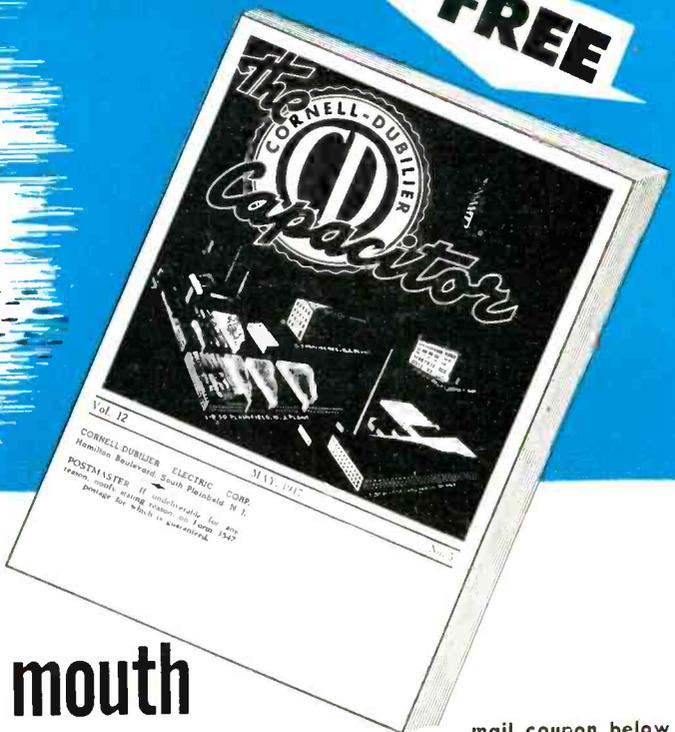




**FREE**



# tips right out of the horse's mouth

The editor of "The Capacitor" probably won't like being referred to as a "horse's mouth." However, that's only our way of "plugging" the scores of hot ideas for servicemen that he includes in every issue of "The Capacitor."

Here's a magazine that's published for servicemen only. Every month it is loaded with ideas for speeding up service procedures — for increasing store traffic — for adding new dollars to your income. Its convenient, pocket-size pages contain valuable technical data — information on the new type tubes — notes on trouble shooting. Yes, and also dozens of helpful hints that will help you to repair any radio ever made, easier, better and twice as fast.

Accept "The Capacitor" with C-D's compliments. Put it to work in your shop speeding up repair jobs — building bigger profits. *Don't wait! Mail coupon below NOW, so your FREE subscription will start at once!* Cornell-Dubilier Electric Corp., Dept. S-5, South Plainfield, New Jersey.

**TITLES OF ARTICLES IN RECENT ISSUES** — These articles are typical of the ones you'll find in "The Capacitor" every month: *How to Use Audio Oscillator and Signal Generator to Simplify Tests* — *New Requirements of FM and Television Servicing* — *Hum Elimination* — *Aligning Superhets*. Think how such articles will help you — mail coupon NOW.

**FINDS "THE CAPACITOR" OF GREAT INTEREST** — Washington, D. C. service shop owner writes, "I wish to thank you for mailing me 'The Capacitor.' The special items are of particular interest because of their easy reading and their simplification of complex circuits."

**FREE ADS FOR SERVICEMEN** — Yes, that's right — your ad will be run absolutely free in The Trading Post which appears in all issues of "The Capacitor." Use this service to buy that new tester you've been wanting — to sell that spare 'scope — or to work out a swap with other servicemen.

mail coupon below  
for your free  
subscription to the  
C-D capacitor

MICA  
DYKANOL  
PAPER  
ELECTROLYTIC



**CLIP THIS COUPON—MAIL AT ONCE**

Cornell-Dubilier Electric Corporation Dept. S-5  
South Plainfield, New Jersey  
Please start my FREE subscription to "The Capacitor"  
at once.  
Name .....  
Address .....  
City ..... Zone ..... State .....

# For finer tone



**GENERAL ELECTRIC**  
*Electronic*  
**RADIO TUBES**



## RADIO TUBES

◀ Monica Lewis, popular singing star, in this 21" by 26" window card, draws attention to the fact that YOU install and sell G-E radio tubes. Handsomely lithographed in four colors, varnished, backed and easled, the display is a "traffic-stopper". Like the many other G-E sales helps for 1947, it will make your cash-register ring to the tune of G-E product-popularity.



↑ Write for your free copy of the General Electric sales-helps Booklet ETR-51, illustrating and describing the big, elaborate array of G-E 1947 display, advertising, and promotion material available to radio servicemen and tube dealers. Also tells how to use each item best and most profitably. Filled with marketing hints! Send for Booklet ETR-51 TODAY!

In dealer displays  
and sales helps—  
as in quality—

# G-E TUBES LEAD!

**E**VEN THOUGH you're handling a product known to be the finest of its type, *it pays to advertise!* That way lies the path to profits! So when you install and sell General Electric radio tubes, the public still should be told and re-told that your shop is local sales headquarters.

Stunning displays like the one shown here, spark an aggressive campaign of G-E tube advertising and sales helps created for one purpose only: to acquaint radio owners in *your* area with *your* facilities to serve them. Thus your circle of customers widens; your income grows.

Many of the G-E pieces subordinate any tube message to the theme of your quality radio service. This service theme is carried through on counter displays, blotters, direct-mail cards, newspaper mats—many other items which actively *sell* for you day-in and day-out.

Make 1947 your biggest year by taking full advantage of G-E technical leadership—universal owner acceptance—brilliant new advertising material that's ready to help *you* secure the volume tube business waiting for you! *Electronics Department, General Electric Company, Schenectady 5, N. Y.*

# GENERAL ELECTRIC

176-P5-8800

FIRST AND GREATEST NAME IN ELECTRONICS

SERVICE, MAY, 1947 • 1

# EDITORIAL

INDUSTRY'S SERVICE MAN business and technical-aid program, proposed a few months ago, will soon swing into action nationally.

The technical aid or clinic plan is expected to begin within the next ninety days. Parts and equipment manufacturers are preparing extensive demonstration sessions which will tour the country. Company specialists will present analyses of tube testers, alignment, trouble shooting, emergency repairs, antenna installations, etc. Service Men will receive answers to many problems which have been puzzling them, particularly with the new f-m and tv models. There'll also be opportunities to actually use the various pieces of new test equipment to familiarize Service Men with operational methods.

These practical clinics will not only be a technical aid to every Service Man, but a business aid, too, for a sound technical knowledge has always made it possible to expedite repairs, minimize returns and build for more business.

We urge every Service Man to watch for these clinics. Local distributors will arrange for the dates of meeting.

Incidentally it would be wise to prepare for these sessions by reviewing the various circuits which are offered every month in SERVICE. A detailed study of the various SERVICE analyses of receivers and methods of servicing and maintenance will also serve as an excellent preparation basis. Interpretation of alignment, trouble shooting and other demonstration procedures will be materially simplified if you are prepared with basic knowledge. So look over your copies of SERVICE carefully . . . and watch for these clinics. They'll help you grow!

IT HAS BEEN GRATIFYING to note the rising activity of servicing associations throughout the country. Local groups, meeting frequently to discuss their business and technical problems, have found many business-building answers.

Some of the groups have indicated that it would be appropriate now to have a national setup to further solidify the position of the Service Man. Comments on the project have also been received from SERVICE readers, one suggestion calling for a society similar to the Institute of Radio Engineers, with various member grades such as senior and associate, predicated on training and particularly servicing experience. The proposal cites that such a society could sponsor standards of servicing practice, business codes, etc.

What views do you have on servicing associations? Do you favor local, regional or national setups?

We would appreciate receiving your opinions, which with your permission, we'd like to present in SERVICE in a special series to appear soon. Hope we'll be hearing from you!

RADIO · TELEVISION · SERVICE

# SERVICE

Vol. 16, No. 5

May, 1947

**LEWIS WINNER**  
Editorial Director

**ALFRED A. GHIRARDI**  
Advisory Editor

**F. WALEN**  
Managing Editor

	Page
AVC Circuits in Battery and A-C/D-C Receivers. By P. L. Elliott	14
F-M/A-M Ratio Detector Table-Model Receiver (Cover)	13
F-M Alignment Using R-F Signal Generator and Oscilloscope	16
Math and the Service Man. By L. A. Mohr	52
Mixer Oscillators in Television Receivers. By Edward M. Noll	20
Motor Maintenance and Repair. By Robert Rosenberg	24
(Testing and Trouble Shooting Shaded-Pole Motors Used in Fans and Phono Motors, etc.)	
Ser-Cuits	32
Servicing Helps	30
Streamlining Service with a Tag System. By Russell S. Morton	18
Tube News	28
(H-F Converters Using the 7F8 Tube)	

## CIRCUITS

Air King 4608 (Avc Circuit)	15
Belmont 5P19 (Avc Circuit)	14
DuMont TV Models (Tv Mixer Oscillator)	47
Farnsworth ET060 (Avc Circuit)	14
G.E. 801 (Tv Mixer Oscillator)	20
G.E. HM171 (Tv Mixer Oscillator)	46
Magnavox CR187 (Avc Circuit)	15
Philco 10TK (Tv Mixer Oscillator)	46
RCA 68R1, 2, 3, 4 (Cover)	13
RCA 630TS (Tv Mixer Oscillator)	20
RCA TRK5 and 12 (Tv Mixer Oscillator)	46
Truetone D2665 (Avc Circuit)	15
Viewtone VP101A (Tv Mixer Oscillator)	46
Ward 64BR-1513A (Avc Circuit)	14

## COVER

F-M/A-M Ratio Detector Table-Model Receiver (RCA 68R1, 2, 3 and 4)	13
--	----

## SERVICING HELPS

Connecting Antenna-Cathode Type Volume Controls	30
Universal-Type Speaker Test Unit	30
Use of Emergency-Type Signal Generator	44

Index to Advertisers	56
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## Manufacturers

New Products	38
News	42
Jots and Flashes	56

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# Like having an EXTRA MAN in your shop

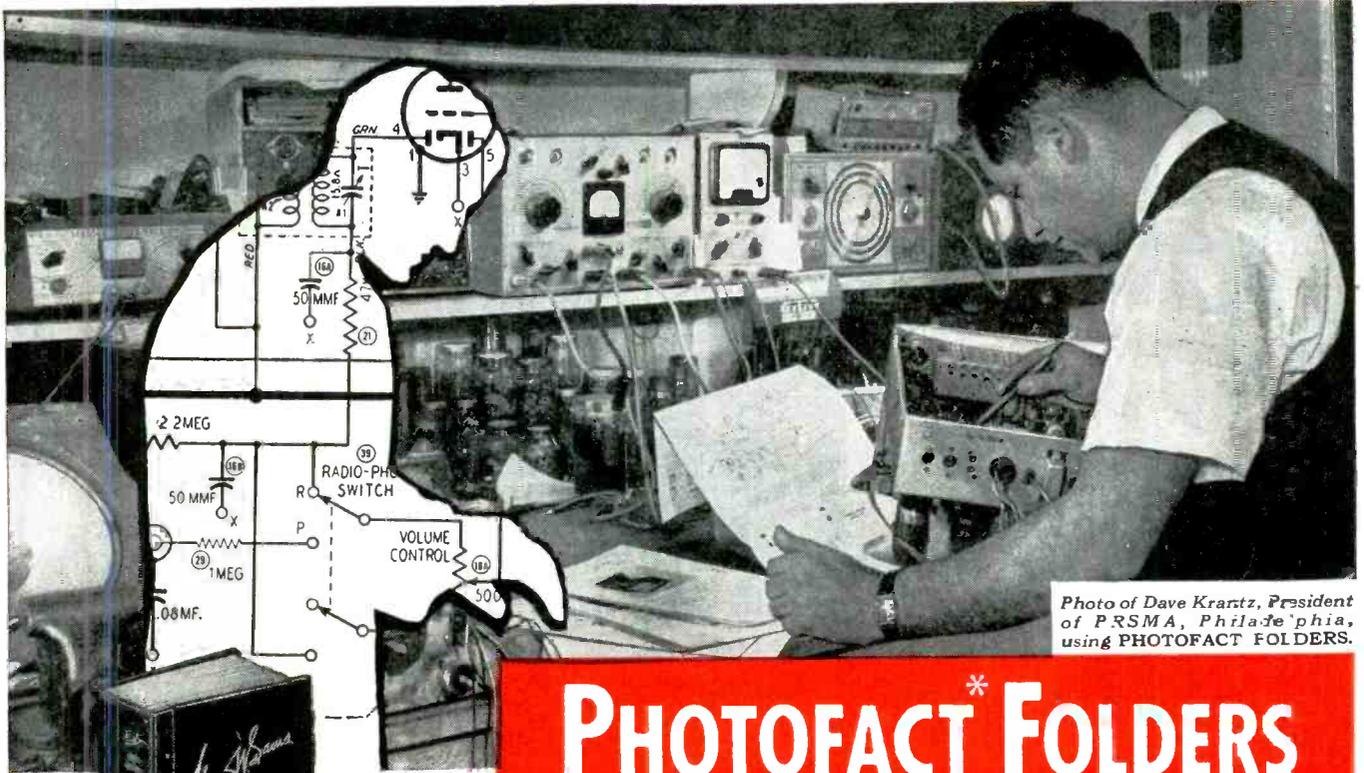


Photo of Dave Krantz, President of PRSMA, Philadelphia, using PHOTOFAC FOLDERS.



VOLUME 1, containing first ten sets of PHOTOFAC FOLDERS in de luxe binder, \$18.39. Individual sets Nos. 1 to 10, \$1.50 each. De Luxe Binder alone, \$3.39.

## PHOTOFAC\* FOLDERS

HELP YOU EARN MORE MONEY..

*Cost less than 9¢ a day*

### COMPLETE ✓

Everything you need in one handy, unified form—large schematics, pictorials keyed to parts lists and alignment data, complete listings of parts values and replacements, alignment, stage gain, circuit voltage and resistance analysis, *coil resistances*, dial cord stringing, disassembly instructions, record changer analysis and repair.

### ACCURATE ✓

All sets are actually taken apart and analyzed by experts in the Sams laboratories. Every part is measured, tested and triple-checked for accuracy. All data is original. This means the data you get is *right*.

### CORRECT ✓

PHOTOFAC FOLDERS are issued twice monthly, as the new receivers come off production lines. You don't have to wait for information. As receiver changes are made, you get correction and addition sheets for your files. Your data is always up to the minute.

### READY TO USE ✓

All diagrams and pictures are coded to numbered parts lists. Everything is positively identified for fast work. All folders are set up in uniform, easy-to-follow style: big type, big illustrations—no hunting, guessing or eye strain—no more loss of time and temper.

"Like having an extra man in my shop" . . . "The kind of 'specialist' I need" . . . that's what hundreds of radio servicemen say about PHOTOFAC FOLDERS. Yet this indispensable "hired help" actually costs less than 9 cents a day!

Here are the straight facts: PHOTOFAC FOLDERS offer the best information ever prepared for radio servicemen—complete, accurate, up-to-the-minute, easy to use. They save you hours of time and effort because they place at your fingertips ALL the information you need to do a better job. And that means you can earn MORE MONEY.

The information in PHOTOFAC FOLDERS is *right* because it is based on actual analysis of sample sets right in our own laboratories. It is *complete* and *current*, too, because it covers *all* radios, phonographs, record changers, recorders, communications systems and power amplifiers as they reach the market.

record changers, recorders, communications systems and power amplifiers as they reach the market.

PHOTOFAC FOLDERS come to you in sets of 30 to 50 at only \$1.50 per set. Low as this price is, it also includes membership in the Howard W. Sams Institute.

Set No. 19 will be ready for mailing May 10th. Set No. 20 on May 25th. Sets Nos. 11 to 18 inclusive, also priced at \$1.50 each, are available for immediate order.

Actually, PHOTOFAC FOLDERS cost you nothing since they pay for themselves again and again. They're ready to help you *now*—at the most difficult time in servicing history. See your distributor or write us today. In Canada, address A. C. Simmonds & Sons, 301 King Street East, Toronto, Ontario.

HOWARD W. **SAMS** & CO., INC.

2924 EAST WASHINGTON STREET, INDIANAPOLIS 6, INDIANA

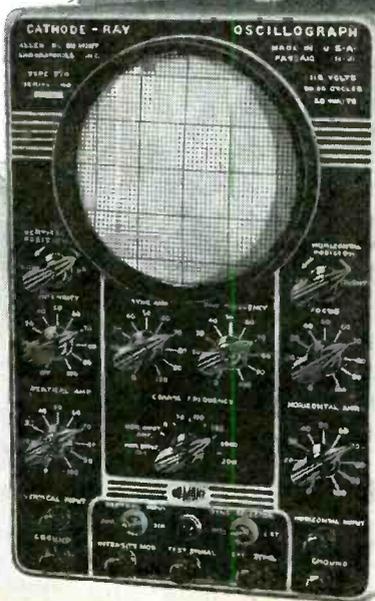
# PHOTOFAC SERVICE

*"The service that pays for itself over and over again"*

*Sure cure for  
technical  
headaches*

*Paid for itself  
in jig time*

*Real  
Time saver*



**That's what servicemen  
say about their**

## **DU MONT Type 274** *Cathode-ray* **OSCILLOGRAPH**

► Yes sir, you can handle more business, make bigger money, promote greater good will, if you modernize your radio servicing with the Du Mont Type 274 Cathode-ray Oscillograph.

