplifier or sweep circuits. Connections are made directly to the deflection plates of the cathode-ray tube of the oscilloscope as shown in Fig. 6.

When the transmitter is not modulated, the r.f. carrier will produce only a vertical line. When modulation is applied, it furnishes the sweep to form a triangle as in *A* of Fig. 4. If transmitter is modulated less than 100%, the triangle will not be filled out, as at *B*. Too much modulation will form a pinched-off pattern, as at *C*, with a bright trailing line. If the sloping sides of the triangle are curved rather than straight, the transmitter under test is distorting due to nonlinear operation.

**General Hints.** There are many other r.f. measurements that can be made with the oscilloscope which may be discussed in future articles. Whenever the 'scope is used for r.f., it is a good idea to keep leads short, with as little shielding as possible. And don't jump at conclusions. You will see a good many "queer" traces during your first investigations but, with growing experience in interpretation, important clues about the condition of your radio-frequency equipment will be clearly revealed to you.

You will find that familiarity with radio-frequency traces will come in handy on many occasions. Wherever signals are actually sent out "on the air," it is necessary to check r.f. stages both at the transmitter and at the receiver, as well as to monitor the degree of modulation wherever the signal itself is more complex than simple c.w.

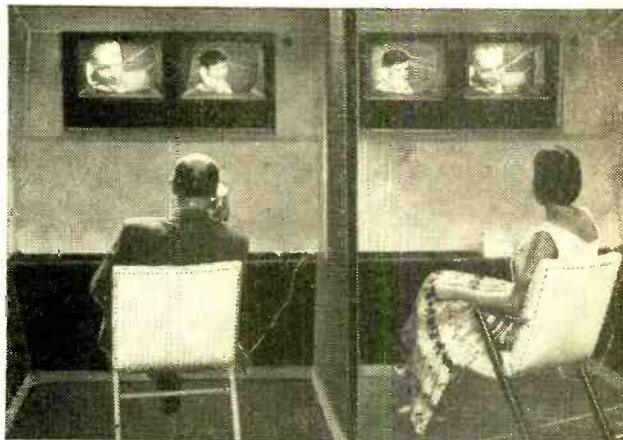


**Fig. 6.** Coupling the oscilloscope to produce a trapezoidal pattern on the screen.

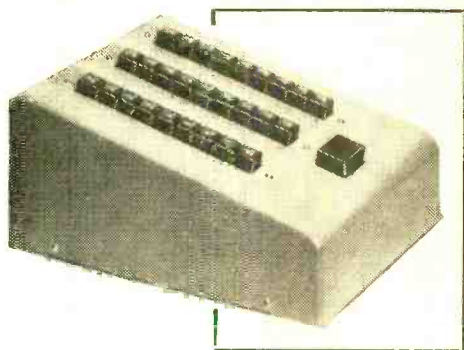


## What's New in Europe?

THE "telephone of the future" bowed in at the Radio, Television and Phonograph Exhibition in Frankfurt, Germany, in August. Built by Deutsche Philips of Hamburg, it was displayed in two adjacent booths (right), which presented what the company conceived as the "normal" phone conversation of the future. Each booth was equipped with a built-in, automatic TV camera focused on the speaker. Each of the "receivers" had two screens, which showed both parties as they appeared on the phone.



Another development, introduced by Nederlandse Industrie Radio Artikelen, Emmen, Holland, is the "Tele-Tracer." This is a paging device for hospitals, offices, factories and other such enclosed areas. Essentially a short-range transmitter and receiver combination, the "Tele-Tracer" consists of a console (right) with 27 keys, each of which activates a different receiver. The receivers are each about the size of a cigarette package (below) and are carried in the pocket. When the key sending to a specific receiver is depressed, the receiver signals with a low buzz, indicating to the person carrying it that he is being paged (below, right). Each receiver weighs only five ounces, and uses transistors so that the batteries will have a long life.



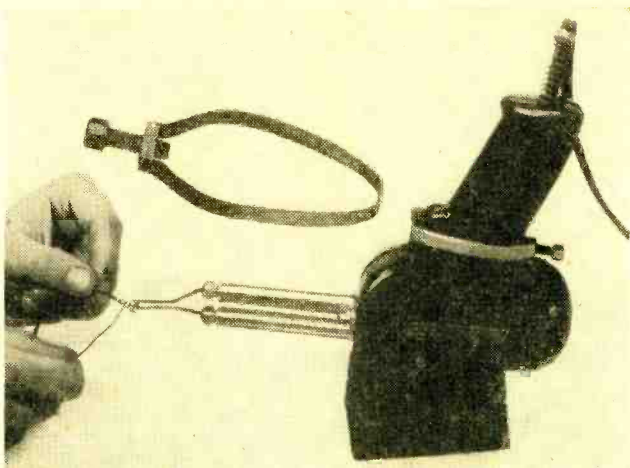
This system is particularly suitable for doctors, who would be relieved of the necessity of watching for light or bell signals and the disturbance of p.a. paging. A special cabinet holds the receivers when they are not in use. Each receiver rests in a numbered slot. When the slot is empty, it is an indication to the signaler that the person assigned to that number is in the building and may be signaled; when the receiver is there, the person is out. —30—



## An Extra "Hand" Comes in Handy for Soldering

While the gun is doubtless one of the most popular types of soldering instruments, it has one big drawback — one hand must be used to hold the trigger. But on some jobs you need both hands. What to do? Build a triggering bracket for your gun and gain an extra hand.

Bend a thin copper strip,  $\frac{1}{4}$ " wide, around the grip and the trigger. About a half-inch should extend in back of the grip. Then solder the two ends of the strip to a  $\frac{1}{4}$ " nut. The bracket can now be slipped in place and a bolt a quarter- or a half-inch long screwed into the nut. As the bolt is tightened, its base pushes against the back of the grip and tightens the band around the trigger. (See photo above right). Adjustment of the bolt will give either a high or low heat position; a bolt with a knurled head makes adjustment easier. And if you don't have a copper strip, you can use a similar strip from a can. Finally, take a 6" piece of 2 x 4 and notch it to fit the contour of the gun. This will hold the gun in place and you can use both hands for soldering.



One note of caution. Soldering guns are *not* designed for continuous operation. Therefore, the gun should not be left on for excessive periods of time. When it has been in use for a long enough time, you can easily slip the band off by loosening the nut. Good soldering practice is to keep the trigger depressed only long enough to make the connection, usually not over two minutes. Keeping it pulled longer than that may burn out the gun. —Wayne Crawford

## Old Gooseneck Lamp Makes Adjustable Mike Stand

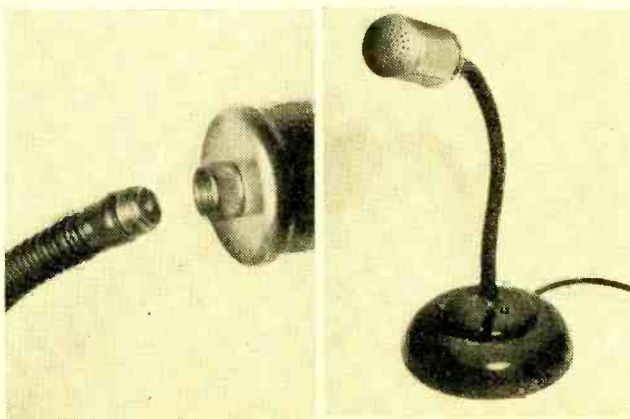
Instead of getting a perpetual crick in the neck when you're on 'phone, make an adjustable stand for your mike and DX in comfort. It's simple, and costs pennies.

Scrounge around for an old gooseneck lamp—the type with a flexible neck—and remove the socket and wiring. If it doesn't just screw off, you may have to use a hacksaw. Then remove the hardware from an Amphenol 75-PC1M chassis unit and drive the unit into the top of the gooseneck. The diameter of the threaded shank may have to be reduced a bit with a file before you drive it in. Use a block of wood between the chassis unit and the hammer head to prevent mashing the head threads when you drive it.

If your mike is the type that feeds the mike connection through the mounting socket, you will first have to solder the center conductor of the mike cable to the eyelet in the chassis unit. Then feed the cable through the gooseneck

and out through the base of the old lamp.

The shielded sleeve of the mike cable can be soldered directly to the metal base of the lamp, since the metal gooseneck completes the circuit and provides shielding. If you have a lamp whose neck is provided with  $\frac{1}{8}$ " pipe thread as connection for the socket, the mounting is simplified. Just connect the two with pipe coupling, and you've got your mike stand. —Carl Dunant





# Do You Have a

# BUZZ

**A**RASPING NOISE accompanied the horizontal bars that cut the TV picture to ribbons. Having just settled down to catch the fights, I wasn't very happy when the interference—although intermittent—continued.

Giving up in disgust, I turned the sound down. Only then could I hear a faint whirring noise from somewhere in the house.

"Your motor's showing," I stated bluntly upon confronting my wife at her sewing machine.

Unperturbed, she finished the seam. "I'm sorry, dear," she replied. "This dress just has to be finished tonight." Examining the seam intently, she added: "Now you know what the rest of the family puts up with when you're working in the basement!"

She was referring to the combination shop and rumpus room I'm trying to build down there. The project hasn't been too popular with the family since I can only work at it in the evenings. My portable electric saw really bugs up the TV picture.

Knowing that she was bound to have the last word, I decided to see if my neighbor, Sam Egan, could help. An electronic technician by trade and hobby, Sam usually had an answer for my electrical problems.

I found Sam occupied with a repair project in his combination shop and garage.

"Are they selling do-it-yourself appliance kits now?" I quipped. A jumble of electric mixer parts, like fugitives from a junk box, covered the bench before him.

"No such luck," Sam replied. Jerking a thumb at the little motor on the bench, he explained: "I'm tired of putting up with the interference this mixer causes. Just about the time I'm trying to pick up something on my receiver, the kids decide to mix a malt or something."

"Know just what you mean," I sympathized. "But why tear down the mixer? I was hoping you could help me out with a plug-in filter for that sort of thing."

"Can do," agreed Sam. "But in a case like this a dirty commutator makes the job just that much harder for a filter."

I watched with eagle eye while he cleaned the commutator and brushes with carbon tetrachloride. "Brush-type motors are the

in the

● **Kitchen Radio?**

in the

● **Hi-Fi?**

in your

● **Belfry?**

in the

● **Bathroom Sink?**

**Don't see a psychiatrist**

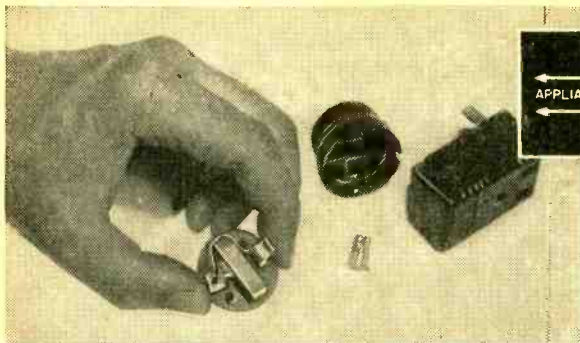
**— install line filters**

By **JOE W. ROCKE**

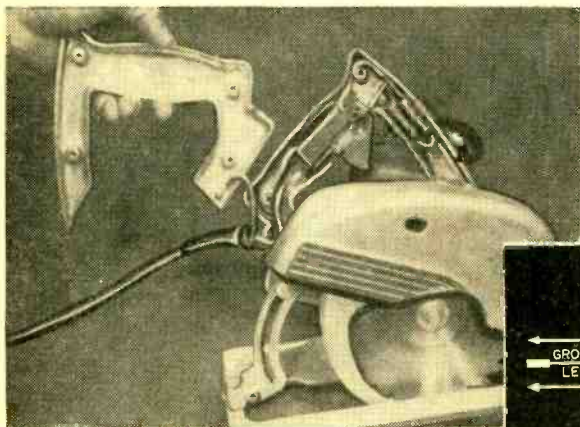
worst offender when it comes to causing interference," he explained. "A dirty commutator aggravates the slight arcing inherent in these motors." Selecting a piece of fine sandpaper, he began polishing the commutator.

"Why sandpaper?" I asked. "Wouldn't emery cloth do a quicker job?"

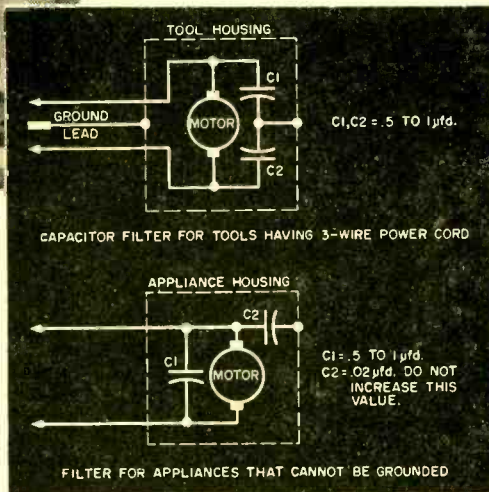
"Sure—it would—and ruin your motor in



**Commercial** plug-in filters (left) reduce interference from electric razors and small appliances, but almost as effective is a 0.1- $\mu$ fd. capacitor wired across terminals of small motor (above). Filtering action is most efficient if capacitor can be put in appliance housing.



**Place filter** in housing of tool, if possible, and insulate with spaghetti (left). Third (ground) wire must be connected to ground as below. For appliances without ground wire, connect C2 to frame (bottom drawing). Check with neon tester from housing to ground to make sure a.c. plug is polarized for shockless operation. Reverse plug if lamp lights.



the process. Emery grains are conductors, and they may short the commutator.

"Poor electrical contact at the commutator," he continued, "causes variations in current flow through the motor. This in turn creates sharp electrical surges that travel through the household wiring system. The result is a lot of hash in radio reception."

"Then putting a motor in top shape is the first step in tackling a motor interference problem," I mused.

"It helps," Sam admitted. "But it doesn't always eliminate the need for a filter. Of course, not *every* motor causes interference," he hastened to add.

Sam sketched a circuit on a scratch pad and handed it to me. "There's a basic filter circuit," he stated. "It's small enough so that the capacitors can usually be installed right in the motor housing."

Studying the circuit, I mused: "Looks simple enough. How about lending me some junk box capacitors so I can try it on my power saw?"

Sam shook his head. "Nope," he answered, "but I'll give you new ones."

"What's wrong with used ones?" I protested. "Afraid they aren't accurate enough?"

"You never know when an old capacitor might short," he advised. "No use in risking a burn out or shock hazard because of a questionable capacitor."

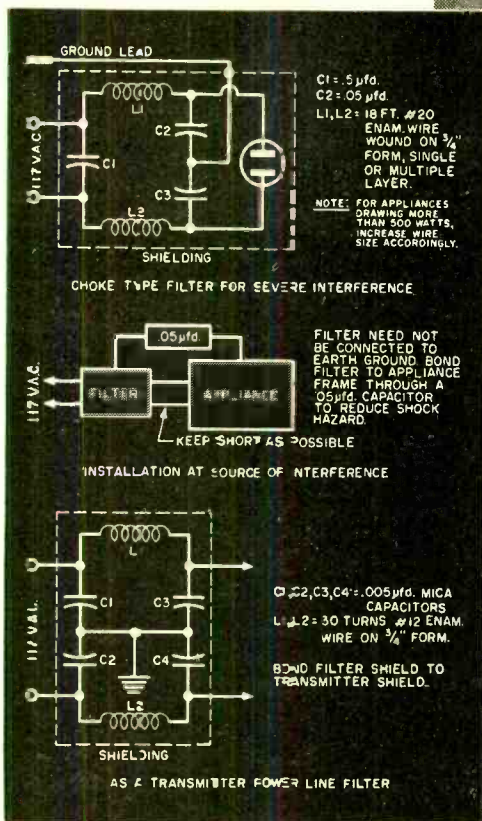
Digging through his stock of parts for new capacitors, Sam continued: "Capacity values aren't critical. Sometimes it's necessary to try different ones before hitting the right combination. Severe interference problems may require capacities as high as one microfarad."

He pointed to the voltage rating on a capacitor. "Working voltage is the important thing. The higher the voltage rating, the greater the safety factor. Capacitors selected for filters should have a rating of at least 600 volts."

"How about plug-in filters?" I asked.

POPULAR ELECTRONICS





A choke will help stubborn cases of power line interference (above.) Wind the inductor on a  $\frac{3}{4}"$  diameter dowel or spool (multiple- or single-layer winding may be used) and put it with the capacitors in a grounded metal box.

"You know, the kind that plug into the wall outlet."

"They may tame mild cases of interference. But signals generated by a motor can be radiated by the power cord, too. Filtering interference at its source is the most effective method."

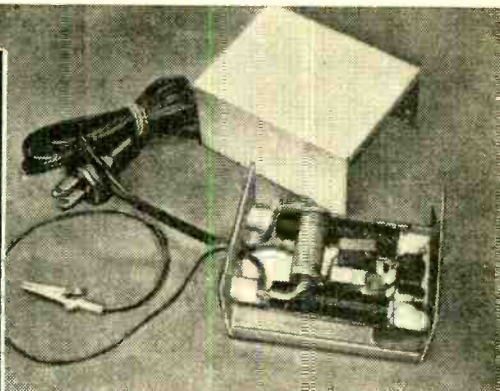
The side door banged as Jim Nelson popped into the garage. Jim, a teen-ager interested in electronics instead of hot rods, spent all the time he could hanging around Sam's shop.

"My ham rig's been restricted," he announced "... at least while the family's watching the evening programs!"

"Interference, no doubt," remarked Sam. "Thought you had your transmitter pretty well shielded."

"It is," agreed Jim. "That's what has me stumped. It doesn't bother the neighbor's radio or TV."

"How about the power line to your trans-



## SOURCES OF POWER LINE INTERFERENCE

### Small Brush or Interrupter Type Motors (razors, sewing machines, grinders, etc.)

**Symptom:** Light buzzing noise, all frequencies; dots and light bars in TV picture.

**Cure:** Capacitor filter installed in motor housing, or plug-in filter at convenience outlet.

### Large Brush Motors (power tools, vacuum cleaners, etc.)

**Symptom:** Moderate to severe interference, all frequencies; light to heavy horizontal bars in TV picture.

**Cure:** Clean brushes and commutator, check motor condition; install heavy-duty capacitor filter in the motor housing.

### Tungsten Lamps (old-style clear-type having "W" type filament)

**Symptom:** Moderate to severe radio and TV interference spread over a large surrounding area.

**Cure:** Replace lamp with modern type. (This kind of interference is more common than one might think.)

### Oil Furnace

**Symptom:** Moderate to severe interference in radio and TV.

**Cure:** Check furnace motor; check and clean relay points; install induction (choke) type filter on ignitor.

### Blowers, Air Conditioners (belt-driven units)

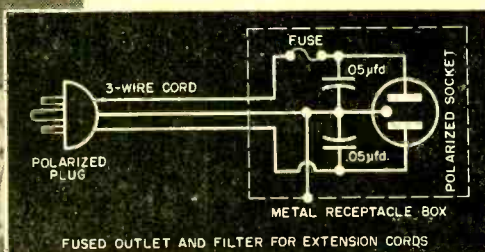
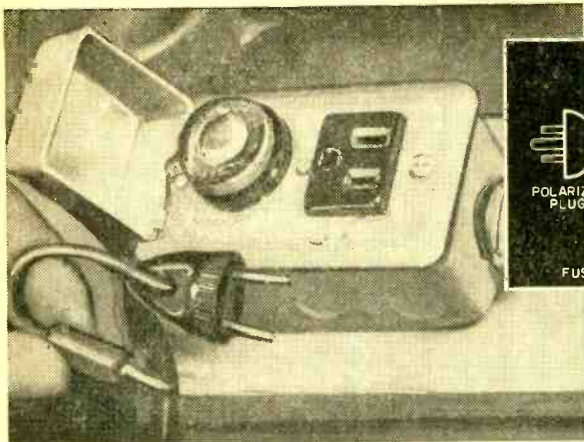
**Symptom:** Light to severe scratching or intermittent popping in radio and TV audio.

**Cure:** Bond all metal parts thoroughly. Static electricity is the culprit, so apply light coating of graphite to belt.

### Office Equipment (cash registers, adding machines, etc.)

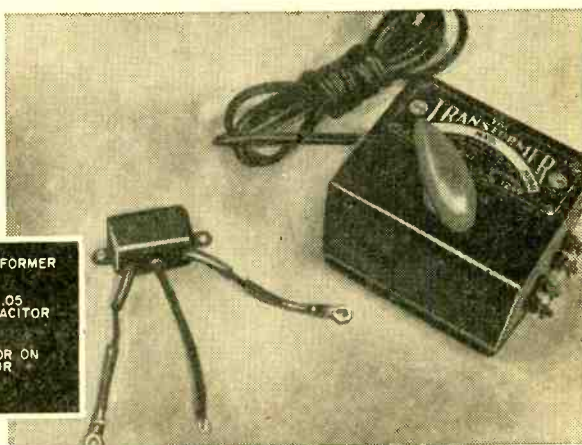
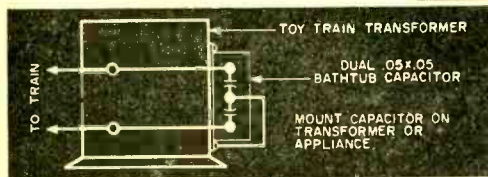
**Symptom:** Moderate to severe interference at all frequencies.

**Cure:** Install choke type filter in power cord as near source of interference as possible.



**Fused outlets** give protection if filter capacitor shorts. Ideal with extension cords, fused polarized outlets (as shown at left) ground filter and tool. To make extension cord assembly (above), use 3-wire line cord. Equip line cord and power tool cords with polarized plugs.

**Bathtub capacitors** provide filter with ready-made shield (right). Connected across the low-voltage terminals of a toy train transformer (right and below), they will cut interference in radios and television sets while the children are playing with their electric trains at Christmas time. These capacitors also simplify installation when there is no room inside the appliance housing.



mitter?" Sam then asked. "Is it filtered?"

Jim looked puzzled. "No," he replied. "I know that an unshielded microphone lead might cause r.f. leakage, but I didn't think the power cord could give any trouble."

"It can," Sam replied. He sketched what seemed to me a rather complicated circuit. "A low-pass inductor filter should do the trick. You can wind the inductors on a piece of wood dowel."

I chimed in. "How would a gimmick like that work as a filter for the TV line cord?"

"Good, with slight modification," Sam answered. "But remember it's only a power line filter. It won't help if the interference is being picked up by the antenna."

Jim had a faraway look in his eye. "I could install it right in the transmitter housing," he mused.

"No," contradicted Sam. "There may be harmonic coupling from the tank circuit."

This was all over my head, but the possibilities of the circuit impressed me. I didn't hesitate to ask how to install the filter.

"The important thing is to shield the filter," Sam explained. "It can be mounted in any type of metal box. Even a can will do the trick. Installation depends upon whether it is used at the source of interference or to prevent power line interference from entering a receiver."

"What's the difference?" Jim inquired. "In either case it can only filter out disturbances carried by the power line. Isn't that so?"

Sam nodded. "Installation becomes critical only when eliminating interference at the source. The filter has to be installed as close to the source of interference as possible, and the filter shield must be bonded to the device being filtered."

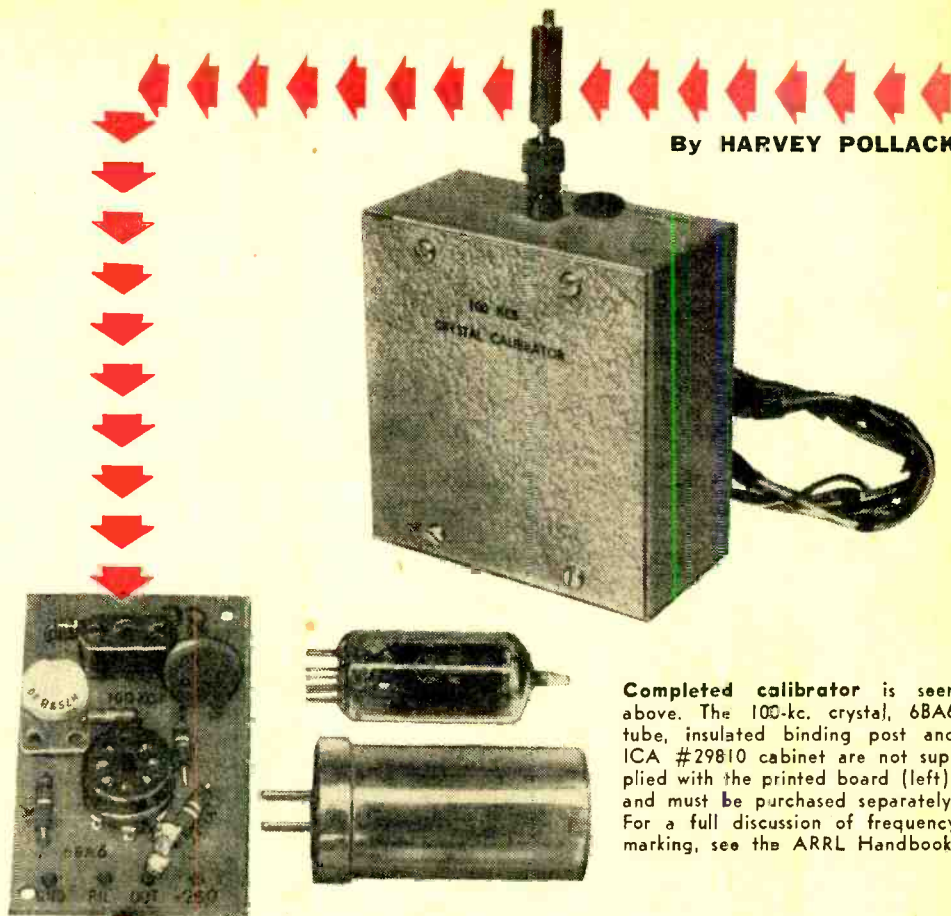
"Any possibility of shock hazard?" asked Jim.

"That can be minimized by using a .05-mike capacitor to bond the filter shield . . . which is a good idea if the filter is used with household appliances. The larger ca-

*(Continued on page 120)*



By HARVEY POLLACK



Completed calibrator is seen above. The 100-kc. crystal, 6BA6 tube, insulated binding post and ICA #29810 cabinet are not supplied with the printed board (left), and must be purchased separately. For a full discussion of frequency marking, see the ARRL Handbook.

## Mark That Frequency

*How to use a printed-circuit crystal calibrator to*

*simplify short-wave listening*

**T**INY ENOUGH to fit into the palm of your hand, this highly stable printed-circuit crystal-controlled oscillator can inject 100-kc. markers into your receiver right up into the 21-mc. band. Due to the printed wiring, construction time is so short that you can start assembly after dinner and have it working before bedtime.

The oscillator is available in kit form, including the board and components, from Petersen Radio Company, 2800 W. Broadway, Council Bluffs, Iowa. Total cost of the project should come to about \$8.00. The 100-kc. xtal is extra—but you may have one in the junk box that would do nicely.

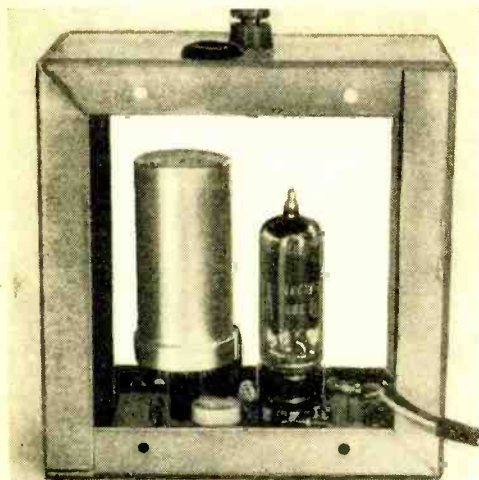
Unpack the parts carefully when you

receive the kit, and check each component to make certain that it corresponds with the value printed on the circuit board.\* Insert the crystal and tube sockets and all other components in their places, sharply bending each pigtail.

**Spot-solder** each of the leads at the point where it comes through the board and trim it off flush with the board. Don't

\* There is an unmarked capacitor connection between the 220,000-ohm resistor and the *OUT* terminal. However, this is no problem. After the 470- $\mu$ fd. capacitor is installed, the only small tubular capacitor left is the unmarked one. All the other markings are clear.

Note that the circuit diagram accompanying the Petersen 100-kc. crystal is *not* the schematic of the printed circuit.



