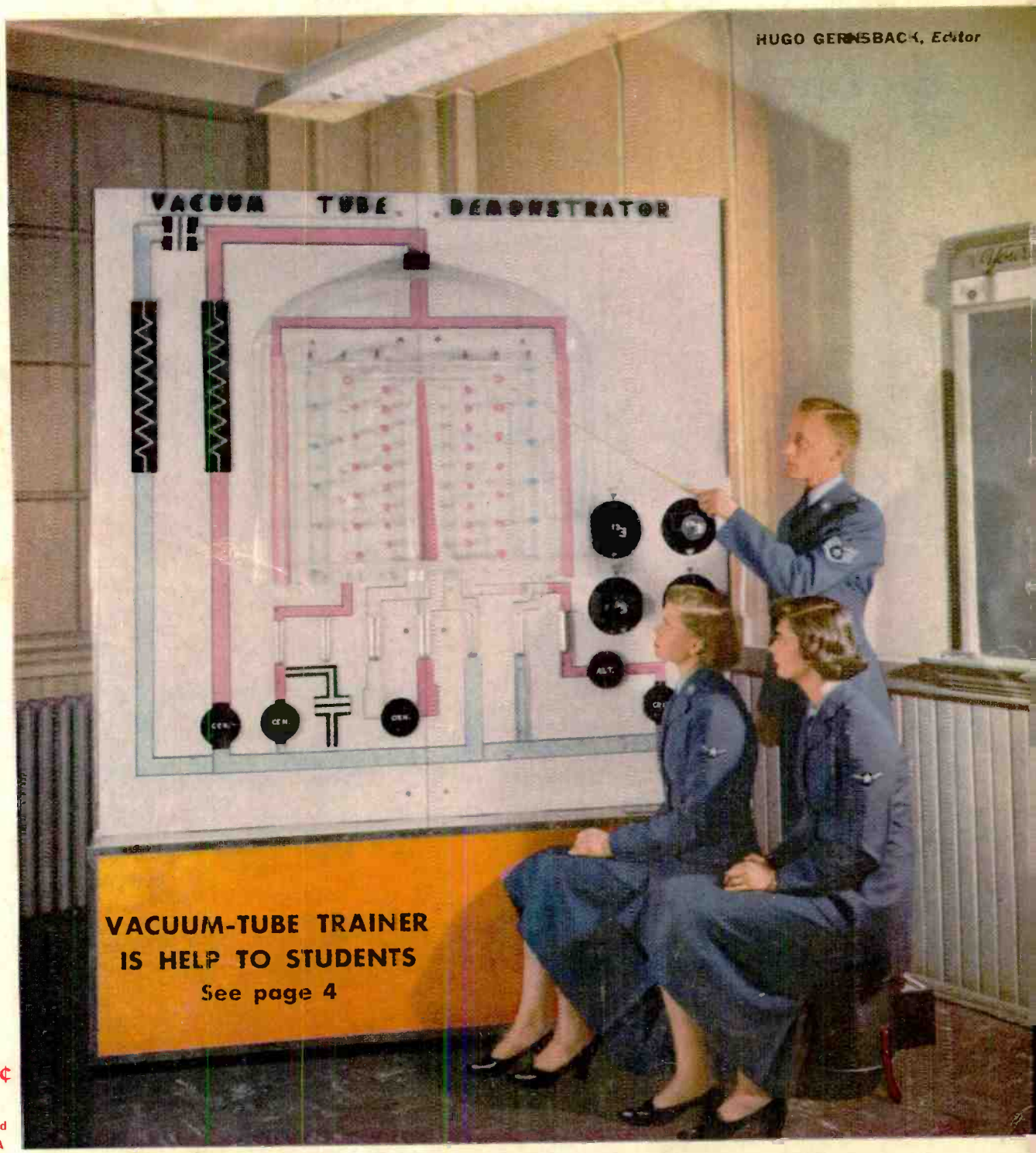
JUNE 1952

# RADIO — ELECTRONICS

LATEST IN TELEVISION • SERVICING • AUDIO

HUGO GERNSBACK, Editor




## VACUUM-TUBE TRAINER IS HELP TO STUDENTS

See page 4

30¢
U. S. and CANADA

*In this issue:* **Hard-to-Locate TV Troubles • Radio-Controlled Plane • Dynamic Signal Tracer**

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## ...here's why:

You're in the *Radio Business.* So are we.

You're interested in promoting the sale and use of *radio products.* So are we.

*If You prosper, so do we!*

That's why we are so anxious to *give you help* when you stock, sell and promote the *RCA Battery Line.*

*That's why we continue to channel our principal battery distribution to You, the radio dealer-serviceman,* thereby assuring *You* the repeat business for RCA RADIO BATTERIES.

*That's why we advertise You, The Radio Service-Dealer, on national network radio and TV programs* . . . and tell millions of listeners that *You are best qualified* to *sell and install* RCA RADIO BATTERIES.

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With all this to back you, your best move is to stock, sell and promote *the RCA Battery Line.*

**Remember:** You're a *Radio Man.*
We're a *Radio Company.*
*If You prosper, so do we!*

That's why you're tops on our totem pole. And that's why *you'll do better . . . make more money . . .* with the RCA Battery Line.

So call your RCA Battery Distributor. Let's get started selling RCA Batteries together . . . *right now.*

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**RADIO CORPORATION of AMERICA**

**RADIO BATTERIES** **HARRISON, N. J.**

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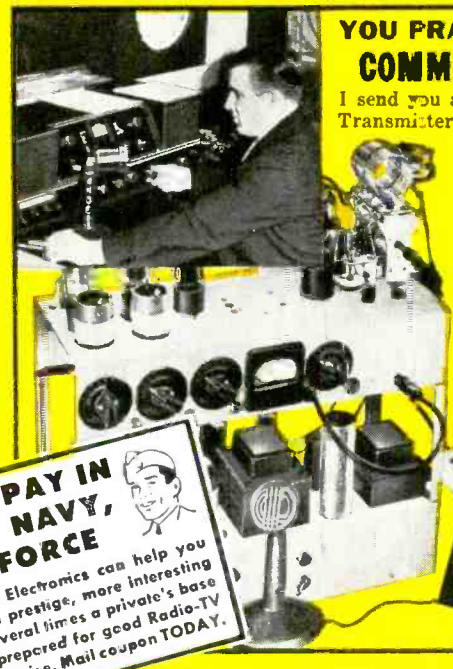
You build the modern Radio shown below as part of my Servicing Course. I send you speaker, tubes, chassis, transformer, loop antenna, everything you see pictured and EVERYTHING you need to build this modern Radio Receiver. Use it to make many tests, get practical experience.



## YOU PRACTICE RADIO COMMUNICATIONS

I send you all the parts to build Transmitter shown below as part of my new Communications Course. Conduct actual procedure of Broadcast Operators, practice interesting experiments, learn how to actually put a transmitter on the air.



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Knowing Radio, TV, Electronics can help you get extra rank, extra prestige, more interesting duty at pay up to several times a private's base pay. You are also prepared for good Radio-TV jobs upon leaving service. Mail coupon TODAY.

NEW

## I TRAINED THESE MEN

"After graduating, worked for servicing shop. Now Chief Engineer of three Police Radio Stations."—S. W. DINWIDDIE, Jacksonville, Illinois.

"While learning, made $5 to $10 a week in spare time. Now have a profitable spare time shop."—L. ARNOLD, Pontiac, Mich.

"I accepted a position as Radio and Television Technician . . . was promoted to manager of Television Service and Installation."—L. HAUGER, San Bruno, California.

"Have my own shop. Am authorized serviceman for five manufacturers and do servicing for 7 dealers."—P. MILLER, Maumee, O.

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"When I enrolled, had no idea it would be so easy to learn. Have equipped my shop out of spare time earnings. I am clearing about $40 to $60 a month."—J. D. KNIGHT, Denison, Tex.

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### Send Now for 2 Books FREE—Mail Coupon

Send for my FREE DOUBLE OFFER. Get actual Servicing lesson. Also get my 64-page book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning. Send coupon in envelope or paste on postal. J. E. SMITH, President, Dept. 2FF, National Radio Institute, Washington 9, D. C. OUR 39TH YEAR.

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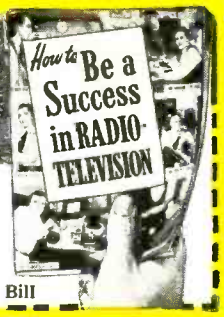


MR. J. E. SMITH, President, Dept. 2FF
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# RADIO-ELECTRONICS

Formerly RADIO-CRAFT • Incorporating SHORT WAVE CRAFT • TELEVISION NEWS • RADIO & TELEVISION*



ON THE COVER:
Staff Sergeant Wm. L. Stevens instructs Pfcs. Nancy A. Edwards and Anna M. Lockard in the vagaries of the electron tube with the help of the demonstrator described on page 42.
*Color original by Avery Slack.*

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**JUNE 1952**



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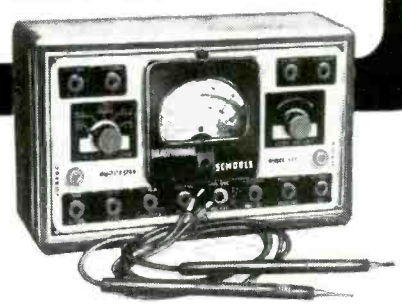


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National Schools Shop Method Home Training gives you basic and advanced instruction in *all* phases of Radio-TV-Electronics. And remember—your training is based on resident school training principles. You learn *fast* from hundreds of diagrams and pictures. All instructions are written by experienced technicians who work in Radio and TV every day. All instructions have been developed and tested in National Schools' own labs and studios, which are equipped with the latest RCA equipment. No wonder this National Schools course is so up-to-date, practical, interesting. And so easy to learn! And no wonder it is held in such high regard by leaders of American industry! Approved for eligible Veterans.

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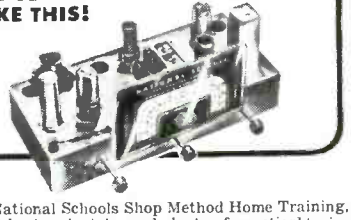
### WE SEND YOU LOTS OF PARTS LIKE THIS!



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## IN TV AND ELECTRONICS?

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Think of the thousands of radio-equipped fire and police departments throughout the U.S. Of the many radio-equipped railroads, of the hundreds of cities with 2-way radio service for cars and cabs. Think of the wide-ranging field of aviation communications—radio-controlled aircraft, navigation-and-traffic control, airport stations.

Think of the maritime world with its navigational aids, fathometers, ship-to-shore and ship-to-ship communications and radar. Think of electronic heating, fax and ultra-fax, of electronic medicine, and all the other applications of electronic know-how.

Countless positions must be filled—in development, research, design, production, testing and inspection, manufacture, broadcasting, telecasting and servicing. Who will get those positions? You—if you prepare today—if you are alert and have the ambition to advance your knowledge. You—if you take 2 minutes to send for a free copy of "Your Future in the New World of Electronics."

This helpful book shows you how CREI Home Study leads the way to greater earnings through the inviting opportunities described above.

However, being an accredited technical school, CREI does not promise you a "bed-of-roses." You have to translate your willingness to learn into saleable technical knowledge —via *study*. Since its founding in 1927, CREI has provided thousands of professional radiomen with technical educations. During World War II, CREI trained thousands for the Armed Services. Leading firms choose CREI courses for group training in electronics at company expense, among them United Air Lines, Canadian Broadcasting Corporation, Trans Canada Airlines, Sears Roebuck & Co., Bendix Products Division, All-American Cables and Radio, Inc., and RCA-Victor Division.

CREI courses are prepared by recognized experts, in a practical, easily-understood manner. You get the benefit of time-tested materials, under the personal supervision of a CREI Staff Instructor. This complete training is the reason why CREI graduates find their diplomas keys-to-success in Radio, TV and Electronics. CREI alumni hold top positions in America's leading firms.

At your service is the CREI Placement Bureau, which finds positions for students and graduates. Although CREI does not guarantee jobs, requests for personnel currently exceed supply by far.

Talk to men in the field and check up on CREI's high standing in electronics instruction. Determine for yourself right now that your earnings are going to rise with your knowledge—and that you get your rightful place in the Age of Electronics. All this CREI can promise you, provided you sincerely want to learn. Fill out the coupon and mail it today. We'll promptly send you your free copy of "Your Future in the New World of Electronics." The rest—the future—is up to you.

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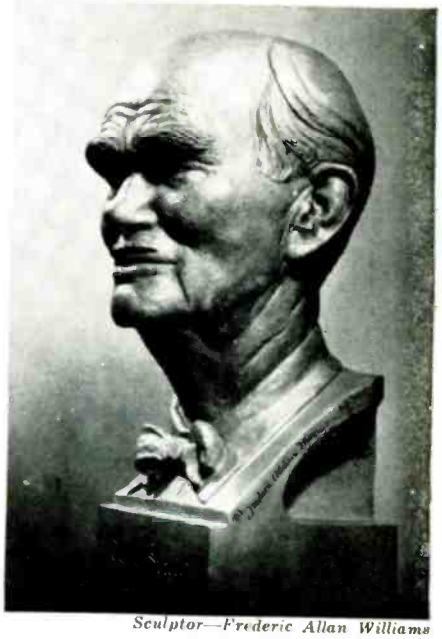
**DR. LEE de FOREST,** the "Father of Radio", was honored on April 8 by a banquet at the Hotel Waldorf-Astoria, New York City. The banquet, held under the auspices of *The Radio Pioneers*, an organization of persons who have worked with or for Dr. de Forest during his career, commemorated the 45th anniversary of his invention of the Audion, or 3-electrode vacuum tube.

The principal speakers were a former president of the U.S. and a former governor. Ex-president Hoover began his speech by listing de Forest as one of the five inventors of modern times whose work has had the greatest impact on modern civilization. He pointed out parallels in his own life and de Forest's, revealing that they had spent part of their boyhood within 15 miles of each other, in Iowa, and that they had graduated as engineers only a year apart, de Forest from Yale's Sheffield School, and Hoover from Stanford. However, Mr. Hoover said, de Forest had taken the better road from there on, staying with science and making vast contributions, each with incomparable benefits to humanity, while he had "deserted the technical field for the slippery paths of public life."

Ex-president Hoover admitted that de Forest's invention had not been an unmixed blessing, and that possibly its worst result was the singing commercial. But, he continued, Dr. de Forest could redeem himself by inventing "a push button with which we could transmit our emotions instantly back to the broadcasters" at any time during a program.

Charles Edison, former governor of New Jersey, cited de Forest as the holder of more than 300 patents, and compared him as an inventor with his own illustrious father, Thomas A. Edison, recalling a meeting between the two at which, according to de Forest's autobiography, Edison had borrowed (and kept) his pencil. He concluded his speech by returning the pencil (or its equivalent) to de Forest.



*Sculptor—Frederic Allan Williams*

A highlight of the affair was the presentation of a bust of de Forest to Yale University, which numbers him among its greatest graduates of the first half of the 20th Century.

De Forest, in replying to the speeches, reminisced about the old days and the old-timers, naming many of his coworkers present and absent, and admitted that, far from resting on his laurels at 77, he was still actively inventing, and had in fact recently taken out a patent on what some people considered the nemesis of the audion—an improved transistor!

**NEW BRITISH TV STATION,** opened in March, links Scotland with London and provides the longest television relay system in Europe. It is situated at Kirk o'Shotts, roughly mid-

**The BBC TV transmitter at Kirk o'Shott's, Scotland. Left: The 750-foot transmitting antenna. Upper right: TV programs relayed from London are received on these microwave parabolic antennas. Lower right: The 5-kw picture transmitter undergoing adjustments. The main operating console is in the foreground.**

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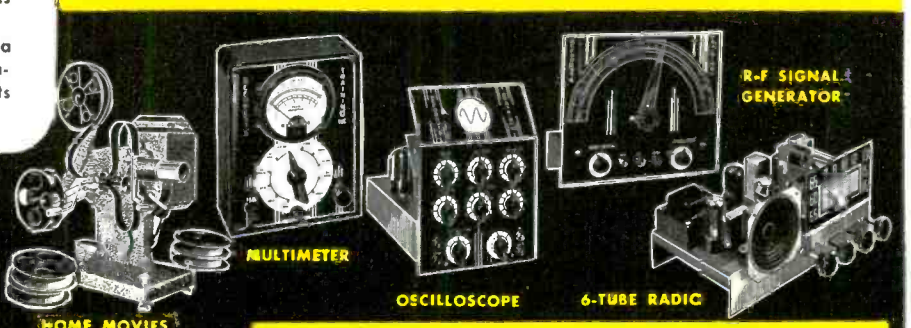
- I admire its remarkable 20 year record of helping men build brighter futures.
- I also admire the business policy of its management and the thoroughness of its large faculty of instructors.
- Never have I heard young men praise a school as enthusiastically as do the students and graduates of D.T.I. They are its best boosters.

## Prepare At Home Or In Our Chicago Laboratory!

See for yourself how readily you may prepare at home, or in our modern Chicago laboratories, for a better job or business of your own in one of America's fastest-growing fields—TELEVISION-RADIO-ELECTRONICS.

If you train at home you get (1) the use of a 16-mm. movie projector and 16 reels of animated movies to help you learn important points faster . . . easier, (2) modern lessons and (3) sixteen shipments of electronic parts enabling you to get valuable practical experience from over 300 projects—including building and keeping the electronic equipment shown below. And upon completing training, you have the optional privilege of building and keeping a big 17-INCH TV set at moderate added cost. Get the full story. Mail coupon today!

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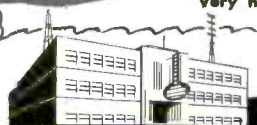

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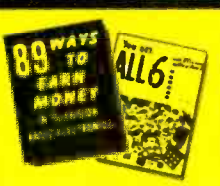


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2533 N. Ashland Ave., Chicago 14, Ill.

I would like your Opportunity News Bulletin showing "89 Ways to Earn Money in Television-Radio-Electronics"; also, the folder showing how I may prepare to get started in this thrilling field.

Name_____ Age____

Address_____ Apt.____

City_____ Zone____ State____

way between Glasgow and Edinburgh, and will provide television service over a wide area in Scotland.

Kirk o'Shotts will receive programs from London, over 400 miles away, by a transmission network divided into three main parts. Programs can be transmitted in both directions over any or all of the three network sections.

Extra-wide-band coaxial cable is used on the first section, which carries programs underground from London to Birmingham. The second section runs from Birmingham through Manchester to the transmitter at Holme Moss, using a smaller type coaxial cable. The final section of the network carries pictures by a microwave radio link.

The 750-foot height of the antenna, combined with the natural elevation of the site, gives an effective height of more than 1,600 feet. The mast and aerial system can withstand gales of 120 miles per hour.

**LOUIS GERARD PACENT,** noted radio pioneer, died April 6th at the age of 58. A wireless experimenter as early as 1906, Mr. Pacent became one of the world's first radio amateurs, and suggested the tests which led to the first successful amateur transatlantic transmissions.

After the first World War he established the Pacent Electric Company which produced many of the components used in early broadcast receivers and electric phonographs.

Mr. Pacent was the author of a number of technical books and a contributor to several technical journals. His last article in this magazine appeared January 1948.

The Pacent Engineering Corporation, which he founded in 1933, is engaged in research and development engineering in military and civilian electronics.

In 1951 Mr. Pacent was cited by the Department of the Army for his services during the second World War, and received the Marconi Memorial Medal of Achievement from the Veteran Wireless Operators Association. He was a Fellow of the IRE and of the Society of Motion Picture and Television Engineers, a Fellow and past president of the Radio Club of America, and a member of the Institute of Electrical Engineers, and the Engineers Club.

**NEW AMATEUR BAND** of 21 to 21.45 mc, opened May 1, may cause interference in television receivers whose i.f.'s are lower than 21.5 mc, warn officials of the American Radio Relay League.

Tests carried out by the League indicate that such interference may be eliminated or minimized by re-aligning the receivers at a sound i.f. of 21.9 mc if possible, and not lower than 21.7.

—end—

RADIO-ELECTRONICS

# Your best picture tube and set tester ... an RCA VoltOhmyst*

**Save time and money—be sure—by *pre-checking* TV chassis and picture tubes *in the home* with an RCA "VoltOhmyst". Here's how . . .**

Bringing your RCA "VoltOhmyst" into the customer's home on every service call is more than good psychology—it's good business—because the features of an RCA "VoltOhmyst" permit you to make a rapid and systematic check of the chassis as well as the picture tube—right in front of the customer.

Here's how you go about it (no picture or a dim picture, but sound okay):

**1.** Turn on set and visually check that picture-tube heater is lighted. Check adjustment of ion-trap and focusing magnets.

**2.** If picture-tube heater is not lighted, remove the socket from the tube and check heater continuity with "VoltOhmyst". Also check heater-to-cathode leakage.

**3.** Measure socket-terminal voltages to ground with "VoltOhmyst." Note action of Brightness Control on grid or cathode voltage.

**4.** Check for video voltage at grid or cathode terminal of picture-tube socket with "VoltOhmyst" AC Probe.

**5.** Replace picture-tube socket and measure high voltage with WG-289 High-Voltage Probe. Note effect of Brightness Control on high voltage.

**6.** If high voltage is lower than normal, measure "B plus" and "boosted B plus" voltages with "VoltOhmyst" DC Probe. If B-plus voltage is normal and boosted B-plus voltage is low, try a new damper tube.

**7.** If "B plus" and "boosted B plus" voltages are both normal, try new tubes in the horizontal output, horizontal oscillator, and HV rectifier.

**8.** If none of these tests indicate the trouble, then it may be concluded that the picture tube is at fault.

These simple tests permit you to give the customer an immediate and positive diagnosis of the trouble . . . and in many cases, permit you to correct the fault on the spot. Most important—you know immediately whether a new picture tube is needed, or whether it will be necessary to take the chassis to the shop.

*Reg. U.S. Pat. Off.

**WG-289 High-Voltage Probe with WG-206 Multiplier resistor, $9.95 Suggested User Price.**

**WV-77A Junior "VoltOhmyst," only $47.50 Suggested User Price.**

**Only RCA makes the "VoltOhmyst"**

RCA "VoltOhmysts" measure DC voltages in high-impedance circuits, *even with rf present*, without the ill effects of heavy circuit loading, regeneration, or frequency shift. They also measure AC over a wide frequency range, *even in the presence of DC* . . . and detect leakage resistances *as high as 1000 megohms.*

See the WV-77A and the WG-289 as well as the WV-87A and WV-97A "VoltOhmysts" at your local *RCA Distributor*, or write for bulletins to Commercial Engineering, Section FX49, Harrison, N. J.

**RADIO CORPORATION of AMERICA**

**TEST EQUIPMENT** **HARRISON, N. J.**

# BIG VALUES • NEW RELEASES


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### "SKY ROVER" PORTABLE KIT

Build this powerful 3-way superhet portable for AC, DC, or battery operation. Covers 535-1650 kc AM broadcast band; has built-in antenna, PM speaker, automatic volume control. Easy to assemble from 8-page illustrated manual. High-quality kit includes all parts, tubes and carrying case (less batteries). Shpg. wt., 6 lbs.

**83-276.** *Only* . . . . . **$17.95**
**80-596.** *Battery Kit* . . . . . **$2.11**

### DEWALD 3-BAND PORTABLE

Powerful broadcast and "round-the-world" Short Wave at low cost! Tunes 540-1600 kc; 2.0-5.45 mc; 5.45-16.7 mc. Operates from AC, DC or batteries. Superhet circuit; loop AM antenna, 53" collapsible SW whip; handsome tan-brown case. 9½ x 11½ x 5¼". Complete with tubes, less batteries. 9 lbs.

**4J-708.** *Only* . . . . . **$42.50**
**80-619.** *Battery Kit* . . . . . **$4.74**

### WELLER SOLDERING IRON

Squeeze the trigger—you're ready to solder in 5 seconds! Double-tube electrode and long tip; with 2 spotlights that light up working area. Air-cooled transformer. 100-135 watt dual-heat type. Shpg. wt., 3 lbs.

**46-589.** *Only* . . . . . **$10.73**

### CHAMPION SPRAY GUN

Smooth-working all-metal electric gun for spraying lacquer, paint, varnish, chemicals, insecticides, etc. No compressor—has motor right in handle—develops over 90 lb. pressure. Pistol trigger. 25-ounce glass jar. With 8 ft. cord. For 110-120 v., 60 cy. AC. Shpg. wt., 5 lbs.

**46-139.** *Only* . . . . . **$9.57**

### MICRO-VOX WIRELESS MICROPHONE

Mike with built-in midget radio transmitter plays through any radio within 50 feet for home entertainment or as small P.A. System. Complete with built-in batteries. Shpg. wt., 3 lbs.

**99-485.** *Only* . . . . . **$5.85**

### E-Z-I TV LIGHT AND CLOCK

Combination TV light and numeral-type clock. When placed on top of TV cabinet, helps reduce viewing eyestrain. Walnut plastic case, 5 x 5½ x 7½". For 110 v., 60 cy. AC. Shpg. wt., 2½ lbs.

**78-328.** *Only* . . . . . **$7.66**

### WHEELER SELF-POWERED PHONE

Self-contained, self-powered telephone handset—no batteries or line voltage needed. Fine for inter-room use. Use with No. 16 or No. 19 twisted wire. With 3½ ft. cable, test clips, insulators. Shpg. wt., 1½ lbs.

**59-350.** *Only* . . . . . **$9.62**

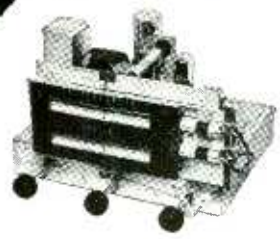
### 4 X 6" OVAL SPEAKER VALUE

Ideal for replacement use in portable and table radios, TV sets and intercom. Fine buy for builders, experimenters. With 1.47 oz. Alnico V magnet. Voice coil imp. 3.2 ohms. Wt., 12 oz.

**81-640.** *Only* . . . . . **$1.69**

*All Prices F. O. B. Chicago*

**ALLIED RADIO**



### PILOT HI-FI AM-FM TUNER

Best buy in a quality tuner covering standard AM broadcast and 88-108 mc FM. Flat response within 2 db, 20-15,000 cps. Slide-rule dial; separate 3-gang condensers for AM and FM; input for phono and TV, with bandswitch; power supply; tuned RF on AM and FM; ceramic loop stick antenna for AM, FM line antenna. Size, 11½ x 6 x 9"; with 9 tubes and rect. For 110-120 v., 50-60 cy. AC. Shpg. wt., 8½ lbs.

**97-944.** *Only* . . . . . **$42.95**

### KNIGHT 3-SPEED PHONO-RADIO

Complete home entertainment at new low cost. Has V-M 3-speed intermix changer, with turnover cartridge—plays *all* records, all sizes and speeds—intermixes 10" and 12" records. Superhet radio covers 540-1730 kc; Alnico PM speaker, tone control. In attractive cabinet, 15 x 9½ x 19¾". With all tubes and loop antenna. For 105-125 v., 60 cy. AC. Shpg. wt., 35 lbs.

**5G-563.** *Only* . . . . . **$56.75**

### PLASTIC SPRAY


Provides tough coating of clear flexible plastic on any surface. Guards against rust, tarnish, etching. Dries hard in an hour. Automatic spray. Shpg. wt., 1¼ lbs.

**43-136.** *Only* . . . . . **$1.03**

### NEW REGENCY TV BOOSTER

Features maximum stability on all TV channels by providing inductive and capacitive neutralization. Single tuning knob for easy operation. Fine tracking accuracy. Improves both picture and sound for greater TV enjoyment. Mahogany plastic cabinet, 4½ x 6 x 4½". For 110-120 v., 60 cy. AC. Shpg. wt., 7 lbs.

**97-211.** *Only* . . . . . **$19.11**

### NEW TV TUBE BRITENER

Extends useful life of older, dull-looking TV picture tubes; increases electron emission, thus adding brightness. Installs inside cabinet in minutes; automatic; 3 boost positions to select desired tube brilliance.

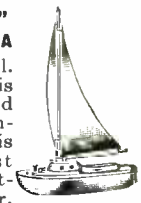
**80-179.** *Only* . . . . . **$5.73**

### NEW TV CLARIFIER

Tunes out antenna-fed interference which causes annoying TV picture distortion. Eliminates FM, diathermy, SW, ignition, amateur interference, etc. Matches any antenna. Easy to install and operate. Brown case, 4 x 3¼ x 1½". Shpg. wt., ½ lb.

**77-566.** *Only* . . . . . **$4.41**

### NEW "TENNA-BOAT" TV INDOOR ANTENNA



Beautiful, practical. Ceramic boat hull is base; mast and boom are the antenna. Plastic sail is rotatable for best reception; has built-in tuning condenser.

**97-047.** Dark Green
**97-048.** Crimson
**97-049.** Harvest Moon
} Each, *Only* **$8.25**

**ALLIED RADIO CORP. Dept. 2-F-2**
**833 W. Jackson Blvd., Chicago 7, Ill.**

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☐ Send Free ALLIED Supplement No. 130.

☐ Enter order for . . . . . .

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**ADVERTISED IN JUNE**
**to the millions of**
**readers of the**
**SATURDAY EVENING POST**
**and**
**BETTER HOMES AND GARDENS**


GET YOUR summer selling season *off to a flying start* with these Philco Accessory products your customers will see advertised in June national magazines. Take a free ride to profits by giving them special display in your store and windows. Feature them in your promotions. *Drive it home* to the buyers of your area . . . that *your* store is the place to buy the Philco Accessories they need.

## "HIT OF THE MONTH" OFFERS

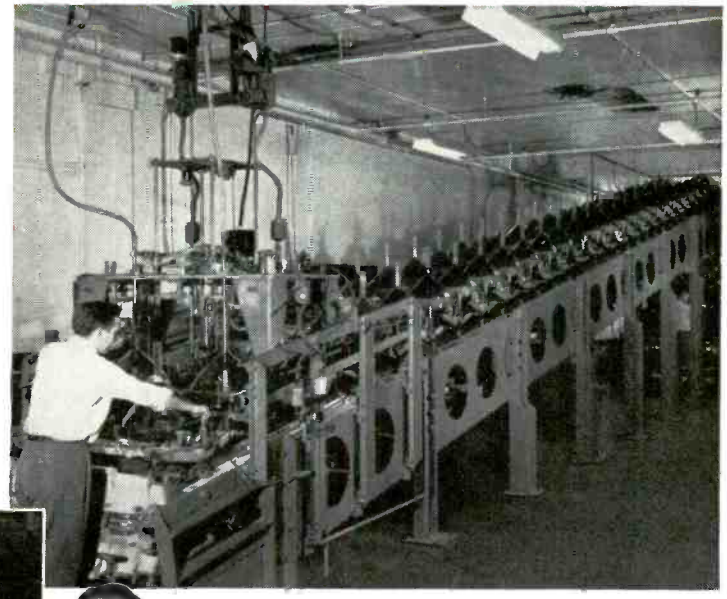
**NEW FOR JUNE!** Ask about the new *extra profit* "June specials" on Philco Parts and Accessories.

***NOW AT YOUR PHILCO DISTRIBUTOR***

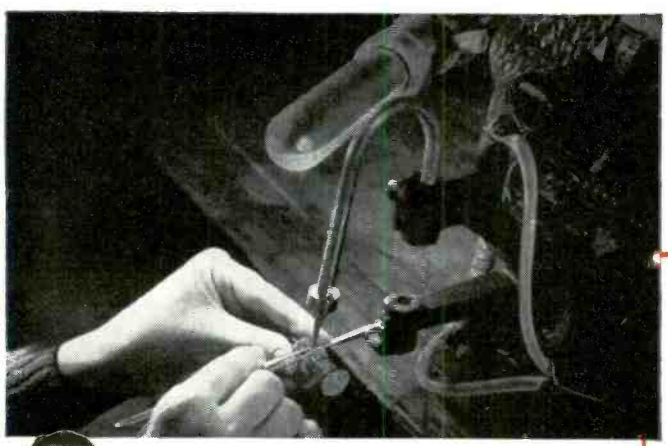
# "Let Me Tell You How It Happened..."

Carl Vineglass,
Al's Radio,
Lawrence, Mass.

**"FOR YEARS I'VE BEEN BUYING TUBES...A LOT OF THEM CBS-HYTRON.** But I didn't know too much about CBS-Hytron. Sure, I'd seen their ads. Read about their original rectangular tube. Their IX2A, 6BQ6GT, 12BH7, 12BY7, etc. Their handy service tools. (I just couldn't get along without my Soldering Aid.) Their Budget Plan. And so on.



"I like to know the fellows I buy from though. So last week I drove over to Salem. The CBS-Hytron gang, from President Bruce A. Coffin down, gave me a real welcome. Also the low-down on CBS-Hytron tubes, and what's behind them.



"First off, I discovered that CBS-Hytron is *big*... and getting bigger fast. I saw receiving tubes rolling out of their combined Salem and Newburyport plants at 300 a minute. With their new Danvers plant, it'll be 600 a minute! And their picture tubes run at 5000 a day! You may already know that CBS-Hytron is now a division of Columbia Broadcasting System, Inc.

"CBS-Hytron has a saying, 'Tubes are known by the company they keep.' In their shipping rooms, I saw tubes being rushed out to most of the top manufacturers and jobbers I ever heard of... and lots I don't even know.

"The reason for all the popularity wasn't hard to find. I never saw such painstaking manufacturing and testing in my life. From raw materials to finished tube. Every single tube gets the works.

"And is making tubes complicated! That ingenious machinery does everything but talk. The flying fingers of the girls assembling the tubes, though, are what caught my eye. I just couldn't believe you could get that watch-like precision with that amazing speed. And talk about engineers! I saw electronic, mechanical, chemical, metallurgical, production, industrial engineers by the score.

"I've read that CBS-Hytron's picture-tube plant is the most modern in the world. I believe it. It's really something the way that push-button, automatic plant handles those big bottles. And that new Danvers receiving-tube plant is more of the same. Floor space covers approximately five acres. Main production floor is longer (500 feet) than the longest home run ever hit by Babe Ruth. That plant has everything. They tell me the whole idea was to produce at economical top speed the finest receiving tubes in the world. To my way of thinking, they succeeded.

"Believe me, I'm glad I made that trip to CBS-Hytron. They're a real on-their-toes outfit. Before I never was too fussy what standard brand of tube I bought. But now I want CBS-Hytron, and that's that! You would, too, if you'd seen what I have."

**AN OPEN INVITATION...**

to all service-dealers and their distributors. You are mighty welcome to drop in at CBS-Hytron any time. How about this summer?

CBS HYTRON RADIO TUBES

MANUFACTURERS OF RECEIVING TUBES SINCE 1921
HYTRON
RADIO AND ELECTRONICS CO.
A DIVISION OF COLUMBIA BROADCASTING SYSTEM INC.

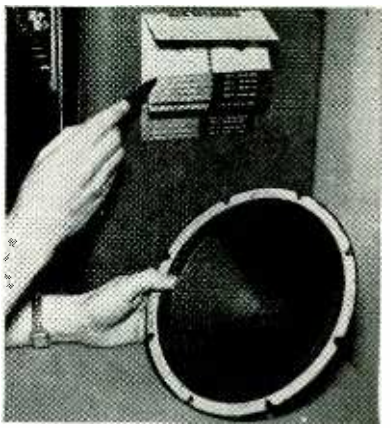
MAIN OFFICE: SALEM, MASSACHUSETTS

## Merchandising and Promotion

**Cornell-Dubilier Electric Corp.**, Jobber Division, South Plainfield, N. J., is delivering a two-piece lightning-arrester merchandiser to stimulate point-of-purchase sales of its new UL-approved lightning arrester for TV and radio

protection. The merchandiser consists of a wall dispenser which holds 12 individually-cartoned arresters and a 24-unit self-service counter display.

**The RCA Tube Department**, Harrison, N. J., designed a flip-type index as a finger-tip reference on RCA radio-television speakers. Less than six inches square, and suitable for mounting on



the wall or service bench, the index provides all data necessary for the installation of any one of 22 different RCA speakers. It is available to service technicians through distributors.

**Radio Merchandise Sales, Inc.** (RMS), New York City, is continuing its series of forums on TV antennas and allied products. A meeting was held recently in Albany, N. Y., under the sponsorship of the Fort Orange Radio Supply Co.

**Littelfuse, Inc.**, Des Plaines, Ill., released its first completely illustrated list-price sheet on fuses. It is a 4-page sheet containing actual-size drawings of 25 fuse types.

## BAROMETER of the PARTS INDUSTRY

During April, 53 of the leading 400 manufacturers of Radio-Television-Electronic parts and equipment made changes in their lines. Actually there was a decrease in "change activity" as compared to the previous 3 months.
In price revisions by the number of manufacturers and products affected, the following summary illustrates the comparative trend for the months of March and April.

| | No. of Manufacturers | |
|---|---|---|
| | March | April |
| Increased prices | 12 | 10 |
| Decreased prices | 28 | 14 |

| | No. of Products | |
|---|---|---|
| | March | April |
| Increased prices | 482 | 179 |
| Decreased prices | 492 | 321 |

As evident now for the second month, price decreases still predominate. For a summary of the most active product categories, see the following table:

| Products Group | Increased Prices | | Decreased Prices | | New Products | | Discontinued Products | |
|---|---|---|---|---|---|---|---|---|
| | No. of Mfrs. | No. of Products | No. of Mfrs. | No. of Products | No. of Mfrs. | No. of Products | No. of Mfrs. | No. of Products |
| Antennas & Access. | 1 | 8↑ | 4 | 25↓ | 6 | 43↓ | 5 | 21↓ |
| Capacitors | 2 | 41↑ | 1 | 6↑ | 3 | 48↓ | None | None |
| Controls & Resistors | 1 | 10↓ | None | None | 2 | 420↑ | None | None↓ |
| Sound & Audio | 1 | 1↓ | 1 | 1↓ | 7 | 40↓ | 9 | 25↓ |
| Test Equipment | None | None↓ | None | None↓ | 4 | 7↓ | 1 | 1↓ |
| Transformers | None | None | None | None↓ | 1 | 22↓ | None | None↓ |
| Tubes | 5 | 119↓ | 7 | 153↓ | 11 | 74↑ | 1 | 6↑ |
| Wire, Cable, etc. Connectors | None | None | 1 | 36↓ | 3 | 75↑ | 2 | 3↓ |

↑ Increase over March
↓ Decrease

**Comment:** Tube prices continue to show the most activity without any apparent trend.

↑ Increase over March
↓ Decrease

**Comment:** With the exception of 1 manufacturer of Controls, there is no apparent change in the trend of new and discontinued products.

*This data is prepared by the staff of United Catalog Publishers, Inc., 110 Lafayette Street, New York City, publishers of RADIO'S MASTER, the Official Buying Guide of the Parts Industry.*

**Permo, Inc.**, Chicago, inaugurated a complete merchandising service for its *Fidelitone* special type replacement needles. The ten-point plan includes inventory, packaging, installation, and advertising aids. Among the promotional materials supplied are broadsides, needle and cartridge data sheets, dis-


play packages, etc. Permo also announced that the manufacturing processes used in the production of its phonograph needles would be featured on one of the "Industry on Parade" TV shows, sponsored by the National Association of Manufacturers.

**Snyder Manufacturing Co.**, Philadelphia, designed a self-service merchan-


dising kit for its indoor *Directronic* TV antenna system. The components for the antenna are packed in a box which may be opened and folded as a counter display.

**The Ward Products Corp.**, Division of The Gabriel Co., Cleveland, designed a new counter display for its line of auto antennas. The new blue, orange and


black display mounts three types of the company's antennas, the *8-Ball*, *Phantom* and *Air King*. It is available through distributors.

**Vaco Products Co.**, Chicago, is underway on a campaign promoting its line of Lynn Lightning Solderless Terminals. A catalog showing the com-


plete line of solderless terminals, connectors, crimping tools, self-service display boards, etc., has been released. A two-color kit counter display holding a complete service kit in a plastic box is also included.

**Channel Master Corp.**, Ellenville, N. Y., is telling the complete technical and sales story of its *Z-Match* Yagi


antennas in a give-away promotion involving giant-size matchbooks available from its distributors.

**Perma-Power Co.**, Chicago, has prepared catalog sheets, technical data, etc., on its *TV Tube Britener* which, it states, increases the brilliance of older picture tubes.

**JFD Manufacturing Co.**, Brooklyn, N. Y., prepared a four-color display featuring its *Sky-Streak* line of automobile antennas. The company also announced it is working on three new catalogs covering its entire line for service technicians, representatives and distributors.

## Production and Sales

The RTMA issued a 29-page booklet giving radio and TV set production statistics for the past five years. The report showed there were 75,117,262 radio sets and 17,002,169 TV sets produced from 1947 through 1951. Manufacturers' dollar value of the radio output was estimated at $2,175,936,597 and of TV at $3,166,986,300.

## New Plants and Expansions

**National Electronic Products Corp.**, Pittsburgh, announced the establishment of an Electronics Division with headquarters at Ambridge, Pa. The new division will consist of two departments: Television and Radio at Ambridge, and Radar at the new million-dollar Elizabeth, N. J., plant. The new Division will manufacture and distribute Nepco Yagi TV antennas, Nepco TV masts, and allied products.

**Workshop Associates**, division of Gabriel Co., Needham Heights, Mass., took a long-term lease on two additional buildings, a one-story structure which will include offices and production facilities, and a four-story plant housing production and production testing equipment. The new buildings are located in Norwood, Mass.

**Hycon Manufacturing Corp.**, Pasadena, purchased control of Arcturus Electronics Corp., Newark, N. J. New officers were installed, including Trevor Gardner, president; Alden Acker, vice-president; and Jack Sheehan, general manager.

**Radion Corp.**, Chicago, announced the completion of its plant modernization program, including a new plant at 1130 W. Wisconsin Ave., and the refinishing of its Plant No. 2 at 1137 Milwaukee Ave. Completion of the program gave the company nearly 40,000 square feet of space.

**Sylvania Electric Products Inc.**, Electronics Division, announced expanded facilities for the production of electronic tubes. New division headquarters will be located at Woburn, Mass., and another new building in Newton, Mass., has been purchased. This brings the number of Electronics Division plants to three.

## Business Briefs

. . . **Standard Transformer Corp.**, Chicago, established a 21-member Serviceman Advisory Board composed of selected service technicians to advise the company on replacement transformer problems and to represent the servicing industry in Stancor's product planning.

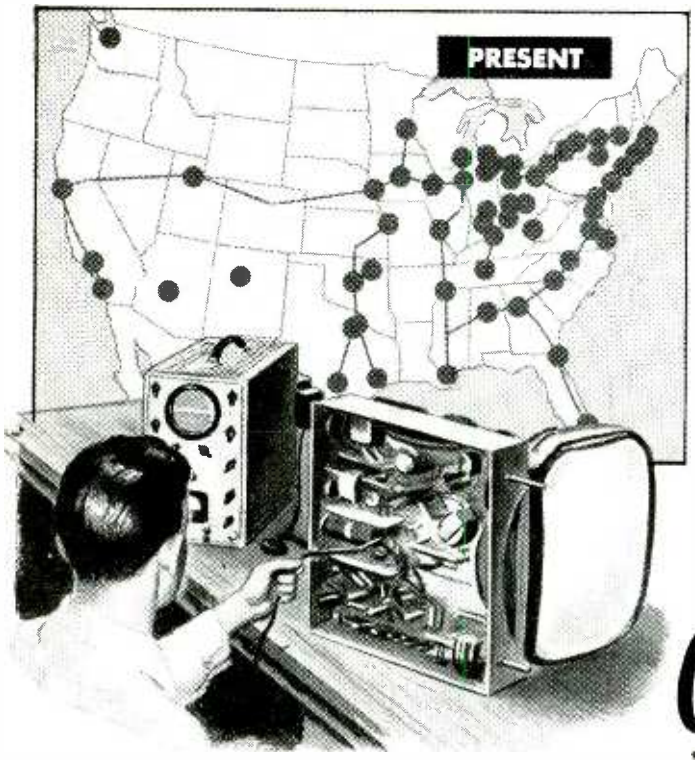
. . . **Centralab** electronic components for the Canadian market will now be manufactured by Globe Union, Ltd., a wholly-owned subsidiary in Toronto.

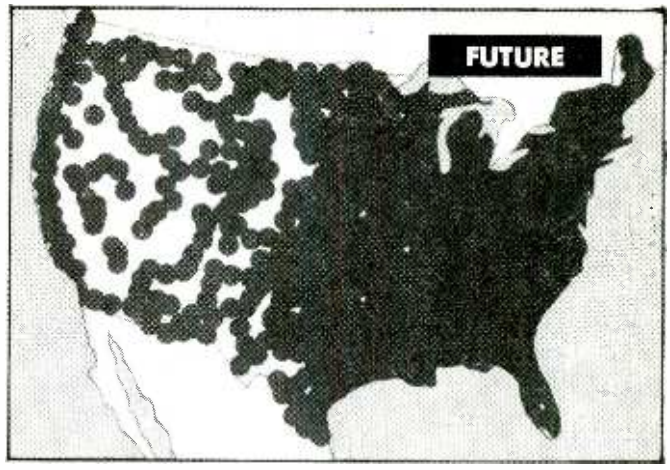
. . . **The RTMA** voted to amend its by-laws on three points: Changing the name of the Transmitter Division to Technical Products Division; increasing the number of directors representing the Amplifier and Sound Equipment Division to two; and giving the Board of Directors more flexibility in calling special meetings.

. . . **Milton S. "Mike" Roth**, former jobber sales manager of Radiart Corp., established his own representative firm, Mike Roth Sales Co., Cleveland. Among the companies he will represent are JFD Manufacturing Co., Brooklyn, N. Y., and United Transformer Co., New York City.

. . . **Radar-Radio Industries of Chicago, Inc.**, president, Leslie F. Muter, reported that although employment in the Chicago area's electronics plants was off 27.3% from last year, the region had not been classified as a "distressed area," and therefore was at a distinct competitive disadvantage.

—end—




**FUTURE**—*How new TV stations are expected to cover the nation.*
**PRESENT**—*Chart shows extent of current coverage.*

# Cash in on this Great Opportunity

# . . . for good-pay jobs in TV SERVICING

**YES,** thousands of opportunities are going begging right now for good-pay jobs in TV Servicing.

The lifting of the "freeze" on new television stations clears the way for the expansion of the industry for 2,053 new stations, in 1,291 communities in the United States, its territories and possessions. There are only 108 stations telecasting now.

This is your golden opportunity to get all set for a good job that can mean employment security and a bright future for years to come. It's a great opportunity that can lead you, as a trained and experienced TV Serviceman, into establishing a profitable business of your own.

### Big shortage of TV Technicians creates opportunities—NOW

Industry experts have estimated over 130,000 experienced TV technicians will be needed for the installation, trouble-shooting and repairing of television receivers in use by 1955. There are fewer than 50,000 fully trained TV service technicians available today. What an opportunity this creates for you!

Here are some of the good-pay jobs you can choose—installation and trouble-shooting of TV receivers in homes . . . bench technician in radio-TV service shops . . . inspector, tester, repairman, field serviceman for TV receiver manufacturers, distributors and dealers . . . testing and servicing with electronic instrument manufacturers and companies with military contracts for electronic equipment . . . civilian serviceman with U. S. Military Bases . . . your own TV service shop—and many more.

### RCA Institutes home study course trains you in your spare time

If you are associated with the radio-electronics industry, with no experience in TV servicing, the addition of the RCA Institutes Home Study Course in TV Servicing to your present experience will quickly qualify you to step out and grasp the good jobs now open in television.

The RCA Institutes course gives you a sound knowledge of television fundamentals . . . intensive practical instruction on the proper maintenance and servicing of TV receiver circuits . . . teaches you the "short cuts" on TV installation and trouble-shooting. Learn TV servicing (based on actual experience of hundreds of skilled technicians) from RCA engineers and experienced instructors—pioneers and leaders in radio, television and electronic developments.

### RCA Institutes home study course planned to your needs

You keep your present job. In your spare time, you study at home. You learn "How-to-do-it" techniques with "How-it-works" information in easy-to-study lessons prepared in ten units. Cost of RCA Home Study Course in Television Servicing has been cut to a minimum—as a service to the industry. You pay for the course on a "pay-as-you-learn" unit lesson basis. You receive an RCA Institutes certificate upon completion of the course. The RCA Institutes Home Study Course in Television Servicing is approved by leading servicemen's associations.

Don't pass up this lifetime opportunity for financial security and a bright future in TV.

### SEND FOR FREE BOOKLET

**Mail the coupon—today. Get complete information on the RCA INSTITUTES Home Study Course in Television Servicing. Booklet gives you a general outline of the course by units. See how this practical home study course trains you quickly, easily. Mail coupon in envelope or paste on postal card.**

**RCA Institutes conducts a resident school in New York City offering day and evening courses in Radio and TV Servicing, Radio Code and Radio Operating, Radio Broadcasting, Advanced Technology. Write for free catalog on resident courses.**

## MAIL COUPON NOW!


**RCA INSTITUTES, INC., Home Study Department RE-652**
**350 West Fourth Street, New York 14, N. Y.**

Without obligation on my part, please send me copy of booklet "RCA INSTITUTES Home Study Course in TELEVISION SERVICING." (No salesman will call.)

Name_____
(please print)

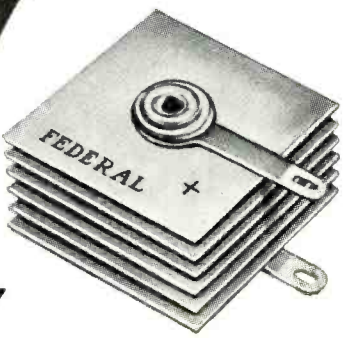
Address_____

City_____ Zone_____ State_____

**RCA INSTITUTES, INC.**
***A SERVICE OF RADIO CORPORATION of AMERICA***
***350 WEST FOURTH STREET, NEW YORK 14, N.Y.***

JUNE, 1952

# "It pays to replace with the BEST" Federal-



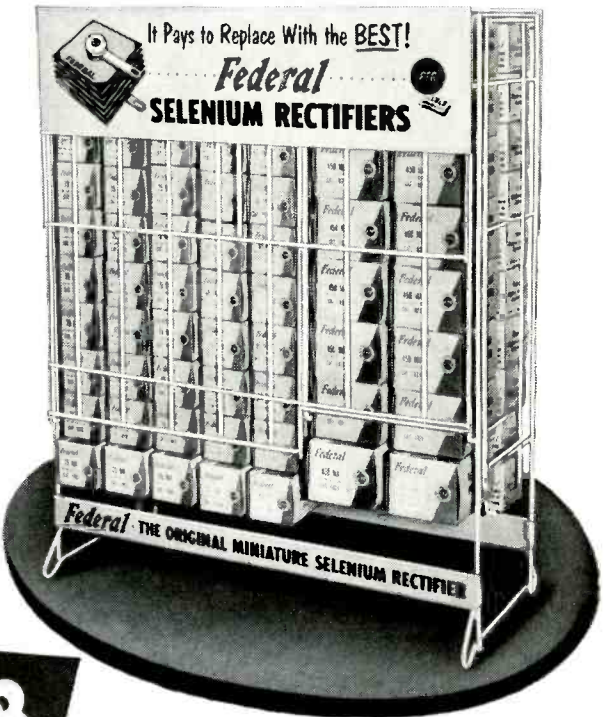

## The Original Miniature Selenium Rectifier!

**IT PAYS YOUR CUSTOMERS** in finest quality and dependable, long-life performance—proved by over 30,000,000 units shipped to the field!