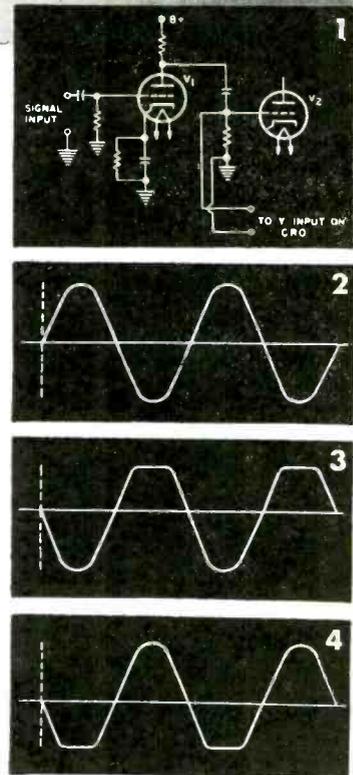
This is no high-priced new-fangled instrument even though it's a genu-

ine Du Mont oscillograph with a genuine Du Mont cathode-ray tube. Type 274 is built for the serviceman's shop. It's practical, rugged, economical. A great time-saver, it pays for itself—and very soon. Note the following typical example of time-, trouble- and effort-saving:

- 1 Portion of audio amplifier of typical set. It is required to examine correctness of cathode bias of V1 as well as to determine maximum signal it can amplify without distortion. So...
- 2 This oscillogram of the Type 274 screen shows signal input to amplifier, or the undistorted output of V1. Now...
- 3 Note output due to grid cut-off, with flattened waveform at upper part of cycle. Again...
- 4 Here's the distorted output due to driving grid too high. Note flattened waveform at lower part of cycle.
- 5 The method of rapidly performing this check and many other servicing problems is described in clear, concise, simple language in the operating manual you get with your 274.
- 6 And keep this in mind! The Type 274 has a power takeoff on the back for use of accessories.

► Ask your favorite distributor to show you the Du Mont Type 274 serviceman's oscillograph. Ask for literature—or write us.

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# DUMONT

*Precision Electronics & Television*

ALLEN B. DUMONT LABORATORIES, INC., PASSAIC, NEW JERSEY • CABLE ADDRESS: ALBEDU, PASSAIC, N. J., U. S. A.

# STANCOR

has the acceptance, the facilities and  
the designs that make transformers  
the profitable part of your business



THE NEW PLANT OF STANDARD TRANSFORMER CORPORATION  
IN CHICAGO AT ELSTON, KEDZIE AND ADDISON

**224  
OPPORTUNITIES  
TO WIN!**

**\$4,325<sup>00</sup>**  
WORTH OF

**PRIZES**

**IN CASH  
and  
Servicing Equipment**

**JUST TELL WHY**  
(in 100 words or less)

**"RIDER MANUALS  
MEAN  
SUCCESSFUL SERVICING"**



Yes, that's all you need do. Nothing to buy, nothing on which to beat your brains out.

Anyone of the tens-of-thousands of servicemen who have enjoyed the many benefits of RIDER MANUALS during any of the past seventeen years has the answers at the end of his pencil, ready for placing on the official entry blank available at all jobbers. And, a newly established serviceman has an equally good chance of winning by merely going over RIDER MANUALS at his jobbers' and reading the RIDER MANUAL ads appearing in national radio publications every month. You don't need to be a fancy writer, even spelling and grammar are unimportant. Just, in plain, everyday conversational English, write us 100 words or less on why you believe "RIDER MANUALS mean SUC-

CESSFUL SERVICING." The first thing you write may win you one of the many substantial cash or servicing equipment prizes.

Note the rules which have been kept easy in order to promote the purpose of the contest, i.e., to quickly acquaint as many servicemen as possible with the many time-saving, profit-making features of RIDER MANUALS.

Entries should be submitted on the official RIDER MANUAL CONTEST entry blanks which are available at your local parts jobbers. It is designed to make it still easier for you to win one of the 224 valuable prizes. Do it today. Send in your entry early!

**DON'T PUT IT OFF—WRITE IT DOWN!  
SEND IN YOUR ENTRY TODAY**

**SUCH EASY CONTEST RULES!**

1. Nothing to buy. Just send in 100 words or less giving your reasons why "Rider Manuals mean Successful Servicing," and indicate on the official form, the name of your preferred parts jobber.
2. Mail entry on the official-contest entry blank obtainable from parts jobbers, or write direct to John F. Rider Publisher, Inc. for blank.
3. Entries must be postmarked no later than Sept. 15, 1947.
4. Entries will be judged on completeness, compactness and originality of expression of reasons. Judges will be John L. Stoutenburgh, Executive Editor of "Radio Retailing"; Herman L. Finn, C.P.A.; Lansford F. King, Advertising Agent. The decision of the judges will be final. Duplicate prizes will be awarded in case of a tie. All entries become property of John F. Rider Publisher, Inc.
5. Contest open to anyone interested in radio servicing, living in continental U.S., its possessions and Canada, except employees (and their families) of John F. Rider Publisher, Inc., its advertising agency, accounting company, the principals and executives of Rider jobbers, or Caldwell-Clements, Inc., publishers of "Radio Retailing."

**LOOK AT THESE PRIZES!**

For Contestants

1st Prize .....	Cash	\$500
2nd Prize .....	Cash	300
3rd Prize .....	Cash	200
4th Prize .....	Cash	100
5th Prize .....	Cash	75
6th to 10th Prizes (\$50 each).....	Cash	250
11th to 40th..... (30 equipment Prizes worth \$25 each)		750
41st to 80th..... (40 equipment Prizes worth \$15 each)		600
81st to 140th..... (60 equipment Prizes worth \$10 each)		600
141st to 224th..... (84 equipment Prizes worth \$7.50 each)		530

For Jobbers of Winning Contestants

1st Prize .....	Cash	\$100
2nd Prize .....	Cash	75
3rd Prize .....	Cash	50
4th Prize .....	Cash	25
5th Prize .....	Cash	20
6th to 10th Prizes (\$10 each).....	Cash	50
<b>Total</b>		<b>\$4,325</b>

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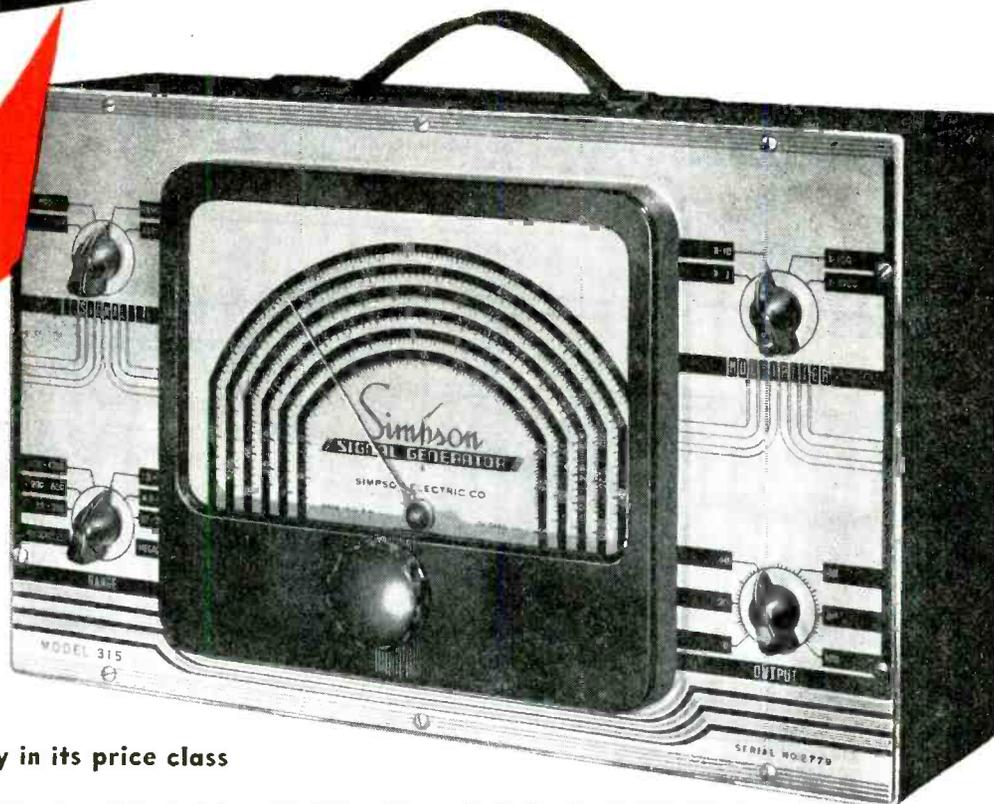
## Simpson Model 315 Signal Generator

Here's a test signal source that maintains its accuracy under constant use. The Simpson Model 315 Signal Generator produces fast and accurate "trouble-shooting" every time. The reason is as clear as its signal: this generator is Simpson engineered and built.

Like all Simpson test equipment, Model 315 is made almost entirely within the various Simpson plants. This, plus our tremendous investment in expensive production tools, is your assurance that Simpson testers will not quickly become obsolete and will be of unvarying quality.

An investment in the Model 315 is an investment in lifetime, trouble-free service.

**GET  
YOUR  
SIGNALS  
CLEAR**



- ★ Accuracy
- ★ Stability
- ★ Minimum leakage
- ★ Good wave form
- ★ —extraordinary in its price class

The Model 315 Signal Generator has a big nine-inch meter type dial, with hair-line pointer, for high readability. Smooth vernier control permits close settings.

**Circuit:** Electron coupled circuit assures extreme stability and output uniformity throughout the band. Three tubes are utilized in the circuit — full wave rectifier, modulator and oscillator. Standard 30% modulation at 400 cycles is used.

**Output:** Signal is controlled through an ingenious step attenuator of the ladder type. Volume level of each step is regulated by a smooth non-inductive control which pro-

vides an R.F. output from a few microvolts to .15 volts and a 400 cycle output from zero to 3.5 volts.

**Bands:** Six R.F. coils provide ranges of 75-200; 200-600; 600-1700 kilocycles and 1.5-4; 4-12; 10-30 megacycles. Coils are designed to retain original inductance regardless of temperature or humidity changes. A special switch automatically eliminates "dead spots." Frequency accuracy is 1%.

**Shielding:** Coils, attenuator and signal selector are individually shielded. Oscillator and modulator assemblies are sealed in a rigidly welded, entirely enclosed chassis. An

effective line filter is used. Even the line cord is shielded. Result: leakage is negligible.

**Calibration:** Each coil is individually calibrated to close tolerances against crystal standards by means of variable inductance and variable minimum capacitance. Tests show negligible changes over long periods of time under extreme temperature and humidity variations.

Size 16"x10"x6". Weight, 15 lbs. Shipping weight, 20 lbs.

Dealer's Net Price.....\$67.35  
For 220 Volt 50 or 60 cycle  
add ..... 7.50

SIMPSON ELECTRIC COMPANY

5200-5218 Kinzie Street, Chicago 44, Illinois

**Simpson**

INSTRUMENTS THAT STAY ACCURATE

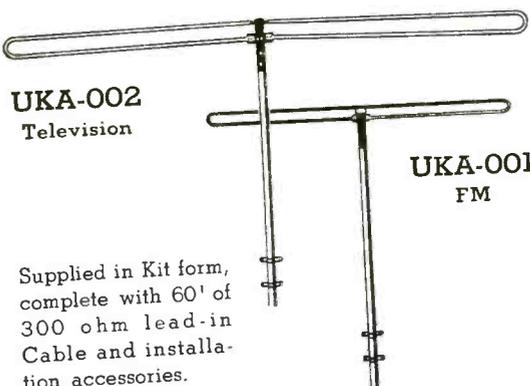
# TUNE IN TO MORE PROFITS\* WITH GENERAL ELECTRIC ANTENNAS

## AUTO ANTENNAS

New cars are rolling off the lines . . . older cars are taking to the road . . . both mean more car radios in service. But car radio reception can only be as good as the antenna that picks up the program. That is why G-E quality antennas are your best bet in getting this business.

General Electric auto antennas are easy to install, bring a big return for labor, have features that will appeal to every motorist and give satisfaction in operation.

\*SUGGESTION TO DEALERS—Keep in touch with new and used car dealers for leads to more business.



**UKA-002**  
Television

**UKA-001**  
FM

Supplied in Kit form, complete with 60' of 300 ohm lead-in Cable and installation accessories.

## FM & TELEVISION ANTENNAS

New FM and television stations are being erected. Receiver stocks are being built up by dealers and public enthusiasm is at a high pitch. Cash in on this market—grow with it . . . specialize in General Electric FM and Television antennas.

Simple in construction and highly efficient, General Electric antennas are designed to assure maximum reception.

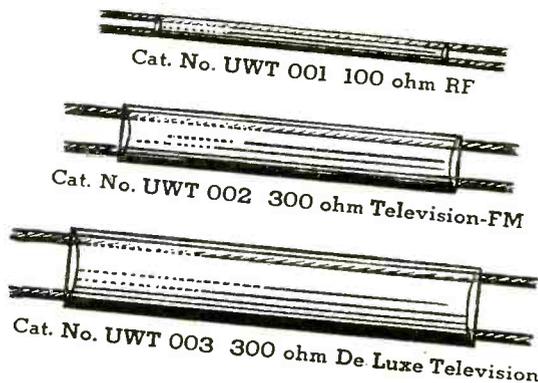
Be first in the field—first to realize the profit in this rapidly expanding field.

## G-E LOW-LOSS LEAD-IN CABLE

G-E polyethylene lead-in cables have been especially designed to provide better reception in FM and television installations. They assure that energy received by the antennas is transmitted with minimum loss.

Radio amateurs may also use this cable with transmitters, and instrument engineers have found it excellent for special purpose wiring. Selling these additional markets can mean additional profits for you.

For complete information on these products, write: *General Electric Company, Electronics Department, Syracuse 1, New York.*



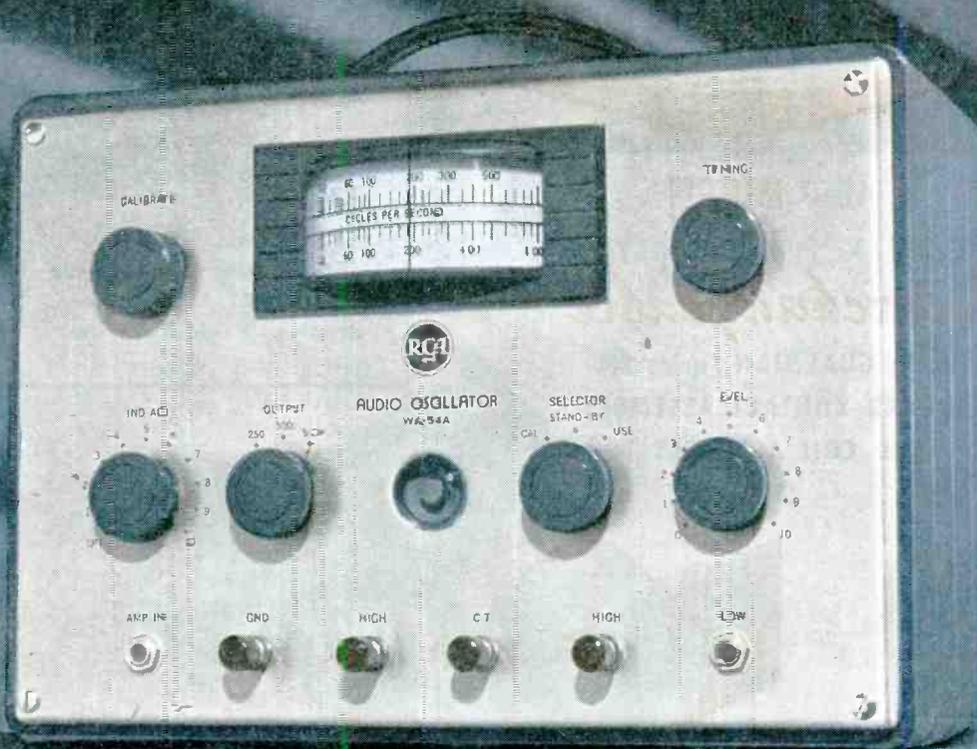
Cat. No. UWT 001 100 ohm RF

Cat. No. UWT 002 300 ohm Television-FM

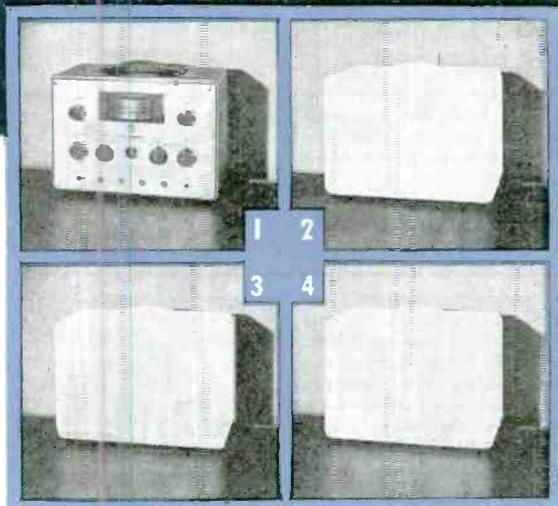
Cat. No. UWT 003 300 ohm De Luxe Television

# GENERAL ELECTRIC

**DESIGNED FOR THE BETTER SERVICE SHOP...**



**RCA's NEW AUDIO OSCILLATOR**  
 ... first unit of a  
 revolutionary new line



**ON THE WAY**—a superior line of test equipment that puts time-consuming service jobs on a profitable, production-line basis . . . that anticipates all FM and television needs. Matched styling of all instruments permits attractive, convenient grouping. Watch for announcements of the other units in this new line. *Keep in touch with your RCA Test Equipment Distributor.*

**A real time-saver for  
 loudspeaker testing and radio servicing**

Profitable applications include such diverse jobs as finding the cause of loudspeaker rattle, measuring receiver fidelity and audio amplifier response.

The WA-54A is a temperature-compensated, beat-frequency oscillator with an electronic output-level indicator. The electronic eye serves as a reference to provide an even signal level at all frequencies, and also acts as a zero-beat calibration indicator.

Other outstanding features of this audio-frequency signal source include: wide range . . . continuous tuning . . . low distortion . . . low hum level . . . balanced line outputs . . . application as an a-f amplifier . . . all explained in the WA-54A bulletin, which is yours for the asking.