**Plug** the 6BA6 tube and 100-kc. crystal into printed-circuit board and mount in cabinet as shown.

use extra flux, and try to prevent the flux in the rosin-core solder from running along the surfaces between connections. Solder a color-coded lead about 1½ to 2 feet in length to each of the terminals marked *GND*, *FIL*, and *250*. Connect a 4" lead to the *OUT* terminal.

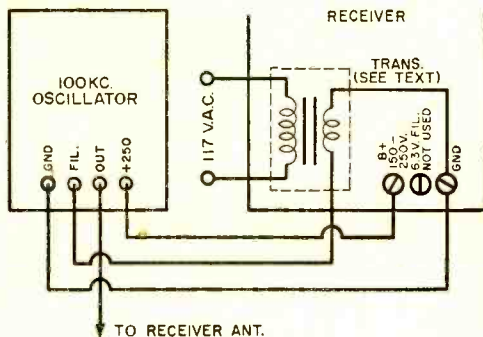
Drill the holes in the cabinet to match the two mounting holes in the printed-circuit board. Drill two extra holes paired off so that two more screws can be inserted to provide a 4-point base on which the case can stand without tipping. Now line up the printed-circuit board in the bottom of the case and drill a ½" hole directly over the ceramic trimmer screw. A screwdriver or aligning tool will later go down through this hole for trimmer adjustment. A ⅝" hole is drilled in the center of the top of the case for the binding post.

Two ¼" spacers under the printed-circuit board hold it clear of the case. Solder the *output* lead to the lug on the

binding post. Drill and grommet a ⅜" hole about 1" from the edge of a side-plate and pull the three color-coded power leads through. Install the crystal and tube and screw down both side-plates.

**The oscillator** is designed to operate from your communications receiver's auxiliary power output socket. But because the oscillator is wired for a *common* ground and filament, you must determine which of the following hookups is found in your receiver.

(1) If one leg of the heater of each tube in your receiver is grounded, no



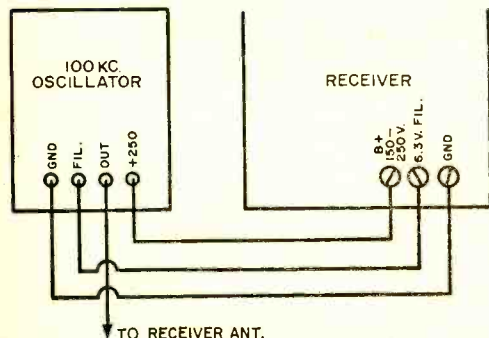
**Fig. 2.** Primary of added filament transformer can be connected across the primary of the original power transformer as shown or across the power line immediately after the receiver's on-off switch.

changes are necessary. Connect the power leads as shown in Fig. 1. Any B-plus voltage from 150 to 250 volts will do.

(2) The hookup in Fig. 2 is suggested for the following conditions: receivers which are designed for a.c./d.c. operation; receivers in which the *center-tap* of the 6.3-volt transformer is grounded; and receivers in which there is *no* ground in the filament circuit. Note that a separate, small, inexpensive 6.3-volt heater transformer (such as the Stancor Type P-8190) is required for proper operation.

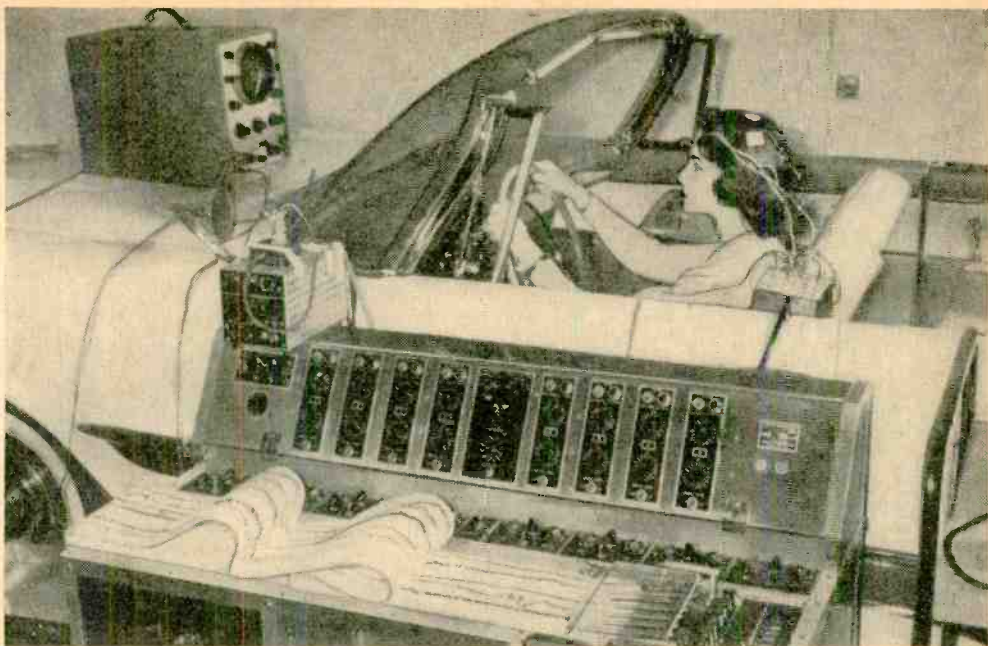
**Connect** the 100-kc. calibrator to the receiver power supply and couple the output terminal to the antenna post. Then turn on your receiver and tune it to WWV (2.5 mc., 5.0 mc., 10.0 mc., 15.0 mc.). Listen for "ticks" separated by precise 1-second intervals.

With your BFO *off*, you should be able to hear a beat-note between the harmonic of the 100-kc. oscillator and the WWV signal. Using an aligning tool or plastic-handled screwdriver through the grommeted hole at the top of the case, carefully rotate the trimmer until exact zero beat is obtained. You may now be quite confident that the injected 100-kc. markers are right on the nose!



**Fig. 1.** Hookup used when the calibrator can be wired directly into the short-wave receiver circuit.





## The Mysterious EEG—And You

Every time she thinks—and even when she doesn't—those wires coming out of the lady's head (above) record her brain wave pattern. Although the car's standing still, she's "driving" down a busy highway. The purpose of the "trip" is to test driver alertness on the "EEG" (electroencephalograph) parked next to the car.

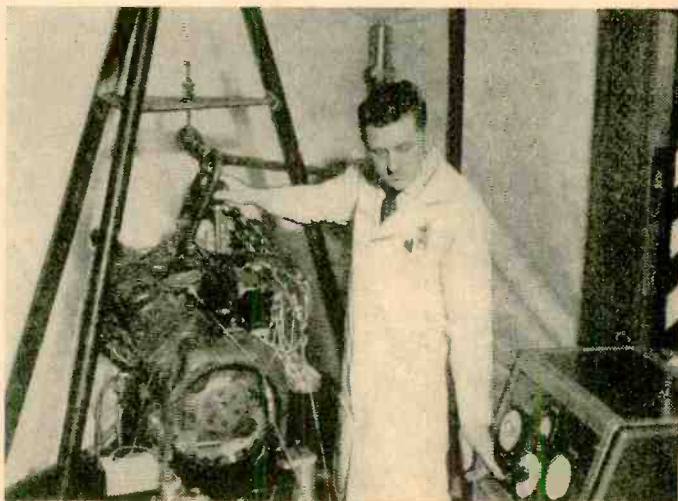
The "EEG" is a device which graphs electrical impulses from the brain. Also recorded are pulse action and the tendency to perspire. From this data, reaction time can be learned. In tests made by Chrysler engineers, the subject turns the steering wheel to keep a moving beam of light in

line with a stationary beam on the screen in front of the windshield. Tape recordings of traffic noise and engine sounds played through a speaker in front of the car make the tests as realistic as possible.

An advantage in using the "EEG" to measure driver alertness is that it does not interfere with the driver's natural tendency to become drowsy in long simulated driving tests. Many of the previous methods which were used tended to keep the drivers awake, Chrysler engineers found, and thus defeated their purposes. The tests show alertness drops after one-and-a-half hours of steady "driving."

## Balancing Act

A new electronic unit for balancing auto engines has been developed by General Motors. The Pulse Synchronized Unbalance Indicator (right) detects and corrects unbalance at lower limits than was possible before. At any running speed, PSUI takes the engine's "pulse" so that the unbalance can be corrected both at the flywheel (see photo) or at the fanbelt pulley wheel at the front end. It's done by putting on counterbalance slugs.

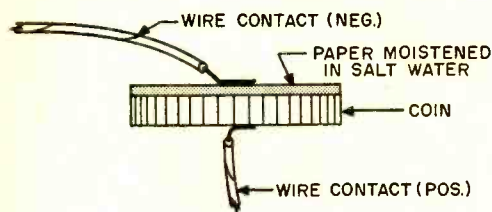


## Hear That Jingle? There's a Battery in Your Pocket

In these days of rising costs, it's hard to get something for nothing. However, Uncle Sam makes you a present of a free battery every time you change a dollar bill.

Take an ordinary piece of white paper and moisten it with warm salt water. Hold it in place on one side of a silver coin with a rubber band, and you've got a battery powerful enough to drive a small transistor oscillator (see schematic at right) or receiver. Transformer *T1* is an Argonne AR-103. The contacts of the coin should be made according to drawing below. Use 2000-ohm headphones.

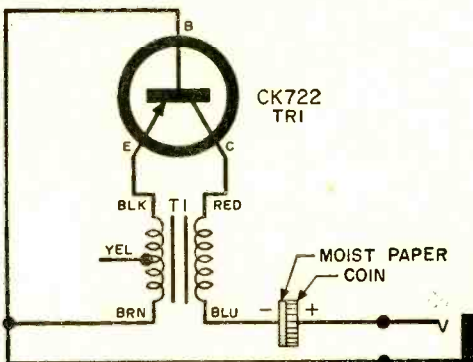
For best results, the coin should be clean and shiny. The negative end can be



held to the wet paper with a rubber band. This type of battery will remain effective as long as the paper is damp.

A dime will deliver 0.5 volt at a load of 50  $\mu$ a., enough for the oscillator. A quarter will give a bit more voltage at double the current, and a half-dollar will deliver 0.7 volt at 125  $\mu$ a. Place cells in series for higher voltage.

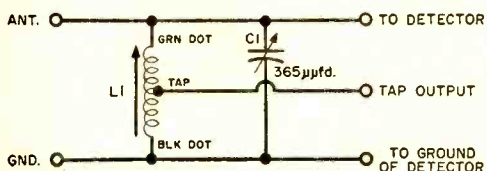
—William I. Orr



## Build a Handy Broadcast-Band Tuner Assembly

You'll find this handy broadcast-band tuner ready for instant action, whether you experiment with germanium diodes, transistors, vacuum tubes, or all three. It consists of a ferrite antenna coil (Lafayette Radio MS-299) center-tapped to match it to the comparatively low impedance of a common-emitter transistor stage and a 365- $\mu$ fd. variable capacitor. Five Fahnestock clips allow quick connections for antenna, ground, detector or detector/amplifier. (See the schematic and photos below.)

The coil is mounted on a wood base by

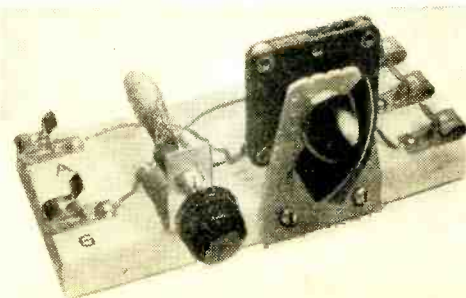
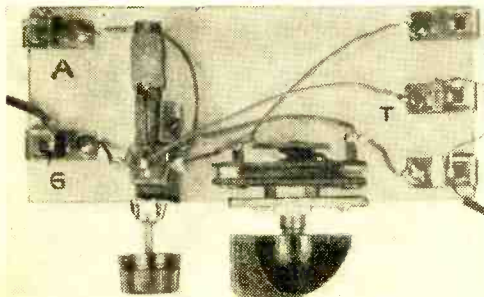


means of the metal bracket which comes with the coil. Simply bend the bracket at right angles and use two round-head wood screws about  $\frac{3}{8}$ " long. The capacitor is held by a  $1\frac{1}{2}$ " x 2" piece of Bakelite or similar material and fastened with screws to the edge of the wood base, as shown in the right-hand photo. A standard or miniature type tuning capacitor can be used.

All wiring is point-to-point. The wire leads are soldered directly to the ends of the clips before the clips are fastened to the base with screws. A midget setscrew knob is fastened to the end of the threaded shaft of the ferrite coil, while a larger knob with a  $\frac{1}{4}$ " hole should be mounted on the shaft of the capacitor. The clips can be marked with ink for handy identification.

The base may be of any size you desire, although I found 5" x 2" x  $\frac{1}{2}$ " very convenient in this case.

—Art Trauffer





# Quieting

## Fluorescent Lamp Interference

**O**CCASIONALLY you find incompatible elements in a home. Aunt Emma's repeated sneezing at Fido or father's allergy rash after mother's last supper surprise can be problems. But *we* are not expected to do anything about them, except sympathize. However, when the living-room radio kicks up a storm because it can't get along with the kitchen fluorescent fixture—then they turn to us with a "What are you going to do about it?" look in their eye. Well—we *can* do something about it!

**What Is the Noise?** It's honest-to-goodness radio interference by big-as-life radio waves—coming from the lamp itself. To add insult to injury the graph on the next page shows that the "hash" is apt to be concentrated right in the AM broadcast band—where we least want it.

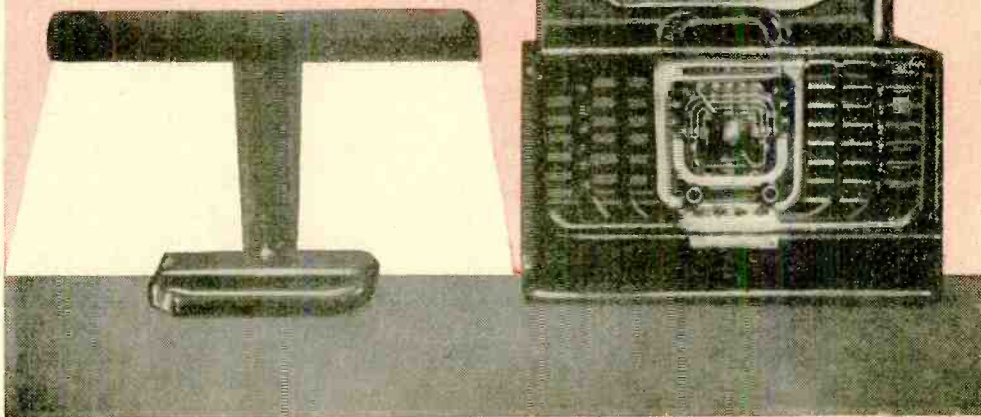
The waves are generated by a very tiny arc which occurs when electrical circuits are made or broken. In the fluorescent lamp, the making and breaking of the mercury arc 120 times each second (double the 60-cycle line frequency) is the cause of all the trouble.

The noise heard is usually one of two types. First of all, there is a sharp crackling noise heard at starting. Crackling is normal, and typical of the noise created by almost any switched circuit; this we can ignore. The second is the steady buzz (or

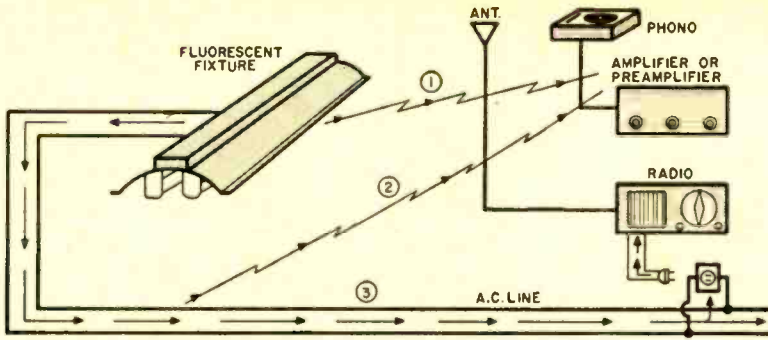
*Some words of wisdom on the cause and cure of fluorescent lamp noise*

By **EUGENE F. CORIELL**  
Lt. Col., USAF

**Locating** a radio alongside a fluorescent lamp is asking for trouble. The radio is probably flooded with all three types of interference described in this article.



**Paths of r.f. noise from lamp to radio or amplifier:** ① direct radiation, ② a.c. line radiation, and ③ a.c. line conduction of the noise.



even sometimes a *roar*) heard when the lamp is in operation. The buzz reaches your radio or hi-fi gear in three ways:

(1) It can be radiated either *directly* from the lamp or *indirectly* by "bounce" from a nearby metal object.

(2) It can be radiated from the a.c. line supplying the lamp.

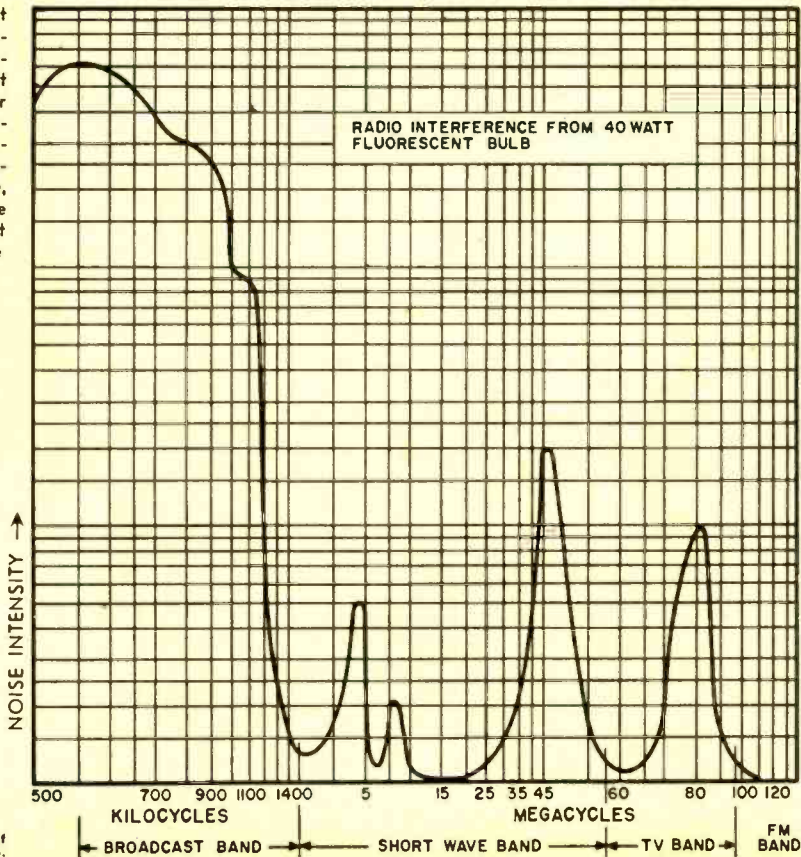
(3) It can be conducted along the a.c. line to your equipment power plug.

Direct radiation interference when the radio is over 15 feet away from the light fixture is unusual. However, when the

local station is weak or when reradiation is taking place, noise can be a problem over much greater distances. Occasionally, you may even get complaints from your neighbors in the next apartment.

**Identify the Source.** The first thing to do is to make sure the noise is coming from a fluorescent light and not from some other appliance. Turning off all lamps and other devices and turning them on again one at a time should point out the noisy one—or ones. (Since noise of this type does not generally "add up," locating and eliminat-

The graph at right shows the interference frequency coverage for a 40-watt bulb only. Other sizes manifest different areas of interference. The 72" "Slim-line," for example, has a noise null at the top of the broadcast band and its noise peak at about 5 mc.



Graph courtesy of General Electric Co.



ing one source may allow interference from some other device to take center stage).\*

Now, that we have located the culprit, should he be eliminated at the source of the crime—the radio, or in his home ground—the fixture? Ideally, interference should be corrected at the source; however, as this is not always the easiest approach, let's try a few of the simpler possibilities.

(1) Reverse the power plug of the radio, amplifier or, if possible, the lamp.

(2) Remove the bulb and rotate it 180° or swap it end-for-end. Unfortunately, either of these tricks may give only temporary relief.

(3) Install a new bulb. Older ones are more likely to be noisy. If a new bulb is not available, try one from another lamp.

(4) If either the radio or the lamp can be moved, you might find that even a few feet will make considerable difference.

**Radiation or Conduction?** From here on in, things are apt to be more time-consuming and possibly more expensive. Let's find out whether the interference is being *radiated* or *conducted*. Short out the radio antenna lead to the ground post or chassis. On loop-equipped sets, short out the two loop terminals. In audio gear, remove all input cables from the amplifier or preamplifier (record player, tape recorder, tuner cables) and short-circuit each input to chassis.\*\*

If the noise stops, the interference is probably being radiated. If it continues, it's being conducted along the power line. If the hash is cut down somewhat, radiated interference has probably been masking weaker conducted interference which can be heard now that the radiated variety has been shorted out. When we know the type of noise we are dealing with, we're free to try the remedies below.

**Radiated Interference.** Having determined that the interference is of the radiated variety, there are various approaches we can try. Any one of them or any *combination* may prove effective.

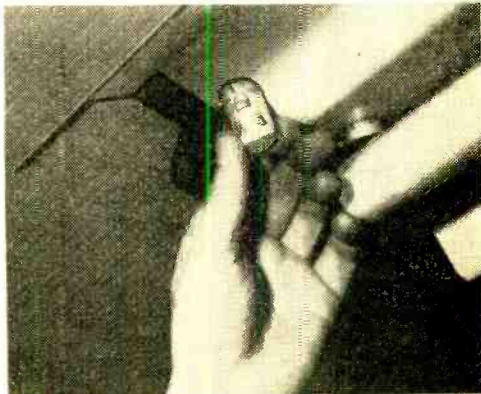
(1) Shorten the a.c. cord of the affected equipment, thus reducing the antenna action of the cord.

(2) Make sure any metal shields provided for GT/G glass-type tubes are installed properly.

(3) For sets equipped with a loop antenna, try an outside antenna using a low-capacity shielded lead-in.

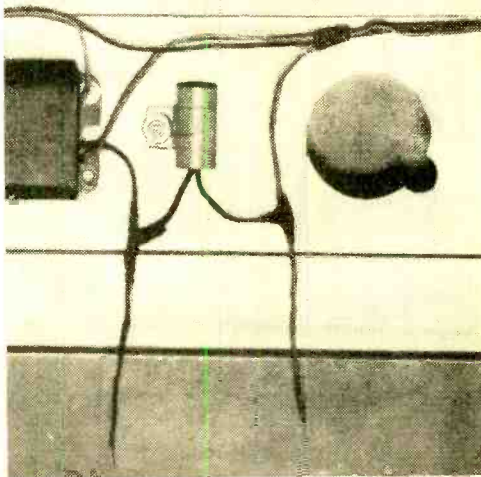
(4) For hi-fi gear not already connected to an external ground, try bonding *each*

chassis to a water pipe by a heavy wire.\* If you find that the external ground causes more noise than it cures, try removing the bonding wire from one chassis at a time. This will break any ground loop that might result from any two chassis being connected both by the cable shields *and* the bonding wire. You can also try replacing



Some cases of interference can be eliminated by simply replacing the starter (above).

**Difficult** cases require the installation of a filter mounted in the fixture itself (below). This type of filter is most effective with the line-conducted variety of interference.



the first preamp tube (12AX7, 12AT7, 6SC7); if the old one is gassy, it may be rectifying the r.f. "hash" to audibility.\*\*

**Conducted Interference.** If the shorting test described above does not kill the  
(Continued on page 118)

\* For quieting electrical appliances in general, see the book "How To Locate And Eliminate Radio And TV Interference," by Fred D. Rowe, published by John Rider.

\*\* A simple phono shorting plug can be constructed by soldering the plug's center pin to its shield.

\* The wires should be run individually from each chassis to the pipe. The chassis grounds should *not* be interconnected to each other at any point except the pipe.

\*\* See "First Steps in Servicing Hi-Fi Equipment" in POPULAR ELECTRONICS, June, 1957.



## Short-Wave Report

By HANK BENNETT

**R**ADIO JAPAN is the name of the International Broadcasting Service conducted by the Nippon Hoso Kyokai (NHK), the only public service broadcasting organization in Japan. Its aim is to give the listener a correct picture of the country and an inside view of the current situation in Japan. Programs of news, native and classical music, art, culture, politics, and customs are transmitted to 13 different areas of the world in 15 languages.

Two frequencies are used simultaneously for each of the 13 transmissions. This insures easy reception by listeners in remote parts of the world in relation to Japan. The simultaneous transmissions originate from the Yamata and the Nazaki transmitting stations respectively—the former being equipped with a 50-kw. and a 100-kw. transmitter, and the latter with a 50-kw. transmitter. Upon installation of a 100-kw. unit at the Nazaki station, most—if not all—of the programs of *Radio Japan* will be switched to the higher power.

The following frequencies are employed according to the four seasons of the year: 6069, 6080, 7180, 7242.5, 9675, 9695, 11,705, 11,725, 11,780, 15,135, 15,225, 15,235 and 17,785 kc. *Radio Japan* classifies the seasons as Summer (May-Aug.), Winter (Nov.-Feb.), and Equinox (March-April

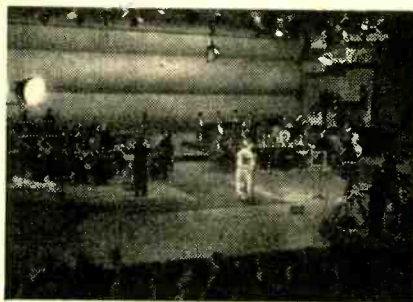
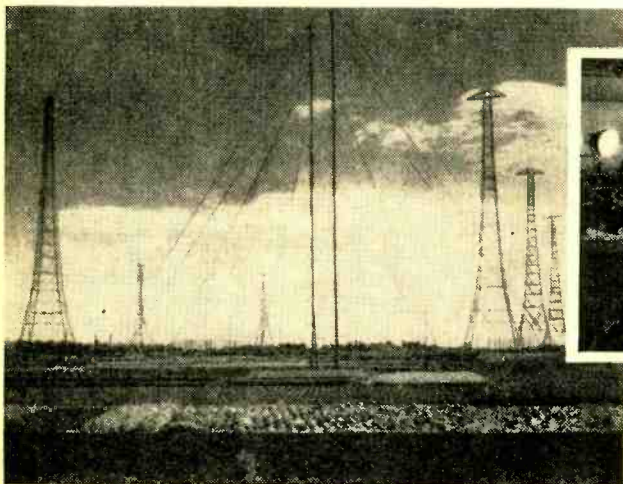
and Sept.-Oct.). Though the change-over of channels is made in full consideration of various conditions, it is kept to a minimum to avoid inconveniencing listeners. Frequencies difficult to receive are being replaced whenever the occasion arises.

Complaints are frequently received from listeners to the effect that the duration of programs is too short. Every effort is being made to rectify this condition and *Radio Japan* hopes to be able to meet listeners' requirements in the near future. Antenna-wise, they are well equipped, employing the following types: a doublet HFT-100 kw., all-wave type AWW, AWH-50 kw., and rhombics for 50 and 100 kw.

*Radio Japan* is represented by the call letters "JOA" (Nazaki) and "JOB" (Yamata). Both of the stations are 70 kilometers north of Tokyo and the facilities are owned by the International Telephone and Telegraph Company. The studios are housed in the NHK main building in downtown Tokyo. Programs are sent by land wire to the transmitting stations.

Reports of reception are welcomed from listeners everywhere. The correct address is: Nippon Hoso Kyokai, 2-2, Uchisaiwai-cho, Chiyoda-ku, Tokyo. Verification will be in the form of either a card or a letter.

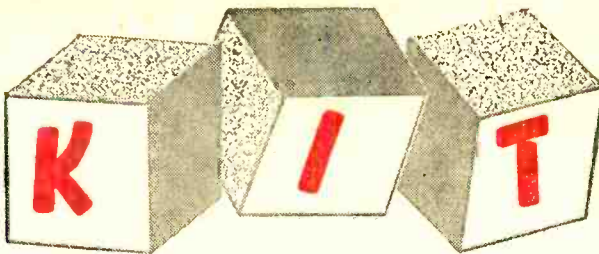
(Continued on page 126)



**Radio Japan's** Nazaki transmitting station is at left. Above, a popular song show is broadcast from its Radio and Television Hall. The singer is Miss Chiyoko Shimakura.