**IT PAYS YOU, Mr. Serviceman,** in customer satisfaction and goodwill—*and a good profit on every job!*

### Here Are Other Specific Reasons Why "Federal" Is Your No. 1 Choice for Servicing the Big, Growing Radio-TV Replacement Market:

- Tests by receiver manufacturers show a life expectancy of well over RTMA guarantee.
- Over 250,000 tests prove superior immunity to shelf-aging.
- Federal's synthetic barrier layer stops change during long storage.
- Quality rigidly controlled. All units fully tested before release.
- Units available either packed in the attractive Federal resale box or in bulk.
- Constant research keeps you up-to-date on rectifier progress.




**SAVE TIME—SERVE YOURSELF from *Federal's* NEW**

**RECTIFIER DISPENSER**

***LOOK FOR IT ON YOUR DISTRIBUTOR'S COUNTER!***

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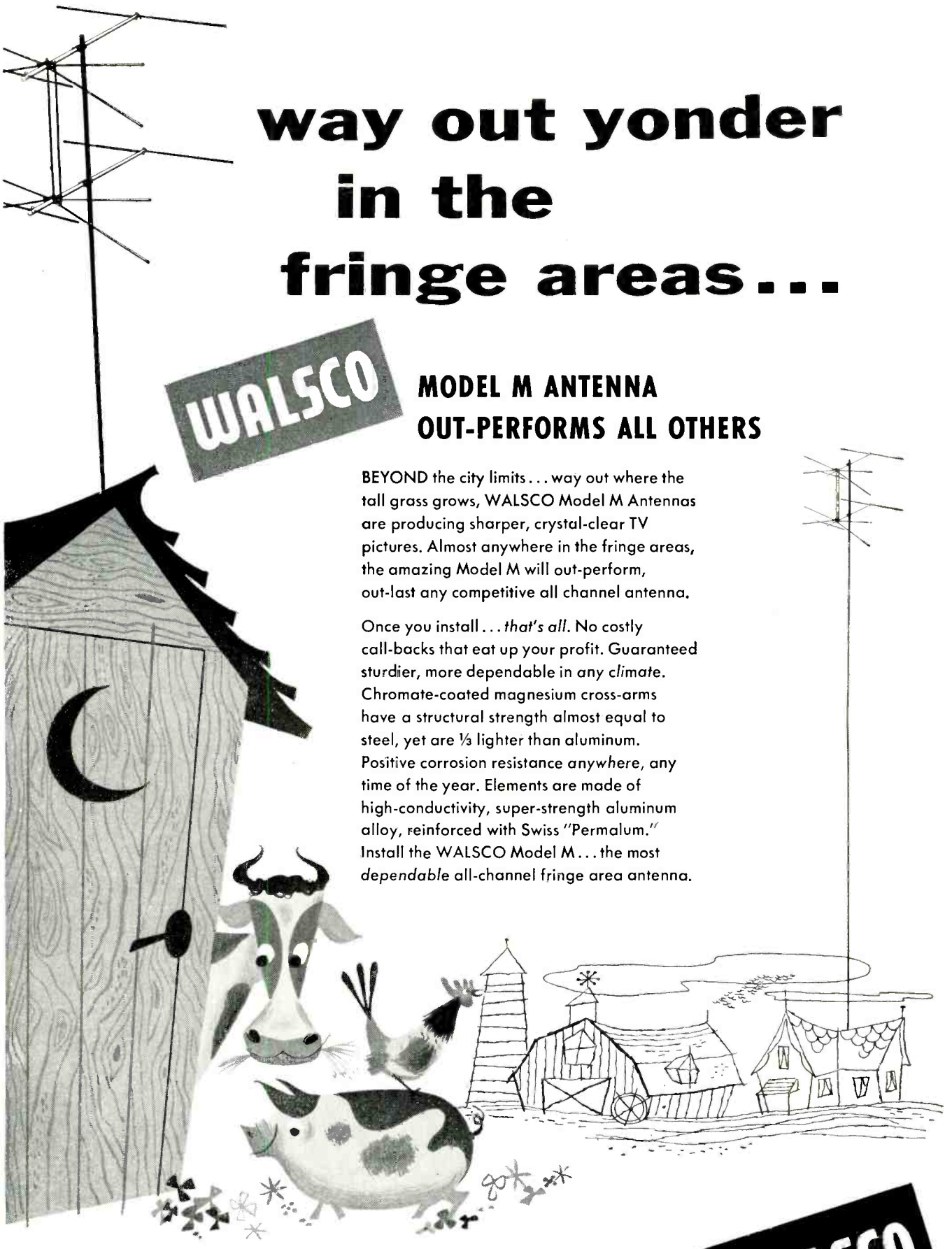

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# THE TRANSISTOR

# A picture report of progress

**FIRST TRANSISTORS** were of this point contact type (picture three times life size). Current is amplified as it flows between wires through a wafer of germanium metal. These transistors are now being made at the Allentown plant of Western Electric, manufacturing unit of the Bell System. They will be used in a new selector which finds the best routes for calls in Long Distance dialing.

**NEW JUNCTION TRANSISTORS,** still experimental, also use germanium but have no point contacts. Current is amplified as it flows through germanium "sandwich" —an electron-poor layer of the metal between two electron-rich ends. This new transistor runs on as little as *one-millionth* of the power of small vacuum tubes.

**MUCH HAD TO BE LEARNED,** especially about the surface of germanium and the effect of one part in a million of alloying materials. Transistors promise many uses—as amplifiers, oscillators, modulators . . . for Local and Long Distance switching . . . to count electrical pulses.

**ASSEMBLY PROBLEMS;** such as fixing hair-thin wires to barely visible germanium wafers, have been solved through new tools and mechanized techniques. Finished transistors withstand great vibration and shock. Engineers see many opportunities for these rugged devices in national defense.

**MOIST PAPER AND COIN** generate enough current to drive audio oscillator using junction transistors. Half as big as a penny matchbox, an experimental two-stage transistor amplifier does the work of miniature-tube amplifiers ten times larger.

A tiny amplifying device first announced by Bell Telephone Laboratories in 1948 is about to appear as a versatile element in telephony.

Each step in the work on the transistor . . . from original theory to initial production technique . . . has been carried on within the Laboratories. Thus, Bell scientists demonstrate again how their skills in many fields, from theoretical physics to production engineering, help improve telephone service.

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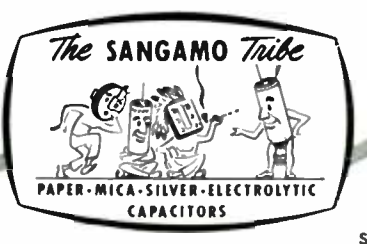



IN CANADA: SANGAMO COMPANY LIMITED, LEASIDE, ONTARIO

SC52-1

# 1,945 New Television Stations

*. . . . The second U.S. Television boom is now on. . . . . .*

By HUGO GERNSBACK

THE long interdict of new TV station construction was rescinded by the Federal Communications Commission on April 14, 1952. The so-called television "freeze" had run for three and one-half years, during which time only the 108 television stations, now on the air, went into operation.

The future transmitter construction program will eventually put on the air in continental U. S. a total of 2,053 v.h.f. and u.h.f. television stations.

When this program is completed, there will be almost 350 cities with television stations instead of the 65 cities operating transmitters now. Recognizing the great power of television in the educational field, the FCC has assigned 242 channels to non-commercial educational stations, 115 in the present v.h.f. band and 127 in the u.h.f. band.

The FCC wisely inaugurated the television station freeze in 1948 because of the then-prevailing great interference of the low-band v.h.f. channels and to forestall the otherwise inevitable chaos of interference between television stations.

It should be realized that the coming second television boom which the unprecedented number of projected TV stations is bound to bring, will not come overnight. Fortunately for the economy of the country, it will be extended over many years. The reasons for this are simple. To begin with, completely equipped television stations are not built overnight. Moreover, prospective television station owners must first be licensed by the FCC in Washington. This means hearing after hearing to ascertain who is entitled to get such a practically priceless license, and what the prospective owners in turn will do for the public's good. A television station nowadays is a tremendous responsibility, and it cannot be one hundred percent commercial. It must render a valuable service to the public. Hence, long extended hearings are in prospect in Washington.

It should also be noted that the majority of the new stations will not be connected with present networks—and may never be—on account of their geographical location. This means that most of the new stations will have to be independent, using local talent and motion pictures almost exclusively.

It is felt that within about five years, all the 1,945 new stations will be operating full blast, blanketing the entire country with television. This contrasts with the fact that only 60% of the U. S. population has television today. In the future there will be few sizable towns that will not have one or more television outlets.

Fortunately, there is at present no freeze or shortage of television equipment. The manufacturers of television transmitter equipment had foreseen the lifting of the freeze and had made preparations to meet it. The prospective television station operators therefore will have no difficulties in building their stations as fast as they have been licensed by the FCC. According to the *Radio and Television Manufacturers Association*, more than 20 stations in cities not now served by TV will be operating before the end of the year.

What does the second television boom mean to the country's economy? Benjamin Abrams, president of the Emerson Radio and Phonograph Corporation, predicted in the middle of April that the industry's present annual turnover of two billion dollars would reach five billion to six billion dollars within three years. All sources agreed that the new boom will be one of the important factors in the national economy, and is certain to last for five years and in our own estimation perhaps longer.

The reason for the last statement is that it is fairly certain that the boom will be extended beyond five years, when color television has come into its own.

Up to the present time, American manufacturers have produced 17,000,000 television sets. Spokesmen for the industry assert that by the time all of the new television stations are operating, there will be over 50,000,000 TV sets in continental U. S.

From the servicing, converting or adapting standpoint of television sets now in use, it is interesting to note that for once American manufacturers had foreseen what was ahead. Many of them had for years designed their sets in such a manner that they could be adapted to the new u.h.f. stations with little additional cost. Tuning strips will be supplied—they are even available now—by many of the television set manufacturers whose sets use turret tuners. Thus the service technician can convert a receiver to receive one or two u.h.f. stations in a matter of fifteen minutes to one-half hour by means of a tuning strip supplied by the manufacturer. The cost in many cases will not be much more than $10.00 per set. Converters will be available for sets which do not use turret tuners, or where a larger number of u.h.f. stations are to be received.

Set manufacturers also say that the u.h.f. sets will give better pictures in some instances, for the reason that these frequencies are not so sensitive to man-made static caused by home appliances, X-ray, diathermy and other electrical apparatus.

In the past, the radio press has been criticized by some members of the radio servicing industry who felt that radio magazines and the press in general have devoted too much space to television. Inasmuch as a large part of the country from which such complaints originated was not served by television, this criticism was understandable. All such objections have now been removed and radio technicians who have not had a chance to service television receivers before, now have the opportunity of their lives. They should immediately get ready for the coming boom in their sections of the country if they wish to share in the new prosperity.

**We have mentioned before, and we now reiterate, that radio technicians in areas soon to be equipped with television must immediately take active steps to become expert in television servicing. The best way to do this is to get a television chassis and go to work on it and familiarize oneself with its intricacies. Nor is it necessary to work on a "dead" set. Even if there is no television station in the neighborhood, many tests can be made with a signal generator, which all service technicians possess. And with a good, high antenna some excellent dx is bound to be received in all parts of the country during the summer season. Nor is it necessary to buy a brand new television set. Many dealers in the larger cities all over the country have second-hand 10-inch chassis for sale at low prices. They are ideal for the purpose.**

# START YOUR TV HOUSECLEANING NOW

"Now is the time—" This will be a busy summer for TV. Sell maintenance for slack-time profit

By JOHN B. LEDBETTER

EVERY TV receiver, regardless of age or make, should be given a thorough inspection, tube-check, and cleaning at least once a year. In a year's time, the cumulative effects of heat, tube-aging, vibration, and dirt invariably degrade the picture.

Normally, the most logical time for cleaning and overhauling a set is in summer, when the average owner uses it least. This summer, however, the presidential nominating conventions and the following campaigns will stimulate televiewing to an all-time high.

Start your own campaign, by mail, newspaper advertising, or phone, reminding your customers of what the summer will mean on TV. When you get a receiver, be sure to cover *everything*. Make a brief but thorough inspection of the chassis for corrosion, loose mountings, dust, and wax. Examine the wiring, terminal strips, components, and sockets for evidence of overheating or arcing, poor terminal contacts, and poorly-soldered joints. After this, you can proceed with the cleaning chores.

## Cleaning the picture tube

Wear protective goggles when you remove the picture tube. As soon as the tube is exposed, lay a heavy canvas cloth or towel over the top and sides as added protection. This may seem repetitious or over-cautious, but take a look at page 114 in the February issue of RADIO-ELECTRONICS. This shows what *can* happen when a kinescope implodes.

Clean the tube face with a soft, lint-free cloth dipped in mild soapy water (or use regular window cleaner). *Do not* wipe the glass with a dry rag—it may scratch the surface and pave the way for a subsequent implosion. Clean the inside of the safety glass in the same way and dry with a soft paper towel or lint-free tissue. If lint collects on the safety glass, remove it with the furniture-cleaning attachment of a vacuum-cleaner. This is much more effective in removing lint than blowing or attempting to wipe it off with a cloth or brush. Several portable-type vacuum cleaners are now available which will serve this purpose very well.

In restaurants and taverns, nicotine- and grease-laden smoke deposits a yellowish coating on the safety glass and face of the picture tube. Owners of these sets should have them cleaned regularly (at least twice a year, and oftener if required). Check the position of the mask—it should fit snugly around the picture-tube face as dirt and grease will accumulate very quickly. In many cases this can be corrected by sealing the mask to the picture-tube face with masking tape. Sealing the edges of the tuner shield compartment in the same way will keep grease from getting into the head end and seriously affecting reception.

For cleaning rubber ring masks or gaskets, use a piece of soft cotton saturated with carbon tetrachloride. Be careful not to get the liquid on any plastic mask or insulating sleeve.

## Cleaning the receiver chassis

A layer of dust on the chassis reduces normal air circulation around the tubes and other components. In addition, it increases the danger of arcing and breakdowns (especially in the high-voltage power supply) by absorbing moisture. The best way to clean the set is with the vacuum-cleaner attachment mentioned above. A blower is *not* recommended because it only blows the dust *into* the set where it may cause trouble on switch contacts and other moving parts. After cleaning, make sure all tubes, tube shields, connectors, and leads are in place and properly seated.

## Refinishing wood cabinets

After the picture tube and chassis have been cleaned, start on the cabinet. Usually the finish will show some damage, but with a little effort it can be made to look like new. Here are a few hints on cabinet rejuvenation—BUT—if you have never done any cabinet refinishing don't practice on TV receivers! Learn the game on some of those old radio sets the customers didn't call for. Strange and irreversible things can happen when a green man and a rag of furniture stain get together on a good cabinet.

**Wax spots, polish marks, cloth burns.** For high-gloss finishes use Johnson's new liquid cream wax polish. Rub gently with a soft cloth. For satin finishes, saturate a soft cloth with rottenstone and light machine oil and rub lightly *with* the grain until the marks disappear. Another method is to use a soft cloth saturated with Simoniz cleaner. Rub gently with the grain. *Never use circular motions or rub across the grain.*

**Minor scratches.** Use regular furniture polish, a polish stick, or analine dye (available at most furniture repair shops). If the scratch has not completely penetrated the finish, take a fine needle and carefully scratch through the surface to the wood. This allows the stain to soak *into the wood* instead of merely filling in the hard top finish. Analine dye should be applied carefully with a small water-color or camel's-hair brush. Apply several times if necessary until the scratched area matches the cabinet finish in color. Wipe the excess from the surface and allow a few minutes for drying before wax or polish is applied.


**Deep scratches.** If not too deep or conspicuous, try filling in with varnish stain or a polish stick. (One of the furniture touch-up kits now on the market will help here). If the scratch is deep or if it has chipped off any veneer, stripping, or inlay, *leave it alone or turn the job over to an experienced furniture repairman.* Wood fillers seldom produce satisfactory results in these cases.

**Liquid marks, cigarette burns, other "party hazards."** These usually damage the finish permanently and make it necessary to call in a cabinet refinisher. (Some dealers and distributors maintain their own cabinet repair departments—you might check on this in your own locality.) Small, slightly-damaged areas may respond to one of the wax-spot treatments already described.

**Finger-marks.** Remove with warm water, mild soap, and a soft cloth. Dry quickly. In some cases blowing on the spot and quickly wiping with a soft, dry cloth will remove them. Do *not* use carbon tetrachloride or similar cleaners on any plastic surface.

**Candy marks, food marks, grease spots.** Use warm water, a soft cloth (and mild soap if necessary). *Do not* scrub, but rub gently *with* the grain. Dry and polish with soft tissue or a soft, lint-free cloth, and finish with furniture polish or cabinet wax.

**Pencil marks, crayon marks.** Remove with Simoniz cleaner and polish with a soft cloth. Carbon tetrachloride, benzine, gasoline, or other available cleaning agents can be used on *wood* cabinets if removed immediately and the surface polished with a good wax or furniture polish. An art gum eraser is effective on pencil marks if they have not dented or punctured the finish.

**Fingernail polish.** If damage is not too serious, try softening with nail-polish remover. (Extreme care is required to prevent further damage to the finish.) Remove with Simoniz cleaner and polish to the desired luster. If the finish is damaged, try one of the wax-spot methods to smooth out the surface. If the damage is extensive or too noticeable, turn the cabinet over to a professional refinisher.

## Refinishing plastic cabinets

**To clean:** Use mild soap and a soft cloth dampened with warm water. Do *not* use carbon tetrachloride or any kind of cleaning powder which contains fine abrasives or chemicals. These will ruin the finish and roughen or even dissolve the plastic.

**To polish:** Use Simoniz Kleener, Johnson's Carnu, Wright's Silver Cream, or equivalent. Apply with a soft, lint-free cotton cloth or tuft of absorbent cotton.

**Soft drinks, liquids.** These will roughen or pit plastic surfaces. To restore the finish, try rubbing with No. 0000 steel wool, moistened with light sewing-machine oil. (*Do not* use this method on lacquered or enameled surfaces.) Polish with Johnson's new liquid cream wax or a similar high-luster wax.

**Aerosol bombs, DDT, similar liquids.** Direct application may attack the surface of plastic cabinets and plastic safety masks. If the mask is fogged or roughened, it must be replaced. If the damaged area is small, try rubbing it *gently* with Bon Ami or similar cleaner and then buff with jewelers' rouge. Apply these with a soft, damp cloth. Apply pressure with the tips of the fingers. If this smoothes the area, finish by polishing with Glasswax.

**Scratches on plastic cabinets.** Extreme care is required in removing these scratches. The following method will be satisfactory in many cases:

a. Use No. 400 sandpaper; apply with a generous amount of water. Use free, easy, circular motions in applying. Finish with very light strokes.
b. When the area has been sanded, clean thoroughly with wet cotton, then dry with a clean tuft of cotton.
c. Apply polish generously and rub vigorously with rapid circular motions. Several minutes may be required to give a good luster.
d. Remove the polish with a damp piece of cotton and dry with another piece. Go over the entire area if necessary with another piece of dry cotton.

## Materials for touch-up work

You can do these jobs faster and more efficiently if you have the following items arranged in a portable case.

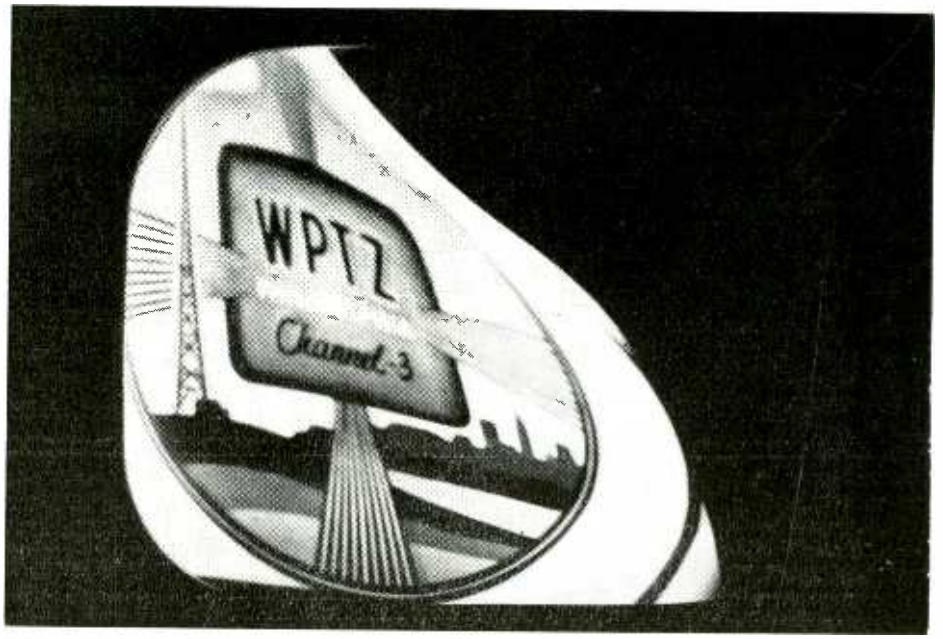
1. Hand-type vacuum cleaner with furniture-cleaning attachment.
2. Assortment of small camel's-hair brushes.
3. Small bottle of carbon tetrachloride.
4. Several clean, lint-free cloths.
5. Touch-up kit for cabinet work.
6. Small-size Johnson's new liquid cream wax.
7. Small amount of rottenstone.
8. Small can of 3-in-1 machine oil.
9. Small jar of Simoniz Kleener.
10. Small bottle of furniture polish.
11. Polish stick.
12. Small vials of analine dye (mahogany, walnut, etc.).
13. Small bottles of walnut and mahogany varnish stain.
14. Razor blades (single-edge for safety).
15. Several small pins or needles.
16. Small can of benzine.
17. Small bottle of nail-polish remover or solvent.
18. One-half bar of mild (vegetable) soap.
19. Small jar of Wright's Silver Cream.
20. Small roll of absorbent cotton.
21. No. 0000 steel wool. Wrap to prevent mixing with other items.
22. Several sheets of fine sandpaper (No. 400).
23. Small can of Bon Ami.
24. Small jar of jewelers' rouge.
25. Small bottle of Glasswax.
26. Small bottle of window cleaner

Assembling all these items and fitting them into a small bag may represent quite a job. It is entirely practicable, however, and will save you many steps as well as providing you with materials *when you need them!*

—end—

# hard-to-locate TV TROUBLES

There's a solution to every TV service problem —often of the "Why didn't I think of that before?" variety. Here are a few that had an expert guessing.




Picture distortion caused by proximity of speaker magnetic field.

By WALLACE WANER

WHEN the experienced television technician runs across a "toughie" in his daily servicing, he usually sets it aside until he has gone through the receivers that have lesser troubles. Then his procedures usually include signal tracing, voltage and resistance checks, and other tests until the fault is finally located.

On occasion, however, he runs into a real sticker which taxes not only his ingenuity but his patience. Ordinary checks often fail to localize the defect and the problem child defies time-tested and usually reliable methods of diagnosis. Eventually, after endless chain-smoking and head scratching, he stumbles on some simple little item that takes only a few minutes to correct. Admirably refraining from throwing his v.t.v.m. through the picture tube, he sits down and wonders how he can avoid this time-consuming and nerve-racking experience in the future.

Unfortunately, however, he rarely comes up with any pat solution. Next time he may get an entirely different set of symptoms and find the same part responsible as in the previous case. The only thing he really learns is to be suspicious of *every symptom* in such instances and to exhaust every possible cause and effect. Swallowing his pride and consulting other experienced men also helps. After all, if doctors need an occasional consultation, the television technician should not feel any hesitation in doing likewise. Maybe the other fellow doesn't have the answer either, but he probably can add to your "could it be this or that" routine, and between the two of you the trouble can often be found in much shorter order.

Just to nudge you into adopting such an open-minded attitude, let's run over a few of the tougher problems which had to be solved recently by one eastern service shop. Perhaps you will be smarter than we were, and put your finger on the sore spot right away. To us, however, these and many prior toughies no doubt contributed to the distinguished gray which now graces our temples. While this may capture the adoring glances of the female of the species, we'd rather dispense with the charm and knock these television headaches out in quicker time.

## Check the line voltage!

One problem which defied routine checks was a Hallicrafters T-54 7-inch receiver which had developed severe vertical and horizontal sync instability. The condition seemed to be intermittent and on occasion the receiver would be perfectly stable. The set was removed to the shop and thoroughly checked. All tubes, parts, and voltages were found to be normal. The set was run for two days yet developed no horizontal sync instability. It was returned to the customer and immediately the sync instability returned.

At first it was suspected that the line voltage was below normal, but inasmuch as the customer had a 17-inch receiver in the same home which was working perfectly, no a.c. voltage check had been made. This oversight was, of course, our first mistake. Upon checking the line voltage in the evening it was found to be less than 100. After additional thought the solution became apparent. The Hallicrafters, like many other receivers, uses a low-voltage tripling system to develop the proper plate potentials for the vertical and horizontal sweep oscillators. (See Fig. 1.) A voltage tripling system suffers more severely than a conventional power supply during line voltage fluctuations. Thus, if the line voltage is 115 volts, an unloaded voltage tripler develops over 460 volts because the capacitors charge to the peaks of the rectified a.c. signal. Under load, however, the voltage may drop to about 306. If the line voltage decreases to 90 (a 25-volt difference) the final voltage in the tripling process may reach only

200, *a 100-volt difference*. This was the cause of the instability. A line regulator transformer solved this problem.

### A tube teaser

Another case of unstable horizontal sync occurred in an Emerson receiver using Synchroguide horizontal lock. The vertical was relatively unaffected, though the hold control seemed critical. Again, all parts, tubes, and voltages were normal. The step-by-step alignment procedures for the Synchroguide were undertaken with an oscilloscope but this was no help. The sync separator and amplifier tubes and their associated resistors, capacitors, and voltages were checked. Again, nothing seemed amiss. Finally, even though the tubes checked well in an emission-type tube tester, the tubes in the sync-separator and amplifier circuits were replaced. This cured the trouble. It was found that the sync amplifier tube had varying characteristics which caused intermittent output amplitude.

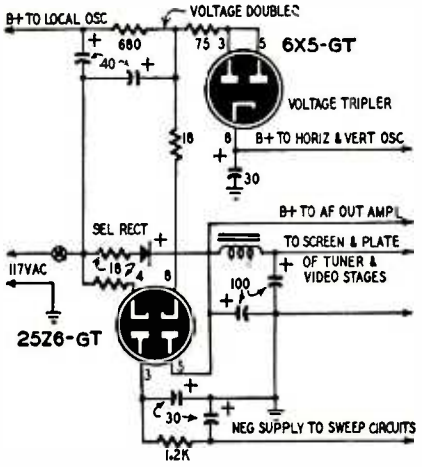



**Fig. 1—Voltage tripling system used in Hallicrafters TV models T-54 and T-155.**

The Synchroguide responds to the *area* of the signal at the grid of the control tube. For this reason, manufacturers strive to present a constant amplitude sync level to the Synchroguide circuit. This solution also helped the vertical system, although this does not rely as much on sync amplitude as on the repetition rate of the incoming pulses.

### Laying a ghost

Another job which consumed considerable time before a solution was found was an Admiral 20A1 with intermittent ghost reception. Pictures were often ghost-free, but at other times pronounced ghosts were present. As there were no high buildings or water towers in the neighborhood, our first thought was that the characteristics of the tuner or video i.f. stages were changing and causing an unsymmetrical bandpass. If the bandpass of the video i.f. stages is such that it is humped at the high-frequency sidebands of the television carrier, it will often pulse video-amplifier stages into momentary transient oscillation at the higher modulating frequencies. This can simulate ghost reception.

A check at the shop showed the i.f. response to be correct and the set operated normally. When the set was returned, the intermittent ghost reception appeared again. Upon further checking it was found that the reflections were coming from another receiving antenna off the path of the stations in the area.

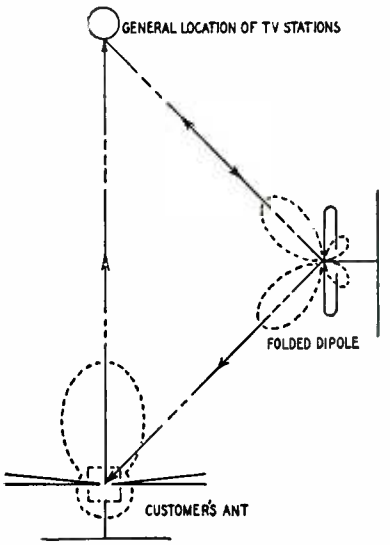



**Fig. 2—Ghost signals were caused by re-radiation from a distant rotary antenna.**

This is shown in Fig. 2.

The offending antenna was motor-driven. When rotated, it would, in certain positions, reflect sufficient signal to cause ghost reception. Additional checks indicated that this condition is much more pronounced when the two antennas have the same physical length. This condition is also aggravated by antennas having two primary lobes, such as a folded-dipole with reflector working on the higher channels.

There was nothing that could be done except to ask the owner of the offending antenna to keep it stationary or to erect a screen between the customer's antenna and the remote antenna. It was found that a small section of chicken-wire screening, erected eight feet away from the antenna, and grounded to the roof, was sufficient to suppress the undesired reflections.

### The perfect alibi

Manufacturers are sometimes at fault. They will bring out a new model and publish complete service notes for it. Often, however, field tests and reports from dealers indicate that certain circuit changes should be made. Future runs of this model are modified, and supplementary service notes covering the changes are issued. Thus, unless such design changes and corrections are made by the servicing technician, a characteristic trouble may never be entirely corrected. The technician should always check to see if supplements have been issued.

Possible faults or omissions in the original assembly should not be overlooked. In one instance, a pronounced buzz was traced to the speaker. It was found that the leads running to the speaker terminals were mechanically fastened but not soldered.

Another instance which proved particularly troublesome occurred recently in a receiver of a well-known make. The picture and raster were intermittent but the sound was all right. Checks were made at the grid of the picture tube and the associated controls. All voltages were normal and remained stable for hours of operation. Even the picture tube socket was inspected and found to be all right. A new picture tube was about to be installed when one of the technicians applied pressure to the base of the original tube and found that it was loose. A closer inspection revealed that some of the socket pins were not cleanly soldered. As the base cement was not holding to the glass neck, the pin leads were unsoldered and the base removed. Two of the wires were found badly tarnished and had been cold-soldered during the tube assembly.

Each lead was cleaned and tinned and the base reconnected and recemented. This cured the trouble.

### Divide and conquer

Some cases are recurrent and eventually are recognized for that reason. Earlier, we had a habit of replacing only one of a pair of parallel 5U4 rectifiers if one of the tubes went bad. This often resulted in the new tube carrying most of the load. Manufacturers use paralleled low-voltage rectifiers for the prime purpose of distributing the load evenly between the two tubes. When one is replaced, it will have greater emission than the old one and the current will be unevenly divided. The new tube will have a much shorter life than if both tubes were replaced. This is also good practice in high-voltage systems where two 1B3 or 1X2 tubes are used in voltage-doubling circuits.

Mistakes are costly in terms of wasted time. One of our men had placed a chassis on its side to replace a low-voltage filter capacitor. When finished he checked the receiver without putting it right side up, and got the picture shown in the photo on the opposite page. After an hour of frantic (and useless) linearity and centering-control adjustment he found the trouble. The speaker was wedged under the glass picture tube and its magnetic field was distorting the beam. Fortunately the tube was not metal, or we would have had a demagnetizing job to perform. Which just goes to show, you never know what you'll run up against next in this TV business. Never a dull moment, though.

—end—

# short circuits

A discussion of new features in the circuits of modern television sets and 3-way portables

By ROBERT F. SCOTT

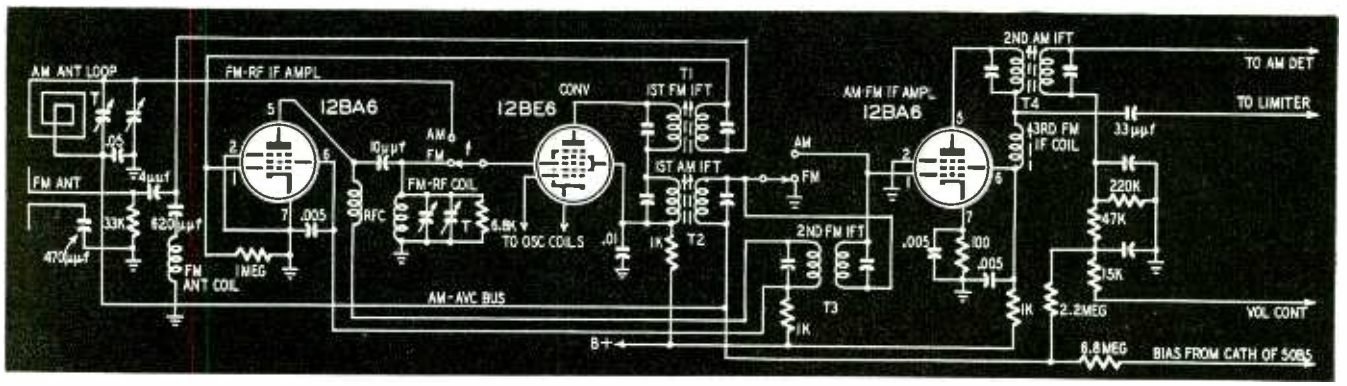



Fig. 1—A partial schematic showing the operation of the reflexed r.f.-i.f. amplifier used in the G-E model 218 receiver.

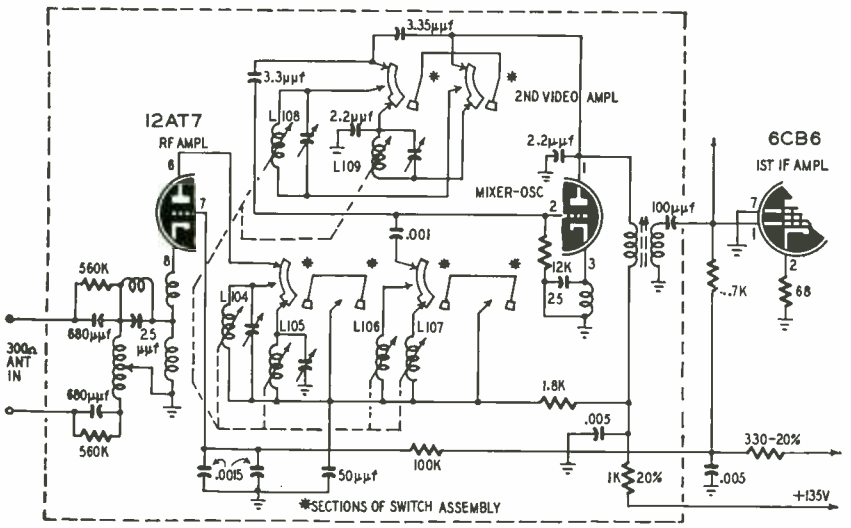
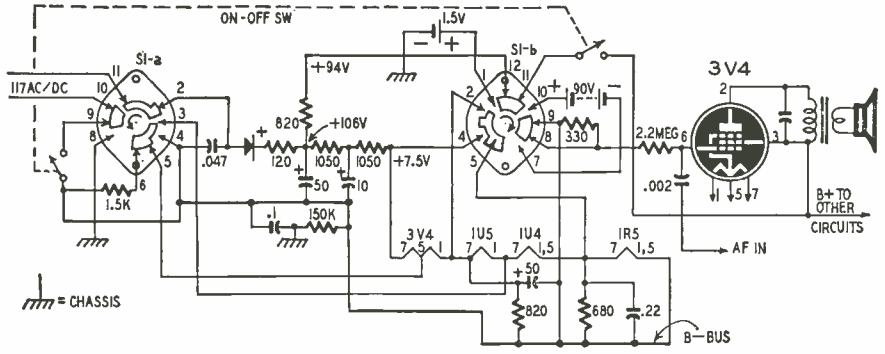



Fig. 2 (above)—Diagram of the 1-tube TV tuner used in some Tele-Tone chassis. Fig. 3 (below)—Diagram of the filament switching circuit in the Philco 51-629.




SOMETIMES we feel that a title like "The Unexpected" or "Surprise!" would be far more descriptive than the one which we have chosen for this column. The drawing-board wizards and assembly-line Houdinis are certainly coming up with some shockers. We have been keeping an eye on foreign receiver circuits for a few years and are not too surprised when we see an r.f. or i.f. amplifier also used as an audio amplifier. But when we find a set in which the r.f. amplifier serves as a reflex i.f. amplifier, as in the G-E 218 6-tube AM-FM receiver, it's time to swear off and reach for an aspirin. The reflex circuit of this set is shown in Fig. 1.

On FM operation, the 12BA6 acts as both r.f. and i.f. amplifier. The signal from the antenna is developed across the antenna coil and fed *through the secondary of the first FM i.f. transformer* T1 to the grid of the 12BA6 amplifier. The r.f. signal is amplified and fed through a 10-μμf coupling capacitor to the grid of the 12BE6 (The r.f. choke has sufficient reactance to prevent the FM r.f. signal from straying into the primary of the second FM i.f. transformer.) The r.f. signal is reduced to 10.7 mc and appears in the primary of the first FM i.f. transformer. The signal in the secondary is fed back to the grid of the first 12BA6 now operating as first FM i.f. amplifier.

From the plate of the 12BA6, the signal passes through the r.f. choke to the primary of T3, the second FM i.f. transformer. The signal then passes from the secondary of T3 to the grid

of the second 12BA6 which is used as the first AM and second FM i.f. amplifier. The amplified 10.7-mc signal next appears across the third FM i.f. coil where it is coupled into the grid of a 12AU6 limiter (not shown) through a 33-μμf capacitor.

On AM, the circuit is more conventional. The signal is fed from the AM loop antenna directly to the grid of the 12BE6 converter. The 455-kc AM i.f. signal passes through T2 to the 12BA6 i.f. amplifier, then through T4 to the AM detector and a.v.c. diode of the 19T8. The a.f. signal follows the same path as it does during FM operation.

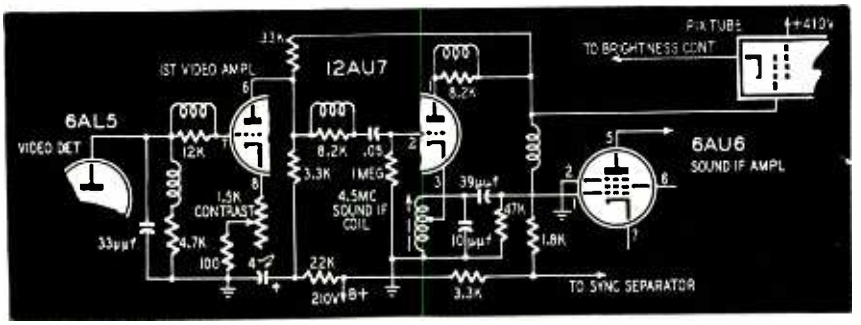



Fig. 4—Interesting sound take-off employed in a number of Majestic models.

## One-tube TV tuner

Have you ever seen a one-tube TV tuner? If you haven't, take a close look at the next Tele-Tone TV set that comes in. If it uses a TAM or TAP chassis, you are likely to see one lone 12AT7 on the tuner chassis. This tube performs the functions of r.f. amplifier, mixer, and oscillator. The TV band is covered in two ranges, channels 2 through 6 on one, and 7 through 13 on the other.

One triode of the 12AT7 is a grounded-grid r.f. amplifier—a circuit which minimizes oscillator radiation through the tube into the antenna while generating comparatively little noise. See Fig. 2. The remaining triode is the oscillator and mixer. The various channels are selected by a combination of variable-inductance and variable-capacitance tuning. The r.f. amplifier plate coils L104 and L105, mixer coils L106 and L107, and oscillator coils L108 and L109 are stamped into bakelite sheets sandwiched between movable brass plates which act as the rotor plates of a capacitor. The oscillator is a modification of the familiar ultraudion. The sound i.f. is 21.25 and the picture i.f. is 25.75 mc.

## Three-way filament operation

The filament switching circuits of many 3-way portables are complex and are likely to cause trouble for the service technician who is not too familiar with them. Therefore, we will discuss the switching circuits of a typical 3-way portable.

Fig. 3 is the circuit used in Philco's 51-629. The voltage-selector switch S1-a and S1-b is shown in the LINE position. When the on-off switch is closed one side of the power line connects to B minus through the on-off switch and contacts 9 and 10 of S1-a. The other section of the line connects through contacts 2 and 11 to the selenium rectifier which supplies A and B voltages. Contacts 5 and 6 connect a shunting resistor between the center-tap of the 3V4 and ground. Pin 1 of the 3V4 is 4.5 volts positive with respect to the grid. This voltage provides fixed bias for the 3V4 during line operation.

Approximately 94 volts from the B supply is fed to the plates and screens through contacts 11 and 12 of S1-b. Part of the output of the selenium rectifier is dropped to 7.5 volts for the filaments. The 820- and 680-ohm resistors carry the cathode currents of tubes between the dropping resistor and B minus. Contacts 8 and 9 of S1-b ground the grid return of the 3V4.

For battery operation, sections 8 and 9 of S1-a connect the B minus bus to the chassis through the on-off switch. Sections 4 and 5 connect the 3V4 center tap to B minus. One of the filament pins of the 1U4 and 1U5 is connected to B minus through sections 3 and 4 of S1-a. The ungrounded filament pin of each tube in the string is connected to the positive side of the 1.5-volt filament battery through contacts 1, 2, 4, and 5 of S1-b. The negative side of the filament battery connects to the chassis so the line switch must be on and S1 set for battery operation before current can be drawn from it.

Sections 10 and 11 of S1-b connect the positive side of the 90-volt B battery to the B plus line in the set. Sections 7 and 8 connect the negative side of the battery to the junction of the 330-ohm and 2.2-megohm resistors so the smaller resistance is between B minus and ground. This resistor biases the 3V4 during battery operation.

## Novel sound take-off

In most intercarrier TV sets, the sound is taken off either at the output of the video detector or the plate circuit of a video amplifier. The novel arrangement shown in Fig. 4 is used in the Majestic 700, 712, and 801. These sets have a 2-stage video amplifier using a 12AU7. The sound take-off is in the second video amplifier stage which has its cathode grounded through a tap on the 4.5-mc sound i.f. coil.

—end—

## TV DX IN JUNE

If you've had the idea up to now that TV dx is something that happens to somebody else, June is your month. Sporadic-E dx occurs somewhere in the United States practically every day.

June, 1951, reports received by RADIO-ELECTRONICS showed 26 days of dx, and there is every reason to expect that 1952 will be at least as good; perhaps better, as there is some evidence to indicate that sporadic-E dx is more prevalent in years of low sunspot number.

Dx reception will be frequent in the mid-morning hours, dropping out usually around the middle of the afternoon, and often returning in the early evening. The best dx will usually be over by 10 to 11 p.m., local time, but as the month wears on, late-evening reception will become more common. In fact, there will be times in the latter part of June when dx will be receivable during just about any hour that there are stations on the air in the right places.

The most frequently logged distances will be 600 to 1,100 miles, but intense ionization will bring the skip distance down to as little as 300 to 400 miles at times. Ionization over wide areas simultaneously will make multiple-hop effects possible, and the distance you can cover will be limited only by the number of stations on a given channel. Eastern viewers who don't mind staying up until their nearer stations have left the air should be able to log some West Coast stations, though the multiple-hop reception will not generally be as good as the single hop. Reports of reception in excess of 1,500 miles, particularly, are solicited.

Though the main item of interest to the TV dx enthusiast will be the sporadic-E skip sessions, we should not overlook the possibilities of tropospheric dx, particularly on the high channels. Along both our coasts, all across the southern part of the country, and in the region around the Great Lakes, June will provide the kind of weather that makes for considerable extension of the normal reception range. Look for excellent high-band reception in the early morning hours, particularly on fair calm days. Late evening hours will also provide good hunting on the high channels. (The normal range will be extended on the low bands, too, but tropospherically reflected signals may often be obscured by sporadic-E dx on channels 2 through 6.)

While all this early-summer dx will be fun for the viewer who is interested in long-range propagation, it will be a source of trouble for TV technicians. A high percentage of TV set owners are interested only in entertainment. Few of them will know what causes the pile-up of signals that is almost certain to occur when stations a thousand miles away start rolling in with almost local signal strength.

—end—

# TV SERVICE CLINIC

**Conducted By**

**MATTHEW MANDL***

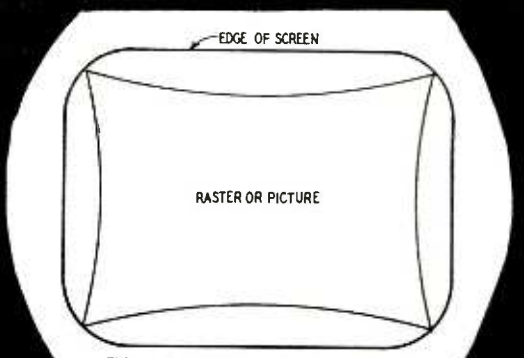



Fig. 1—"Pincushion" effect.

MANY of the new receivers use the curved-face (or so-called "cylindrical") rectangular tubes designed to eliminate room glare. These include the 17LP4, 17QP4, 21EP4A, 21FP4A, and 21KP4A. When a cosine-wound yoke is used with these tubes for sharp edge-to-edge focus, pincushion effects are set up.

To eliminate them, two magnet slugs are placed above and below the tube at the beginning of the flare. These magnets extend slightly beyond the frame of the yoke housing and are suspended by an adjustable wire support.

When replacing defective picture tubes of this type, the magnets may have to be readjusted, particularly if they are accidentally moved from their original position.

Unless a station pattern is on, or a cross-bar generator used, the pincushion effect may not be too noticeable. But when viewing televised scenes with vertical or horizontal sections, the viewer would notice the bending effect and distortion. Adjustments are simplified if the picture size is reduced slightly so the pincushion effect is noticeable as shown in Fig. 1. The magnets should then be adjusted until the picture is perfectly rectangular, after which the size can be increased to fill the mask properly.

This adjustment will not correct poor sweep linearity or overdrive conditions. Such defects must still be overcome with the usual controls.

Another factor important in servicing such television receivers: Adjustments of the centering ring may disturb the edge-to-edge focus procured from the cosine yoke. Thus, after positioning the picture with the centering ring adjustment, check the edge-to-edge focus by closely observing whether the horizontal line trace is sharp along its entire length.

If this is difficult to see, misadjust the vertical hold control slightly until the picture rolls slowly. This will eliminate interlace and cause line-to-line pairing. Under this condition the line structure is heavier and edge-to-edge focus is easier to check. Readjust the focus control and recheck picture centering, for the focus control has a slight effect on picture position. Finally, readjust the focus control until full beam clarity is regained.

Also check the ion trap magnet. Too weak a magnet will make it difficult to eliminate corner shadows at the setting which gives maximum brightness. Incorrect ion trap magnet position will cause ion burns eventually—the length of time depending on how far off true position it is. (See the article on that subject in the February, 1952, issue.) If the magnet is weak it may have to be placed closer to the focus unit. The fields of the latter will influence the ion trap and make it difficult to adjust either one correctly. A new ion trap magnet is relatively inexpensive and can save costly picture tubes as well as permit you to make proper adjustments for better performance.

## Intermittent interference

*In a location across the street from a high-voltage substation there is an intermittent roaring noise from the speaker, accompanied by sync loss. Could this noise and interference originate in the substation? J. P. F., Roan's Prairie, Texas.*

It is quite possible that an intermittent high-voltage arc at the substation could cause the symptoms you describe. When this condition again occurs, remove the antenna lead-in from the receiver to see if the interference decreases. If the noise is still present, the a.c. mains are feeding it into the receiver. A line filter would then help.

This test, however, could also indicate that the trouble might be a loose or intermittent connection within the receiver itself. This can be verified by trying another receiver in the same house.

If the interference is from a radiated source the solution is more difficult. You will have to get the power company to check their equipment to eliminate the arcing condition, for at such a close distance little can be done in the way of antenna line filtering.

## High-voltage rectifier troubles

*In a Sylvania model 7120BF receiver I've had to replace the 5642 high-voltage rectifiers repeatedly. Some picture blooming now occurs. R. L. B., Canton, N. Y.*

The high voltage circuit of this receiver uses the voltage-doubling principle with two 5642 rectifiers. Try a 3.3-ohm resistor in series with the filament wire to the tube which burns out more frequently. You could also rewire the circuit to accommodate the more rugged 1B3.

## Replacement tuners

*Would fringe area reception be improved by the installation of one of the new type front ends using the cascode circuits? Would the receiver or tuner require alignment after installation? C. E. C., Lynchburg, Va.*

The new front ends containing the cascode tuner have exceptional characteristics for fringe areas. They have considerably more gain and much less snow effect than the older tuners. Most of these replacement tuners are accurately tracked at the factory, so extensive realignment procedures would not be needed. Usually all that is required is a slight retouching of the output picture and sound coils. Complete installation information is usually furnished with the new replacement tuners. Make sure you get one to match your present i.f.

## Booster oscillation

*I have three boosters hooked up to an RCA 630TS. All the boosters are of different makes but all use 6AK5's. I have trouble keeping them from oscillating between each other. Would you tell me how to keep them from oscillating? R. D., Washington, D. C.*

Your boosters oscillate because of overloading the inputs to the second and third booster. Virtually all boosters are designed for the specific purpose of building up a very weak signal. When you inject the output of one booster into another, the second booster (and third) receive signals far in ex-

* Author: *Mandl's Television Servicing.*

cess of those for which they were designed. This trouble often occurs when *two* boosters are placed in series and would be even more likely with your combination of three.

You could install gain controls in the first two boosters so the output of each one does not overload the next one. These could be potentiometers in the cathode circuits. They would regulate the bias, and thus the gain. The potentiometers should have slightly more resistance than the existing cathode resistors. With sharp-cutoff tubes the control would not be as effective as with remote-cutoff types.