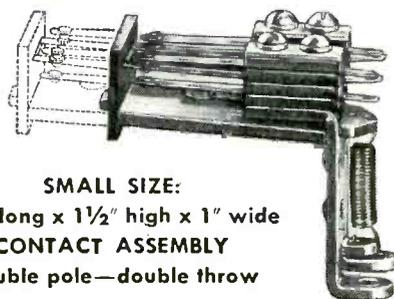
**TEST AND MEASURING EQUIPMENT**  
**RADIO CORPORATION of AMERICA**  
 ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

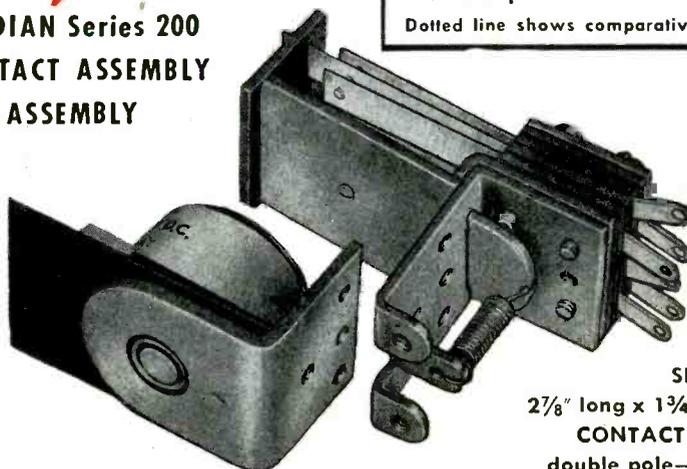
# GUARDIAN

presents...

a new **MIDGET**  
CONTACT ASSEMBLY  
*Interchangeable*  
with the **GUARDIAN Series 200**  
STANDARD CONTACT ASSEMBLY  
AND COIL ASSEMBLY



**SMALL SIZE:**  
1 5/8" long x 1 1/2" high x 1" wide  
**CONTACT ASSEMBLY**  
double pole—double throw  
Dotted line shows comparative size



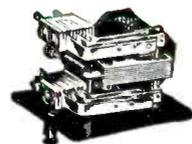
**SIZE**  
2 7/8" long x 1 3/4" high x 1" wide  
**CONTACT ASSEMBLY**  
double pole—double throw

## Popular RADIO RELAYS in the GUARDIAN line:



**K-100 Keying Relay** For low voltage control of high voltage transmission. Guardian Series K-100 Relay will follow key or bug at highest WPM rate attainable. High speed response, strong magnet and return spring give clean make and break, produce best CW note. Coils: 5 to 16 v., A.C.; coils for other voltages on specifications.

**B-100 Break-in Relay** For break-in operation on amateur transmitters. The Guardian B-100 Relay has laminated field piece and armature. Fine 1/4" silver DPDT contacts, capacity to 1500 watts, 60 c., non-inductive A.C., and in A.C. primary circuit of any inductive power supply delivering up to 1 KW, inclusively.



**T-100 Time Delay Relay** In radio transmitter circuits, Guardian's T-100 Time Delay Relay prevents damage of rectifiers and tube filaments by preventing plate current before filaments are sufficiently heated. Laminated field piece and armature. Mounted in dust-proof metal box.

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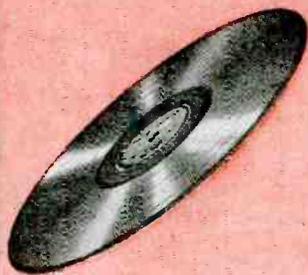
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MAY

Prepared by SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa.

1947

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# SERVICE

## F-M/A-M RATIO-DETECTOR Table Model Receiver

[See Front Cover]

ON THE COVER, this month, appears the circuit of a table model f-m/a-m receiver, RCA 68R1, 68R2, 68R3, 68R4, featuring a 6AL5 ratio detector, a circuit which eliminates the need for a limiter stage preceding the detector. In addition, the detector, which replaces the discriminator type detector, has an inherent insensitivity to a-m signals. This type of circuit permits the use of a high-gain i-f stage instead of a low-gain limiter.

The conventional f-m discriminator stage consists essentially of two diode rectifiers which are differentially connected so that the d-c potentials across their respective load resistors are subtractive. These two d-c voltages are proportional to the a-c voltages applied to the diodes.

Ordinarily, discriminators are preceded by limiters which remove most of the amplitude variation from the f-m carrier but the discriminator itself is not a device capable of rejecting ampli-

(Continued on page 50)

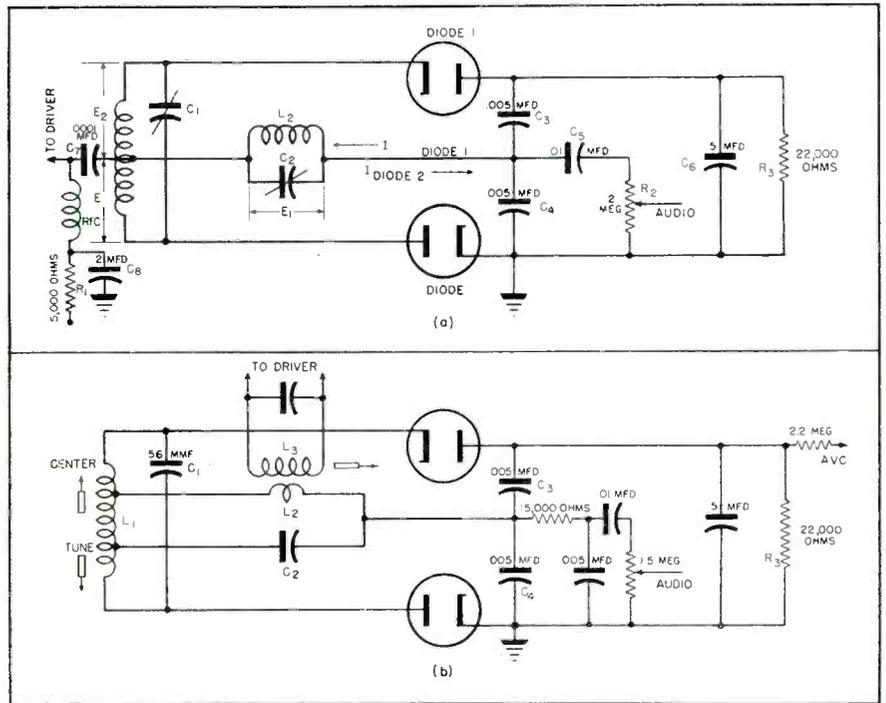
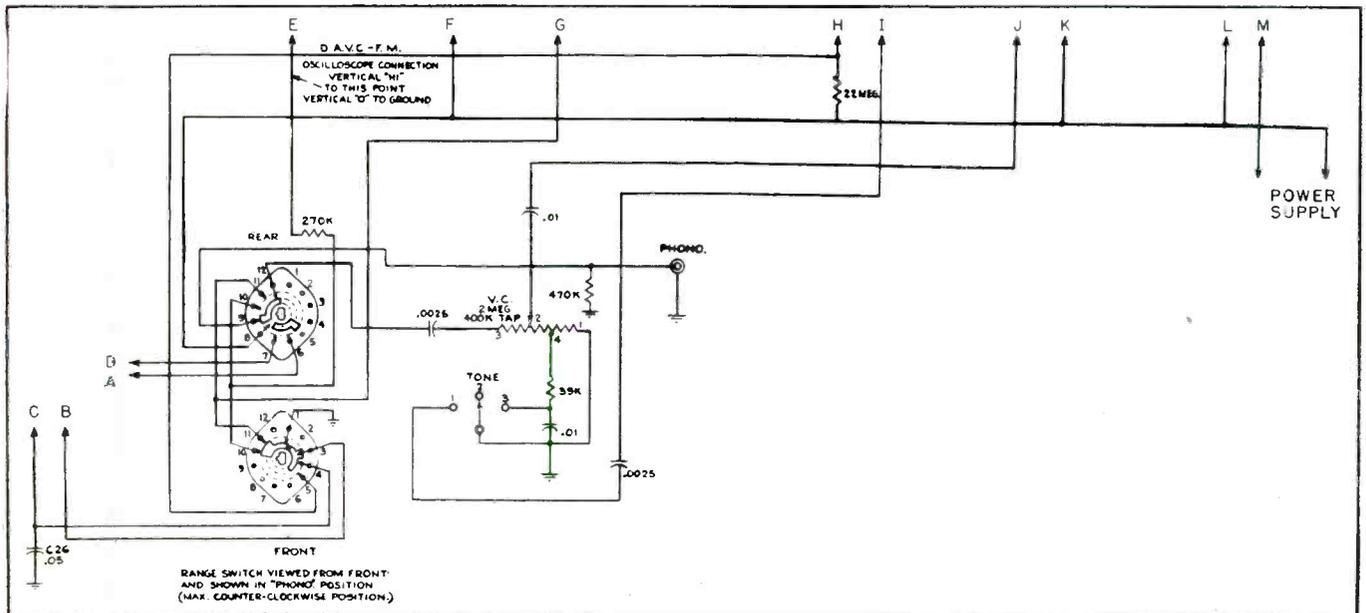


Fig. 1 (below). Switching arrangement for f-m/a-m table model receiver. Figs. 2a (above) and b (below): Fig. 2a. Fundamental ratio-detector circuit. Fig. 2b. Ratio detector used in RCA f-m receivers.







# F-M

# Alignment

## With an R-F Signal Generator and Oscilloscope

UNDER NORMAL OPERATING conditions, it should not be necessary to realign the tuned circuits of an f-m receiver due to the good stability of the components and the wide-band characteristics of the tuned circuits. However, if alignment is necessary either of two methods can be used; the conventional with a fixed frequency a-m

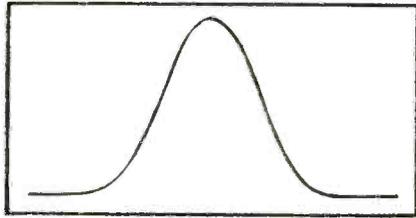
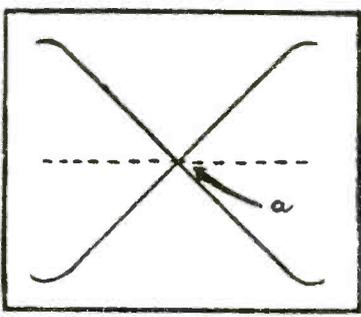


Fig. 1. I-f alignment curve.

Fig. 2. Discriminator alignment curve. At *a* we have the crossover point which should be midway between peaks.



oscillator and output indicator, or *visual* with an oscilloscope as the indicating device and a signal generator which is frequency modulated. The visual method is the more effective, providing a very accurate control of each alignment step.

For the visual procedure, it is necessary to have a good signal generator covering all the frequencies to which the receiver will tune. This instrument should have a range of from 100 kc to 30 mc, with an accuracy of calibration of 1% or better. Its maximum output should be at least 1 volt. The unit should also feature internal audio modulation (400 cycles) of reasonable accuracy. In addition the instrument should also have attenuation, variable over  $\frac{1}{2}$  to 100,000 microvolts, with about 10% accuracy. An output measuring device, such as a vacuum-tube voltmeter, is also desirable.

Another required instrument is a wide-band signal generator covering the i-f of the receiver with a sweep circuit of  $\pm 200$  kc. This instrument could be included with the r-f signal generator.

The cathode-ray oscilloscope should be a wide-range type using preferably a 5" tube.

### I-F Alignment

Alignment should be started by connecting the vertical amplifier of the scope across the grid resistor in the limiter circuit. The low side of the vertical amplifier should connect to

ground and the high side should connect to the grid load resistor through a  $\frac{1}{2}$ -megohm resistor to isolate the connecting lead. The sweep generator should be adjusted so that the middle or center of the sweep is exactly at the i-f frequency of the receiver to be aligned; sweep width should be  $\pm 200$



Fig. 4. Typical v-h-f signal generators suitable for f-m set alignment. Model above is a G. E. YGS-3 featuring an r-f oscillator with a fundamental frequency range of 100 kc to 150 mc in seven continuously variable bands. Model below is a Silver 906 with an 8-range rotary turret-type oscillator to cover the 90- to 170-mc range on fundamental frequency output.

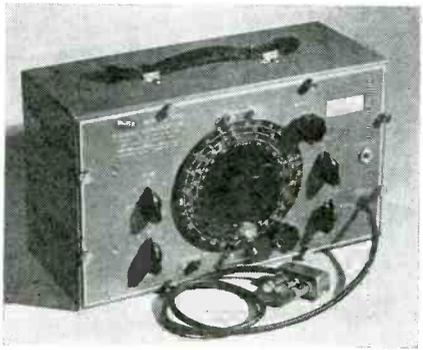
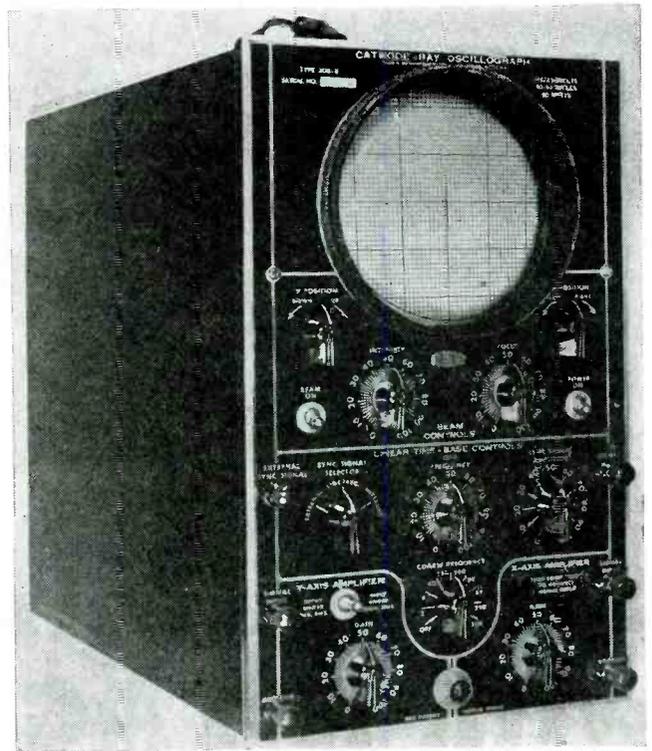


Fig. 3. Typical cathode-ray 'scopes which can be used for v-h-f alignment. Unit at right is a DuMont 208; below, G. E. CRO-5A. Both use a 5" tube.



kc. The high side of the signal generator should be connected through a .05 mfd capacitor to the grid of the i-f tube preceding the limiter. The low side of the signal generator should be connected to the same ground used for the oscilloscope; if different grounds are used, oscillations in the i-f circuits are likely to develop. The signal input from the oscillator should be sufficiently high so that the limiter is functioning. This point is indicated when an increase in signal input no longer changes the amplitude of the curve. The limiter input transformer is aligned by adjusting the primary and secondary trimmers so that the curves on the 'scope screen on the forward and reverse sweep coincide and are as nearly flat-topped as possible without materially reducing the amplitude of the curve. During these adjustments the horizontal sweep of the oscilloscope should be adjusted to synchronize with the synchronizing pulses developed in the signal generator so as to keep the pattern on the scope stationary.

After the limiter input transformer has been adjusted, the input of the signal generator should be connected to the grid of the next preceding i-f tube (if there are two i-f tubes, which is the usual case). The trimmers on the i-f transformer connected to the plate of this tube are adjusted for coincidence of the forward and reverse sweeps and the curve is made as nearly flat-topped as possible without loss of amplitude. The next step is to connect the signal generator to the grid of the converter tube through a 22-

mfd capacitor and adjust the trimmers on the first i-f transformer as before so that the resultant curve will appear as shown in Fig. 1. This completes the alignment of the i-f transformers and the next step is to align the discriminator transformer. The i-f transformers have been aligned stage-by-stage and no over-all adjustments should be made after completing the stage-by-stage adjustments.

#### Discriminator Alignment

The signal generator is left connected to the grid of the converter tube and its frequency setting remains the same as before, but the 'scope is removed from across the limiter grid resistor and is now connected across the diode load of the discriminator, which simply means that it is connected across the audio output of the discriminator. When this is done, the trimmer on the primary of the discriminator transformer should be adjusted for center crossover of the two curves. This crossover point should be approximately midway between the two sets of peaks: Fig. 2. If necessary the crossover lines should be re-adjusted.

#### R-F Alignment

In this operation the signal generator is removed from the grid of the converter tube and connected directly to the antenna input terminal of the receiver. The 'scope should be removed from across the diode load and a sensitive d-c voltmeter connected across

the limiter grid resistor with a ¼-megohm resistor in series with it to isolate the lead. The dial pointer must coincide with the proper mark on the low-frequency end of the scale when the gang capacitor is completely closed.

The signal generator is then adjusted to some frequency near the high end of the receiver dial and the dial pointer set to this frequency. The output of the signal generator should be unmodulated. The oscillator trimmer is then adjusted for maximum output as indicated on the voltmeter across the limiter grid load. Then the high-frequency trimmers in the antenna and r-f tuned circuits are adjusted for maximum output. This completes the alignment of the high end of the dial.

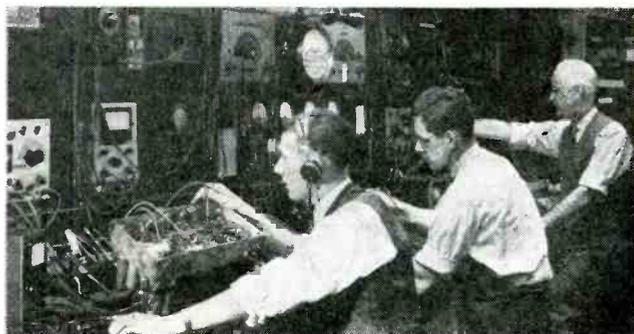
In the next step the signal generator is adjusted to some point on the low end of the dial and the dial pointer set to this frequency. The oscillator padder, if one is provided, is then adjusted for maximum output. The low-frequency trimmers in the antenna and r-f circuits, if provided, are then adjusted for maximum output.

The r-f alignment on the low end of the dial may not be necessary on some receivers. During alignment of the r-f stages, the output of the signal generator should be kept as low as possible for satisfactory meter reading.

During the alignment of the i-f stages, the output of the signal gen-

(Continued on page 53)

Left, below: Preparing the tag with complete customer-complaint data. Right, below: bench in the Morton Service Shop.



# Streamlining Servicing with A TAG SYSTEM

by RUSSELL S. MORTON

THE USE OF TAGS, with detailed data on service work, has been found to be exceedingly important in our Service Shop. The tag we adopted is quite simple and provides much invaluable information, such as the exact complaint and previous performance of the set. This eliminates any friction with

the customer on a *call back*, when the set has stopped due to other causes.

### Itemization

After repairs are completed, the exact nature of the repairs are itemized on the tag. The parts and tubes are listed at list prices. Time, mileage, pickup and delivery charges are also shown.

ered, the customer is told to keep the tag, as that is his guarantee.

This system has been used for several years and fills all requirements with a minimum of bookkeeping. The cost is very low, averaging about a cent a piece, in lots of five thousand.