POPULAR ELECTRONICS



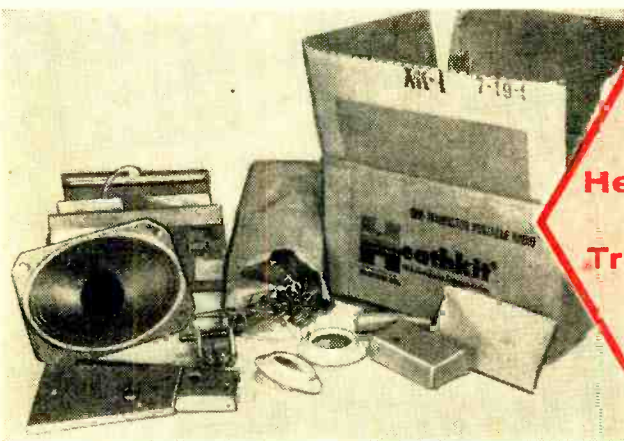


## BUILDER'S KORNER

**T**HE AVERAGE PERSON thinks of transistors *only* in connection with miniaturized equipment. There's no technical reason, however, why the other advantages of transistor operation—light weight, ruggedness, low power require-

entire AM broadcast band using a super-heterodyne circuit.

There are six transistors and two diodes. The transistor line-up includes a 2N252 converter, a 2N253 first i.f. amplifier, a 2N254 second i.f. amplifier, a 2N238



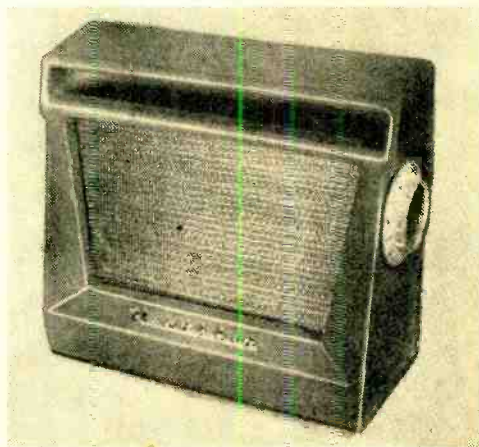
**Heathkit Model XR-1  
Transistor Receiver**

ments, long service life—can't be extended to the design of "full-sized" equipment. An important step along this line has been taken by the Heath Company (Benton Harbor 20, Mich.) with the introduction of a *standard-sized* transistorized radio in kit form—the Heathkit Model XR-1 Transistor Receiver.

Designed for use as a "universal" AM receiver, the Model XR-1 serves equally well as a table model set in the home or as a lightweight and rugged portable for use at the beach, on outings or on picnics. Its shock-free design insures complete safety in the kitchen or bathroom, while its ample volume, sensitivity, and tone quality are equivalent to those of a.c. line-operated receivers. As a construction project, the XR-1 will not exceed the ability of the rank beginner, nor be an insult to the more advanced worker.

**Putting It Together.** The Model XR-1 mounts into an unbreakable plastic case measuring approximately 9" x 8" x 3 3/4". Over-all weight, including batteries, is slightly under five pounds. With a built-in rod type antenna, the XR-1 tunes the

first audio stage, and a pair of 2N185 transistors in a Class E push-pull audio output stage. One diode serves as a second detector and, in addition, supplies the a.v.c. control signal to the first i.f. amplifier;

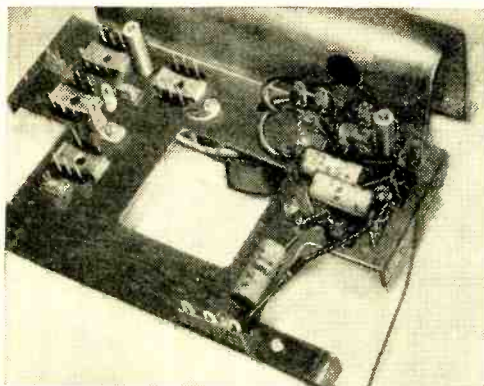


**The completed XR-1 mounted in its unbreakable plastic case. It serves as a table model or portable.**

the other diode is connected between the converter and first i.f. amplifier stages and provides protection against strong signal overloads. The i.f. value is 455 kc.

A detailed step-by-step instruction manual includes both pictorial and schematic diagrams. In addition, "wall-size" prints of the pictorials are supplied which make the job even easier.

Actual assembly is broken down into more or less independent stages, thus allowing the builder to take an occasional



**Circuit wiring** is done in stages according to the electrical breakdown of the receiver's circuit.

"break" during construction. First, of course, most of the basic chassis hardware is mounted, including terminal strips, transistor sockets, audio and i.f. transformers, and the local oscillator coil.

The circuit wiring is done in stages according to the electrical breakdown of the receiver's circuit. Thus, following the manual, you'll wire the stages in this order: audio output; audio driver; then i.f. amplifiers. The r.f. oscillator and antenna circuits are wired as part of the final assembly step.

Assembly time will vary considerably with the individual worker. However, if you like to take things slow and easy, with frequent "breaks," you still should be able to complete the kit in less than a week, working a couple of hours each night . . . or over a week-end.

**Special Features.** Heath has taken special steps to make the alignment of the XR-1 as painless and as simple as possible. No r.f. signal generator or other special test equipment is necessary. A plastic alignment tool is furnished as part of the kit. And all coils are pre-adjusted at the factory so that relatively little readjustment is needed for peak performance. Chances are you'll be able to pick up most local stations on your first try.

A 4" x 6" PM loudspeaker easily handles

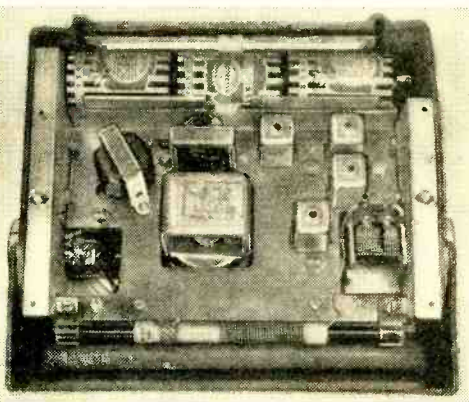
the output of the Class B power amplifier stage. Good tone quality is insured not only by the comparatively large speaker (for a transistor receiver) but by a built-in special baffling arrangement.

One of the most important features is the use of standard flashlight batteries in the receiver's "power pack" and the long life (500 to 1000 hours) obtained from the batteries under normal operating conditions. Operating power is supplied by a 9-volt power pack, made up of six size "D" flashlight cells.

Your reviewer calculated the cost of operating this receiver, assuming that you pay "list" prices for your batteries (instead of the somewhat lower "net" prices), and compared this cost to that of operating a standard line-operated table model radio receiver. At average electric power rates, it costs no more—if as much—to operate the XR-1 as it does to operate a "conventional" a.c. or a.c./d.c. receiver.

**Comment.** The XR-1 assembles without difficulty and the test model worked when first turned on. Almost all local stations could be picked up with good volume even before alignment.

Construction could have been made a little easier if one or two modifications were made in the order of assembly. In a few instances, one part interfered some-



**Rear view** of the completed XR-1 with the fiberboard back removed. Flashlight batteries in the receiver's "power pack" are easily replaced.

what with the installation of another part. And a minor point: the fiberboard back doesn't match the color of the cabinet.

As far as the performance of the completed receiver is concerned, it is equal to—if not superior to—any of the transistor receiver kits we have seen to date. In fact, the XR-1's tone quality, sensitivity, selectivity, and output volume are as good as those of most of the commercially built transistor receivers.

-30-



# AFTER CLASS

Special Information on Radio, TV,

Radar and Nucleonics



## USING INDUCTORS

*"I know what an inductor is—I think—but I'm pretty hazy as to its use in an electronic circuit. And while we're talking about inductors, exactly what's the difference between a solenoid and a toroid, which I understand are two forms of inductors?"*

**PICTURE** a complicated highway interchange with no directional signposts, traffic lights, or highway police, and you have a pretty good idea of what an electrical circuit would be like without "oppositional" components that guide, cajole, and coax electrons to follow prescribed paths. Resistors, capacitors, and inductors—occurring singly or in various combinations—comprise the fundamental oppositional elements that direct electronic traffic so skillfully even in complex circuits.

Ordinary resistors are indiscriminating components; they oppose d.c., a.c., high frequency, and low frequency alike. A given current of *any* type passing through a specific resistor causes the same voltage drop. Capacitors are different; they oppose changes of voltage in any circuit of which they form a part but do not react significantly to rapid current variations.

**Inductors vs. Capacitors.** An inductor may be viewed as the exact opposite of a capacitor. Made up of turns of wire in the form of a coil, an inductor opposes current rather than voltage changes, especially when these variations occur at a high frequency. This characteristic makes the

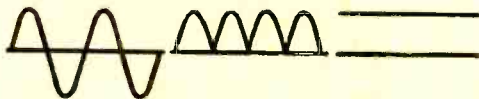


Fig. 1. Rectifier changes a.c. to pulsating d.c.

inductor a useful complement to the capacitor in a power supply filter circuit.

A full-wave rectifier circuit changes alternating current to pulsating direct current (Fig. 1). This "hill and valley" formation of pulsating d.c. is usually not suited for operating d.c. electronic equipment until the "valleys" are filled in.

Consider the filter circuit shown in Fig. 2. As the pulsation appears across the

capacitor  $C$ , the latter charges to the peak voltage (points labeled  $A$ ) of the input wave. When a valley appears (points labeled  $B$ ), the capacitor attempts to discharge through the inductor  $L$  into the load, which may be any device that uses direct current.

Since such a discharge would constitute a sudden surge of current, the opposition that inductor  $L$  offers to such an abrupt

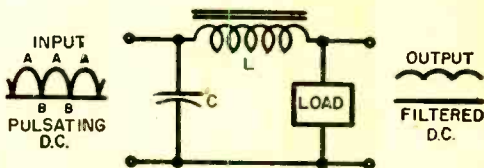


Fig. 2. Filter smoothes pulsating direct current.

change forces  $C$  to retain most of its charge until the next peak appears to bring it back to full charge again. In this way,  $L$  assists  $C$  in maintaining the circuit voltage constant, an action necessary to change pulsating current into pure d.c. In this circuit,  $L$  is termed a *choke*.

**Opposition Factors.** The opposition an inductor or choke presents to varying currents depends upon two factors: (1) how fast the current varies (frequency), and (2) the physical construction of the coil—the number of turns, turn spacing, coil diameter, and kind of core. A filter choke of the type just described has hundreds of turns of fine wire, an iron core, and is said to have a high *inductance*. Just as

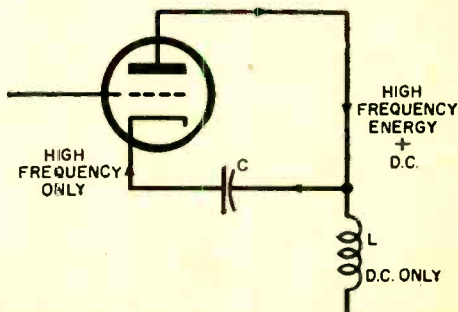


Fig. 3. "L" blocks high frequency, "C" passes it.

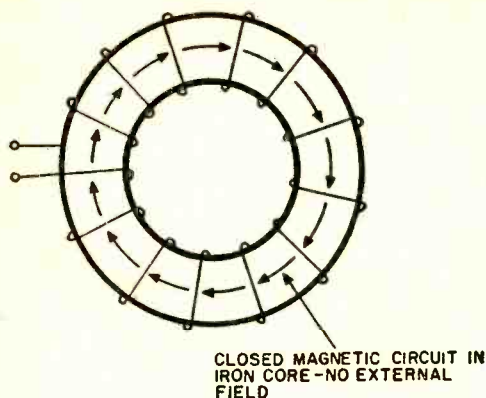


Fig. 4. The toroid has a doughnut-shaped core.

resistance is measured in ohms, e.m.f. in volts, and current in amperes, inductance is measured in *henrys*. The symbol "L" signifies inductance. Smoothing chokes usually run from 10 to 30 henrys.

Any time a circuit condition calls for choking off a rapidly varying current, an inductor of the correct size used in conjunction with a properly chosen capacitor can do the job. For example, suppose an electron tube is generating a current of high frequency, say 1,000,000 cycles per second (1 mc.). This tube is fed d.c. voltage and current from a power supply, but the high-frequency current is not to be permitted to flow backward through the supply.

Connecting an inductance and capacitor as shown in the partial schematic (Fig. 3) fulfills this requirement by permitting the d.c. to flow through the inductor but opposing the high-frequency current back-flow through the inductor. The capacitor provides an easy path for the high-frequency current to return to the tube—a necessary arrangement to assure a complete circuit for this energy. An inductor like this has relatively few turns wound on a ceramic or plastic core; its inductance might range from 2 to 10 *millihenrys* (0.002 to 0.01 henry). Because the frequency is so high, not much inductance is needed to place a barrier in front of the incoming varying current.

In summary, an iron core coil of many turns has a high inductance and is especially useful as a choke in low-frequency circuits; high-frequency hookups call for low-inductance coils of few turns on non-magnetic cores.

**Toroids and Solenoids.** Over the years, toroids have been used desultorily by many of the larger overseas communications companies for the special filter applications in which they perform particularly well. The last decade has seen a steady

growth in the number of circuits and devices in which toroidally wound coils have come to be preferred over solenoid types.

The word *toroid* describes a method of coil winding—Fig. 4. Turns are placed around a doughnut-shaped core which forms an absolutely closed magnetic circuit as illustrated. A solenoid, on the other hand, is generally defined as a coil fabricated on a straight core, sometimes iron, and other times air or non-magnetic solids like plastics or fiber—see Fig. 5. Certain types of transformers have two separate solenoid coils on a common core.

What is the secret of the toroid's sudden rise to prominence? Known for many years to be vastly superior to solenoids in certain important respects, toroids were avoided by designers and manufacturers for two reasons. Suitable core materials were not available, especially in applications involving the higher audio frequencies and the radio frequencies. And automatic machines for winding turns around a

OPEN MAGNETIC CIRCUIT—STRONG EXTERNAL FIELD

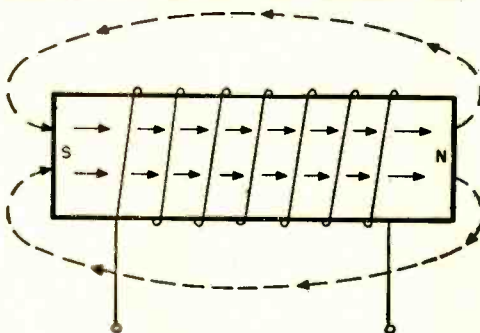


Fig. 5. Solenoid is wound around straight core.

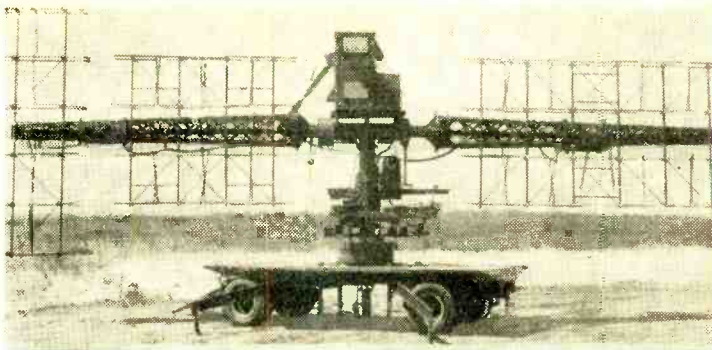
doughnut core were virtually unobtainable at any price.

Neither of these problems exists today. High-speed automatic toroid winders form these inductors just as quickly as solenoids; and modern core materials like Permalloy dust, the ferrites and mu-metal make them practical for use at the higher frequencies.

The "open" magnetic circuit of the solenoid forces its lines of force to travel through the surrounding open space to link with the core at both ends, whereas the "closed" path of the toroid core confines the field to the molecules of the core so that there is little or no external field. Two very significant advantages arise from this behavior: first, it makes possible higher inductances with fewer turns of wire, and second—probably much more important—it does away with the need for careful shielding. Where there is no external field

(Continued on page 118)

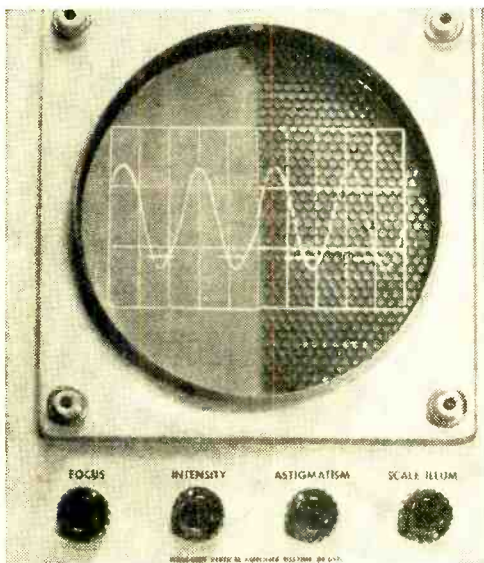




## Father of Radar Gets His Reward from Patent Office

The U. S. Government finally recognized the daddy of radar by granting a patent to Col. William R. Blair (Ret.), above, right, who conceived the pulse-echo method of direction finding prior to 1930. It was developed during the 1930's at the Signal Corps Laboratories in Fort Monmouth, N. J. In 1937 a prototype, SCR-268, radar system (above, left) was demonstrated for the Secretary of War and Members of Congress. Plans for this set were turned over to manufacturing companies so that they could build radar equipment for the U. S. Army.

Due to the high degree of secrecy surrounding the development of radar, a patent application was not filed by the Army Signal Corps until 1945, and since then the Patent Office has had the matter under consideration. This radar patent is considered to be as important to the military as the first U. S. patent issued on the telephone was to commercial communication.



## Scope "Shadow-Screen"

The oscilloscope Shadow-Screen manufactured by Van-Dec Products, Laguna Beach, Calif., is said to end the need for subdued light or an oscilloscope hood. It consists of hundreds of small, hexagonal openings that serve as individual shadow boxes, shutting off glare. The shape of the openings permits observation from any point within 45° of face-on position. Note contrast in photo above.

## Open Sesame

Genie Lift-A-Dor (not the luscious lady below, but what she's holding) is a new R/C system for opening garage doors from your car. If you should ever want to put the car away with *her* around, you'll find that a simple touch of the button she's holding will unlock the door, open it and turn on the garage lights. Another push will close and lock the door, and turn out the lights. Made by Alliance Manufacturing Co., Inc., Alliance, Ohio, the device works on a limited-range low frequency which prevents false activation by stray signals.



# Make Those Noisy Tapes

## The Splice of Life

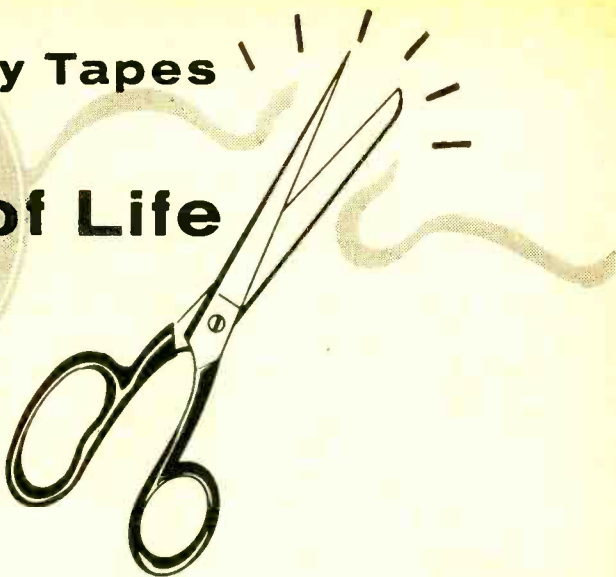
By EUGENE GARNES

"THE FACE on the cutting room floor" is an old adage of movie-making that has turned many a dull film into a masterpiece. Like the movie-maker, the tape recorder fan can turn his noisy, stumbling reels into gems by some judicious cutting.

It's easy, and you should wind up with a perfect splice, as shown in Fig. 1(A). Figures 1(B), 1(C) and 1(D) show how it *shouldn't* be done.

All you need is a splicing block (\$2 or so), single-edge razor blades,  $\frac{3}{4}$ " splicing tape and a good scissors (Fig. 2). Ordinary cellophane tape is not satisfactory as it will creep with age and cause sticking. Stable, pressure-sensitive adhesive is used with professional tape equipment. Be very certain that neither the blade nor the scissors is magnetized, since that can cause an audible thump in playback. A head demagnetizer will also demagnetize tools.

The popular diagonal splice will give a strong, durable junction which should last the life of the tape. This is used to remove fairly large sections. The vertical splice



**A little careful editing  
can save a valuable reel**

gives a weaker bond, is used when short syllables are to be removed. It is made in the same way but with a vertical slice.

The mechanical segue, which is a smooth "dissolve," akin to the dissolve from one scene to another in the movies, is a form of diagonal splice. It provides a smooth transition point rather than an instantaneous one. With a long diagonal cut, 12" or so, the head begins to contact less and less of one tape's pickup surface, reducing the volume accordingly, and more and more of the other, increasing its volume in the same proportion. Result, a smooth dissolve.

Follow the drawings on the next two pages for perfect results . . .

-30-

Fig. 1. Right (A) and wrong (B, C, D) splicing.

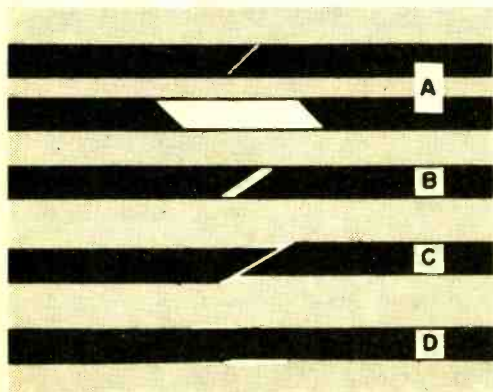
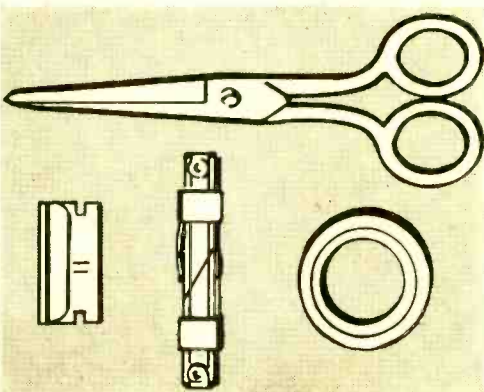


Fig. 2. All you need to make a perfect splice.







The tape is placed plastic (shiny) side up in the splicing block which will grip the tape in any one of a number of ways used by different manufacturers. The tape is then carefully cut with a sharp razor blade by following the diagonal slot milled into the splicer. This should result in a perfect, clean cut. It might be better if you experimented a few times with some scraps of tape to achieve just the right technique, before you start in on your first good tape. If you find your cuts are on the ragged side, check your razor once more. If it's dull, use another one. Use a quick, one-stroke slice and don't hesitate

in mid-stroke. After you've cut your good tape, the section containing the desirable material remains in the block. The section to be deleted is removed. Next, the section of tape to be joined to the first is placed in the block from the opposite end. In exactly the same way, you should then cut this piece. Now you will have the two diagonal cuts of the pieces to be joined facing each other, ready to be spliced. The next step is taping the ends together.



The next step is probably the most important in the whole operation. Very carefully adjust the tapes so that the ends butt perfectly. You should get an exact fit, since both were cut in the same groove of the cutting block. If you don't get a perfect match, you might find that you're suffering momentary loss of sound or sticking during playback, such as in (B) of Fig. 1, at left. Or if the diagonal cuts are out of line, as in (C), you may get the same poor results. Now cut a piece of splicing tape about two inches long and press the sticky side down directly over the joint with the ball of your thumb. Don't disturb the alignment of the tapes as you press down. Also, make sure the sides of the splicing tape are parallel to the diagonal cut. With care, press the splicing tape on firmly, working away from the center. Now pick up the recording tape by the ends of the splicing tape and place it on a flat surface. Again apply firm pressure over the entire splice area to insure that the tape edges are bonded to the adhesive. Remove the recording tape in the same way, and use scissors to trim off excess splicing tape, cutting slightly into the recording to prevent future sticking on the edge of the tape. Be careful not to cut too far. And try to make the cut as even as possible, so that it doesn't resemble Fig. 1(D).

December, 1957

#### HOW TO EDIT

When working closely with material such as interviews, you must be able to jockey the tape back and forth while in contact with the playback head and yet not have the driving mechanism engaged. All professional machines provide this feature. You can get the same result with many home machines by cocking the *Forward* control about halfway between off and "full on." This is generally impossible with push-button machines, however.

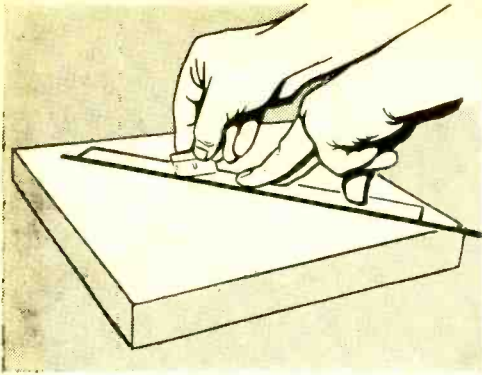
Now let's assume that we wish to edit an "Ah" from the start of a phrase. We "see-saw" the tape, beginning just ahead of the "Ah" up to two or three words of the phrase. After doing this a few times, we get the feel of the phrase, with a pretty good idea as to where to make the cut. By jockeying the tape slowly, the individual sounds that make up the words can be recognized and the undesirable sound pin-pointed.

If there's a definite break between the wanted and unwanted sounds, it should be easy to make a clean vertical cut there. However, if the sounds run into each other, as in the case of "Ah, yes," where there is no perceptible break, we have to jockey the tape slowly to determine where the "Ah" leaves off and the "yes" begins. If it is difficult to locate the exact spot, it may be wise to cut a little on the "Ah" side. Then if that's not satisfactory on playback, you can peel the tape and cut another 1/16-inch or so, resplice and check again, until you get exactly what you want.

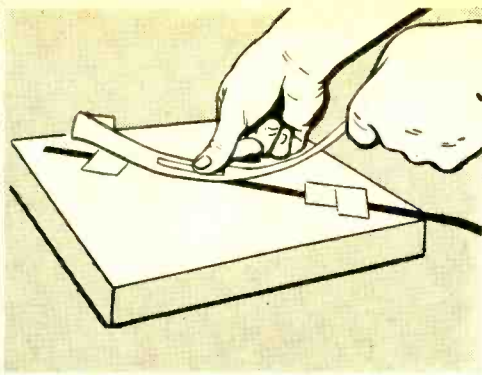
In the above case a diagonal splice is recommended, since it will give a very rapid fade-in. This helps to create an effect not unlike that of the voice, which needs a few microseconds to reach full normal output when starting from a quiet state. In editing excess syllables, of course, the vertical splice must be employed.

When non-professional equipment not designed for editing is used, the playback head may not be visible, making it impossible to do close work. In such a case, place a reference mark on the head cover, directly above the head gap, and work from that.

There are certain limitations. You can edit only single-track tape, or dual track tape where only one track has been recorded. Stereo tape can be spliced provided that it is of the stacked-head type.



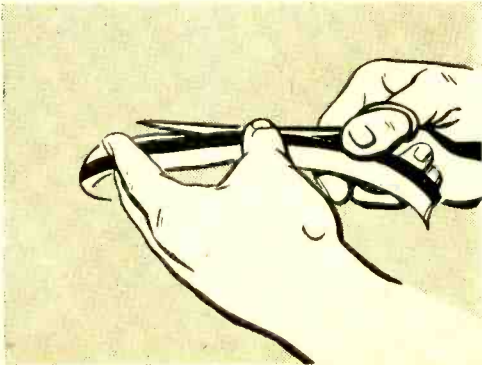
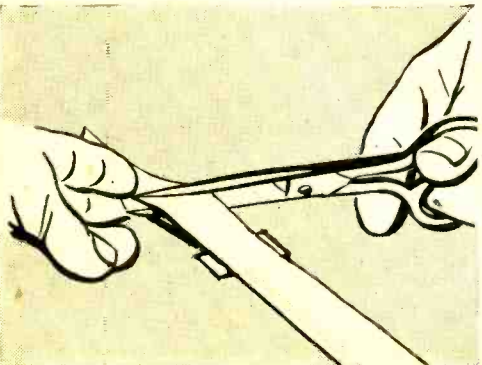
**Now that** you've made your first diagonal splice, you might want to try a mechanical segue. The procedure is essentially the same as in the previous steps. Put the first section of tape on a flat surface, preferably a wooden cutting block. Carefully place a ruler on the tape for the long diagonal cut—a 12" length might be good for your first try. Cut the tape cleanly in one stroke. Then place the second piece of tape in the same position, and measure off the exact same length. This time, however, make the cut in the opposite direction, so that the two cuts match. The next step is shown at right.