## Tuner trouble

*I have installed a new Standard tuner in an RCA 8-T-243. The tuner works all right except for channel 5. For this station there is a difference of about 3 or 4 turns of the oscillator screw between the sound and picture. How can I correct this trouble? B. D., Knowlton, Quebec, Canada.*

As there is an appreciably greater difference in the trimmer adjustments of the oscillator screw on channel 5 than on other channels, it may indicate improperly adjusted coils. Since the coils are of the snap-in type, you can remove the two and increase the coupling between the coil sections. This will increase the band-width and might give you both picture and sound for one setting of the oscillator trimmer adjustment.

This receiver is of the split-sound type and will always receive best picture and best sound at slightly different settings. The receiver should be adjusted for best sound for both the oscillator set-screw and the fine-tuning control.

If coil correction cannot cure the trouble, you can get coil replacements for channel 5.

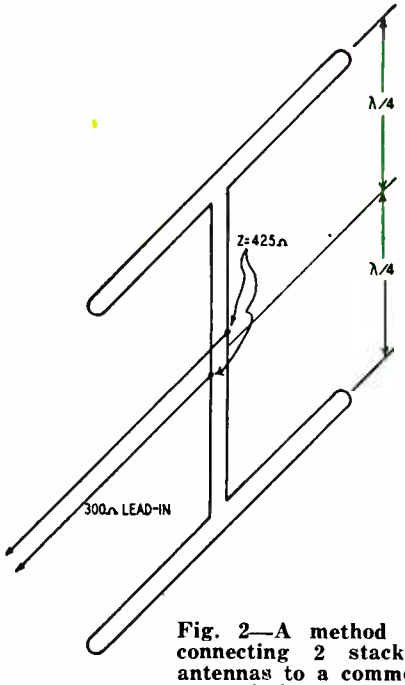



**Fig. 2—A method of connecting 2 stacked antennas to a common transmission line. Although folded dipoles are shown, the method and impedance values shown in the drawing apply equally to vertically-stacked Yagi antenna arrays. Matching section is described in the text.**

## Interference traps

*What can be done to reduce diathermy interference? I have tried homemade traps, but these had little effect except to reduce signal strength. E. M., Ottowa, Ontario, Canada.*

Probably your homemade traps were tuned within the television band and therefore diminished the desired signals instead of the interference. Try commercial traps; these are calibrated at the factory and are more effective. They are made by several companies, including Drake, JFD, and Telematic. The JFD BR 106-10-30 is for shortwave and diathermy from 30 to 60 megacycles. The BR 106-60-90 is for diathermy or other interference from 60 to 90 megacycles, as is also the Telematic WT-16. The Drake model is the TV-300-50HP. A number of manufacturers will now supply traps gratis for any of their models subject to such interference.

## Stacking Yagi antennas

*We are located in an extreme fringe area and receive channels 3 and 6 from Omaha and channel 4 from Kansas City. The five-element tuned Yagi antennas have proved satisfactory, but I would like to stack this type. What is the best spacing? W. H. K., Mankato, Kansas.*

For best reception with the Yagi antennas you should stack them one-half wave-length apart. In this manner you will get true broadside reception with a gain increase of approximately 4 db. Often, broadband antennas are stacked less than this to favor the higher channels, but, since you are using a single channel Yagi, a half-wavelength spacing is recommended. Use parallel bars to interconnect the two and feed them in the center. See Fig. 2. The impedance of the matching section should be 425 ohms. This may be ¼-inch tubing spaced 4½ inches or No. 12 wire spaced 1½ inches. You'll get additional gain if you use the double-stacked Yagis for one channel because stacking gives the 4-db gain mentioned above.

## Antenna choice

*In this area all channels (2 through 13) are broadcast from Mount Wilson, about 90 miles away. Evidently a Yagi would not be suitable because it is not broadband. What suggestions do you have for an antenna system? J. J. D., Edwards, Calif.*

If all your channels are broadcast from Mount Wilson, 90 miles from your receiver, you could use a stacked biconical antenna array with reflectors. If it is mounted high enough you should get good results. Use an open-wire transmission line for minimum lead-in loss. Use the biconical with three rods each side of the insulator, for this helps broadband reception and increases impedance. A Yagi would give some 5 db greater gain but—as you stated—would be narrowband. Some Yagis are available for two-channel operation but are not much use beyond that. Several Yagis, of course, could be used with separate lead-ins and a switch arrangement for antenna selection. If more gain is desired, use a booster.

## TV conversion for Europe

*I am planning to send a television set to my brother in Sweden. He is located 12 miles from a TV station which is transmitting on a frequency similar to channel 3 here. They use FM for the sound and AM for video but they are using a system of 625 lines and 25 frames.*

*The set I expect to send is an RCA Victor, model 17T172.*

*I am wondering how many changes would be necessary to make this set work over there. G. A., North Wildwood, N. J.*

You mention that the receiver is to be used in an area where a system of 625 lines and 25 frames is used. This would give a horizontal sweep frequency of 15,625 in contrast to the 15,750 in use in the United States. This would be close enough so that no changes need be made in the horizontal sweep circuit. Possibly, slight readjustment of the hold control or the frequency control in the Synchroguide system may assure better stability.

The vertical sweep of the RCA is designed for 60 cycles, using the interlace principle. Our standards of transmission utilize 30 frames per second, interlaced 2:1, which results in 60 fields per second. We are using 525 lines per frame (525 times 30 equals 15,750). If this receiver is to be used with interlaced scanning at a 50-cycle rate, no vertical changes would be necessary either.

You should ascertain whether the power supply requirements in Sweden can be satisfied. Many parts of that country use 25 cycles. Is this receiver to be used in an area where 110-117 volts, 50 cycles is available?

Another factor would be the r.f. tuner. You mention that transmission is from a station on a frequency "similar to" channel 3. Possibly, slight oscillator slug adjustments would have to be made if there is a slight frequency difference. Other factors are bandwidth and type of transmission. The RCA is designed for a bandwidth of transmission in the tuner of 6 mc. U. S. TV standards call for vestigial sideband transmission and spacing of 4.5 mc between video and sound carriers, with the sound carrier 4.5 mc *above* the video.

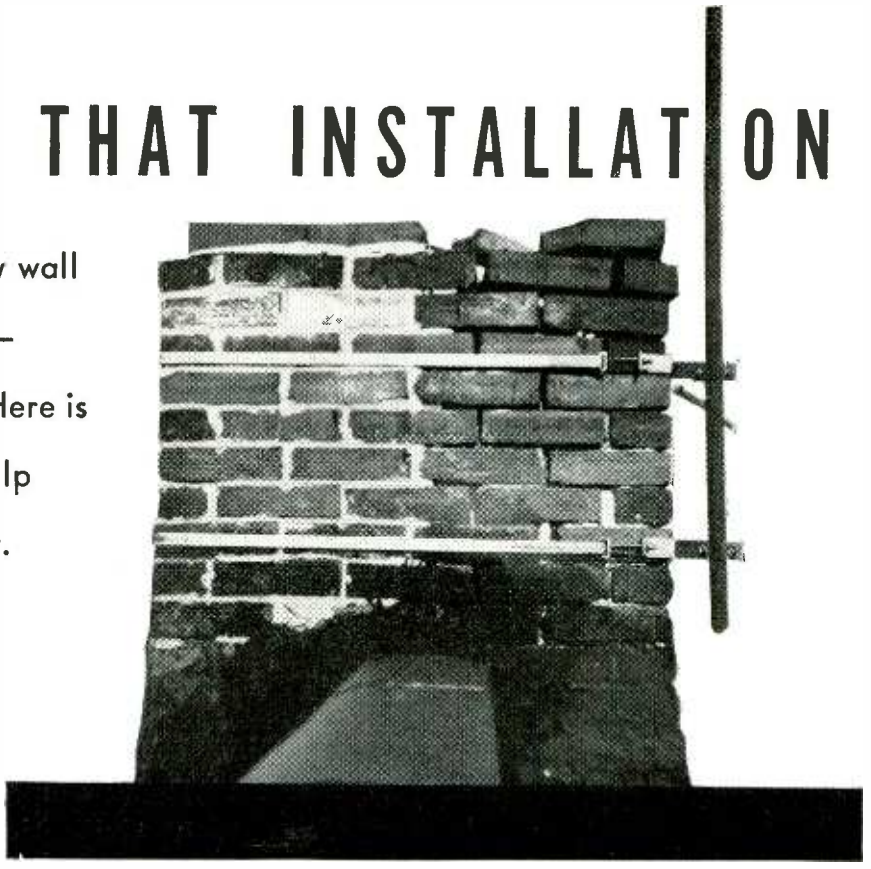
Note: Letters addressed to this Clinic are answered directly and those of general interest are published. When writing to this department enclose a stamped, self-addressed envelope and give model number of receiver, name of manufacturer, and chassis number. Include such information as antenna type, channel numbers of stations which can be received in your area, and what preliminary checks you have undertaken prior to writing us. Explain in detail exactly what the trouble symptoms are.

—end—

# BEWARE THAT INSTALLATION

Every chimney and party wall carries an invisible sign—"NO TRESPASSING!" Here is some advice that may help you avoid costly liability.

By H. L. MATSINGER



**Two costly mistakes for the installer: The antenna mounting straps cross the property line (marked by the parapet); the brickwork tells its own story.**

SUPPOSE that one morning while you are tangling with the innards of a recalcitrant receiver a customer dashes into your shop and excitedly announces that he is being sued because of an antenna installation that you made. Would you consider his remark preposterous and impossible? If you would, read on, brother!

On November 9, 1951, the Philadelphia *Evening Bulletin* carried the headlines: "Neighbor Sues Over TV Antenna; Court Suit Says That Mast Is On Wrong Roof." The article goes on to state that Robert and Maria Egizi of 913 South Delhi filed an injunction suit in Common Pleas Court against Alex and Ida Giordano, who live at 911 South Delhi, charging them with maintaining the antenna despite repeated requests to remove same, including a written request made on June 29, 1951. The suit asks relief from a number of retaliatory measures taken by the Giordanos, asks for removal of the antenna, and for $1,500 as punitive damages, holding that the presence of the antenna is a "continual trespass."

Unfortunately, this is not an isolated case, although few ever are brought to court. Normally, the aggrieved neighbor just goes to work on the moorings with a hacksaw or tinsnips. Dual chimneys, of the type commonly found in row-house construction, belong only in part to any individual owner. It is apparent, therefore, that when you use chimney straps to support a TV antenna on such a chimney, you are trespassing on the other man's property. This is true, not only of the straps but of any part of the antenna structure which may extend over the property line. The abutting owner, at his discretion, may insist upon the removal of all parts so offending, or trim them back to the property line.

If, in the process of trimming back the chimney straps, the antenna mast happens to fall down (and it likely will), your customer has no redress unless the straps have been trimmed too far. If you have failed to get a signed easement from the adjoining owner you have no recourse but to erect a new mast for your customer, since you were negligent in the original installation.

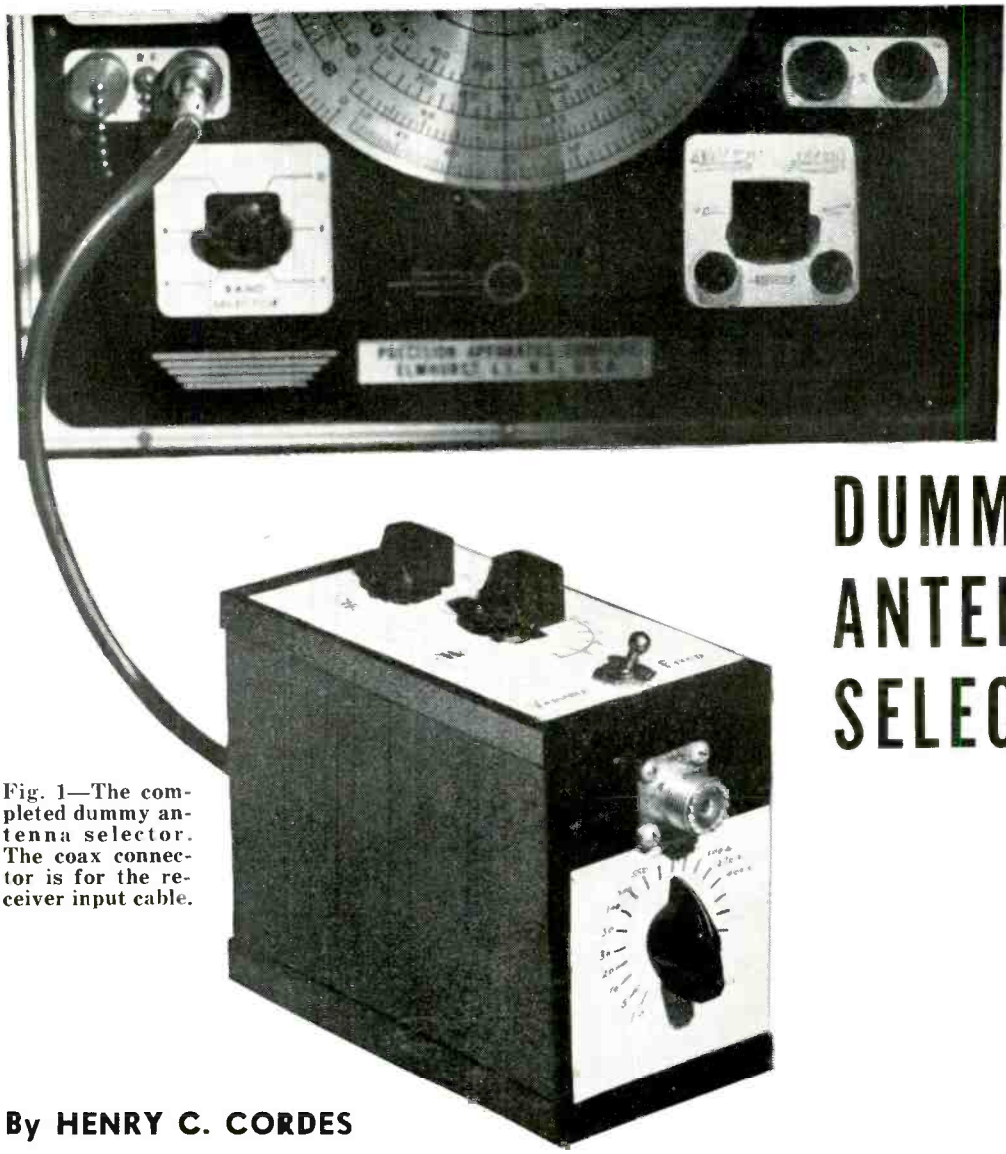
Aside from the legal aspects of chimney mounts, certain mechanical considerations are also involved. Brick chimneys, being a layer type of masonry, do not offer very high resistance to a bending moment or torsional type of strain. This means that when straps are used, the continual swaying of the antenna and mast will loosen and eventually ruin any such chimney. Even the practice of inserting lead plugs in a top and bottom brick of the chimney is bad, for the strain is concentrated on these two bricks, and in a very short time the mast is likely to be leaning at a precarious angle.

Then, too, when the antenna and lead-in are mounted over the flue, hot corrosive gases play over the elements and connections, while soot deposits create a low-resistance short circuit. Naturally, this will reduce the efficiency.

To be on the safe side, it is always best to mount the antenna in the center of the roof if possible. Mount the mast on a plank or block of wood to prevent piercing the roofing, and use a floor flange or a base collar to keep the end of the mast from kicking out. Add a mast ring, and at least four guy wires, with turnbuckles to permit adjustment, and anchor the ends with adequate screw-eyes. If you do this you can feel reasonably certain that you will have no nasty come-backs. It is highly improbable that this type of mounting will blow down, even in an extremely heavy wind, but if it does the antenna will remain solely on the property of your client.

(In many localities, building department and fire department regulations may require installation of an antenna in such a manner that its movement or collapse will not endanger, damage, or obstruct access to adjoining property. Deeds and leases on semi-detached or row-type structures often contain restrictive clauses of the same character. Even if the antenna structure is to be entirely on your customer's building, and there is no normal trespass on adjacent property, you should check the possibility of existing restrictions for your own protection. Remember that the liability is yours, and that lawsuits are expensive even if you win them.—*Editor*)

The photograph accompanying this article serves to accentuate the main points made, and to act as a signpost for your guidance. —end—



# DUMMY ANTENNA SELECTOR

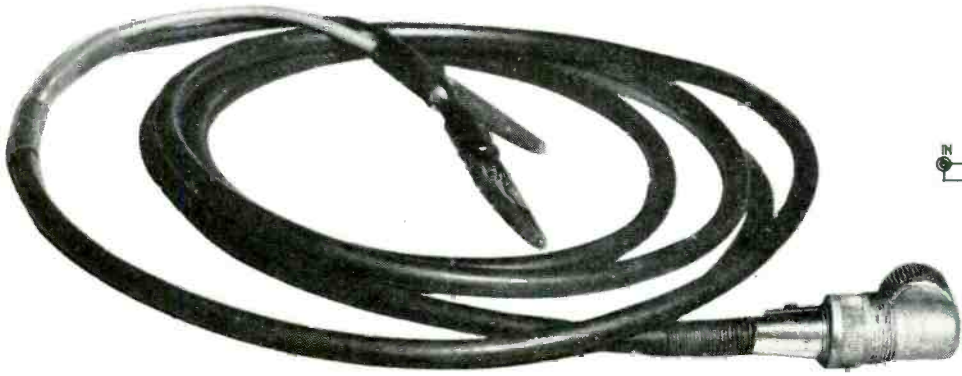
Fig. 1—The completed dummy antenna selector. The coax connector is for the receiver input cable.

**By HENRY C. CORDES**

EVERY receiver alignment job calls for the use of one or more different dummy antennas between the signal generator and the receiver. Most technicians have an assortment of made-up dummy antennas lying around *somewhere*. These usually consist of a resistor, a capacitor, or an unmounted combination, with a clip at one end for connecting to the receiver, and a fragile bare wire lead at the other end for the signal generator cable clip.

Whenever one is needed, the technician generally has to dig it out of a box of miscellaneous junk, only to find that one of the leads is broken.

Since the number of types required is already large and is constantly increasing, the well-equipped service shop should have some device for quickly selecting the right unit and automatically connecting it in the generator output circuit. An additional advantage of such a device would be to simplify



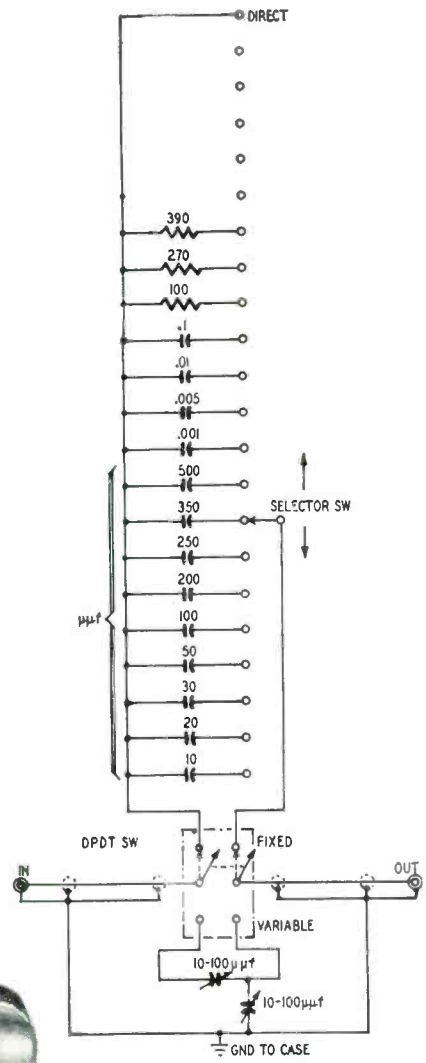



Fig. 2—Schematic of selector unit.

the connections to the receiver. Instead of cluttering up the chassis with a bulky network and an assortment of clips (especially when working with miniature tubes), the dummy antenna selector could be installed at or near the signal generator, and only a single cable run to the receiver. This would also reduce the radiation problem.

After much planning and experimenting this versatile dummy-antenna selector was born. It was built in a metal can from an old auto-radio power supply. Any enclosed metal box large enough to accommodate the components without too much crowding may be used.

Fig. 1 shows the completed unit and the locations of the controls. On the front panel are the dummy-antenna selector switch and the output jack. On the top are two variable-capacitor control knobs and a d.p.d.t. VARIABLE-FIXED switch. These variable capacitors are connected in a series-parallel arrangement required only for aligning the front ends of some late-model auto radios. Technicians who do not handle this type of work can omit these capacitors and the VARIABLE-FIXED switch.

The circuit diagram is given in Fig. 2. The dashed lines show the connections with the VARIABLE-FIXED circuit eliminated. With the d.p.d.t. switch in the FIXED position the selector switch connects the desired dummy antenna in series with the hot side of the signal-generator output cable. The selector switch used in this model had 22 taps, but any nonshorting switch with at least 17 taps may be used.

The sizes of the fixed capacitors and resistors were selected after a detailed search through many volumes of service manuals, as representing the most commonly needed values. Special dummy antenna networks can be inserted in the external circuit, as described later.

In the VARIABLE position of the d.p.d.t. switch, the special series-parallel combination for auto-radio use is connected between the generator and the receiver. The variable capacitors are of the straight-line-capacitance type, to simplify calibration.

## Construction details

If used, the variable capacitors should be mounted at least one-half inch apart at their nearest points to minimize interaction. Leads to the variables should be dressed away from each other and from all other wiring and the case. Do not use shielded wire for these leads. The series-connected variable capacitor must be completely insulated from the case.

For best results and minimum size the fixed capacitors (up to .01 μf) should be of the ceramic type. Half-watt resistors are adequate. One lead from each fixed capacitor and resistor is soldered to a common bus from the d.p.d.t. switch. Their respective opposite ends are soldered to taps on the selector switch, with the values increasing in the clockwise direction as viewed from the knob end of the shaft. Note that the last tap on the selector switch is connected directly to the bus bar. This feeds the generator output directly to the circuit under alignment, or permits the insertion of special dummy antennas between the output cable and the receiver. Unused taps on the switch may come in handy later if additional dummy antennas are required.

Drill a hole in the metal housing for the shielded input cable, and ground the shield to the housing. The hot lead is connected directly to the d.p.d.t. switch. Also ground the shielded lead to the output jack. A jumper wire between the shields of the input and output cables inside the unit insures good ground continuity.

The dial scales were made from white card stock cemented to the top and front of the case and marked with India ink. The variable-capacitor circuit was drawn on the top scale to show the function of each control.

Based on the manufacturer's rating of the variable capacitors, the low point on each calibration scale was marked 10 μμf, and the high point 100 μμf. The mid-point was marked 55 μμf. Other capacitance values were marked off uniformly in proportion. (*These markings may be inaccurate, especially at the low end of the scale, because they do not include stray capacitances. If possible, the actual values should be measured on a bridge after the unit has been completed.—Editor*)

The unit is connected to the generator via the new input cable. The original generator test cable is connected to the selector output jack.

## Testing the selector

The selector unit can be tested with a signal generator, an ordinary radio, and an output meter.

Turn on the generator and the radio and allow time for thorough warmup. Set the generator and radio to the same frequency and connect the output cable from the selector unit to the receiver antenna post. See that the switch is in FIXED position. Set the selector switch on the .1-μf tap. Connect the output meter across the receiver voice coil and adjust generator and volume control for normal output.

Switch the selector to the next lower sized dummy. A lower reading should be noted on the output meter. Each successive reduction in the size of the dummy antenna capacitors should result in a lower output reading.

The resistor dummies can be checked with an ohmmeter between the input and output cable ends.

There may be a few types of sets which require dummy antennas which cannot be simulated by this selector. Even in these cases it will be useful, as the setup usually will call for only one or two resistors or capacitors in addition to those in the unit.

One point should be checked regardless of which selector you decide to build. The selector-switch arm must make perfect contact with all taps for trouble-free operation.

### Materials for dummy antenna selector

**Resistors:** 1—390 ohms, 1—270 ohms, 1—100 ohms, ½ watt.

**Capacitors:** (Paper) 1—0.1 μf, 400 volts. (Ceramic) 1—10 μμf, 1—20 μμf, 1—30 μμf, 1—50 μμf, 1—100 μμf, 1—200 μμf, 1—250 μμf, 1—350 μμf, 1—500 μμf, 1—.001 μf, 1—.005 μf, 1—.01 μf. (Variable) 2—100 μμf max. midget air trimmers (National UM-100, Hammarlund APC-100, Bud LC-2081, or equivalent.)

**Miscellaneous:** 1—single-circuit rotary switch, 17 or more contacts, nonshorting type (Mallory 13124L or equivalent); 1—d.p.d.t. toggle switch; 1—coaxial output connector, chassis type; 1—coaxial input connector, cable type (see text); 2 feet signal generator cable; 1—6 x 5 x 3-inch metal box; wire, solder, hardware, knobs.

—end—


*Suggested by Burton J. Teague, Canton, Ohio*

"The set fades a lot."

# AVOID LAWSUITS


Costly legal pitfalls may trap the service technician or dealer. Some recent adverse decisions should serve as warning guideposts.

By LEO T. PARKER*

RADIO and television technicians and dealers will do well to keep informed of new higher court cases involving others in the same business. A great deal of money, time, and effort may be saved by *avoiding adverse lawsuits.*

In the following higher court decisions, various points of law are discussed which may help readers avoid suits, or win those which are unavoidable.

## Law of warranties

Higher courts now consistently hold that a seller who breaches his warranty or guarantee must take back the subject of the sale and refund *the full purchase price,* plus interest. Therefore, sellers of radio and television sets must avoid making unreasonable guarantees such as that "the set will operate satisfactorily to the purchaser," or that "satisfaction is guaranteed."

For example, in *Keeler v. General Products, 75 Atl. (2d) 486,* the testimony showed facts as follows: A restaurant owner bought a television set from General Products for $1,523.25. The purchase was made in reliance upon the assurances of the seller's president and vice-president, and one of its salesmen, that the set would operate satisfactorily in his town. However, it failed to provide good reception, and the seller replaced it with another model. The same officials renewed their assurances of satisfactory performance by the substitute set. The second set proved to be no better than the first. The purchaser then demanded the return of the purchase price and offered to return the set, which was in substantially the same condition as when delivered. Although the demand was repeated on numerous occasions, the seller refused to accept the set or to refund the money. The restaurant owner sued the seller to recover the full purchase price of $1,523.25 plus legal interest.

The higher court promptly ordered the seller to take back the television set and refund the full purchase price. The higher court said:

> Several remedies were available to the plaintiff upon the breach of warranty. He elected to rescind the sale. When the defendant refused to take the set back, the plaintiff held it as bailee and acquired a lien thereon to secure repayment of the purchase price.

The seller could have avoided an adverse decision in this litigation by proving that its officers and salesman had merely represented that the television set would operate *as satisfactorily as other sets at the same price.* However, when the officers and the salesman made a positive statement and guaranteed that the set "would be satisfactory," the purchaser had a legal right to sue and recover the full purchase price upon proof that the set did not operate *satisfactorily to him.*

## Uncertain sale contract

Higher courts now consistently hold that all contracts of sale are void if made through error, violence, fraud, or menace. Hence, where a purchaser proves that he did not receive *what he thought he was purchasing,* there is no valid contract, and the purchaser may compel the seller to take back the merchandise and refund the purchase price.

For example, in *Jake v. Blem Electrical Company, 46 So. (2d) 631,* these facts were proved: The Blem Electrical Company, a retailer of television receivers and other appliances, had in its employ a salesman who was learning to sell television sets. He sold the plaintiff a television set for an agreed price of $1,095.00, plus an installation charge of $200.00, and taxes and freight charges of $48.85, or a total amount of $1,343.85, to which were to be added finance or carrying charges. The purchaser made a deposit of $100.00, and verbally obligated himself to pay a further sum of $350.00 cash when the set was delivered, and to execute a note for the unpaid balance. It is important to observe that two disinterested witnesses were present when the order was placed with the salesman.

When the television set was delivered it was not in a cabinet, but was mounted on a chassis and enclosed by a steel frame. Later a service technician volunteered suggestions as to the manner in which a cabinet might be constructed to enclose the set. It was then that the purchaser realized that a misunderstanding might have occurred, and he immediately telephoned the seller, stating that he was rescinding the contract because he had been under the impression that a "beautiful cabinet" would enclose the set.

In subsequent litigation the higher court held that the seller must take back the television set and refund the payments. This court said:

> "After carefully considering the record, our opinion is that there was never a meeting of the minds as between plaintiff and defendant's representative, with respect to the sale and purchase of the television receiver. We are impressed by the fact that plaintiff testified that C and S (the disinterested witnesses) were present during the entire negotiations leading up to the sale . . . The testimony convinces us that he did not get delivery of what he *intended* to buy . . .

This court explained that sellers of merchandise may eliminate controversies of this nature by having a written contract signed by the purchaser.

Therefore, the seller could have avoided taking back this television set if the salesman had been provided with a *printed* order form which the purchaser would have signed. Under these circumstances the court would *not* have listened to the testimony of the two disinterested witnesses in favor of the plaintiff. Verbal guarantees, statements, and assertions are *not* good evidence nor acceptable by the court when a written contract determines the legal rights and liabilities of the contracting parties.

Motto: Never sell any merchandise on a verbal agreement. Always have the purchaser sign an agreement printed, typewritten, or written in ink.

## Repairman liable for tax

According to a recent higher court decision owners of television service shops must render bills to customers, *clearly separating material charges from labor charges.* Failure to do so renders the technician liable for the state's sales tax on *the full amount* of the bill.

For example, in *Muench v. Glander, 93 N.E. (2d) 606,* it was shown that a technician failed to charge any sales

*Attorney at Law, Cincinnati, Ohio

tax to customers for repairs. In subsequent litigation the higher court held that he was liable to the state for the sales tax on the full amount charged, notwithstanding the repairman had made no deliberate attempt to evade the sales tax law. The court said:

> Where a person sells material and in connection therewith furnishes labor or service in applying such material to his customer's property, the entire transaction shall be considered a sale and subject to tax, unless there is a clear separation, in the making or billing of a charge therefor, of the material furnished and the labor or service performed.

Here is a specific example: Assume that a television technician installs a part for which he charges 25¢. If he charges the customer $3.25, that is: 25¢ for the part and $3.00 for labor, *without separating the part cost from the labor cost*, he must pay the state a sales tax on $3.25. The technician *cannot* go back over his books and correct or separate the cost of materials from the labor cost. On the other hand, if the technician makes out a bill to the customer, or if the customer pays cash, the technician may enter the account as 25¢ for parts; $3.00 for labor, and he may pay the state's sales tax on only 25¢, instead of $3.25.

Don't forget this! If you do, two, three, or four years from now the state's tax collector may go back over your books and collect a considerable amount of delinquent taxes, plus heavy penalties.

### Minor cancels contract

Recently a higher court held that if a television dealer sells to a minor, the latter can rescind the contract, return the set at any time and demand refund of the *full* purchase price. This is so, although the minor's father may have signed the purchase contract, mortgage, or notes.

In *Davis v. Clelland, 92 N.E. (2d) 827*, minor sued a dealer alleging that as a minor he was entitled to rescind the purchase contract and recover the full purchase price.

The dealer defended the suit by contending that the appliance was purchased by the father of the minor. However, since the testimony showed that the title was made to the minor, the higher court held that the dealer must refund the full purchase price to the minor. The court said:

> If the father purchased it, the dealer was required by law to deliver to him the title. The source of the purchase money was immaterial as to the right of the defendant (dealer) and did not fix the identity of the purchaser.

In other words, irrespective of who pays the purchase price, the minor may rescind the contract and recover the full purchase price if the testimony shows that the seller delivered the merchandise to the minor.

—end—

Battery failures in portable equipment can be costly and aggravating. Here are some methods of preventing them.

# MONITORING BATTERY INSTRUMENTS

**By RUFUS P. TURNER**

IT'S often a good idea to use test instruments with self-contained batteries. Battery power allows operation at locations remote from power lines. It also provides complete isolation from the a.c. line and thus prevents introducing hum into either the instrument or the device under test. The battery unit is portable—often an important feature. Instruments in which battery operation frequently offer advantages include electronic voltmeters, oscillators and signal generators, distortion meters, frequency meters, wave-shapers, field-strength meters, and instrument amplifiers.

One of the annoying drawbacks of battery operation is the rapid rundown of batteries due to needlessly leaving the power switch in its ON position during periods when the instrument is not actually in use. This costly nuisance has caused much concern to users and designers of battery-operated equipment, and often prompts the sacrifice of the obvious advantages of battery operation in favor of more foolproof a.c. operation.

There are several practical ways in which battery power supplies can be monitored, and often protected, to prevent untimely exhaustion of the batteries. With civilian battery supplies still in uncertain condition and with high prices prevailing, it will pay builders and users of battery-operated equipment to utilize these schemes. The particular method chosen will depend upon a number of factors, mainly electrical and mechanical feasibility. The writer makes no claim to originality, since each scheme has been used in some piece of battery-operated electronic equipment. Our aim is to call attention to what can be done.

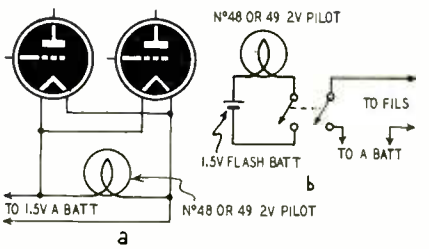



Fig. 1—Protection with low-current lamps.

### Pilot lights

The mere thought of a current-consuming pilot light in a battery power supply ordinarily creates horror. However, there are instances where the drain of an A-battery pilot light is not unreasonable. An example is the case of 1-volt tubes operated from a large-size dry cell. Type 48 (screw base) and 49 (bayonet base) lamps draw only 60 milliamperes at 2 volts and around 50 ma at 1.5 volts. This current drain is small for the protection provided, and a large-size cell will handle the load. The pilot light is connected in parallel with the tube filaments (See Fig. 1-a) and glows only when the A battery is switched on. For designers who do not favor the shunt connection, there are other methods of pilot-light operation.

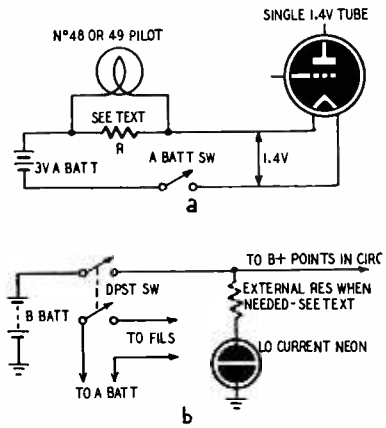
### Pilot light with separate battery

To remove extra drain from the A battery, a separate flashlight battery

may be provided for a type 48 or 49 pilot lamp. This lamp gives adequate light on 1.5 volts. By using a d.p.s.t. on-off switch, a separate set of contacts is provided for the pilot-light circuit. This arrangement is shown in Fig. 1-b.

## Pilot light in series with tube

The pilot lamp may also be operated in series with the tube filament so that it lights only when the switch is on.




This arrangement is shown in Fig. 2-a and is best applied to instruments and devices employing one tube.

A 3-volt A battery supplies the lamp and tube filament in series. When a 0.1-amp filament is employed, the lamp must be shunted with a 27-ohm, ½-watt resistor R. When using a tube with 0.05-ampere filament, no resistor is required across the lamp, but a 140-ohm, ½-watt resistor must be connected in parallel with the tube filament. In either case, burnout of the lamp will not damage the tube.

## Neon B-battery pilot light

When at least 90 volts of B battery are available, a low-power neon lamp (¼-watt or 1/25-watt size) may be connected as shown in Fig. 2-b to glow when the on-off switch is closed. Types NE-2 and NE-51 1/25-watt lamps, each require a 200,000-ohm external series resistor. In the ¼-watt group, types NE-17 and NE-48 require external series resistors of 30,000 ohms. All other ¼-watt types have built-in resistors. The technician who desires a more elaborate and economical set may use the blinker system described in RADIO-ELECTRONICS, October, 1949. The neon lamp, flashing only at intervals, uses negligible current and attracts more attention than a steady light.

## Switch flags

Where no extra current may be drawn from the batteries, on-off switches may be provided with eye-catching "flags" of one sort or another to signal the ON position. Individual mechanical ingenuity can provide many variations of this scheme.

Fig. 3-a shows a simple flag arrangement. A rotary on-off switch is provided with a disc-plate in which a hole or slot is cut. A piece of brilliant white paper or plastic is cemented to the instrument panel in such a position as to be visible through the hole when the switch is in its ON position.

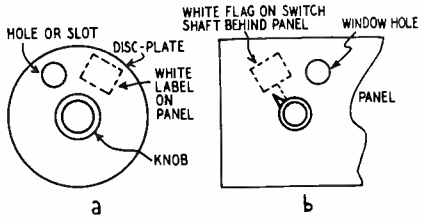



Fig. 2 (left)—Series pilot-lamp and shunt neon-lamp methods of monitoring.

Fig. 3 (above)—Eye-catching indicators mounted on the battery on-off switch.

Another scheme which may be used with a rotary switch is shown in Fig. 3-b. Here, a small white flag is attached to the switch shaft behind the instrument panel by a stiff wire or blade. A window-hole is drilled through the panel at a point where the flag will show through when the switch is on.

## Lid-operated switch

A scheme used by several instrument manufacturers, which makes it impossible to store the instrument with batteries running (provided the cover or lid of the instrument case is closed), is the lid-operated switch (See Fig. 4). The switch is a spring-return pushbutton type with normally-closed contacts. This switch is wired in series with the battery power supply and may be provided with two sets of contacts, one for the A battery and the other for the B battery. A small dowel or plug is attached to the inside of the lid so as to push down on the switch button when the lid is closed. This action opens the switch contacts and disconnects the batteries.

The on-off switch may be wired in series with the lid-operated switch.

## Additional methods

Where cost is not a factor, a miniature panel-type d.c. voltmeter may be connected in parallel with the tube filaments or wired from a B plus-circuit point to ground. This meter will serve the dual purpose of warning when the batteries are on, and also of showing continuously the condition of the batteries. In order to minimize drain, the meter circuit must have as high resistance as possible. Under no circumstances should this be less than 1,000 ohms per volt. In lieu of a voltmeter a plate current milliammeter in one B-battery lead may be used if desired.

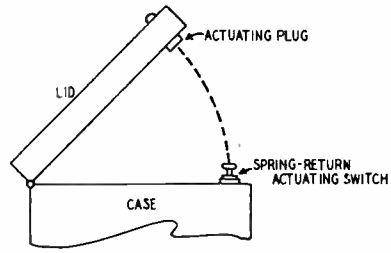



Fig. 4—Automatic protection for cased instruments with a lid-operated switch.

A small clockwork-driven switch may be employed as the regular on-off switch in battery-operated equipment. These mechanical timers may generally be set for any running time up to one hour, which would appear to be ample for most testing operations. Its timing action will be started automatically when the instrument is switched on, and the batteries will be switched off automatically at the end of the interval.

Undoubtedly, there are numerous other methods of signaling to the operator that his batteries are switched on. Only a representative few could be covered in this space, but the methods suggested should provoke thought on the part of technicians. Battery-operated instruments are preferable to line-operated devices in many applications, and their advantages should not be sacrificed because of fear that the batteries will run down through carelessness.

—end—

# A DYNAMIC SIGNAL TRACER

By W. CARL MARSH

Extra-sensitive r.f.-a.f. tracer has valuable features, many service uses

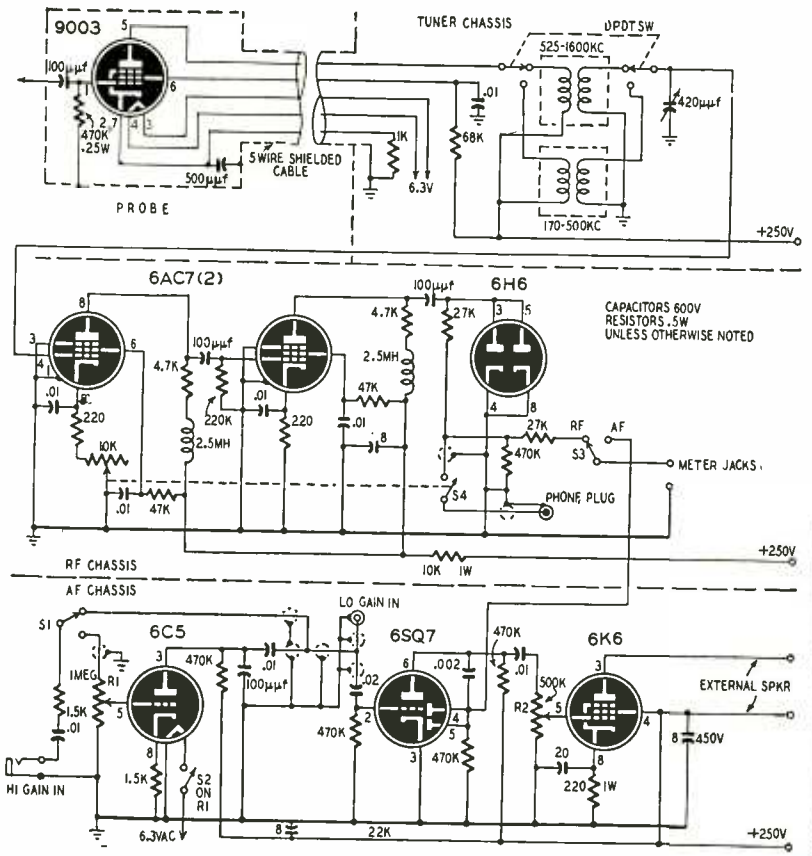



Fig. 1—Signal circuits of the tracer. Probe and tuner sections are at the top; the r.f. amplifier-detector unit is in the center; the audio amplifier at the bottom. The completed tracer is shown at the right. Its housing may be enlarged to accommodate the power supply and speaker.

SERVICE technicians have been offered many signal tracers which claim to trace the signal "from the antenna to the speaker", but they neglect to tell you that *you* have to furnish that signal, either from a strong local station or a signal generator.

We have no local stations where I am located. The nearest stations, WSM Nashville and WREC Memphis, are more than 100 miles away, so a signal tracer that will follow a signal from antenna to speaker has to be a sensitive one. With this in mind I have, through an evolutionary process, arrived at a practical and extremely flexible signal tracer. It has been used in my shop for approximately twelve months and is invaluable in saving time and eliminating some tough jobs of hunting with voltmeter and soldering iron. As proof of its sensitivity I can place the contact point of the prod against the insulation of my antenna lead-in and tune in half a dozen stations, including WSM and WREC.

The signal tracer is built in a steel cabinet 7½ x 12 x 7 inches. The schematic is shown in Fig. 1. Power supply and speaker were not included because I already had both built into my bench. Any power supply delivering 6.3 volts a.c. at 2.5 amps and 250 volts d.c. at 100 ma will serve the purpose.

The audio section is a straightforward 3-stage high-gain amplifier. Metal tubes should be used in the first two stages for maximum stability. The main volume control (R2) is in the grid circuit of the 6K6 with an auxiliary control (R1) at the input to the first amplifier. Where extremely high gain is not required switch S1 can be used to bypass the input stage. S2 is ganged with R1 and opens the 6C5 heater circuit when this stage is not used. A low-gain input connection is also provided for direct connection to the second stage.

A portion of the audio signal is rectified by the diode plates of the 6SQ7, and fed to one terminal of S3 for signal voltage measurements. Be sure to take proper precautions to eliminate feedback by liberal shielding and separation of grid and plate leads. The audio section is placed in the bottom of the signal tracer cabinet.

The r.f.-i.f. section uses two untuned 6AC7 amplifiers and a diode detector. The control in the cathode of the first 6AC7 is a sensitivity control. Switch S4 disconnects the output of the r.f. unit when only the audio section is being used, to prevent spurious sounds issuing from the speaker.

Each stage of this unit is completely isolated from the next by interstage shields. The interstage coupling-capacitor leads run through small holes in the shields. Be sure to use a bottom

shield as well to eliminate the possibility of pickup from the audio amplifier. The r.f.-i.f. amplifier is placed in the upper part of the cabinet with the tubes projecting through holes in the top.

After this unit has been completed and connected to the audio amplifier it can be tested by connecting an antenna, through a 100-μμf mica capacitor, to the input. (*Editor's note:* Temporarily connect a 10,000-ohm resistor from the grid of the first 6AC7 to ground.) As there is no selectivity in this unit several stations should be heard simultaneously.

The coils for the tuner were made from i.f. transformers with enough turns removed to bring the frequency up to the proper range and the primaries wound over the secondary. The tuning capacitor is a war surplus job and has a capacitance of 420 μμf, but any coil and capacitor combination that will cover the desired frequency ranges can be used. The ranges of this tracer are 170–500 kc on the i.f. band and 525–1600 kc on the r.f. band.

The probe assembly is shown in Fig. 2. The housing was made from the shell of an old MG type 6F6 tube. The crimps holding the shell to the base were pried out and the inside glass tube removed from the base. The guide pin was broken off and the hole enlarged to pass a 5-wire shielded cable. The base of another tube was also used as an insulating washer by grinding it down until it fit inside the shell. The cable was passed through the holes in the base piece and washer and connected to a 7-pin miniature socket for the 9003 pickup tube. A hole was made in the closed end of the shell to take a small feedthrough insulator. A long bolt through this insulator serves as the probe tip and connects to the 100 μμf mica isolating capacitor. Be sure to ground the shielding on the cable to the shell of the probe and connect an external ground lead and clip.

The tuner was calibrated with a signal generator. Broadcast stations can be used for the 525–1600 kc range if enough are available.

After calibration you are ready to use one of the handiest test instruments you will ever own. The possible uses are limited only by the ingenuity of the operator.

Due to the high sensitivity of this tracer it is not necessary to make actual contact with the circuits being tested. Thus there is no detuning of critical circuits.

To check a receiver oscillator, turn S3 to the RF position and connect a v.t.v.m. set to the 10- or 15-volt range to the meter terminals. Tune the receiver to the low end of the dial and add the i.f. to the dial reading. Tune the signal tracer to this frequency and hold the probe tip near the oscillator coil or tuning capacitor. If the oscillator is operating on or near the correct frequency, the meter needle will kick strongly as the tracer is tuned back and forth across this frequency.

To locate trouble in a dead receiver where supply voltages are normal, simply tune the receiver to the frequency of a strong station and trace the signal from grid to plate through each stage. Use the correct tuning range of the signal tracer for the r.f. and i.f. sections of the receiver. Only the audio section of the tracer is needed when you have passed the detector.

For testing phono pickups and microphones, simply feed the output into the proper stage of the audio amplifier. For crystal pickups use the low-gain input and volume control R2. If the crystal is good you will be able to hear the output with plenty of volume. With a standard test record and a good crystal pickup you can calibrate the v.t.v.m. for comparison checks. The high-gain input should be used for dynamic (variable-reluctance) pickups, and microphones.

If proper precautions and good workmanship are used in constructing this signal tracer, you will have an instrument that you will depend on more and more as time goes by. Many new uses will suggest themselves as you become more accustomed to handling your tracer.

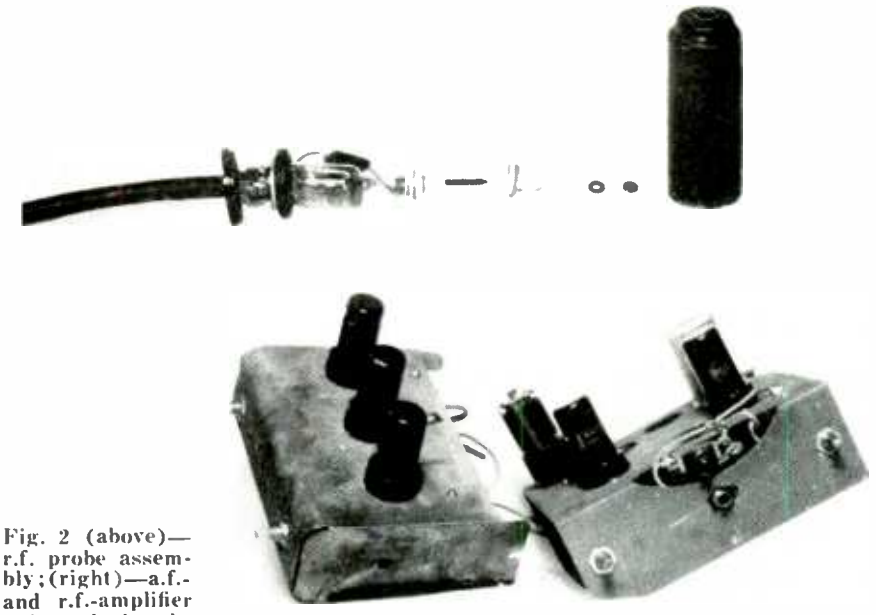
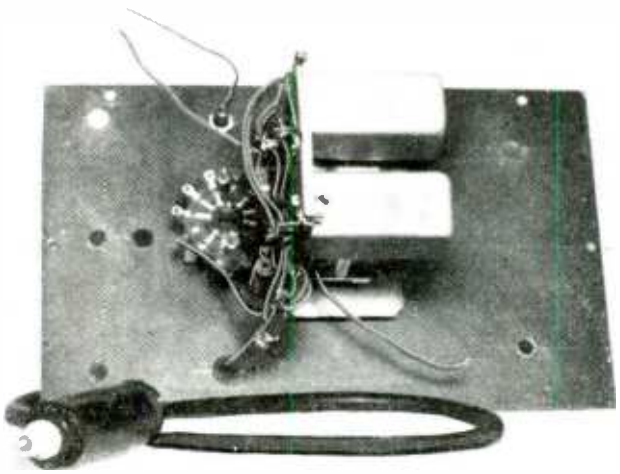


Fig. 2 (above)—r.f. probe assembly; (right)—a.f.- and r.f.-amplifier unit sub-chassis.



The r.f.-i.f. selector unit sub-assembly, shown mounted to the tracer panel, and the completed r.f. probe unit.