### Billing Practice

Billing for a fixed amount, without itemizing, is not practiced, as this invites customer friction and suspicion. For instance, if the set should stop within a few days, and the cause was found to be something not connected with the original complaint, the repair tag would show it.

### Tag Wired to Set

The repair tag is wired to the back of the set and stays there. As the customer picks up the set, or it is deliv-

Front and rear of tags used by Russell S. Morton in his Shop.

Date 4-27-47

Name MR. JOHN DUP  
 Address 26 - PRAD - 1  
 Make and Model PHILCO - 650  
 Estimate  (1500) (6-57)  
 Promised - 4-28-47  
 Complaint (Fully)  
 BAD HUM. - WEAK - PREVIOUSLY OK.  
 Nature of the Repairs  
 Rebalanced  F. 455 Kc.  
 Kc. - 600  760  1170  1400  1500   
 Mc. - 3.6  7.2  10.8  14.4  18.0   
 REBALANCED - OPEN INPUT FILTER  
 AND LOW C. 2ND FILTER - REBALANCED  
 WEAK 455'S WITH CATHODE LEAKAGE  
 OTHER TUBES - OK. NEW PILOT  
 CLEANED LUB. WGS. AND. CONTROL  
 LUB. PARKS. REBALANCED ARM  
 TADDER. OPERATED. 3 HRS. AFTER  
 REPAIRS.  
 New Parts Installed  
 1 - B-450 - INPUT 1.70  
 1 - B-450 - 2ND FILT. 1.30  
 1 - PILOT 1.0  
 Tubes 2/42 (1.15) 2.30  
 P.U. AND DEL. Mileage 18 @ 6.9 1.26  
 (OVER) Labor \$ 6.75  
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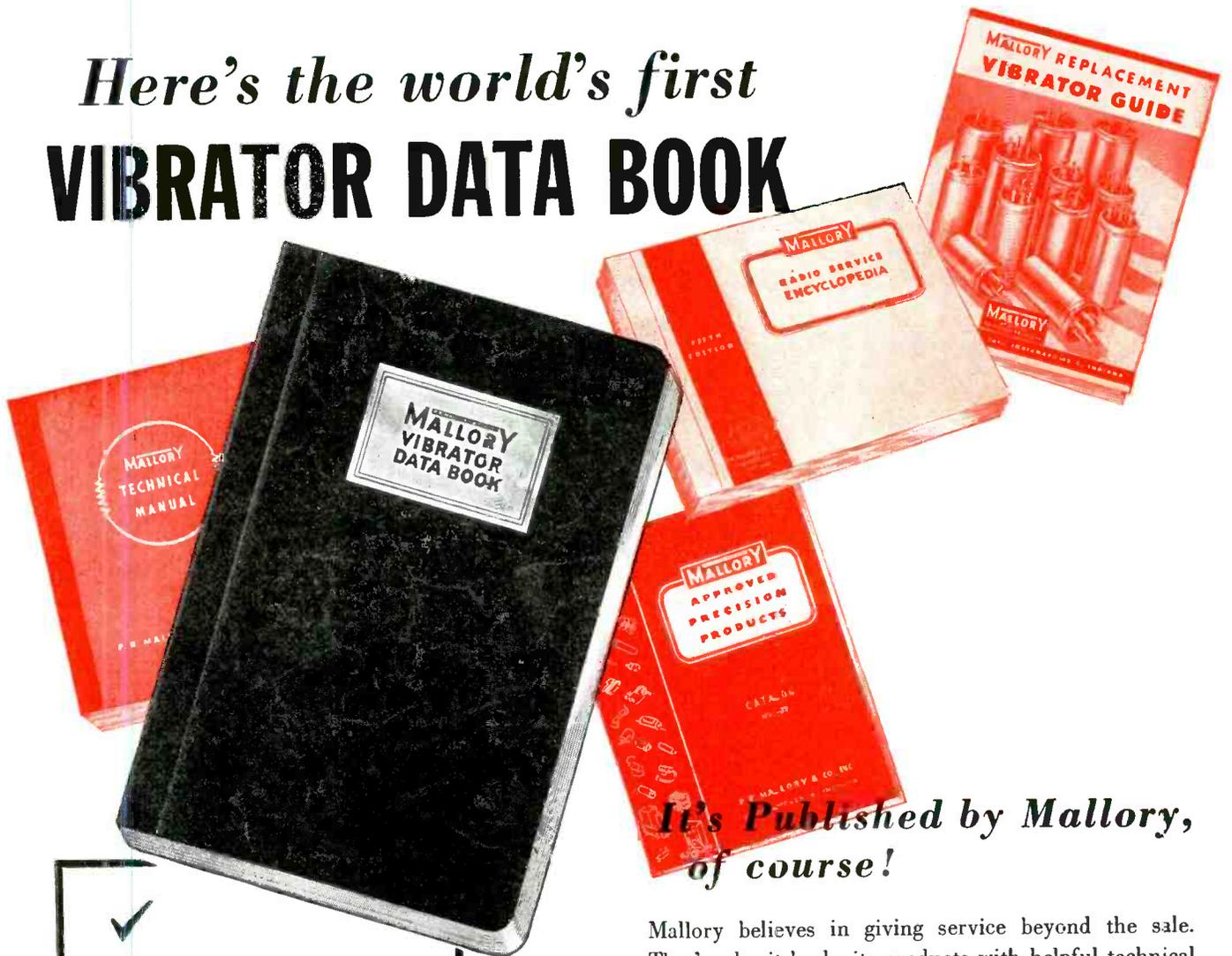
We hereby state that only the highest grade of new parts and tubes were used in the servicing of this set, and if any new part installed by us, proves defective within a period of 90 days from the date of installation, such part will be replaced by us **ABSOLUTELY FREE.**

. . . . .

This set, before leaving our Laboratory was thoroughly checked personally for satisfactory Radio reception.

Signed  
**RUSSELL S. MORTON**  
 RADIO TECHNICIAN  
 Associate I. R. E.  
 Est'd 1920  
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# MIXER-OSCILLATORS In Television Receivers

**A Detailed Analysis of Mixer-Oscillator Systems Used in G. E. 801, RCA 630 TS, Viewtone VP101A, Philco 10 TK, RCA TRK-5 and 12, G. E. HM 171 and Du Mont Models**

by **EDWARD M. NOLL**

*Instructor in Television  
Temple University*

ONE OF THE MOST CAREFULLY DESIGNED sections of the television receiver is the mixer-oscillator, for it is here that the noise-to-signal problem is quite acute. When the antenna and transmission line are properly installed, in a reasonably noise-free location, the primary source of noise is usually the r-f amplifier or the mixer-oscillator; a dominant noise is the mixer-conversion noise. But the greater the signal on the grid of the mixer and the more efficiently the converter utilizes this signal, the more the signal will rise above the noise.

## Conversion Conductance

Conversion conductance is an important factor in the noise-signal problem, for it is the measure of how effective a tube is in converting a small grid voltage change at signal frequency to a substantial plate current change at the i-f frequency. This conversion conductance is always less than the actual mutual conductance of the tube. Nevertheless, conversion conductance

can be made ample by holding up the  $L$  to  $C$  ratio of the grid input and plate output tuned circuits, and by injecting the local oscillation from a separate local oscillator directly into the signal control grid of the mixer. In many television receivers triodes are used as mixers because of their lower noise characteristics.

## Features of Mixer-Oscillator Systems

1. Band switching is a feature of many sets. Inasmuch as proper choice of the value of parts and the mechanical arrangement of the tube circuits are so very critical in obtaining the most gain at the required bandwidth, one set of operating constants will

only suffice as an efficient combination at one frequency. Consequently, when bandswitching is used for channel changing, an entire new set of constants are usually substituted on each channel. Thus, the r-f section operates at optimum efficiency on each channel. This system, with push buttons or rotary switches, of course, affords a very convenient method for the televiewer. In some new receivers a continuous tuning system is used to tune over 13 television channels, in one or two bands.

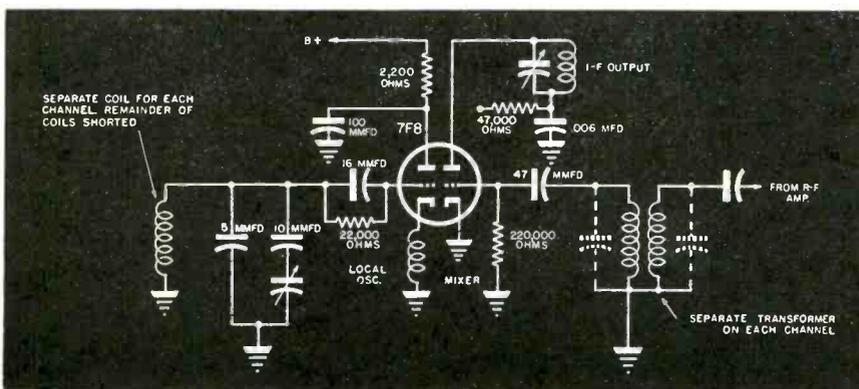
2. A small variable capacitor is used for fine tuning, varying the local oscillator frequency over a limited range. Inasmuch as the r-f amplifier and mixer stages are very broadly tuned, it is only necessary to vary the local oscillator frequency to set the picture and sound carrier frequencies at the proper point on the bandpass characteristic.

3. Push-pull amplifier mixer and oscillator stages are used because of their added stability and high-frequency efficiency. These stages employ linear tank circuits which can be conveniently tuned by a shorting-bar arrangement.

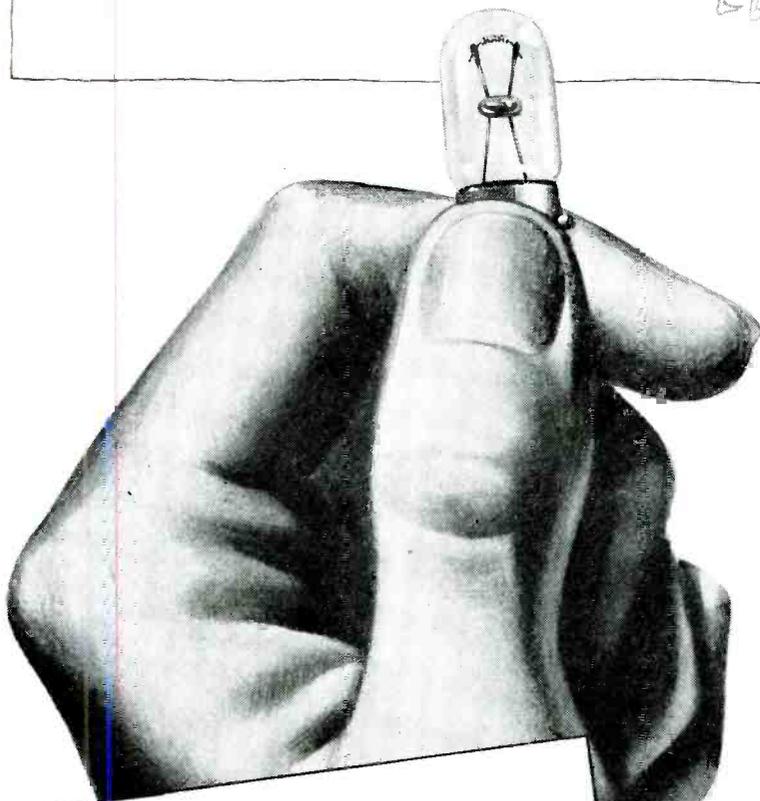
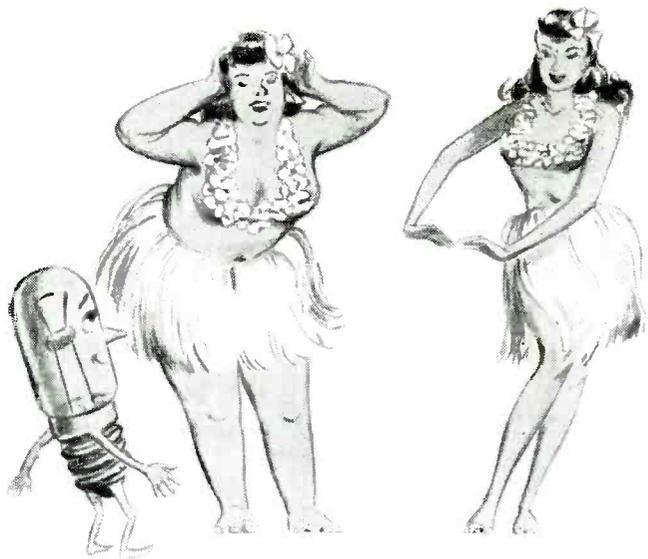
4. In many r-f transformer circuits the resonant circuits are tuned by varying the resonant circuits inductance with a movable metallic core. This method does not require a physical variable capacitor which would add capacity to the circuit and lower the  $L$  to  $C$  ratio.

5. Tubes with a high-conversion conductance, particularly miniature

Fig. 1. Mixer-oscillator of G.E. 801.

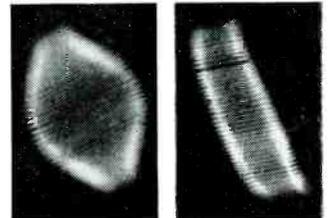


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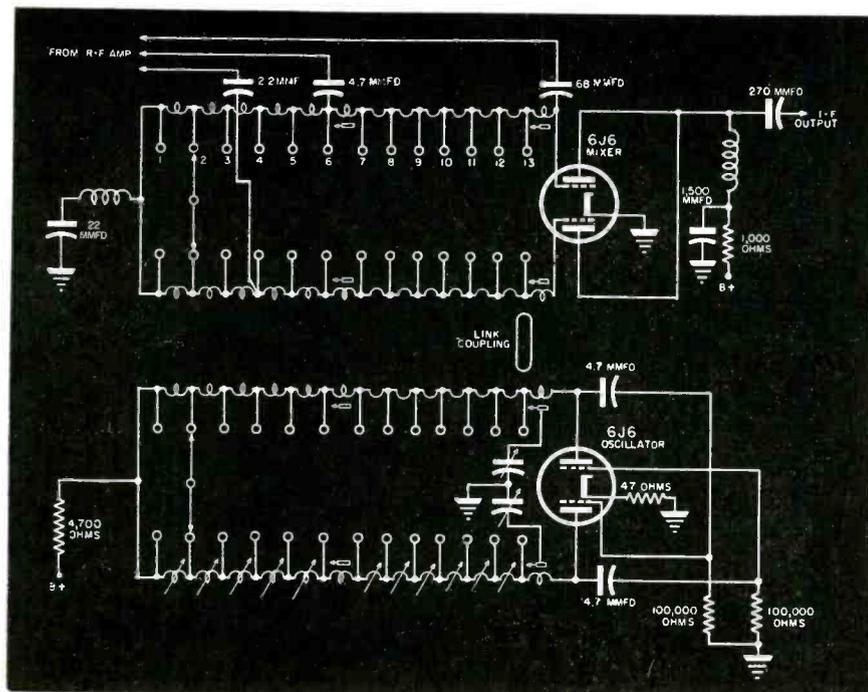


Fig. 2. RCA 630 TS mixer-oscillator.

and at the same time grounds all the remaining coils.

The mixer oscillator stage is a dual triode 7F8; one section serves as a mixer and the other as a local oscillator. Feedback for the local oscillator is obtained from a cathode coil; the actual tuned circuit of the local oscillator exists between grid and ground. A small capacitor shunts the tuned circuit and serves as a fine tuning control.

An unusual r-f mixer-oscillator appears in the RCA 630TS television receiver; Fig. 2. This model employs linear tank circuits as the tuned elements and the tubes are dual-triode miniatures connected in a push-pull arrangement. The mixer stage uses tuned grid lines, while the oscillator stage utilizes tuned plate lines. Channel switching is accomplished by effectively moving a shorting bar up and down the tuned lines. A small trimmer capacitor, also used to tune the local oscillator plate line, acts as a fine tuning control.

Actually the linear tank circuits are not made up of long continuous rods, with which we are familiar in the usual high-frequency circuit. Instead we have small coils which are mounted around the periphery of a rotary switch. Whenever the channel switch is turned from the high to a lower frequency a new section of inductance is added to the transmission lines. This new section is in the form of a small coil mounted on two contacts at the top of the rotary switch. Local oscillations from the plate lines of the local oscillator are link coupled to the grid lines of the mixer.

The 6J6 miniature duo-triode has a very low input capacity and a high mutual conductance. This high-frequency tube, in conjunction with the tuned lines, form a very efficient and stable high-frequency circuit.

The mixer oscillator circuit of the Viewtone VP101A is in Fig. 3 (page 46). This receiver does not use an r-f stage and the antenna is coupled directly to the grid of the mixer through the proper antenna input transformer. The mixer tube is a high  $G_m$  6AC7 pentode, while the local oscillator is a miniature triode, a 6C4. The local oscillator signal is injected directly to the grid circuit of the mixer through a small 1-mmfd capacitor. The local oscillator is an ultra-audion, and channel switching is accomplished by

(Continued on page 46)

tubes with low capacities, are used in practically all tv models. Separate oscillator tubes are used with grid injection of mixer tube to raise conversion efficiency; more i-f signal per given signal on mixer grid.

6. Models also use special resonant circuits and filters to reduce sensitivity of r-f sections to i-f and other unwanted frequencies. These filters and resonant circuits insure maximum transfer of desired signals and maximum rejection of undesired signals. Thus high-gain i-f systems can be used without danger of feedback or interference.

7. Relatively low-value grid resistors or other loading resistors are often used to load the tuned circuits somewhat and to flatten the bandpass characteristic.

### Local Oscillator

It is necessary that local oscillator tube also have a high mutual conductance and low capacity to oscillate efficiently and be stable at the high frequencies. Tubes such as the 6J6, 6C4, 6J5, 7A4 and other new miniature triodes are used and connected in modified Hartley or ultra-audion circuits.

When switching channels, the local oscillator frequency must also be changed. This is done in most receivers by adding sections of inductance to the tuned circuit. In some receivers this is accomplished by switching actual trimmer capacities. Each oscillator tuned circuit, corresponding to a certain position of channel switch, is tuned by means of a movable core or small trimmer capacitor.