**The first** piece of recording tape is held in position by squares of masking tape applied at each end of the cut. Very carefully line up the second piece of tape so that the diagonal cuts butt and match. Anchor the second piece of tape in position with additional masking tape. Next, cut a 14" length of splicing tape and place it over the splice area. Apply the tape at the center of the splice only and work the splicing tape toward each end, being careful not to separate the butted cuts. You can check on this since the splicing tape is translucent. If they separate, you must start over.

**Before** reaching the ends of the splicing tape, cut off about a half-inch diagonally. This will allow for smooth passage during playback. Complete the application of splicing tape, pressing it out all the way to the ends. When you reach the masking tape supports, it will be safe to remove them, since the already applied splicing tape will offer sufficient support. Make certain, however, that you don't disturb the butt as you pull off the masking tape, or you'll have to begin all over again. Press it down firmly.

**Pick up** the spliced tape and cautiously trim the excess splicing tape, cutting slightly into the recorded tape. This completes your mechanical segue, which—if properly made according to the preceding steps—will result in a smoothness equal to the most skillful mechanical segues of professional engineers. This method is best for slower tape speeds,  $7\frac{1}{2}$  and  $3\frac{3}{4}$  ips being ideal. At the latter speed a 12" splice will give a four-second segue, while at the former speed the segue will last for just about two seconds.







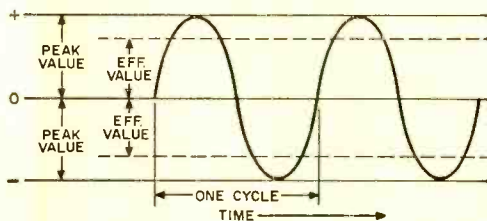
# Among the Novice Hams

By HERB S. BRIER, W9EGQ



**SEE NEXT PAGE FOR**  
list of those who request help  
in obtaining their ham licenses

IN DISCUSSING the theory behind questions appearing in the FCC amateur license examinations (October and November issues), so far we have made no distinction between *direct current* (d.c.) and *alternating current* (a.c.). This is because everything that we have learned up to now is equally true for either type of current. Nevertheless, there are many important differences between the two which must be understood before you can learn much about radio. Anyone who learned how to do long division in school has enough on the ball to master sufficient a.c. and d.c.



$$\text{PEAK VALUE} = 1.41 \times \text{EFFECTIVE VALUE}$$

$$\text{EFF. VALUE} = 0.71 \times \text{PEAK VALUE}$$

**Fig. 1.** The difference between the effective and peak values of an alternating current. A direct current has the same effective and peak value.

theory to qualify for an amateur license. So let's get started.

**The Two Currents.** Direct current, as its name implies, always flows in the same direction—from the negative terminal of the power source to its positive terminal. To most of us, flashlight batteries, portable radio batteries, and storage batteries are the most familiar sources of direct current.

Alternating current, however, starts at zero, builds up to a maximum value in one direction, decreases to zero again, builds up to a maximum value in the opposite direction, and again drops to zero. The whole *cycle* repeats itself over and over many times per second as the terminals of the a.c. generator become alternately positive and negative. The electric power delivered to our homes by the power company is 60-cps alternating current.

Figure 1 shows how a.c. peak and effective voltages differ. The part of the *sine* curve above the base line indicates that the voltage and the current are building up in one direction (positive), and the part below the base line indicates that they are building up in the opposite (negative) direction. The arrow pointing to the right represents the passage of time.

Obviously, if an a.c. generator is connected across a load, such as a light bulb, the current flowing through the load will increase and decrease in step with the voltage. Consequently, maximum power can flow into the load during only a small portion of each cycle. With d.c., however, full

(Continued on page 134)



**When Al, KN9IDZ,** finishes an operating session, he folds up the desk leaf and closes the door of his built-in wall cabinet, concealing his equipment.

# HELP US OBTAIN OUR HAM LICENSES

Prospective amateurs requesting help and encouragement in obtaining their licenses are listed here. To have your name listed, write to Herb S. Brier, W9EGQ, c/o 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

Peter L. Norris (16), Box 167, Strong, Me. (Code and theory)

Richard Bonin, 1039 Main St., Pawtucket, R.I. Phone: PA 3-9834. (Code, theory and selection of equipment)

Ronald Lefebvre (15), 510 Bernon St., Woonsocket, R. I. Phone: PO 9-8858. (Code and theory)

Laurent Ruel, 18 Dearborn Ave., Biddeford, Maine.

Scott Sederquist, 48 Sunset Dr., Beverly, Mass.

David Perrin, 1096 Highland Ave., Needham Heights 94, Mass. (Theory)

Joe Liro (15), 12 Berkshire St., Ludlow, Mass. Phone: JUniper 3-2324. (Code and theory)

Dick Wasta, 12 Joseph St., Terryville, Conn. (Code and selection of equipment)

Roy Gould (13), 7 Thomas St., Maynard, Mass. Phone: TWIn Oaks 7-8174. (Code and theory)

James H. Powell, 78 Nelson St., New Bedford, Mass. (Code and theory)

## K2/W2 CALL AREA

Jerry Schwartz, 547 Saratoga Ave., Brooklyn 12, N. Y. (Code, theory and selection of equipment)

Donald E. Josephs, 30 Meridian Rd., Levittown, N. Y. (Code and theory)

Michael Wodynski (14), 514 Chase Ave., Lyndhurst, N. J. (Code and theory)

David Luberto, 620 Tenth St., Lyndhurst, N. J. Phone: WE 9-8122. (Code and theory)

Rip Wands (17), 21 Laurel Ave., Tenafly, N. J. Phone: LOwell 9-8527. (Code and theory)

Lewis Lester, 2241 Creston Ave., Bronx 53, N. Y. Phone: FO 5-1294. (Code and selection of equipment)

William Steckman (13), 32-75 44 St., Long Island City 3, N. Y. (Code and theory)

Dick Cunningham (15), 17 Moore Ave., Pearl River, N. Y. Phone: PE 5-2398. (Code and theory)

Raymond G. Luzi, 1341 Purdy St., Bronx 62, N. Y. (Code)

Howard Messing, 458 Kingsland Ave., Lyndhurst, N. J. Phone: GE 8-6497. (Code and theory)

Daniel Weiner (16), 1340 Wilkins Ave., Bronx 59, N. Y.

James Huss, R.F.D. #1, Eaton, N. Y.

Owen Goldfarb, 330 Blacksmith Rd. W., Levittown, N. Y.

Martin Belber, 121 Vermilyea Ave., New York 34, N. Y. (Code and theory)

John R. Van Sciver (14), 337 Barclay St., Burlington, N. J. (General Class code and theory)

## K3/W3 CALL AREA

Lamar Heckler, 2135 Chestnut St., Hatfield, Pa. Phone: ULYssey 5-2513. (Code)

David Schade, 2801 Pyramid Ave., Pittsburgh 27, Pa. Phone: TU 1-0514. (Code and theory)

Lynn Price, R. D. #3, Box 51, Johnstown, Pa.

Tom Newman, Unit 7, Green Hill, Milton Hershey School, Hershey, Pa. (Code and theory)

Robert Myers (14), 672 Davenport St., Meadville, Pa. Phone: PO 2-5624.

Domenick Nardi (14), 1432 So. Clarion St., Philadelphia 47, Pa. Phone: HO 8-4096. (Code and theory)

Anthony Gargano (15), 1320 Dickinson St., Philadelphia 47, Pa. Phone: FULton 9-6476. (Code and theory)

Fred Hershey (16), P. O. Box 88, Dalmatia, Pa.

## K4/W4 CALL AREA

James Burleson (15), Rt. 2, Box 403, Panama City, Fla. Phone: SU 5-4770. (Code and theory)

Morris Sandlin (17), P. O. Box 143, Calera, Ala. (Code and theory)

Ray Linnville, 1106 E. Tunis St., Pensacola, Fla. (Code, theory and selection of equipment)

## K5/W5 CALL AREA

Ronald Eddy, Box 8, Waldo, Ark. (Selection of equipment)

Jim Landreth (14), 1124 Third Ave. N., Texas City, Tex. (Code and theory)

Don Wilder, Box 72, Ruston, La. (Code and theory)

Jeryl Fullen, Box 36, Wister, Okla. Phone: 2547. (Code, theory and regulations)

J. D. Hall, 208 Grace Ave., Ft. Worth, Tex. (Code and theory)

Artie M. Davis (13), Rt. 3, Box 40A, Leesville, La.

Billy Parry (13), 715 So. 12th St., Edinburg, Tex. Phone: DU 3-1198. (Code and theory)

## K6/W6 CALL AREA

Josephie G. Fischer (9), 12808 Miranda St., N. Hollywood, Calif. (Code, theory and selection of equipment)

Wayne Claybaugh, 8692 Hoffman, Riverside, Calif. (Theory)

John DuBry (15), 10321 McClemon, Tununga, Calif. (Code and theory)

Dale Shonyo (15), 380 W. Joaquin, San Leandro, Calif. Phone: LO 9-6538. (Code and theory)

## K7/W7 CALL AREA

Lynn J. McKell, 244 E. Center, Spanish Fork, Utah. (General class code and theory)

Bill P. Lambing, Rt. 3, Twin Falls, Idaho. (Theory)

Joseph Steely, 977 Wilson Ave., Salt Lake City, Utah. (Code and theory)

Samuel John Reed, 2020 E. Turney Ave., Phoenix, Ariz. (General Class code and theory)

## K8/W8 CALL AREA

John Goetz (15), 536 Hedgewood Ave., Zanesville, Ohio. Phone: GL 3-2268. (Code and theory)

Kenneth Wallace, Rt. #2, Walhonding, Ohio.

Barry Shaw (13), 5960 Shell Ct., Waterford, Mich. Phone: OR 3-3280. (Code and theory)

Douglas Mark (14), 2209 Levern St., Flint 6, Mich. Phone: CEDar 4-2166. (Code, theory and selection of equipment)

Michael DeFrancesco, 28460 Shamrock Dr., Birmingham, Mich.

Michael Chobanian, 2019 Glendale Ave., Flint 3, Mich. (Code and theory)

## K9/W9 CALL AREA

Bill Steffey (13), 599 Lincoln Ave., Glencoe, Ill. (Code)

Robert Woos, 327 E. Georgia St., Brazil, Ind. (Code and theory)

## K0/W0 CALL AREA

Bill Congdon, Crane Lake, Minn. (Code and theory)

Michael Sweeney, Lismore, Minn. (Code and theory)

Lawrence D. Harrison, 5532-31 Ave. S., Minneapolis 17, Minn. Phone: PA 2-4977. (Theory)

Peter Backlund, 754 W. Idaho St., St. Paul 13, Minn. Phone: HU 8-4236.

## VE AND OTHERS

Noel Donawa, 22 Prizger Road, San Juan, Trinidad, B. W. I. (Code and theory)

Jerry Zemell, 388 Rusholme Rd., Toronto, Ont., Canada. (Code and theory)

To help prospective amateurs obtain their Novice licenses, the Radio-Electronics-Television Manufacturers Association offers a set of code records (recorded at a speed of 33 1/3 rpm) and a Novice Theory Course for \$10.00, postpaid. The complete course or more information on it is available from RETMA, 1721 DeSales St., N.W., Washington 6, D. C.



# Do Your Tapes Sound "Real Pro"?



By WILLIAM H. O'BRIEN

***A little care for your home recorder  
helps it sound like a studio model***

**Y**OU'VE propped up your tape recorder before the high school band, being careful about mike placement to avoid the tonal fog spread over the bright blare of the brass by the acoustics of the old gym. Or, recording your Wednesday night chamber music group, you monitored for balance between the instruments and for the intimate detail that distinguishes such music. Yet, despite all this care in your recording setup, the tapes somehow don't sound like professional products. Perhaps you accept this lack of quality as inevitable, blaming it on the quality of your small home tape recorder.

The reason for better quality in the professional's end product is not only the equipment utilized but the way he goes

about the job, so you might be doing your machine an injustice. Your home tape recorders are capable of far more "professional-sounding" results than you obtained in the past. Devote the same care to your machine that a professional lavishes on his and you may be surprised how closely your taping resembles professional sound.

We won't tell you here how to make a recording. Choice and placement of microphones, acoustic preparation of the recording room, etc., are another story. We are concerned with only one thing: how to assure peak performance of your recorder before you even start to spin the reels.

**Pad, Clutch and Tension.** The first step is a professional-style pre-recording check of the machine's operation. Take a

close look at the pressure pad holding the tape against the recording head. If it is not pressing firmly enough against the head, high frequencies will be lost. Pressing too tightly, the tape will slow down. Gently but firmly is the rule. Don't be afraid to adjust the pad.

Now let's check the clutch take-up for tension. An overly tight clutch can spoil a recording by "overpowering" the capstan. The clutch starts to pull the tape instead of the capstan, producing noticeable wow and flutter.

Here is a simple test for clutch tension which can be used on most small home tape recorders. Place a pencil against the tape at a point just beyond the capstan. If the tape readily "bows" out, you have correct tension. If not—if the tape skews out of line only by exerting pressure—there is too much tension on the clutch.

The most inexperienced amateur should not hesitate to adjust the clutch. In all likelihood, your home tape recorder has a setscrew or nut to loosen or tighten the

**Great improvement** in the quality of home recordings can be attained by following the same equipment maintenance routine employed by professional engineers in sound recording studios.



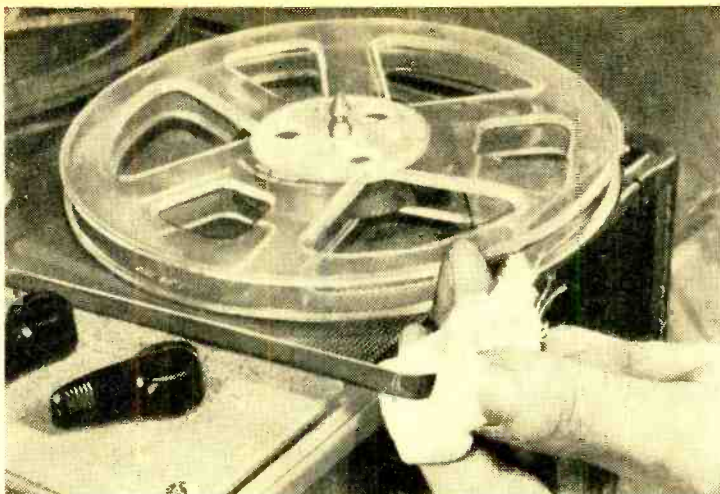
**Cleaning** the pressure pad of the recorder, the pressure roller and the capstan is a simple remedy for slow-running machines where dirt creates a mechanical hindrance.

felt clutch pad and spring device. Make the necessary adjustment, using the "pencil test."

**"Greasing" the "Skids."** Smooth operation of the clutch, as well as correct tension, is essential for maximum performance of your machine. It's a good idea to lubricate the felt clutch pad. Remove the

part containing the pad from the clutch assembly and saturate it with silicone lubricant. Long Life lubricant is one brand used by professional tape recording engineers. The saturated felt pad should be left out all night; the fluid will evaporate, leaving the silicone behind to form a smooth surface on the pad, reducing fric-





**Running tape** through a pad soaked with lubricating fluid removes abrasive particles that accumulate on heads and guides, causing wear and impairing quality of recordings.



**Recording heads** may be cleaned with a special cleaning fluid which dissolves binder and oxide deposits that build up near the magnet gap. Despite its solvent quality, the fluid doesn't attack metal or plastic parts of the recording head.

tion to a minimum and eliminating any tendency for jerky action.

**Caution:** Under no circumstance use any kind of lubricating oil or similar product (common machine oil) on the clutch, unless the manufacturer of your recorder expressly specifies it for use. The heat produced by the machine in operation causes petroleum products to break down and, instead of lubricating, create friction.

**Clear Heads.** Magnetized heads have a bad habit of erasing the very high frequencies on your recorded tapes. It is a good practice to demagnetize the recording and playback heads of your machine before every use. Head demagnetizers are manufactured by a number of companies and can be purchased for approximately \$10. Before using the demagnetizer, cover the pole pieces of the recording head with a double layer of Scotch Brand cellophane

tape. This will protect the head from scratches or other damage. The cellophane tape also acts as a "buffer" between the head and the demagnetizing field, helping to maintain even distribution of the field, and enables you to withdraw the demagnetizer in such a way as to assure complete demagnetization. Make two or three passes up and down the length of the pole pieces with the demagnetizer, moving it slowly and steadily and gradually raising it upward and away from the head. Be careful to avoid any abrupt motion, or the head will not be completely demagnetized. It is not necessary to demagnetize the erase head of the machine.

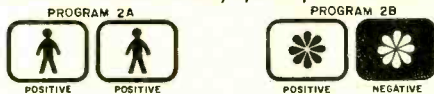
**Smooth Travel.** Correct speed and even tape travel are of primary importance in getting peak performance from your tape recorder. When playing back record-

*(Continued on page 112)*

## "Bi-Tran"—New Approach to "Pay-Television"

### HOW BI-TRAN WORKS

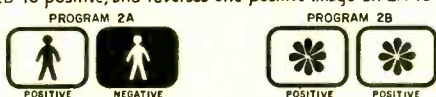
- ① The tv station broadcasts effectively 2 pairs of pictures on same channel:



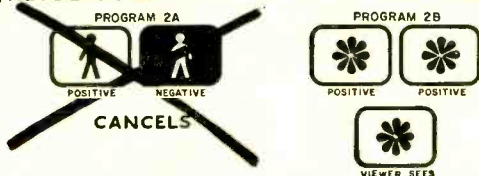
- ② To receive program 2A—receiver is tuned to channel 2, and receives 2A only because negative-positive images of 2B cancel each other out.



- ③ To receive program 2B Bi-Tran decoding signal reverses negative image on 2B to positive, and reverses one positive image on 2A to negative:



- ④ RESULT channel 2A cancels out and viewer sees 2B



A completely different approach to "pay-TV" has been revealed to the FCC by Blonder-Tongue Labs., Newark, N. J. The system would double up the existing TV channels—in effect, create new channels—by sending two programs over each one.

As shown at left, each program would consist of two signals—in one case two positives, allowing the picture to be seen, and in the other a positive and a negative, which would cancel each other. The latter would be the "pay" portion. When a viewer wished to see it, a coding signal, coming in over a telephone line, would switch the "pay" signals to positive, and the "free" signals to positive and negative, allowing the "pay" picture to be seen and canceling the "free" one. At the same time, this information would be transmitted back to the telephone exchange, and the toll added to the telephone bill.

In addition to pay-TV, Blonder-Tongue believes that the system would be useful to the Armed Forces for transmitting secret information, and would serve as an aid to educational telecasting.

## G. E. Honors Nation's 150,000 Hams for Public Service

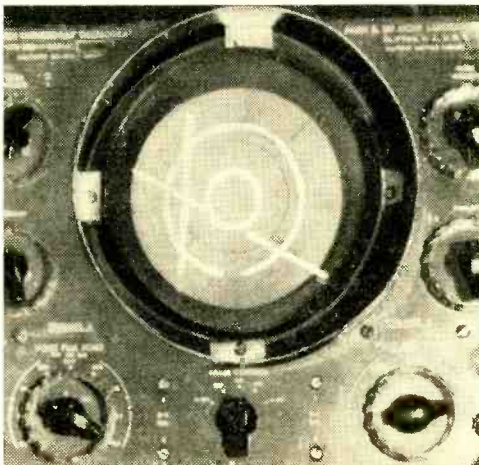
Nominations are again open for General Electric's annual Edison Amateur Award. Anyone may submit nominations on behalf of radio amateurs who have performed outstanding public service during 1957. Top award will be \$500 and a trophy, with runners up getting plaques.

Letters must include the amateur's name, address, call letters, and full description of the public service. They must be postmarked not later than Jan. 3, 1958, and mailed to the Edison Award Committee, General Electric Co., Owensboro, Ky. All of the nation's amateurs are eligible.

## Aircraft "Peeping Tom" Checks on Pilot's Accuracy

The Air Research and Development Command has come up with a telemetry method which allows a ground observer to view the action in an airborne single-seat jet interceptor—to "look over the pilot's shoulder" as it were.

For many years the only accurate method of evaluating a pilot's performance was to have an instructor watch his actions from a second seat in the aircraft. When the picture on the student pilot's radarscope is telemetered—by means of a series of high-frequency radio signals—it will be reproduced on a ground scope (see photo at right). The instructor will thus be able—through voice communication—to instruct the pilot from the ground. This telemetry method will also aid the instructor in measuring the pilot's capabilities.

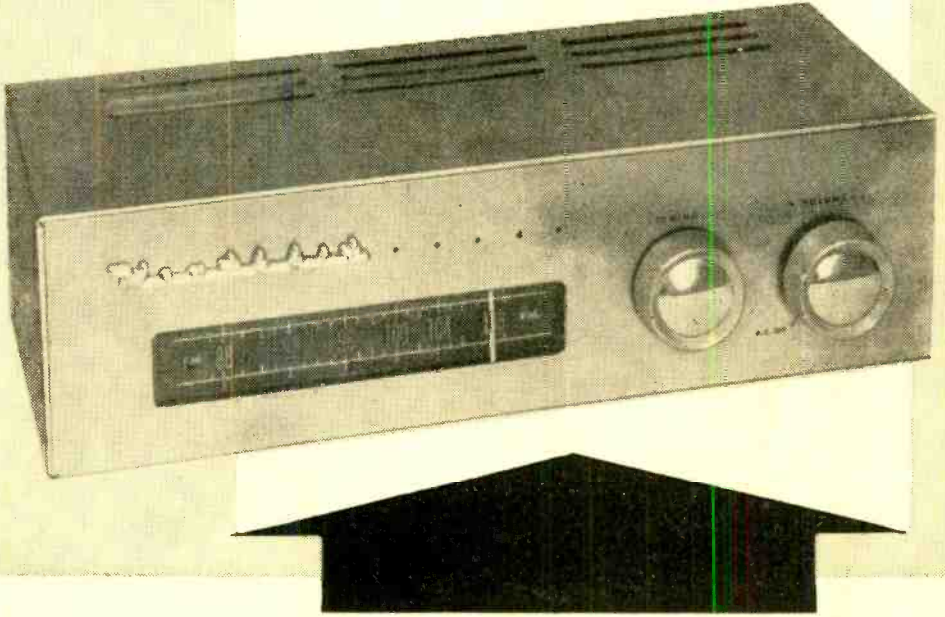


POPULAR ELECTRONICS





## You Can Up-date Your Heathkit FM-3



***Tuners are basically temperamental—but a few simple modifications will serve to keep this one “on the nose”***

**I**F YOU OWN an FM-3 tuner, you can now incorporate in it the design refinements of the FM-3A. A kit of parts for the purpose is available directly from the Heath Company, Benton Harbor, Mich. Designated as the C-FM-3, it contains numerous capacitors, resistors, a new front panel (with dial calibration), an additional pilot lamp and holder, a new dial drive system, and wire and hardware to complete the conversion.

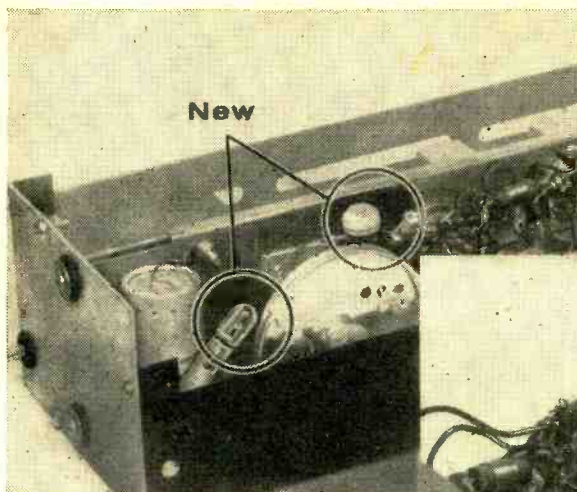
This kit will improve the performance of the FM-3 from several standpoints. The improved mechanical drive results in much easier tuning. Automatic gain control action is made more effective by applying the control voltage to an additional i.f. amplifier stage. The edge-illuminated glass dial enhances the unit's appearance. Parts are provided to stabilize drift, if this has

**By DONALD L. STONER**

been a problem with your FM-3 tuner. And decoupling components will reduce regeneration and noise.

It is advisable to have the original FM-3 construction manual at hand for reference as you work. It will facilitate the conversion.

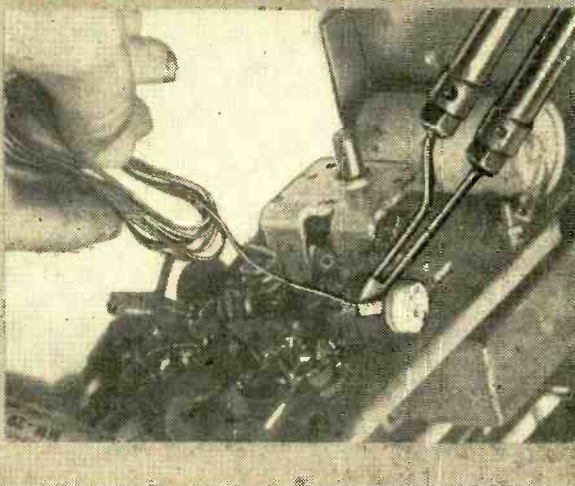
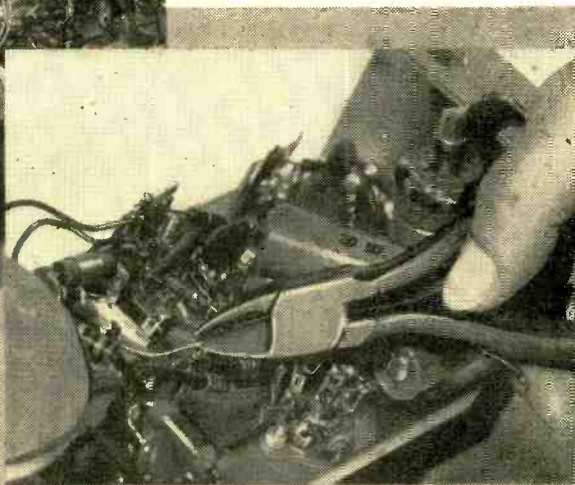
**Reduce Drift and Hum.** A new oscillator trimmer capacitor is supplied as well as a temperature-compensating capacitor to solve your drift problem. If you have no such problem, skip this part of the conversion. Any change in a circuit which is working perfectly may tend to cause trouble rather than make for further improvement. Drift characteristics may be considered normal if warm-up drift time



The modifications are completed with the new parts shown in the photograph at left. But the only change in the external appearance of the unit is the edge-lit dial.

Apply a.c. voltage to one additional stage in the i.f. amplifier simply by clipping and moving one wire. This results in more effective automatic gain control action, especially on strong stations.

It's a tight squeeze and a soldering gun comes in handy. Solder the trimmer capacitor securely to prevent mechanical instability.



is ten minutes or less. The tuner should be perfectly stable after this period of time.

If tunable hum has been a problem for you, it can be minimized by installing an r.f. filter at the output of the power rectifier. This consists of a 0.001- $\mu$ fd., 1000-volt disc ceramic capacitor connected between the rectifier cathode (pin 7) and ground.

The final steps of the conversion consist of reorienting the large pulley, installing the new dial plate (a long black plate that provides a new background for the dial), installing a new dial drive shaft, and re-

stringing the dial with a new cord and a white pointer.