### Materials for the signal tracer

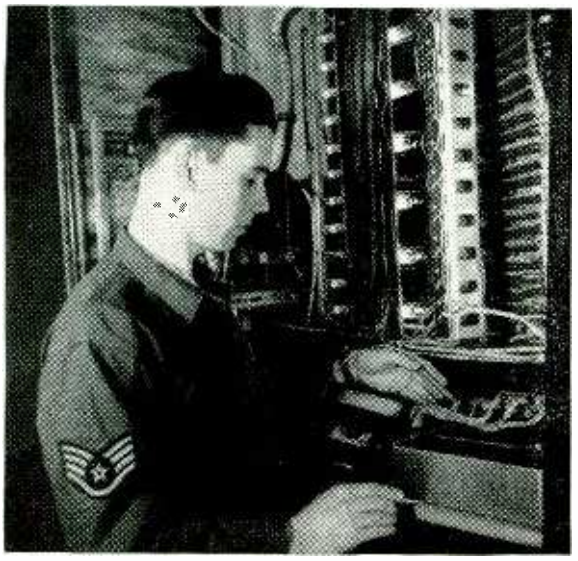
**Resistors:** 2—220 ohms, ½ watt; 1—220 ohms, 1 watt; 1—1,000, 2—1,500, 2—4,700 ohms, ½ watt; 1—10,000 ohms, 1 watt; 2—27,000, 2—47,000, 1—68,000 ohms, ½ watt; 1—220,000, 6—470,000 ohms, ½ watt; Potentiometers: 1—10,000 ohms; 1—500,000 ohms; 1—1 Megohm, with s.p.s.t. switch.

**Capacitors:** (Mica) 4—100, 1—500 μμf; (Paper) 1—0.002, 8—0.01, 1—0.02 μf, 600 volts; (Electrolytic) 2—8 μf, 450 volts; 1—20 μf, 25 volts. (Variable) 1—420 μμf (max).

**Miscellaneous:** Tubes: 1—6H6, 2—6AC7, 1—6C5, 1—6SQ7, 1—6K6-GT, 1—9003. Tube sockets. Coils (see text). Switches: (Wafer) 2—s.p.d.t.; 1—d.p.d.t. Cabinet. Chassis. Connectors. Hardware. Wire. Solder.

—end—

# VACUUM TUBE TRAINER HELPS STUDENTS



Checking the circuits of the vacuum-tube trainer.

Air Force trainees learn electronic principles from huge animated tube model.

By M/S FORREST C. WOLFERD

THE problem of constructing a classroom trainer that would clearly and swiftly demonstrate electronic activities of the radio vacuum tube was presented to me in March, 1948, while I was stationed at Chanute Air Force Base, Illinois. The "poser" was handed me by Major General Charles C. Chauncey, then deputy commander of the United States Air Force's technical training program. His decision to seek a new-type trainer was the result of advice from instructors that existing trainers and charts were hopelessly inadequate in helping a student to understand the elusive behaviorisms of the vacuum tube.

To assist in the construction of the trainer, I called on Technical Sergeant Robert C. Williams, a man with five years experience designing training aids for Army and Air Force schools. We decided on a device that would demonstrate every vacuum tube operation, from the diode to the pentode tube.

We wanted to show current and voltage variations, space charges, erratic movement, grid action, and secondary emission. We wanted everything that happened in an actual tube to occur clearly and simply on the face of our trainer.

To present these effects in a way that would appeal to students, we decided to use moving lights, similar to those seen on a theater marquee. These lights would vary in brilliancy to show changes in the amount of voltage; change colors to demonstrate polarity and increase or decrease in number to illustrate the strength of current. Lights would move about, imitating electron flow exactly.

In addition, all parts of the tube were to be included in the trainer, looking as much like themselves as possible.

Planning these effects was one thing—achieving them another.

We began construction with the face panel. Williams suggested all parts be made of Plexiglas, as it was durable, light, and easy to work and handle.

For our filament, we used a V-shaped rod, inside a half-cylinder representing the cathode. This was cut away in front so the filament could be seen.

Next came the grids—1-inch tubing curved like a coil. To reveal the lights demonstrating electron flow, they were also cut away.

We made the external circuits of half-inch plastic strips with corners beveled and outlined in black.

The plate element was a large half-cylinder which fitted over the other elements and grids.

All these parts were mounted on a translucent Plexiglas panel. The external circuits and grids were detachable and could be added one at a time to build in succession a diode, triode, tetrode, and pentode tube. The filament, cathode, and plate circuits, were cemented to the panel.

Behind the panel glowed the lights. Because of the translucence of the Plexiglas, the lights could be seen, but not as distinct individual bulbs. This gave a more realistic effect.

We then drew up the arrangement of all bulbs within the tube. We arranged the bulbs in 43 horizontal rows, 44 to a row. Even-numbered rows showed normal electron flow and odd-numbered rows demonstrated space charge, erratic movement, and secondary emission.

Each of the even-numbered rows was cut in half, placing 22 bulbs on each side of the cathode. Each side was then divided into four circuits of 5 to 6 bulbs each. The divisions were: (1) cathode to control grid; (2) control grid to screen; (3) screen to suppressor; and (4) suppressor to plate.

In the odd-numbered rows we used 24-bulb circuits to demonstrate erratic movement and secondary emission. All remaining bulbs showed space charges.

External circuits for the filament, control grid, and screen grid came next. They contained 5- to 6-bulb circuits and were arranged in their proper positions.

Next came the plate circuit. To show greater variations in current, it contained 24 bulbs per circuit.

The final step in the lighting system was the design of lights inside the elements. These were 110-volt lamps mounted behind the Plexiglas pieces representing the filament, cathode, grids, and plate. To make the moving lights flow smoothly, we spaced our bulbs only five-eighths inch on centers.

We searched six months before finding enough bulbs to do the job. We finally discovered what we needed: 28-volt, miniature screw-base, type T lamps. Getting suitable commercial sockets to fit the bulbs proved impossible, so all sockets were designed and built by Sergeant Williams.

After designing and building our lighting system, we began wiring. This was the toughest part of the project. It took us two years, and it required 60,000 feet of wire to connect the maze of bulbs so they would operate the way we wanted.

First, we went to work on the marquee flow. On the 5- and 6-bulb circuits, we connected each bulb to four rings of spiral-wired breaker points. Every ring contained six points, one for each bulb.

A cam revolved continually inside the rings, activating the six points in succession. Thus, by energizing one ring, one light moved across the circuit. By energizing another ring we put another light in motion. In this way up to four lights in each circuit flowed. This

gave us our marquee effect plus a varying number of bulbs to show changes in current.

To achieve both these effects in the 24-bulb circuits we used a commutator switch with 24 brushes. The commutator contained 16 segments, each energized by a slip ring. This gave us up to 16 bulbs in motion.

Changes in polarity were shown by passing cellophane shields in front of bulbs, while variations in the amplitude of voltage were illustrated by changing the brilliancy of the lights, using variacs.

All these effects—current, polarity, voltage, and marquee-flow—were regulated by only four front-panel controls. Five motor-control systems, interconnected with bridges and micropositions, enable proper interaction throughout the trainer. Wafer switches connected to the motor controls automatically energize the rings of breaker points, brushes of the slip rings, and sections showing space charge.

Because of the automatic interlocking controls, a change in one element is always followed by the proper reaction elsewhere.

In use, the filament control is turned on and one side of the filament circuit glows red (positive), the other side green (negative).

As the voltage is turned up, brilliancy of the lights increases. As current increases, more lights appear.

After a short time delay, the filament and cathode glow red, indicating heat. As their glow becomes more intense, white lights representing electrons move away from the cathode.

At first, these electrons form no definite pattern, demonstrating erratic movement. As more are emitted, however, they form clusters representing space charges.

Next, the plate control is turned on, causing the plate circuit to glow red (positive). As voltage increases, the plate becomes brighter and electrons move toward it from the cathode in definite patterns.

At the same time red lights in the plate circuit become brighter and increase in number, illustrating stepped-up voltage and current. Space charges diminish, erratic movement stops.

By applying a negative voltage to the plate control, lights in the plate circuit change to green and movement ceases. The ground circuit, represented by blue lights, automatically increases as current becomes greater.

When the diode demonstration ends, the Plexiglas control grid is attached to the face panel and a triode tube is formed. By regulating the next front panel control, all activities in a triode tube take place on the trainer's face.

Tetrode and pentode demonstrations are given in the same way: successively adding a grid and turning on another control panel for each one.

By the end of March, 1951, we had ironed out the last of the bugs and our project was ready for display.

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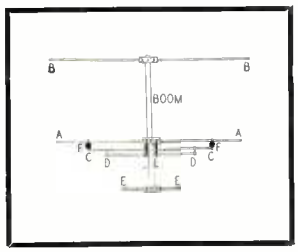
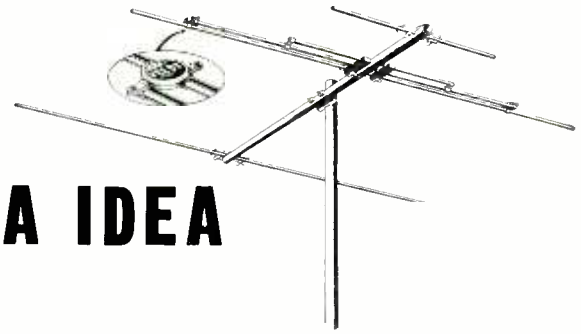
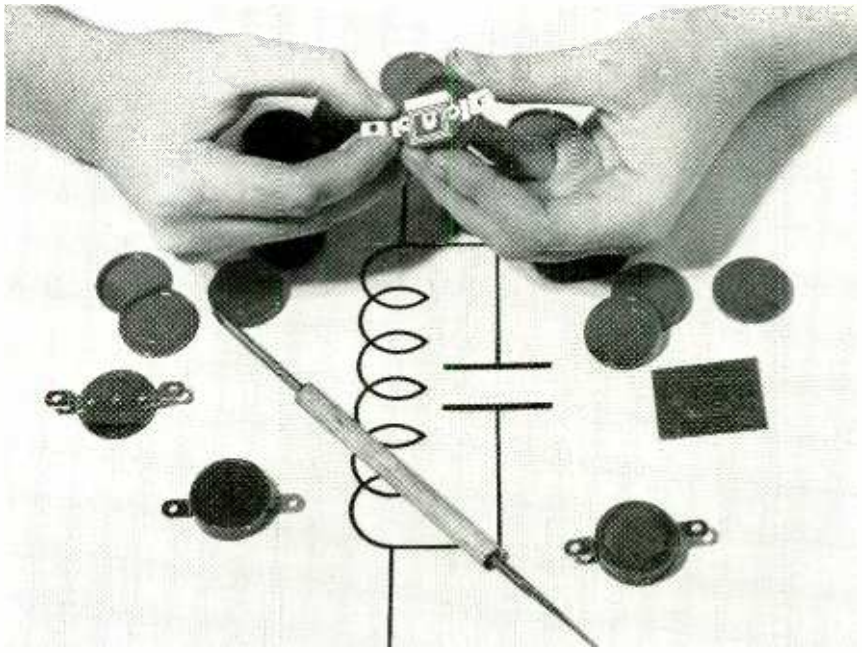



# NEW ANTENNA IDEA





The printed circuit has now reached the top in its advance as a radio and TV component! It is used by Vee-D-X as an integral part of their new *Q-Tee* antenna, whose driven element consists of a series of T-matched dipoles which provides a 300-ohm match on both the high and low channels. The printed circuit is a part of the matching system and prevents detuning effects between the high- and low-channel elements, while providing a driven element of extremely low Q. The close proximity of the high and low elements and the elimination of the adverse interaction by the printed circuit results in an exceptionally broadband driven element. A high-channel director and a low-channel reflector give it the desirable front-to-back ratio and gain characteristics of parasitic type antennas such as the Yagi.

The printed-circuit matching unit is shown in the photo and the complete antenna in the diagrams above. Operation fundamentals can be understood easily with the help of the figure. On the low channels, B-B acts as a reflector for dipole A-A. F and F are the printed circuit isolation filters in weatherproof plastic housing—on the low channels they have low reactance and connect A-A through sections C-C and D-D to the 300-ohm line at L and L. Thus C-C and D-D act as a T-match between the line and dipole A-A. The printed circuit filters F and F are antiresonant at the center of the high channels (195 mc) and effectively isolate A-A from the 300-ohm line at these frequencies. However, C-C forms a fullwave antenna in this range, coupled to the 300-ohm line through the T-match of sections D and D. In these high channels, E-E acts as a director for optimum forward gain and directivity.

The multiple T-match further adds to the broadband characteristics of the antenna because the proximity of A-A and C-C provides capacitance coupling that makes the elements appear to be "fatter" and thus have a lower Q and consequent broader frequency response.

—end—

# ELECTRONICS and MUSIC

Part XXIV—The simple Minshall electronic organ—Ingenious circuitry produces true organ tones with few components.

BY RICHARD H. DORF

Fig. 1—The Model J Minshall Electronic Organ has two manuals, pedal clavier, and built-in amplifier and speaker. Other models have external tone cabinets rated at 20 and 40 watts. The instrument is all-electronic, with tube generators; tones are colored by formant method.

THE Minshall electronic organ (Minshall-Estey Organ Co., Inc., Brattleboro, Vt.) is one of the most interesting instruments in the electronic music field. It is capable of producing excellent organ tones and is used with great success in churches, homes, and radio stations; yet its circuits and mechanical construction are remarkably simple. It contains just about the minimum of circuitry and materials necessary to produce a genuine musical instrument, a goal which is not easy to achieve. Electronic organ design tends to become complex if for no other reason than that there must be at least 61 tone generators and a multiplicity of tonal effects. It is not really difficult to design an instrument that will sound good and have good flexibility. To get the same results with economy is hard but very desirable—it makes possible a low price and easier servicing, as well as reduced bulk.

The simplicity of the Minshall centers first in the ingenious frequency dividers, each of which employs only half of a duo-triode tube, five capacitors, and three resistors. The tone-color circuits (of the formant type), instead of using a separate filter for each stop, have several of the filters "collapsed" into a few groups so that any one filter component is used for more than one tone color. A unique type of vacuum-tube filter is employed. All of this will be explained in detail and diagrammed.

Fig. 1 is a photograph of the Minshall model J, a two-manual instrument with a 25-note radiating pedal clavier. This type has a built-in loudspeaker for maximum compactness. Where space is not at a premium model E is usually installed. The E is similar to the J but has a solid wood front and requires a separate tone cabinet (model C-20 or C-40, giving 20 or 40 watts output). A single-manual organ, model H, is also in wide use. Its circuitry is even simpler than that of the J and E. In this article we shall describe models E and J.

(Readers should note that the present-day Minshall organ is entirely electronic, with vacuum-tube tone generators. It should not be confused with an amplified-reed organ (model B) which was made by this company shortly after the war. The reed organ is no longer manufactured.)

The block diagram of Fig. 2 illustrates the scheme of operation of the Minshall electronic organ. The tone-generator assembly produces five octaves of notes. The tones go to the two key manuals and the pedal clavier, thence to the tone filters through the tablet-board control switches. The resulting tones are amplified and fed to a loudspeaker.

## Tone generators

Each of the 12 tone-generator chassis contains three 12AX7 duo-triodes, power and output plugs, and a tuning control. It produces five octavely related notes. One of these chassis strips is shown in Fig. 3.

The topmost tone for each chassis is generated by a phase-shift oscillator, illustrated schematically in Fig. 4, using half of the first tube. The usual phase-shift oscillator has series capacitors and shunt resistors; the opposite arrangement, however, appears to be

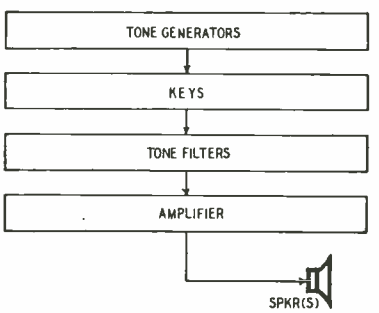



Fig. 2—Simplified block diagram of the Minshall organ operation scheme.

more stable. The 5,000-ohm variable resistor between the bottom of the network and ground permits tuning each oscillator over a range of slightly more than one semitone above and below the desired frequency. The .0015-μf capacitor across the control minimizes leakage between oscillators.

Eight different oscillators are manufactured on the Minshall assembly lines, differing in the values selected for C1, C2, C3, and C4. The capacitors used are standard high-quality micas with 10% tolerance. As they come off the production line the oscillators are tested for center frequency and are then inserted into appropriate generator chassis. This is an economy which would not be possible if very small component tolerances were necessary or if each component had to be individually selected and measured.

The remainder of a generator chassis is shown schematically in Fig. 5. The first triode, which is the second half of the 12AX7 used in the oscillator of Fig. 4, is a buffer stage used to isolate the highest-note output connection from the oscillator itself. It is also used to feed the first frequency divider.

The circuitry of the frequency dividers is unique in commercial electronic musical instruments. With only a single tube per divider, they produce sawtooth output waveforms, the type best suited for use with formant filters because of their progressive harmonic content.

The output of the master oscillator, which is approximately sinusoidal, is fed to the buffer grid through blocking capacitor C1. Because the triode is operated at zero bias with a fairly large grid-leak resistor R1, the grid draws current on positive input half-cycles. As a result the tube is biased to cutoff over most of the input cycle. When the tube is cut off, its plate is at maximum voltage, since no current is drawn through plate resistor R2. Plate shunt capacitor C3 therefore charges at a rate determined by the R-C time constant. During the small portion of the cycle when the tube conducts, it acts almost as a short circuit across C3 and discharges it quickly. The result of the slow charge and fast discharge is a sawtooth potential across C3, at the same frequency as the master oscillator. The sawtooth signal is taken through blocking capacitor C2 to the keying circuits, as the highest of the five notes generated on the chassis. The circuit of this buffer is extremely interesting since it transforms a sine wave to a sawtooth.

The first divider has been redrawn in Fig. 6 to make its operation clearer. C4-C5 is a capacitive voltage divider which reduces the amplitude of the input signal. If $C_X$ were omitted, the divider would operate in the same way as the buffer. The reduced signal fed to the grid is large enough to cause the tube to cut off after the initial input peak. While the tube is cut off capacitor C6 will charge through R3. On the next positive peak of the input cycle the tube will conduct, C6 will discharge, then charge slowly again as the tube again is cut off. Output is taken from the plate, just as in the buffer, both for the keying circuits and for the next divider.

However, the presence of the feedback path from plate to grid through $C_X$ changes all this and makes the tube respond only to *every other* input peak, so that the output is at half the input frequency.

$C_X$ is a large capacitor whose only function is to provide a feedback path from plate to grid. At the initial peak of grid voltage from the buffer, a negative pulse appears at the plate of the tube. (This is the time at which C6 discharges through the tube.) This pulse is fed back to the grid through $C_X$. However, the feedback voltage reaching the grid is delayed by the series circuit of R2 and C5. For this reason the fedback negative pulse does not reach the grid in full strength until the second input peak from the buffer arrives. Now the grid is so negative—due to the fedback negative pulse—that this second input peak cannot make the tube conduct. Therefore C6 continues charging.

When the third input peak comes along C6 is almost fully charged. The charge on C5 due to the fed-back negative pulse has leaked off through R1 and R2. Again the grid is excited by the input pulse, the tube conducts momentarily, and C6 discharges. And again the tube is quickly cut off by the drop across R1-R2 caused by the grid current.

Because the tube is sensitive to the first, third, fifth, and following *odd* input pulses, while the even input pulses do not affect the charging of C6, the output taken from the plate for the keying circuit and the next divider input is one-half the frequency of the input from the buffer. And because the output is the potential across a slow-charge, fast-discharge capacitor—as in

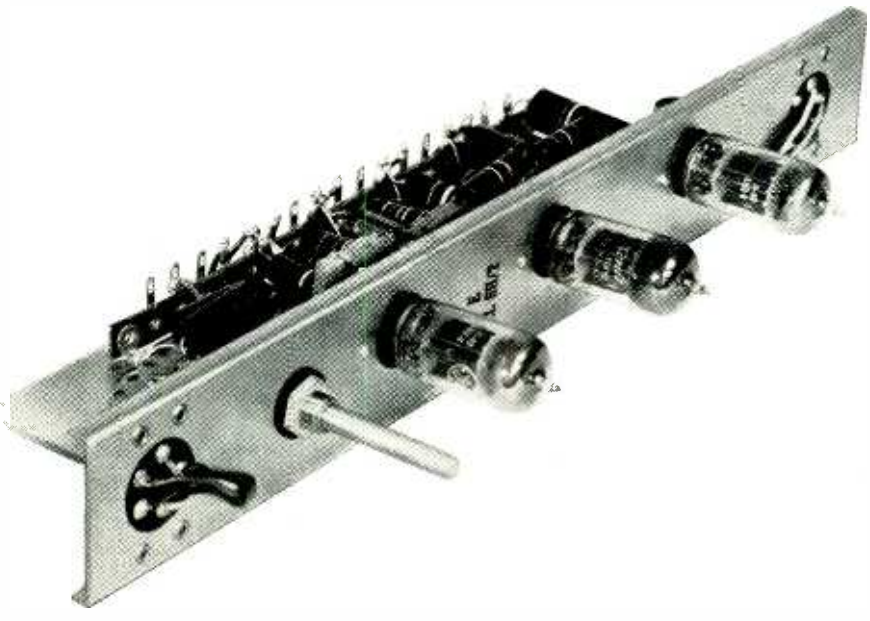


Fig. 3—Each of the 12 generator chassis holds four tubes, two connectors and tuning control.

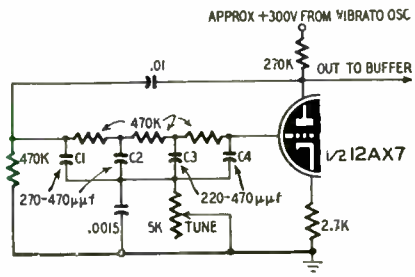
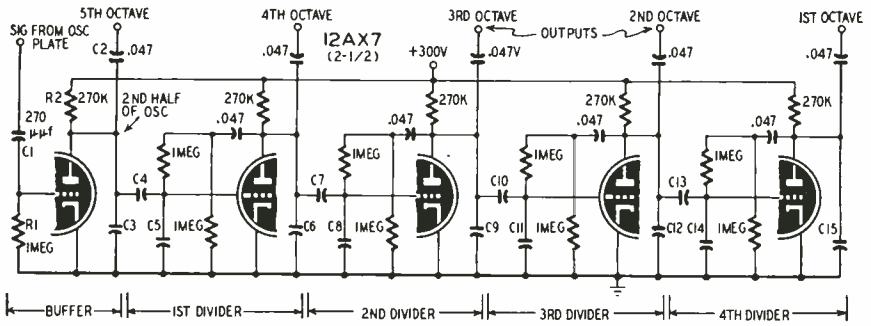



Fig. 4—Special phase-shift circuit used to generate the highest frequency for each oscillator-frequency divider chassis unit.



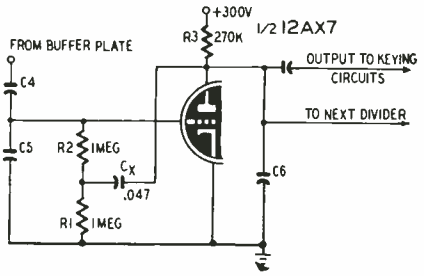




Fig. 5 (left)—Schematic of an oscillator-divider chassis. Fig. 6 (right)—A single frequency-divider circuit redrawn.

the buffer—the waveshape is a sawtooth.

The succeeding three dividers work in exactly the same manner, each energized by input waves from the previous divider, each having sawtooth output of half the input frequency. In order to understand this circuit thoroughly it is helpful to remember that the outputs are *not* voltage drops across resistors due to tube plate current, as in ordinary vacuum-tube circuits. They are potentials appearing across a charging and discharging capacitor. The tube is used merely to control the charge and discharge of the capacitor between plate and ground.

This unusual frequency divider can be explained in another way, which analyzes its operation in a more exact manner. Fig. 7 shows waveforms at various points in the circuit. The input waveform is represented by *a*, the sawtooth from the buffer or previous divider. If we assume initially (leaving the proof until later) that the tube conducts on alternate input-wave peaks, the plate current waveform is as shown in *b*—with pulses at half the input frequency.

The solid line in *c* of Fig. 7 shows the plate voltage—which is the voltage across the charging and discharging capacitor C6 (Fig. 6). The capacitor discharges each time the tube conducts, and the solid line shows the accompanying fall of plate voltage. After each pulse of plate current (*b* in the figure) the capacitor again charges slowly and the plate voltage (*c*, solid line) rises. Notice that this plate-voltage waveform is a sawtooth at half the frequency of the input (*a*).

The sawtooth voltage—appearing across C6—is a complex wave consisting of a fundamental and even harmonics. Because the output network is capacitive the fundamental component of the output voltage lags almost 90 degrees behind the pulse of plate current. This fundamental component (which cannot of course actually be seen with an oscilloscope) is shown by the dashed line in *c* of Fig. 7. It is important because of the feedback.

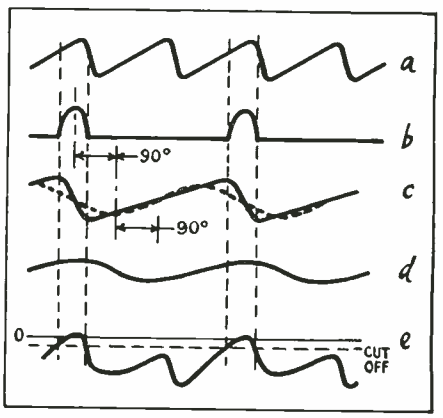
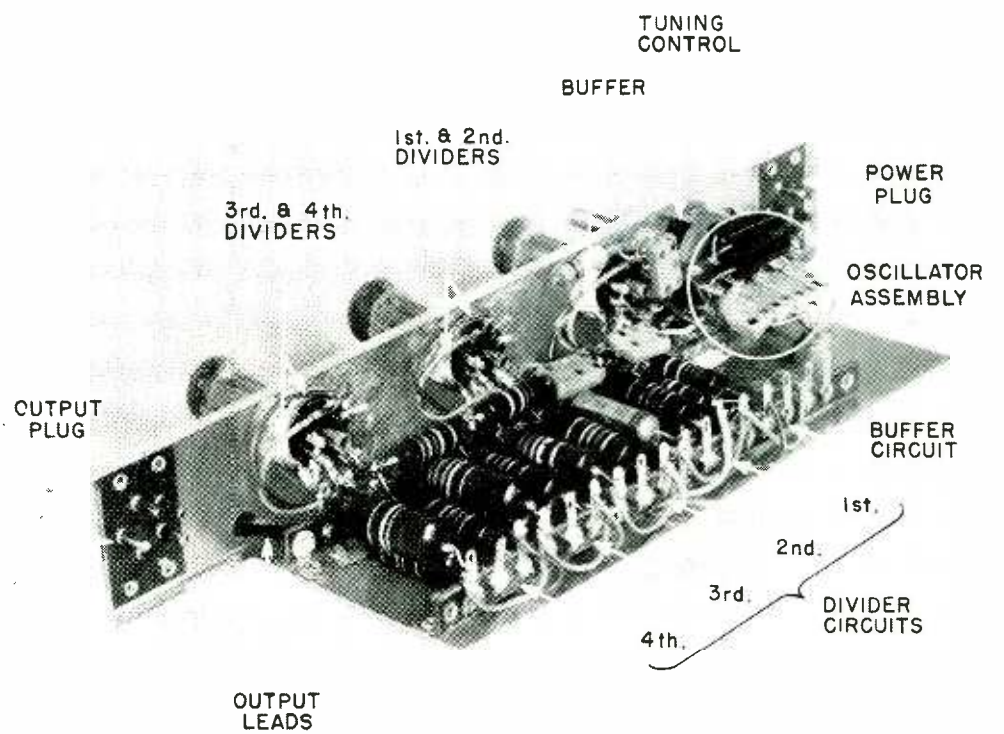



Fig. 7—Waveforms in the frequency-divider circuits of the Minshall electronic organ. Their derivation is explained in the text.

Feedback from the plate takes the path through $C_x$ (a blocking capacitor of large value which has no effect on phase or waveform), and the series




This underside view of one of the 12 divider chassis shows the compact, yet accessible arrangement of the resistors and capacitors. The oscillator assembly at right is a separate unit and is selected and added as the last operation in divider manufacture.

# S-METER FROM SURPLUS

By GEORGE H. HAGUE

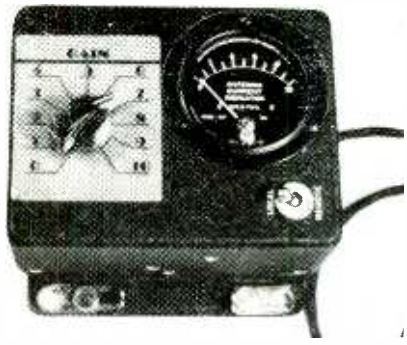
AS the owner of a low-priced communications receiver I have come to realize the advantages of a signal-strength indicator. The prospects for adding one looked poor since there is no suitable space on the front panel. A cable-connected S meter mounted in its own cabinet or chassis seemed a likely alternative.

During the process of designing an S meter a glance across the work-bench, discovered, bold as brass, a BC-442-A antenna relay. Here was a neat looking unit, with a fairly sensitive meter already mounted in a small metal box. The current required for full-scale deflection was checked. This was between 4.5 and 5 ma, but 1 ma swung the needle to the point marked 6 on the meter scale. (It apparently has a non-linear movement with a linear scale.)

Construction was started by removing all parts except the local-remote switch from the relay. The meter was remounted so it could be read in a horizontal position. When the antenna standoffs were taken out the three large holes were concealed by mounting the zero-set control in such a position that the dial plate would just cover them. Another hole was drilled in the bottom plate for the connecting cable.

Because of the current requirements of the meter, I preferred the circuits that use the plate current of an i.f. tube connected to the a.v.c. The basic circuit shown in Fig. 1 makes the meter read backward and hard to calibrate.

After mulling it over I decided to use the circuit shown in Fig. 2. This allows the meter to read up-scale. It is the familiar bleeder type using the meter in a balanced bridge circuit. Since the value of the bleeder resistor R will



Complete cable-connected S meter.

vary with the tube types and voltages used in other receivers, the constructor should try different values until the proper size is found. I use a 25,000-ohm 2-watt resistor. It gives the S meter fairly good sensitivity and does not impose too heavy a load on the power supply. It would be a good idea to insert a milliameter in the B+ lead of the connector cable to check the actual current drain. In my receiver this amounted to only 3.5 ma, and allowed a weak signal to register on the meter.

The local-remote switch shunts the meter and disconnects the bleeder from the B supply when the meter is not being used. A 3-wire cable from the receiver to the meter is required. A terminal strip at the back of the receiver and lugs at the ends of the cable leads facilitate connection. The brackets on the relay case make it possible to mount the instrument on the wall.

The S meter could be calibrated with

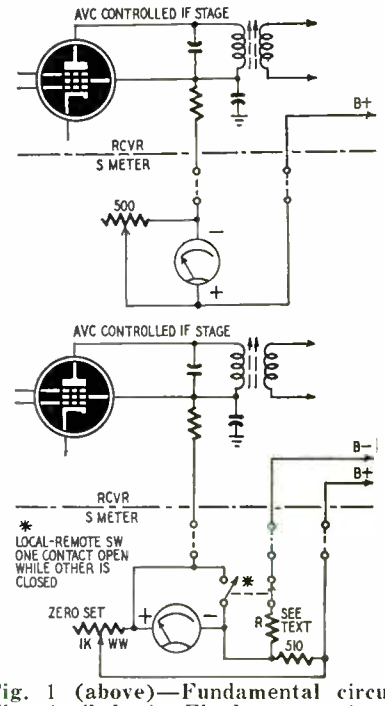



Fig. 1 (above)—Fundamental circuit.
Fig. 2 (below)—Final meter circuit.

an accurate signal generator but since the object is merely to compare relative signal strengths, this is, of course, unnecessary. The zero-set control is adjusted by shorting the antenna post on the receiver to ground and setting the meter to zero. Taking the ground off the antenna post puts you in business with an S meter, which should not cost you over four dollars.

### Materials for the S meter

**Resistors:** 1—510 ohms, 2 watts, 1—24,000 ohms (see text) 2 watts, 1—1,000 ohms, wire-wound potentiometer

**Miscellaneous:** 1—dial plate and knob; 1—3-wire connector cable and terminal strip; 1—BC-442 A antenna relay or a metal box-chassis and a 0-5 milliammeter; rubber grommet, hardware, wire, solder, etc.

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combination of R2 and C5. The C5-R2 combination will be recognized as a low-pass filter or simple integrating network and has two effects. The harmonic content of the sawtooth plate voltage which is fed back through it is almost completely attenuated, so that

**TABLE I**
**Capacitor Values for Fig. 5**

| Cap. | C<br>C♯<br>D | D♯<br>E<br>F | F♯<br>G<br>G♯ | A<br>A♯<br>B |
|---|---|---|---|---|
| C3 | .015 | .012 | .010 | .0082 |
| C4 | 330 | 270 | 220 | 180 |
| C5 | .0027 | .0022 | .0018 | .0015 |
| C6 | .018 | .015 | .012 | .010 |
| C7 | 680 | 560 | 470 | 390 |
| C8 | .0047 | .0039 | .0033 | .0027 |
| C9 | .013 | .027 | .022 | .018 |
| C10 | .0015 | .0012 | .0010 | 820 |
| C11 | .0032 | .0068 | .0056 | .0047 |
| C12 | .068 | .056 | .047 | .039 |
| C13 | .0039 | .0033 | .0027 | .0022 |
| C14 | .018 | .015 | .012 | .010 |
| C15 | 0.12 | 0.10 | .082 | .068 |

Decimal capacitances in microfarads; others in micromicrofarads. Tolerance ±10%.

what appears across C5—and is fed to the grid—is almost a sine wave. This sine wave is the fundamental component of plate voltage shown in the dashed line of *c*. Second, it introduces an additional lag of almost 90 degrees in the phase of the fed-back signal. As a result, the feedback voltage reaching the grid is of the shape and phase indicated in *d* of Fig. 7.

Note the relation between wave *a*, the input signal, and fed-back voltage *d*. The fed-back signal reaches its negative peak at the same time as the input signal reaches every other crest. Combining the input and the fed-back voltages gives the form of *e* in Fig. 7. Every even crest is negatively displaced, preventing it from bringing the tube's grid voltage above the plate-current cutoff point; while every odd crest is displaced positively, aiding tube conduction. Thus it is easy to see that our original assumption—that the tube conducts only on alternate peaks of the input signal—is justified, and a frequency division of 1 to 2 takes place.

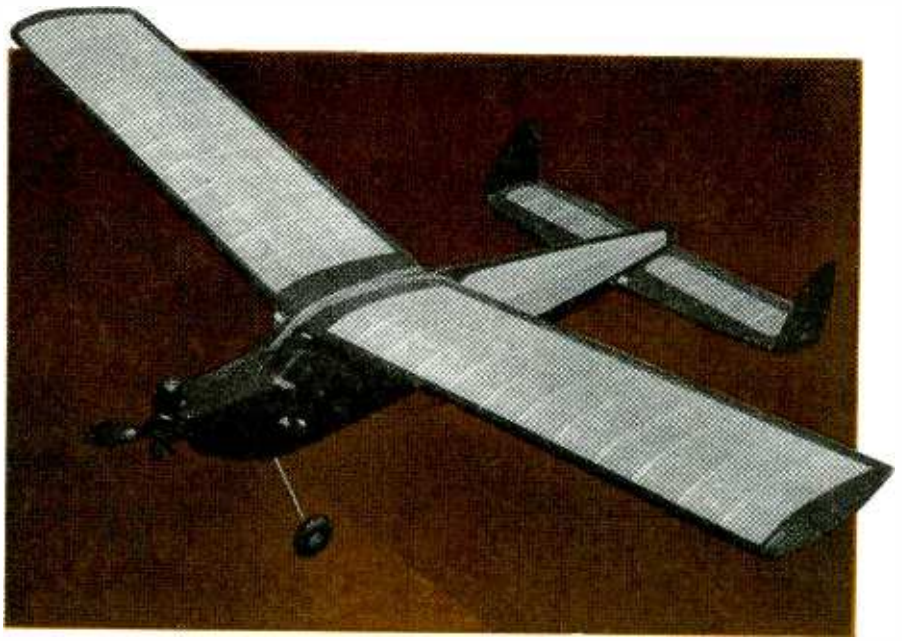
The frequency-sensitive capacitor values for the divider strings are given in Table I and refer to the numbered capacitors in Fig. 5. Standard 10%-tolerance capacitors are used. The resistor values are constant, since either R or C may be varied.

A single divider usually works well over a range of six to eight semitones, or more than half an octave. In an actual generator string, however, the ranges of the four dividers are staggered to some extent by parts tolerances, and the over-all range through which all four dividers work successfully may be limited to five semitones or less. The most important value is the plate (output) capacitor since it affects not only frequency but also level, which must be the same from note to note. In the Minshall plant four different generator string designs are manufactured, as Table I indicates, each useful for three notes.

In next month's article we shall discuss the vibrato, keying, and control circuits of the Minshall organ, the tone-color system, and the amplifier.

(to be continued)

# MODEL PLANE CONTROL . . .



## . . . . . with 27-mc signals . . .

A fascinating hobby—combining the techniques of electronics and flying—now open to non-amateurs too, with the assignment of an exclusive Citizens'-Band spot frequency. Simple equipment gets you started.

**By E. J. BROWN**

MILITARY use of guided missiles and radio-controlled miniature planes for targets and test purposes has become a part of everyday news. The use of radio control has spread to amateurs who build and fly small gas-engined planes as a hobby. The development of miniature components and compact hearing-aid batteries have reduced the size of radio-controlled model planes to half that of prewar types.

The opening of the Citizens band and the marketing (by the Vernon McNabb Co.) of a complete Citizens band control unit, including a transmitter, receiver, and escapement control, has greatly expanded the number of radio-controlled-model builders.

One of the most valuable aids to radio control of plane models is the Raytheon RK-61 tube. This tube, a gas thyratron triode, requires so little operating current that it is possible to reduce the weight of the airborne radio equipment to only 7½ ounces. The RK-61 was in short supply for a while, but is now available again. A British tube, the XFG-1, also may be used without any circuit changes.

This article describes a complete model-control system which can be easily constructed in the home. It is intended for use in the amateur bands above 26,960 mc., and on the new Citizens band radio control frequency of 27.255 mc. While much radio control work is also being done on the 460–470-mc Citizens band, the RK-61 thyratron is not considered suitable for use at frequencies above 100 mc. (Editor's note: No attempt should be made to use radio control for any purpose until the necessary licensing requirements have been met. Consult the FCC for latest regulations.)

The schematic of the superregenerative receiver which is mounted in the plane or other controlled unit is shown in Fig. 1. A spiral-wound inductor L1 is used to reduce space requirements. L1, consisting of 9½ turns of No. 16 enameled wire with a tap at about 3½ turns from the inside, can be seen in Figs. 2 and 3. The relay and the escapement-type control unit (Fig. 4), which moves the rudder, are separate,

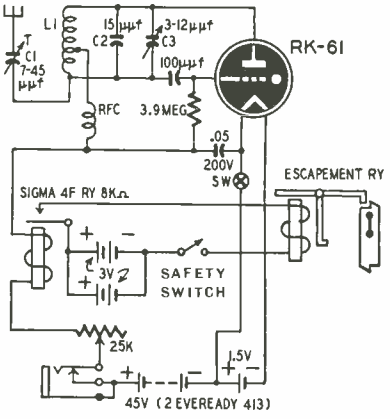
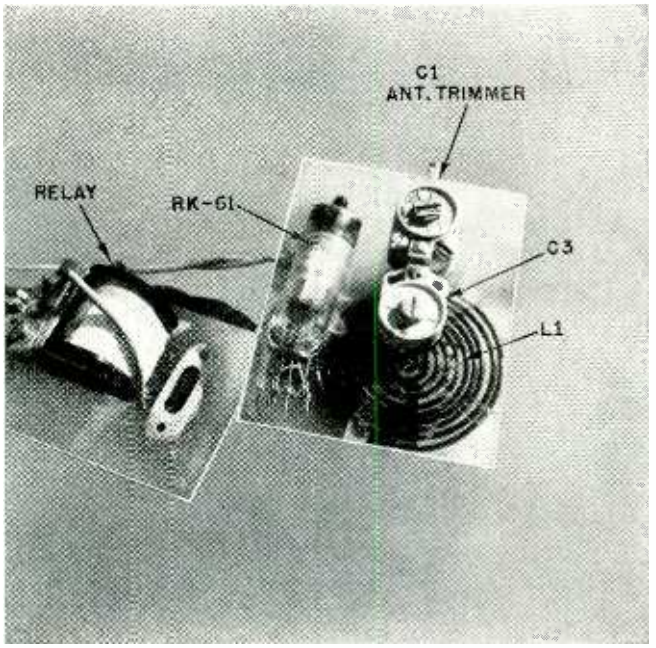



**Fig. 1—Schematic of the receiver. An incoming signal closes the relay contacts.**

Fig. 2 (below)—Close-up view of the receiver tuning assembly, showing the special spirally-wound tuning inductor. The underside of the control relay for the escapement mechanism appears at the left.



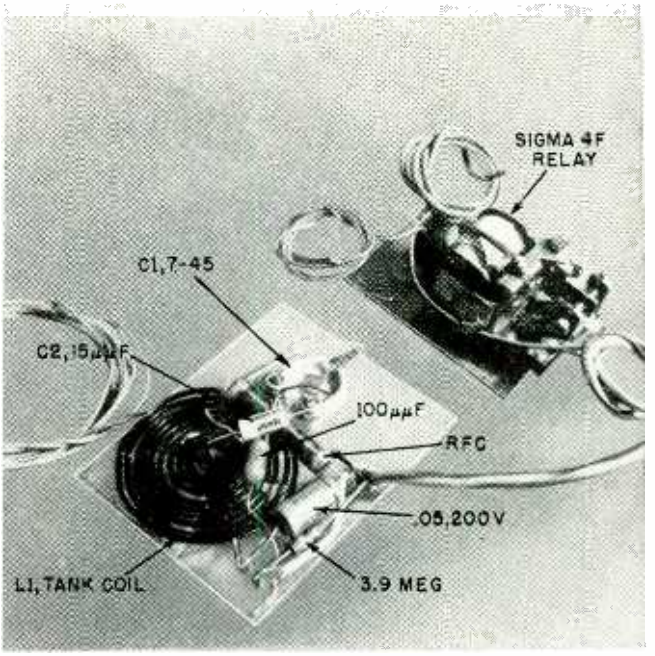




Fig. 3 (above)—The opposite side of the receiver mounting plate, showing the placement of related components and the connecting cable to the control relay unit.

and may be mounted in any convenient location in the model.

The receiver is constructed on a base of polystyrene as shown in the photos. Do not solder the tube wires directly to components, as it may damage the tube and would prevent quick removal. All parts are standard except the r.f. choke, which is made from a burned-out tubular glass fuse, close-wound with a 1-inch long, single layer of No. 32 enameled wire. The three-wire cable connects the receiver to the relay and the batteries.

If dimensions vary from those shown it may be necessary to change the value of the fixed band-spread capacitor C2 to keep the receiver in the band. The L-C ratio of the tank is not critical, but if trouble is experienced try varying the number of turns on the coil and try changing the point of the choke connection to control regeneration.

A 25,000-ohm potentiometer is used to control plate current. Filament current is supplied by two penlite cells wired in parallel. A switch in the A plus–B minus lead turns the receiver on or off.

A closed-circuit jack is used in the B plus lead for plugging in a 0–5-ma d.c. meter to tune the receiver. The no-signal plate current should read between 1.3 and 1.5 ma, dropping to 0.1 to 0.3 when a signal is received. The receiver antenna should be a piece of stranded wire about 60 inches long. Lengths as short as 18 inches will work at short ranges. The antenna-tuning capacitor, C1, will compensate for incorrect lengths.

The relay used in the receiver is a Sigma 4F, 8,000-ohm unit, obtainable on the surplus market or from Control Research Co., P.O. Box 9, Hampton, Virginia, who carry other radio control supplies and specialize in kits for radio-control equipment. This relay is the heart of the set and must be super-sensitive and have adjustable contact spacing and armature spring tension.

Adjust the relay to pull in the armature at 1.1 ma and release it at 0.7 or 0.8 ma. The armature spring tension and contact spacing must be reduced from the original settings. The contact spacing should not be over 10 one-thousandths of an inch to start with, and the armature must not touch the pole piece when pulled in.

The control units may be of the escapement type, pulse type (which rotates back and forth 180°), or small electric motors with self-centering limit

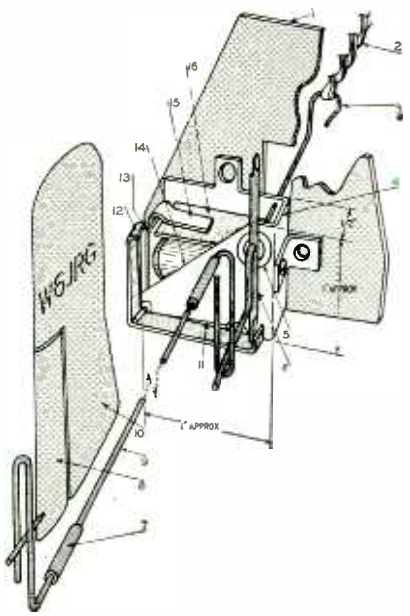
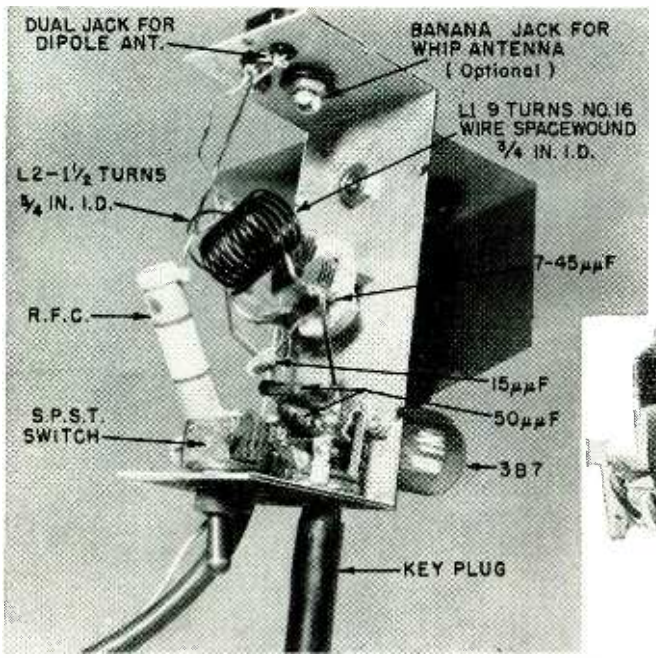
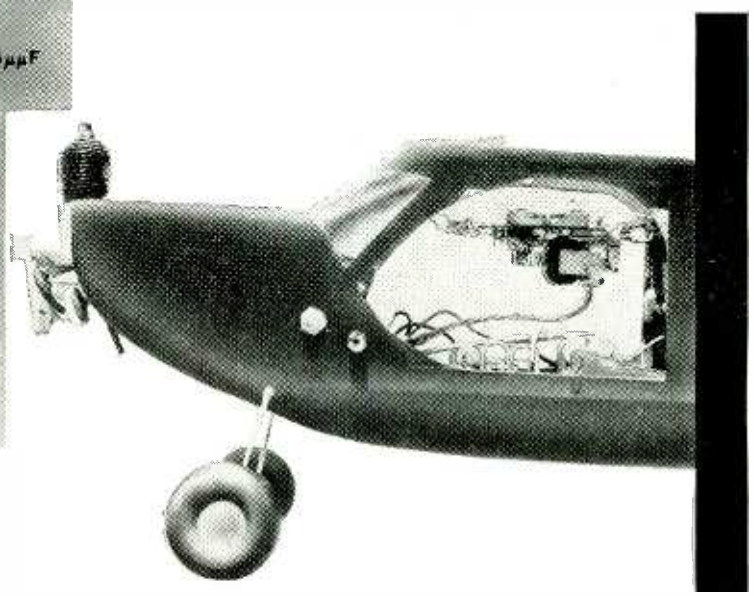



Fig. 4—The escapement mechanism. The parts are identified and described below.

1. Bulkhead.
2. Rubber loop, ⅛-inch flat rubber.
3. Crank-pin hook, 1/16-inch music wire.
4. Frame, .025-inch hard brass sheet.
5. Bearing, model airplane type.
6. Control arm, ⅛-inch brass rod.
7. Bushing, brass tubing.
8. Rudder.
9. Yoke shaft, 1/16-inch music wire.
10. Fin.
11. Spring, .012-inch music wire.
12. Pawl.
13. Armature, 1/16-inch soft iron.
14. Coil: 90 ft. No. 32 enameled wire (or equivalent in No. 31 to give resistance of 6–10 ohms), wound on soft iron core 3/16-inch diameter, ¾ inch long. This coil draws 300–500 ma at 3 volts.
15. Armature stop.
16. L-shaped coil bracket.



(Left)—The 27-mc transmitter assembly (Below)—A typical receiver installation in the cockpit of a flying plane model.

switches. These may be covered in a future article.

The escapement shown in Fig. 4 is also from Control Research Co., available in kit form. The dimensions shown will produce a slightly larger unit with more reliability for operation in a large plane or boat model. This unit should weigh from ½ to 1 ounce completed.

The escapement is wired to the relay so the relay opens the circuit when energized by the no-signal plate current. The circuit closes when the relay opens as a signal is received. A s.p.s.t. switch is required in the escapement circuit to open the circuit when the receiver is turned off.

The batteries used are a factor in weight. Eveready 413E B-batteries will last three to four months, and two penlite batteries in parallel will provide

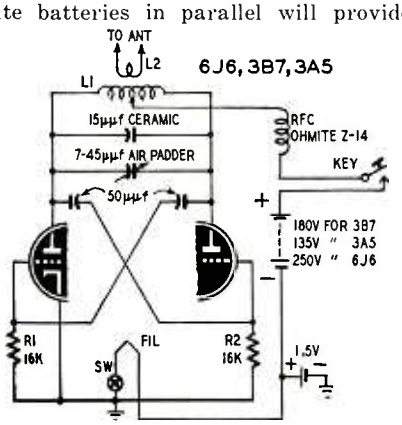



**Fig. 5—Schematic of the transmitter. For a 6J6, heater battery should be 6.3v.**

filament current for a month or more. The batteries used to control the escapement or control unit draw the most current and should be as large as possible. The author uses four to six penlite batteries in series-parallel to develop 3 volts. They are usually good for 12 to 20 flights of 5 to 10 minutes duration each. The weight of the complete installation with above batteries will be about 12 ounces. Smaller batteries may be used to reduce weight, with a corresponding reduction in life and reliability.

The transmitter, diagrammed in Fig. 5, is a conventional push-pull circuit and may use a 3A5 or a 3B7. A 6J6 may be used if operation from a car battery is desired. The author started with a dry-battery-operated 3A5 unit but now uses a 6J6 transmitter with a surplus-bargain dynamotor for B-supply. Both units were equally reliable, but the dynamotor eliminates the worry of battery drain affecting signal strength.