A small variable capacitor, known

as a fine tuning control, is used for precise setting of the local oscillator frequency on each channel. By means of this control, which only changes the oscillator frequency, the picture and sound carriers are centered on the r-f bandpass characteristics. Thus the exact i-f frequencies are produced in the mixer output. It is not necessary to vary the other tuned circuits for this fine adjustment, because they are inherently broad with respect to the small frequency variation of the local oscillator required to put the i-f picture and sound carriers on frequency.

The i-f frequencies of the new television receivers are in the 20 to 26-megacycle regions. The older receivers were in the 7- to 15-megacycle region. It is apparent therefore that the mixer of the television receiver functions as a dual mixer because it acts as a mixer for the picture carrier frequencies and also for the sound carrier frequencies. Consequently, because of this dual-mixer action and the spacing between the emitted picture and sound carrier frequencies, two i-f frequencies are produced in mixer output with a single local oscillator.

### Commercial Mixer-Oscillator Combinations

In the G.E. 801, a 13-channel receiver, Fig. 1, individual coils are used for mixer and oscillator stages on each channel. A tuned transformer couples the plate circuit of the r-f amplifier to the mixer grid circuit on each channel, each channel having its own individual double tuned transformer. The channel switch also switches in a new oscillator coil for each channel



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# MOTOR *maintenance and repair*

THE SHADED-POLE MOTOR is an a-c motor varying in size from approximately 1/100 hp to 1/30 hp. It is used for applications requiring a very low starting torque such as small fans, blowers, oil burners, hair dryers, ventilators, unit heaters and phonos. These motors have a constant-speed running characteristic.

The stator is usually of the concentrated field type somewhat similar to the universal motor, and has a laminated core consisting of salient field poles on which a coil of wire is placed. The poles are provided with a slot near one end, in which a solid copper coil of one turn, called a shading coil, is placed. In the motor of Fig. 2 just one coil is used although two field poles are formed.

All shaded-pole motors have squirrel-cage rotors. The rotor usually consists of slotted laminated iron core and a winding consisting of heavy copper bars which are placed in the core and connected to each other by means of heavy copper rings located on both ends of the core. In many motors the rotor has a one-piece cast aluminum winding, as in Fig. 3.

The end shields or brackets are located on the sides and contain the bearings in which the shaft of the motor rotates. The end shields are

## Part II . . . Testing and Trouble Shooting of Shaded-Pole Type Motors Which are Used in Small Fans, Blowers and Phono Units

by **ROBERT ROSENBERG**

*Instructor in Armature*

*Winding and Motor Repair*

*George Westinghouse*

*Vocational High School*

bolted or screwed to the frame. Self-aligning bearings are generally used.

### Operation:

All self-starting single-phase a-c motors require an auxiliary winding to provide the motor with a starting torque. In a shaded-pole motor the starting winding consists of just one closed turn of heavy copper wire embedded in one side of each stator pole. On starting, a current is induced into the shaded poles from the main poles. The shading coils establish a magnetic field which is out of phase with that established by the main fields and a

rotating field is produced sufficient to give the desired starting torque. When the motor reaches speed, the effect of the shading coils is negligible.

### Shaded Pole Motor Windings

The ordinary shaded-pole motor has projecting field poles on which are placed the shading coils; Fig. 4. The coils fitting over the poles are either wound on forms like those used for winding universal motor fields or wound directly on the core depending on the original manner of winding. Leads are connected to the coil ends and are taped or tied to the coil. The

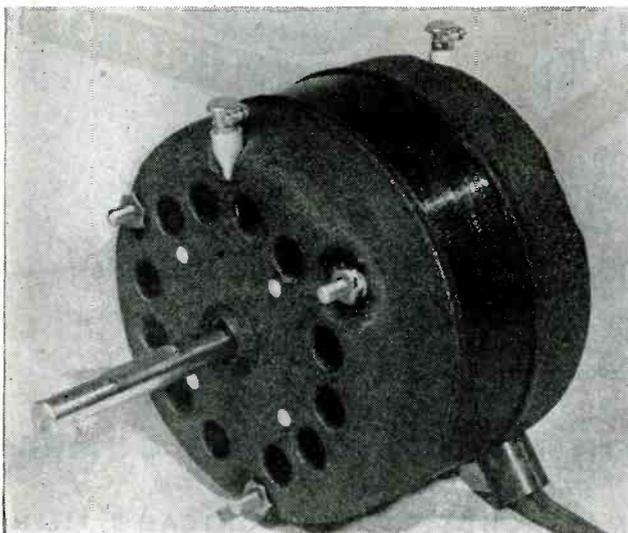
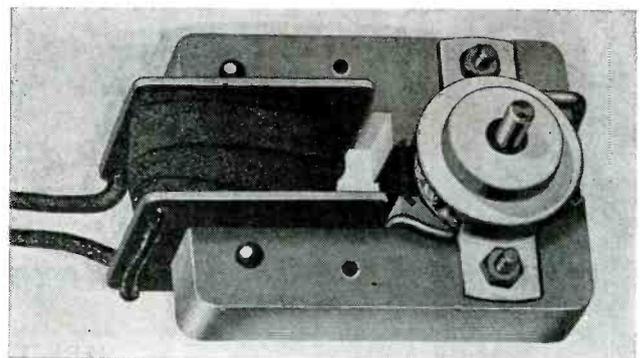


Fig. 1. Shaded pole motor used for phonograph service. (*Alliance Mfg.*).

Fig. 2. Another type of shaded-pole motor for phonographs. (*Alliance Mfg.*).



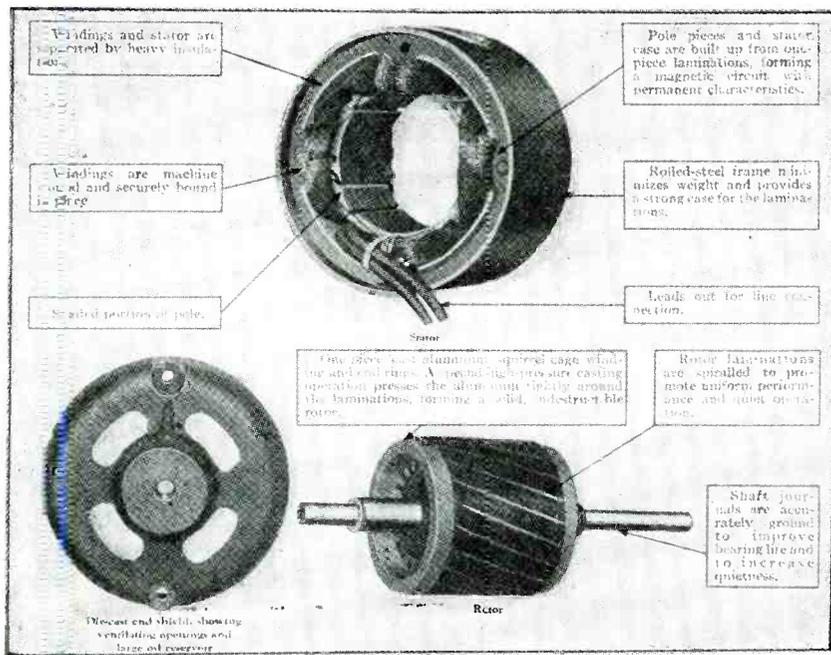


Fig. 3. The main parts of a shaded-pole motor (G. E.)

field coils are held in position in the same manner as universal field coils.<sup>2</sup>

In rewinding, it is necessary to replace the same number of turns of the same size wire and with the same insulation. The new coils must be same size as the old ones, otherwise difficulty may be encountered in slipping them over the pole.

Where the turns are wound directly on the core, insulating paper must be placed on the core to prevent the wires from grounding in the core. It is good practice to put insulating paper on the core whenever the coil touches the core.

These type motors are made for 2, 4, 6, and 8 poles; adjacent poles are usually connected for opposite polarity. A connection diagram of a 4-pole shaded-pole motor is shown in Fig. 5.

Some shaded-pole motors are constructed with a stator core having slots into which coils are wound, instead of salient pole pieces. The main poles are wound into the slots and connected for opposite polarity. The shaded-pole windings also consist of coils of wire instead of the solid copper ring. The shaded windings are connected for opposite polarity and closes on itself. It occupies only about one-third of a pole side. Fig. 6 shows a wiring diagram of this motor.

#### Reversing a Shaded Pole Motor

Some shaded-pole motors are so constructed that they can be reversed

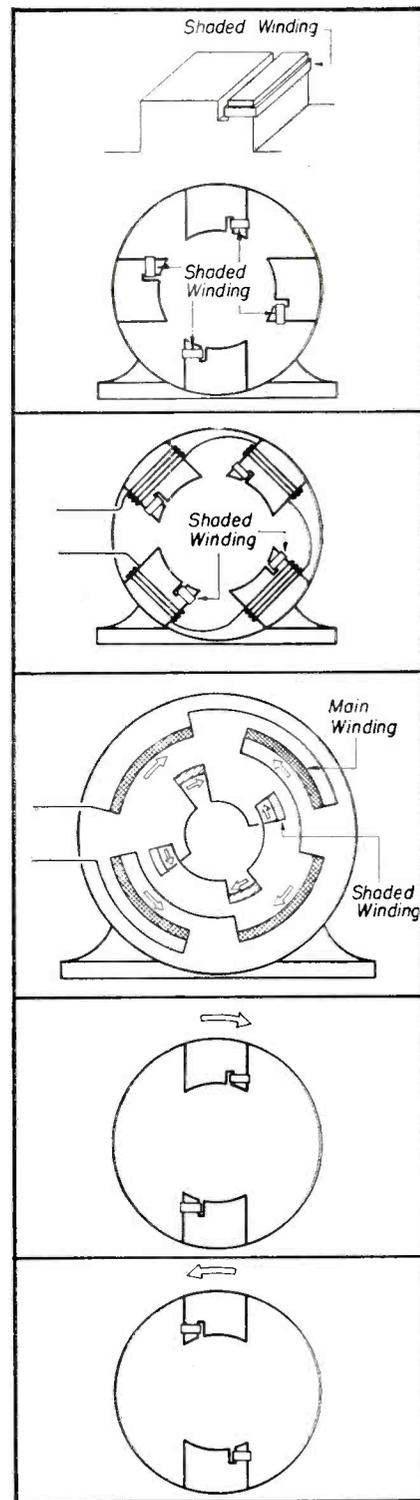
<sup>2</sup>See April discussion.

merely by throwing a switch. Most of them, however, cannot be reversed unless they are taken apart. To reverse a motor of this type, it is necessary to disassemble the motor, reverse the stator end and reassemble.

Because the direction of rotation of a shaded pole motor is from the main pole to the shaded pole, the direction is clockwise, as in Fig. 7a, and counterclockwise, as in Fig. 7b. This method of reversing must be used if the motor is not externally reversible.

There is also one type of shaded-pole motor that can be reversed externally; this has one main winding and two separate shaded windings. The stator of this motor has slots into which the windings are placed.

The main winding is usually distributed over several slots, but may have only one coil per pole. Each of the two shaded-pole windings has as many poles as the main windings, but only one shaded winding is used at a time. One shaded winding forms at one side of each main pole, the other forms a pole on the other side. This is illustrated in Fig. 8 where a complete pole consists of one main coil and two shaded coils. Fig. 10 shows a diagram of the connections for this type motor. The main poles are connected in series for alternate polarity and so are the shading poles. When rotation is desired in a certain direction, the circuit of one shaded winding is closed and the other left open; Fig. 9. To reverse the motor it is necessary to open the closed shaded winding circuit and



Figs. 4, 5, 6, 7a and 7b (top to bottom): Fig. 4. A four-pole shaded-pole motor, showing the projecting field cores and the shading windings. Fig. 5. Four-pole shaded-pole motor with the field poles connected in series for alternate polarity. Fig. 6. Connection diagram of a shaded-pole motor having slots instead of projecting field cores. Fig. 7a and b. In a we have the position of the stator core for clockwise rotation. In b appears the counterclockwise rotation position.

close the other shaded winding circuit. Thus the position of the shaded poles is changed, with reference to the main

poles, thereby causing a reversal in direction of rotation.

### Speed Control of a Shaded-Pole Motor

In Fig. 10 appears a diagram of a shaded-pole motor used for fan service. The speed of these motors is varied by inserting a choke coil in series with the main winding, and taps on the choke coil provide the different speeds.

### Procedure for Analyzing Shaded-Pole Motor Trouble

When this type of motor fails to run properly, a definite procedure should be followed to determine what repairs are necessary to replace in running condition; a series of tests should be made on the motor to discover the exact trouble.

In the first step the motor should be inspected externally to detect such mechanical trouble as broken end shields, bent shafts, burned leads, etc. Then the motor should be tested for bearing trouble. This trouble is very frequently the cause of motor troubles, particularly in shaded-pole units. If the shaft can be moved vertically in the bearing, a worn bearing or a worn shaft is indicated. Rotation should be then tried by turning the rotor by hand. A shaft that does not turn freely usually indicates bearing trouble. The next step involves disassembling. In this instance, the shields are marked before disassembling so that the motor can be put together properly after repair.

### Testing Shaded-Pole Motors Ground Test

**Ground Test:** The ground test is the next step. A test lamp set, described in April article, is used. One test lead is connected to one of the leads of the motor and the other test lead to the frame of the motor. If the lamp lights the winding is grounded.

If the motor is grounded it will be necessary to locate and remove the ground before making the other tests. Visual inspection should be tried first; in other words, the winding should be examined closely to see whether any wires are touching the core. If the ground cannot be located it will be necessary to rewind the coil. If the motor has more than one field coil it will be necessary to disconnect the connections between field coils to find the coil that is grounded.

**Open Circuits:** Open circuits in a shaded-pole motor may be due to a break in the coil or loose connections at splices. To locate an open a test

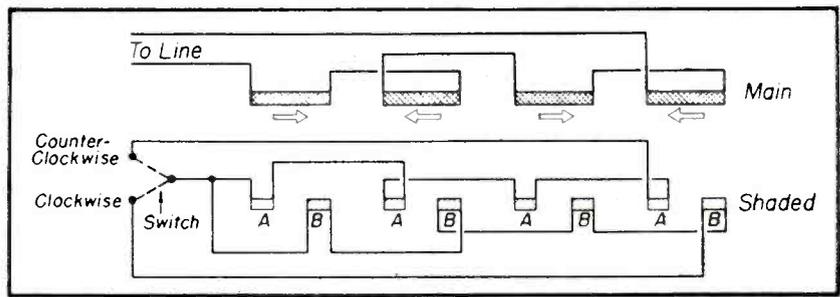


Fig. 9. Diagram of a reversible shaded-pole motor. To reverse this motor one series of shading coils is opened and the other series closed.

lamp is used to test each coil for opens. Where the lamp does not light an open is indicated.

If the open can be located and is due to a broken wire, a splice will usually suffice to close the open. In many cases, however, the open may be deep in the coil and therefore rewinding will be necessary.

**Test for Correct Polarity:** In shaded-pole motors of more than one coil, it is necessary to connect the coils for alternate polarity. To test for correct polarity the coils must be connected in series to a source of low-voltage d-c and a compass placed alongside each coil. The compass needle should reverse at each coil. If the same compass needle end points to two adjacent coils the leads of the second coil should be reversed.

### Common Troubles and Repairs

(1) If a shaded-pole motor fails to start the trouble may be:

(A) **Burned out fuse.** The fuses should be removed and tested with test lamp. If the lamp lights, the fuse is good; a burned-out fuse is indicated when the test lamp does not light.

(B) **Worn bearings.** If the bearing is sufficiently worn, the rotor will rest on the stator core thereby preventing rotation. This is due to the fact that this type of motor has very little starting torque and consequently will refuse to turn over when the rotor touches the stator. To check a motor for this condition the shaft should be moved up and down as shown in Fig. 11. Motion in this manner indicates a worn bearing. The only remedy is to replace the bearings.

(C) **Shorted or burned-out coil.** Shorted coils can usually be detected by eye or smell. The only remedy is replacement or rewinding. When the insulating enamel on the wire fails, the individual turns become shorted and cause the coil to become extremely hot and burn out.

(D) **Assembled improperly.** When a motor is assembled properly the rotor

can be turned very easily by hand. If the rotor cannot easily be turned, there is indication that the end plates are not fastened securely to the frame or that  
(Continued on page 49)

Fig. 8. One pole of a reversible shaded-pole motor. Note two shading coils.

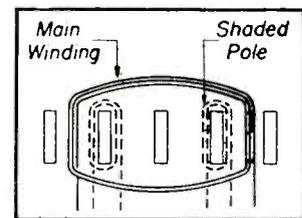


Fig. 10. Connections for variable-speed shaded-pole motor. The speed is controlled with a tapped choke coil.

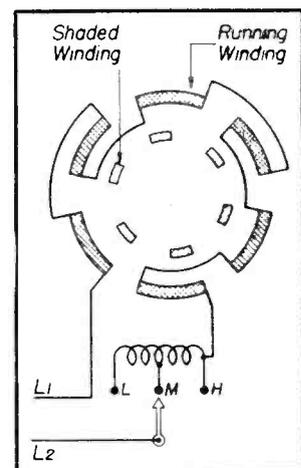
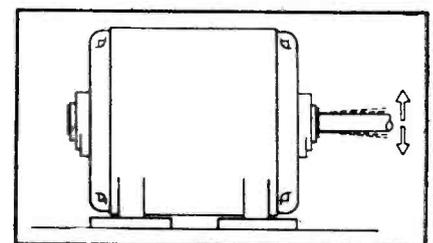


Fig. 11. Up and down movement which indicates a worn bearing.



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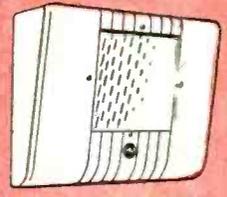
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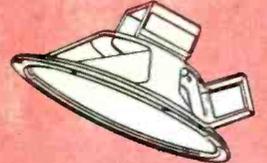
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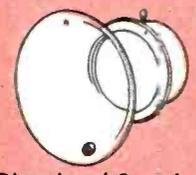
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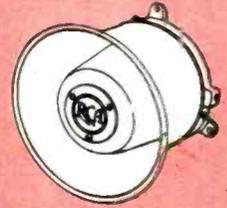
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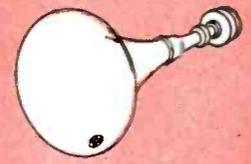
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# TUBE

## News

### H-F Conversion With the 7F8<sup>1</sup>

ON THE 88 TO 108-mc f-m and the 44 to 216-mc tv bands, best results are obtained with high-conversion gain and low noise-level type tubes. A tube providing such service and widely used in v-h-f receivers is the 7F8, a high mutual conductance duo-triode. In triode-converter applications, two effects must be considered very carefully. Both effects are caused by the relatively high grid-to-plate capacity of the triode which results in degeneration at the i-f and loading of the input circuit at the signal frequency.