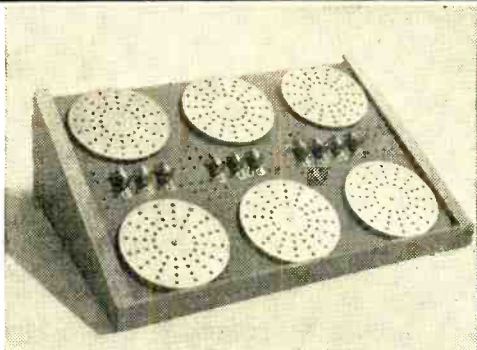
**Check Alignment.** After completing the modifications, check the r.f. alignment. The only adjustment that might be incorrect is the oscillator frequency. With the dial set to the frequency of a known station, adjust the new oscillator trimmer until the station is received properly. The r.f. trimmer can be repeaked for maximum signal strength although it will not be off very far if your receiver was previously aligned.

These simple but worthwhile changes should only take you an hour or two. —50—

POPULAR ELECTRONICS



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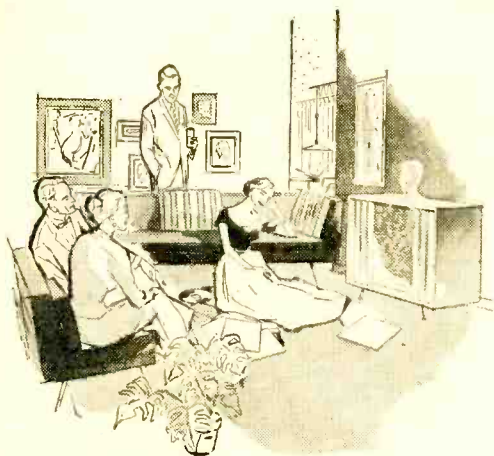
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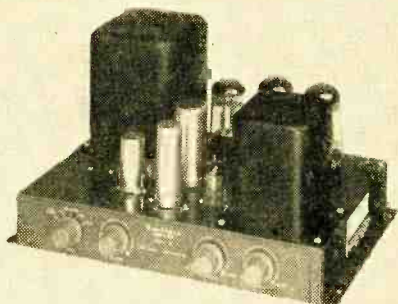


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This amazing speaker system can fulfill your present needs and still provide for future expansion. Fine hi-fi performance the result of using high quality speakers in an enclosure especially designed for them. Features two Jensen speakers to cover 50 to 12,000 CPS within  $\pm 5$  db. Power rating is 25 watts, and impedance is 16 ohms. Enclosure constructed of veneer-surfaced plywood,  $\frac{1}{2}$ " thick, and measures  $11\frac{1}{2}$ " H x  $23\frac{1}{2}$ " W x  $11\frac{1}{4}$ " D. Precut and predrilled for quick assembly.

Shpg. Wt. 30 Lbs.

Model SS-1

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

## HEATHKIT RANGE EXTENDING HIGH FIDELITY SPEAKER SYSTEM KIT

Designed especially for use with SS-1 "Basic" system. Contains 15" woofer and compression-type super tweeter. Extends basic unit to 35—16,000 CPS,  $\pm 5$  db. Impedance 16 ohms. Measures 29" H x 23" W x  $17\frac{1}{2}$ " D, and is constructed of  $\frac{3}{4}$ " veneer-surfaced plywood.

Shpg. Wt. 80 lbs.

Model SS-18

**\$99<sup>95</sup>**

## HEATHKIT A-9C HIGH FIDELITY AMPLIFIER KIT

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

Shpg. Wt. 23 lbs.

Model A-9C

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

## HEATHKIT HIGH FIDELITY FM TUNER KIT

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

Shpg. Wt. 8 lbs.

Model FM-3A

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

(with cabinet!)

## HEATHKIT BROADBAND AM TUNER KIT

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

Shpg. Wt. 8 lbs.

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

(with cabinet!)

## HEATHKIT "MASTER CONTROL" HI-FI PREAMPLIFIER KIT

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

Shpg. Wt. 7 lbs.

Model WA-P2

**\$19<sup>75</sup>**

(with cabinet!)

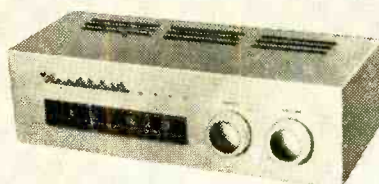
## HEATHKIT 25-WATT HIGH FIDELITY AMPLIFIER KIT

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

Shpg. Wt. 31 lbs.

Model W-5M

**\$59<sup>75</sup>**



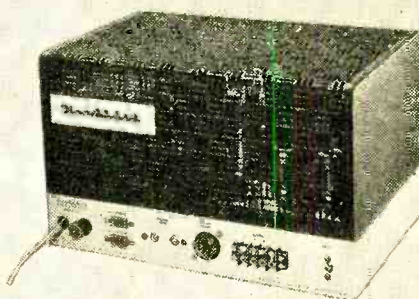
FM TUNER



AM TUNER



PREAMPLIFIER



W-5M 25-WATT AMPLIFIER

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that plays anywhere!



TRANSISTOR  
PORTABLE RADIO

### HEATHKIT TRANSISTOR PORTABLE RADIO KIT

A new concept in radio reception! Now you can forget about external electrical connections and have fine radio performance anywhere! Low-drain circuit using regular flashlight cells makes battery operation cheaper than power-line operation of table model sets. Tunes 550 to 1600 kc and features a 4" x 6" speaker for "big-set" tone, six Texas Instrument transistors for fine sensitivity and selectivity, built-in rod-type antenna, and unbreakable molded plastic cabinet in "Holiday" gray. Measures 9" L x 8" H x 3 3/4" D. Appearance and performance are unmatched at this price level. Easy to build! Shpg. Wt. 4 lbs.

Model XR-1

**\$34<sup>95</sup>**

(with cabinet less batteries)

### HEATHKIT BROADCAST BAND RADIO KIT

Covers 550 to 1600 kc with good sensitivity and selectivity. Has 5 1/2" PM speaker for good tone quality. Features transformer power supply and built-in antenna. Signal generator recommended for alignment. Cabinet, as shown, available separately. Shpg. Wt. 10 lbs.

Model BR-2

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

(less cabinet)

### HEATHKIT CRYSTAL RADIO KIT

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

Model CR-1

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

### HEATHKIT ENLARGER TIMER KIT

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

Model ET-1

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

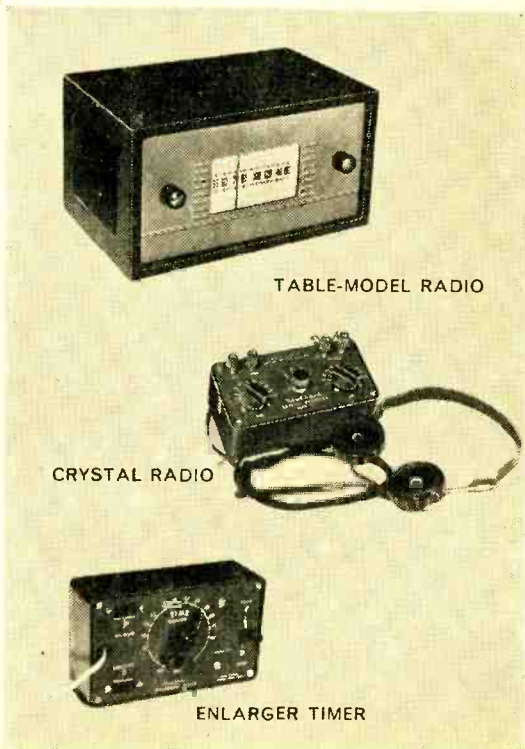


TABLE-MODEL RADIO

CRYSTAL RADIO

ENLARGER TIMER



### HEATHKIT FUEL VAPOR DETECTOR KIT

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

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

**\$35<sup>95</sup>**  
each

### HEATHKIT RF POWER METER KIT

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

Model PM-1

**\$14<sup>95</sup>**

### HEATHKIT TRANSISTOR RADIO DIRECTION-FINDER KIT

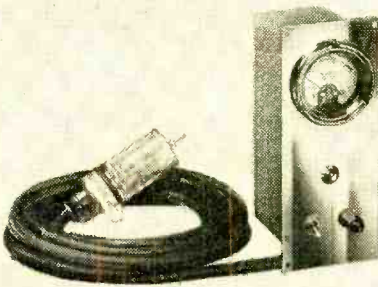
The Heathkit Transistor Radio Direction-Finder model DF-1 is a self-contained, self-powered, 6-transistor super heterodyne broadcast radio receiver incorporating a directional loop antenna, indicating meter, and integral speaker. It is designed to serve primarily as an aid to navigation when out of sight of familiar landmarks. It can be used not only aboard yachts, fishing craft, tugs, and other vessels which navigate either out of sight of land or at night, but also for the hunter, hiker, camper, fisherman, aviator, etc. It is powered by a 9-volt battery. (A spare battery is also included with the kit.) The frequency range covers the broadcast band from 540 to 1600 kc and will double as a portable radio. A directional high-Q ferrite antenna is incorporated which is rotated from the front panel to obtain a fix on a station and a 1 ma meter serves as the null and tuning indicator. The controls consist of: tuning, volume and power (on-off), sensitivity, heading indicator (compass rose) and bearing indicator (antenna index). Overall dimensions are 7½" W x 5¼" H x 5¼" D. Supplied with slip-in-place mounting brackets, which allow easy removal from ship bulkheads or other similar places. Shpg. Wt. 4 lbs.

Model DF-1

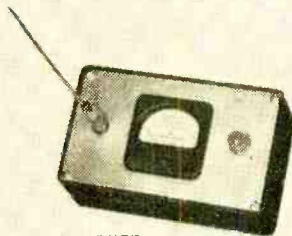
**\$49<sup>95</sup>**

(Available after  
November 15)

## NEW! Heathkits for the boating enthusiast



FUEL VAPOR DETECTOR



POWER METER



RADIO DIRECTION-FINDER

AVAILABLE AFTER  
NOVEMBER 15

**HEATHKIT**



**DX-20 TRANSMITTER**



**RF SIGNAL GENERATOR**



**GRID DIP METER**



**HANDITESTER**

#### HEATHKIT DX-20 CW TRANSMITTER KIT

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

Model DX-20

**\$35<sup>95</sup>**

Shpg. Wt. 18 lbs.

#### HEATHKIT GRID DIP METER KIT

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

Model GD-18

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

Shpg. Wt. 4 lbs.

#### HEATHKIT RF SIGNAL GENERATOR KIT

Produces rf signals from 160 kc to 110 mc on fundamentals on five bands, and covers 110 mc to 220 mc on calibrated harmonics. Output may be pure rf, rf modulated at 400 CPS, or audio at 400 CPS. Prewound coils eliminate the need for calibration after completion.

Model SG-8

**\$19<sup>50</sup>**

Shpg. Wt. 8 lbs.

#### HEATHKIT HANDITESTER KIT

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

Model M-1

**\$14<sup>50</sup>**

Shpg. Wt. 3 lbs.

#### HEATHKIT ETCHED-CIRCUIT VTVM KIT

Sensitivity and reliability are combined in the V-7A. It features 1% precision resistors, large 4½" panel meter, and etched circuit board. AC (RMS) and DC voltage ranges are 0—1.5, 5, 15, 50, 150, 500, and 1500. Peak-to-peak AC ranges are 0—4, 14, 40, 140, 400, 1400 and 4000 volts. X1, X10, X100, X10k, X100k, and X1 megohm.

Model V-7A

Shpg. Wt. 7 lbs.

**\$24<sup>50</sup>**

#### HEATHKIT ALL-BAND RADIO KIT

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

Model AR-3

Shpg. Wt. 12 lbs.

**\$29<sup>95</sup>**

(less cabinet)

#### HEATHKIT "GENERAL PURPOSE" 5" OSCILLOSCOPE KIT

This oscilloscope sells for less than the previous model, yet incorporates features for improved performance. The OM-2 provides wider vertical frequency response, extended sweep generator coverage, and increased stability. Vertical channel is essentially flat to over 1 mc. Sweep generator functions from 20 CPS to over 150 kc. Amplifiers are push-pull, and modern etched circuits are employed in critical parts of the design. A 5BP1 cathode ray tube is used. The scope features external or internal sweep and sync, 1-volt peak-to-peak reference voltage, three-position step attenuated input, and many other "extras."

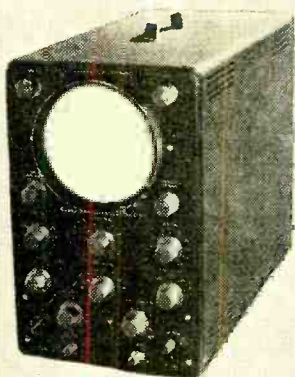
Model OM-2

Shpg. Wt. 21 lbs.

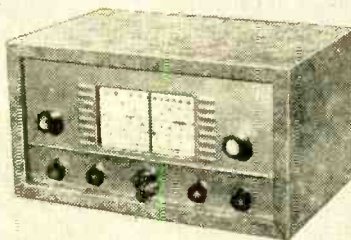
**\$42<sup>50</sup>**

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VACUUM TUBE VOLTMETER



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press agency at time of delivery. On parcel post orders include postage for weight shown. Orders from APO's must include full remittance. NOTE: All prices are subject to change without notice and are F.O.B. Benton Harbor, Mich.

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# TOOLS



and

# GADGETS

## COLOR-TV ACCESSORY

Checking color-TV sets in the past necessitated turning down each color control separately, making the adjustments, then turning up each color for the proper level of hue and saturation. Or the control grid wires on the cathode-ray tube socket had to be disconnected or shorted to the chassis to make the adjustment. Now, with



the PC-120 convergence and purity checker, the socket is simply removed from the color tube and the checker plugged in. By flipping one of three switches, any of the colors may be switched on or off. (*Vidare Electronics Mfg. Corp., Baldwin, N. Y.*)

## "ELECTRIDUCT"

Serious accidents in homes, offices, and workshops caused by tripping on electrical wiring, small hoses, metal tubing, etc., can



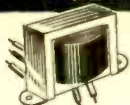
be eliminated by using this new noiseless rubber duct. It is stumble-proof and un-

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Specifically designed for transistor applications. Very small... 1 1/2" x 3/4" x 1/8". Comes with instructions. Worth \$4.00!

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|---|--|
| A Primary 10,000 ohm<br>Secondary 4-8 or 16 ohm | Secondary 4-8 or 16 ohm                        |
| B Primary 60 ohm<br>Secondary 4-8 or 16 ohm     | E Primary 500 ohm<br>Secondary 4-8 or 16 ohm   |
| C Primary 1,000 ohm<br>Secondary 4-8 or 16 ohm  | F Primary 10,000 ohm<br>Secondary 200 ohm      |
| D Primary 4,000 ohm                             | G Primary 2,500 ohm<br>Secondary 4-8 or 16 ohm |

No. 1 Each \$1.19

## HIGH IMPEDANCE CRYSTAL LAPEL MICROPHONE



Measures only 1 1/2" in diameter, weighs less than 1 oz. Perfect for public-address, for recording, etc. Can be used for earphone. Polished chrome case; 5 foot shielded cable. Response: 50 to 5,000 cps. Output level: 50 db.

No. 2 Reg. \$8.95 Each \$1.95

## CHROME-PLATED HAND MICROPHONE



Rod type small and light crystal mike; easily removed from stand for use in the hand. Response: 150 to 8,000 cps. Sensitivity - 55 db. Built-in ON-OFF switch. W/o stand.

No. 3 Reg. \$15.00 Each \$3.69



## CRYSTAL PICKUP

Offers improved quality in any record player. Uses a light-weight turnover type cartridge. Supplied with 1 mil. and 3 mil. osmium type needles. The output is over 1 v., with frequency response from 50 to 12,000 cps.

No. 4 Reg. \$11.25 Each \$2.35

## MAGNIFICENT NEW VISCOUS-DAMPED 12" TRANSCRIPTION TONE ARM



Finest professional transcription tone arm with "floating action". Arm is supported at a single point by a jewel bearing; thus there is almost no friction. Automatic fluid control. Perfect record tracking and cannot damage records by drooping. Accommodates all popular cartridges and permits instant plug-in cartridge change. In gray hammertone finish. Comes complete with arm rest.

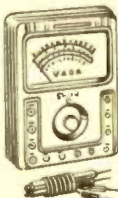
No. 5 Regular \$49.95 Each \$13.95

Cartridge prices below include Tone Arm:  
Fetrenild 225A Diamond Micro Groove \$49.95  
GE 4G-052 \$31.28 GE 4G-061 \$29.48 GE 4G-050 \$20.90 GE 4G-041 \$18.20  
Pickingling Fluid Valve 370-13 \$29.80 370-1D \$41.80  
350-DS \$23.95 350-50 \$25.95  
Goldring 500SS \$21.85 200SD \$35.35

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## POCKET-METER



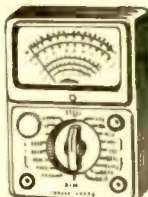
Volts-Ohms-Mills  
Big 3 Inch Meter

Ranges: AC & DC volts: 0-10-50-250-500-2500. DC ma: 0-3-50-500. Ohms: 0-10,000-1 meg. Plus 2 ranges for db. Uses 1% precision resistors. Beautiful grey finish. Size 4 1/2" x 3 1/4" x 1 1/2". Complete with test leads.

No. 6 Reg. \$14.90 Each \$5.95

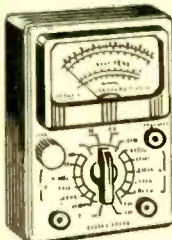
## STUDENT AND AMATEUR MULTI-TESTER

Handsome black cabinet; features rotary switch system with low contact resistance. AC & DC volts: 10-50-250-500-1,000 (2,000 ohm/V). DC current: 500UA, 25MA, 500MA. Resistance: 10,000-100,000-1 meg. DB: minus 20 to plus 22, plus 20 to 36. An extremely accurate instrument. Size 3 1/4" x 5 5/16" x 1-9/16". Complete with test leads.



No. 7 Reg. \$19.95 Each \$7.95

## TECHNICIAN AND SERVICEMAN CIRCUIT TESTER



Features rotary switch with silver contact points. Very sensitive. AC & DC volts: 10-50-250-500-1,000 (20,000 ohm/V). DC current: 50UA, 2.5MA, 25MA, 250MA. Resistance: 5K ohms, 50K ohms, 500K ohms, 5M ohms. DB: minus 20 to plus 5, plus 5 to plus 22. Size: 4 1/2" x 8 1/4" x 2 1/4". Handsome black cabinet. Complete with test leads.



Reg. \$30.70

No. 8 Each \$13.95



## SLIM DYNAMIC MICROPHONE

- IMPEDANCE: 50,000 and 600 ohms
- FREQUENCY RESPONSE: 70 to 12,000 cps

Use it as a hand or stand mike; instantly detachable. Built-in ON-OFF switch. Swivel bracket fits all standard 3/8"-27 thread floor or desk stands. Can be adjusted to any position horizontal to vertical. Polar pattern is omni directional. Case finished in black and satin-chrome. Really ruggedly built. Overall size: 8" x 1 1/4". With 5 foot cable.

No. 9 Reg. \$24.95 Each \$8.95

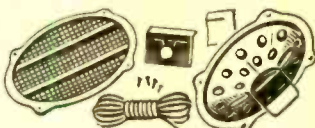
## DOUBLE-CARTRIDGE CRYSTAL MICROPHONE



Fully non-directional for PA, recording or communications. Can be tilted toward speaker for directional effect. Uses two crystal units. Freq. range 40 to 8,000 cps. Sensitivity is minus 54 db. Black painted body with punched basket, plated with chrome. 5 ft. shielded cable.

No. 10 Reg. \$28.70 Each \$6.95

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HUNTINGTON, INDIANA

Expt. Dept. Fidevox International, Chi., Ill.

obstructive. Heavy equipment on casters rolls over it easily.

Electriduct comes in two forms: a complete electrical extension cord, wired for heavy duty, with wall plug and cord on one end and a duplex outlet on the other, available in various lengths; and ducts, outlets, and fittings available separately for special outlet arrangements. (*Ideas, Inc.*, 615 South 2nd, Laramie, Wyo.)

### "WELCOME LIGHT"

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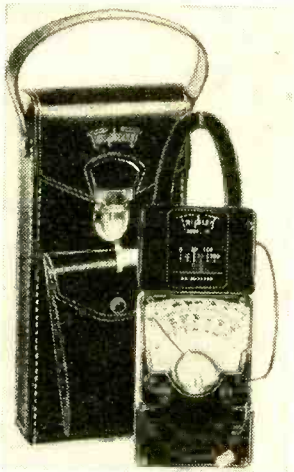
beacon which will guide and welcome guests. It can be hung anywhere. Four multi-color lenses continuously revolve inside a green weatherproof lantern with gold anodized interior. Ten inches high and



six inches in diameter, it comes complete with hanging bracket and ready to operate. Price, \$29.88, prepaid. (*Trippe Mfg. Company*, 133 N. Jefferson, Chicago 6, Ill.)

### CLAMP-ON AMMETER

Designed to plug into any Triplet Model 310 miniature VOM, the Model 10 adapter converts the VOM to an a.c. clamp-on ammeter for measuring ac. amperes without cutting or opening current carrying wires. The split transformer yoke opens to fit around a single conductor or busbar when a lever at the side is pressed, and direct readings of a.c. amperes from 6 to 300 in six



steps can be made. Price is \$14.50 net.

The Model 10 can be used without the Model 310 by means of a No. 311 lead attachment (\$1.90 net). A complete package, known as Model 100, is available which consists of the Model 310 VOM, Model 10



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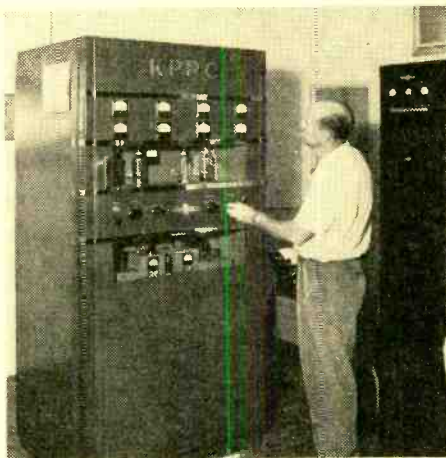
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W. D. Mains, 6332 S. Paramount, Rivera, Calif.	1st	12
Paul Schuett, 1314 20th Ave., Longview, Wn.	1st	10
Robert Todd, 216 West End Ave., Cambridge, Md.	1st	13
Dan Breese, Station KDVE, Lander, Wyo.	1st	12
Joe C. Davis, Station WABO, Waynesboro, Miss.	1st	11
Paul Chuckray, 6874 Weber Rd., Alton Mo.	1st	11
W. Reynolds, 238 1/2 Washington Blvd., Venice, Calif.	1st	12



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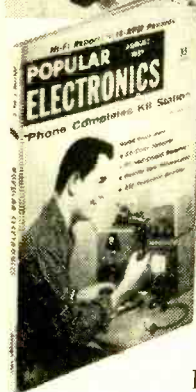
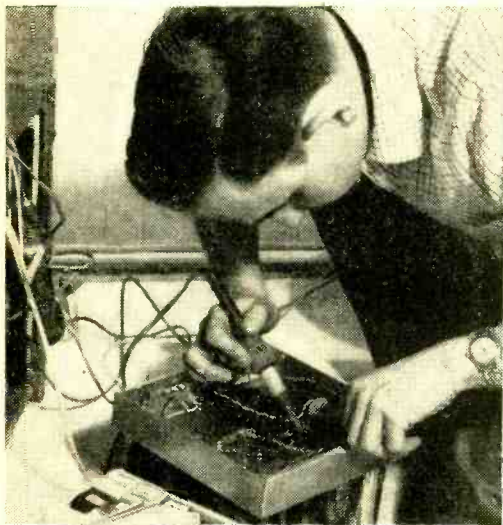
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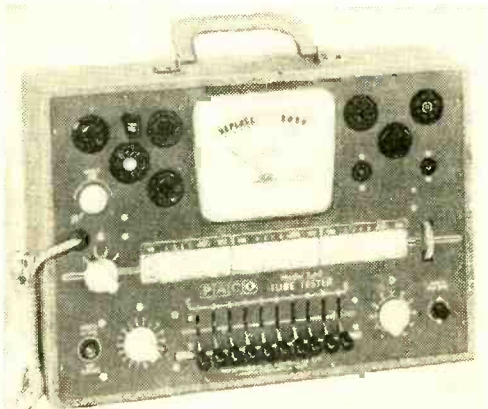
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WITH POPULAR ELECTRONICS**

**POPULAR ELECTRONICS, 64 E. Lake St., Chicago 1, Ill.**

clamp-on adapter, No. 311 leads and a Model 101 line separator. Price, \$61.90, including a handy durable carrying case. (*Triplett Electrical Instrument Co., Bluffton, Ohio.*)

### TUBE CHECKER KIT

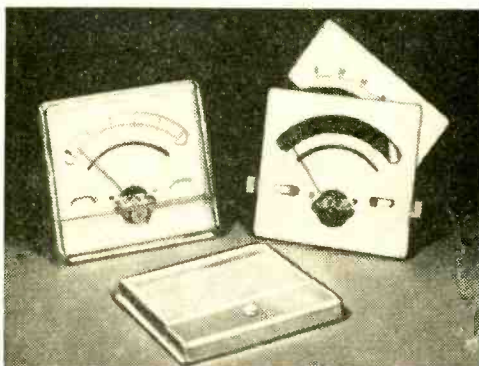
A new tube checker in kit form, the **Paco Model T-60** features a free-point selector system, an extra-large 5" acrylic-cased meter, an illuminated, high-speed,



brass-gearred, 3-column roll chart, ripple-finished steel cabinet, and two-color panel with contrasting knobs. It tests all new AM-FM-TV tubes, including series-string types. Dimensions are 10½" x 15¼" x 4¾". Net price, \$36.75; matching removable cover extra at \$3.95. (*Paco Electronics Company, Inc., 70-31 84th St., Glendale 27, L. I., N. Y.*)

### INTERCHANGEABLE-SCALE METERS

Coverage of more than 100 voltage and current a.c. and d.c. ranges is possible with six custom meters by means of interchangeable scale faces and shunting and multiplier



resistors. The rectangular meters come in a sturdy plastic case in 2½", 3½" and 4½" sizes, and feature d'Arsonval moving coil design, fatigue-tested springs, and stress-released assembled units, within 2% accuracy. Basic meter movements, plus scale

**POPULAR ELECTRONICS**



# 8 reasons why the world's most respected name in communications is **hallicrafters**

## model S-38D \$49.95

Wonderful starting point for the new amateur or short-wave listener. Same meticulous engineering found in all Hallicrafters equipment—at down to earth prices. Coverage: standard broadcast from 540-1650 kc. plus 3 short wave bands from 1650 kc. to 32 Mc.

## model S-53A \$89.95

Has easy-read overseas dial with international stations indicated. Electrical bandspread and logging scale. Complete with 5 in. speaker, head-phone jacks plus phono-jack. Two stages of i.f. Coverage: standard broadcast from 540-1630 kc. plus four SW bands over 2.5—31 and 48—54.5 Mc.

## model S-85, S-86 \$119.95

A superb receiver that pulls them in on 10, 11, 15, 20, 40 and 80 meter amateur bands. Over 1000° calibrated bandspread gives better selectivity on large easy-to-read dial. Features separate tuning condenser and built-in PM 5" speaker. Coverage: Broadcast band 540-1680 kc. plus three S/W bands 1680 kc—34 Mc. S-85 AC, S-86 AC-DC.

## model S-94, S-95 \$59.95

Advanced models that bring in emergency radio, police and fire calls. Newly engineered FM chassis provides low frequency drift and low noise figure. Modern styling with simplified control gives easy operating. Coverage: S-94—30 to 50 Mc.; S-95—152 to 173 Mc.

## model SX-99 \$149.95

The best at its price with all features demanded by DX enthusiast. Has "S" meter, separate bandspread tuning condenser, crystal filter and antenna trimmer. Easy-read dial has over 1000° calibrated bandspread through 10, 11, 15, 20, 40, and 80 meter amateur bands. Coverage: standard broadcast 540-1680 kc. plus three Short-Wave bands 1680 kc-34 Mc.

## model S-102, S-106 \$59.95

The only inexpensive complete receivers for 2 and 6 meter bands. New models with all of Hallicrafters famous engineering. Have 7 tubes with rectifiers, built-in 5" PM speaker, low frequency drift, compact bandspread design, phone jacks. Coverage: S-102—143 to 149 Mc. in 2 meter band; S-106—49 to 55 Mc. in 6 meter band.