The grid-leak resistors R1 and R2 shown in Fig. 5 were reduced to 6,800 ohms for the 6J6 to increase output.

The transmitter is constructed on the U-frame part of a standard 2¼ x 2¼ x 5-inch aluminum box, as shown in the photo above. The tube socket is at the bottom of the U with the tube outside for better cooling.

The control switch in the B plus lead can be any type of push-button switch mounted either on the transmitter or at the end of a 5- or 6-foot cord to permit moving around while operating.

The r.f. choke is an Ohmite Z-14, but one similar to the type used in the receiver will do as well. L1 is 9 turns of No. 16 center-tapped, with an inside diameter of ¾ inch. Turns are spaced one wire diameter. L2 is 1½ turns with ¾-inch inside diameter.

A folded dipole antenna has been found to be the most effective for transmission over distances up to three miles. The dipole is a piece of 300-ohm ribbon line 14 feet, 5 inches long, shorted at the ends. A 300-ohm lead-in connects to the center of one of the antenna conductors. The mast must be mounted in a piece of pipe or other support to permit rotation. A 9-foot vertical rod antenna may also be used if operation is limited to ranges of one-half mile or less. One side of L2 is grounded when using this type of antenna.

Tune the transmitter with an absorption-type wavemeter or grid-dip meter and then tune the receiver to the transmitter frequency as described above.

The transmitter and receiver circuits shown may be used also for operation in the 50- to 54-mc amateur band with the advantage of shorter antennas.

The equipment described above provides an excellent beginning for the newcomer to radio control. The author wishes to thank the Control Research Co. for permission to use the transmitter schematic and the receiver circuit (as modified by the writer with the spiral coil).

—end—

Fig. 1—Interior layout of the frequency spotter.

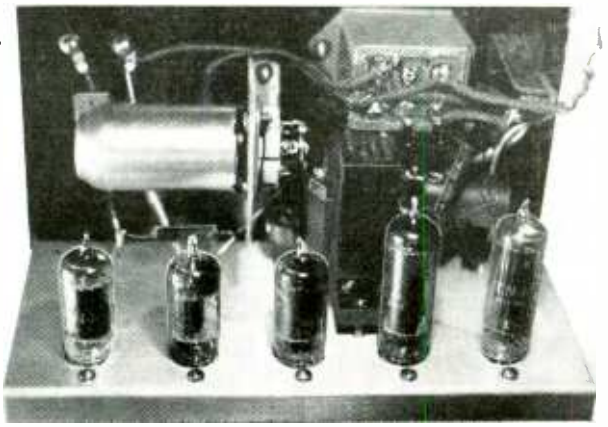
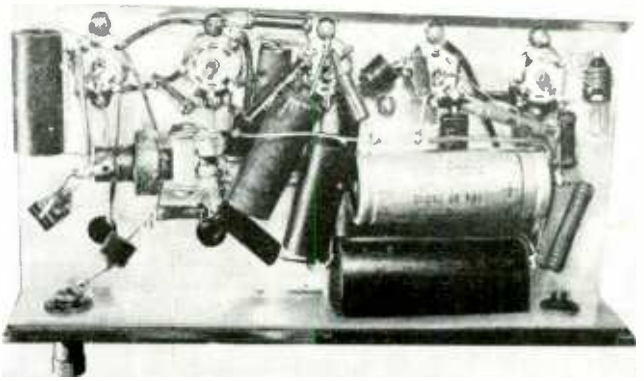


Fig. 2—Component placement beneath the chassis.



# CRYSTAL FREQUENCY SPOTTER

**By ALFRED HAAS**

THE increasing need for v.h.f. and u.h.f. signal sources calls for critical marker frequencies, having fractional megacycle values.

It is not easy to build a highly accurate signal generator with wide frequency coverage, and very few service-type oscillators have the required stability, or scales readable in decimal fractions of a megacycle.

It *is* possible, however, to build a relatively simple crystal oscillator of high accuracy and stability. Its harmonics provide a great many check points that can make even a poor signal generator temporarily accurate.

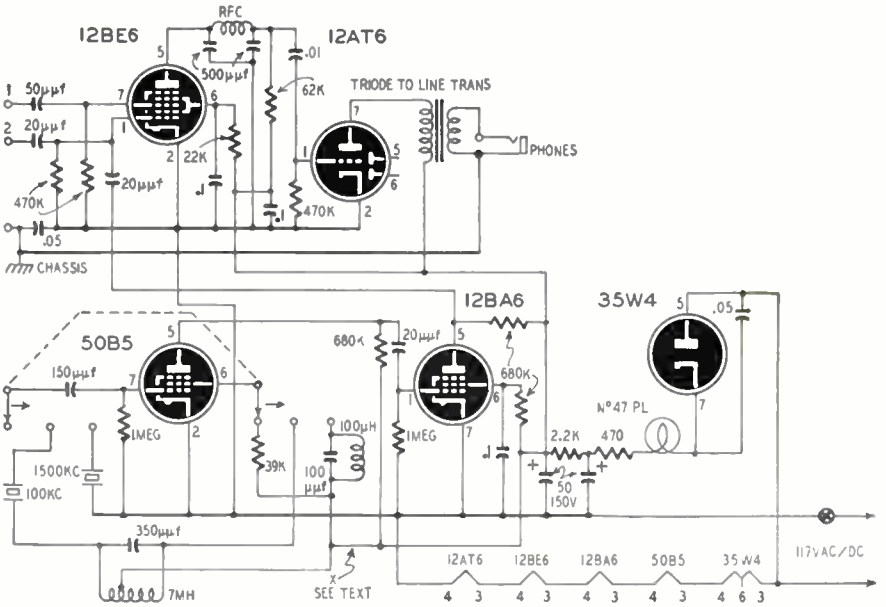
A diagram of such an instrument for a.c.-d.c. operation is shown. It consists of a 50B5 crystal oscillator, a 12BA6 harmonic amplifier, a 12BE6 mixer with two inputs, and a 12AT6 audio amplifier. The 35W4 rectifier provides B plus voltages.

In practice, a crystal having a relatively high fundamental frequency (1500 kc in this case) is used first.

Harmonics of this frequency are fed into the mixer along with the output of the signal generator. If the generator is tuned close enough to one of the crystal harmonics, the difference becomes audible. As the generator approaches the exact frequency of the harmonic, the audible difference decreases in pitch, and at zero difference disappears entirely.

When a sufficient number of check points 1500 kc apart have been marked on the generator dial a 100-kc crystal is switched on. Harmonics of this crystal should zero-beat at each of the original check points and produce 14 additional check points between each original pair.

The parts layout is shown in Fig. 1 and Fig. 2.




## Circuit details

Precision crystals are sometimes sluggish in starting. For this reason ringing-type oscillator circuits are used. The 100-kc circuit requires a 7-millihenry coil, tapped at one-tenth the total number of turns. The coil is tuned by a capacitance of approximately 350 µµf. The 1-mc circuit is tuned by a 100-µh coil and a 100-µµf capacitor. (Slug-tuned r.f. chokes suitable for this circuit are available from several manufacturers—*Editor.*)

The three-position selector switch allows use of either crystal, or a stand-by position in which the oscillator is disabled by reducing the screen voltage. The mixer can then be used for comparing two external oscillators.

The type 47 pilot lamp in the rectifier cathode circuit acts as a fuse and indicates failure of the oscillator circuit by an increase in brightness.

## Tuning procedure

To tune the oscillator ringing circuits, a 0–10 d.c. milliammeter shunted by a 0.1-µf capacitor is inserted at X in the diagram. Each circuit should be tuned for a screen current of about 2 ma. Lower currents may cause instability.

An accuracy of approximately 1% can be obtained by this method. For utmost accuracy terminal 2 should be coupled loosely to the antenna post of a receiver tuned to one of the standard frequency transmissions from WWV. By adjusting the tank circuits to zero beat in the receiver speaker, a short-time accuracy of one part in ten million may be obtained.

### Materials for frequency spotter

**Resistors:** 1—2,200, 1—470 ohms, 1 watt; 2—1 megohm, 3—680,000, 2—470,000, 1—62,000, 1—39,000, 1—22,000 ohms, ½ watt.

**Capacitors:** (Electrolytic) 2—50 uf, 150 volts. (Paper) 3—0.1 uf, 1—.05 uf, 1—.01 uf, 400 volts. (Ceramic or mica) 2—500 uuf, 1—350 uuf, 1—150 µµf, 1—100 uuf, 1—50 uµf, 3—20 uuf.

**Miscellaneous:** 1—50B5, 1—35W4, 1—12AT6, 1—12BA6, 1—12BE6 tubes; 1—triode-to-line low-level output transformer; 1—2-pole-3-position wafer switch; 1—s.p.s.t. toggle switch; 1—1500-kc crystal; 1—100-kc crystal; 2—crystal sockets; 5—7-pin miniature sockets; terminals, chassis, wire, solder, hardware.

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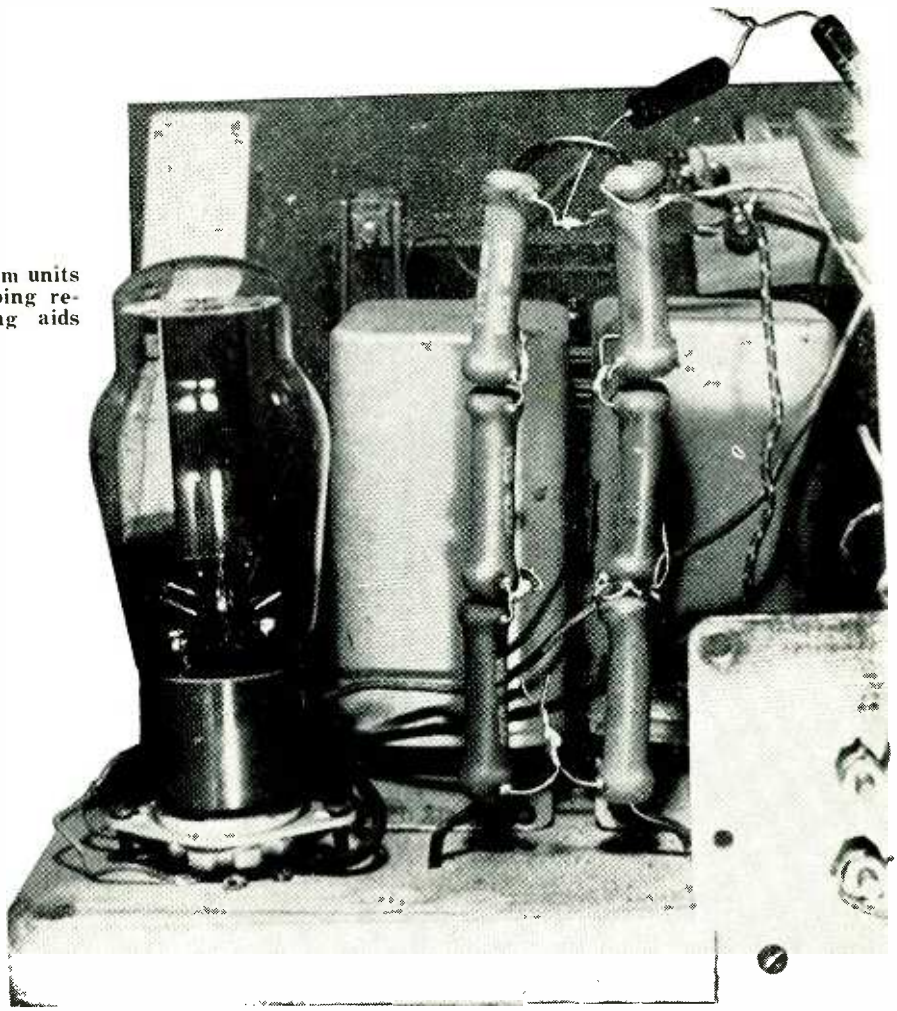


This view shows the six 4,000-ohm units that form the 807 screen-dropping resistor. Above-chassis mounting aids heat dissipation.

Economical,

simple, efficient,

this unit swings

an 807 to 90 watts

peak output

# CLAMP TUBE MODULATOR

By FRED J. LINGEL, W2ZGY

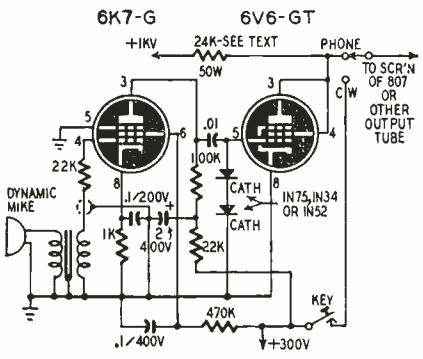



Fig. 1 (above)—Circuit of the clamp-tube modulator. Use of crystal diodes in the 6V6 grid circuit reduces hum modulation.

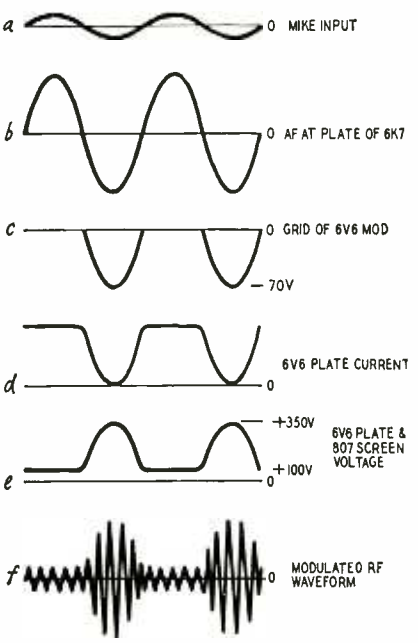
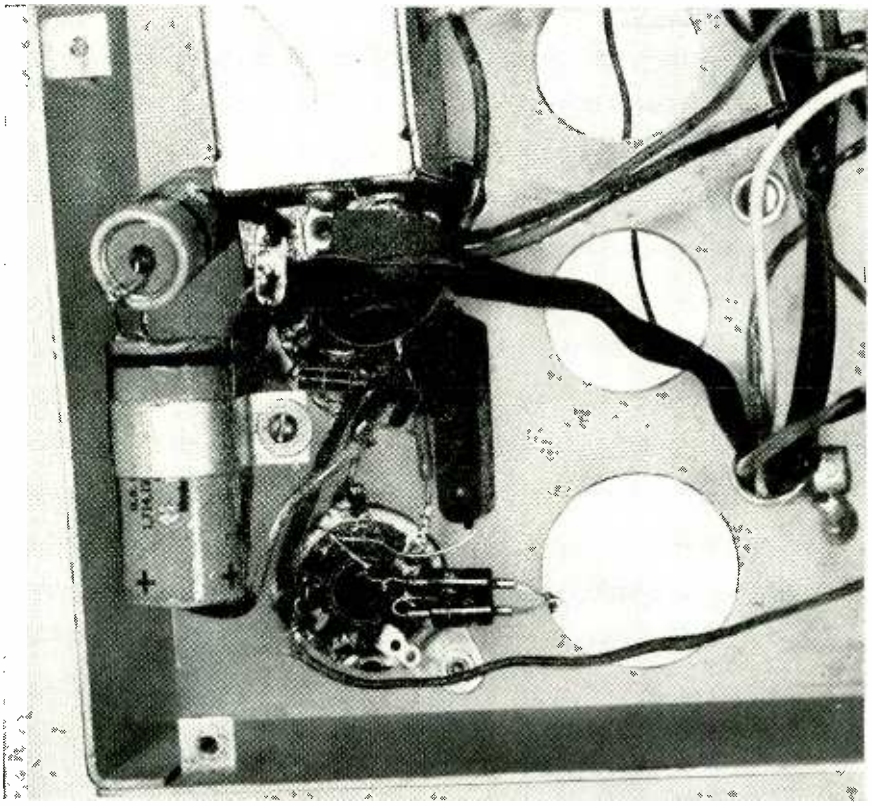



Fig. 2 (right)—Controlled-carrier modulation waveforms from microphone to transmitter output. Details in text.

THIS article describes a two-tube controlled-carrier modulator using two germanium diodes as the audio rectifier. The unit was designed around the intercom amplifier used in the No. 19 Mark II surplus tank transmitter-receiver. Normal telephone speech level at the dynamic mike fully modulates an 807 to 90 watts peak power output. The two-tube assembly reduces r.f. feedback and gives a much simpler modulator than any previously described.

Controlled-carrier modulation is popular in amateur transmitters for a number of reasons:

Few parts—no transformers.
Low cost—uses receiving type tubes.
Small size.
Higher power—phone operation at maximum c.w. ratings.
Easy to adjust—impossible to over-modulate.
Ideal for portable rigs—modulated amplifier plate and screen power on only when speaking.
Simple power-output control—speak low for locals, loud for distance.



Underside of the clamp tube modulator, showing the compactness of the layout. The microphone transformer is at the top, partially concealing the 6K7-G socket. The series-connected germanium-crystal diodes are at the bottom.

Automatic speech clipping—more complete modulation.

The complete circuit diagram is shown in Fig. 1.

The modulator operates as follows: The 6K7 is the a.f. amplifier, and the 6V6-G is the clamp tube, operated with zero bias. With no audio signal input, the 6V6 draws enough current through the 24,000-ohm resistor to drop the voltage on the 807 screen and the 6V6 plate to 50–100 volts. The reduced screen voltage on the 807 drops the plate current to about 20 ma, and the plate power input is limited to about 20 watts.

When an audio signal (*a* in Fig. 2) is applied to the 6K7, the positive half-cycles of the amplified signal (*b*) cause the series-connected germanium diodes to conduct and short-circuit the audio to ground so it does not affect the operation of the 6V6.

On the negative half-cycles, the audio signal drives the 6V6 grid to a maximum of about 70 volts negative with the voltage following the negative half of the speech envelope (*c* in Fig. 2). This negative audio voltage causes a corresponding drop in the clamp-tube plate current (*d* in Fig. 2), which decreases the drop across the 24,000-ohm 807 screen and 6V6 plate resistor. The screen voltage rises as shown at *e*. The r.f. output is modulated by the varying screen voltage.

Although the audio modulating component includes harmonics generated by the clipping action on positive speech half-cycles of the series-connected crystal diodes, and by the non-linearity of the screen characteristic, the halves of the modulated r.f. envelope are symmetrical (see waveform *f* in Fig. 2) because of the flywheel effect of the tank circuit.

By connecting the two diodes across the grid, we eliminate the two grid resistors sometimes used in this type of modulator. The two series-connected diodes provide a high grid resistance with a greater control action. If only one diode is used, the rectified grid voltage is roughly half the value obtained with two.

The 807 screen dropping resistor consists of six 4,000-ohm, 10-watt resistors connected in series. By connecting the 6V6 plate to a tap on the resistor string, you can vary the ratio between the strengths of the unmodulated and fully-modulated carrier.

For c.w. operation and for tuning up on phone, the screen of the 807 is connected to a 300-volt d.c. supply rather than to the modulator resistor. This is preferred to cathode-biasing the 6V6, since the plate of the 6V6 is then not held at an abnormally high voltage for an appreciable period of time with eventual tube failure.

I have used this arrangement very successfully for several months on my "souped-up" No. 19, Mark II surplus transmitter. It runs approximately 10 watts idle carrier and 100 watts peak. The germanium diode rectifier helps keep a.c. hum at a low level, since there is no heater supply in this sensitive portion of the modulator system.

The 807 final amplifier of the Mark II is run with 1,000 volts on the plate. The resting plate current is about 20 ma. It rises to 100 ma on modulation peaks. The screen-grid is run at 50–100 volts in its quiescent state and rises to a maximum of 350 volts under modulation. The modulation is limited to about 80% because the final plate current is not completely cut off on peaks. The 807 plate-current meter indicates comparative r.f. output, audio level, and tank-circuit resonance.

When answering a CQ, I have found it best to switch to the c.w. position for a couple of seconds before modulating. During this interval I check plate current and tuning of the final amplifier. The full carrier power also gives the calling station a more definite indication that he is being answered.

—end—

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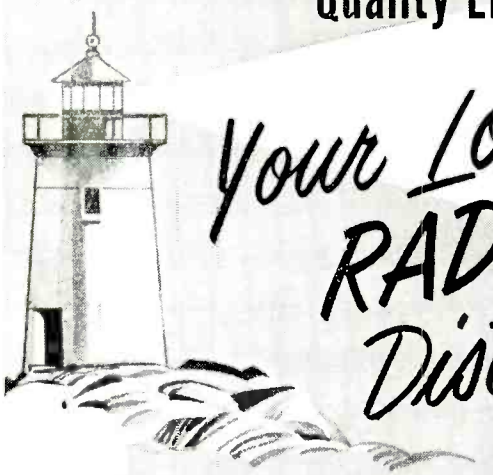

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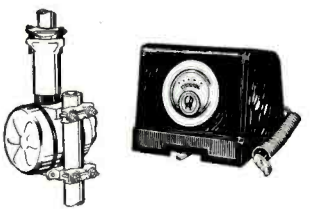

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# SIMPLE MAGNETIC AMPLIFIER

Comparative newcomers to the field of electronics, magnetic amplifiers now play important roles in equipment design.

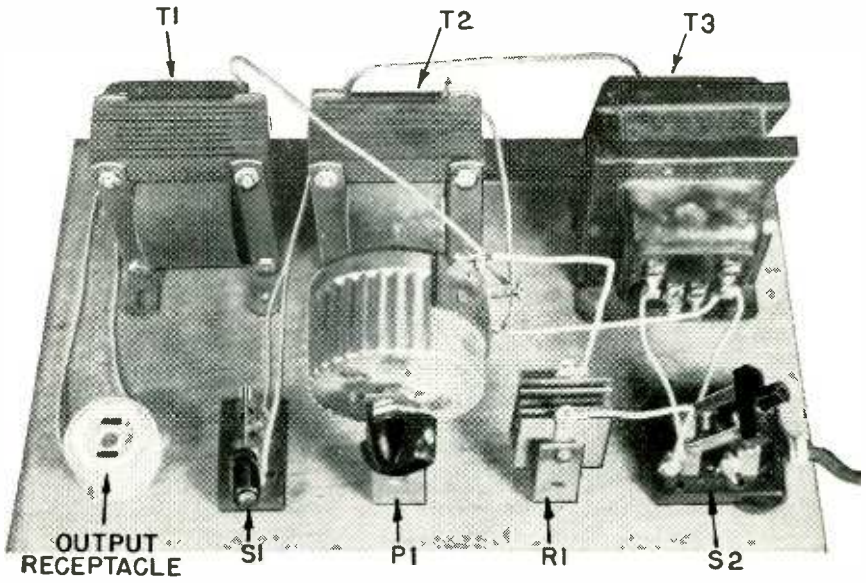



Fig. 1—Layout of the magnetic amplifier. The large potentiometer controls its gain.

By ERWIN LEVEY

THE growing use of magnetic amplifiers in military and industrial electronic equipment has stimulated considerable interest in these relatively unfamiliar devices. This article describes a simple setup for demonstrating the basic principles of magnetic amplification and applying them to controlling the speed of a small a.c. motor.

The equipment requires only three standard filament transformers and a few other readily available parts, all of which are mounted on a 7 x 12-inch wood baseboard.

The layout and all parts are clearly seen in the two photographs, Figs 1 and 5.

## Magnetic amplification

In its simplest form a magnetic amplifier is a magnetic core with two windings (Fig. 2). One of these, the *d.c.* or *control winding*, usually has a large number of turns and is connected across a source of variable d.c. The other, called the *a.c.* or *load winding*, is connected in series with the load and an a.c. supply line. A small amount of power applied to the d.c. winding will control a larger amount of power in the a.c. winding.

This is because varying the amount of current in the d.c. winding can vary the inductance of the a.c. winding over a wide range. As its inductance is varied, so is its impedance to a.c. and consequently the amount of power which can be applied to the load.

When the d.c. is zero the self-inductance of the windings is high and little power is applied to the load. As the amount of d.c. through the control winding is increased, the impedance of the secondary goes down, because the core is becoming saturated magnetically, and variations in the a.c. field no longer have any effect on it. Hence these variations do not set up the bucking voltages which keep the secondary impedance high.

With a large amount of d.c. in the winding, the secondary has practically no impedance, and the load is, in effect, connected directly across the a.c. supply.

The apparatus is an *amplifier* because the amount of power applied to the control winding is less than that controlled in the a.c. winding. This unit—built with ordinary transformers for demonstration purposes—has a gain in the order of two, but magnetic amplifiers made with special core material have extremely high gains. For a more complete and highly understandable treatment of this subject, see the article "Magnetic Amplifiers" in the September, 1951, issue of RADIO-ELECTRONICS.

This model uses a two-core arrangement. Since a low-voltage control system was desired, two 6.3-volt filament transformers were used. These are transformers T1 and T2 in Fig 3. The type of transformer used does not matter but the two must be identical or they will not function as a saturable reactor when connected. When used in this way no physical changes are required; it is necessary only to interconnect the windings so that certain phase relations exist.

## Phasing procedure

To phase the transformer windings correctly the following simple test is used. (A schematic of the arrangement is shown in Fig. 4.) Connect the two primaries in *parallel*. Designate one side of the line as S (start) and the other as F (finish). Mark the leads on each of the transformers accordingly. (It doesn't matter at this point which leads are used, as this coding will be the starting point.) Next, connect the secondaries of the two transformers in *series* and connect a 6.3-v pilot light across the two outside terminals. If the bulb glows brightly when the primaries are connected to the a.c. power line, connection is correct. Under this condition the two coils are in "series-aiding", which means that the total terminal voltage is 12.6. If the bulb is extinguished the connections are incorrect and *one* of the two secondary windings should be reversed.

When the proper connections have been made, mark the two windings as shown in Fig. 4. It is extremely important that this be done correctly, otherwise the unit will not operate in the final circuit.

The transformers can now be connected together to function as a saturable reactor. The 110-volt primaries are used as the d.c. control winding and are connected in "series-opposing" as shown in Fig. 3. The 6.3-v secondaries are used as the a.c. winding and are connected in parallel.

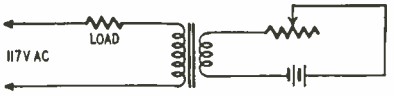
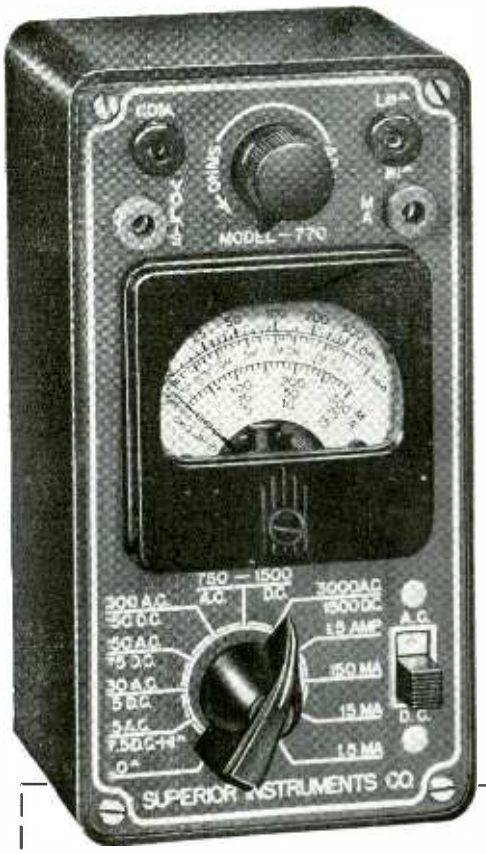



Fig. 2—Basic magnetic amplifier circuit. The magnetizing effect of the d.c. controls the permeability of the iron core.

# WORLD'S FASTEST SELLING VOLT-OHM MILLIAMMETER




**Superior's Model 770**

is an accurate pocket-size V.O.M.

Measures only 3⅛" x 5⅞" x 2¼".

★ Uses latest design 2% accurate 1 Mil. D'Arsonval type meter.

★ Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. in this price range.

★ Housed in round-cornered, molded case.

★ Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use.

**The Model 770 comes complete with self-contained batteries, test leads and all operating instruments.**

**$14.90 NET**

## SPECIFICATIONS

6 A.C. VOLTAGE RANGES:
0—15/30/150/300/1500/3000 Volts.

6 D.C. VOLTAGE RANGES:
0—7.5/15/75/150/750/1500 Volts.

4 D.C. CURRENT RANGES:
0—1.5/15/150 MA. 0—1.5 Amps.

2 RESISTANCE RANGES:
0—500 Ohms. 0—1 Megohm.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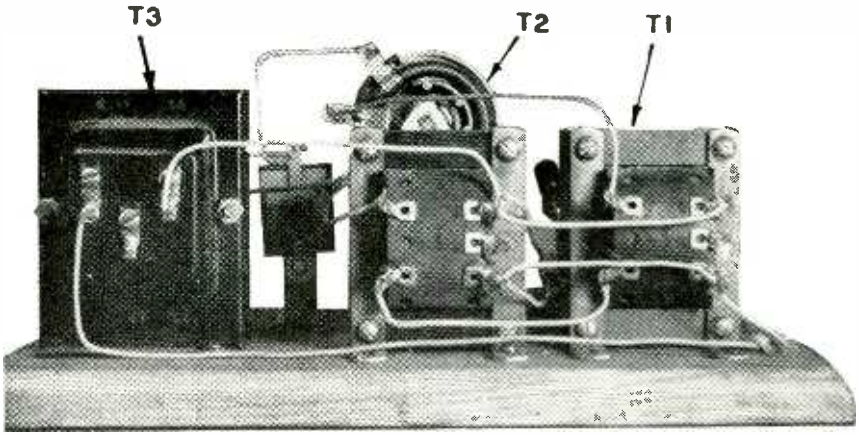



Fig. 5—Rear view of the magnetic amplifier. The two control transformers are at the right. The shielded transformer provides power for a small motor load.

A third transformer (T3) is needed to provide proper voltage for the load. Any small low-voltage motor will serve if the proper operating voltage is obtainable.

A much higher line current is required to *start* a motor than to keep it running. In this circuit even the minimum inductance of the a.c. windings would limit the current to such a small value that the motor could not start. A shorting switch (S1) is connected across these windings to allow full current to be applied to the motor when the power is first turned on. Once the motor is running the switch is opened, transferring control to the magnetic amplifier.

A half-wave selenium rectifier supplies the d.c. control current. The inductance of the d.c. windings provides good smoothing action, and no additional filtering is necessary. A 5,000-ohm, 50-watt potentiometer controls the current to the d.c. coils.

After the circuit has been assembled and all connections checked it can be put in operation. For this test the motor should not have a load attached. First close the shorting switch S1; then set the potentiometer so that full d.c. will flow when the power is turned on. Next close switch S2 to energize the circuit. The motor should start immediately. When it is up to full speed open S1. The motor speed can then be varied by turning the potentiometer. If the d.c. falls below a certain value the motor will stop because of the high inductance of the a.c. windings. It may be started again by closing S1.

The motor speed may be varied over wide limits. A little experimenting will show the best control ranges for different operating conditions.

If the motor stops when S1 is first opened, vary the potentiometer slowly over its full range since it may have been hooked up backwards. If the motor still will not operate, shut off the power. If wiring is correct, transformers T1 and T2 should be checked and the phasing test repeated.

If transformers T1 and T2 do not have adequate current rating they may burn out or give only limited control. If too heavy a load is placed on the motor the control range will be reduced since a larger amount of d.c. will be needed. In this case, two similar rectifiers may be paralleled and the power rating of the potentiometer doubled.

The power gain of this unit is fairly low because ordinary 4%-silicon steel is used as the core material of the transformers. In commercial magnetic amplifiers high-permeability core materials

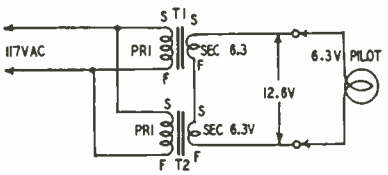



Fig. 4—Connections and polarity markings for the transformer phasing test.

give extremely high amplification. The power gain may be calculated from the formula:

$$\text{gain} = \frac{\text{a.c. power output}}{\text{d.c. power input}}$$

The simple magnetic amplifier described here will help to understand some of the basic operating principles of these units. For clarity the information in this article has been limited to only one application of a specific type of circuit. By varying the circuits and parts almost any amount of a.c. power may be controlled at any voltage desired.

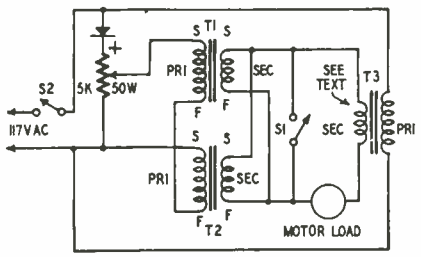
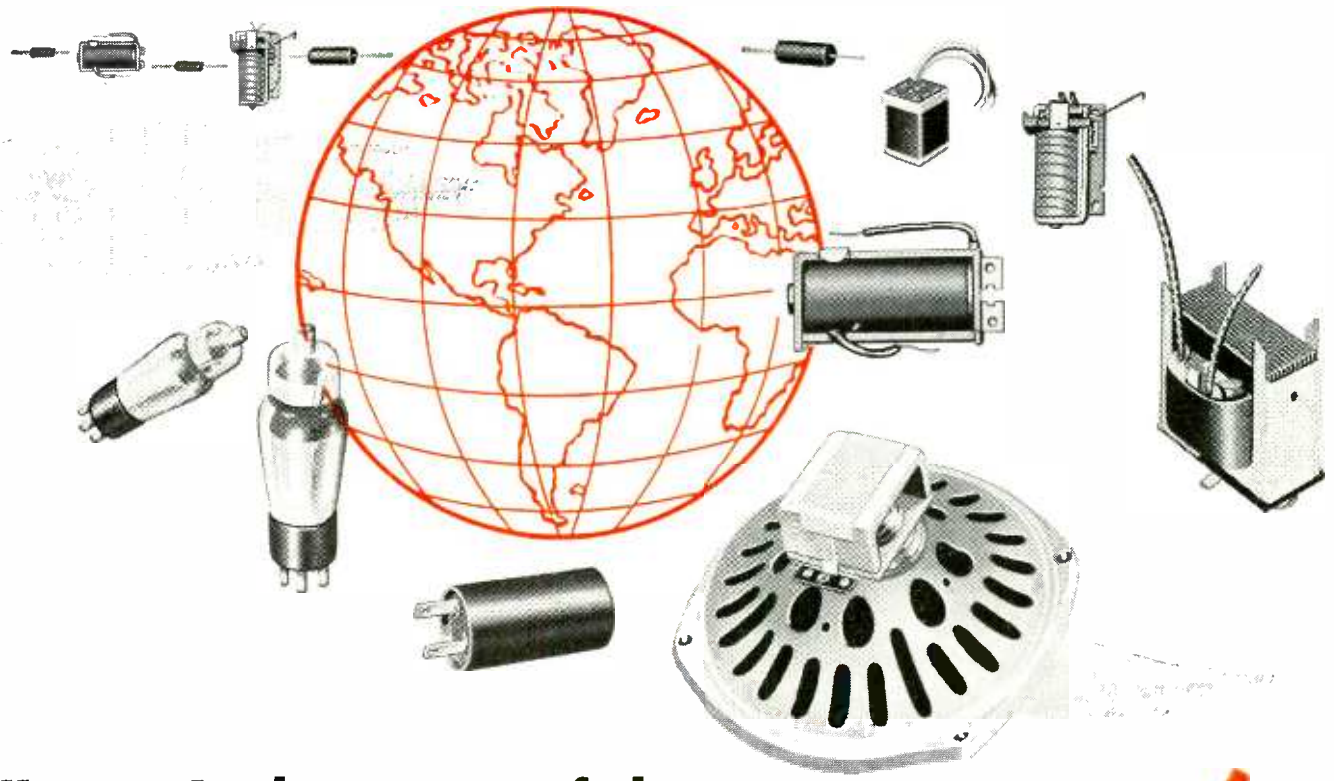



Fig. 3—The magnetic amplifier circuit. Characteristics of the three transformers and rectifier are given in the text.

**PARTS LIST**

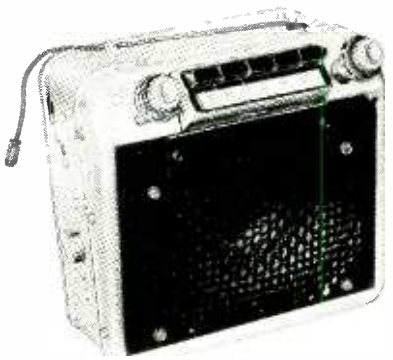
1—200-ma selenium rectifier; 1—5,000-ohm, 50-watt potentiometer;
2—double-pole, single-throw switches; 3—6.3-volt, 5-amp filament transformers (see text for T3);
1—motor (see text).

—end—



## Have a Look at some of the

# World's Finest Radio Parts!



Ordinary radio parts? Not at all! You see, these automobile radio parts—like thousands of others bearing the Delco Radio name—are of uniform high quality.

More than half of all radio-equipped cars are equipped with Delco Radios—*seven million* in all. Think of the volume-building opportunity for you!

**THINGS TO REMEMBER ABOUT DELCO RADIO SERVICE PARTS**

1. Offer largest market for original-equipment replacement parts.
2. Made in the world's largest factory devoted exclusively to automobile radios.
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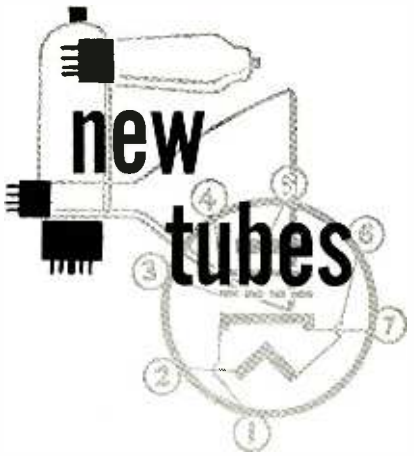
KOKOMO, INDIANA

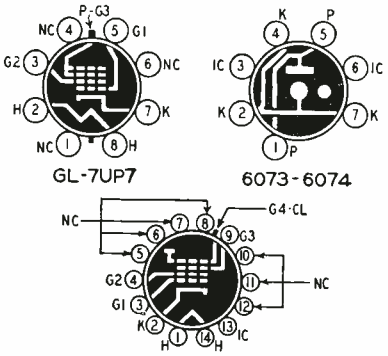



The RCA 7WP4 is a new projection kinescope for use in theater-television equipment. It is capable of providing a clear, bright picture 20 feet by 15 feet when used with a suitable reflective optical system. Contributing to the brightness is a high-efficiency, metal-backed, white fluorescent screen developed especially for theater-projection service.

The 7WP4 is designed with a faceplate curvature for use in an optical system having an 80-foot throw.

The 7WP4 employs electrostatic focus and magnetic deflection. Electrostatic focus facilitates use of the tube with a reflective optical system. Magnetic deflection provides essentially uniform focus over the entire picture area.

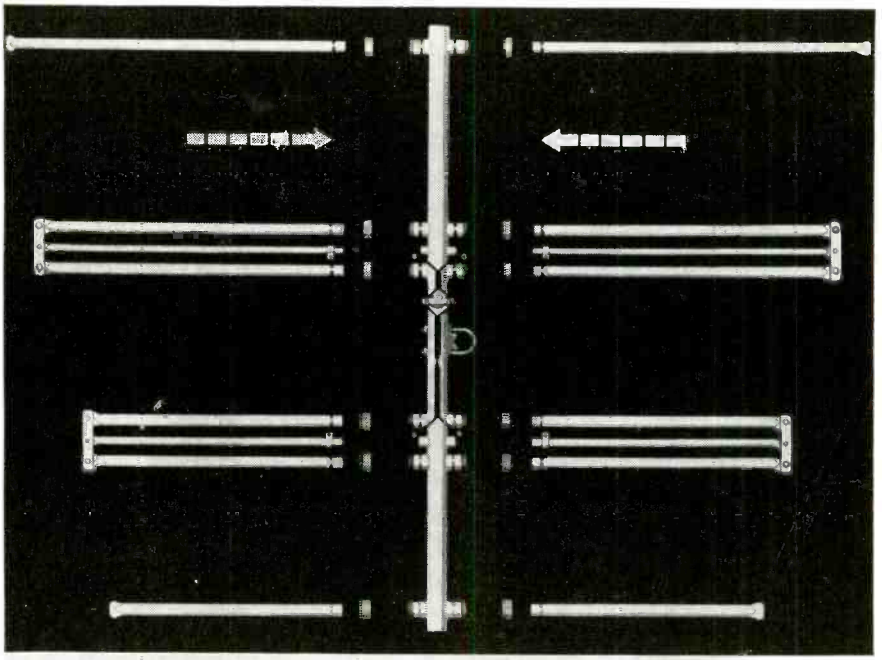
Operating with a maximum ultor voltage of 80,000 volts and a maximum focusing-electrode voltage of 20,000 volts, the 7WP4 incorporates high-voltage design features including a bulb with corrugated side walls with insulating coating to provide a long leakage path over its external surface, an inner cone-neck section to provide adequate vacuum insulation between internal ultor coating and outer neck section, and only one high-voltage envelope connection—all other connections are made through a plastic-filled diheptal 14-pin base (see diagram below).



# Announcing— the New TRIO 'MINIT-UP'

## STRONGEST TV ANTENNA EVER DESIGNED...

## PLUS-ONE MAN/MINUTE ASSEMBLY!



This — is it!

The new TRIO MINIT-UP . . . a revolutionary TV antenna that combines "minute quick" assembly with strength never before attained in *any* TV antenna!

Strong statements, to be sure — but absolutely true. Take a good look at the illustrations . . . see how simple, how fool proof, how "minute quick" assembly is! Note well, also, the many superior construction details that make the new TRIO "MINIT-UP" a veritable tower of strength!

***Feature upon feature makes this new TRIO MINIT-UP the biggest good news in TV antennas yet!***

This "exploded" view graphically illustrates the extreme simplicity of MINIT-UP's assembly. Note the color code bands that show instantly where each element is attached. Note the serrated connectors that provide a firm grip with hand or glove — in any weather. Here, indeed, is the last word in TV antennas. Featuring easy assembly, rugged strength — it's the New TRIO "MINIT-UP"!

**Model 445MU High Gain MINIT-UP for channels 4 and 5**
**Model 479MU High Gain MINIT-UP for channels 7 and 9**

(TRIO's conventional single channel yagis also available with "MINIT-UP" construction)

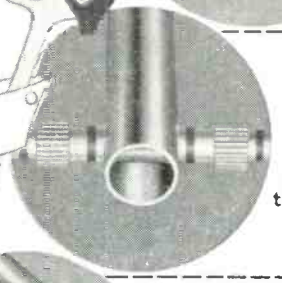
Patent pending — no licensing arrangements granted for duplicating principle of this antenna.

### MINIT-UP STOPS ANTENNA "CALL BACKS"!

TRIO TV Antennas have long been recognized as "leaders in performance"! Now — with new design features and "minute quick" assembly — TRIO is, easily, the "leader in construction"!

Dealers and Installers will find TRIO's MINIT-UP the most profitable TV antenna they can install. MINIT-UP goes up fast — and stays up! Every detail of design and construction is employed to make MINIT-UP the most rugged TV antenna on the market today!

Yagi elements of .035" thick seamless aluminum, are full 5/8" in diameter. Ends are crimped for greater strength and to cut down vibration. Prevents entrance of dirt and moisture.



End view of the heavy gauge 1¼" boom showing how element inserts are swaged to completely eliminate vibrations and to provide tremendous strength.

Double-folded dipole sections have heavy gauge aluminum brace bars securely riveted to element ends thus providing positive electrical connection and extreme rigidity. Workmanship throughout is of the highest order.


TRIO Manufacturing Company
GRIGGSVILLE, ILLINOIS

The G-E Tube Department has announced a new cathode-ray tube for radar indicator service and oscilloscope applications which reduces undesirable screen charging.

The new tube, the 7UP7, employs magnetic focus and magnetic deflection and can be used as a replacement for the 7BP7 or the 7BP7-A.

Use of a reflective aluminized screen reduces undesirable screen charging, permitting more accurate plotting directly from the face of the tube.

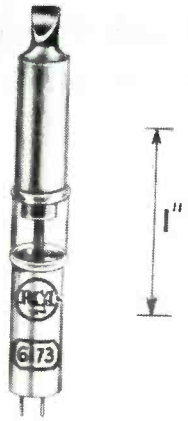
The aluminized screen also improves resolution and definition, reduces screen burns, and increases tube life.

The new tube also uses an improved anode contact design, permitting operation at higher altitudes. A recessed small-cavity cap has been used on the anode contact instead of the conventional recessed small-ball cap.

Basing is shown in the accompanying diagram.

## Special types

The RCA Tube Department has announced a new, high-perveance, pencil-type diode designed especially for pulse-detection and pulse-power-measuring service at frequencies up to 3,300 mc.




The design of this new tube, the 6173, features a coaxial electrode structure of the double-ended, metal-glass type having minimum transit time, low lead inductance, low plate-to-cathode capacitance, and high resonant frequency. It has a 6.3-volt heater, drawing only 0.135 amp. It is of very small size, and weighs only 1/5 ounce. These electrical and mechanical features make the 6173 particularly suitable for use with coaxial and wave-guide-type transmission lines, and in r.f. probes for u.h.f. measurements.

The new RCA 6073 and 6074 are cold-cathode, glow-discharge tubes of the 7-pin miniature type intended for voltage-regulator service under excessive shock and vibration.

These new types are military versions of the 0A2 and 0B2. They can withstand an instantaneous impact acceleration of 900 g, and a vibrational acceleration for extended periods of 2.5 g. Furthermore, they are processed to have very stable characteristics.

The 6073 and 6074 have an operating-current range from 5 to 30 milliamperes. The 6073 regulates at an

average value of 108 volts, whereas the 6074 regulates at an average value of 151 volts. Both types have the basing shown in the accompanying drawing.

### Transmitting tubes

RCA type 6166 is a new, forced-air-cooled power tetrode designed for v.h.f. service in television and cw applications. It has a maximum plate dissipation of 10 kilowatts, is rated for operation up to 220 mc, and utilizes an economical thoriated-tungsten filament.

The 6166 can deliver a synchronizing-level power output of 12 kilowatts in broad-band television service at 216 mc; and a power output of 9 kilowatts in class-C FM-telephony service in circuits operating at 216 mc.

The electrode structure of the 6166 is designed especially for use with high-power circuits of the coaxial-cylinder type. The design provides low-inductance, large-area, r.f. electrode terminals for insertion into the cylinders, and facilitates the multiple use of the 6166 in cavity circuits. An external radiator provides for cooling by forced air.

The Lewis and Kaufman *Los Gatos* type 719A is a clipper diode recommended for use in pulse generators where the pulse-repetition rate is 2,000 per second or less, and peak forward current is 10 amperes. Peak-inverse rating is 25,000 volts.

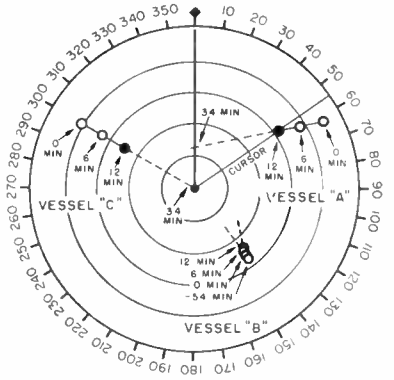
Rated at 75 watts, the tube incorporates a new black-body heat-dissipating anode surface called *Sintercote*. The heater draws 7 amperes at 7 volts. The tube has a maximum height of 5⅞ inches and a maximum diameter of 2 9/16 inches. It fits a standard No. 234 socket.

—end—

## NEW MARINE-RADAR PLOTTER REDUCES COLLISION HAZARDS

Marine Radar may become far more useful as a navigation aid and saver of lives at sea with the help of a new *Reflection Plotter* recently announced by Raytheon.

While radar has been extremely useful in showing the position of other ships as well as stationary objects, it




**Typical reflection-plotter situation. Dot in center is radar-equipped vessel; heavy line (360°), its course. Plot shows vessel "A" will pass ahead; collision with vessel "C" will occur in 34 minutes unless either vessel changes course sooner.**



## PARTS LISTS

**Bills of material for most of the pieces of equipment described in RADIO-ELECTRONICS construction articles are on hand at all radio parts jobbers and distributors who sell the magazine. See your dealer for a complete parts list of any of this apparatus you wish to construct.**

has been necessary to take two or more observations of the position of a moving ship, then plot its course and speed to determine if it is on a safe heading or if there is possibility of collision. This takes time and there are occasions when the officer cannot leave the bridge to do such plotting.

The Reflection Plotter provides a plotting surface, made of non-reflecting plastic, which is fitted over the radar screen. Edge-lighting around the plotter illuminates any objects placed in contact with it, so that by using a grease pencil, marks made on the plotter become luminous. Through an optical arrangement, these notations appear as though they actually are being made on the face of the radar screen below, so that the luminous radar "pips" can be marked and their actions observed. Their movements away from the original marked positions enable the operator to determine the direction and speed of each vessel in relation to his own ship.

**Marking positions on plotter screen.**

The watch officer merely makes a mark indicating the position of the ship, noting the time beside the mark. A given number of minutes later, he makes another mark, again noting the time. These two would be sufficient to determine the other ship's course and speed, but the reflection plotter makes it unnecessary to do so. It is only necessary to draw a line through the two points, showing the course of the strange ship. If that line passes through the center of the screen (the position of a ship is always in the center of its own radar pattern) there is danger of collision. If it does not pass through the center, the ships will pass each other safely.

It will be noted that this method (as well as earlier methods for plotting with the help of radar) assumes that the radar-carrying ship is at a fixed point, and all motion is attributed to the strange ship. This makes for simpler plotting than the traditional method of plotting the course of both ships with relation to the earth, and is the secret of the reflection plotter's operation.