Since it is not practical to neutralize the grid-plate capacity, other precautions must be taken to eliminate its undesirable effects. To prevent degeneration of the i-f frequency the impedance from grid to ground must be made low at the i-f frequency. This is particularly applicable to series-tuned signal input circuits which are

sometimes used to obtain a larger coil and simplify band switching; Fig. 1.

Since the grid to plate capacity is about 1.5 mmfd and the total capacity from grid to ground is about 30 mmfd, a feedback path for the i-f frequency

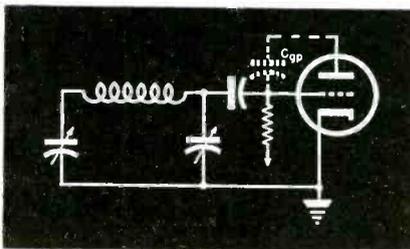
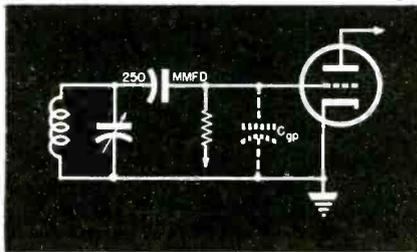


Fig. 1. Series-tuned signal-input circuit used to obtain a large coil and simplified band switching.



Figs. 2 and 3. Circuits that can be used to prevent degeneration. These circuits feature a low impedance to ground.

is created with a percentage feedback of 5%. A stage gain of 20 without degeneration would be reduced to only 10 with this feedback present. To prevent this degeneration, circuits shown in Figs. 2 and 3 can be used. These circuits present a sufficiently low impedance to ground.

Fig. 4 shows a circuit which provides an input resistance of 20,000 ohms for the 7F8. This is in addition to the loading due to transit time, and is low enough to be objectionable. To eliminate this loading, the plate circuit is made inductive rather than capacitive; Fig. 5.

This prompts the introduction of a negative resistance component into the grid circuit which effectively eliminates some of the resistance introduced by the transit time loading and circuit losses. To eliminate the possibility of the circuit oscillating at the frequency at which the inductance is parallel resonant with the tube plate-to-cathode capacity, it is sometimes advisable to shunt the inductance with a resistor of about 1500 ohms. A typical cir-

(Continued on page 54)

<sup>1</sup>From a paper by William P. Mueller, Sylvania Electric.

Fig. 5. Loading is eliminated in this circuit by making the plate circuit inductive rather than capacitive:  $L = .05$  to  $.2$  microhenries.

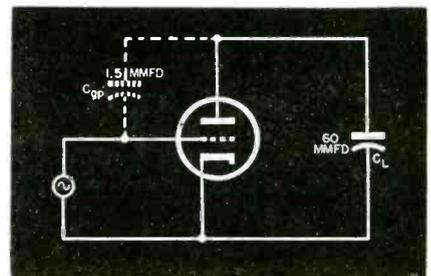
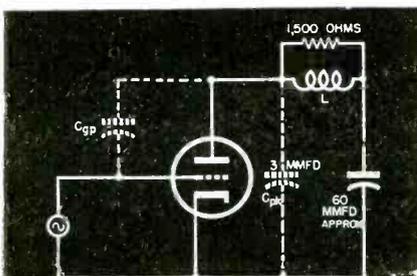
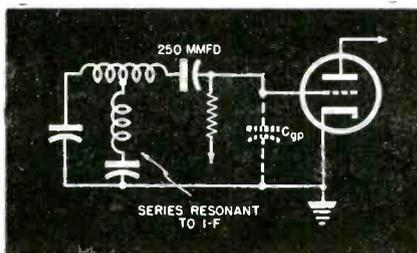


Fig. 4. Here we have a circuit with an input of 20,000 ohms; this is in addition to loading due to transit time and is low enough to be objectionable.



# SPRAGUE TRADING POST

## SWAP-BUY or SELL

**WANTED**—2 Ecophone receivers; one S-20R receiver; 35Z4 tube; 50Z7 tube. New or used equipment will be okay. Will answer all letters. Charles B. Fletcher, 331 W. 20th St., Chattanooga 8, Tenn.

**WANTED**—Good used records. Please state price and how many you have. McDonald's Radio, 506 N. Wood St., Benton, Ill.

**FOR SALE**—Record player on 10 x 12" board, plays up to 12" records, \$10; 4-watt phono amplifier with 4" spkr., \$10; popular assortment of records, all in albums (42) \$32—or trade all 3 for S-38 in good cond. and vital mike. Wendell Plum, Emily St., Mt. Morris, Ill.

**WANTED FOR CASH**—Meissner sig. splicer with coils. Also Shure S95A 3-leg base mike floor stand, must have orig. iridescent gray finish. If good condition, will pay \$9 cash. All letters answered. C. E. Cowper, 58 Rhyl Ave., Toronto, Canada.

**WANTED**—2E5 and 2A7 tube. Walter B. Kulszta, 2908 W. North Ave., Baltimore 18, Md.

**FOR SALE**—7 tuning units BC-375E 200 kc. to 3.5 mc. excluding broadcast band, \$55. George Cole, 514 Vine St., Hamilton, Ohio.

**SELL OR SWAP**—BC-312M 110 V. a-c supply, 8" p.m. speaker, tech. manual, perfect condition, \$35 complete; ERG receiver kit, all parts with cabinet, 2 meter, xtal, all mounted, just needs wiring, \$30 complete. 334 Ballard, 4280 Carmichael Drive, Culver City, Calif.

**WANTED**—Wilcox-Gay records, or any good records. Will trade Hallcrafters S-40 with Gon-Set noise limiter, one month old. All letters answered. W. E. Higgins, 1317 So. Merced Ave., El Monte, Calif.

**FOR SALE**—115 V. 60 cy. power transformer 700V, 36 ma., new, \$12. 0003869 mid 3 range condenser, \$1; 6K7, 6A7, 7B7, 50L6 GT etc., 50¢ each; 7-tube punched chassis. Harry Skoritowski, 1501 Crews Ave., Scranton, Pa.

**FOR SALE**—2 mtr. transceiver all ready to go. Includes everything from folded di-pole to a-c power supply. All for \$75. Erbert Paskin, 14 Markham Drive, W. New Brighton, Staten Island, N. Y.

**WANTED**—For cash—Surplus BC-633 FM receiver in new, or excellent condition. Write price and condition. R. Reams Goodloe, Box 1023, Nashville 2, Tenn.

**FOR SALE**—Complete course in radio, electronics by DeForest. Includes fundamentals of radio and electronics, air-craft radio television, radio servicing, plus 8 b.g. kits of radio parts with instructions. Also other books. Harold Frerichs, Huntington, Neb.

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**FOR SALE**—Hallcrafters Sky Champion receiver S-20R with external speaker. Purchased Aug. 11, '46. A-1 shape, like new. Real buy at \$60. James C. Lindsay, W3GN5C, P. O. Box 81, North East, Md.

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**WANTED**—To buy a set of band spread 16 and 20 mtr. coils for National AC SW-3, coils 60A, 61A. T. H. Lincoln, 807 Main St., Winchester, Mass.

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**WANTED**—SW-3 or similar receiver; also portable or mobile transmitter-receiver for 10 mtrs or lower. Cash or trade. Fried W2KXII, 936 Fox St., Bronx 59, N. Y.

**SWAP OR SELL**—QST's 140 issues '27 to '46, complete issues for '31, '32, '42 to '46. William J. Praetz, 223 Warwick St., Brooklyn, N. Y.

**WANTED**—25B8 tube of any make, new or used in good condition, or any tube that can be easily substituted if 25B8 isn't available. Jack N. Bussell, R.R. 20, Box 873, Indianapolis 44, Ind.

**FOR SALE**—Navy TBX-8 transmitter, receiver. Transmitter operates from 2-5.8 meg. Power output e.w. 3 watts (A-1), phone 3 watts (A-3). Receiver 2-8 megs. Complete with tubes, cables, dynamotor and instruction book, \$30. M. Greenberg, 241 Bristol St., Brooklyn 12, N. Y.

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**FOR SALE**—Video section for a TV set with 15 tubes, including 5" CRT, as is \$20; Philco car radio, no controls or cables, \$10. Walter Brunn, Box 466, Montvale, N. J.

**WANTED**—Wiring circuit and alignment data for Sig. C. BC-318 receiver, aircraft or photostat copies. J. H. Parker, 302 S. Summit Ave., Charlotte, N. C.

**FOR SALE**—Jensen 12" speakers D-9 and J-1. Auditorium Ortho-dynamic, 900 ohm field, handles 25 watts; Ghirardi's Radio Physics, 2nd ed. All letters answered. H. Hinchcliffe, 612 Vine St., Liverpool, N. Y.

**WANTED**—Schematic and wiring diagrams for BC-375E. Either or both at your price or will rent. WTKQX, Box 292, Moscow, Idaho.

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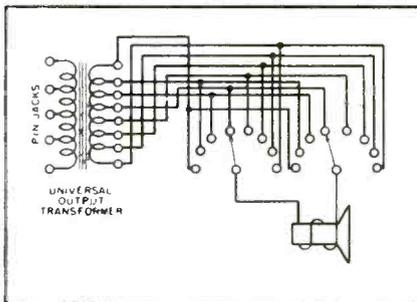
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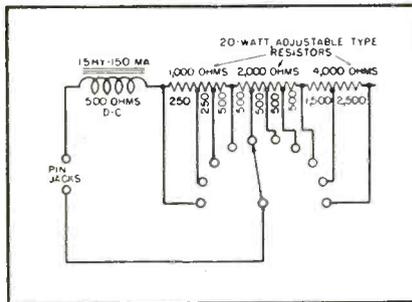
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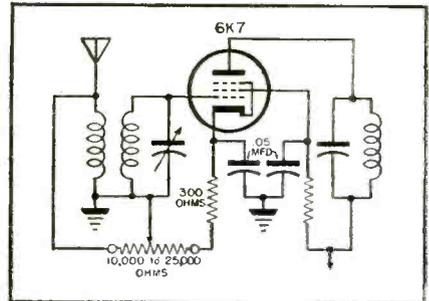
**Fig. 1.** Circuit of a universal-type speaker test setup for rapid speaker substitution. Two switches permit instant selection of the proper secondary impedance for matching to receiver output circuits. The chart supplied with the transformer should be cemented on the test speaker cabinet for ready reference. An added refinement would be a chart of the load impedances of all output tubes, obtained from any tube manual.



**Fig. 2.** Diagram of an added feature for a universal test speaker; a 15-henry choke connected in series with three adjustable 20-watt resistors, suitably tapped and brought out to a switch, which permits the substitution of an appropriate value of choke and resistance for defective field coils. The use of universal field and speaker-test systems permits the checking of a receiver when these parts are either missing or defective.



**Fig. 3.** Correct method for connecting an antenna-cathode type volume control. A limiting resistor, usually 300 ohms, should be installed in series with the cathode to prevent excessive plate current when the control is set for maximum volume. Note that the low end of the control is connected directly to the antenna terminal, and *not* to the antenna-coil primary return. Wire-wound volume controls are better since high current passes through the control.



# Serviceing Helps

## UNIVERSAL TEST BENCH SPEAKER SETUP

QUITE OFTEN, Service Men have to repair a receiver whose speaker is missing; usually it's left in the console by the customer. A universal-type speaker mounted on the bench is quite handy for testing the set. The speaker is also quite useful for checking distortion, hum or low volume that may be caused by a defective speaker.

In Fig. 1 appears a hookup for a test-speaker setup. The output transformer is of the universal type, with two sets of push-pull connections on the primary side, and a tapped secondary. Almost any combination of impedance values is thus made possible. The impedance ratios may be obtained by referring to the chart which usually accompanies the transformer. This chart should be mounted in a convenient location for ready reference.

The speaker should be of the p-m type, preferably an 8", 10-watt type, capable of handling the output of the larger receivers. It is also suggested that a smaller p-m speaker of the 5" type be installed for checking table models, since with the larger speaker connected to a table type receiver, it may appear that the midget speaker is not supplying adequate reproduction.

If the output transformer is of the better type, the reproduction may be superior to that of the original speaker, and some allowance should be made for the difference in quality. On the other hand, if the test speaker is

## Universal-Type Speaker Test Unit. Connecting Antenna-Cathode Type Volume Controls. Use of Emergency-Type Signal Tracer

mounted in a small cabinet of the wall type, the reproduction may be inferior to that of the original speaker in the larger cabinet.

By bringing out the primary connections to pin jacks, suitably labeled, and using two rotary switches for the secondary, a very workmanlike job can be constructed. However, the switches are a refinement, but they will speed up the work. Soldered connections are just as effective, and may be reconnected for each specific job.

Where the speaker being replaced is of the field coil type, the problem is complicated, particularly where the speaker field is being used in the filter network. The substitution of a resistor of the same d-c resistance may not be satisfactory due to the hum level. If the original speaker is available, the best plan is to use the field coil and disconnect the voice coil leads. However, quite often the field coil is open, and a check of the receiver, in spite of this failing, is necessary to find out if any further servicing is necessary, for purposes of price quotation.

A choke and adjustable resistor are also handy for a quick temporary repair. A hookup for this combination is shown in Fig. 2. Here, a 15 henry

150-ma choke, of 500 ohms d-c resistance, has been connected in series with three tapped 20-watt resistors, permitting the selection of ten values for speaker field substitution. The values shown should cover the majority of field resistance values to a fair approximation. The switch should be of the heavy-duty type, because of the high current demands of the usual speaker field circuit. This circuit also serves another function: it may be used to determine the resistance of a speaker field, whose value is not known. The method used is to set the switch for the highest value circuit resistance, and then reduce the value until the proper tube voltages are obtained. The proper value of the field coil resistance may then be read from the calibrated switch.

### INSTALLING ANTENNA-CATHODE CONTROLS

IN INSTALLING ANTENNA-CATHODE type volume controls the low end of the control is often improperly connected to the antenna coil primary return. The correct method for installing this type of control is shown in Fig. 3. The low end of the volume control must be connected directly to

(Continued on page 44)

**SINCE  
1895**

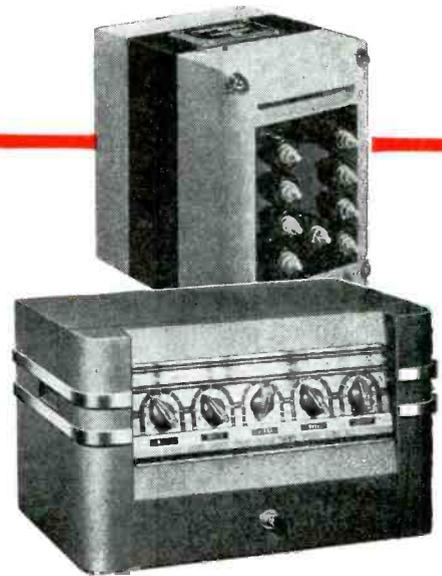
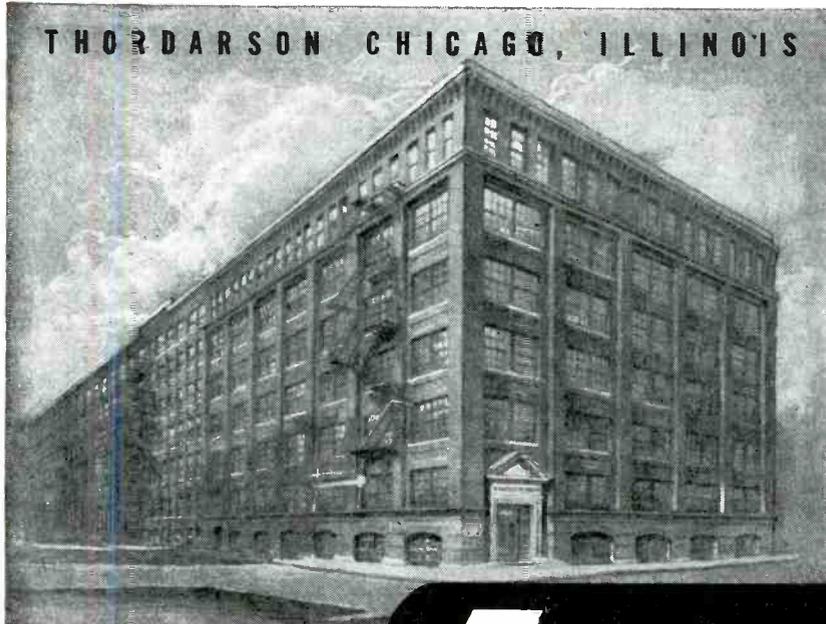
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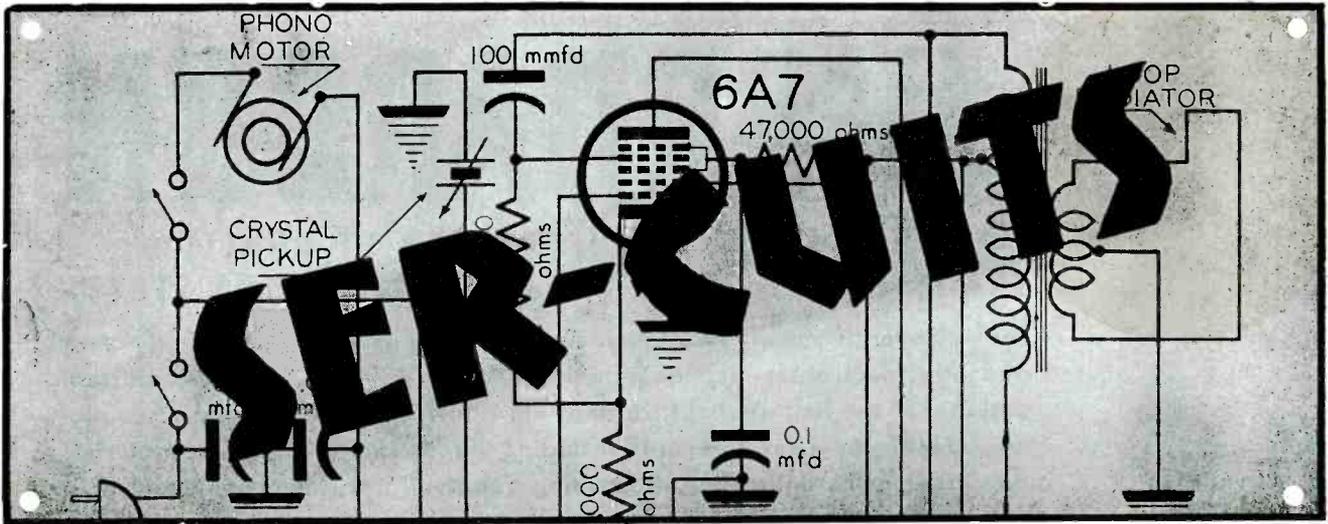


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IN THE APRIL ISSUE DISCUSSION of television receiver r-f amplifiers by Edward M. Noll,<sup>1</sup> it was indicated that the grounded-grid and linear-tank r-f circuits would be used in many of the new tv models. It now has been learned that two recently-announced tv models, the G. E. 801 and the RCA 630 TS, are using these type r-f stages; the G. E. model employing the grounded-grid method and the RCA set with the linear tank. These circuits are shown in Figs. 1 and 2, respectively.