## model SX-104, SX-105 \$89.95

Two new high frequency crystal controlled/tunable receivers at low cost. First time available on single band receiver. Ideal for monitoring government marine, fire, police and other emergency frequencies. Coverage: SX-104—30 to 50 Mc.; SX-105—152 to 173 Mc.

**THE NEW ONE  
THAT'S ON THE  
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TODAY!**

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Radio Parts Distributor*

**where the best ideas in communications  
are born!**

Export Sales: International Operations,  
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# the *Most Popular*

**NOVICE TRANSMITTER IN THE COUNTRY!**

From "the World's Largest Distributor of Amateur Radio Eqpt!"

## Globe Chief 90

A completely bandswitching, 90 watt transmitter for 10-160M.



Here's a compact, 8x14x8", sturdy rig with well-filtered, built-in power supply. Pi-network matches most antennas from 52-600 ohms. Modified grid-block keying is employed for maximum safety. Has provisions for VFO input and operation. Kit form includes complete manual and all tubes and parts. Meter and cabinet carefully shielded for reduction of unwanted TVI.

Just  
\$6.75 Down

**\$547**  
per mo.

Net: \$67.50  
Kit: \$54.95

**AND WRL'S TRIED AND TESTED . . .**



## Globe Scout 680

65 watts CW; 50 watts on fone, plate modulated.

Net: \$109.95

Kit: \$89.95

\$11.00 Down

**\$891**  
per mo.

A compact, self-contained, bandswitching transmitter for operation of the 6 through 80 meter bands, with built-in power supply. High level modulation is maintained. TVI-suppressed cabinet. Pi-network output on 10-80M; link-coupled on 6M, matching into low impedance beams. New type, shielded meter. Globe Scout 66 is identical, except band-switching 10-160M. Size: 8x14x8".

### PRINTED CIRCUIT SCREEN MODULATOR

Designed to permit radio-telephone operation with the Chief and similar CW Xmttrs. Seft contained. Kit: \$13.95.

### FREE 1958 CATALOG!

New 200 page catalog with hundreds of illustrations of over 15,000 quality items from the nation's leading manufacturers. Everything for the ham, hi-fi enthusiast, experimenter and serviceman. Send for your copy today!



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**WORLD'S MOST PERSONALIZED RADIO SUPPLY HOUSE**

## World Radio

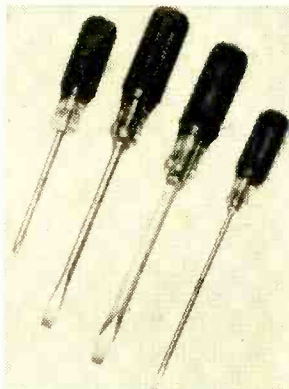
### LABORATORIES

3415 W. BROADWAY, CO. BLUFFS, IA., Phone 2-0277

faces and multiplier and shunting resistors, are available through local electronic parts distributors. (*Precise Development Corp., Oceanside, N. Y.*)

### "CUSHION-GRIP" SCREWDRIVERS

These screwdrivers will never hurt your hand, according to the manufacturer, no matter how hard you grip them. The resilient "Cushion Grip"—made of neoprene rubber permanently bonded to a tough Amberlite handle—is unaffected by water, oil and gasoline, and will not slip. Torque is 50% greater than that of ordinary plastic or wood-handled screwdrivers.



"Cushion-Grip" screwdrivers are available in four styles and in 16 sizes from 3" to 12". List prices range from \$1.00 to \$2.70 each. (*Bridgeport Hardware Manufacturing Corp., Bridgeport, Conn.*)

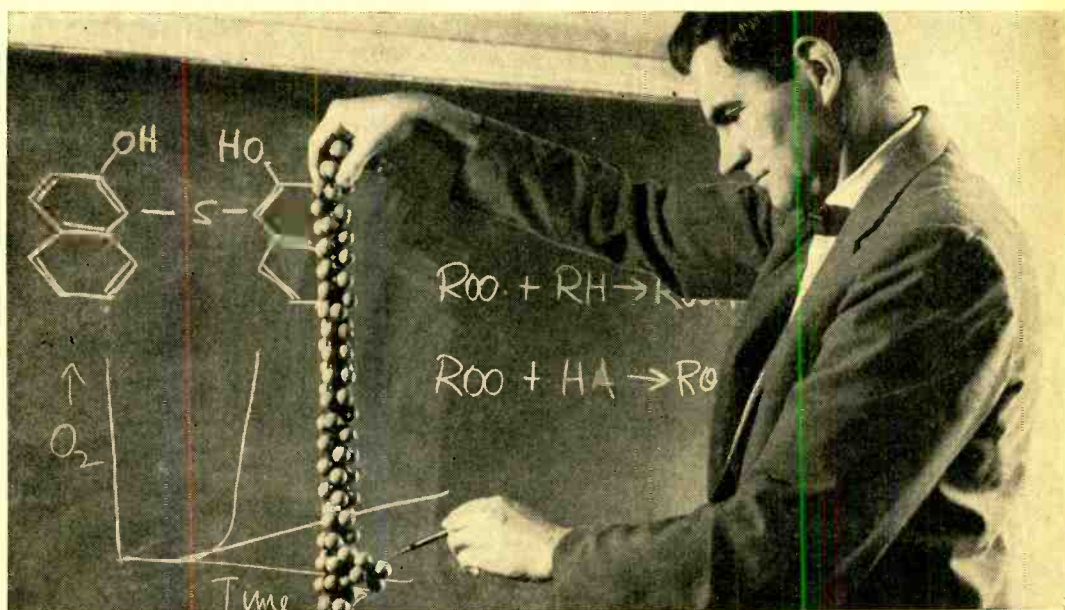
### PLASTIC LAMINATING KIT

With the Photo-Seal plastic laminating kit, you can permanently seal your wallet-size pictures, ID cards, etc., in clear plastic. You just place a photo between two plastic sheets with a polish plate on top and bottom, heat and cool under pressure, then remove and trim. The kit includes a 4" x 5" electric sealing press with a 300-



watt, 115-volt heater, two Nickeloid polish plates, and 50 sheets of plastic. Price, \$14.95. (*Therm Appliance Mfg. Co., Inc., 612 S. First St., St. Charles, Ill.*) -30-





Bell Laboratories chemist Field H. Winslow, Ph.D., Cornell University, with a scale model of a small section of a polyethylene molecule. Branch formation indicated by pencil is vulnerable to oxidation. Dr. Winslow and his associates worked out a simple way to protect long polyethylene molecules needed for durable cable sheathing.

## THE DILEMMA OF GIANT MOLECULES

### Solution: 2 plus 2 equals 5

Polyethylene is used to protect thousands of miles of telephone cables. It is tough, light and long lasting. Its strength lies in its giant molecules—a thousand times bigger, for example, than those of its brittle chemical cousin, paraffin wax.

But polyethylene has a powerful enemy: oxidation, energized by light and heat, shatters its huge molecules to pieces. This enemy had to be conquered if polyethylene was to meet the rigorous demands of cable sheathing. Paradoxically, it was done by making the whole better than the sum of its parts—just as though 2 plus 2 could be made to add up to 5.

To check the ravages of light, Bell Laboratories chemists devised the simple yet highly

effective remedy of adding a tiny dose of carbon black. Then antioxidants, such as those commonly used to protect rubber, were added to check attack by heat. But here the chemists encountered a dilemma: although the carbon black protected against the effects of light, it critically weakened the effectiveness of the antioxidants.

To solve this dilemma, Bell Labs chemists developed entirely new types of antioxidants—compounds not weakened by carbon black but which, intriguingly, are very much more effective when carbon black is present. The new antioxidants, plus carbon black, in partnership, provide long-lasting cable sheath—another example of how research at Bell Telephone Laboratories works to improve telephone service.

BELL TELEPHONE LABORATORIES

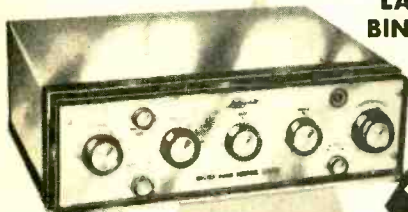


WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

# Lafayette

## Introduces Hi-Fi Gems

### LAFAYETTE MASTER AUDIO CONTROL CENTER with BINAURAL CHANNEL AND DUAL VOLUME CONTROL.



Years Ahead of Every Other Control Unit  
Ahead In Design . . . Ahead In Sound  
Ahead In Features . . . Ahead In Styling.  
• Available In Kit and Wired Form.

**KT-300**  
**39.50**  
IN KIT  
FORM



- Conservatively Rated At 70 Watts
- Metered Balance And Bias Adjust Controls
- Ultra-Stable • Variable Damping
- Available In Kit And Wired Form

**KT-400**  
**69.50**  
IN KIT  
FORM



**LA-22**  
**WIRED**  
**12 WATT**  
**AMPLIFIER.**  
**33.50**  
WITH  
CASE

NEW! MATCHED TUNER AND AMPLIFIER



**LT-25**  
**WIRED**  
**FM-AM TUNER**  
**49.50**  
WITH  
CASE

This is not only the finest hi-fi preamp characterized by unmatched features, but it has been functionally designed to keep pace with the conversion of your present hi-fi system to binaural (Stereophonic) sound. Incorporates an extra channel and dual volume control for binaural reproduction. Features include DC on all tube filaments, negative feedback in every stage, dual cathode follower output stages and latest printed circuit construction. Less than 0.09% IM distortion and less than 0.07 harmonic distortion at 1V. Hum and noise level better than 80 db below 3V. Uniformly flat frequency response over entire audible spectrum. 7 inputs for every type of phono, tuner, or tape. Tasteful styling, brilliantly executed. Size 12 3/4" x 9 1/8" x 3 3/4". Shpg. wt., 10 1/2 lbs.

**KT-300**—Lafayette Master Audio Control Kit Complete with cage and detailed assembly instructions. . . . . Net **39.50**  
**LT-30**—Same as above completely wired and tested with cage and instruction manual. . . . . Net **59.50**

### DELUXE 70 WATT BASIC AMPLIFIER

Here's ultra-stability in a 70 watt basic power amplifier employing highest quality components conservatively rated to insure performance and long life. Features matched pair KT 88's and wire range linear output transformer, variable damping control, meter for bias and balance and gold finished chassis. Frequency response 10-100,000 cps  $\pm$  1db. Hum and noise 90db below full output. IM distortion less than 1 1/2% at 70 watts, less than 0.3% below 30 watts. Harmonic distortion less than 2% at 70 watts from 20 to 20,000 cps  $\pm$  1db. Output impedance 4,8 and 16 ohms. Handsome decorative cage perforated for proper ventilation. Size 14 1/2 x 10 x 7 7/8" including cage and knobs. Shpg. wt., 40 lbs.

**KT-400**—Lafayette 70 watt Deluxe Basic Amplifier Kit complete with cage and detailed assembly instructions. . . . . Net **69.50**  
**LA-70**—Same as above completely wired and tested with cage and instruction manual. . . . . Net **94.50**

### LAFAYETTE 12 WATT AMPLIFIER WITH CASE

Complete 12 Watt Power Amplifier with Built-In Preamplifier-Equalizer Brings Real Hi-Fi at Low Cost

The Lafayette LA-22 amplifier features wide range frequency response and low hum and distortion. Utilizes premium quality EL84 tubes in a pentode connected balanced output circuit. Five inputs provided for every type of phono cartridge, tuner, tape head, TV, crystal phono, etc. Function selector and equalization switch give instant choice of proper equalization for all types of records and tape head. Loudness control approximates Fletcher-Munson characteristics for tonal balance at low listening levels. Bass and treble controls afford wide variation of cut or boost of highs and lows. Frequency response 30-20,000 cps  $\pm$  1 db. Sensitivity, for full output 1/2 V on tuner, crystal or aux., 8 mv for magnetic phono or tape head. I.M. Distortion less than 1 1/2%. Attractively finished to harmonize with both modern and traditional decor, its appearance matches the Lafayette LT-25 tuner. Size 13 3/8" x 6 3/8" x 4 1/2". Shpg. wt., 15 lbs.

**LA-22** Amplifier, Complete With Removable Case. . . . . Net **33.50**

### LAFAYETTE HI-FI FM-AM TUNER WITH CASE

- Armstrong Circuit With Limiter • Foster-Seeley Discriminator
- Temperature Compensation and AFC • Custom Styled

Like its matching amplifier, the Lafayette LT-25 FM-AM tuner is a most unusual value with outstanding specifications and superlative performance. Circuit features temperature compensation for stability and low drift, AFC to "lock-in" the station and AFC defeat for precision tuning of weak stations. Inertia flywheel makes tuning smooth. High selectivity and sensitivity. Meets FCC requirements for radiation. Distortion less than 1% on FM and AM. Frequency Response 20-20,000 cps  $\pm$  1 db on FM; 20-5000 cps  $\pm$  3 db on AM. Hum level 60 db below 100% modulation. Attractively finished to match the LA-22 amplifier. Comes complete with removable cover, with provisions for mounting either in cabinet or on panel. Size 13 1/2" x 8-3/16" x 4 1/2". Shpg. wt., 15 lbs.

**LT-25** FM-AM Tuner, Complete With Case. . . . . Net **49.50**

Lafayette Radio

165-08 Liberty Ave.  
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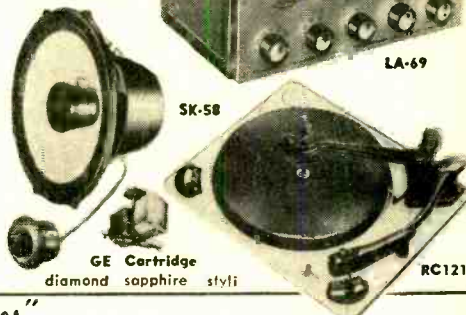
## LAFAYETTE MATCHED HIGH-FIDELITY PHONO SYSTEM

**NOBODY BUT LAFAYETTE** can bring you a phono system of this quality—and at this price. Indeed a Lafayette "best buy" system designed around the new **Lafayette LA-69 20 watt amplifier**. The performance of this phono system surpasses the most critical requirements of music lovers at a price below that of commercial phonographs. Twenty-four combinations of record equalization provide an almost endless variety of tone compensation to match varying recording characteristics. In addition to the LA-69 this system includes the famous **Garrard RC-121 4-speed Record Changer** featuring full automatic and manual positions and Simple-mix operation; the new improved **VRD Variable Reluctance GE Triple Play Turnover Cartridge Model 4G-052** with genuine GE diamond and sapphire styli, and the celebrated **Lafayette SK-58 12" Coaxial Hi-Fi Speaker**. All units are supplied with plugs, jacks and prepared colored interconnecting cables for quick easy installation. For 110-125 volt, 60 cycle AC. Shpg. wt., 50 lbs.

**HF-179—Complete Phono System.....Net 119.50**

Reg. Value 158.55

**SALE!  
119.50**



## Lafayette Introduces Hi-Fi "Music Mates" Style Matched Tuner and Amplifier

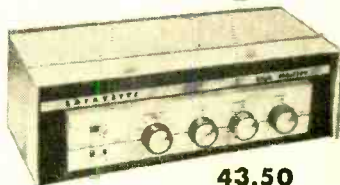
The Lafayette Music-Mates have all of the features required of a fine high-fidelity system. Brilliantly engineered, beautifully styled and moderately priced, the Music-Mates are matched in performance, decor and size. Units are finished in attractive dark maroon and gold. Size 13½" W x 5⅞" D x 4-3/16" H.

### MUSIC-MATE 15 WATT AMPLIFIER

This deluxe amplifier utilizes new premium quality E184 tubes in push-pull. Distortion less than 1%. Frequency response 20-20,000 CPS ± .5db. Has separate bass, treble and volume controls, plus loudness control. 5 input channels with tape and record equalization. Noise minimized by hum adjustment control and rumble filter switch. For use on shelf or custom mounting.

**Lafayette LA-41 Amplifier (Less Cage).....Net 48.50**

**Lafayette LA-40 Amplifier (With Cage).....Net 46.50**



**43.50  
LESS CAGE**

### MUSIC-MATE DELUXE FM-AM TUNER

A sensitive, selective, stable FM-AM tuner. Temperature compensated oscillator and AFC action assure freedom from drift and "locking-in" of a program. Armstrong circuit with Foster-Seeley discriminator employs 6 tubes plus matched pair crystal diodes plus rectifier. Superior hum and distortion specifications assure excellent reception. AFC defeat for tuning in weak stations. Built-in FM and AM antennas. For use on shelf or custom mounting.

**Lafayette LT-41 FM-AM Tuner (Less Cage).....Net 64.50**

**Lafayette LT-40 FM-AM Tuner (With Cage).....Net 67.50**



**64.50  
LESS CAGE**

## TRANSCRIPTION-TYPE MANUAL PLAYER



**PK-160  
with  
TONE ARM  
and TWO  
PLUG-IN  
HEADS**

- MAGNETIC BRAKE FOR FINE ADJUSTMENT OF EACH SPEED
- 4-POLE, HEAVY DUTY TRANSCRIPTION-TYPE MOTOR

- STYLUS WEIGHT ADJUSTMENT SCREW ON TONE ARM
- ACCOMMODATES ALL POPULAR CARTRIDGES

All the important features of professional transcription players have been incorporated in this precision turntable. Extremely smooth and quiet heavy duty 4-pole motor plays 78, 45 and 33⅓ RPM records. Exclusive magnetic brake, controlled by knob on base plate, permits instantaneous fine adjustment of each speed. Stroboscope disc included checks speeds. Speed selector safety switch protects mechanism by making it necessary to pass through OFF position when switching from one speed to another. 10" weighted turntable has rubber traction mat. Mounting plate has pickup rest and ON-OFF switch. Size: 12-15/16" left to right. 10⅞" front to rear. Requires 2⅝" clearance below motor board and 3" above. With AC line cord, 2 plug-in heads, output cable, 45 RPM adapter. For 105-120V., 60 cycles AC. Shpg. wt., 12 lbs. (NOTE: For protection in shipping, tone arm is separate. Just fasten to mounting plate.)

**PK-160—Less cartridge and base.....Net 25.95**

**PK-164—Same as above except equipped with new genuine GE VRII Triple Play Magnetic Cartridge with diamond-sapphire cartridge.....Net 37.50**

**PK-162—Wood base for PK-160. Shpg. wt., 5 lbs.....Net 3.95**

**PK-163—Unfinished mounting board only. Shpg. wt., 1 lb.....Net .95**



**12" VISCIOUS DAMPED TONE ARM  
PK-90—11.95**

## VISCIOUS DAMPED TRANSCRIPTION TONE ARMS

LICENSED UNDER CBS  
U. S. PATENT NO. 2676806



**16" VISCIOUS DAMPED TONE ARM  
PK-170—17.95**

*Lafayette Radio*

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## LAFAYETTE CATALOG

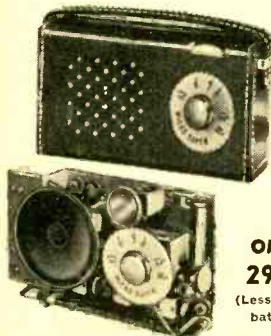


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## LAFAYETTE 6 TRANSISTOR SUPERHET RECEIVER KIT GIVES SUPERB PERFORMANCE . . . INCOMPARABLE VALUE



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29.95

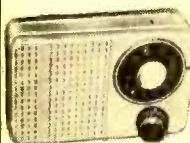
(Less case & battery)

- 100% SUBMINIATURE PARTS—NO COMPROMISES!
- LABORATORY DESIGNED—SENSITIVE, SELECTIVE, STABLE!
- CLASS B PUSH-PULL AMPLIFICATION—PLENTY OF POWER!

Lafayette is proud to present its 6 Transistor Superhet Receiver Kit KT-119. This kit represents the optimum in sensitivity, selectivity and stability. You'll be amazed at its superior commercial quality! You'll be elated with its surprising performance! The circuit uses 3 high frequency RF Transistors, 3 dependable audio Transistors and Crystal Diode and features a specially matched set of 3 I.F.'s, Oscillator, High-Q Loop, Class B Push-Pull Audio Amplification, and Transformer Coupling in audio and output stages. Special care has been taken in the design for exact impedance matching throughout to effect maximum transfer of power. Has efficient 2 1/2" speaker, and earphone jack for private listening. Complete with all parts, transistors, pre-punched chassis, battery and easy-to-follow step-by-step instructions. 6" x 3 1/2" x 1 1/2". Shpg. wt., 3 lbs.

KT-119—Complete Kit—Less Case.....	Net 29.95
MS-339—Sturdy, attractive brown leather case with carrying strap for KT-119.....	Net 2.95
Shpg. wt., 1 lb.....	
MS-279—Sensitive matching earphone.....	Net 2.39

### 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. 4 1/2" x 2 1/2" x 1-1/16". Shpg. wt., 1 lb.

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

### LAFAYETTE SIGNAL GENERATOR

COMPLETELY WIRED AND TESTED!  
ACCURACY AND QUALITY  
GUARANTEED!

22.50

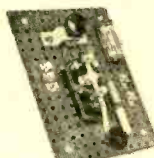
- FREQUENCY 120KC to 260MCI
- 120KC to 120MC ON FUNDAMENTALS!
- 30 DAY TRIAL PERIOD! FULL REFUND IF YOU ARE NOT SATISFIED FOR ANY REASON

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.

LSG-10—Signal Generator.....	22.50
------------------------------	-------

### 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 penicillin 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 ECI—Single Headset.....	Net 1.13

### 20,000 OHM PER VOLT MULTITESTER SEMI KIT

- 20,000 OHMS PER VOLT DC—5,000 OHMS PER VOLT AC
- 40 MICROAMPERE 3" D'ARSONVAL METER MOVEMENT
- HIGH INPUT RESISTANCE ON ALL DC AND AC RANGES



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 3 3/4" x 4 3/4" x 1 1/4". Shpg. wt., 3 lbs.

TK-20—Kit.....	Net 11.95
----------------	-----------

**Lafayette Radio** 165-08 Liberty Ave.  
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NAME \_\_\_\_\_

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CUT OUT  
AND MAIL  
TODAY!

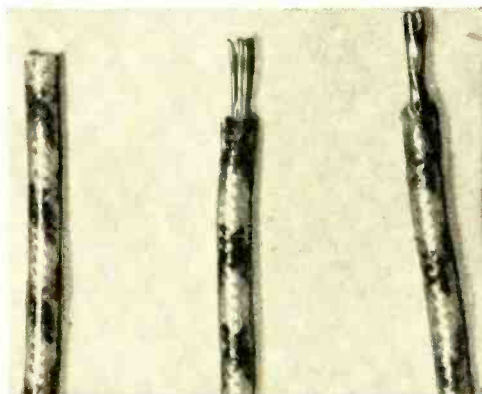




## Tips and Techniques

(Continued from page 38)

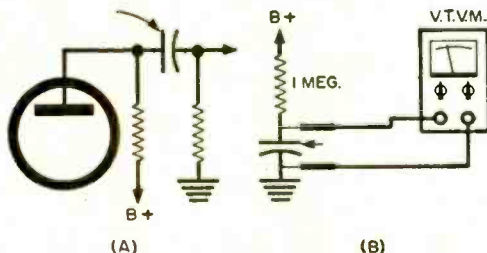
dure. Only three simple steps are necessary prior to installation: (1) pre-cut all



wires to length needed; (2) strip a small amount of insulation (usually  $\frac{1}{4}$ " to  $\frac{1}{2}$ ""); and (3) twist the strands together and "tin" with solder. —E.G.L.

### FINDING FAULTY CAPACITORS

One of the most troublesome and difficult-to-locate defects in a radio or amplifier is the leaky coupling capacitor (A). An ohmmeter test will usually show infinite resistance, meaning that the capacitor is good. Intermittent operation or distortion occurs, however, because the capacitor breaks down during operation and



allows high voltage from the plate to the grid of the following stage.

A sure way to check a capacitor (B) for an intermittent short is to connect it to a power supply through a 1-meg. resistor as shown. If the capacitor is okay, the voltage read by the vacuum-tube voltmeter will be slightly lower than the B+ voltage. An intermittent capacitor will cause the reading to rise and fall, while a good capacitor can be squeezed and leads moved with no meter reading shift. —H.C.B.

### UNTANGLE YOUR LINE CORDS

Is your test bench a rat's nest of tangled line cords attached to various instruments? One solution is to remove the line cord

December, 1957

# Grommes Little Genie

## HI-FI KITS

### NEW!

So simple... it's like magic!  
LAYER-BUILT • COLOR-GUIDE

Each Kit complete with all parts and instructions

### NEW LJ-6K

\$24.95

**LJ-6K 10 Watt Amplifier (Little Jewel).** Highest value in the low priced field, with built-in pre-amplifier and record compensator on phono channel.  
Freq. Response:  $\pm 1\text{dB}$  20 to 20,000 CPS at 1 watt. Distortion: 2% harmonic or less at 10 watts. In Charcoal and Brass. Shpg. Wt. 10 lbs. Complete Kit and instructions.....Net 24.95

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## NEW RECORD CHANGER ACHIEVES HIGH FIDELITY TURNTABLE PERFORMANCE

## GLASER-STEERS

**GS** *Seventy Seven*

**offers fully automatic operation  
and added record and stylus protection**

At last, the quality performance of a turntable has been combined with flawless record handling convenience. The result is—the new Glaser-Steers GS Seventy Seven. Wow and flutter are virtually non-existent. Rumble, for all practical purposes, has been eliminated, and automatic features such as the amazing 'SPEEDMINDER' mark the GS-77 as the most advanced record changer of our time.

'SPEEDMINDER' does your thinking — prevents you from using the wrong stylus with your records; selects the correct turntable speed . . . and intermixes and plays 33 and 45 rpm records automatically, without regard to size or sequence.

Another important GS-77 feature is that the turntable pauses during change cycles and doesn't resume motion until next record has come into play position and stylus is in lead-in groove. This eliminates record surface wear caused by grinding action of record dropping on moving disc — a common drawback in other changers.

Other GS-77 features include — **CHANGE CYCLE** — only 5 seconds — fastest in the field. **MOTOR** — 4-pole induction; dynamically balanced, hum shielded and shock suspended. **ARM** — acoustically isolated; has vernier adjustment for stylus pressure, and convenient finger lift for manual play, as well as indicator to facilitate location of stylus on groove; variation in stylus pressure between first and tenth record is less than 1 gram. **MUTING SWITCH & R/C NETWORK** — maintains silence except when record is being played. **IDLER** — automatically disengages in 'off' position to prevent flat spots. **PRE-WIRED** for easy installation, replaces most other changers.

The new GS-77 is absolutely jamproof. A single knob controls all automatic and manual speed operations. \$59.50 less cartridge and base (base illustrated, \$9.60). See and hear the new GS-77 at your local high fidelity dealer, or write for further information. Dept. PE-12

## GLASER-STEERS CORPORATION

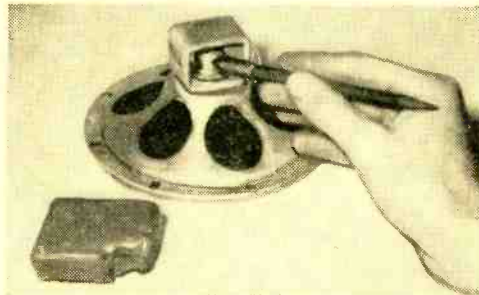
20 Main Street, Belleville 9, New Jersey

In Canada: Glaser-Steers of Canada, Ltd., Trenton, Ontario.  
Export Div.: M. Simons & Son Co., Inc., New York 7, N. Y.

from each instrument and install a recessed male TV cord connector. From then on, when instruments are not in use, the cord can be detached. —W.F.M.

## CLAY "PROBE" REMOVES FILINGS

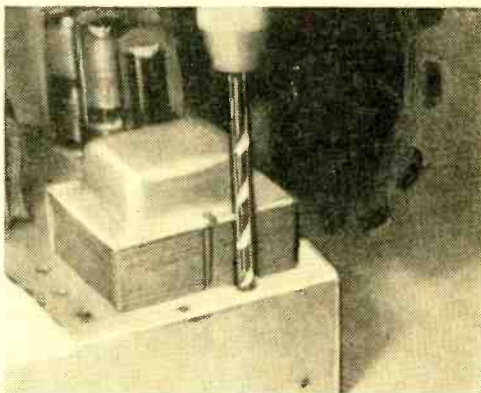
Has the pole piece of that speaker of yours grown metallic whiskers? You can easily shave away those clinging metal filings that are very apt to get in the voice-



coil gap—with a piece of modeling clay on the end of a pencil. This pencil-clay "probe" also comes in handy for picking up small parts dropped in inaccessible places. —J.A.C.