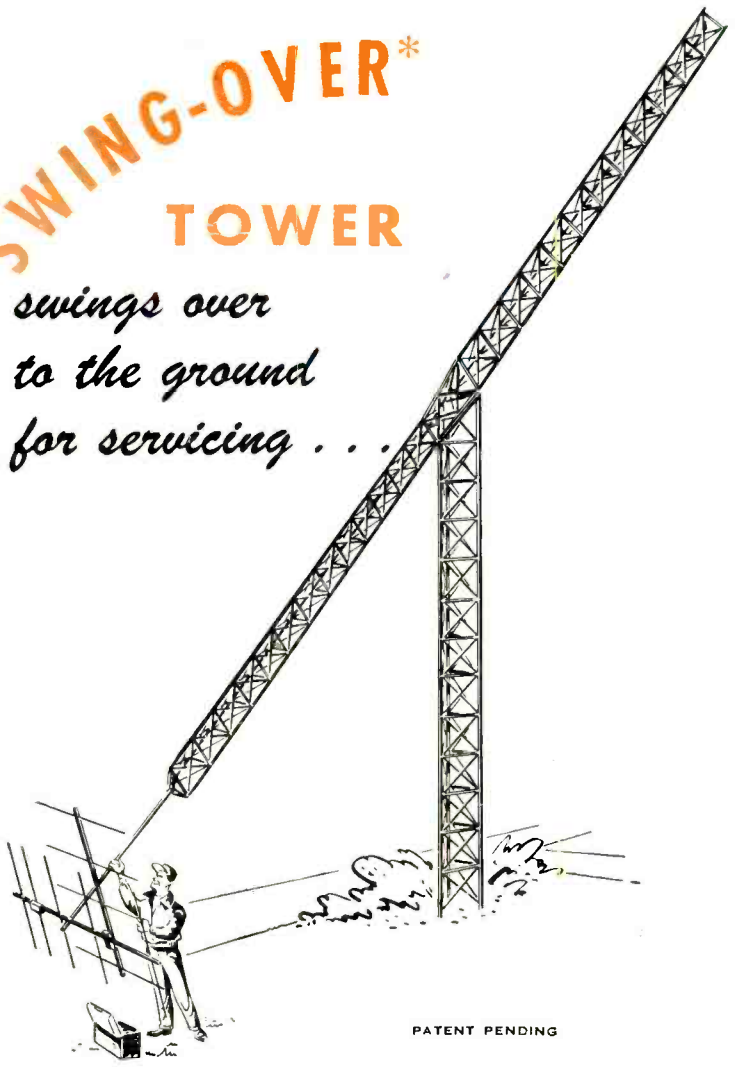
—end—

# the most convenient TV tower ever made

THE TEL-A-RAY

## SWING-OVER* TOWER

*swings over to the ground for servicing . . .*



PATENT PENDING

The biggest new idea in television — the Tel-a-Ray Swing-Over Tower* — swings over to the ground for easy servicing! One man can raise or lower this counterbalanced tower in three minutes!

Model TT1, for ground installations, is 50 feet high when a recommended 10 feet of water pipe is added — can be quickly erected with no guy wires.

Model TT2 is designed for roof tops, reaches up 24 feet with the addition of an eight-foot pipe.

Although light in weight, the Swing-Over Tower is ruggedly built with steel angles and welded construction.

Simple to assemble . . . no machinery necessary . . . low in price.

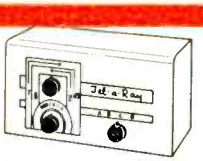
Write today for information.

## FOR WONDERFUL TV RECEPTION WHEREVER YOU ARE

The weatherproof Model T antenno . . . brings in wonderful reception up to 200 miles.


Only low-priced Pre-Amplifier on the market, the TB. Multiplies signal gain . . . holds noise to a minimum.

Butterfly Swivel-Positioned TV and FM antenna . . . designed to give the finest reception in primary areas.




Tel-a-Ray's new Switching Booster (Model PTB1) — one switch changes channels and antennas. Eliminates the need for a separate booster for each antenna . . . for as many as four antennas. Automatic features make this outstanding.

FOR COMPLETE INFORMATION WRITE

**Tel-a-Ray**

**ENTERPRISES, INC.**

TRADEMARK

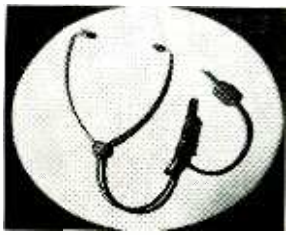
BOX 332E

HENDERSON, KY.

## LIGHTWEIGHT HEADSET

**Telex, Inc.**, Telex Park, St. Paul 1, Minn., has announced a new addition to the line of Telex headsets.

The new Dynaset model with under-the-chin styling and light weight (1.25 oz.) is designed to be worn all day without fatigue.



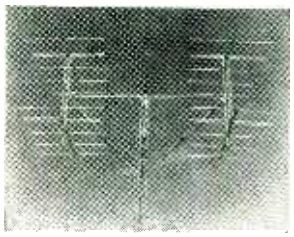
Among additional features is a higher fidelity range, permitting more exact reproduction of highs and lows of both music and speech.

The Dynaset is suitable for office transcribing machines, telecasting, radio monitoring, amateur radio, record stores, theaters, phone-order boards, electronic laboratories, and commercial communications of all kinds.

## TV ANTENNA MOUNT

**Channel Master Corp.**, Ellenville, N. Y., has announced the *Super Mount*, a new ready-made mounting structure which permits side-by-side stacking of any 4 antennas, regardless of make, and opens the way to many new stacking arrangements.

The structure is heavy-gauge, seamless steel tubing, bright zinc plated. Full-wave spacing for each channel is clearly marked.



Featuring a unique sliding arrangement which simplifies installation, the mount may be either assembled at the top of the tower or assembled on the ground and swung up into position.

A 4-bay array of Channel Master 5-element Z-Match Yagis, installed on the *Super Mount* produces over 15 db gain on the low band.

## WEATHERPROOF SPEAKER

**RCA Victor Division** of Radio Corporation of America, Camden, N. J., has designed a new speaker, the MI-6441, which performs equally well as a high-efficiency microphone in talk-back systems or as a re-entrant speaker in low-powered voice paging systems. Ruggedly constructed and completely weatherproofed, the speaker can be used in outdoor or indoor industrial sound installations, and is designed to replace cone-type speakers in intercommunication systems where maximum acoustic output is required.

The removable diaphragm unit is enclosed in a weatherproof spun aluminum cover. It has a spun-aluminum flared bell and reflector, which can be locked in the desired position. The distribution angle is 120 degrees. The speaker is finished in a baked dark umber gray enamel.

Electrical specifications show a power handling rating of 12 watts, sensitivity of 105 db, frequency response of 350 to 10,000 cycles, and impedance of 16 ohms. It is 6 11/16 inches long, with a bell diameter of 6¾ inches. The speaker weighs 2½ pounds.

## HIGH-VOLTAGE JACK

**Insuline Corp. of America**, 36-02 35th Ave., Long Island City 1, N. Y. has introduced a new high-voltage tip jack for electronic test equipment. The nylon insulation withstands 10,000 volts, and has negligible moisture absorption. The one-piece contact is phosphor bronze and takes all standard phone tips and test prods. The jack is furnished with a molded washer that affords positive protection against shorts to a metal panel.

## TELEVISION BOOSTER

**Regency Division, I.D.E.A., Inc.**, 7900 Pendleton Pike, Indianapolis 26, Indiana, has incorporated an exclusive circuit stabilizer, for which patent application has been made, in the new Regency television signal booster model DB-520. The stabilizer provides both inductive and capacitive neutralization to assure maximum stability on all channels.

The new model also features a single off-on switch for booster and TV receiver; single tuning knob; push-pull triode circuit; link coupling for optimum impedance matching; improved tracking accuracy; a compact cabinet; and broadband response which insures equal enjoyment of both video and audio on all channels. The model is approved by Underwriters' Laboratories.

## AUTO SPEAKERS

**Quam-Nichols Co.**, Chicago, Ill., has announced two new rear-seat auto speakers. The economy model, AS-1 kit includes a Quam 6½-inch PM *Adjust-A-Cone* Speaker with capacity to handle the full output of any single-ended auto set. The de luxe model, AS-2 kit includes a Quam heavy-duty 6 x 9-inch PM *Adjust-A-Cone* speaker with capacity to handle the most powerful auto set made.

The economy model features a 1.47-oz. Alnico V magnet; 3-position switch for dash mounting, ample cable for any installation; flocked grill screen; baffle plate; miscellaneous hardware and installation instructions.

The de luxe model features a 2.15-oz. Alnico V magnet; three-position switch for dash mounting; sufficient cable for any installation; flocked grill screen, baffle plate, sponge rubber gasket for easy and trouble-free installation; miscellaneous hardware and installation instructions.

## ANTENNA ROTATOR

**Brach Manufacturing Corporation**, of 200 Central Ave., Newark, N. J., announces its new Diamond antenna rotator No. 470.

The rotator features a special aluminum alloy casting whose streamlined design reduces wind resistance and precludes ice formation. The weatherproof, moisture-sealed drive unit is capable of clockwise and counterclockwise 365-degree rotation, and uses simple 3-wire rotator lead.

The indicator is styled to match the decor of any room, and it houses a light to signal change of direction of rotation.

## FM PHONO CARTRIDGE

**Weathers Industries**, 510 Richey Ave., West Collingswood 6, N. J., has introduced a new FM phonograph cartridge, operating on a variable capacitance principle.


With a good transcription arm, the Weathers cartridge tracks at a stylus pressure of 1 gram. When installed in modern record changers the stylus pressure can be adjusted to 3 grams or less. Frequency response is 20 to 20,000 cycles per second.

The cartridge requires an auxiliary oscillator unit using one 6AT6 tube. Filament and plate current may be taken from the audio amplifier, or from a separate power supply.

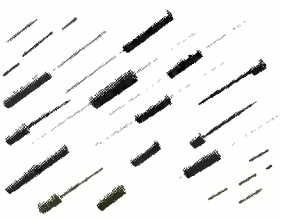
## CRT REACTIVATOR

**Crest Laboratories, Inc.**, Whitehall Building, Far Rockaway, N. Y., announces a plug-in type cathode-ray tube rejuvenator. Its simplicity of installation permits quick salvage of weak picture tubes.

## FERRITE CORE KIT

**Grayburne Corp.**, 103 Lafayette St., New York 13, N. Y., has announced a special experimenter's ferrite-core kit to enable engineers to familiarize themselves with ferrite cores.

The kit, type FCK, consists of 27 various-sized cores adopted for experimentation in i.f. and r.f. coils, solenoids, linearity or width controls, and in other electromechanical applications.



## SUPER-TWEETER

**Jensen Manufacturing Company**, 6601 So. Laramie Ave., Chicago 38, Ill., has developed a new high-frequency unit which makes a three-way system of any coaxial speaker, or a 2-way system of a single-unit direct radiator. The RP-302 "super-tweeter" is adapted from the h.f. channel of the Jensen G-610 Triaxial speaker. Installation is simple—atop cabinet or flush on baffle in a 1-11/16-inch hole. The RP-302 provides response from 4,000 cycles up, extending speaker range to approximately 18,000 cycles, with extremely low distortion. The small Hypex horn disperses sound with a useful coverage angle of 120 degrees in both horizontal and vertical planes. A special plastic diaphragm gives

freedom from breakup. Impedance is 16 ohms, maximum power rating 30–40 watts when used with the Jensen A-402 crossover network. The unit can be connected with a 2-μf series capacitor across any low-impedance speaker line up to 16 ohms.

## MARKER GENERATOR

**Precise Development Corp.**, Oceanside, N. Y., has introduced an unusual r.f.-a.f.-TV marker generator. Available complete or in kit form, the Precise model 630 reaches 110 mc on fundamentals and 330 mc on harmonics.

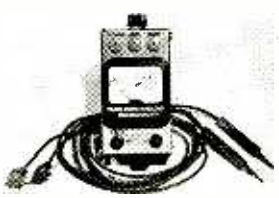
A built-in Wien-bridge audio oscillator covering 20–20,000 cycles provides controllable-percentage modulation or may be used independently. The r.f. circuits are individually tuned and load-compensated for constant output on all ranges. A separate crystal-controlled marker oscillator is included.

Other features of the generator are: cathode-follower output, with step-type attenuator; complete shielding and line filtering; and vernier tuning of both r.f. and a.f. oscillators. External modulation may be used, with the internal modulator acting as a speech amplifier.

Kits are available with or without the r.f. sections completely prewired and aligned.

## POCKET V-O-M.

**Trade Associates**, 128 South 1st St., Brooklyn, N. Y., is producing a pocket volt-ohm-milliammeter, measuring only 2¼ x 2¼ x 4 inches. The instrument has the following ranges: Volts (a.c. or d.c.): 1, 10, 50, 100, 500, and 1,000 at 1,000 ohms per volt; d.c. ma: 1, 10, and 100; ohms: 1 megohm (22,500 ohms mid-scale). A crystal-diode rectifier is used for a.c. voltage measurements.



## PORTABLE TAPE PLAYER

**Pentron Corporation,** 221 E. Cullerton St., Chicago 16, Ill., is producing a portable playback machine for standard magnetic tape recordings.

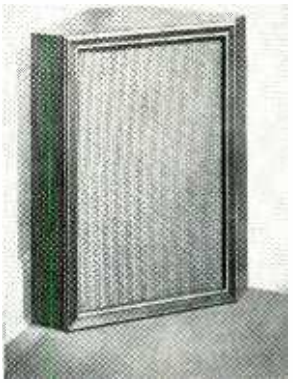
It is available either as a self-contained unit with speaker and amplifier, or with preamplifier only, ready to plug into any existing amplifier, radio, or TV set. Both feature double-track operation and tape speeds of 3¾ and 7½ inches per second. Both types are also available with single-track (full-width) heads for broadcast applications.

Frequency response is 50-8,000 cycles at 7½-inches per second and 50–3000 cycles at 3¾ inches per second. Flutter is less than 0.5%.

Model PB-1 (with preamplifier only) weighs 19 pounds and is 11⅜ x 10 x 9¾ inches. Model PB-A2 has a 5-watt amplifier, 6-inch Alnico V speaker and weighs 22 pounds. Its dimensions are 11⅜ x 12¼ x 9¾ inches.

## MULTIPLE SPEAKER ENCLOSURE

**Permoflux Corporation,** 4900 West Grand Ave., Chicago, Ill., is marketing a new corner horn enclosure for four 8-inch speakers.



Special features of the new corner horn include: Smooth over-all response, achieved by proper low-frequency loading in an enclosure of reasonable proportions; decreased distortion due to limited cone travel; corner placement, giving response from 30 to 12,000 c.p.s.

Two models are available, CH-8M in mahogany finish for traditional settings, and CH-8B in blond mahogany for modern interiors. The enclosure is 25 inches high, 20 inches wide, and 11 inches deep. Shipping weight (without speaker) is 20 pounds.

## BATTERY ELIMINATORS

**The Schauer Manufacturing Corp.,** 4500 Alpine Ave., Cincinnati, Ohio, is distributing improved models of its Electrox battery eliminators.

The Electrox AR-5, featuring adjustable output voltage, replaces the AR-2. Principal changes include complete redesign of the case and the addition of an ammeter.

The AR-5 is hum-free and delivers 6 volts d.c., at any load current up to 15 amperes. The case is finished in metallic grey and is 7½ inches wide, 9¼ inches deep and 9 inches high.

Model AR-4, which replaces the AR-1, is similar to the AR-5, except that the output voltage is not adjustable. Output is 6 volts d.c. at approximately 15 amperes. Case dimensions are the same.

## MULTIMETER

**Electronic Instrument Co., Inc.,** 84 Withers St., Brooklyn 11, N. Y., manufacturers of EICO test instruments, have announced a new 1,000-ohms-per-volt multimeter.

Available either wired or in kit form, mode 566 uses a 4½-inch, 400-μa meter movement, and has the following

ranges: volts (a.c. or d.c.): 1, 5, 10, 50, 500, 5,000; current (a.c. or d.c.): 1 ma, 10 ma, 0.1 amp, 1 amp; resistance: 500 ohms, 100,000 ohms, 1 megohm; db: minus 20 to plus 69 (6 ranges).

Model 566 is housed in a high-impact bakelite case, 6¾ x 5¼ x 3 inches.

# New Devices

## V-M CHANGER

V-M Corporation, Benton Harbor, Michigan, has introduced a de luxe version of the V-M tri-o-matic record changer, especially designed for high-fidelity applications.

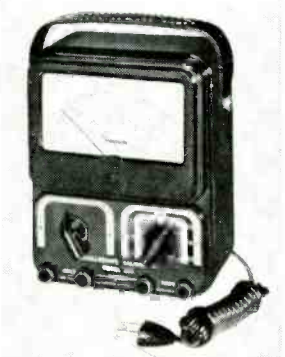
Called the V-M tri-o-matic 956-GE, this newest model features a hum-free four-pole motor, muting switch, and G-E variable reluctance cartridge, in addition to the tri-o-matic standard features.

The 956-GE is mounted on a metal base and is equipped with 6-foot a.c. cord and 4-foot phono cord. The 951-GE is the same unit without the base, for custom installations and for replacement. Precut mounting boards are available.

Both models shut off automatically after the last record plays. Arm set-down is automatic for any size record.

## SCOPE CALIBRATOR

Simpson Electric Co., 5200 W. Kinzie, Chicago, Ill., has introduced the model 276 direct-reading oscilloscope calibrator. Model 276 provides sine-wave output up to 250 volts peak-to-peak,



in six ranges. The meter is calibrated directly in r.m.s., peak, and peak-to-peak values. Each range is continuously adjustable from zero to full-scale value.

The calibrator comes in a black molded-bakelite case identical to models 260 and 303.

## POCKET TESTER

Neo-Lite Manufacturing Company, Rockford, Ill., has introduced the *Dandy-Lite* pocket-size circuit tester. Operating on the neon glow lamp principle, the *Dandy-Lite* will test for grounds or polarity on lines from 90 to 550 volts a.c.-d.c., and can be used to check automotive cables and circuits, fuses and spark plugs. In addition, electric fences, radios, and television sets can be checked.

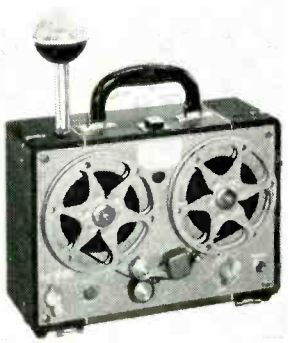
## BATTERY-POWERED TAPE RECORDER

Amplifier Corp. of America, 398 Broadway, New York 13, N. Y., has announced the *Interviewer* battery-operated midget tape recorder as the latest model in its series of Magnemite recorders.

The *Interviewer* carries its own power supply of small dry-cell flashlight batteries, so that it may be operated anywhere, regardless of the availability or type of current on hand. Its detachable nondirectional microphone plugs directly into the microphone input jack, and is supported by its own rigid tubing. A table stand, complete with extension cable, is also available.

The *Interviewer*, in a two-tone leatherette-covered cabinet, measures only 11½ x 8½ x 5½ inches, and weighs 9¾ pounds, including batteries which last 100 operating hours.

The spring-wound drive motor runs 15 minutes on a single winding and may be rewound during operation. A warning light goes on approximately one minute before rewinding is necessary. A special governor assures constant tape speed and vibrationless control.



Two hours of recording are accommodated on a 5-inch reel of standard ¼-inch tape. Tape speed is 1⅞ inches per second. The frequency range, up to 3,000 cycles, permits accurate recording of individual speech characteristics for absolute recognizability. Sensitivity is sufficient to pick up normal conversations at a distance of 100 feet from the microphone.

Headphone monitoring while recording is possible. The *Interviewer* also contains its own playback preamplifier, which will feed directly into earphones or into an external amplifier and speaker.

## SPEAKER ENCLOSURE

Electro-Voice, Inc., Buchanan, Mich., has developed a new folded-horn corner enclosure for 8-inch speakers.

Utilizing the Klipsch principle of folded-horn corner loading, the *Baronet* conceals the throat of a horn formed by the walls of the room. With a volume of 1½ cubic feet, it provides response down to 35 cycles, with direct front radiation of high frequencies. Proper air-loading of the driver cone holds the voice coil in the flux gap and reduces distortion.

The Baronet is conservatively modern in design and is available in mahogany and blond hand-rubbed finishes. Height 23½ inches; width 14½ inches; depth (bottom) 14½ inches; depth (top) 10½ inches.

—end—

All specifications given on these pages are from manufacturers' data.

## HOME REPAIR GUIDES

Since our recent article, "Fix It Yourself" (April, 1952, issue) the situation on the home repair guide front has become considerably more tense. Sales of these books have skyrocketed almost into a major national industry. Full-page ads from newspapers in several of the larger cities have been sent us by readers, and one book's publisher had a three-color, four-column ad in a syndicated comic section which presumably appears in the Sunday papers of most large and medium-sized cities in the country. Two of the books have come out with new editions (one looks in vain for "condensors" and "lack of electronic power" in the new versions).

The ads scream that "Thousands of TV Owners (are) Being Swindled!", and that the non-owner of the magic book "will probably waste $30-$100" on his set during the next year, presumably in payments to service technicians for unnecessary repairs and adjustments.

And the remedy is easy. All the TV owner needs is "5 minutes a week for perfect reception!" (Whether this is straight repair-and-adjustment time or whether it includes time spent studying the book is not stated.) With "A TV Expert at Your Elbow 24 Hours a Day" he can "Avoid 90% of All TV Repair Calls," as well as "Save $50 to $150 on New, Giant-Screen Set." All the new homeowner has to do is buy this book and he can complete his library with a five-foot-shelf bought from the savings he'll accumulate!

Service associations are blasting the ads and in many cases have persuaded newspapers that their publication is contrary to set-owners' interests. Radio stations have been even quicker to grasp the danger to unskilled owners and their receivers, and have cancelled or refused advertising.

One of the most striking cases is reported by *Retailing Daily* from St. Louis. According to that paper, the *Post-Dispatch* and the *Globe Democrat* have promised not to run advertising on the "TV Owners' Guide" until the ad is cleaned up. This action was taken at the instigation of the Association of Television Service Companies of Greater St. Louis. Not only did the city's two important papers refuse the ad, but Radio Station KMOX, which ran two tape recording advertisements on the book, has promised not to repeat the ad until it has been changed "to meet truthful requirements", according to Vincent Lutz, president of the Association. Promoters of the book were then said to have approached the local program guide, the *TV Review*. That publication also declined to sell them advertising space.

Philadelphia TV technicians protest the contents of the book as much as the advertising. While it is held in some quarters that such books will promote rather than harm service business, the technicians are not happy over the prospect of handling the traditionally mean owner-botched job, which promises to be a worse mess in television than it ever

was in radio. The chairman of the Pennsylvania Federation, Dave Krantz, points out that attempts by the owner to repair his own set "will result in a violation of the safety underwriters' instructions" as well as in ultimately higher repair bills. Frank Moch of the National Alliance of Television and Electronic Service Associations reports that his organization has sent out more than 75 telegrams to manufacturers, newspapers, radio stations, and others, and reports that "Philco, Capehart, G-E, Belmont and Hallicrafters have offered positive support, as have Howard Sams and John Rider." The Radio Television Manufacturers Association has also condemned the books, but declined the request of a Philadelphia meeting to engage in a national advertising campaign denouncing them. Local action, believes the RTMA, is the most effective approach. A New York service technician has printed at his own expense a book called "Why You Should Not Try to Fix Your Own TV" which he hopes to sell to at least part of the public who have read the other books. (See *Book Reviews*)

The reaction of John TV Owner is not readily discovered, except in the fact that he has flocked to buy the books. Whether or not he has attempted to put the instructions into effect after reading his book is unknown. However, the more articulate section of the public—the writers and cartoonists—have expressed themselves as being at least mildly doubtful. The strip printed on page 39 of our May issue (which appeared originally in the *New York Herald Tribune*) is typical of the cartoonist's reaction to the books. A number of one-picture cartoons with the same general theme have also appeared. Cartoonists—like most other technicians with a special skill—are highly skeptical about the possibilities of learning a skilled craft at a cost of $1.98 and a few minutes of time.

## COLUMBUS STOPS AD

One of the speakers at the March meeting of the Association of Radio-Television Service Dealers of Columbus, Ohio, was Mr. William Schmitt of the *Columbus Citizen*. He explained the attitude of the paper toward advertising, stated that insertion of certain unethical advertising had occurred as a mistake and guaranteed that it would not recur. He also informed the meeting that the editor of the paper would be interested in printing an editorial presenting the ARTSD point of view as an answer to the offending ad. The *ARTSD News* did not explain the nature of the "unethical ad" but readers will have little difficulty guessing it correctly.

## PARTS SHOW AND LICENSING

A proposal presented by the Board of Directors of the Chicago Electronic Parts Show which stated that "the question of servicemen's licensing laws requires the concerted action of the entire industry" and which would have placed Show funds at the disposal of a serviceman-dealer advisory committee

for the purpose of "aggressively pursuing this activity," was voted down by a majority of the organizations sponsoring the Show.

Two of the associations who voted down the measure expressed themselves as being opposed to licensing of service technicians. One of these, the Sales Managers Club, expressed itself as being "extremely sympathetic to the non-licensing of radio servicemen," but felt that no funds should be diverted from the Show corporation's treasury except for the purpose of distributor education. The other, the Association of Electronic Parts and Equipment Manufacturers, felt that the industry could best be served by combating local efforts to license independent radio and television service technicians. Only one of the groups, the West Coast Electronic Manufacturers Association, did not express its opinion on the merits or demerits of licensing, but voted bluntly that the Show corporation confine its activities to Show problems.

## N. J. OPPOSES BONDING

The Radio and Television Servicemen of (Paterson) New Jersey, Inc., has registered objection to Assembly Bills 222 and 227, which were introduced in the 1952 session of the Legislature.

Bill 222 would create a system to guarantee performance of television contracts by creating special trust funds under the State Department of Banking and Insurance. Bill 227 would require that a performance bond be issued with every service contract sold.

J. Palmer Murphy, secretary of RTSNJ and manager of the distribution division of the Paterson Chamber of Commerce, stated that filing of performance bonds for each contract would cause endless complications and trouble. A general surety bond for each company would not be as expensive, he said, and he did not believe that even such a bond would be necessary.

The organization's president, H. B. Rhodes, said that the two bills, while designed to protect the public, were not properly drawn for that purpose, and instead would increase the cost of service to the customer and would drive reputable companies out of contract servicing.

## CAPITAL PLANS CAMPAIGN

Television service companies and dealers are planning a campaign of education for the Washington, D.C. consumer. Its keynote will be to urge set owners to know the firms with which they deal.

According to Norman Sellinger of the local TV technicians' association, the campaign will be aimed at firms who advertise cut-rate service.

## OBJECTIVES SET

The new Television Service Association of Pittsburgh, Pa., gives as its objectives:

1. To develop a consumer education program which will tell the set buyer and user what he can reasonably ex-

pect from his television receiver.
2. To create a means whereby the consumer can recognize the responsible, ethical, service technician.
3. To develop an understanding of warranty problems locally and throughout the industry. This should result in abatement of practices which have been found objectionable by the service industry.
4. To find a suitable method for resolving customer complaints as quickly as possible and to develop means for avoiding their undue repetition.

Robert A. Laneve was elected temporary chairman of the association and Penny Martin secretary and public relations director. L. C. Reed, M. J. Reich and Thomas Ulrich were appointed members of the acceptance committee, with the task of setting technical qualifications and standards for membership eligibility.

## CALIFORNIA TO LICENSE?

A copy of Assembly Bill No. 26, entitled Radio and Television Service, has been forwarded to us by Harry F. Ward, public relations director of the Long Beach Radio Technicians Association. In many respects it resembles bills recently introduced in Pennsylvania and New York City.

The proposed law would create a 5-member state board of radio and television examiners.

One member would be connected with radio-TV manufacturer or distributor factory service, one an independent radio and television dealer, one affiliated with the broadcasting industry, one a journeyman radio and television repairman not employed by any manufacturer or distributor organization, and one a member who is not affiliated with either the radio or television industries.

It would be illegal to operate as a servicing dealer or service organization without a license from the board, and no dealer or service organization would be permitted to employ other than registered technicians to install, repair, maintain or adjust radio or television sets or electronic record players.

Service dealers and service organizations would be charged a license fee of $25 for the first year and $15 for each succeeding year. Technicians would be charged an annual registration fee of $5 and apprentices one of $2. In addition, technicians and apprentices would pay application fees of $5 and $2 respectively.

There would be three classes of technicians: radio technician, television technician, and installation technician. Applicants would be required to have taken a course of training in a trade, vocational, or technical school, or have completed a four-year apprenticeship, and would be given an examination in technical knowledge and practical skill. Apprentices would also be registered, but would not need technical qualifications. Examinations might be waived if the applicant could submit evidence of sufficient education, training, and experience to meet the required qualifications.

The bill would also prohibit any servicing dealer, service organization, technician, or apprentice from making any fraudulent statements or using misleading advertisements, with respect to the skill of technicians or quality of materials used in servicing electronic equipment.

## INSTRUCTION BOOKLETS

A bill recently introduced in Congress by Representative Walter Horan of Washington would make it compulsory for manufacturers of electrically operated household appliances to supply instruction booklets with their products. The booklets would contain "an adequate explanation of the operation and care of the appliance, an adequate description of the functions of the various parts of the appliance, including the names of such parts, and adequate instructions for the making of such repairs and adjustments as do not normally require the services of expert technicians."

There has been objection to the bill from both electrical-appliance and radio-television service associations. Objections appear based on the fear that such booklets would encourage the owner to repair his own appliances and radio or TV receivers, with damage to the customer and equipment and loss of business to service organizations. A reading of the bill shows no ground for such fears. Since the booklets are to be prepared by the manufacturer, there is little reason to believe that any repairs or adjustments would be recommended beyond those now recommended in operating manuals or leaflets put out by better manufacturers with their equipment. Nor is there any reason to believe that the Federal Trade Commission (whose approval the instruction booklets would be required to have) would have any reason to suggest amendments or changes to a reasonably competent instruction book.

The effect of the law, if passed, would simply be to make universal a practice which has always been followed by the more reputable manufacturers of both mechanical and electrical appliances.

The reaction of the radio-TV technicians, (most of whom have at least one piece of equipment in the shop which is useless or of limited use because no information on it can be obtained) is likely to be that the bill should be broadened to:

Provide that additional instruction booklets be obtainable from the manufacturer at a reasonable price in cases where the old ones are lost or damaged; and

Extend the Act to cover radio and TV test equipment as well as household appliances!

## NEW MICHIGAN GROUP

The Television Technicians of Michigan was formed recently at a mass meeting of technicians from Detroit, Flint and Pontiac. A series of technical and practical tests has been set up and must be passed by all applicants whose

qualifications are not such as to make entrance tests superfluous.

Membership cards that will serve also as identification cards are being issued, and will be renewable every three months. Members will follow a code of ethics that will include refusal to carry out orders of unscrupulous employers.

### TISA HOLDS FORUM

A proposal to police the service industry was made at the open forum held under the auspices of the Television Installation Service Association in Chicago, March 26. According to president Frank Moch, within 30 days TISA will begin an advertising campaign, inviting set owners to present all complaints about poor television servicing directly to the Association.

A secret vote was taken on the subjects of unionization and licensing. The forum was neutral on the subject of unionization, but a strong vote was cast in favor of a state law which would license both technicians and shops. It was suggested that it might be based on the state's Medical Profession Bill.

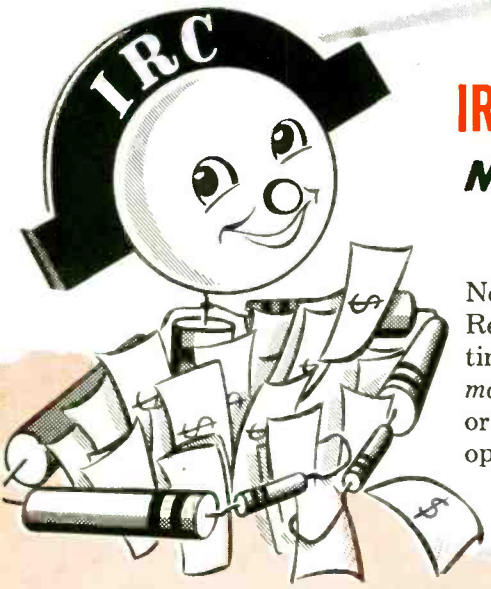
TISA has organized a company known as Western United Services, in an attempt to forestall possible penetration of the Western Union Telegraph Co. into the Illinois television servicing picture. It would presumably go actively into business under that name should the Eastern TV service subsidiary of WU start operations in the area.

—end—

# DOUBLE-YOUR-MONEY-

# FOR SATISFACTORY FIT AND

**No Shafts Too Short• No Switches Where Not Needed• No Reversing of Connections • No Improper Tapers• No Overlong Shafts• No Unsatisfactory Resistance Values**



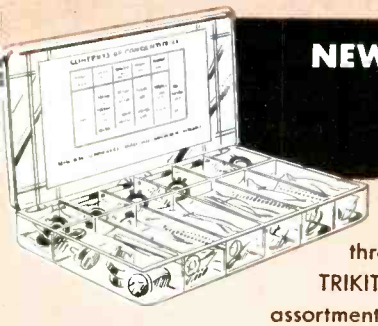

## IRC'S NEW UNIVERSAL REPLACEMENTS

### *Must* Fit and Operate Satisfactorily or Double Your Money Back!

Never before has any manufacturer dared to guarantee Universal Replacements for satisfactory fit *and* electrical operation—without cutting or filing of shafts. IRC makes that guarantee now—*double your money back* if any IRC new Universal Replacement, employing K-2 or K-3 CONCENTRIKITS with Exact Duplicate Shafts, fails to fit and operate satisfactorily!

### LESS-THAN-A-MINUTE ASSEMBLY OF CARBON OR WIRE WOUND REPLACEMENTS USED IN OVER 5,000 TV MODELS

With IRC's two new, simplified, four-piece CONCENTRIKITS, you can actually assemble carbon or wire wound concentric duals in *less than a minute*—in home or shop—without special tools! And with a small stock of new CONCENTRIKITS—plus our Exact Duplicate Shafts and Base Elements—you can cover 416 Manufacturers' Concentric Dual Parts Numbers used in over 5,000 TV Models!



### NEW IRC DEALER ASSORTMENTS GIVE WIDEST COVERAGE AT LOWEST STOCK COST

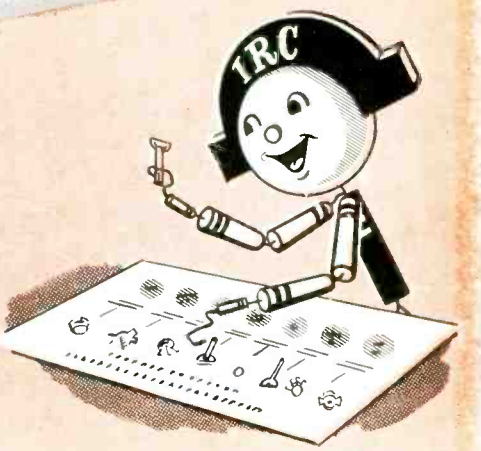
You'll tie-up less money in inventories—and lose less stock through obsolescence—when you buy IRC's new CONCENTRIKITS in low-cost, easy-to-stock CONCENTRIPAKS. These handy assortments include Base Elements, Exact Duplicate Shafts and Switches to suit specific brands of TV sets. And with them you get wide coverage at a fraction of the cost of factory-assembled controls. For example . . .

**CONCENTRIPAK for Philco—KC-1.** Replaces any of 13 Philco concentric dual controls—plus 21 others. Costs only $10.20.

**CONCENTRIPAK for RCA—KC-2.** Replaces any of 14 RCA concentric dual controls—plus 38 listings among 15 other makes. Costs only $7.44.

**CONCENTRIPAK for Admiral—KC-3.** Replaces any of 14 Admiral concentric duals plus others. Costs only $7.80.

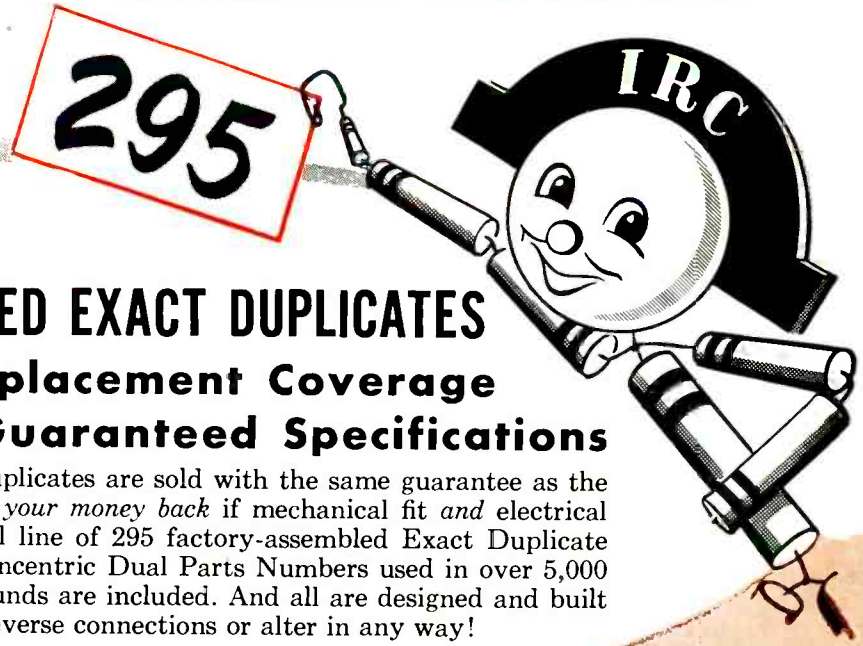
**IRC DEALER ASSORTMENT #14.** Wide-coverage, low-cost dealer stock of CONCENTRIKIT parts. Gives coverage of 240 concentric dual listings (which would require 149 different concentric duals). Supplies replacement coverage among 59 trade names, including the most popular and widely sold.




IRC's new pictorial instruction sheet makes Concentrikit assembly a snap.

# BACK GUARANTEE

# OPERATION OF IRC TV CONCENTRIC DUALS




## IRC FACTORY-ASSEMBLED EXACT DUPLICATES

### Give Widest Replacement Coverage with Dependable, Guaranteed Specifications

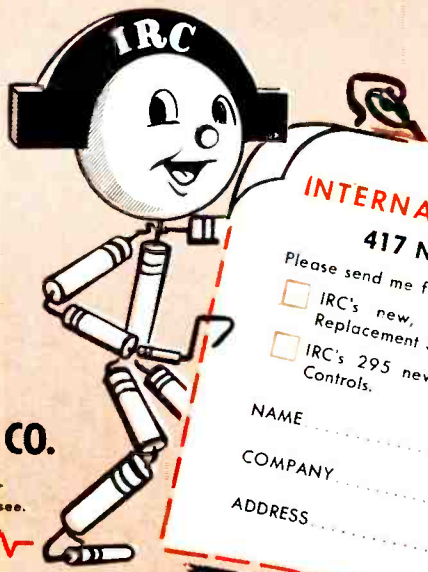
IRC's new factory-assembled Exact Duplicates are sold with the same guarantee as the new IRC CONCENTRIKITS. *Double your money back* if mechanical fit *and* electrical operation are not satisfactory! The full line of 295 factory-assembled Exact Duplicate Controls covers 416 Manufacturers' Concentric Dual Parts Numbers used in over 5,000 TV Models. Both carbons and wire wounds are included. And all are designed and built to accurate specifications. No need to reverse connections or alter in any way!

## *COMPLETE* CONCENTRIC DUAL COVERAGE FROM ONE RELIABLE SOURCE

Whether you prefer Universal Replacements or Exact Duplicates, you can get your choice now from a single, dependable source. That's time and money saved—for now you can *schedule* your trips to your IRC Distributor. And regardless of the concentric dual units you buy, IRC's guarantee protects you—*double your money back if fit or operation are unsatisfactory!*

**GET THE FULL STORY TODAY**

Mail the coupon today for full details of IRC's new, improved CONCENTRIKITS and FACTORY-ASSEMBLED EXACT DUPLICATE CONTROLS. Catalog Data Bulletin DC1C contains stock numbers, prices, TV sets covered and parts numbers. Yours without obligation.




IRC

**INTERNATIONAL RESISTANCE CO.**

401 N. Broad Street, Philadelphia 8, Pa.

In Canada: International Resistance Company, Ltd., Toronto, Licensee.

*Wherever the Circuit Says* —WW—

**INTERNATIONAL RESISTANCE COMPANY**

**417 N. Broad Street, Philadelphia 8, Pa.**

Please send me full details of:—

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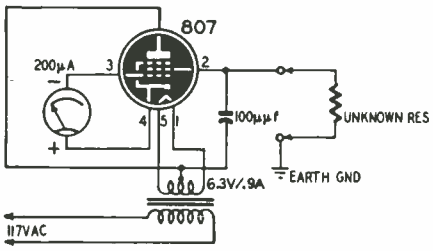
## "EDISON EFFECT" FINDS A NEW USE

**By IRVING GOTTLIEB**

Interesting and useful effects may result from using vacuum tubes in unconventional ways. Commonly all the tube elements are parts of closed circuits, with proper external voltages applied. But there are cases where an element may be left "open." A capacitance-operated "floating-grid" relay was described in this magazine in June, 1943, and a biological microvoltmeter with a normally-open grid circuit in the May, 1944 issue. As can be seen from the dates, these accounts are rare.

The long known but little used Edison Effect (flow of current in a vacuum tube between a hot cathode and any other element having a lower temperature, but no applied a.c. or d.c. potential) may also have its uses. The author worked out this simple circuit to demonstrate a possible use of this effect—measurement of very high resistances. It has the great advantage that it does not require the high potentials found in most equipment designed for high-resistance measurement.

The circuit will measure resistance values of 10 to 1,000 megohms. When applied to composition and film type resistors used in conventional electronic equipment, and to the measurement of surface leakage of insulating materials it yields good accuracy over a far greater range than the average ohmmeter. It is not suitable for determining the insulation resistance of dynamos or other devices in which the capacitance between measuring points exceeds about 15 μμf. This circuit is shown below.




The principle of operation is: Electrons are emitted from the heated cathode. Some of these electrons are intercepted by the control grid and return to the cathode through the meter circuit. Others, which have higher velocities or are emitted at different angles, pass the control grid and accumulate on the screen grid. If these electrons are not removed from the screen grid, their cumulative negative charge will deflect free electrons back to the control grid and increase the current in the meter circuit.

On the other hand, if the negative charge on the screen grid is removed, fewer electrons will be intercepted by the control grid. This will reduce the current circulating between cathode and control grid. If any of the inter-grid electrons are deflected back to the

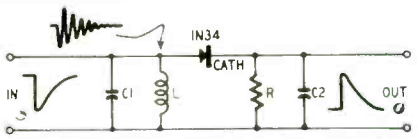
control grid, the external current will have a proportional value.

The best way to remove the charge from the screen grid is by means of an earth-ground. The meter should be calibrated by using known resistors. The scale calibration will not be linear. The 100-μμf capacitor reduces the effects of distributed or lumped capacitance in the resistance being measured. A capacitor larger than 100 μμf will reduce the sensitivity. An air-dielectric capacitor connected by short, heavy leads will give best results.

The 807 tube should be mounted inside a metal box and the screen grid connection should be brought out through a large porcelain feed-through insulator. Most effective shielding is obtained by connecting the plate terminal of the tube and the metal box to the center-tap of the filament winding.

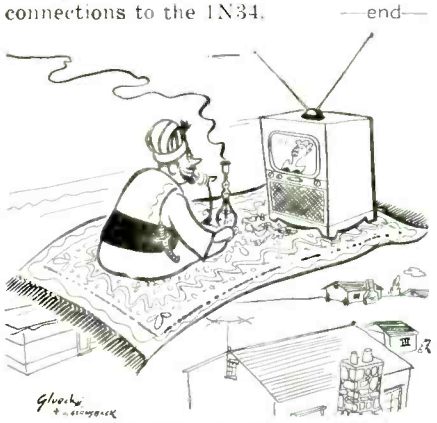
## SIMPLE PULSE INVERTER

Electronic counters, radar, loran, and many other electronic devices often require pulses of a specific polarity for proper operation of a particular circuit. In some instances, the pulse provided by the source is of opposite polarity to that required by the circuit. In such cases, a transformer or tube is usually used as a phase inverter. Leonard Reiffel, in *The Review of Scientific Instruments*, describes a simple circuit which may be used for phase inversion when the pulse does not require further amplification.




The inverter is shown in the diagram. When a negative pulse is applied to the input terminals, it shock-excites the tuned circuit (L-C1) and sets up a train of damped oscillations. The positive half-cycles of the oscillations are rectified by the 1N34 and integrated by R and C2 into a positive pulse with a gradual decay.

The voltage across the output terminals is a positive pulse having a decay corresponding to the positive half of the envelope of the damped oscillations. The output pulse is delayed one-half cycle with respect to the input cycle. To invert positive input pulses, reverse the connections to the 1N34. —end—



Television is Amazing
*Suggested by Robert W. Gluerkstein*

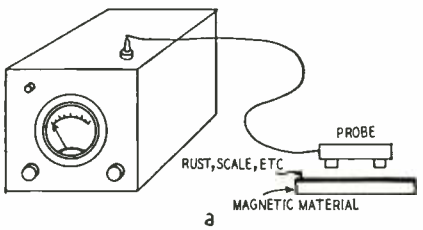
## THICKNESS GAUGE

Patent No. 2,572,908

Irving R. Brenholdt, Chicago, Ill.
(assigned to Standard Oil Co., Chicago)

This instrument measures iron or steel from 1/64 inch to one inch thick. Accuracy is not affected by rust or dirt on the metal. A practical form of the device is shown at *a* and the basic schematic is drawn in B.

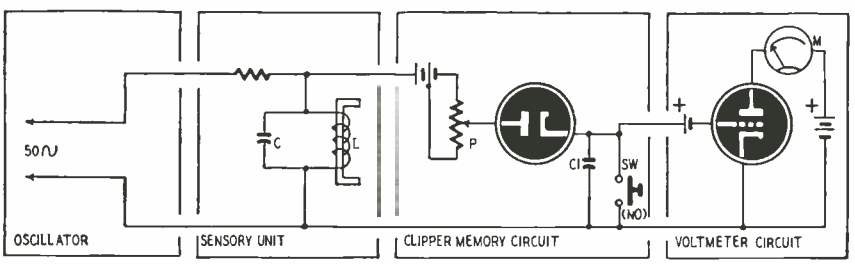
An oscillator generates a frequency of 50 cycles which is fed to an LC circuit. L is the inductance of a laminated core probe. Its coil may have about 1500 turns. LC is tuned to slightly below 50 cycles. When the probe approaches magnetic material, its inductance drops and resonance is reached. LC may be designed for resonance when the probe is about 1/8 inch from a mass of metal.




a

To measure thickness, the probe is brought near the metal. When the gap is 1/8 inch, peak probe voltage occurs. This peak is rectified and stored on C1 which is unloaded. The v.t.v.m. indicates C1 voltage. The probe may be moved about, but only the peak voltage (at 1/8-inch probe distance) is indicated.

Although the peak always occurs with the same probe gap, the maximum depends upon metal thickness. The thicker the metal, the greater the eddy current loss, therefore the lower the peak. The instrument is calibrated by potentiometer P on a metal sample of known thickness. After completion of a measurement, SW is closed to discharge C, and bring M to zero.




b

## AID TO THE BLIND

Patent No. 2,582,728

Joseph B. Walker, Hollywood, Calif.

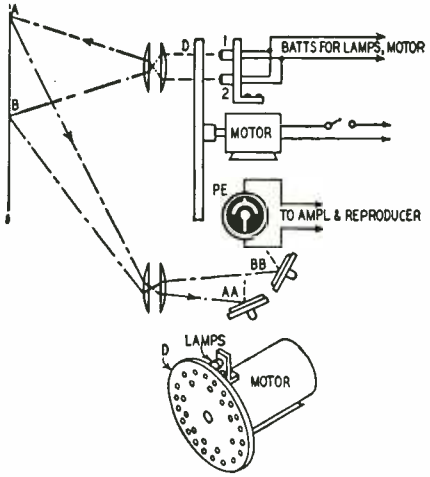
This invention detects obstacles by means of light beams. Reflected light from an obstacle is converted to sound to warn the blind person. The apparatus is portable and powered by batteries.

Essential parts are shown in the illustration. Lamps 1 and 2 project light beams through perforations in revolving disc D. Another view of D appears in the insert. Light from 2 passes through the inner perforations and is deflected *upwards* toward A. Therefore this beam can detect obstacles several feet above ground. If reflections occur at this level, the light falls on mirror AA and photocell PE. As the reflected light is interrupted at an audio rate by the perforations in the rotating disc, the photocell current is modulated and its amplified output heard in the reproducer.

Light from 1 passes through the outer perforations and is projected *downward* by the lens. This detects obstacles nearer the ground. Reflections (if they occur) fall on mirror BB and on PE.

Note that the outer ring of perforations has twice as many holes as the inner ring. Therefore the 1 beam is interrupted at twice the rate and is responsible for a higher frequency than the beam from 2.

Output from PE may operate an ear-phone or other reproducer. When the blind person hears a low-pitched tone he is warned of an obstacle several feet above ground. A high-pitched tone indi-




cates a lower obstacle. With experience, obstacles may be judged as to height, distance and even approximate outline by manipulating the device in various ways.

In another form of the device covered in the same patent, a single light source is used. By an interlocking lever arrangement, the light beam and a reflecting mirror are made to scan the area to be covered. The rotating light-modulator disc has several concentric rings of perforations, each ring containing a different number of holes. As the beam moves vertically, reflections pass through different rings, modulating the output according to the height of an obstacle.

## PULSE REGISTER CIRCUIT

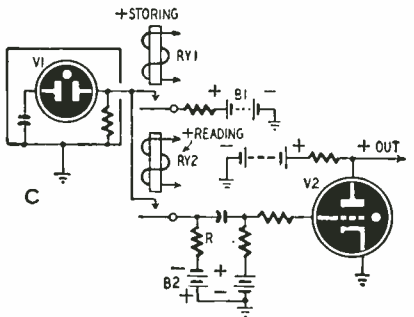
Patent No. 2,582,480
Thomas L. Dimond, Rutherford, N. J.
(Assigned to Bell Telephone Laboratory, Inc.)

This device stores a pulse or voltage, and subsequently registers it. It can be used in computing machines, telephone switching networks, and similar devices. No heater type tubes are used. No stand-by power is wasted.

The circuit shown here can store a *positive* voltage and register it. When RY1 is energized (even momentarily) a positive voltage fires the gas tube V1 (similar to a neon lamp) and therefore charges C. As the charge grows, the potential drops across V1. Finally V1 is extinguished and the charge is trapped on C.

Later, RY2 may be energized to test for a positive charge on C. The negative voltage from B2 adds to the positive charge on C. The total is large enough to trigger V1 again. A pulse of current flows through R and this transmits a voltage pulse (through a capacitor) to thyratron V2. If desired, the output from V2 may be fed to a mechanical register or counter.

Additional relays and associated circuits may be used to store and read *negative* voltages. The circuits are like those shown except for reversal of power-supply polarities. For example, negative pulses are read by a circuit like that of RY2, except for a reversal of B polarity.