#### G.E. Circuit

In the G. E. circuit a miniature pentode is connected as a triode. The grid is grounded and the cathode circuit consists of a tuned circuit on each channel. The inductor of tuned circuit resonates with the total distributed capacity on the proper frequency. This cathode circuit is tuned on each of the thirteen channels with a rotary switch, which adds additional inductance on

each channel as the switch is rotated from thirteen to one.

The inductance of the plate-tuned circuit is also changed on each band. In this case, however, an individual coil is inserted for each channel position. Antenna is capacitively coupled to cathode-tuned circuit. Inductor  $L_1$  shunts off any low frequencies (around i-f range) attempting to enter receiver.

#### RCA System

The RCA receiver r-f stage consists of a miniature 6J6 dual triode connected as a push-pull amplifier. The plate circuit contains a transmission line section as a tuned circuit. Channel-switching is accomplished by adding or subtracting sections of line in the same manner as the frequency of any linear-tank circuit is varied, by moving a shorting bar up or down the line. In this case, however, the lines are not stretched out in one long

length, but form a part of a rotary switch which adds a small inductor to the linear tank circuit as the channel switch is varied from channel thirteen to one.

Antenna is also capacitively coupled to the grids of r-f amplifier. Antenna and transmission line are properly terminated in 300 ohms by two 150-ohm resistors connected grid-to-grid. Transformer  $T_1$  shunts out low frequencies. Two small neutralizing capacitors prevent r-f oscillations.

#### Instrument Analysis: Supreme 561 A-F/R-F Signal Generator

This test unit (Fig. 3; page 34) is a combination signal generator incorporating an a-f generator, r-f generator and a frequency modulator.

#### A-F Generator

The a-f generator is of the beat-frequency type designed to produce a controlled source of signal covering 15 to 15,000 cycles. The output of this section is provided with a transformer which offers a choice of four impedances to match the input of p-a amplifiers, motion picture sound equip-

(Continued on page 36)

<sup>1</sup>See article on mixer-oscillator circuits in television receivers; page 20.

Fig. 1. G.E. 801 r-f stage.

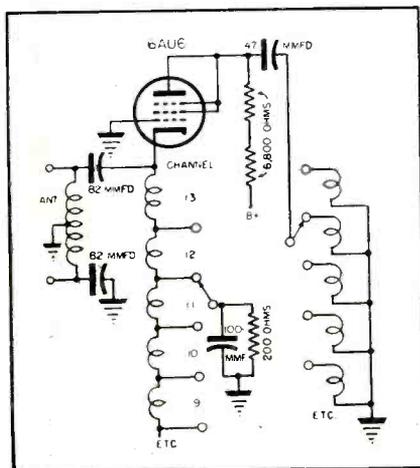
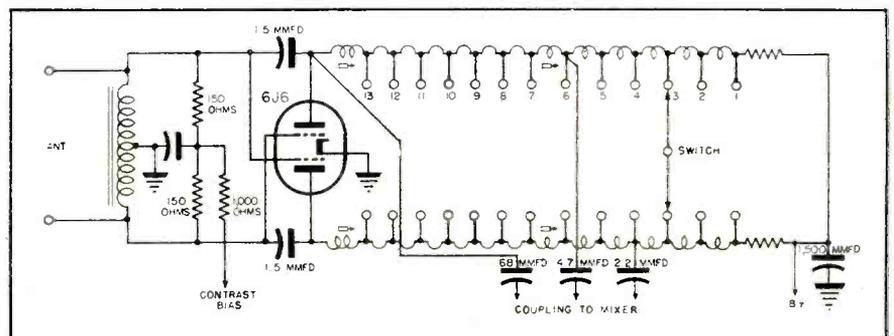


Fig. 2. RCA 630TS r-f stage.



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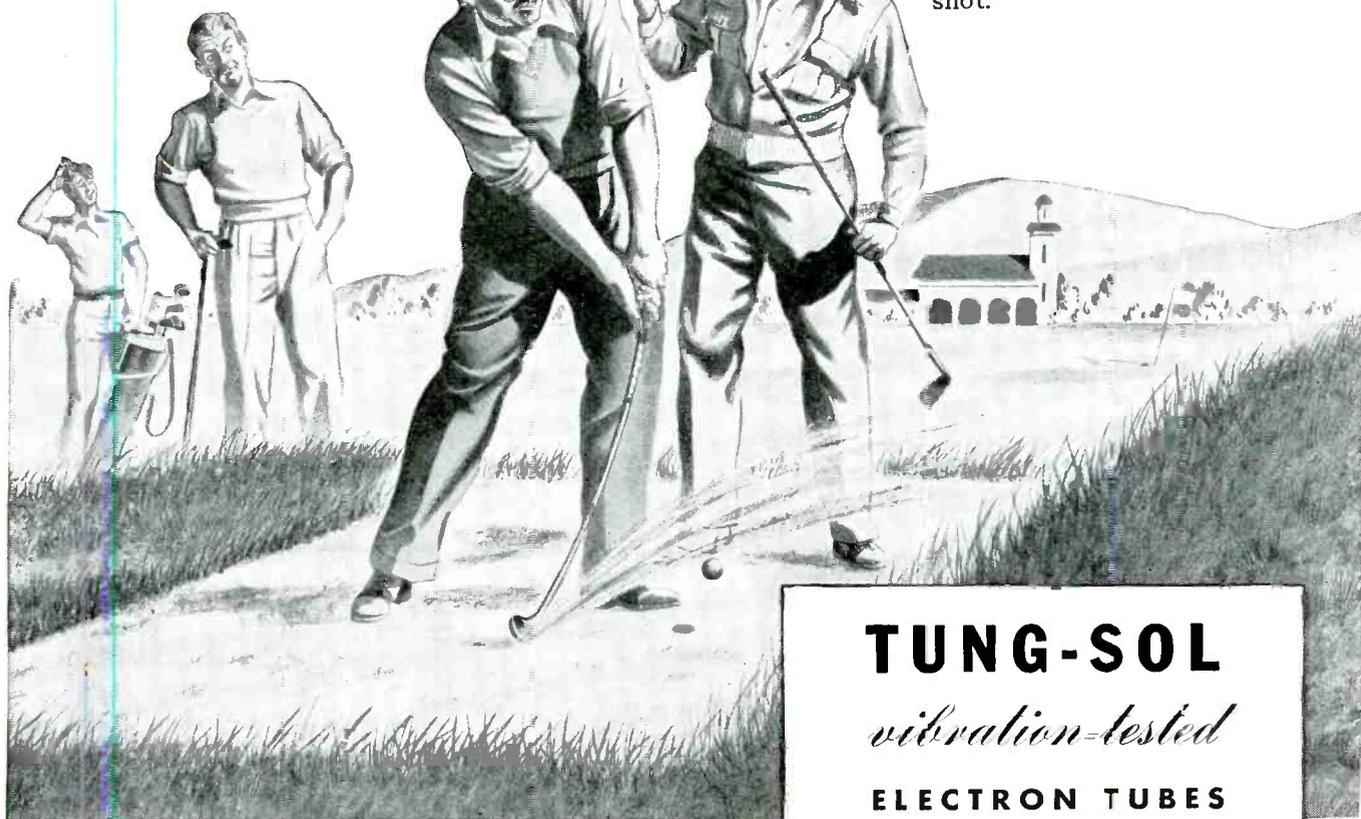
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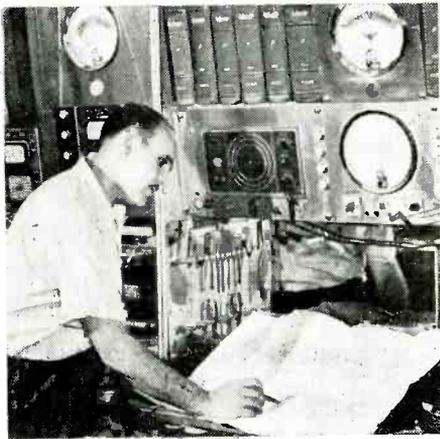


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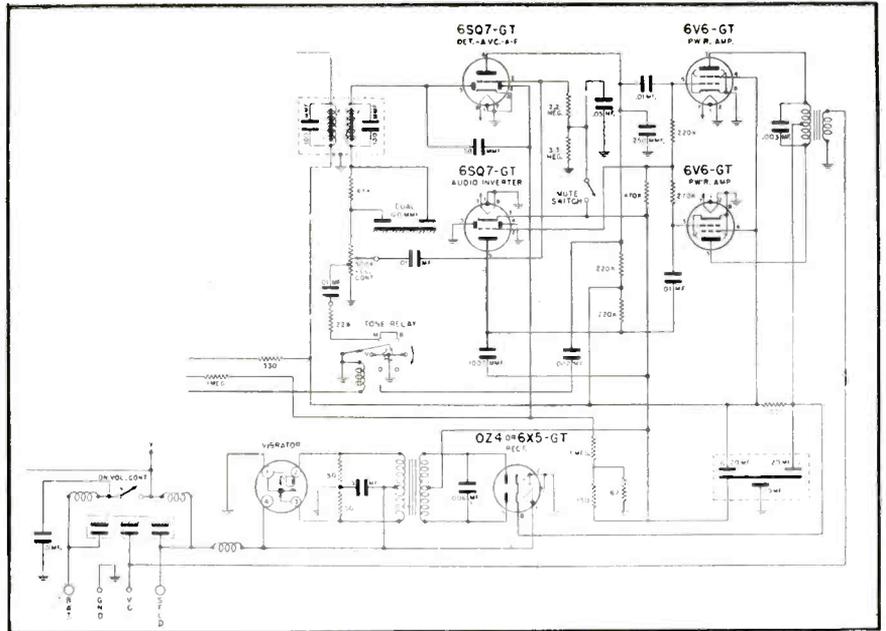


Fig. 5. The detector/ave/a-f, audio inverter and power amplifier circuit of Motorola 8-tube car receiver.

## Ser-Cuits

(Continued from page 32)

ment, inter-department communication systems, etc.

### R-F Generator

The r-f generator is of the cathode-tap feedback type using a separate tube as a buffer amplifier and modulator. The r-f coils provide coverage from 65 kc to 20.5 mc in five bands of two scales. The r-f coils use adjustable iron cores and air trimmer capacitors. Output is equipped with a shielded attenuator network to provide continuous variation of the output signal.

### Electronic F-M

The frequency modulator is of the electronic type and produces a variable frequency signal of almost constant amplitude over a predetermined band.

### V-T-V-M In Unit

The instrument also contains two vacuum-tube voltmeters, one for monitoring the a-f output and percentage modulation and the other for checking the amplitude of the unmodulated signal.

A switching arrangement makes it possible to use each of the three gen-

erators individually or in conjunction with each other.

### R-F/A-F Tubes

In the audio generator section are two 6SK7 as r-f oscillators, one 6C5 as a mixer, and one 6C5 as amplifier.

In the r-f section one 6SK7 is used as variable r-f oscillator, one 6K6 as buffer-mixer, one 6SN7 as f-m oscillator and a-f vacuum-tube voltmeter, one 6SN7 as r-f vacuum tube voltmeter and frequency control tube. In the power supply one 6X5 is used as a rectifier.

Five push buttons select output impedances; 50, 500, 5,000, 50,000.

There are also five push buttons for selection of r-f band; 65 kc-205 kc,

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205 kc-650 kc, 650 kc-2,050 kc, 2,050 kc-6.5 mc and 6.5 mc-20.5 mc.

**Motorola 6-Tube Car Models: Pontiac, Nash, Ford and Mercury, Oldsmobile and Chevrolet**

A 6-tube Motorola superhet basic chassis having a tuned r-f stage and used for the Pontiac, Nash, Ford and Mercury, Oldsmobile and Chevrolet cars (PC6, NH6, FD6, OE6, and CT6 chassis, respectively) is shown in Fig. 4. A 3-gang permeability tuner, electrically operated, provides 5-automatic station positions and a manual tuning position. A three-position electrically operated tone control is used; this is operated by momentarily pushing in on the volume knob.

**Tubes Used**

A 6SK7GT is used as an r-f amplifier; one 6SA7GT, osc.-mod.; one 6SK7GT, i-f amplifier; one 6SQ7GT, det. a-w a-f amp.; one 6V6GT, power amplifier, and one OZ4 or 6X5GT as a rectifier, vibrator is full wave non-synchronous.

Tuning range is from 535 to 1,600 kc.

**Permeability Tuner**

The 3-gang permeability-type tuner has five preset and one manual tuning position. The tuner is designed to operate with 4½ to 7.3 volts input.

This tuner depends on dashpot action between the plunger and the solenoid for proper operation. Accordingly when the fit between the plunger and solenoid is too tight, the air can't get out fast enough; the result is a slow or sluggish operating tuner. All late production tuners have an adjustable air release in the solenoid end plate. Early production tuners that do not have the adjustable air release and operate sluggishly due to too much dashpot action should have the solenoid end plate replaced with a new end plate having an adjustable air release.

**Solenoid-Coil Position**

The tuner solenoid coil must be in a horizontal or near horizontal position or the tuner will not operate properly. If it is operated with the coil in a vertical position, the solenoid and carriage

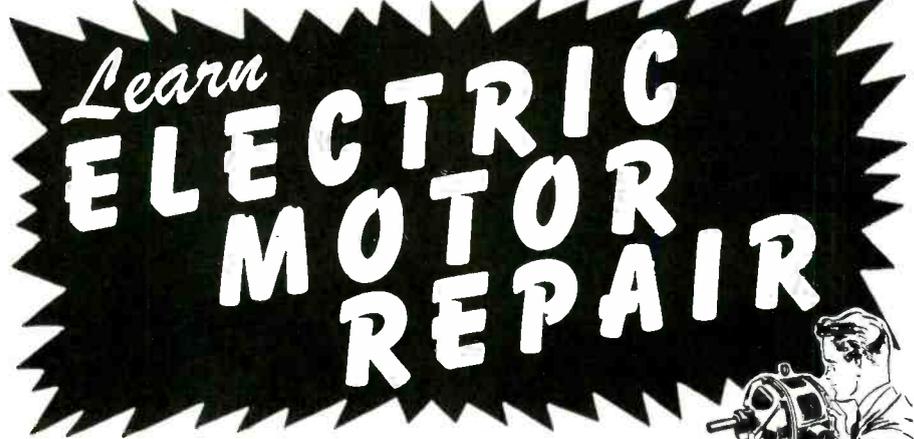
(Continued on page 50)

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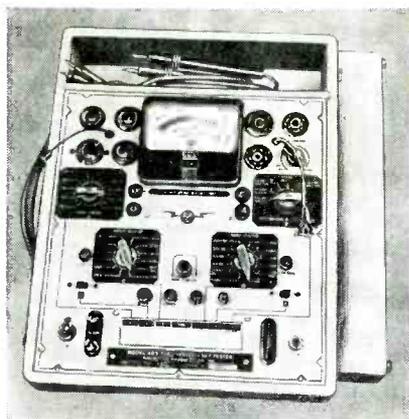
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# NEW PRODUCTS

## RCP PORTABLE TUBE AND SET TESTER

A portable tube and set tester, 805B, with sockets for standard base and miniatures and subminiatures has been announced by the Radio City Products Company, Inc., 127 West 26th Street, New York 1, N. Y.

Instrument features a volt-ohm-milliammeter, tube tester, battery and capacitor leakage tester. Uses a germanium crystal-diode rectifier. Has a built-in "Rolindex" roll-chart.



\* \* \*

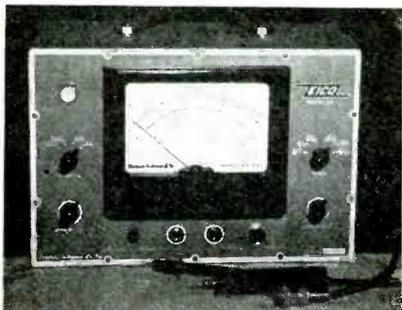
## ELECTRONIC INSTRUMENT CO. VTVM/VISUAL SIGNAL TRACER

A vacuum-tube voltmeter and visual signal-tracer, model 210, has been announced by the Electronic Instrument Company, Inc., 926 Clarkson Avenue, Brooklyn 3, New York.

The d-c readings up to 5,000 volts are made with a single high-voltage test probe.

Twenty-nine ranges are available for a-c, d-c, resistance and db readings.

A u-h-f diode is used for a-c rectification and designed for visual signal tracing on r-f, i-f and a-f, as well as all other frequencies from 20 cycles to 100 megacycles. The a-c input capacitance is said to be 7 mmfd. with ranges: 0/5/10/100/500/1,000 volts. The ohmmeter covers ranges from 0.1 ohm to 1,000 megohms in six ranges: 0-1,000 ohms, 9.5 ohms (center scale); 0-10,000 ohms, 95 ohms (cs); 0-100,000, 950 ohms (cs); 0-.01 meg, 9,500 ohms (cs); 0-10 meg, 95,000 ohms (cs); 0-1,000 meg., 9.5 megohms (cs).