## HOLES PROLONG PART LIFE

The life of power transformers and other heat-handling components used in radio-electronics gear can be prolonged by drilling a series of 1/4" holes in the chassis around the component. This allows air to flow up through the chassis. The bottom



plate, if present, should also be drilled. In some cases the chassis can be raised above its shelf with wooden strips to encourage air flow beneath the bottom plate. The added ventilation will lengthen the life of the component and others nearby.

Be especially careful to clean away all chips that may have fallen between contact points on the underside of the chassis. You can avoid getting metal chips in the tube sockets by covering the sockets with tape.

—J.A.C.



# Just published: 1958 HI-FI ANNUAL & AUDIO HANDBOOK

Latest Hi-Fi developments, circuits, systems — all in one volume!!



- Realistic High Fidelity
- The Effect Of Room Acoustics
- Reverberation And Good Sound Reproduction
- Diaphragm Type Reproducers
- Pros & Cons Of Dual-Cone Units
- Coaxial Units & Other Multi-Channel Systems Using Crossover Networks
- Baffles And Enclosures
- Straight, Folded And Corner Horns
- Output Stage Characteristics
- Selection Of Tubes And Circuits
- The Ceramic Cartridge And Equalization
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- Simplifying Tone Control Units
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- Distortion And Phase Splitter Unbalance
- A Portable Audio Amplifier System
- Measuring Amplifier Damping Factor
- A 3-Channel Amplifier
- The Distributed Port Loudspeaker Enclosure
- Loudspeaker Damping And Tonal Response
- Ionic Cloud Tweeter
- Corona Loudspeaker
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- A Professional Tape Recording Amplifier
- Recording From Tape To Tape With A Single Deck
- A New Approach To Hi-Fi Stereophonics
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- Transistor Mike Preamp
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The 1958 Hi-Fi Annual & Audio Handbook is the most authoritative guide to hi-fi construction, maintenance and equipment . . . circuits and systems, and the latest high fidelity developments . . . compiled by the editors of **Radio & TV News**. The listing of contents above is only part of the tremendous number of articles and discussions in this giant bargain volume. Plus: more than 20 clear-cut, step-by-step plans for hi-fi projects.

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makes his tape recordings on



That alone is not the reason why you should use



Here's why you should use



It's the best-engineered tape in the world...gives you better highs...better lows...better sound all around! Saves your tape recorder, too—because the **irish FERRO-SHEEN** process results in smoother tape...tape that can't sand down your magnetic heads or shed oxide powder into your machine. Price? Same as ordinary tape!



Available wherever quality tape is sold.  
**ORRadio Industries, Inc.**, Opelika, Alabama  
Export: Morhan Exporting Corp., New York, N. Y.  
Canada: Atlas Radio Corp., Ltd., Toronto, Ontario

## Do Your Tapes Sound "Real Pro"?

(Continued from page 87)

ings made on the same machine, correct speed is not particularly important. But when playing back tapes recorded on professional equipment which maintained exact speed, a speed variation in your machine will seriously impair fidelity by noticeably changing the pitch of music and voice. To get full enjoyment from the many fine pre-recorded tapes now on the market, you will naturally want to obtain accurate reproduction.

Here's how you can check the speed of your machine the way the professionals do with a timing tape manufactured especially for this purpose. Such tapes display a printed pattern which repeats itself with complete assurance every 15 inches. At 7½ ips, the pattern will appear once every two seconds; at 3¼ ips, every four seconds. Count out 56 consecutive 15-inch segments of the timing tape. Then, with a red wax crayon, make a mark at a point three segments in from each end. This leaves 50 segments between the two red marks. Thread up the timing tape, setting the first

### WHERE TO GET IT

You can obtain information on the tape recorder accessories mentioned in this article and names of retail suppliers by writing to the following manufacturers:

#### Head Cleaner

Long Life Fluid	Audio Devices, Inc.
EMC Recording Corp.	444 Madison Ave.
806 E. 7th St.	New York, N. Y.
St. Paul 6, Minn.	

#### Tape and Clutch Lubricant

Long Life Fluid
EMC Recording Corp.
806 E. 7th St.
St. Paul 6, Minn.

#### Head Demagnetizers

Ampex Corp.	Audio Devices, Inc.
Redwood City, Calif.	444 Madison Ave.
	New York, N. Y.

Int'l Pacific Recording Corp.  
860 Vine St.  
Los Angeles, Calif.

#### 4"-Hub Tape Reels

EMC Recording Corp.	Samuel Candler
806 E. 7th St.	Enterprises
St. Paul 6, Minn.	1050 Ponce de Leon
	Ave., N.E.
	Atlanta, Ga.

These accessories permit the tape recording amateur to give his equipment the same routine maintenance as is employed in professional sound studios.



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VIDEO • INDIVIDUALLY BOXED—ALL GUARAN-  
TEED FOR ONE YEAR OR YOUR MONEY BACK  
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Standard Brand—Others	with Famous	VIDEO Brand
6U4G	6H6GT	12AT7
	614	12A6
	6J5GT	12AU7
		12AV6
		12AV7
		12AX7GT

Some Standard	Brand—Others	with Famous	VIDEO Brand
5U4G	6H6GT		12AT7
5U8	6I4		12AU6
	6J5GT		12AU7
	6J6		12AV6
			12AV7
			12AX4

[illegible]

5AN8	6CE5	12A6	117Z
5AQ5	6CD6G	12AH7GT	
5AT8	6CF6	12AT6	
5AW4	6CS6		
5AZ4	6CU6GT		
5J6	6ES		
5TA			
5TB			

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10"	\$23.00	19"	\$58.00
12"	\$28.00	20"	\$64.00
14"	\$33.00	21"	\$72.00
16"	\$40.00	24"	\$99.00
17"	\$46.00		

When ordering TV's state whether table model or console is desired. Also preference on make of set. All TV's sent railway express F.O.B. Newark. On any quantity WIRE or CALL today!

**SEND for our  
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TUBE AND  
PARTS LIST  
and order  
blank.**

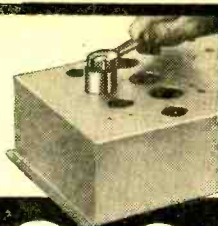
**FREE POSTAGE** in U.S.A. and Territories on orders over \$5.00. 25¢ handling charge on orders under \$5.00. 25% deposit required on C.O.D.'s. Please send approximate postage or freight on Canadian and foreign orders. Subject to prior sale.

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Photo

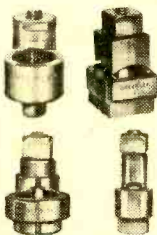
Humboldt 4-2848

## CUT CHASSIS HOLES FAST!



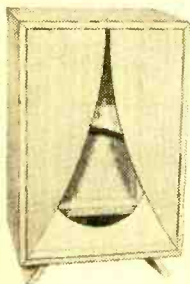
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**GREENLEE**

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No skilled musical instrument maker, including even those in aboriginal tribes, has ever found a rectangular box satisfactory. **IN SPITE OF THIS**, today many HI-FI speaker systems proclaim the ultimate in high fidelity, yet they employ nothing more than the most elementary boxes to perform the complicated function of transforming the vibrations of the loudspeaker into sound.

In the **KARLSEN ENCLOSURES**, specially curved internal and external structures are used to provide you with the highest performance capabilities available in the industry today. Actually the Karlsen Enclosure is one of the most fabulous musical instruments ever created and is capable of reproducing every sound from a baby's breath to the mighty roar of thunder. After long and rigorous tests, we know definitely that the

Karlsen Enclosures can outperform all other units now available on the market at any price.

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Brooklyn 29, N. Y.

Please send catalog.

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Address .....

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

red mark right next to the capstan, and start the machine.

Note the time in seconds that it takes for the second red mark to appear at the capstan. If a machine is running at exactly 7½ ips, it will take 100 seconds; at exactly 3¼ ips, 200 seconds. Don't expect to hit this reading on the nose. If your machine times out at 98 or 102 seconds, it is satisfactory. Most home tape recorders of good quality will be within plus or minus two per cent of the rated speed. If the machine falls within these limits, there's no problem.

A slow machine probably means that the capstan is slipping. Correct by cleaning the capstan with Long Life cleaning fluid. Once the capstan and rubber pressure roller have been thoroughly cleaned, the machine should speed up to its correct rate. The bottom photo on page 86 shows how to clean the capstan and pressure pad.

A machine consistently running at excessively slow or fast speeds should be returned to the manufacturer.

**Tape Treatment.** All of the major brands of tape will give completely satisfactory results on home tape recording equipment. Just the same, recording tape does need some special attention if you are aiming at maximum performance. Here's why that's so.

All magnetic recording tape is manufactured in wide rolls and then slit into ¼ widths, giving it jagged edges. Passing through the machine, these jagged edges cause a build-up of binder and oxide deposit to accumulate on the heads and guides. Like a fine rouge abrasive, these particles gradually wear away the laminated metal of the head. The harmful effects aren't noticeable at once. A single roll of tape will not do any immediate damage, but in time a definite loss of recording quality will result.

Fortunately, it is easy to prevent this type of damage by removing the abrasive particles from the edge of the tape. Saturate a wad of cotton with the same fluid that you used to lubricate the clutch. Squeeze out excess fluid until the cotton is wet but not "drippy." Holding the cotton between your thumb and forefinger, grasp the tape lightly and run its entire length at fast forward or rewind as shown on page 87. When you've finished, take a look at the cotton. You'll be amazed at the amount of oxide and particles that has been removed.

Be sure to rewind the tape after completing this treatment. It is under tension from being wound while under the pressure of your fingers and, if stored in this condition, it will be damaged.

The treatment will also give the tape a



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**See Other Side**



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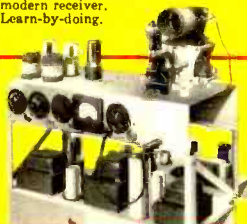


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uniform layer of silicone to reduce friction and promote more intimate contact between head and tape with less noise and tendency to "drop out."

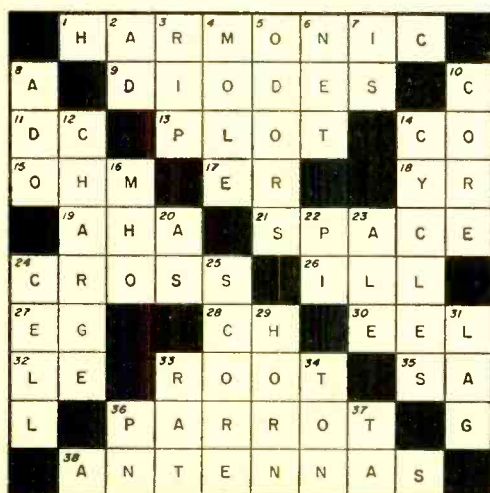
**Tape Thickness and Reel Size.** Two factors often overlooked by the home recordist are tape thickness and reel size. Professional engineers favor tape with the oxide coat on 1-mil backing. Thinner than standard tape (1½-mil backing), it is more compliant and makes closer contact with the head; yet it is not so thin that it will stretch or break, as occasionally happens with the extremely thin ½-mil tapes.

Another problem of recording on either amateur or professional equipment is keeping the ratio between the outside diameter of the reel and the hub diameter at a minimum. If a considerable ratio exists, the difference in tension between a full reel and an almost empty one can cause a speed variation from the beginning to the end of a recording. A special 7-inch reel has been introduced which holds 1200 feet of 1-mil tape and yet has a hub diameter of four inches. With this larger hub, there is little or no danger of distortion on the layers of tape next to the hub, a mishap prevalent with small hubs and the cause of many poor tape recordings. So, before you make your recording, it's a good idea to remove your tape from the original reel and rewind it onto a reel with a 4-inch hub. It is also recommended that you use the same type of reel for take-up.

The maintenance and operational procedures described here require a great deal of time. However, by employing these techniques, you will obtain better, more professional results and derive greater pride and satisfaction from your hobby.

Now, ready—set—roll 'em!

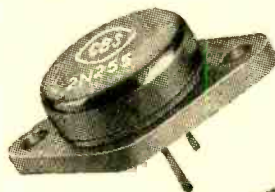
—50—



**Solution** to crossword puzzle appearing on page 56.

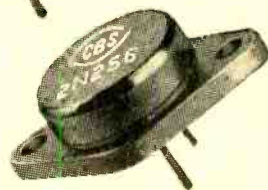
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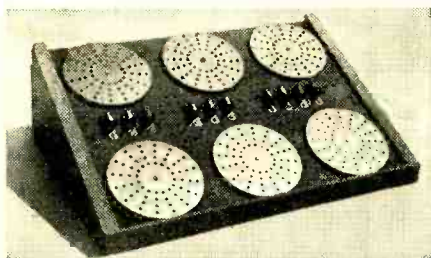
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## After Class

(Continued from page 77)

surrounding inductors, there can be no electromagnetic coupling to cause unwanted regeneration and oscillation.

In general, toroids may be stacked one on top of the other in the same case without interaction for the reason given above. Their most important use at present is in wave-filters (resonant and non-resonant traps and peaking circuits). They may be made very stable and unresponsive to temperature changes and vibration, and may be designed with very high Q's even at frequencies up to 60 kc. or 70 kc.

Look for toroid transformers to replace solenoid types in many of the forthcoming high-fidelity systems still on the design boards.

-30-

## Fluorescent Lamp Interference

(Continued from page 73)

interference, the noise is probably being conducted along the a.c. wiring. Try these steps:

(1) Plug the radio or hi-fi rig into an a.c. outlet on a different circuit, to take advantage of a possible noise-weakening effect of the longer wiring path.

(2) Check for open line filter capacitors in the radio or amplifier. The capacitors eliminate some types of line noise (but not others) and are connected from either or both sides of the line to chassis. If no line filter is present, add one from one side of the line to chassis. To avoid the possibility of a nasty shock, keep the value of the capacitor about 0.02  $\mu$ fd. and use a 600-volt, good-quality component.

**Remedies at the Lamp.** If we decide to attack the problem at the lamp, it may have to be removed from the ceiling. But first, check the starter. Occasionally, even though the starter operates, its r.f. grounding capacitor may be open. If the starter seems okay, then we've got to open up the "patient."

(1) Check the "innards" of the fixture for loose metal parts and components. Make sure that the lamp assembly itself is well grounded through its mounting or suspension system. And tighten the clamps on the cable or pipes entering the fixture. The mechanical hum or buzz which you may sometimes hear when you are close to the lamp should not be confused with the r.f. interference. The hum is internal vibration of the ballast, and aside from tightening the ballast's mounting bolts, the only practical way to eliminate excessive hum is replacement.

(2) Install one of the metal-cased filter

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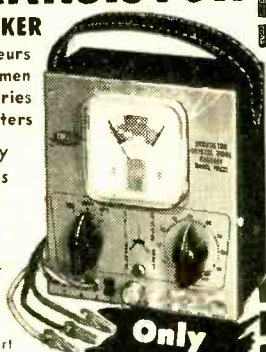
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assemblies designed for mounting in the fixture as shown on page 73 (bottom photo). Such filters are readily available and will often do the job when all else fails. The filter case must be grounded to the fixture frame through the filter mounting flange. And as a last resort for really "rough" cases of radiation—install a copper-mesh screen across the bottom and ends of the lamp reflector. This serves as a shield against bulb radiation and should be grounded to the fixture. The finer the mesh, the better the shielding but, of course, the greater the light loss.

We know that *all* fluorescent lights do not cause interference. However, a survey of three radio-equipped offices in a skyscraper, for example, showed severe lamp interference in all three rooms. While the simple remedy in each of these cases was a shielded lead-in from a short outside antenna, there are instances where a lot more work is required. But, with a supply of filters, a systematic approach and a little elbow grease—the noise problem can be eliminated!

-30-

## Do You Have a Buzz . . .

(Continued from page 66)

capacity jobs employed in such cases can present a shock hazard."

"Does this hold true even if the filter is being used at a convenience outlet?" I asked.

Sam shook his head. "No. All you have to do is connect the filter shield to a good, solid ground."

Jim suddenly let out a whoop. "I heard that!" he exclaimed. "What if a capacitor shorts?"

"That's always a possibility," Sam said. "So how about using a fused filter?"

He plucked an extension cord from beneath the bench, displaying the outlet receptacle. "These fused outlets make the job easy," he said. "They provide fuse protection, a good idea for portable power tools, while the metal box provides a filter shield."

Pointing to the polarized receptacle, he continued: "The outlet provides a sure ground when wired to a 3-wire cord. The third wire is the ground lead. It eliminates shock hazard and serves as a filter ground when portable power tools are plugged into the outlet."

"Hey," I protested. "One thing at a time. All I wanted was a simple little filter for the wife's sewing machine!"

"Sure," came Sam's quick reply, "but you'll find that one filter leads to another before you're finished!"

-30-

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## Transistor Topics

(Continued from page 53)

type" oscillator. Base bias is determined by  $R_1$ .

In operation, the a.c. voltage developed across the "primary" winding by the oscillator is stepped up by the secondary and used to operate a small (15-watt) fluorescent lamp (A) as a soft "night light," or power an "electric fence" (B) to keep livestock from straying.

Construction of the basic circuit is relatively simple and the wiring is completely non-critical.  $R_1$  is a 22-ohm, 2-watt carbon resistor.  $B_1$  can be any standard medium or large-sized 6-volt battery (such as a Burgess F4P1 or 2F4).

The combination oscillator/step-up transformer ( $T_1$ ) is made from a discarded vacuum-tube audio output transformer. The secondary (low-impedance) winding is partially unwound and center-tapped. It is then rewound and becomes the "primary" winding in the oscillator circuit. The original primary winding (high-impedance) then becomes the high-voltage secondary winding, providing the necessary boost.

**Code Practice Oscillators.** Back in April, we reviewed currently available transistorized superhet receiver kits. As a result, we received quite a number of requests that such "reviews" be a regular feature of the column . . . so here goes with a review of transistorized code practice oscillators.

Of the various code practice oscillator (CPO) kits now available, the KT-72, offered by Lafayette Radio (165-08 Liberty Ave., Jamaica 33, N. Y.), is the least expensive. Catalog price is \$2.99 (plus postage), including both batteries and a standard hand key. This kit assembles on a small piece of perforated Masonite. The oscillator is designed for headphone operation only.

Allied Radio Corporation (100 N. Western Ave., Chicago 80, Ill.), offers a nice CPO which assembles into an attractive black plastic box. It operates from a single penlite cell (included). The kit number is 83Y 239 and the catalog price is \$3.95 (plus postage), less hand key and 'phones. This unit is also designed for headphone use only.

WRL Electronics (Council Bluffs, Iowa) offers a CPO with an easy-to-wire etched-circuit wiring board which assembles in a sturdy aluminum case. Two penlite cells (included) power the circuit. WRL's kit sells for \$4.95 (plus postage), and is for headphone operation. The hand key and headphones are available as optional accessories.

Lafayette Radio is the only firm currently

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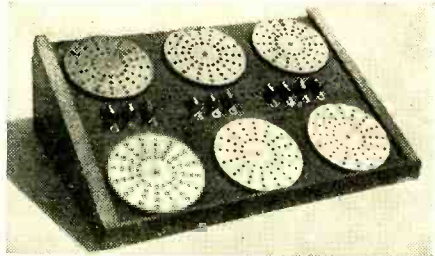
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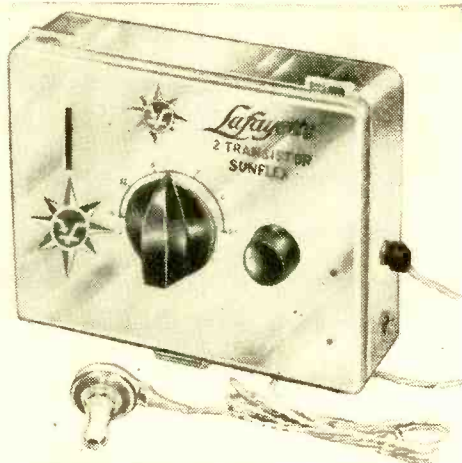
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Lafayette Radio's two-transistor "Sunflex" receiver.

offering a CPO kit which provides *loud-speaker* operation. The KT-118 kit assembles into a small plastic case not much larger than a package of cigarettes but which includes the loudspeaker, transistor, battery, and entire circuit. Catalog price of the KT-118, less hand key, is \$7.95 (plus postage).

**Sun Batteries.** While a "sun battery" is not, strictly speaking, a transistor item, it is often used in conjunction with transistorized equipment and, therefore, is of interest to *Transistor Topics*' readers.

The International Rectifier Corporation (1521 East Grand Ave., El Segundo, Calif.), will shortly release a new *silicon* solar cell with a lower cost per watt than previously available units. For full specifications, price and availability information, write directly to the manufacturer.

Lafayette Radio's latest catalog offers a "Heliodyne" *silicon* battery at \$6.65 (plus postage). A multicell unit, this solar battery will supply up to 2.0 ma. at 3.2 volts in full sunlight. This is ample power for most small one- and two-transistor radio receivers or amplifiers, and is considerably more than that supplied by standard selenium cells of comparable size and cost.

In addition, Lafayette has announced a new two-transistor radio receiver kit, the "Sunflex," designed especially for solar battery operation. It uses a highly efficient reflexed, complementary symmetry circuit which permits two transistors to give the performance of three. Able to operate on standard penlite cells as well as a solar battery, the KT-132 Sunflex receiver kit sells, less earphone and solar battery, for \$11.95 (plus postage).

That's all for now, fellows. See you next year.

Lou

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1B3GT	.66	5A95	.49	68G6G	1.17	6V3	.79	12SA7	.47		
1C5GT	.40	5AT3	.79	68HG	.50	6V6GT	.45	12SG7	.54		
1C6	.25	5J6	.59	68J6	.46	6W4GT	.39	12SJ7	.44		
1C7G	.25	5T8	.79	68K5	.67	6W6GT	.52	12SK7	.47		
1D5GP	.42	5U4G	.48	68K7	.75	6X4	.38	12SL7GT	.59		
1M4G	.45	5U8	.79	68L7GT	.74	6X5	.38	12SN7GT	.56		
1J6GT	.46	5V4G	.57	68N6	.57	6X8	.74	12SQ7	.39		
1L4	.45	5V6GT	.49	68Q7GT	.79	7A4	.46	12V6GT	.44		
1L6	.54	5X8	.79	68T7	.75	7AS	.52	12W6	.59		
1LA4	.55	5Y3	.38	68Y5G	.57	7A6	.44	12X4	.36		
1LA6	.46	5Y4G	.42	68Z7	.75	7A7	.44	14A7	.44		
1LB4	.58	5Z3	.44	6C4	.36	7B7	.44	14B6	.44		
1LC5	.48	6A7	.56	6C8G	.50	7AU7	.69	14Q7	.44		
1LC6	.46	6A8	.46	6C8GQ	1.17	7B4	.43	19T8	.69		
1LD5	.56	6A84	.44	6C8U6	.79	7B5	.40	19B8G6G	1.17		
1LE3	.56	6AC7	.66	6D6	.47	7B6	.41	25BQ6GT	.84		
1LH4	.63	6AF4	.75	6E5	.43	7B7	.42	25CA5	.79		
1LN5	.46	6AG5	.49	6F5	.36	7B8	.40	25CD6	1.29		
1M5GT	.48	6AG7	.68	6F6	.37	7C4	.40	25CUG	.39		
1R5	.50	6AM4GT	.69	6MG	.37	7C5	.41	25L6GT	.46		
1S5	.45	6AH6	.70	6J4	1.59	7C8	.42	25W4GT	.42		
1V2	.70	6AK5	.53	6J5	.58	7E7	.48	26	.36		
1U4	.46	6AL5	.41	6J6	.48	7E5	.44	27	.24		
1U5	.45	6AM8	.79	6K6GT	.38	7E6	.44	35B5	.47		
1X2	.66	6AQ5	.45	6L6	.67	7F7	.58	35C5	.47		
2A3	.49	6A55	.47	6N7	.59	7F8	.65	35W4	.38		
2A7	.54	6A7G	2.25	6Q7	.73	7G7	.74	35Y4	.38		
2D21	.95	6ATG	.38	6S4	.39	7H7	.57	35Z3	.40		
3A4	.50	6AT8	.79	6S8GT	.70	7Q7	.58	35Z5GT	.38		
3A5	.50	6AU4GT	.64	6S47	.47	7X7	.64	39/44	.25		
3AL5	.52	6AUSGT	.60	6S7Y	.75	7A6	.34	50A5	.47		
3AUG	.52	6AUG	.42	6SC7	.47	7Z4	.39	50D5	.47		
3BZ6	.57	6AUS	.79	6SC7	.40	12A4	.59	50C5	.47		
3BC5	.57	6AV5GT	.60	6SH7	.42	12A6	.59	50L6GT	.44		
3BN6	.57	6AV6	.38	6S17	.42	12A85	.59				
6C8G	.57	6AW8	.89	6SK7	.49	12A95	.49	64 624	.45		
3Q4	.56	6AX6GT	.65	6SL7GT	.56	12AT6	.40	117L7GT	1.25		
3Q5GT	.56	6AX5GT	.56	6SN7GT	.56	12AT7	.65	117N7GT	1.25		
354	.46	6BA6	.46	6S07	.40	12AUG	.42	117T7GT	1.25		
3V4	.55	6BC5	.49	6S57	.40	12AUV	.58	117Z3	.36		
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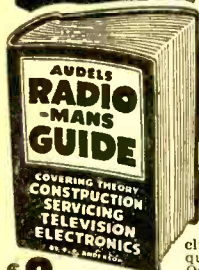
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## Short-Wave Report

(Continued from page 74)

The following is a resume of the current reports. All times shown are EST and the 24-hour system is used. At the time of compilation, all reports were correct. Station frequencies and/or schedules may change with little or no advance notice.