## ULTRASONIC MICROPHONE

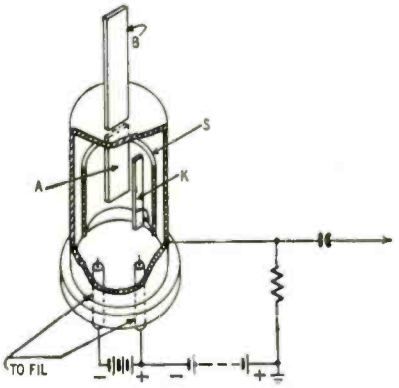
Patent No. 2,579,136
Leslie J. Anderson, Moorestown, N. J.
(assigned to Radio Corp. of America)

This microphone is designed specifically for ultrasonic frequencies used in secret signalling, obstacle detection, and similar applications. It does not respond to audible waves which may also be present.

The invention utilizes a flat metal bar fixed at its center. End A is inside a metal vacuum tube and may be used as the anode. End B is outside

the tube. K is the cathode. A cylindrical shield S surrounds these elements and the heater.

Ultrasonic waves set end B into vibration and the energy is transmitted to A. When the anode vibrates, it causes corresponding variations in




tube current. The signal is then amplified as required.

Bar dimensions depend on the frequency of operation. As an example, the bar may be 2.54 cm long and .1 cm thick. The top of the tube (which supports the bar) may be .2 cm thick and 1 cm in diameter. The bar may be of stainless steel or beryllium. Under these conditions, the resonant frequency will be about 26 kc.

The bar is bidirectional. Each side is sensitive to supersonic waves.

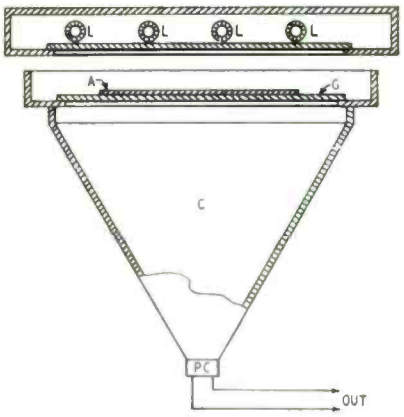
## AREA MEASUREMENT

Patent No. 2,578,882

George H. Eash, Toledo, Ohio

(Assigned to Selby Shoe Company, Portsmouth, Ohio)

This is a form of light-measuring circuit. An opaque pattern is placed in the path of a steady light beam. It partially blocks the light falling on a photocell and there is correspondingly less cell output. The unknown pattern area is determined from the cell output either by calibration or comparison with a known area.




The figure shows a recommended arrangement. L is a bank of lamps, fluorescent or incandescent. The lighting must be uniform. Light from the lamps falls upon G, a layer of translucent glass which diffuses and equalizes the light. The area to be measured (A) is placed in front of G. At the other end of C is photocell PC. Cell output corresponds to light transmission through G.

Without A, maximum light falls upon PC and the output current is noted. Now if a flat object of any shape is placed in front of G, it blocks part of the light. For example, if A has half the area of G, output from PC will be reduced to one-half (assuming proportional output).

—end—

## ANTENNA DESIGN DATA

The data in the table is based on material in an Admiral radio course and was prepared as an aid to antenna installation crews and experimenters. Adding radiators or reflectors to an antenna causes a sharp reduction in the antenna impedance and makes it necessary to use a matching section to couple the array to standard transmission lines. The impedance of the matching section can be found by finding the square root of the product of the antenna and transmission line impedances or, $Z2 = \sqrt{Z1 \times Z3}$, where Z1, Z2, and Z3 are impedances of the antenna, matching section, and line, respectively. The length of the matching section or stub is

$$L = \frac{246}{f} \times VP,$$

where L is the length of a quarter-wavelength section in feet, f the operating frequency in megacycles, and VP the velocity of propagation. VP is 0.77 for 150-ohm lines and 0.68 or 0.71 for 75-ohm coaxial lines.—*W. G. Eslick.*

(See "Transmission-Line Constants" in the January 1950 issue. The folded-dipole impedances are approximately correct only when the dipole conductors are the same size. If the driven conductor is smaller than the other, the impedance will be higher. The stepup in impedance over a dipole depends on the conductor diameters and spacing. —*Editor*)

| TYPE | IMPEDANCE | GAIN (DIPOLE AS ZERO) |
|---|---|---|
| DIPOLE | 72 | 0 |
| FOLDED DIPOLE | 300 | 0 |
| DIPOLE WITH REFLECTOR | 60 | 2–2-1/2 |
| FOLDED DIPOLE WITH REFLECTOR | 250 | 2–2-1/2 |
| DIPOLE, REFLECTOR & DIRECTOR | 20 | 2-1/2–5 |
| FOLDED DIPOLE, REFLECTOR & DIRECTOR | 80 | 2-1/2–5 |
| DOUBLE DOUBLET, REFL. & DIR. | 225 | 4 |
| DOUBLE STACK "TWO OVER TWO" | 300 | 5 |

## RECEIVING FM ON TV SETS

If you are using a TV set which has a turret-type tuner, it is quite possible that you can modify it so you can receive a few of the local FM broadcast stations. Channel 6 must be vacant in your locality. Sets with intercarrier sound won't work.

You simply adjust the channel 6 oscillator-tuning slug until you receive FM stations in the low-frequency half of the band. The printed-circuit tuner can be adjusted to bring in stations between 88 and about 94 mc. The Standard Coil tuner can be adjusted to bring in stations a few megacycles higher. The fine-tuning control can be used to tune in stations adjacent to the one on which the oscillator is centered.

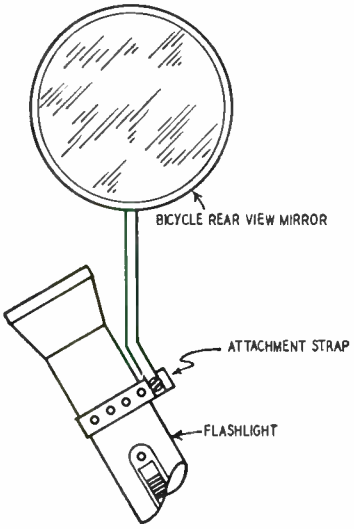
The mixer and antenna circuits are not tuned to the FM band, so this trick works best for local stations.—*M. G.*

## IMPROVING IMAGE REJECTION

Many sets which use external antennas have poor image rejection on the broadcast band. The region between 550 and 800 kc is often filled with heterodynes and garbled speech. A simple remedy for this is to insert a 2.5-mh r.f. choke in series between the antenna lead and the top of the primary of the antenna coil. If the set has short-wave bands, install a switch to cut out the choke because it will attenuate signals in the short-wave range. On band-switching receivers, install the choke between the broadcast antenna coil and the band-switch.—*Charles Erwin Cohn*

## HANDY SERVICING LIGHT

Time after time, I have run into TV sets which have flat, wafer-type miniature sockets mounted behind i.f. cans, capacitors, transformers, and other components where they cannot be seen without pulling the chassis. Taking the tubes out for checking isn't so bad, but




getting them back into the sockets can be a time-consuming, frustrating job. The same problem also arises frequently in seating alignment tool tips in tiny tuning slug slots.

After several such experiences, I devised the flashlight-mirror combination shown in the drawing. A bicycle rear-view mirror is fitted to the barrel of the flashlight with a metal strap clamp. With this arrangement, I can throw light into the socket and see the reflection clearly in the mirror. The swivel on the mirror permits it to be set at the most convenient angle.—*Harry E. Brooks*

## HUM REDUCING KINK

Sometimes, you may find that hum in an audio amplifier is originating in a push-pull driver or output stage which uses directly heated tube types such as the 45, 47, 2A3, 6A3, 6B4-G, and 6B5. In this case, try transposing the filament leads of *one* tube and use the connection which gives the least hum. This connection is the one which makes the hum voltages in phase in the plate circuits so they cancel out. —*John Sareda*



## OPPORTUNITY AD-LETS

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"NEEDLE-BRUSH" AUTOMATICALLY REMOVES fuzz during phonograph change cycle. 79¢ postpaid. Henry Industries, Ames, Iowa.

WANTED—TOP PRICES PAID—Navy Selsyns 1F, 1G, 1CT, 5F, 5G, 5CT and BC-348, BC-221, AN/ART-13, AN/ARC-1, AN/ARC-3, RTA-1B. Lectronic Research, 719 Arch St., Philadelphia.

WANTED: AN/APR-4, other "APR-", TS-", "IE-", ARC-1, ARC-3, ART-13, BC-348, etc. Microwave Equipment, everything Surplus. Special tubes, Tec Manuals, Lab Quality Equipment, Meters. Fast Action, Fair Treatment, Top Dollar! Littell, Farhills Box 26, Dayton 9, Ohio.

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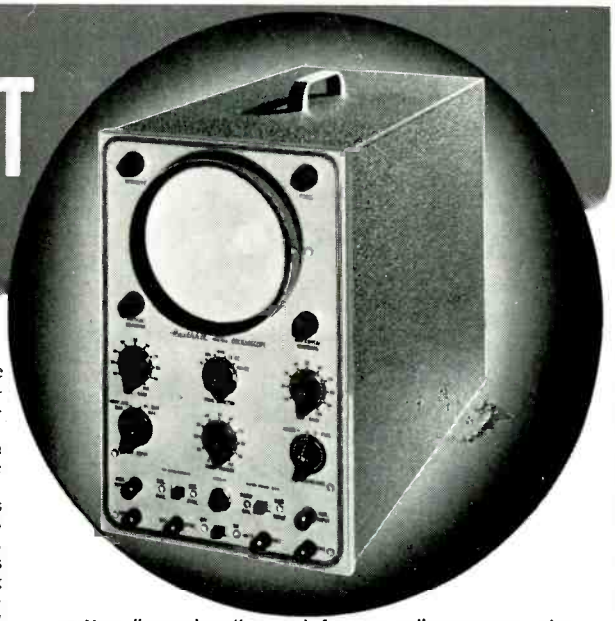


The Heathkit 0-7 Oscilloscope with its 10 tube lineup (including CR tube) and carefully engineered circuit using highest quality components is truly the most outstanding scope value on the market today.

The "spot shape" (astigmatism) control working in conjunction with the focus control assures clear, sharp focusing . . . extended sweep range and faster retrace time permits the study of high frequencies . . . step-attenuated frequency-compensated cathode follower vertical input contributes to the excellent frequency response of the vertical channel . . . .03V RMS per inch vertical sensitivity makes weak input signals easy to study . . . push-pull operation of both vertical and horizontal deflection plates reduces pattern distortion . . . specially designed extra-wide CR tube mounting bracket places vertical cascade amplifier, vertical phase splitter, and deflection amplifiers near base of CR tube to reduce distributed wiring capacity and increase high frequency response.

Ideal for TV servicing — steep wavefronts encountered in TV work are easily handled. Fine for production line testing — rugged quality components can stand up under continuous hour-after-hour use. Excellent for laboratories — electrical performance comparable to scopes costing 4 and 5 times as much.

You'll like the complete instructions showing all details for easily building the kit — includes pictorials, step-by-step construction procedure, numerous sketches, schematic, circuit description. All necessary components included — transformer, cabinet, all tubes (including CR tube), completely punched and formed chassis — nothing else to buy.

- **New "spot shape" control for spot adjustment — to give really sharp focusing.**
- **A total of ten tubes including CR tube and five miniatures.**
- **Cascaded vertical amplifiers followed by phase splitter and balanced push-pull deflection amplifiers.**
- **Greatly reduced retrace time.**
- **Step attenuated — frequency compensated — cathode follower vertical input.**
- **New mounting of phase splitter and deflection amplifier tubes near CR tube base.**
- **Increased frequency response — useful to 5 Mc.**
- **Tremendous sensitivity .03V RMS per inch Vertical — .6V RMS per inch Horizontal.**

## Heathkit ELECTRONIC SWITCH KIT

MODEL S-2

SHIPPING WT. 11 LBS.

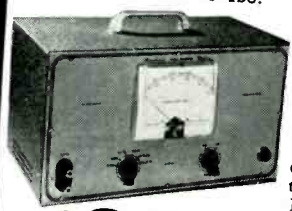
**$19.50**

The companion piece to a scope — Feed two different signals into the switch, connect its output to a scope, and you can observe both signals — each as an individual trace. Gain of each input is easily set (gain A and gain B controls), the switching frequency is simple to adjust (coarse and fine frequency controls), and the traces can be superimposed for comparison or separated for individual study (position contol).

The kit is complete with tubes, switches, cabinet, power transformer and all other parts, plus a clear detailed construction manual.

## NEW Heathkit AUDIO FREQUENCY METER KIT

MODEL AF-1
SHIPPING WT. 15 LBS.



**$34.50**

The ideal instrument for determining frequencies from 20 cycles to 100 KC. Set the selector switch to the proper range, feed the signal into the input terminals — and read the frequency from the meter — completely simple to operate, and yet dependable results.

Quality Simpson 200 microampere meter has two plainly marked scales (0-100 0-300). These scales read in conjunction with the seven position selector switch, give full scale readings of 100, 300, 1000, 3000, 10,000, 30,000, and 100,000 cycles. Convenient ranges for fast and easy readings.

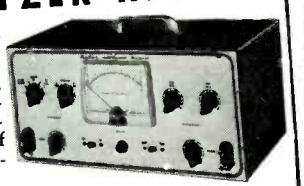
For greatest accuracy, the 1-3-10 ratio of ranges is maintained and each range has an individual calibrating control.

A signal voltage anywhere between 2 and 300V can be fed directly into the instrument and a change in signal voltage between these limits will not affect the meter reading. In addition, input wave shape is not critical (the unit will read the frequency of either sine wave or square wave input).

The tube complement consists of a 6SJ7 amplifier and clipper, 6V6 amplifier and clipper, 6H6 meter pulse rectifier, 6X5 power supply rectifier, and OD3/VR150 voltage regulator.

Construction is simple, and quality components are used throughout.

## Heathkit INTERMODULATION ANALYZER KIT



MODEL IM-1
SHIPPING WT. 18 LBS.

**$39.50**

Intermodulation testing of audio equipment is rapidly being accepted by more and more engineers and audio experts as the best way to determine the characteristics of audio amplifiers, recording systems, networks, etc.

The Heathkit Intermodulation Analyzer supplies a choice of two high frequencies (approx. 3000 cycles and 7000 cycles) and one low frequency (60 cycles). Both 1:1 or 4:1 ratios of low to high frequencies can be set up for IM testing, and the ratios are easily set by means of a panel control and the instrument's own VTVM. An output level control supplies the mixed signal at the desired level with an output impedance of two thousand ohms. The Analyzer section has input level control and proper filter circuits feeding the instrument's VTVM to read intermodulation directly on full scale ranges of 30%, 10% and 3%. Built-in power supply furnishes all necessary voltages for operating the instrument.

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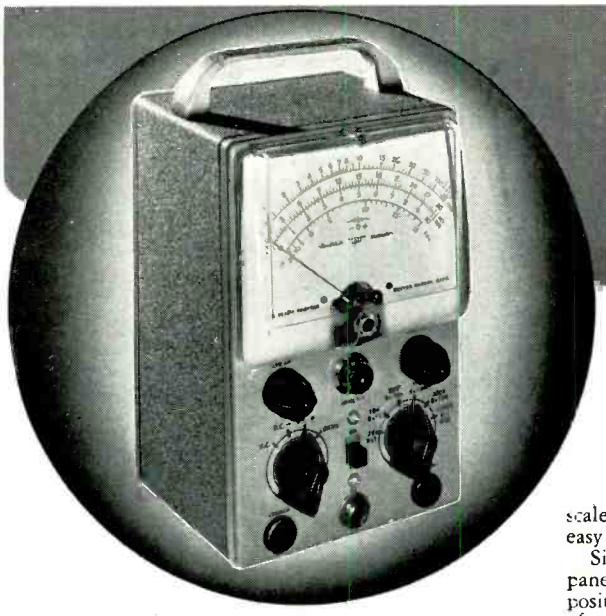


# THE *New* 1952 *Heathkit* VTVM KIT

MODEL V5-A
SHIPPING WT. 7 LBS.

**$24.50**

- New styling, — formed case for beauty.
- New truly compact size. Cabinet 4⅛" deep by 4-11/16" wide by 7-3/8" high.
- Quality 200 microamp meter.
- New ohms battery holding clamp and spring clip — assurance of good electrical contact.
- Highest quality precision resistors in multiplier circuit.
- Calibrates on both AC and DC for maximum accuracy.
- Terrific coverage — reads from ½V to 1000V AC, ½V to 1000V DC, and .1 to over 1 billion ohms resistance.
- Large, clearly marked meter scales indicate ohms, AC Volts, DC Volts, and DB — has zero set mark for FM alignment.

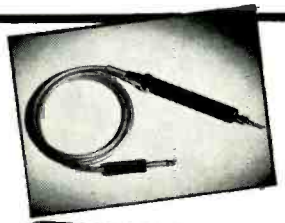
Designed to take up a minimum of space, yet designed to be the most important and useful instrument on your workbench. Really handsome looking — note the rounded edges on front panel and rear cover. New compact size has cabinet dimensions of only 4⅛" deep x 4 11/16" wide x 7⅜" high.

Tremendous coverage — will read from ½V to 1000V AC, ½V to 1000V DC, .1 to over 1 billion ohms resistance, and Db. Meter scale has zero-set mark for FM alignment — all scales clearly marked for easy and fast readings and Db scale is in red for easy identification.

Simple to operate. Ohms adjust and zero adjust controls located on front panel along with selector and range switches. Selector switch has four positions: AC, DC—, DC+ and Ohms to set up the instrument for type of reading desired. DC— position allows negative voltages to be taken without reversing test prods. AC and DC voltage ranges are full scale 3V — 10V — 30V — 100V — 300V — 1000V and resistance ranges are RX1, X10, X100, X1000, X10M, X1 Megohm. Convenient ranges for fast and accurate readings.

Strictly highest quality components used throughout — 1% precision resistors in multiplier circuit, Simpson 200 microampere meter movement, sturdy cabinet, excellent positive detent smooth acting switches, etc. New miniature tube used in meter balancing circuit and new battery holding clamp and spring clip assure good contact to ohms string of resistors.

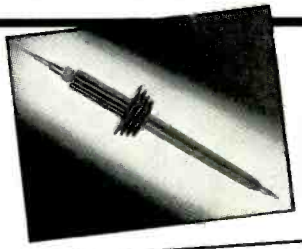
Kit comes complete — and the instruction manual with its step-by-step instructions, pictorials, figures, and schematic makes assembly a pleasure.



## *Heathkit* R F PROBE KIT

Extends range of Heathkit VTVM to 250 MC ± 10%. Designed for taking RF measurements. All parts furnished including probe housing and crystal diode detector. Shipping Weight 1 lb.

**$5.50**



## *Heathkit* 30,000 V DC PROBE KIT

For taking readings up to 30,000 V DC when used with the Heathkit VTVM (or any standard 11 megohm VTVM). Comes with two color molded plastic probe body and all parts. Shipping Wt. 2 lbs.

**$5.50**

## *Heathkit* A. C. VACUUM TUBE VOLTMETER KIT

Now — as a Heathkit — at a price anyone can afford, an AC VTVM. Makes possible those sensitive AC measurements required by audio enthusiasts, laboratories, and experimentors. The kit audio men have been looking for. Ten ranges consisting of full scale .01, .03, .1, .3, 1, 3, 10, 30, 100, 300 volts RMS assure easy and more accurate readings. Ten ranges on DB provide for measurements from −52 to +52 DB. Frequency response within 1 DB from 20 cycles to 50 KC.

The ingenious circuitry incorporates precision multiplied resistors for accuracy, two amplifier stages using miniature tubes, a unique bridge rectifier meter circuit, quality Simpson meter with 200 microampere movement, and a clean layout of parts for easy wiring. A high degree of inverse feedback provides for stability and linearity.

Extremely compact, cabinet size — 4-1/8" deep x 4-11/16" wide x 7-3/8" high. Newly designed cabinet makes this the companion piece to the VTVM.

MODEL AV-1
SHIP. WT. 5 LBS.

**$29.50**

## *Heathkit* SQUARE WAVE GENERATOR KIT

The Heathkit Square Wave Generator is an excellent square wave frequency source with features you won't want to be without. Especially notable is the wide range of the instrument — 10 cycles to 100 kilocycles continuously variable. This wide range makes it useful for television and wide band amplifier work as well as audio experimentation. The output impedance is low, and the output voltage is continuously variable between 0 and 20 volts. Because a multivibrator stage cannot be accurately calibrated, terminals on the front panel can be used for synchronization to an external source should it be desired.

The circuitry consists of a multivibrator stage, a clipping and a squaring stage, and a cathode follower output stage. The power supply is transformer operated and utilizes a full wave rectifier tube with 2 sections of LC filtering.

For a good, wide range, and low priced square wave generator, the SQ-1 just can't be beat.

MODEL SQ-1
SHIP. WT. 14 LBS.

**$29.50**

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*Heathkit*

# SIGNAL GENERATOR KIT

**Model SG-6**
**Shipping Wt. 7 lbs.**

**$19.50**

The new Heathkit Signal Generator Kit has dozens of improvements. Covers the extended range of 160 Kc to 50 megacycles on fundamentals and up to 150 megacycles on useful calibrated harmonics; makes this Heathkit ideal as a marker oscillator for TV. Output level can be conveniently set by means of both step attenuator and continuously variable output controls. Instrument has new miniature HF tubes to easily handle the high frequencies covered.

Uses 6C4 master oscillator and 6C4 sine wave audio oscillator. The kit is transformer operated and a husky selenium rectifier is used in the power supply. All coils are precision wound and checked for calibration making only one adjustment necessary for all bands.

New sine wave audio oscillator provides internal modulation and is also available for external audio testing. Switch provided allows the oscillator to be modulated by an external audio oscillator for fidelity testing of receivers. Comes complete, all tubes, cabinet, test leads, every part. The instruction manual has step-by-step instructions and pictorials. It's easy and fun to build a Heathkit Model SG-6 Signal Generator.

*Heathkit*

## CONDENSER CHECKER KIT

*Only*

**$19.50**

**Model C-2**
**Shipping Wt. 6 lbs.**

Checks all types of condensers — paper — mica — ceramic — electrolytic. All condenser scales are direct reading and require no charts or multipliers. Covers range of .00001 MFD to 1000 MFD. A Condenser Checker that anyone can read. A leakage test and polarizing voltage for 20 to 500 V provided. Measures power factor of electrolytics between 0% and 50% and reads resistance from 100 ohms to 5 megohms. The magic eye indicator makes testing easy.

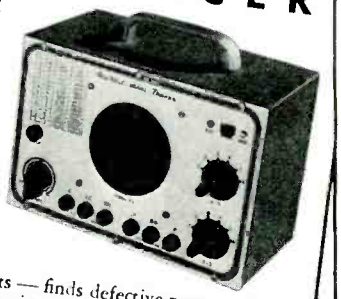
The kit is 110V 60 cycle transformer operated and comes complete with rectifier tube, magic eye tube, cabinet, calibrated panel and all other parts. Has clear detailed instructions for assembly and use.

NEW *Heathkit*

## SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT

**$19.50**

**Model T-2**
**Shipping Wt. 7 lbs.**



The popular Heathkit Signal Tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker — locates intermittents — finds defective parts quicker — saves valuable service time — gives greater income per service hour. Works equally well on broadcast, FM, or TV receivers. The test speaker has an assortment of switching ranges to match either push-pull or single output impedances. Also tests microphones, pickups and PA systems. Comes complete: cabinet, 110V 60 cycle power transformer, tubes, test probe, all necessary parts, and detailed instructions for assembly and use.

**Model TC-1**
**Shipping Wt. 12 lbs.**

**$29.50**

*Heathkit*

## TUBE CHECKER KIT

The Tube Checker is a MUST for radio repair men. Often customers want to SEE tubes checked, and a checker like this builds customer confidence. In your repairing, you will have a multitude of tubes to check — quickly. The Heathkit tube checker will serve all these functions — it's good looking (with a polished birch cabinet and an attractive two color panel) — checks 4, 5, 6, 7 prong Octals, Loctals, 7 prong miniatures, 9 prong miniatures, pilot lights, and the Hytron 5 prong types. AND IT'S FAST TO OPERATE — the gear driven, free-running roll chart lists hundreds of tubes, and the smooth acting, simplified switching arrangement gives really rapid set-ups.

The testing arrangement is designed so that you will be able to test new tubes of the future — without even waiting for factory data — protection against obsolescence.

You can give tubes a thorough testing — checks for opens, shorts, each element individually, emission, and for filament continuity. A large BAD-?-GOOD meter scale is in three colors for easy reading and also has a "line-set" mark.

You'll find this tube checker kit a good investment — and it's only $29.50.

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NEW 1952 *Heathkit*

# BATTERY ELIMINATOR KIT

$24.50

Model BE-3
Shipping Wt. 17 lbs.

- Can be used as battery charger.
- Continuously variable output 0 - 8 Volts — not switch type.
- Heavy duty Mallory 17 disk type magnesium copper sulfide rectifier.
- Automatic overload relay for maximum protection. Self-resetting type.
- Ideal for battery, aircraft and marine radios.
- Dual Volt and Ammeters read both voltage and amperage continually — no switching.

The new Heathkit Model BE-2 incorporates the best. Continuously variable output control is of the variable transformer type with smooth wiper type contacts.

There are no switches or steps and voltage between 0 and 8 Volts is available at 10 Amperes continuous and 15 Amperes intermittent. Maximum safety from overloads and shorts provided by automatic overload relay which resets itself when overload is removed.

The new rectifier is a 17 plate Mallory magnesium copper sulfide type. This is the most rugged type available for long trouble-free use.

Output is continuously metered by both a 0 - 10 Volt Voltmeter and a 0 - 15 Amp Ammeter. Shorted vibrators indicated instantly by ammeter.

Equip now for all types of service — aircraft — marine — auto and battery radios — this inexpensive instrument vastly increases service possibilities — better be ready when the customer walks in.

NEW *Heathkit*

## SINE AND SQUARE WAVE AUDIO GENERATOR KIT

Model AG-7
Shipping Wt. 15 lbs.

$34.50

Designed with versatility, usefulness, and dependability in mind, the AG-7 gives you the two most needed wave shapes right at your fingertips — the sine wave and the square wave.

The range switch and plainly calibrated frequency scale give rapid and easy frequency selection, and the output control permits setting the output to any desired level.

A high-low impedance switch sets the instrument for either high or low impedance output —on high to connect a high impedance load, and on low to work into a low impedance transformer with negligible DC resistance.

Coverage is from 20 to 20,000 cycles, and distortion is at a minimum — you can really trust the output wave shape.

Six tubes, quality 4 gang tuning condenser, power transformer, metal cased filter condenser, 1% precision resistors in the frequency determining circuit, and all other parts come with the kit —plus, a complete construction manual — A tremendous kit, and the price is truly low.

THE NEW *Heathkit*

## HANDITESTER KIT

$13.50

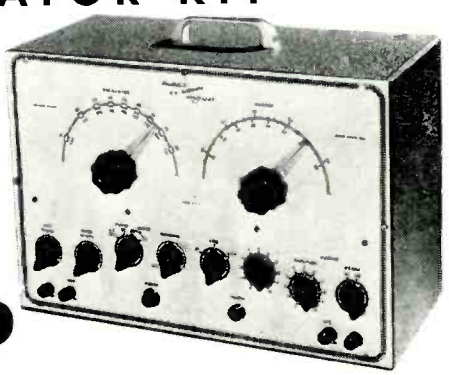
Model M-1
Shipping Wt. 3 lbs.

A precision portable volt-ohm milliammeter. Uses only high quality parts — All precision 1% resistors, three deck switch for trouble-free mounting of parts, specially designed battery mounting bracket, smooth acting ohm adjust control, beautiful molded bakelite case, 400 micro-amp meter movement, etc.

DC and AC voltage ranges 10 - 30 - 300 - 1000 - 5000V. Ohms range 0 - 3000 and 0 - 300,000. Range Milliamperes 0 - 10 Ma, 0 - 100 Ma. Easily assembled from complete instructions and pictorial diagrams.

NEW *Heathkit*

## T.V. ALIGNMENT GENERATOR KIT



Model TS-2
Shipping Wt. 20 lbs.

$39.50

Here is an excellent TV Alignment Generator designed to do TV service work quickly, easily, and properly. The Model TS-2 when used in conjunction with an oscilloscope provides a means of correctly aligning television receivers.

The instrument provides a frequency modulated signal covering, in two bands, the range of 10 to 90 Mc. and 150 to 230 Mc. — thus, ALL ALLOCATED TV CHANNELS AS WELL AS IF FREQUENCIES ARE COVERED.

An absorption type frequency marker covers from 20 to 75 Mc. in two ranges — therefore, you have a simple, convenient means of frequency checking of IF's, independent of oscillator calibration.

Sweep width is controlled from the front panel and covers a sweep deviation of 0-12 Mc. — all the sweep you could possibly need or want.

And still other excellent features are: Horizontal sweep voltage available at the front panel (and controlled with a phasing control — both step and continuously variable attenuation for setting the output signal to the desired level — a convenient instrument stand-by position — vernier drive of both oscillator and marker tuning condensers — and blanking for establishing a single trace with base reference level. Make your work easier, save time, and repair with confidence — order your Heathkit TV Alignment Generator now!

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# Heathkit IMPEDANCE BRIDGE KIT

Model 1B-1B
Shipping Wt. 15 lbs.

**$69.50**

This Impedance Bridge Kit is really a favorite with schools, industrial laboratories, and serious experimenters. An invaluable instrument for those doing electrical measurements work. Reads resistance from .01 Ohms to 10 meg., capacitance from .00001 to 100 MFD, inductance from 10 microhenries to 100 henries, dissipation factor from .002 to 1, and storage factor from 1 to 1000. And you don't have to worry about selecting the proper bridge circuit for the various measurements — the instrument automatically makes the correct circuit when you set up for taking the measurement you want. Bridge utilizes Wheatstone, Hay, Maxwell, and capacitance comparison circuits for the wide range and types of measurements possible. And it's self powered — has internal battery and 1000 cycle hummer. No external generator required — has provisions for external generator if measurements at other than 1000 cycles are desired. Kit utilizes only highest quality parts, General Radio main calibrated control, Mallory ceramic switches, excellent 200 microamp zero center galvanometer, laboratory type binding posts with standard ¾ inch centers, 1% precision ceramic-body type multiplier resistors, beautiful birch cabinet and ready calibrated panel. (Headphones not included.)

Take the guesswork out of electrical measurements — order your Heathkit Impedance Bridge kit today — you'll like it.

## Heathkit LABORATORY RESISTANCE DECADE KIT

**$19.50**

Shipping Wt. 4 lbs.

An indispensable piece of laboratory equipment — the Heathkit Resistance Decade Kit gives you resistance settings from 1 to 99.999 ohms IN ONE OHM STEPS. For greatest accuracy, 1% precision ceramic-body type resistors and highest quality ceramic wafer switches are used.

Designed to match the Impedance Bridge above, the Resistance Decade Kit has a beautiful birch cabinet and attractive panel. It's easy to build, and comes complete with all parts and construction manual.

## Heathkit LABORATORY POWER SUPPLY KITS

*Limits:*

| | | |
|---|---|---|
| No load | Variable | 150-400V DC |
| 25 MA | Variable | 30-310V DC |
| 50 MA | Variable | 25-250V DC |

**Higher loads: Voltage drops off proportionally**

**$29.50**

Model PS-1.....Ship. Wt. 20 lbs.

Every experimenter needs a good power supply for electronic setups of all kinds. This unit has been expressly designed to act as a HV supply and a 6.3 V filament voltage source. Voltage control allows selection of HV output desired (continuously variable within limits outlined), and a Volts-Ma switch provides choice of output metering. A large plainly marked and direct reading meter scale indicates either DC voltage output in Volts or DC current output in Ma. (Range of meter 0-500V D.C., 0-200 Ma. D.C.). Instrument has convenient stand-by position and pilot light.

Comes with power transformer, filament transformer, meter, 5Y3 rectifier, two 1619 control tubes, completely punched and formed chassis, panel, cabinet, detailed construction manual, and all other parts to make the kit complete.

## Heathkit ECONOMY . . . 6 WATT AMPLIFIER KIT

MODEL A-7
Shipping Wt. 8 lbs.

**$14.50**

- **Choice of 4-8-15 ohm output impedances.**
- **Response flat ± 1½ db from 20—20,000 cycles.**
- **6 watts output.**
- **Good fidelity at low cost.**
- **Output tubes working in push pull.**
- **Volume, bass, and treble controls.**
- **Two separate inputs.**

The purpose of this kit is to provide to the kit builder a low cost amplifier with excellent fidelity. The circuit consists of four tubes with following functions: a 12SL7, one section working as an amplifier and one as a phase splitter, two 12A6 output tubes working in push pull, and a 5Y3 rectifier in a full wave rectifier circuit.

The unit operates from a husky power transformer, and has good output transformer with a choice of 4—8—15 ohm output impedances. (Speaker not included).

The kit provides excellent listening pleasure and the price is really low. Compare it with all others. You won't find a better buy.

**MODEL A-7:** For tuner and crystal phono inputs. Has two position selector switch for convenient switching to type of input desired.

**Model A-7-A:** Has a 12SH7 preamplifier stage with special compensation network for operation with reluctance phono input.
Shipping Wt. 8 lbs.....**$16.50**

## Heathkit HIGH FIDELITY 20 WATT AMPLIFIER KIT

MODEL A-8
Shipping Wt. 18 lbs.

**$33.50**

The A8 (or A-8A) is a high quality amplifier for those who want high fidelity output at moderate cost. Frequency response within ± 1db from 20-20,000 cycles. Distortion at 3db below maximum power output (at 1,000 cycles) is only .8%. Kit has a Chicago power transformer in drawn steel case and a Peerless output transformer with output impedances of 4—8—16 ohms. Bass and treble controls permit listener to select output with tonal qualities of his own liking.

The tube lineup is composed of a 6SJ7 voltage amplifier, a 6SN7 amplifier and phase splitter, two 6L6's in push-pull output and a 5U4G rectifier. All parts furnished (speaker not included) and the construction manual makes assembly easy.

**MODEL A-8:** For tuner and crystal phono inputs. Has two position selector switch for convenient switching to type of input desired.

**MODEL A-8A:** Features an added 6SJ7 stage (preamplifier) for operating from variable reluctance cartridge phono pickup, mike input, and either tuner or standard crystal phono pickup. A three position selector switch provides flexible switching. Shipping Wt. 18 lbs.....**$35.50**

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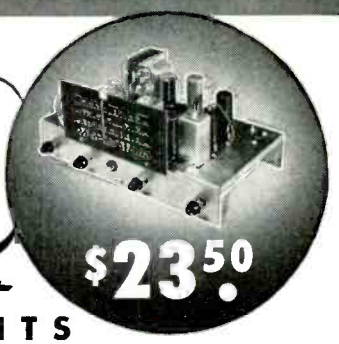
# Heathkit RECEIVER & TUNER KITS for AM and FM

$19.50

Model BR-1 Broadcast Model Kit covers 550 to 1600 Kc. Shipping Wt. 10 lbs.

Model AR-1 3 Band Receiver Kit covers 550 Kc. to over 20 Mc. continuous. Extremely high sensitivity. Shipping Wt. 10 lbs.



$23.50

## TWO HIGH QUALITY Heathkit SUPERHETRODYNE RECEIVER KITS

Two excellent Heathkits. Ideal for schools, replacement of worn out receivers, amateur and custom installations.

Both are transformer operated quality units. The best of materials used throughout — six inch calibrated slide rule dial — quality power output transformers — dual iron core shielded. I.F. coils — metal cased filter condenser. The chassis has phono input jacks, 110 Volt output for phono motor and there is a phono-radio switch on panel. A large metal panel simplifying installation in used console cabiners is included. Comes complete with tubes and instruction manual incorporating pictorials and step-by-step instructions (less speaker and cabinet). The three band model has simple coil turret which is assembled separately for ease of construction.

Model FM-2
Ship. Wt. 9 lbs.

$22.50

## TRUE FM FROM Heathkit FM TUNER KIT

The Heathkit FM Tuner Model FM-2 was designed for best tonal reproduction. The circuit incorporates the most desirable FM features — true FM.

Utilizes 8 tubes: 7E5 Oscillator, 6SH7 mixer, two 6SH7 IF amplifiers, 6SH7 limiter, two 7C4 diodes as discriminator, and 6X5 rectifier.

The instrument is transformer operated making it safe for connection to any type receiver or amplifier. Has ready wound and adjusted RF coils, and 2 stages of 10.7 Mc IF (including limiter). A calibrated six inch slide rule dial has vernier drive for easy tuning. All parts and complete construction manual furnished.

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|---|---|---|---|---|---|
| | Heathkit Oscilloscope Kit — Model O-7 | | | Heathkit H.V. Probe Kit — No. 336 | |
| | Heathkit VTVM Kit — Model V-5 | | | Heathkit R.F. Signal Gen. Kit — Model SG-6 | |
| | Heathkit FM Tuner Kit — FM-2 | | | Heathkit Condenser Checker Kit — Model C-2 | |
| | Heathkit Broadcast Receiver Kit — Model BR-1 | | | Heathkit Handitester Kit — Model M-1 | |
| | Heathkit Three Band Receiver Kit—Model AR-1 | | | Heathkit Power Supply Kit — Model PS-1 | |
| | Heathkit Amplifier Kit — Model A-4 | | | Heathkit Resistance Decade Kit — Model RD-1 | |
| | Heathkit Amplifier Kit — Model A-6 (or A-6A) | | | Heathkit Impedance Bridge Kit — Model IB-1B | |
| | Heathkit Tube Checker Kit — Model TC-1 | | | Heathkit A.C. VTVM-KIT — Model AV-1 | |
| | Heathkit Audio Generator Kit — Model AG-7 | | | Heathkit Intermodul. Analyzer Kit—Model IM-1 | |
| | Heathkit Battery Eliminator Kit — Model BE-2 | | | Heathkit Audio Freq. Meter Kit — Model AF-1 | |
| | Heathkit Electronic Switch Kit — Model S-2 | | | Heathkit Square Wave Gen. Kit — Model SQ-1 | |
| | Heathkit T.V. Alignment Gen. Kit — TS-2 | | | | |
| | Heathkit Signal Tracer Kit — Model T-2 | | | | |
| | Heathkit R.F. Probe Kit — No. 309 | | | | |

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## PEAKING TWO-BAND SET

A fisherman friend wanted to hear the marine band on an old two-band broadcast set which uses 6D6's and other tubes of that vintage. (The set was insensitive on short waves; only a few mushy police calls could be heard.) To further complicate matters, he wanted to use a 6-foot wire as the antenna.

Realigning the set did not improve its sensitivity on short waves. The detector trimmer couldn't be peaked without disturbing calibration on the broadcast band. We hooked the 6-foot antenna wire to one end of a 10-turn scramble-wound loop of No. 28 c.c. wire. The loop was just large enough to pass over the antenna coil. We tuned the set to ship frequencies and moved the loop down the coil until a sensitive spot was found where signals and noise peaked up. Then we scramble-wound 10 turns of wire around that spot and cemented it tight with coil dope. The end of the new antenna coil was left ungrounded as a precaution against shock because set was an a.c.-d.c. type with one leg of line going to chassis. Previous signal strengths of R1 and R2 are now R9. Broadcast signals are louder and more stations are received.—*B. W. Welz*

## STICKY VIBRATORS

New vibrators and those which have not been used for a long time often fail to start on d.c. because of oxidization of the contacts. The usual method of clearing up this trouble is to connect a 50-watt lamp in series with the vibrator and run it on 117 volts a.c. for a few minutes.

I find it more convenient to plug the unit into a tube tester and operate it on 12 volts a.c. from the filament transformer. If the tube tester does not have a flexible switching arrangement, test leads fitted with banana plugs can be inserted in the filament pins of a 4- or 6-prong socket and the other ends clipped to the vibrator pins.

This method does not harm the tester. Usually a few seconds of running on a.c. is all that is needed to remove the oxidization. When the hum of the vibrator changes to an unsteady buzz, this is an indication that the contacts have cleaned up and that the vibrator will start without trouble on d.c. —*Frank Greene*

## TOOL FOR COAX CABLE

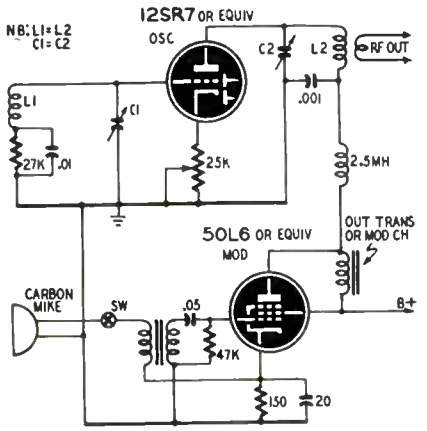
A standard copper-tubing cutter, available at most hardware stores for less than a dollar, is a handy tool for preparing coaxial cable to receive fittings. In using the tool, the first step is to twirl the cutter around the plastic jacket, cutting through it to the outer braid.

After removing the jacket, cut through the outer braid and remove it. The cable can now be finished with a pocket knife and the fitting can be installed in a professional manner—*Clyde C. Cook, W6GBV*

—end—

### STABLE OSCILLATOR

The stability of a heavily loaded, modulated, tuned-plate tuned-grid oscillator may be greatly improved by installing a carefully chosen cathode biasing resistor. Moving the grid-leak and its bypass capacitor from the normal position to the grounded end of the grid coil provides more constant output over the tuning range when the cathode biasing resistor is correctly adjusted. A variable potentiometer is recommended. When it is adjusted for best modulation quality, and antenna loading is optimum, the band-width and audio quality of the modulated oscillator compares favorably with a well-designed AM transmitter running the same power input.



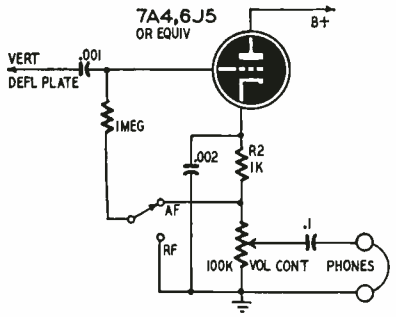

When loaded with a dummy antenna, the oscillator performed well on the broadcast band as well as on 2 and 3 mc. The basic circuit of the modulated oscillator is shown in the diagram. It may be used as a phono oscillator, home broadcaster, or carrier-current transmitter. The tuning range depends on the inductance of the coils and the values of the variable capacitors. Power output may be raised by using heavier tubes and raising the power input to the oscillator plate and modulator. For phonograph and home broadcast use, antenna length and power input should be held to a minimum, to avoid illegal radiation.—*G.P. Oberto*

### HEAR YOUR OSCILLOGRAM

An oscilloscope is a highly useful instrument. However, when working on a radio receiver or audio amplifier, it is often difficult to interpret the oscillograms, because the signals which they represent are intended for the ear instead of the eye. When using an actual signal for servicing, it is often difficult to tell whether the observed waveforms are normal or not. The obvious solution is to connect a headphone jack somewhere in the vertical deflection circuit of the oscilloscope, enabling the waveform to be heard as well as seen. However, such a direct connection is useful only for audio-frequency signals. The circuit shown is capable of making audible audio-frequency signals, and the modulation on rf. signals.

Its operation is simple. Throwing the switch to the AF position connects the

tube as a cathode follower, while the RF position connects the tube as an infinite-impedance detector. The input is connected through the .001-μf capacitor to the vertical deflection plate or the output of the vertical amplifier, thus getting plenty of signal. The output is controlled by the potentiometer which also acts as the tube load resistor. The oscilloscope circuit should be checked carefully to make sure that the signal take-off point is not at a dangerously




high potential. In any event, the .001-μf coupling capacitor must have a voltage rating high enough to withstand the peak potential at the point of signal takeoff.

Although it requires a little work to add this circuit to an oscilloscope, it can make a great improvement in the instrument's usefulness. It makes it possible to use the ears to detect troubles such as distortion, noise, or hum, which are difficult to detect from oscillograms, especially when they are slight. Then, a close examination of the oscillogram of the defective signal can be used to determine the electronic nature of the defect.—*Charles Erwin Cohn*

## VOLUME EXPANDER

Various types of volume expanders and their relative merits have long been the subject of debate among sound engineers and high-fidelity music lovers. Expanders of different types have been incorporated in PA and high-fidelity amplifiers and in some of the more elaborate receivers. They may be classified into variable-gain and variable-output types. A new expander design of the former type is described in patent No. 2,556,692, granted to V. L. Holdaway and assigned to Bell Telephone Laboratories.

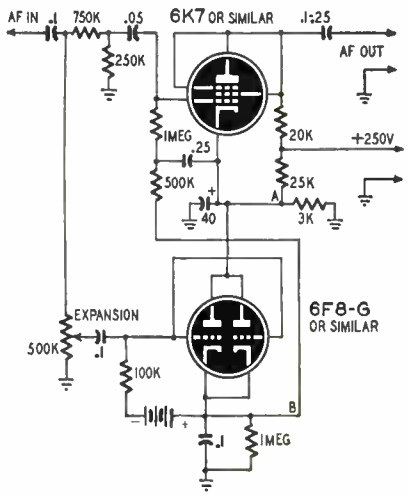
The circuit of the variable-gain amplifier is shown at *a*. The 6K7 is the main amplifier and the 6F8-G is the side or control amplifier. The cathode of the 6K7 and the plates of the 6F8 are tied together and connected to point *A* on a voltage divider which sets the bias on the 6K7 cathode at 25–30 volts. The 6F8 is biased to (or nearly to) cutoff by the battery in series with its grid return. The signal which is applied to the 6F8 control tube appears across the 500,000-ohm expansion control. The signal to the 6K7 is taken from the junction of the 750,000- and 250,000-ohm resistors which make up a voltage divider.

When no signal is applied to the input terminals, the 6F8 is cut off and

no current flows through the 1-megohm cathode biasing resistor. Point *B* remains substantially at ground potential, thus holding the bias on the 6K7 to that value supplied by the tap at *A*.

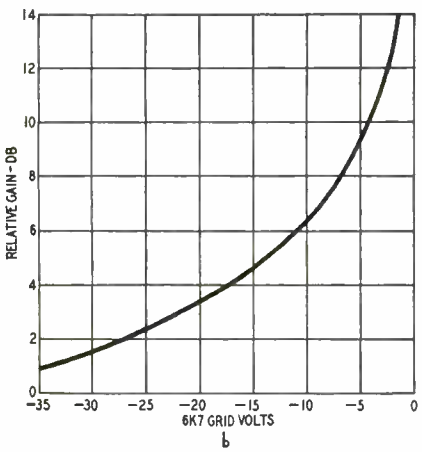
When a signal of increasing amplitude is applied to the expander, the 6F8—if initially biased to cutoff—conducts on the positive half-cycles and develops a positive voltage across the 1-megohm resistor. The positive voltage thus developed at *B* biases the grid of the 6K7 and opposes the positive bias supplied to its cathode from point *A*. The effective bias of the main amplifier will decrease, thus increasing its gain. The gain-grid-bias curve is shown at *b*.

The drop between plate and cathode of the 6F8 insures that the maximum




a

voltage developed at *B* can rise to within a volt or two of point *B* but cannot exceed it. Therefore, the grid of the 6K7 always operates with negative bias, preventing any distortion

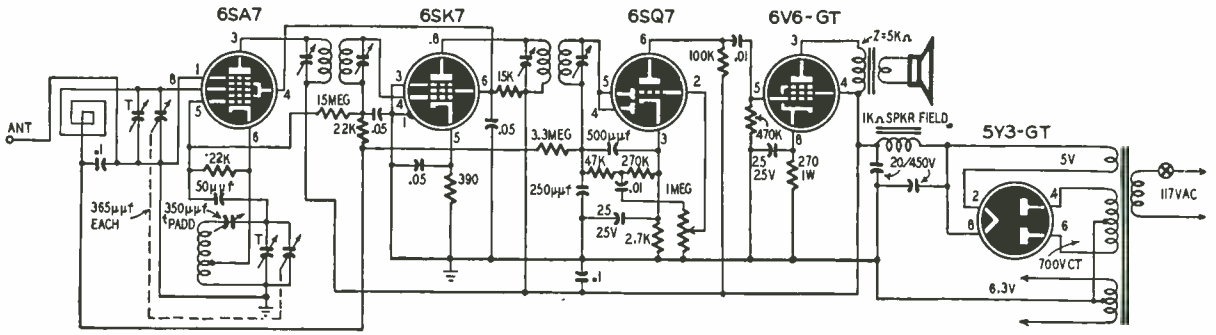



b

which would occur if the tube were operated with positive grid bias. Since the 6K7 operates with only one or two volts of bias with high input signals, the voltage divider in the input circuit holds the maximum signal drive below this value.

The sizes of the resistors and capacitors in the 6F8 cathode circuit and in the 6K7 grid return determine the attack and decay times of the expander action. These values may be varied to control the rate of expansion.

—end—




Schematic of a 5-tube, a.c.-operated broadcast receiver, following standard commercial circuit practice throughout.

## 5-TUBE BROADCAST SET

? *I would like to construct a 5-tube AM broadcast receiver using a 6SQ7 detector, a.v.c., and a.f. amplifier, 6SK7 i.f. amplifier, 6SA7 converter, and a 6V6-GT power amplifier tube. I would like the diagram to show a loop antenna and connections for a speaker with a 1,000-ohm field.—E.S.T., New York, N.Y.*

**A.** The diagram of the receiver is shown. All components are conventional and the circuit should work nicely after alignment. The intermediate frequency may be anywhere in the range of about 450-470 kc. The oscillator padder capacitor is correct for most broadcast oscillator coils, but consult the coil manufacturer's recommendations for exact value.

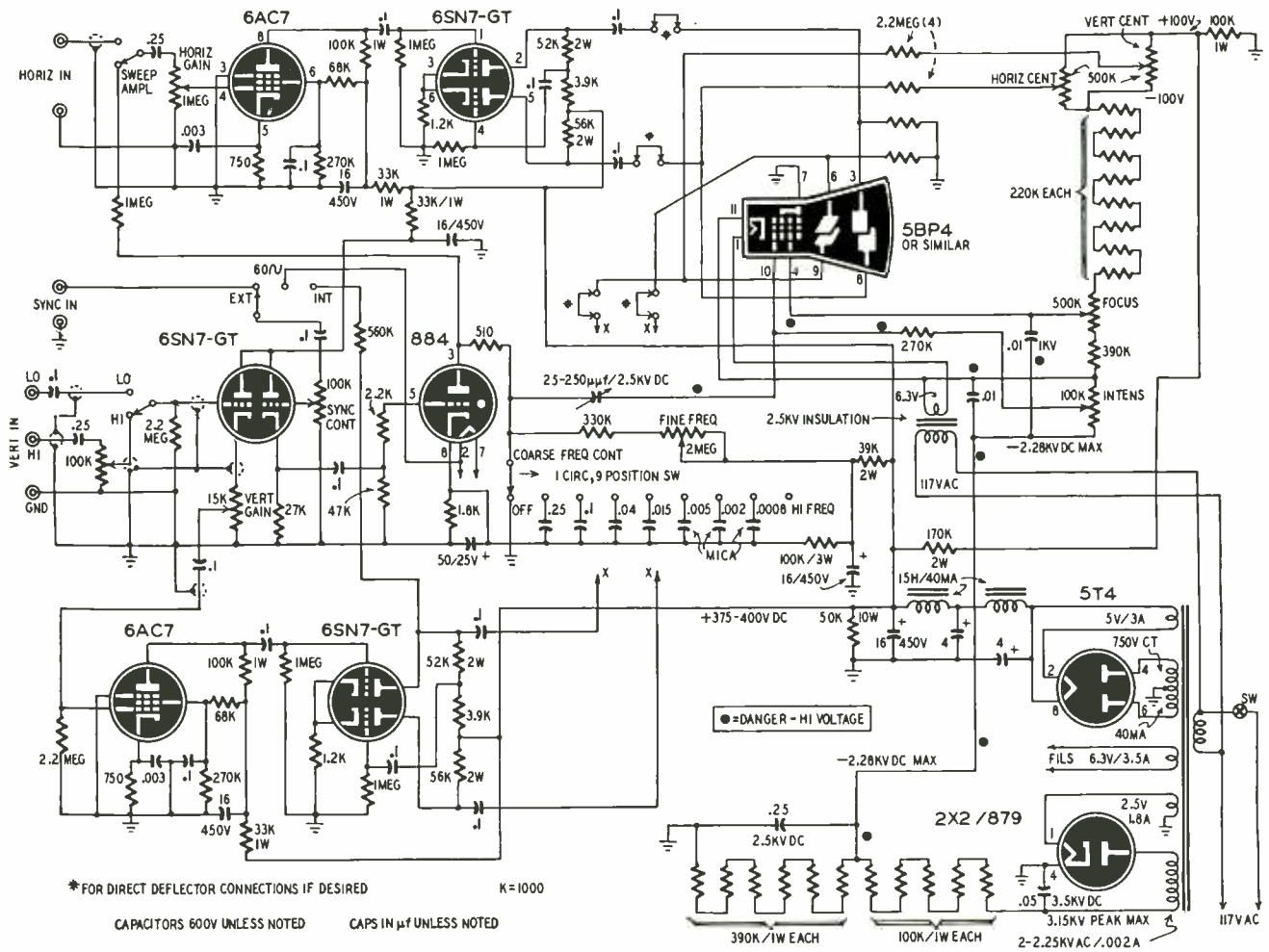
## 5-INCH OSCILLOSCOPE

? *I have a high-voltage transformer which has a 700-volt, 40-ma low-voltage secondary, a 2,250-volt, 2-ma half-wave high-voltage secondary, and filament windings delivering 5 volts at 3 amp, 6.3 volts at 3.5 amp, and 2.5 volts at 1.8 amp. Please show how I can use this in a general-purpose scope using a 5BP1 or 5BP4 tube.—G. H. K., Chicago, Ill.*

**A.** The scope diagram is shown. The power transformer and filter chokes should be placed well away from the amplifiers and the picture tube to prevent hum pickup. The centering, focus, and intensity controls should be insulated from the chassis and driven from the front panel through insulated shafts. The deflection-signal leads and interstage coupling capacitors should be dressed well away from the chassis to minimize wiring capacitance which causes loss of high frequencies. Shield the scope against external fields with a steel case. Be sure to discharge the high-voltage filter capacitors before beginning work under the chassis.

## I.F. INTERFERENCE

? *I live on the coast where there are a number of marine and commercial stations operating on the low-frequency side of the broadcast band. Their fundamentals and harmonics fall within the i.f. range of my superhet-type high-fidelity tuner and spoil reception with cross-talk and whistles. Please tell me how to eliminate this trouble.—A. R. G., Atlantic City, N. J.*




Circuit diagram of the 5-inch cathode-ray oscilloscope. A steel or iron case should be used for magnetic shielding.

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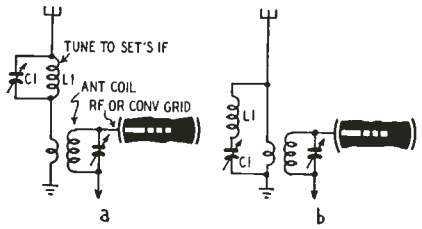
**A.** Most likely, the interfering signals are coming in on the antenna. If so, you




can eliminate them by inserting one or more tuned traps in the antenna circuit of the set. The drawing at *a* shows a parallel-tuned trap, and the drawing at *b* shows one which is series-tuned. If the interference is severe or is from two stations, it may be necessary to use both types of traps. In any case, the traps should tune to the i.f. range of your set. L1 and C1 may be one winding and tuning capacitor from a standard i.f. transformer.

### RECEIVER-TRANSMITTER QUERY

**?** *I have a model 11-UF-ED-6 Link receiver and a model 32-UFM-ED-2 transmitter. Both are crystal controlled on 39.46 mc. I want to shift the frequency to 33.86 mc. The transmitter crystal is at 1,059.25 kc. The receiver uses two crystals: one at 5.456 and the other at 6.892 megacycles. What crystals must I use for the new frequency? —G. F. B., College Park, Md.*

**A.** The transmitter output is on the 32nd harmonic of the crystal frequency. Therefore, the new crystal frequency is 33.86/32, or 1.05812 mc (1,058.12 kc).

The receiver is a double superheterodyne with the first i.f. at 5 mc and the second at 456 kc. The 5.456-mc crystal is in the oscillator circuit of the second converter and is not changed. The heterodyning frequency for the first converter is 5 mc below the signal frequency and is the fifth harmonic of the 6.892-mc crystal. Therefore, at the new frequency, the heterodyning signal is 33.86 minus 5, or 28.86 mc. Since the 5th harmonic of the crystal is used, the new crystal for the receiver must be 28.86/5 or 5.772 mc.

Some of the tuned circuits may not have sufficient range to tune down to the new frequencies, so you may have to shunt the coils with small padders or add a few turns to the coils. A grid-dip meter will be helpful in checking the tuning range of the coils and in making sure that you don't pick up the wrong harmonic of the crystal.

### TUBE NUMBERING SYSTEM

**?** *I am preparing for an amateur examination and have been studying the various types of tubes used in transmitters. I find it difficult to compare different types of tubes without referring to the tube manual or the handbook. Is there any way that I can determine pertinent data on a tube from its number?—E. E. K., Bronx, N. Y.*

**A.** This can't be done under the old numbering system in which we have

such tubes as the 812, 813, and 815. There is no similarity between them.

A new numbering system is in use by Eimac and other manufacturers. Many of the older types are now identified under a dual numbering system. The new number enables the user to determine the type, plate dissipation rating, and amplification factor. The old familiar 250TH now bears the numbers 3-250A4/250TH. The number ahead of the dash indicates the number of elements in the tube, the number or numbers between the dash and the letter gives the plate dissipation rating in watts, and the letter stands for the version of the tube. The letter A is used on the original design; B, C, and so on indicate later modifications. The modified versions of a given basic type are not necessarily interchangeable either physically or electrically.

The number (if any) following the letter indicates the mu of the tube. The number 1 is used for a mu of 10 or less, 2 is for a mu of 11 to 20, 3 for 21 to 30, and so on. The new 4E27A's are now marked 4E27A/5-125B. The 5- stands for pentode or 5-element tube; 125 is the plate dissipation in watts; and B is the version of the tube.

In some receiving-transmitting types, such as the 6L6, the first numeral(s) gives heater voltage to the nearest lower whole number; the letter (s) shows the type; the last numeral gives the number of independently-connected elements in the tube.

—end—

### SENTINEL MODEL 312

When these sets are inoperative on line operation, replace the 1R5 oscillator tube and the selenium rectifier. If the tube and rectifier are good, the set will operate at line voltages as low as 105. If either unit is weak, the 1R5 is likely to stop oscillating when the line voltage drops to 112 or lower.

A three-way set which operates on the service bench may not operate correctly in the customer's home if the line voltage is low. Before returning such sets to the owner, always check their operation on low line voltage. A Variac or other voltage-reducing device can be used for this purpose.—*Sentinel Radio Service Dept.*

### STROMBERG-CARLSON TV-12

The 12JP4 picture tube in these sets is directly replaceable with a 12RP4. The operating characteristics of these tubes are identical and the latter type can be used as a replacement in any set using the 12JP4. When making the substitution, be sure to use an ion trap on the 12RP4.—*Stromberg-Carlson Current Flashes*

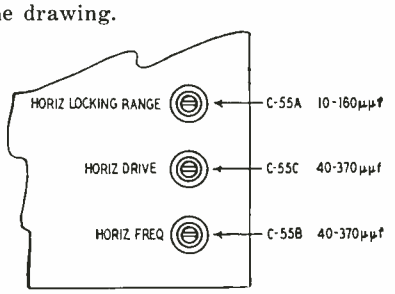
### HOWL IN FM SETS

When using superregenerative-type FM receivers like the Fremodyne, a howl may be heard during commercials on some stations. The stations which cause the howl are storecast stations which transmit ultrasonic tones to control the volume of storecast receivers. The ultrasonic tone is not heard on standard superhets but it beats with the ultrasonic quench frequency of the superregenerative detector and produces an audible howl. This is one of the inherent disadvantages of these circuits and cannot be eliminated.—*Charles Erwin Cohn*

(Some listeners of course will prefer the howl to the commercial.—*Editor*)

### AIRLINE 94WG-3006A, -3009A

In some sets, the trimmer capacitor strip consisting of C-55A, C-55C, and C-55B is physically reversed. This places C-55A at the bottom instead of the top. These capacitors were wired normally. Therefore the 10-160-μμf capacitor was connected in the HORIZONTAL FREQUENCY CONTROL circuit and the 40-370-μμf capacitor in the HORIZONTAL LOCKING RANGE circuit. The correct positions of these capacitors are shown in the drawing.



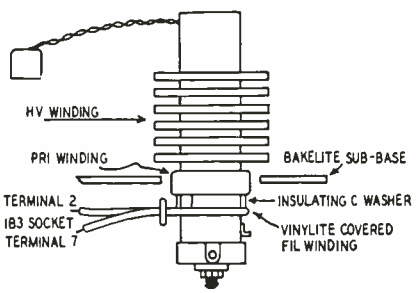

This error does not affect the operation of the sets as long as all circuit constants remain normal. Variation of some components with age may make it necessary to run the horizontal-lock capacitor at extreme minimum capacitance and the frequency control at maximum. If it is difficult to set these two controls, check the positioning of the capacitor strip. The low-capacitance unit (10-160 μμf) should be at the top and the two 40-370-μμf units at the bottom.—*Montgomery Ward General Service Letter*

### AIRLINE 84BR-3004 TV SETS

The high-voltage winding of the r.f.-power-supply coil extends through a bakelite subpanel and cannot be removed without first removing the rectifier filament winding. The latter winding is not considered a part of the high-voltage oscillator coil and new coils do not have this winding on them.

To remove the coil:

1. Unsolder the vinylite-covered filament leads from the 1B3-GT socket. Use minimum heat to prevent damage to the insulation on the leads.
2. Loosen the fiber spacer on the fil-



ament winding and enlarge the loop to clear the coil form.

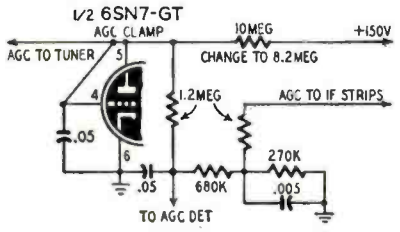
3. Remove the C-washer. Take care to avoid damaging the primary winding (See diagram.)

4. Unsolder the other leads to the coil form and remove the coil.

The replacement coil is installed in the reverse order. Place the original filament winding in the same position on the new coil.—*Montgomery Ward Service Letter*

### DUMONT RA-109A

To reduce snow on weak signals, increase the a.g.c. delay bias so the signal level at the grid of the first i.f. stage is high enough to override the tube noise of the i.f. amplifiers. To do this, substitute an 8.2-megohm resistor




for the 10-megohm unit connected in the 150-volt line to pins 4 and 5 of the 6SN7-GT a.g.c. clamp and horizontal saw-tooth forming (discharge) tube. The position of this resistor is shown in the partial schematic above. This change has been made in all chassis beginning with No. 0959931.—*DuMont Service News*

### OLYMPIC 762, 783, 967, 968, 970

Horizontal oscillator drift which causes the picture to deteriorate into bars sloping downward to the left is caused by the 150-μμf mica capacitor in the oscillator circuit. Replace this capacitor, C75, with a 150-μμf, 10%, N750 negative temperature coefficient ceramic capacitor. This capacitor is connected from terminal F of the horizontal oscillator coil to pin 4 of V18, the 6SN7-GT tube. Reset the horizontal oscillator as described in the service manual.—*Olympic Service Bulletin*

### BUZZ IN TV SETS

An annoying buzz is sometimes present in the audio of TV sets which use a 6T8 as a discriminator and first-audio tube. This buzz, which can be heard with the volume control turned all the way down, is comparatively common when the 6T8 is located under or close to the picture tube. The trouble can be eliminated by placing a well-grounded shield over the 6T8—*Hubert L. Frazier*

### FARNSWORTH GV-260

Flashes of light or unsteady background illumination can be traced to trouble in the d.c. restorer circuit. This is usually caused by an increase in the value of R40, a 10,000-ohm resistor, which changes the time-constant of the d.c. restorer. This resistor connects to the grid of the picture tube.—*Wilbur J. Hantz*

—end—

## ELECTRONIC LITERATURE

Any or all of these catalogs, bulletins, or periodicals are available to you on request direct to the manufacturers, whose addresses are listed at the end of each item. Use your letterhead—do not use postcards. To facilitate identification, mention the issue and page of RADIO-ELECTRONICS on which the item appears. All literature offers void after six months.

### SUN RADIO CATALOG

Sun Radio's Catalog No. 52 is a large (8½ x 11-inch) book containing 164 pages. Special attention is called to the comprehensive transformer and capacitor sections covering 50 pages, to the listings of connectors which take up 10 pages, and to the industrial sound section, containing 12 pages. There are also very complete listings of tubes and crystals, including special, transmitting and industrial types and transistors, as well as a great number of small hardware items. There are two indexes—one by product and one by manufacturer—and the user is told on the cover just where the index is.

*Gratis from Sun Radio & Electronics Co., Inc., 122-124 Duane St., New York 7, N. Y.*

### SELENIUM RECTIFIERS

A 28-page booklet which describes rectifier fundamentals, the process of manufacturing rectifier stacks, design details and applications of these increasingly important devices. A complete glossary of rectifier terms is included.

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### PRODUCT INDEX

A condensed catalog of P. R. Mallory products, including mercury batteries, capacitors, contacts, rectifiers, resistors, switches, vibrators, resistance welding necessities, metals and ceramics, and tuners. Considerable descriptive material, in language designed to be equally readable by engineer and layman, is devoted to each set of items, thus making the publication considerably more valuable than an ordinary catalog.

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### 1952 HEATHKIT CATALOG

The Heathkit line now includes 6-volt power supplies, intermodulation analyzers, audio-frequency meters and Williamson audio-amplifier kits as well as the older and more familiar pieces of test equipment advertised in earlier catalogs. All these items are described in a 16-page catalog, which also carries some information on Heath Company facilities.

*Gratis from Heath Co., Benton Harbor, Michigan.*

### COUNTER TUBES

The radiation counter tubes manufactured by Amperex are described in a 22-page loose-leaf catalog. A six-page introduction reviews briefly the history

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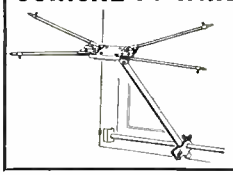

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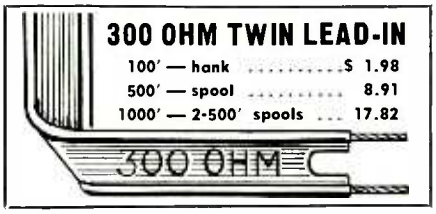


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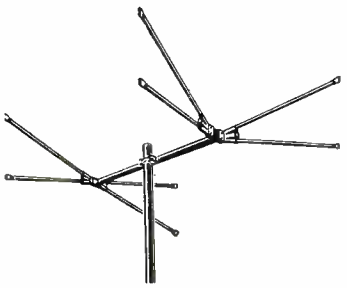

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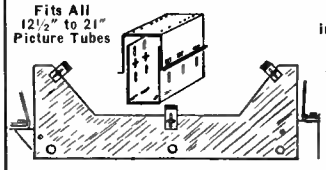

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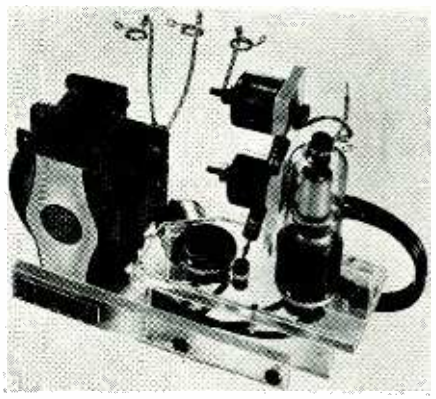

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Electrically the circuit remains the same. Unassembled form allows for modifications in mounting and wiring.

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*ILLUSTRATED CONVERSION MANUAL SUPPLIED WITH EACH KIT*

(add $3.99 for Universal Mounting Brackets)

| | | |
|---|---|---|
| **DEFLECTION YOKE** 70° | 206D1.. | $3.98 |
| **FOCUS COIL**, 470 ohms | 202D2.. | 3.42 |
| **ION TRAP BEAM BENDER**, (single) | 203D1.. | .79 |
| **PLASTIC RING**, for insulating rim 16" CRT | | 1.97 |
| **PLASTIC SLEEVE**, for insulating 16AP4.... | | 1.88 |
| **PLASTIC SLEEVE**, for insulating 16GP4.... | | 1.88 |
| **PLASTIC RING**, for insulating rim 17" CRT | | 2.04 |
| **PLASTIC SLEEVE**, for insulating 17CP4.... | | 1.92 |
| **PLASTIC RING**, for insulating rim 19" CRT | | 2.08 |
| **PLASTIC SLEEVE**, for insulating 19AP4.... | | 1.96 |
| **PLASTIC RING**, for insulating rim 24" CRT | | 3.89 |
| **PLASTIC SLEEVE**, for insulating 24AP4.... | | 2.94 |

## Modernize Your #630 TV Set With a New STANDARD CASCODE TUNER

For better all around performance

Complete w/tubes, instructions **$22.49**

# BROOKS RADIO & TV CORP., 84 Vesey St., Dept. A, New York 7, N. Y.

of the counter tube and explains its characteristics. Following this is a series of data sheets on the various types of tubes made by the company.

*Gratis from Amperex Electronic Corp., 25 Washington St., Brooklyn 1, N. Y.*

## N. T. C. RESISTORS

An 8-page booklet describing the characteristics of Keystone negative temperature coefficient resistors, some basic application information, and answers to the most commonly asked questions about this type of resistor.

*Gratis from Keystone Carbon Co., St. Marys, Pa.*

## FOLDED HORN DESIGN DATA

Drawings and instructions for building the backloading folded horn which is used with the new Jensen G-610 Triaxial speaker are being offered would-be speaker-enclosure constructors. The horn can be mounted in a 5 x 3 x 2-foot cabinet, utilizing all of it. The manufacturer claims that this new horn design reduces loudspeaker resonant frequency by almost an octave, increases efficiency 4 to 6 db over the entire piston range, improves transient performance and allows doubling the loudspeaker power rating for a given amount of distortion.

*Gratis from Jensen Manufacturing Co., 6601 South Laramie Ave., Chicago 38, Ill.*

## Radio Thirty-Five Years Ago
### In Gernsback Publications

**HUGO GERNSBACK**
***Founder***

| | |
|---|---|
| Modern Electrics | 1908 |
| Wireless Association of America | 1908 |
| Electrical Experimenter | 1913 |
| Radio News | 1919 |
| Science & Invention | 1920 |
| Television | 1927 |
| Radio-Craft | 1929 |
| Short-Wave Craft | 1930 |
| Television News | 1931 |

Some of the larger libraries still have copies of ELECTRICAL EXPERIMENTER on file for interested readers.

### JUNE, 1918
### ELECTRICAL EXPERIMENTER

The Phenomena of Electrical Conduction in Gases, by Rogers D. Rusk, M.A.
Television and the Telephot, by H. Gumslacht
The Dynatron—a New Vacuum Tube
A "Fountain Pen" Radio Receiving Set
Radio Signal Generator For Teaching Students, by Geo. F. Paul
Radio Key With Ball Bearing Contacts
Radio Operating in Alaska, by Howard S. Pyle
Code Buzzer Tricks, by E. Duskis
Design and Use of the Wave-Meter, by Morton W. Sterns
Preventing Burning Out Audion Filaments, by E. T. Jones
A Detector Hint, by P. B. Kingsley
A Simple Ball-Joint Detector, by Clarence Sousley
Improved Tickler Coil Hook-up, by E. T. Jones
Variable Condenser Control for Panel Sets, by Walter Peterson

## THE FUND NEARS $9,500

# HELP - FREDDIE-WALK FUND

Those of our readers who have been following the growth and progress of little Freddie Thomason, the armless and legless son of Herschel Thomason, radio technician of Magnolia, Arkansas, will be interested in learning that he celebrated his fourth birthday a short while ago with a barbecue given by the Kiwanis Club. Soon afterwards, he made another visit to the Kessler Institute, West Orange, New Jersey, where necessary adjustments were made in the mechanical appliances on which he is so dependent.

Others who are meeting Freddie for the first time will want to know that it

has been largely through the Help-Freddie-Walk Fund, instigated by RADIO-ELECTRONICS many months ago and enthusiastically supported by hundreds of its readers, that Freddie and his appreciative family have been able to look forward to the future with optimism and hope. Although the Fund now totals almost $9,500, many thousands more will be needed before the job of rehabilitating the unfortunate child can be considered as complete as human ingenuity can make it.

The continued support from people in all stations of life all over the world is very encouraging. With a donation of $5.00, Frank C. Okleberry, c/o Fleet Post Office, San Francisco, writes: "... I am greatly relieved to know that people are doing what they can for Freddie. You can count on me!" Eugene A. Tracy, of the S.S. Edwin Booth, Yokohama, Japan, sent $25.00, and commented: "I wish I could send a million, but I hope that the enclosed will swell the fund." And we should also like to take special note of a $4.00 contribution received from Sgt. A. L. Howell, in the name of the personnel of the U.S. Armed Forces Blood Donor Center, Fort Leonard Wood, Missouri.

Please send your contributions, large or small, from time to time. *Make all checks, money orders, etc., payable to Herschel Thomason.* Address all letters to:

Help-Freddie-Walk Fund
c/o RADIO-ELECTRONICS
25 West Broadway
New York 7, N. Y.

## FAMILY CIRCLE CONTRIBUTIONS

| | |
|---|---|
| Balance as of March 18, 1952 .... | $ 521.50 |
| Mrs. Edna Bachmann, Chicago, Ill. | 2.00 |
| Eugene A. Tracy, S.S. Edwin Booth, Yokohama, Japan ..... | 25.00 |
| Mrs. Addie Schlenck, Oxford, Ohio . | 2.00 |
| FAMILY CIRCLE Contributions Received to April 18, 1952 ..... | $ 550.50 |

## RADIO-ELECTRONICS CONTRIBUTIONS

| | |
|---|---|
| Balance as of March 18, 1952 .... | $8,855.96 |
| Alliance Radio & Television Repair Shop, Claymont, Delaware ..... | 2.00 |
| Anonymous, San Antonia, Texas ... | .20 |
| V. A. Boker & Sons, Minneapolis, Minnesota ..... | 10.00 |
| Sven Bourghardt, Goteborg, Sweden | 1.00 |
| Chester's Radio Sales & Servico, Winnipeg, Manitoba, Canada .. | 5.00 |
| Ned Fleishman, Fayetteville, North Carolina ..... | 1.00 |
| C. A. Fleming, Lafitte, Louisiana .. | 10.00 |
| W. N. Gurnee, WOJG, Fort Bliss, Texas ..... | 5.00 |
| Mr. & Mrs. Robert Gray, Richmond, Indiana ..... | 1.00 |
| C. T. Haley, Chicago, Illinois ..... | 1.00 |
| George F. Jephson, Bloomfield, New Jersey ..... | 5.00 |
| Norman C. Jones, Ballston Spa, New York ..... | 5.00 |
| Mr. & Mrs. Thomas F. Malone, Arlington, Virginia ..... | 2.00 |
| C. R. Mitchell, Newark, Ohio ..... | 2.00 |
| Frank C. Okleberry ATI, F.P.O., San Francisco, California ..... | 5.00 |
| Personnel of the U.S. Armed Forces Blood Donor Center, Fort Leonard Wood, Missouri ..... | 4.00 |
| John Piatkiewicz, North Chicago, Ill. | 2.00 |
| A. V. Predki, Detroit, Michigan .... | 2.00 |
| Paul Trinker, Orleans, Indiana ..... | 1.00 |
| RADIO-ELECTRONICS CONTRIBUTIONS ..... | $8,920.16 |
| FAMILY CIRCLE CONTRIBUTIONS | 550.50 |
| TOTAL CONTRIBUTIONS to April 18, 1952 ..... | $9,470.66 |

## MODERN XTAL SET DX REPORT

The following report is published through the courtesy of Dr. W. H. Grace, Jr., of Bronxville, N. Y.

The past winter was a favorable one for xtal-set dx reception in Richmond, Va., according to Mr. Joseph Amorose. Using a homemade receiver with only a germanium-diode detector, headphones, a single-wire antenna, and ground, Mr. Amorose heard the following stations:

WOR—New York, N. Y.
WJZ—New York, N. Y.
WNBC—New York, N. Y.
WCBS—New York, N. Y.
WKBW—Buffalo, N. Y.
WCKY—Cincinnati, Ohio
WLW—Cincinnati, Ohio
WBT—Charlotte, N. C.
WSB—Atlanta, Ga.
WLWL—New Orleans, La.
WHAS—Louisville, Ky.
KMOX—St. Louis, Mo.
WBBM—Chicago, Ill.
WGN—Chicago, Ill.
WHO—Des Moines, Ia.
WJR—Detroit, Mich.
WGY—Schenectady, N. Y.
WBZ—Boston, Mass.
WSM—Nashville, Tenn.
WWVA—Wheeling, W. Va.
WTAR—Cleveland, Ohio
WBAL—Baltimore, Md.
KTHS—Little Rock, Ark.

A station in Miami and one in Salt Lake City were also heard but their calls could not be obtained. Reception from the more or less local stations was normal.

—end—

# People

George E. McAllister was appointed Division manager of the Norwood plant of WORKSHOP ASSOCIATES, Division of The Gabriel Co. Mr. McAllister served over eighteen years with Gabriel as industrial engineer, plant manager, purchasing agent, and for the past five years general manager of The Ward Products Division.

G. E. McAllister

George L. Loomis succeeds Walter A. Weiss as manager of SYLVANIA ELECTRIC PRODUCTS' radio tube plant at Burlington, Iowa. Mr. Weiss was appointed general manufacturing manager of the Radio Tube Division. Before his promotion, Mr. Loomis was engineering manager of the Division's Products Development Section.

G. L. Loomis

H. R. Letzter was appointed sales manager of the Industrial Division of WEBSTER-CHICAGO CORP., manufacturer of record changers, phonographs, and magnetic wire and tape recorders. Mr. Letzter has been with Webster-Chicago for the past four years in various executive sales capacities, including sales to the government.

H. R. Letzter

Harold L. Herndon, former service manager of the RAYTHEON MANUFACTURING COMPANY'S Cleveland district, was promoted to the post of district manager in charge of sales and service for the Cleveland district. Albert R. Wolfe, who assisted Mr. Herndon as field engineer, succeeded him as service manager.

H. L. Herndon

Raymond Rosen, president and senior member of the RAYMOND ROSEN CO., distributors of RCA Victor products and president of Raymond Rosen Engineering Products, Inc., died of a heart attack in his home in the Germantown section of Philadelphia.

## Personnel Notes

. . . John J. Radigan, Jr., recently assumed duties as newly appointed vice-president in charge of industrial relations at P. R. MALLORY & CO., INC., Indianapolis. He came to Mallory from E. W. Bliss Co.

. . . Stanley R. Andrews was elected vice-president in charge of STANDARD COIL PRODUCTS CO., INC., Chicago pro-

duction facilities. He was previously works manager of Standard Coil's three Chicago plants.

. . . David Hughes joined the industrial sales staff of SIMPSON ELECTRIC CO., Chicago. He was formerly director of the instrument school of the Industrial Training Institute.

. . . **Donn F. King** was appointed east central district sales manager of the Parts Division of SYLVANIA ELECTRIC PRODUCTS, INC., with headquarters in Cincinnati. He was previously on the supervisory sales staff of the division. Sylvania also announced the appointment of A. W. Keen as manager of Application Co-ordination. He was formerly assistant to the manager of Sylvania's Product Development Laboratory at Kew Gardens, N. Y.

. . . **Donald G. Fink** joined the PHILCO CORP. as co-director of Research-Operations. Mr. Fink was formerly editor of *Electronics* magazine.

. . . **A. M. Repsumer** was promoted to the post of television supervisor for the BAKER MANUFACTURING CO., Evansville, Wis., manufacturer of television masts, towers, and roof mounts.

. . . **Edward Cappucci** was appointed plant superintendent for RADIO MERCHANDISE SALES (RMS), New York City. He was previously with the George S. May Co. Gene Reich, previously with Magnavox, will head the company's Quality Control Section. Rubin Agdern continues as production manager. Mal Greenberg joined the company's sales engineering staff, and Harold Merson was appointed chief electronic engineer.

. . . **Edward S. Hill, Sam R. Alexander,** and **Oscar K. Leisher** were appointed district sales managers for CHANNEL MASTER CORP., Ellenville, N. Y., in the southeast, the southwest, and the Maryland and central Pennsylvania territories, respectively.

. . . **Joseph Holzman** was appointed industrial sales engineer for the INSULINE CORPORATION OF AMERICA, Long Island City, N. Y.

. . . **J. D. Ceader** was re-elected president of the OXFORD ELECTRIC CORP., Chicago. Hugo Sundberg was re-elected vice-president and general manager, and David E. Davis secretary-treasurer. All members of the board of directors were also re-elected.

. . . **Leo Brook** was appointed industrial and broadcast sales manager of ALLIED RADIO CORP., Chicago distributor, in a move to expand the Sales Division. Other appointments included: Dave Kennedy, sales development manager; Gordon Hough, inside sales administration; George Kelly, government sales manager; Jack Lizars, dealer sales manager; Fred Prehn, Chicago Store sales manager; Eugene Carrington, general product promotion; and Julian McBarron, general account promotion.

. . . **Russell J. Tinkham** was named manager of the newly established Chicago office of AMPEX ELECTRIC CORP., Redwood City, Cal., manufacturers of magnetic tape recorders.

—end—

## TV "FIX-IT" BOOKS A BOON?

*Dear Editor:*

I read with great interest "Fix It Yourself" in the March RADIO-ELECTRONICS. While this is a remote area for television I have found some of these fix-it-yourself booklets on our newsstands and heard their radio commercials.

I have been a service technician since crystal-set days, and I do not agree with Mr. Leslie. I am all for the fix-it-yourself books, and would like to see them sell several million. *If the readers of these books do exactly as instructed I am sure service technicians will be working day and night taking care of their calls.*

One of my customers is a doctor. I tried in vain to get him last week and found he had been operating for 7 hours and was two days behind in his calls. I can just see him at home after such a day, at about 11 pm, prying the back off his television set, and going over his little book trying to find the trouble.

No, Mr. Leslie, I don't think we need worry about these books putting us out of work; in fact I think they are doing us a big favor. I remember the customer's son who was handy with a screwdriver and tried to fix the family radio. He tightened up all the screws. That was very profitable for me and I'm looking forward to more like that in television.

All this time in the service field I've been reading your fine magazine, and can truthfully say it has gone a long way in making me a successful radio technician.

FRANCIS D. BUCHANAN
*Keokuk, Iowa*

(Thanks for a fine letter, Mr. Buchanan, but note that the article did not suggest that business would be lost on account of the books; it objected to the implications of dishonesty and incompetence in the books *and* their advertising.—*Editor*)

## FAVORS SMALL-TOWN AM

*Dear Editor:*

I have noticed many letters complaining of "too much this" or "too little that", and I, too, find some articles of no interest to me *at a particular moment*. But as I study and broaden my understanding of electronics these articles soon find a place in my interests.

Along with Mr. Hawbaker, I advocate more AM broadcast stations. Theoretically, maybe, the band is crowded, but from a practical viewpoint it is wide open. Here in Linton, Indiana, with a good receiver, and when conditions are right, I can get only about 10 stations, all over 75 miles away, and half of them go off the air at 6 pm. We can "detect" 3 FM stations here, but only 1 is listenable.

Therefore I go along with Mr. Hawbaker in demanding more local low-power AM stations, which would be assets to community business and a public service, as well as providing good entertainment.

LOU S. BITTON
*Linton, Indiana*

## AN AID FOR TECHNICIANS

*Dear Editor:*

Almost every day you can pick up a magazine or a newspaper and read a derogatory article on the ethics and honesty of radio and television service dealers. These smears have been greatly accelerated recently due to the tremendous growth of television, but they are by no means a new development. *Reader's Digest* initiated the first of these attacks more than ten years ago and press at the consumer level at frequent intervals since has kept the service dealers constantly in the public's "doghouse."

The opinion has developed that no one has tried to help the service dealers. Nothing could be farther from the truth.

In 1946 the Receiving Tube Division of the Raytheon Manufacturing Company instituted the RAYTHEON Bonded Electronic Technician Program—a program developed to help service dealers re-establish themselves in the good graces of the public. Raytheon distributors screened the service dealers in their areas, and those with modern and sufficient test equipment, sound financial background, and adequate manpower were selected for bonding consideration. Once these dealers qualified they were bonded with American Mutual Liability Insurance Company, one of the nation's leading surety companies, presented with a registered bond certificate and were pledged to observe an eight-point Code of Ethics designed to protect them and the consumer.

The eight points of the Code are:

1. Guarantee all radio and television repair work for 90 days from date performed and replacement parts 90 days from date installed.
2. Use only parts of recognized quality in such repair work.
3. Charge no more than established prices for parts installed in such repair work.
4. Test customers' tubes as accurately and reliably as possible.
5. Keep charges for labor in such repair work at a fair and reasonable level.
6. Perform only such repair work as is necessary or authorized.
7. Maintain and use service equipment essential to good repair work and reliable tube checking.
8. Maintain in such repair work the high quality service indicated by the experience required of all bonded electronic technicians.

Thousands of service dealers who are operating under the preceding Code of Ethics are enjoying excellent relationships with their customers and are doing much to regain the confidence of consumers in radio-TV service shops.

Incidentally, the bonded program does not cost the dealers a penny—the entire cost of the bond being paid by Raytheon.

The Raytheon bonded program was instituted because we believe the public has been misinformed about the majority of service dealers. We feel that anything that can be done to help

correct this unfortunate situation is more than worth the effort.

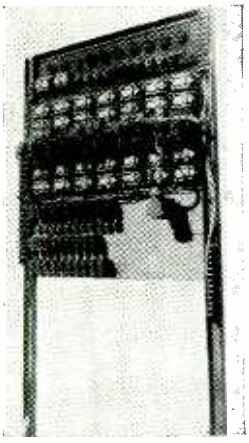
Very truly yours,
RAYTHEON MANUFACTURING COMPANY
*Receiving Tube Division*
E.I. Montague
*Sales Promotion Manager*
*Newton, Mass.*

## A COMPUTER ENTHUSIAST

*Dear Editor:*

I have read Edmund Berkeley's articles on computers and related subjects with great interest (Oct. '50—Oct. '51 —*Editor*) I have constructed for my own edification and amazement a small digital computer which I call "Dadac".

It is capable of handling 10 binary digits and at present is able to add and subtract. It has over 80 relays, 30 rectifiers, and quite a few switches. A multiplying circuit is just about complete and will be able to handle two binary-digit numbers and retain a 20-digit answer.



**First home-built electronic computer?**

I am going to incorporate a teletype printer so that answers may be typed out directly in decimal notation.

This has been one of the most interesting projects I have ever started and I hope you keep on giving us more interesting and informative articles on computers and Boolean algebra.

ROBERT C. DAY
*Monrovia, California*

## CORRECTIONS

In the article "Using Blanking Time", on page 117 of the April issue, the last paragraph should be changed to read "The answer is .7835 *seconds* of picture per second."

The author, Mr. William C. Stoecker, and Mr. George P. Steiner, have called attention to an error in the article "A Practical Multitester", in the March issue. On page 45 the formula for the unknown resistance should read:

$$R = \frac{R_c}{I} - R_c$$

(where I is the meter current in milliamperes).

In "Put Those Crystals to Work", in the April issue, WWV's modulating frequencies should read "440 or *600* cycles".

—end—

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This 669-page volume is the ideal guide for servicemen who realize it pays to know what really makes modern radio-TV receivers "tick" and why. Gives a complete understanding of basic circuits and circuit variations; how to recognize them at a glance; how to eliminate guesswork and useless testing. 417 illus. Price separately $6.

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**MUSICAL ENGINEERING, by Harry F. Olson. Published by McGraw-Hill Book Co., New York, N. Y. 6 x 9 inches, 369 pages. Price $6.50.**

It is unfortunate that many sound technicians, home recordists, and hi-fi enthusiasts know so little of the theory of music. Understanding music could add to the enjoyment of those who listen and could improve the technical results of those who record, pick up, or amplify music. This is one of the truly rare books on the subject which teach it clearly and completely. It is written for engineers, musicians, and music lovers. No previous knowledge of music, mathematics or engineering is required.

There are nine chapters. The first three show the nature of sound, music theory, scales, chords, and terminology. The next three deal with characteristics of vibrating systems and resonators. They give interesting descriptions of various stringed, percussion, and wind musical instruments. The last three chapters describe the properties of music and sound-reproducing systems. Human hearing and vocal mechanisms are illustrated. Loudness, volume, and timbre are explained. Diagrams and charts show optimum placement of musicians and audience for recording and broadcasting music. Acoustics is discussed at length. Microphones, speakers, sound-film, tape, discs, and hearing aids are treated briefly.—*IQ*

**WHY YOU SHOULD NOT TRY TO FIX YOUR OWN TV, by John D. Burke. Published by the John D. Burke Co., 88-14 168th St., Jamaica 32, N. Y. 5½ x 9 inches, 44 pages. Price 50¢.**

Latest of the fifty-cent books says "Don't Do It!" More than one TV technician, reading the fix-it books, has seen places where the owner would get in wrong if he attempted to put the instructions in practice. Burke points these out in capital letters. Some chapter heads are: "Very Few Bad Tubes Are Cold; No Kidding, You Could Get Killed; Why Be Ignorant?; You Can Easily RUIN Your Picture Tube; Some Examples of Amateur Tinkering."

The book is written in the individualistic and racy style of the author's articles in this magazine ("Don't Touch Those Screws!; Formula for TV Success"). It would be an excellent text for every TV owner—*if* he could be persuaded to read it.—*FS*

**ALL ABOUT TELEVISION, by John Derby. Published by Popular Mechanics Press, Chicago, Illinois. 6 x 9½ inches, 171 pages. Price $3.00**

This book is written especially for the person who knows little or nothing about television. It describes how TV works and gives hints for making it work when it doesn't. It tells how to choose a set, erect an antenna, adjust focus and the ion trap, replace tubes, and make other simple repairs. Jobs of this type are within the capabilities of many careful laymen who have had no experience with electronics.

## ADVERTISING INDEX



### RADIO SCHOOL DIRECTORY

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Commercial Radio Inst.
Electronics Inst., Inc.
Indiana Tech. College
Martin School, Don
RCA Institutes
Rehrig School
Tri-State Colleges
Valparaiso Tech. Inst.



Radio-Electronics does not assume responsibility for any errors appearing in above index.

There is also information on more delicate, complicated (and even dangerous) repairs such as tuning the oscillator, removing the kinescope and replacing high-voltage components.

Theory is given from a very elementary and popular viewpoint. It covers transmitters as well as receivers, projection and color TV.

**TV TERMS SIMPLY EXPLAINED, by H. G. Cisin, 200 Clinton St., Brooklyn 2, N. Y. 8½ x 10½ inches, 24 pages. Price $1.00.**

An elementary compilation of TV terms and their meanings, including definitions of terms used in TV transmission as well as reception.

Also shown are various defective picture patterns and the descriptive term which applies to each of them. Probable circuit defects are listed with the faulty patterns. Some of the defects are not too completely captioned; the circuit troubles to which they are attributed might easily cause other effects which are not shown.

**INTRODUCTION TO ELECTRONIC CIRCUITS, by R. Feinberg. Published by Longmans, Green & Co., New York, N. Y. 5½ x 8½ inches, 163 pages. Price $3.50.**

This is a fairly rigorous textbook based on a course for students at University of Manchester (England). It is concise and clear, but requires mathematical skill. Equations, curves, and diagrams appear frequently. Each chapter gives numerical problems (with answers) and lists experiments for the reader.

The first two chapters are titled "Thermionic Vacuum Tubes." They describe the construction and use of tubes, including magnetron and cathode-ray types. Special type tubes are discussed in the last two chapters. These include phototubes, mercury-pool, and cold cathode tubes. The last four chapters discuss amplification, tube nonlinearity, and oscillators.—*IQ*

**TELEVISION SERVICING, by Matthew Mandl. Published by The Macmillan Co., New York, N. Y. 6 x 9 inches, 421 pages. Price $5.50.**

This volume teaches modern circuit theory and indicates practical methods for trouble-shooting. A separate chapter describes each basic section of a receiver. Among them are sweeps, antennas, power supplies, mixers, sync circuits. More advanced material appears toward the end of the book. This includes projection TV, u.h.f., test equipment, and color TV.

Explanations are accompanied by simplified diagrams. The reader need not wade through a complicated diagram while the author tells the function of a certain tube or network. Waveforms are drawn at critical points so the reader may compare normal conditions with those he encounters. A very helpful and time-saving feature is the 12-page trouble index. It lists trouble symptoms and probable causes, together with the particular chapter and section which discusses the problem.

You will want to keep this book near your soldering iron, multimeter, and scope.—*IQ* —end—

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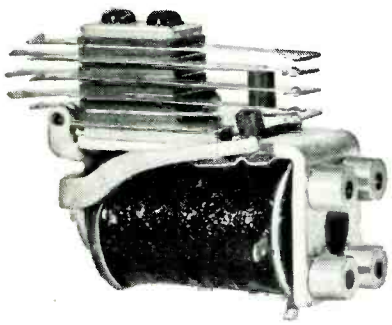

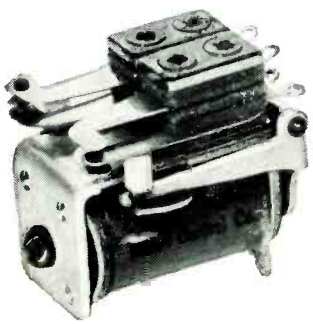

## Midget Relays

| STK. NO. | VOLTAGE | OHMAGE | CONTACTS | MFG. & NO. | UNIT PRICE |
|---|---|---|---|---|---|
| R-416 | 4 VDC. | 9 | 1C @ 1.5 AMP. | ADVANCE 1603S | $1.65 |
| R-378 | 6 VDC. | 100 | 1A @ 1.5 AMP. | ADVANCE 1601S | 1.50 |
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| R-379 | 19/27 VDC. | 250 | 2A @ 1.5 AMP. | ADVANCE 1605 | 1.65 |
| R-694 | 24 VDC. | 300 | 1A @ 5 AMP. | ADVANCE 1601A | 1.50 |
| R-935 | 28 VDC. | 1000 | 1C @ 1.5 AMP. | ADVANCE 1603S | 1.65 |
| R-572 | 24 VDC. | 256 | 1C | AIRCRAFT RADIO CORP. | 1.25 |
| R-857 | 24 VDC. | 260 | 1 MAKE BEFORE MAKE | AIRCRAFT RADIO CORP. 9453 | 1.75 |
| R-912 | 4/5 VDC. | 20 | 3A-1C CERAMIC | ALLIED TKX50 | 1.45 |
| R-291 | 6 VDC. | 5 | 1A | ALLIED .73A71 | 1.25 |
| R-921 | 6.7 VDC. | 18 | 1A Dbl. Brk. @ 10 amp. | ALLIED CRX-11 | 1.45 |
| R-738 | 12 VDC. | 60 | 3A | ALLIED TX3A | 1.20 |
| R-922 | 12 VDC. | 75 | 1A Dbl. Brk. @ 10 amp. | ALLIED CRX-13 | 1.45 |
| R-144 | 12 VDC. | 228 | 1A | ALLIED D-283486 | 1.45 |
| R-696 | 24 VDC. | 230 | 1A @ 8 AMP. | ALLIED 55837 | 2.00 |
| R-145 | 18/24 VDC. | 250 | 2A CERAMIC | ALLIED 7252 | 1.45 |
| R-723 | 24 VDC. | 280 | 1C | ALLIED 7251 | 1.50 |
| R-298 | 21 VDC. | 300 | 1A | ALLIED CB-5 | 1.25 |
| R-296 | 21 VDC. | 300 | 1A | ALLIED CA-5 | 1.25 |
| R-586 | 21 VDC. | 300 | 1A & 1C | ALLIED 73A-69 | 1.25 |
| R-142 | 24 VDC. | 400 | 2C | ALLIED 73A50 | 1.50 |
| R-785 | 24 VDC. | 200 | 2C @ 10 AMPS. | AUTO. ELECT. ZH-37169-1 | 2.00 |
| R-375 | 24 VDC. | 200 | 2A heavy duty | AUTO. ELECT. H-87063-1 | 1.75 |
| R-373 | 12/20 VDC. | 225 | 1A split | AUTO. ELECT. SQA | 2.50 |
| R-370 | 12 VDC. | 75 | 1C | AUTO. ELECT. MANKATO R-25 | 2.30 |
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| R-606 | 24 VAC. | INT. | 1A & 1B | AUTO. ELECT. MANKATO R-45-F | 1.20 |
| R-605 | 24 VAC. | INT. | 3A | AUTO. ELECT. MANKATO R-45-G | 1.20 |
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| R-376 | 24 VDC. | 300 | 1A | CLARE.....K | 1.25 |
| R-818 | 18/24 VDC. | 300 | 1B | CLARE.....A-8058 | 1.30 |
| R-133 | 24 VDC. | 300 | NONE | CLARE.....A-20388 | .75 |
| R-348 | 18/24 VDC. | 300 | 2A | CLARE.....A-16734 | 1.15 |
| R-138 | 24 VDC. | 300 | 4A | CLARE.....A-16280 | 1.45 |
| R-349 | 18/24 VDC. | 300 | 1C | CLARE.....B-16947 | 1.25 |
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| R-415 | 60/85 VDC. | 1800 | 2A | CLARE.....K | 1.95 |
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| R-755 | 24 VDC. | 300 | 1A | COOK.....55340 | 1.45 |
| R-150 | 6 VDC. | 30 | 1A | E-Z ELECTRIC | 1.50 |
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| R-947 | 12/24 VDC. | 320 | 1C @ 3 AMP. | LEACH.....P-3 | 1.25 |
| R-692 | 6/24 VDC. | 1280 | 1C @ 3 AMP. | LEACH.....P-3 | 1.35 |
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| R-834 | 6 VDC. | 20 | 3A, 1C | RBM | 1.45 |

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- Voltage Regulators
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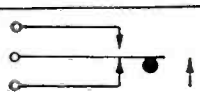
Form B—"Break" (Single Throw, Normally Closed)



Form C—"Break-Make" (Double-Throw)

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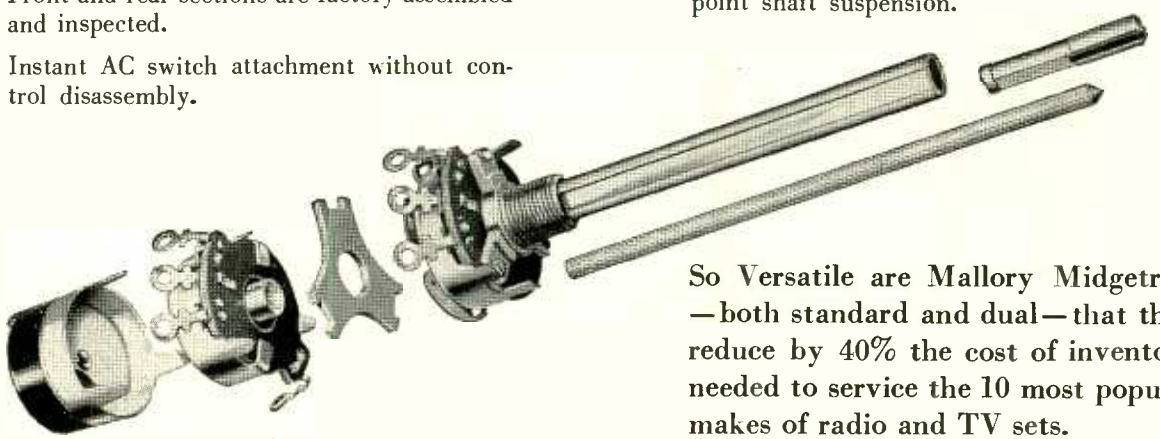

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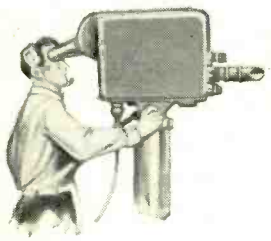

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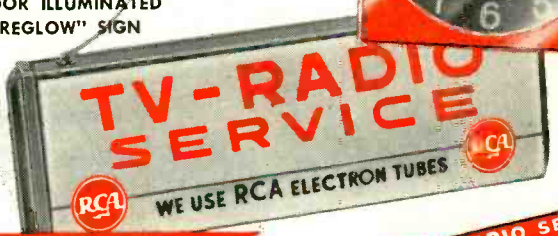



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