**Argentina**—LRA, Buenos Aires, 9690 kc., carries an Eng. newscast at 2325-2340; s/off at 2343. They verify but it takes a long time to receive an answer. (286)

**Belgian Congo**—OTM, Leopoldville, has moved slightly from 9380 to 9385 kc. and is powerful around 0000-0030 with classical music. (166)

**Belgium**—Brussels continues to be well heard with its *World Fair Radio* program on Sat. at 1815-2000 with news, music, and talks in Eng. on 9745 kc. This is parallel to 15,335, 11,850, and 9705 kc., and relayed by Leopoldville (Belgian Congo) on 9655 kc. (61, 279, and 298)

**Brazil**—PRA8, R. Clube de Pernambuco, Recife, 6015 kc., has been noted at 2115 with classical music. This is the first time it has been reported. (275)

PSH, *Agencia Nacional*, Rio de Janeiro, is being tuned on 10,220 kc. from 1715 s/on to 1800 s/off with music and native language. This is a hard one to log! (10)

**British Guiana**—Here are three reports on ZFY, Georgetown.

The 5981-kc. outlet is being noted at 0455-0517; news in Eng. at 0500 is followed by a religious program. (JM)

The 6035-kc. outlet is tuned with very good signals from 0415 daily (from 0440 Sundays) in English. On some days it may suffer QRM from New Caledonia (*Radio Noumea*) on the same channel. (104)

One of the rarely heard xmtrs is on 9440 kc. It was noted recently from 1815 to 2145 s/off with talks and music, interrupted by news of election returns. (275)

**Burma**—An unidentified station noted on 9543 kc. is believed to be Rangoon. It is heard with "Radio Newsreel" at 1000 followed by a mixture of Eng. language and native music to 1030. Very little is readable and the 11,764-kc. outlet is not even heard. (39)

**Dominican Republic**—Another station reported for the first time is HIIR, *Voz de Fundacion*, San Cristobal, on 6175 kc. It is heard at 1900-2005 in Spanish; the IS is four gongs. (76)

**Ecuador**—An unidentified station tuned at 0000-0100 with L. A. music and Spanish anmts on 5566.5 kc. is believed to be HC4BQ, *Radiodif Feliz voz de Simpatia Manabita*, Manta. QRM, QRN, and aero stations on the channel make reception difficult. (23)

**Egypt**—The Egyptian B/C Service, Cairo, is easily heard at 1830-1900 in Portuguese and at 1900-1930 in Spanish to South America on 9790 kc. (104)

The outlets on 17,915 and 17,778 kc. are noted at 1400-1520 in Eng. and French to Europe with usually strong signals being received. (RB, GC)

**Ethiopia**—Radio Addis Ababa has an Eng.

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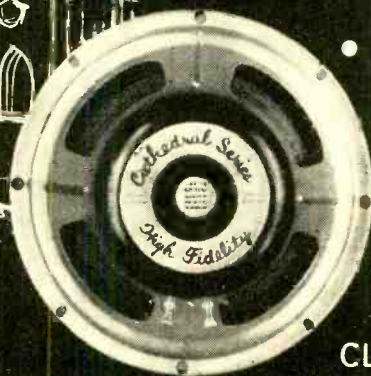
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**Formosa**—The Voice of Free China, Taipei, is heard on 15,235 kc. at 0005-0030 in Eng., followed at 0030 in Cantonese. This broadcast has been noted so far as being on Tuesdays only. (EC)

**BED67**, Taipei, 15,345 kc., is heard with "The Little Dragon" at 0700-0730 in Eng. Pop records continue to 0805 but the broadcast is often jammed. (23, 59)

**France**—Paris is conducting a test pgm to South America at 1755-2100 with L. A. records and frequent anmts in French, Spanish and Portuguese on 9492, 9680, 11,845, and

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The Radio Society of Great Britain has announced a DX Listener's Century Award. This Certificate may be claimed by any person not holding an amateur radio transmitting license who submits evidence that he has received signals from amateur



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15,365 kc. They are asking for reports. (RB, NR, 10, 59, 104, 150)

**French Equatorial Africa**—R. Brazzaville has been found on 11,745 kc. from 1745 to 1755/close with Eng. pgm, anmts and ID in French. QRM was noted from Moscow on 11,740 kc. and Japan on 11,750 kc. When this channel is used, the 5970-kc. outlet is not heard, and vice-versa. (61)

**Germany (East)**—Radio DDR, Berlin, is heard daily on 9730 kc. at 1730-1800 in English. (289)

**Haiti**—Radio Commerce, Port-au-Prince, has changed from 9485 kc. to 9545 kc. for 4VC and is scheduled in Eng. on Sundays at 1700-1730. They also have Eng. on Tuesdays, Thursdays, and Fridays on 4VB, 5980 kc., at 2100-2115. (104, 226, 308)

**India**—Delhi on 15,105 kc. is being heard at

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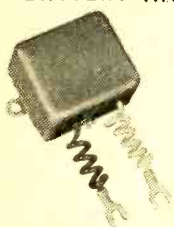
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1450-1645 in Eng. to Australia and New Zealand. This test pgm carries Oriental music and is dual to 11,710 and 17,860 kc. The 11,710-kc. outlet is better at times. (59, 101, 234)

Another Delhi outlet, 15,090 kc., is fair to good at 1445-1545 in Eng. to Europe and England with news, talks, and native Indian music. (61)

**Indonesia**—Those who have not received a verification from YDF6, Djakarta, 9710 kc.,

## SHORT-WAVE ABBREVIATIONS

A—Approximate frequency  
anmt—Announcement  
BBC—British Broadcasting Corporation  
c.w.—Morse code  
Eng.—English  
ID—Identity, identification  
IS—Interval signal  
kc.—Kilocycles  
kw.—Kilowatts  
L.A.—Latin America  
N.A.—North America  
pgm.—Program  
QRM—Station interference  
QRN—Atmospheric interference.  
R—Radio  
s/off—Sign-off  
s/on—Sign-on  
xmsn—Transmission from station  
xmtr—Transmitter used by station

can try a second report after nine months. The reply to that is averaging about two weeks. YDF6 can be tuned at 0600 to Australia and at 0930 to the U. S. A. with news at 0945. (286)

**Iran**—Radio Teheran, 9680 kc., has Eng. at 1500-1530 (news at 1500), dual to 15,100 kc. The 1400 xmsn is in Turkish, Russian, and Arabic. (286)

A late report indicates that the 15,100-kc. xmtr has moved to 17,700 kc. and is being noted at 1330-1530. (CH)

**Italy**—Rome can be heard on 9575 and 6010 kc. at 2125-2145 to N.A. in Eng. with news and music, and on 15,400 and 11,905 kc. at 1915-1935 in Eng. to N.A. and at 1935-1955 in French to Canada. (CH, 61, 298)

**Jamaica**—Voice of Jamaica, Kingston, has been found on 17,493 kc. at 1645-1700. They verified by airmail in eight days. (226)

**Japan**—Radio Japan has changed from 17,825 kc. to 17,855 kc. and is being well heard generally to Eastern N.A. at 1800-1900. The parallel channel, 15,325 kc., is not heard in many areas. (26, 59, 226, 240)

**Jordan**—Hashemite Radio, Ramallah, has Eng. on 6060 kc. at 0630-0700 daily. (WC)

**Kenya**—R. Mombasa, ZHW6, Kisumu, has changed from 4923 kc. to 4965 kc. It was also noted, apparently testing, on 4985 kc. (MW)

**Lebanon**—Beirut has been noted on 8007 kc. from 1610 with instrumentals, and from 1647 with Arabic music. (166)

**Liberia**—According to a verification, ELWA, Monrovia, transmits as follows: to Ghana and French West Africa at 0145-0415 and 1445-1645 daily and at 0215-0545 and 1445-1815 Sundays only on 4835 kc.; to N.A. at 2000-2130 on 9650 and 21,535 kc. European listeners can also try for ELWA on 710 kc. at 0145-0415 and 1315-1645 daily, and at 0215-0545 and 1145-1815 Sundays only. Another



xmsn is reported on 15,200 and 21,535 kc. at 1815-1945. (AF, SF, RM, JW, MW, 176)

**Malaya**—The BBC Far Eastern Station, Singapore, is being heard well on 21,655 kc. from 1100 to 1150/close, relaying programs from BBC, London. It operates dual to 17,890, 15,310, and 9690 kc. The schedule is 0915-1150. (61)

**Monaco**—3AM3, 6035 kc., and 3AM4, 7140 kc., Monte Carlo, are excellent at 0030 s/on but fade by 0330. All programs during this time are in French. These stations are also noted with religious programs in Eng. on Mondays, Wednesdays, and Thursdays at 1705-1735. (104, 289)

**Netherlands**—Hilversum has changed frequency and is now using 6025 kc. rather than the 19-meter outlets. The daily pgm to N.A. begins at 2130, lasts about 40 minutes. (298)

**Netherland New Guinea**—Radio Omroep Nieuw Guinea, Biak (formerly Hollandia) is

#### RADIO CLUBS

There are several radio clubs and organizations to which you may wish to belong. Here is a brief resume of the larger clubs.

**Newark News Radio Club (NNRC)**—The NNRC issues a monthly bulletin covering the broadcast, ham, FM, TV, short-wave broadcast and short-wave commercial bands. A year's membership is \$4.00, and a sample bulletin and application blank may be had by writing to NNRC, 215 Market St., Newark 1, N. J.

**Universal Radio DX Club (URDXC)**—The dues of \$3.00 covers membership and a total of 19 bulletins yearly which cover the short-wave broadcast and ham bands. Complete details are available from URDXC, 21446 Birch St., Hayward, Calif.

**International Shortwave Club (ISWC)**—This club issues a monthly bulletin covering the short-wave broadcast and ham bands. Complete details on membership requirements and dues can be obtained from ISWC, 100, Adams Gardens Estates, London, SE 16, England.

**DX-Club**—As mentioned in the September column, a new club, mainly for ham band DX'ers, has come into being. Dues are \$2.00 (\$3.50 to foreign countries except Canada and Mexico). They have recently issued their first bulletin and it contains 4½ pages of interesting items for ham DX'ers. Complete information is available from Allen Kelly, President, Route 3, Box 354-A, DeRidder, La.

heard daily at 0400-0730 on 7190 kc. in Dutch. (WC, 275)

**Nicaragua**—A station that is off the regular s.w. bands is Radio Atlantico, Bluefields, on 7753 kc. This all-Spanish station is usually heavily QRM'ed by c.w. stations of the various services but the ID is easily read. It is heard from 2200 to 2300 s/off. (286)

**Portugal**—Lisbon is widely reported and can be tuned as follows: on 9636 kc. at 2240-2300 s/off to N.A.; on 17,895 kc. in Portuguese at 1215-1300 with news at 1230; on 21,495 and 17,880 kc. in Eng. at 0815-0915 with news, talks, and classical music; on 15,100 kc. in Portuguese at 2000-2300 and on 11,840 kc. at 2115-2300. (CB, 59, 61, 104, 210)

**Reunion**—St. Denis, 7170 kc., 100 watts, is

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being noted from 2315 with all programs in French. The 40-meter amateur stations provide much QRM. (286)

**Saudi-Arabia**—Jidda is being tuned on 11,850 kc. at 0600-0620. It is also scheduled, but inaudible, at 1200-1300 on 6100 kc. (11)

**Sierra Leone**—*Freetown Calling* has been heard on 3316 kc. at 0145 s/on. Eng. news is presented first; then the broadcast continues in native language. The signature tune is played on a native instrument. They verify by letter. (FW)

**South Vietnam**—*Radio Saigon*, 7290 kc., is heard well at 0830-0900 with native music and Vietnamese and French language. This

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Tom Buckley (TB), Snyder, N. Y.

Esther Cottingham (EC), Redwood City, Calif.

Glenn Cuthrell (GC), Maxton, N. C.

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George Alfman (GA), Norwich, Ohio

Robert Miller (RM), Philadelphia, Pa.

John Buttolph (JB), Skaneateles, N. Y.

is a daily xmsn in the Home and Overseas Service. (61)

**Spain**—*Radio Nacional Emissora (RNE)*, Madrid, has been found on 9590 kc. from 2225 with Spanish music. (59)

RNE has also been noted on the very low frequency of 2510A kc. from 2340 with the regular N.A. Service. Has anyone else heard it here? (275)

**Radio Alerta**, Valencia, 6950A kc., is noted at 1500-1600. Do not confuse this with the regular RNE stations. (11)

**Spanish Guinea**—Bata, Rio Muni, 7698 kc., was noted from 1650 with vocals in Spanish. It appears to be under-modulating. (166)

**Sweden**—Stockholm has moved from 15,240 kc. to 11,705 kc. to the Middle East, and from 17,840 kc. to 11,880 kc. to the Far East. (10)

**Switzerland**—Frequency and schedule changes of *Radio Switzerland*, Berne, are as follows: to the United Kingdom and Ireland at 1345-1530 on 9656 and 7210 kc.; to South-



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east Asia and Japan at 0745-0930 on 15,305 and 21,605 kc.; to India and Pakistan at 0945-1130 on 11,865 and 21,605 kc.; to Portugal at 1545-1600 on 11,865 and 9665 kc.; to Spain at 1600-1730 on 11,865 and 9665 kc.; and to Africa at 0015-0200 on 21,520 kc. in German, French, and Italian. (61)

**Uruguay**—CXA71, Montevideo, is testing on 9515 kc. Tuesdays and Fridays at 1930-2130 with Eng. anmts and N.A. & L.A. pop music. This is apparently the forerunner of regular broadcasts to come later. Reports go to *Radio Sarandi*, Montevideo. (TB, DF, 59, 149, 240)

**Vatican City**—The Vatican Radio can be tuned in Eng. at 1000-1015 and 1315-1345 daily on 7280, 9645, 11,685, and 15,120 kc. and at 1100-1130 Tuesdays only on 11,685 and 21,515 kc. (ST)

—30—

## Among the Novice Hams

(Continued from page 83)

power is delivered to the load constantly.

Thus, a direct current of a given voltage will do more work per unit of time than an alternating current of the same peak voltage—exactly 1.41 times as much. But don't jump to the conclusion that the power company is making a 30% profit by selling a.c. instead of d.c.

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Standard a.c. meters are calibrated to measure the effective values of alternating currents and voltages, rather than their peak values. Cathode-ray oscilloscopes show the peak values as well as the actual shape of the a.c. wave. Peak-reading vacuum-tube voltmeters also indicate the peak values.

**Advantages of Each.** The big advantage of alternating current over direct current for utility power is the ease with which it can be sent long distances from the generating plant to the consumer. It can be generated and distributed to strategically located substations at very high voltages—approaching a million volts in some installations. This means that every ampere of current represents thousands of kilowatts of power. As it is the amount of current to be carried that determines the size of wire that must be used in a transmission line, this high-voltage distribution permits carrying a maximum amount of power on a given size of conductor.

\* Also called the root-mean-square (r.m.s.) value after the mathematical method of computing the effective value.



At substations, the extremely high voltages are stepped down in huge transformers to a few thousand volts and transmitted to neighborhood "pole" transformers, where they are reduced to a safer 117 or 235 volts before the power is delivered to the individual customers. Such voltage division is possible because passing a.c. through a heavy-duty type transformer very slightly affects the amount of power available. It simply changes the ratio between the current and the voltage. Thus, when the voltage is stepped down, the current available is increased, and vice versa.

In contrast to a.c., once d.c. is generated at a given voltage, it is impossible to change that voltage with something as simple as a transformer. You can reduce both d.c. and a.c. by passing the current through a resistance, but this just wastes the unused power. To raise or lower d.c., you can use the current to drive another motor-generator (or dynamotor) to generate the desired new voltage. You can also convert it to a.c.—step it up or down to the desired value—and then convert it back to d.c.

Both systems are used to power mobile radio equipment from an automobile storage battery. In vibrator-type power supplies, for example, the vibrator, which is

actually a vibrating switch, reverses the connections between the battery and the primary winding of the power transformer 100 to 200 times a second, thereby converting the d.c. from the battery to a.c. in the transformer, although not the sine wave a.c. shown in Fig. 1. This a.c. is then stepped up to the desired voltage in the transformer and reconverted to d.c. to power the radio.

The higher power requirements of mobile transmitters are often taken care of by dynamotors driven by the battery and delivering 400 to 1000 volts, d.c.

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to do the job.) Also, tremendous amounts of power are required to span even moderate distances at such low frequencies, while low-power high-frequency transmitters are capable of sending a signal around the world under favorable conditions.

**Frequency and Wavelength.** Electrical waves travel through space with the speed of light—186,000 miles or 300,000,000 meters per second. Consequently, the distance that a radio wave will travel in the time it takes for it to go through a complete cycle is equal to the distance traveled divided by the number of cycles, or: wavelength in meters = 300,000,000/frequency in cycles. As radio frequencies are usually given in kilocycles (thousands of cycles) or megacycles (millions of cycles), the formula is often written: wavelength<sub>meters</sub> = 300,000/freq.<sub>kc</sub> or wavelength<sub>meters</sub> = 300/freq.<sub>mc</sub>. Conversely, freq.<sub>cycles</sub> = 300,000,000/wavelength<sub>meters</sub>.

Substituting a few figures in the formulas reveals that a 3750-kc. signal has a wavelength of 80 meters, a 7000-kc. signal have a wavelength of 42.86 meters, and a 15-meter wave has a frequency of 20,000 kc.

This relationship between the frequency and the wavelength of a radio signal is of great practical importance in designing

transmitting antennas, which must be of a certain length\* for best results for a given frequency. Also, it is important that anyone planning to take an amateur examination be able to determine frequency when wavelength is given, and vice versa, because all classes of amateur examinations contain questions requiring knowledge of this kind.

## News and Views

**Dickie, KN4RJM**, has made 11 contacts in eight states in his first six days on the air on the 40-meter Novice band. He is surprised at his good luck, because his antenna is only a 65' piece of wire 13' high with one end connected directly to his Heathkit DX-20 transmitter. Dickie plans to put up a new doublet, 22' high . . . **Gary, WN6NLF**, has kept his DX-20 transmitter and Hallicrafters S-38D receiver hot in his first month on the air. His record is 49 contacts in six states. He transmits on a folded dipole antenna and receives on a 10' vertical antenna. All work has been on the 40-meter Novice band . . . **Paul, KN1CZU**, operates on the 80- and 40-meter Novice bands with a DX-20 transmitter and an old Hallicrafters Sky Champion receiver. He would like to know just how old the receiver is. In two weeks on the air,

\* Usually an integral multiple of an electrical half-wavelength.

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Paul has worked seven states, five confirmed.

**Bill, KN2UNQ/K2UNQ**, ran out of time on his Novice license but has now received his Technician license and is about ready to try again for his General. His Novice record was 45 states worked, 34 confirmed, and five foreign countries. His transmitter is a WRL Globe Chief-90, running 75 watts, feeding off-center-fed antenna, and his receiver is an S-38D . . . **Tom, WN3LHE**, runs his "Sandwich Box" transmitter described in the March, 1956, issue of POPULAR ELECTRONICS from the accessory socket on the back of his Heathkit AR-3 receiver. Running about three watts of power into a 40-meter dipole antenna on 7152 kc., this combination has worked 13 states in one week of operation. His best report was RST599 from Florida. . . . **Al, KN9IDZ**, likes to operate around 4:30 a.m.! It must be a good hour, because he has worked 22 states in less than a month of operating time. He transmits on a Heathkit DX-35 running 65 watts and feeding a 40-meter dipole antenna, and he receives on an S-38D.

**John, KNØJLR**, operates on 80 meters only with his DX-35. But he has made over 300 contacts in 27 states, Canada, and Costa Rica in four months on the air. Receiving is taken care of by a National NC-100A and a Heathkit AR-3 with a QF-1 Q-Multiplier. John offers to schedule anyone needing an Iowa contact, with a QSL card guaranteed, and will help anyone obtain his Novice license.

. . . **Don, K5BJN**, has had his Conditional license for two-and-one-half months. Adding his Novice score to his new stuff worked makes him WAS (Worked All States), most of Canada, Philippines (DU7), Japan (KA2), Costa Rica (TI2), Hawaii (KH6), New Zealand (ZL) and others for 45 DX contacts. He uses a Johnson Viking II transmitter, a 136' Windom antenna, and a National NC-57 receiver. Don operates mostly on 40 and 20 meters now, but he does get on 80 and 15 at times. He will schedule anyone needing an Arkansas contact. . . . **John, KN4MOL**, a Novice since February, is waiting for his General Class license to come through. He has made over 200 contacts in 26 states, all confirmed, as well as England, Scotland, and Puerto Rico, although he has not received QSL's (confirmations) of these foreign contacts. KN4MOL uses a DX-35 transmitter, a Na-



**Jim, KN1DCK**, Fort Devens, Mass., with his Hallcrafters S85 receiver and Heath DX-35 transmitter.

December, 1957

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tional NC-98 receiver, and a 120' end-fed antenna.

Bob, KN4PEM, made only five contacts in his first two months on the air. His antenna was a 40-meter doublet fed with microphone cable in place of coaxial cable. Then, with the aid of Larry, K4LTM, he replaced the cable with RG-59/U coaxial cable. In the first week after the change, he made over 30 contacts in 15 states. His best DX is California. Bob uses an AR-3 receiver and a WRL Globe Chief transmitter. He also offers to help others become hams. . . . Richard, WN6LZZ, uses a Johnson Adventurer transmitter and a Hallicrafters S-20R receiver with a preselector (external r.f. amplifier)

## New Style Call Letters

The Federal Communications Commission is running out of amateur call letters! By the end of 1957, it expects to exhaust its present supply of call letters with the single-letter W and K prefixes in the second and sixth call areas. A final decision as to what to do about this situation has not yet been made; however, according to Miss Mary Jane Morris, Secretary of the FCC, new amateur stations and stations moving into the critical areas will probably be assigned a two-letter prefix from the group WA-WZ. So don't be surprised if you soon hear WA2's and WA6's.

As of June 30, 1957, there were 160,000 amateur stations and 155,850 amateur operators authorized in the United States and its possessions. These figures do not include Novices. In the year ending June 30, the number of amateur licenses issued as a result of examinations for new or higher class licenses were: Extra—180; General—7100; Conditional—4000; Technician—6200; Novice—17,500.

added to it. In about six weeks on the air, he has worked 21 states—17 confirmed—Puerto Rico (KP4) and Hawaii (KP6). . . . Bob, KN4RIV, runs 70 watts to a Globe Chief transmitter feeding a 40-meter doublet about 31' high. He receives with an S-38D receiver. In his first week, Bob worked five states.

Contributors to News and Views: Dickie Loftin, KN4RJM (15), 404 Dakota St., Piedmont, Ala.; Gary Andersen, WN6NLF (15), 936 Anza Drive, Pedro Valley, Calif.; Paul Messenger, KN1CZU, Pleasant St., Groton, Mass.; Bill Dryden, KN2UNQ (15), 2231 Brewerton Rd., Syracuse, N. Y.; Tom Wright, WN3LHE, 7415 Tilden St., Landover Hills, Md.; Albert R. Karel, KN9IDZ, 127 Eastern Ave., Clarendon Hills, Ill.; John Stewart, KN0JLR, 890 17th Ave., Marion, Iowa; Don, K5BJN, Basin Park Hotel, Eureka Springs, Ark.; John Paul Francis, KN4MOL, RM3 USN, 2508 Ellsmere Ave., Norfolk, Va.; Robert W. Smith, KN4PEM (15), 1605 Atlanta Ave., Portsmouth, Va.; Richard McDonnell, WN6LZZ, 7436 Amestoy, Van Nuys, Calif.; Bob Webb, KN4RIV, 1104 East Dakota St., Pensacola, Fla. Have a Merry Christmas. 73,

Herb, W9EGQ

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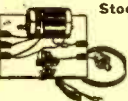
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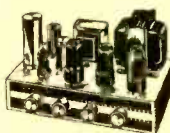
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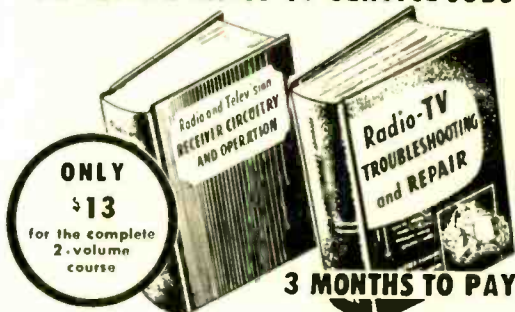
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If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.



# TRY FOR 10 DAYS

**before** you buy! **then** if satisfactory pay in easy, interest free, monthly payments. See coupon below.

Superior's New

Model 70

## UTILITY TESTER®



Model 70

Terms: \$3.85 after 10 day trial then \$4.00 per month for 3 months.

### AS AN ELECTRICAL TROUBLE SHOOTER

- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakage, etc. • Will measure current consumption while the appliance under test is in operation • Incorporates a sensitive direct-reading resistance range which will measure all resistances commonly used in electrical appliances, motors, etc. • Leakage detecting circuit will indicate continuity from zero ohms to 5 megohms (5,000,000 ohms) • Will test Toasters, Irons, Broilers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorescents, Fans, Switches, Thermostats, etc. • Will test all TV tubes for open filaments, inter-element shorts, burned out tubes, etc. (Will not test TV tubes for quality. An emission type tester such as the Model TD-55, TW-11 or TV-12 is required to test tubes for quality)

### AS AN AUTOMOTIVE TESTER

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

Model 70 comes complete with 61 page book written in plain easy-to-understand language. Explains laws of electricity, how to proceed with repairs of appliances and automobile circuits, how to test TV tubes, etc. Only.

**\$15<sup>85</sup> Net**

Superior's New

Model 670-A

## SUPER-METER

A Combination VOLT-OHM MILLIAMMETER PLUS Capacity, Reactance, Inductance and Decibel Measurements

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 • D.C. CURRENT: 0 to 1.5/15 150 Ma. 0 to 1.5/15 Amperes • RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms • CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad-scale for

checking quality of electrolytic condensers.) • REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms • INDUCTANCE: .15 to 7 Henries, 7 to 7,000 Henries • DECIBELS: -6 to +18, +14 to +38, +34 to +58. **\$28<sup>40</sup> Net** Complete with test leads



Model 670-A

Terms: \$7.40 after 10 day trial then \$3.50 per month for 6 months.

Superior's New

Model TV-40

## PICTURE TUBE TESTER

**NOT A GADGET—NOT A MAKE-SHIFT ADAPTER, BUT A WIRED PICTURE TUBE TESTER WITH A METER FOR MEASURING DEGREE OF EMISSION—AT ONLY \$15.85**

Tests ALL magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!

- Tests all magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Test for open elements.

EASY TO USE: Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube case (Ion trap need not be on tube). Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

Only **\$15<sup>85</sup> Net**



Model TV-40

Terms: \$3.85 after 10 day trial then \$4.00 per month for 3 months.

We invite you to try before you buy any of the models described on this page, the preceding page and the following pages. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

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**SEE OTHER SIDE**

CUT OUT AND MAIL TODAY! ▶

MOSS ELECTRONIC DISTRIBUTING CO., INC.  
Dept. D-402, 3849 Tenth Ave., 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 payment when due, the full unpaid balance shall become immediately due and payable.

- |   |  |
|---|--|
| <input type="checkbox"/> Model TW-11 . . . Total Price \$47.50<br>\$11.50 within 10 days. Balance \$6.00<br>monthly for 6 months. | <input type="checkbox"/> Model TV-40 . . . Total Price \$15.85<br>\$3.85 within 10 days. Balance \$4.00<br>monthly for 3 months.   |
| <input type="checkbox"/> Model 76 . . . Total Price \$26.95<br>\$6.95 within 10 days. Balance \$5.00<br>monthly for 4 months.     | <input type="checkbox"/> Model 670-A . . . Total Price \$28.40<br>\$7.40 within 10 days. Balance \$3.50<br>monthly for 6 months.   |
| <input type="checkbox"/> Model TD-55 . . . Total Price \$26.95<br>\$6.95 within 10 days. Balance \$5.00<br>monthly for 4 months.  | <input type="checkbox"/> Model 70 . . . Total Price \$15.85<br>\$3.85 within 10 days. Balance \$4.00<br>monthly for 3 months.      |
| <input type="checkbox"/> Model TV-50 . . . Total Price \$47.50<br>\$11.50 within 10 days. Balance \$6.00<br>monthly for 6 months. | <input type="checkbox"/> Model TV-12 . . . Total Price \$72.50<br>\$22.50 within 10 days. Balance \$10.00<br>monthly for 5 months. |

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**Model 76**

Terms: \$6.95 after 10 day trial then \$5.00 per month for 4 months.

Superior's  
New  
Model

**76**

IT'S A **CONDENSER BRIDGE**

IT'S A **RESISTANCE BRIDGE**

IT'S A **SIGNAL TESTER**

IT'S A **TV ANTENNA TESTER**

## Specifications

✓ **CAPACITY BRIDGE SECTION**  
4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. Will also measure the power factor of all condensers from .1 to 1000 Microfarads.

✓ **RESISTANCE BRIDGE SECTION**  
2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms.

✓ **SIGNAL TRACER SECTION**  
With the use of the R.F. and A.F. Probes included with the Model 76, you can

make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc.

✓ **TV ANTENNA TESTER SECTION**  
Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? Locates a break in any TV antenna and measures the location of the break in feet from the set terminals.

Complete with R.F. and A.F. probes and test leads **\$26<sup>95</sup> Net**

Superior's New

Model TV-50

# GENOMETER

**7 Signal Generators in One!**

✓ **R.F. Signal Generator for A.M.**  
✓ **R.F. Signal Generator for F.M.**  
✓ **Audio Frequency Generator**  
✓ **Marker Generator**

**R.F. SIGNAL GENERATOR:** 100 Kilacycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

**VARIABLE AUDIO FREQUENCY GENERATOR:** Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

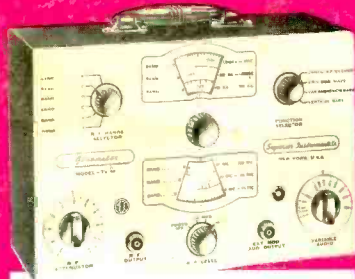
**MARKER GENERATOR:** The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

✓ **Bar Generator**  
✓ **Color Dot Pattern Generator**  
✓ **Cross Hatch Generator**

**BAR GENERATOR:** Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.

**DOT PATTERN GENERATOR (FOR COLOR TV):** The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.

**CROSS HATCH GENERATOR:** The pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect. Complete with shielded leads **\$47<sup>50</sup> Net**



**Model TV-50**

Terms: \$11.50 after 10 day trial then \$6.00 per month for 6 months.

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**SEE OTHER  
SIDE**

**CUT OUT AND MAIL TODAY!**