## BURGESS PERSONAL PORTABLE A BATTERY

An A battery, No. 2R, for service on personal portable radios has been announced by Burgess Battery Company, Freeport, Ill.



\* \* \*

## IRC RESISTOR KIT

A basic kit containing an assortment of 471 resistors in a metal cabinet which can be hung on the wall or set on the bench, has been announced by the International Resistance Company, 401 N. Broad Street, Philadelphia 8, Pennsylvania.

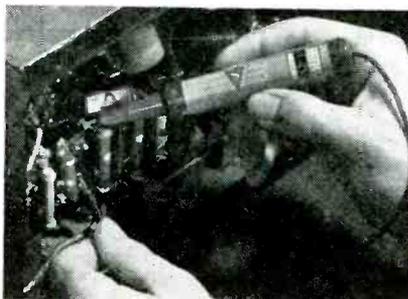
\* \* \*

## SYLVANIA POCKET-SIZED OHMMETER

A pocket-sized ohmmeter for spot checking has been announced by the radio tube division of Sylvania Electric Products, Inc., 500 Fifth Avenue, New York 18, N. Y.

Ohmmeter is enclosed in tubular plastic case  $\frac{7}{8}$ " in diameter and  $5\frac{3}{4}$ " overall. The prod tip base and top cap, constructed of green molded bakelite, are mounted in a transparent cellulose-acetate tube housing the meter.

Direct readings between 0 and 10,000 ohms are given on a 1.5-ma full scale sensitivity meter in series with a 1,000-ohm molded carbon resistor and a standard penlight dry cell. Test electrodes include a stainless steel prod built into the meter case and one secured to the tip of a 17" test cord.



## SANGAMO PLASTIC MOLDED TUBULARS

A paper tubular capacitor molded in thermo-setting plastic has been announced by the Sangamo Electric Company, Springfield, Illinois.

These new capacitors are designated as type 30 and are offered in halo wax impregnated, in tan, and diaclor impregnated, in red.



\* \* \*

## ELECTRO PRODUCTS A-POWER SUPPLY

A power-supply unit, consisting of two 6-volt 7.5-ampere filtered d-c power sources which can be placed in parallel for 15 ampere continuous service or in series for 12-volt 7.5-ampere continuous service, has been developed by the Electro Products Laboratories, Inc., 549 West Randolph Street, Chicago 6, Illinois.

The weight of the unit is 31 pounds in a carton and operation is from 105, 115 or 125 volts, 60-cycle power source.

\* \* \*

## TRITON PRES-TO-HEAT SOLDERING TOOL

A soldering iron, *pres-to-heat*, has been produced by Triton Manufacturing Company, East Haddam, Conn.

Iron operates on a-c, using a six-volt transformer and a heating unit. A spring-actuated lever, when compressed, closes two plier-like carbon electrodes on the parts to be soldered. By further compressing the actuating lever, the current is switched on for the short period required to melt the solder. Slightly releasing the lever turns off the current and permits the work to be held between the jaws until the solder has cooled. Current is consumed only when the actual soldering operation is being performed.



## NEW PRODUCTS

### G.E. F-M/TV ANTENNA

Two folded-dipole f-m and television antennas, UKA-002 and UKA-001, designed to match 300-ohm transmission lines, have been announced by the specialty division of G. E.

The dipole elements, constructed of reinforced aluminum tubing, are directional both front and rear broadside to the antenna. Masts are 5' high. The tv dipole's over-all width is 96", while the f-m dipole's width measures 48".

\* \* \*

### SIMPSON PORTABLE SOUND SYSTEM

A portable 8-watt sound system, MAS-808, for small halls has been announced by Mark Simpson Manufacturing Co., Inc., Long Island City, New York.

\* \* \*

### WARD F-M ANTENNAS

Folded and straight dipoles, either of which may be reflector equipped, have been announced by the Ward Products Corporation, 1523 East 45th Street, Cleveland 3, Ohio.

Designed to operate in the 88 to 106 mc band, and to match impedance to a 60' polyethylene-insulated 300-ohm co-linear transmission line.

Supplied with universal base mounts for any angle on roof or wall. A ring is provided for attaching guy wires.

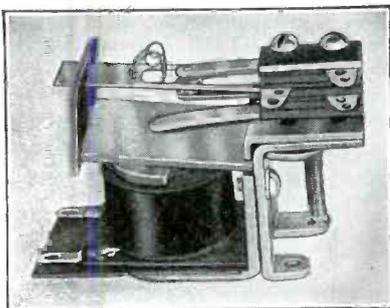
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### GUARDIAN SNAP-ACTION SWITCHES

A line of snap-action switches has been announced by the Guardian Electric Mfg. Co., 1623 West Walnut Street, Chicago 12, Illinois.

The snap-action feature is suited to control applications that involve slow-moving, mechanical devices or where a given stroke is required to provide quick, positive "make" or "break" contact action.

Chattering, arcing, intermittent contact pressure and many other circuit and operating problems are eliminated with snap-action switches.



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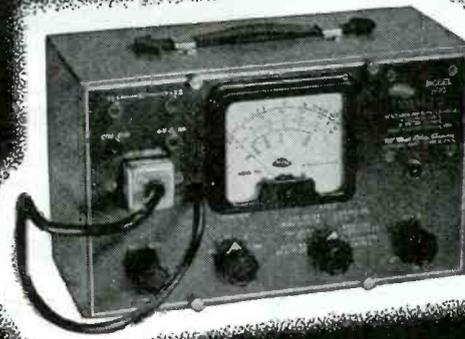
### ATR REPLACEMENT VIBRATORS

A line of auto radio replacement vibrators, featuring 3/16" diameter tungsten contacts, mica-ceramic and metal stack spacers with two-bolt stack construction, has been announced by the

(Continued on page 40)

# SILVER

# EXPERTS CHOOSE



"VOMAX" is the overwhelming choice of experts because it is the finest, perfected v.t.v.m. . . . because greatest demand makes greatest production and lowest cost to you.

"VOMAX" gives you a total of 51 ranges to directly measure c.c., a.c., a.f., i.f. and r.f. volts up through hundreds of megacycles, six resistance ranges covering 2 10ths ohms through 2,000 meg-ohms, three output meter-ductal ranges from -10 through +30 db., six direct current ranges measuring from 50 microamperes through 12 amperes. Most important is the absolute stability, complete freedom from usual grid current errors . . . and its astronomical input resistance . . . an honest 6.6 megohms upon a.c., a.f., i.f. and r.f.; 5 and 126 megohms upon d.c. Voltage ranges measure from 1 through 3000 volts d.c., 1 through 1200 volts a.c.

If you want to guard your meter dollar investment . . . to make it only once for many years to come . . . then "VOMAX" at its present low \$59.85 net price is your logical choice . . . as thousands more wise technicians like yourself have proved to their profit.

Let's look at this matter of what meter you buy seriously . . . for your choice of this, the service technicians basic instrument, can spell either peace and profit . . . or annoyance and loss to you. You must have the best meter to meet "smart" competition. And "smart" competition overwhelmingly uses "VOMAX." The reason is simple. Other manufacturers have had to copy "VOMAX" inventions to try to satisfy your demand for a modern, post-war, obsolescence-proof universal meter. Yet, "VOMAX," the perfected v.t.v.m., stands head and shoulders above all other meters. This is proved by its heavy purchase end use by the Bureau of Standards in Washington, by Western Electric, G. E., Westinghouse, university after university, by top-ranking industrial laboratories, F.C.C., C.A.A., Veterans Administrations, schools, colleges . . .

## NEW IMPROVED "SPARX"



Thousands of technicians today rely on "SPARX" dynamic signal tracer to save time . . . increase efficiency . . . cut their costs. It lets you hear and see signals . . . traces signal right on thru every receiver circuit from antenna thru voice-coil . . . is sharp test speaker, too. Continuous laboratory research has now improved "SPARX" immensely . . . created the Improved Model . . . tremendously increased sensitivity . . . greatly expanded general usefulness. And the SILVER policy of protecting your dollar investment pays out handsomely . . . a free bulletin tells every user how to convert his "SPARX" into the new, Improved Model in a jiffy . . . goes to prove that for the really serious, profit-conscious technician there's no substitute for SILVER, that "SPARX" costing you only \$39.90 is outstandingly the world's best signal tracer. "SPARX" will earn you, too, more profits in less time than any other instrument you can buy.

# 906

Thanks for your patience. Model 906 Signal Generator is now flowing to your favorite jobber. And what an instrument . . . 90 kc. through 170 mc. on fundamentals . . . 8 air-trimmed bands . . . variable % 400 ~ amplitude modulation . . . built in variable electronic FM sweep . . . laboratory triply adjustable attenuator . . . meterec microvolts . . . output 1/2 microvolt to over 1 volt . . . multiply shielded strays lower than \$500.00 laboratory generators! Yet all this costs you only \$89.90 net. Better order your 906 now for demand far exceeds production capacity or this precision instrument for months to come.

Send Post Card for Catalog of new measuring equipment, communication receivers, transmitters, kits, parts. See them at your favorite Jobber.

OVER 36 YEARS OF RADIO ENGINEERING ACHIEVEMENT

*McMurdo Silver Co., Inc.*

1249 MAIN ST., HARTFORD 3, CONNECTICUT

# FOR FM AND AM SERVICING



**TYPE  
YGS-3**

## SIGNAL GENERATOR

**S**ERVICE men, research technicians and design engineers find this new General Electric Signal Generator an extremely valuable aid in their work.

Four basic units have been combined to form one compact, labor-saving, portable equipment which is simple in construction and easy to operate.

The General Electric Signal Generator, Type YGS-3, con-

sists of an RF oscillator (fundamental frequency range 10 kc to 150 mc); an FM oscillator (center frequencies of 1, 20 and 50 mc and frequency deviations of  $\pm 20$ ,  $\pm 300$  and  $\pm 750$  kc); a 1 mc crystal calibrator and a variable frequency audio oscillator. This combination of units enclosed in a single case will help to simplify and speed up FM and AM receiver analysis.

### NOTE FOLLOWING DISTINCTIVE FEATURES:

- Economical and convenient to use.
- Extremely wide sweep deviation.
- Reference level indicator for output.
- Constant output impedance attenuator. Wide Frequency range.
- Lines up any FM or AM receiver, stage by stage by visual alignment methods.

*New free booklet on FM servicing available.*

Write: General Electric Company, Electronics Department, Syracuse 1, New York.

# GENERAL ELECTRIC

164-F4

## NEW PRODUCTS

*(Continued from page 39)*

American Television and Radio Co., 300 East Fourth Street, St. Paul 1, Minnesota.

\*\*\*

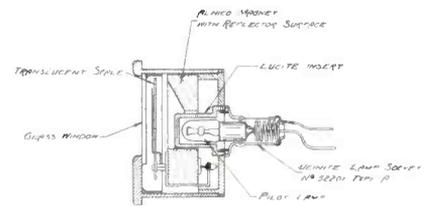
### MARION ILLUMINATED METERS

Panel-type instrument illumination applicable to 2½" and 3½" round and square instruments, the 4½" rectangular and tuning meter, have been announced by the Marion Electrical Instrument Company, Manchester, N. H. Utilizes a



transparent lucite cavity which seals the opening against dust.

Has an alnico magnet, whose front face is shaped somewhat like a flashlight reflector which concentrates the rays on the dial.



\*\*\*

### SIMPSON POCKET-SIZE ELECTRICAL APPLIANCE TESTER

A pocket-size electrical-appliance tester, 390, providing volt, ampere and wattage readings, has been announced by the Simpson Electric Company, Chicago.

Ranges are AC...60 cycles; volts... 0-150, 0-300; amperes...0-3, 0-15; watts... 0-300, 0-600, 0-1500, 0-3000.



\*\*\*

### NO-OX LUBRICANT

A cleaning and lubricating agent, NO-OX, that is said to clean, lubricate, dissolve rust and corrosion and prevent future oxidizing action, has been announced by NO-OX Laboratories, 1517 W. Pico Blvd., Los Angeles.



\*\*\*

### EVEREADY H-V BATTERIES

A dry battery weighing one pound, Mini-Max B battery No. 493, providing

300 volts, has been announced by Ever-ready.

The battery is 2 $\frac{1}{8}$ " long, 2 $\frac{1}{2}$ " wide, and, includes flush-mounted pin-jack terminals, 3 $\frac{1}{8}$ " high.

\* \* \*

#### VOLT-OHM-CAPACITY-MILLIAMMETER

A volt-ohm-capacity-milliammeter with a low-capacity, high-frequency probe, model 20<sup>c</sup>, has been announced by the Hickok Electrical Instrument Co., 10521 Dupont Avenue, Cleveland 8, Ohio.

Voltage ranges, a-c, d-c, ma; 0-3, 12, 30, 120, 300, 1,200; capacity: 1-10,000 mmfd in two ranges, 1-1000mmfd in five ranges. Inductance is 50 mh—100 henries resistance, 1/10 to 10,000 megohms in eight ranges.

Input impedance, volts, a-c, 12 megohms shunted by 6 mmfd; volts, d-c, 15 megohms.

Tubes include two 6X5GT rectifiers, one 6SJ7 cathode follower, one 6SN7GT vacuum-tube voltmeter, one OD 3/VR 150 voltage regulator and one 9006.



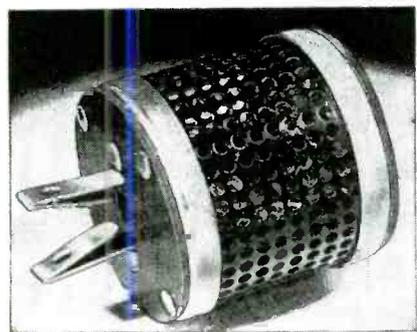
\* \* \*

#### CLAROSTAT FLUORESCENT LAMP D-C CONVERSION RESISTOR

Two types of d-c conversion resistors have been announced by Clarostat Mfg. Co., Inc., 130 Clinton St., Brooklyn 2, N. Y.

One type, the accessory type of series AA, plugs between usual socket or outlet, and the usual attachment plug. The unit measures 1 $\frac{3}{4}$ " dia. x 1 $\frac{3}{4}$ " long. Three different ratings are available for use with 15-watt 120-v, 15-watt and 20-watt 110-v lamps.

A built-in type or series GT is a flat perforated-case unit with mounting flanges, measuring 7" long x 1 $\frac{1}{8}$ " wide x 1 $\frac{1}{4}$ " high. Available for use with 15-, 20-, 30- and 40-watt lamps on 110- and 220-v supply.



\* \* \*

#### FEDERAL HEAVY-DUTY AUTO POWER SUPPLY

A heavy-duty selenium-rectifier power supply which can be used as test bench power for auto radio sets has been de-

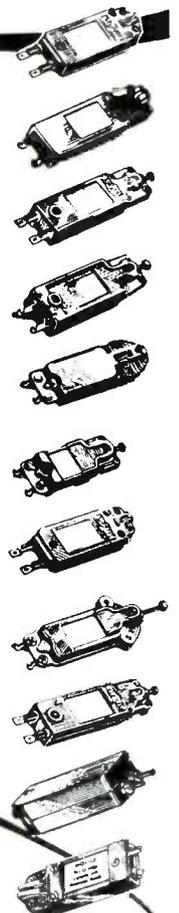
(Continued on page 51)



## IT'S RISKY

*... to accept a lift from a stranger*

**W**HILE AT FIRST it may seem a quick and easy way of reaching some destination . . . experience shows that it is not alone risky . . . but often dangerous . . . to accept help from a stranger. When you have a phonograph pickup cartridge to replace, you'll be playing it safe to duplicate the original cartridge . . . the one you know . . . the cartridge selected by the engineers and manufacturers of such equipment for the most satisfactory results. Cartridge characteristics, ideal for one instrument, may be entirely unsuitable for another. For exact, duplicate replacements in a majority of Phonographs now in use, Astatic Crystal Pickup Cartridges are available at your Radio Parts Jobber's.



**THE Astatic CORPORATION**  
**ASTATIC**  
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IN CANADA: CANADIAN ASTATIC LTD., TORONTO, ONTARIO

Astatic Crystal Devices Manufactured under Brush Development Co. patents.

**These Newcomb selling features  
are important to you!**

KX-30 Deluxe  
30-Watt Amp.



**COMPLETENESS:** Two complete lines of amplifiers and portable systems . . . utility and deluxe . . . provide great flexibility in meeting various customer requirements.

**QUALITY:** Top-flight performance and dependable, low-cost operation . . . these qualities are carefully planned and built into every Newcomb amplifier.

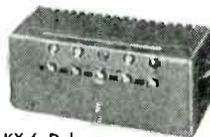
**PRICE RANGE:** No other line of amplifiers offers so wide a price range . . . from very moderately priced utility models to the finest deluxe amplifiers for your most discriminating customers.

The proven quality of operation . . . the perfect suitability to every requirement . . . the wide price range . . . these mean greater customer satisfaction and more REPEAT SALES for you.

**NEWCOMB**—the logical choice of the quality-minded buyer—is your key to a continued, expanding success in the sound equipment field.  
Let us send you complete information.



KX-60 Deluxe  
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KX-6 Deluxe  
Mixer Pre-Amp.



K-60P Deluxe  
Power Amp.



KXP-30 Deluxe  
Phonograph Amp.



H-10 Standard  
10-Watt Amp.



H-14 Standard  
14-Watt Amp.



H-30 Standard  
30-Watt Amp.



H-60 Standard  
60-Watt Amp.



Dept. E, 6824 Lexington Ave., Hollywood 28, Calif.

"NOT MERELY AS GOOD AS THE OTHERS . . . BUT BETTER THAN ALL OTHERS."

the Monoset, radio pillow speakers and parts.



**BITTAN-NEVINS NOW TELEX REPS**

The Bittan-Nevins Company, 53 Park Place, New York City, has been appointed eastern representative of the Electro-Acoustic Division of Telex, Inc. Dan Bittan and Irvin Nevins will represent Telex in New York and the New England states in the handling of



Dan Bittan

**LAND-C-AIR SALES BECOMES REP FOR H. H. SMITH**

Land-C-Air Sales Inc., 14 Pearl Street, New York City, have been named east-

ern representatives for Herman H. Smith, Inc., 405 44th Street, Brooklyn 20, N. Y.

\* \* \*

Henry M. Krueger of 990 Fulton Street, San Francisco, California, will represent H. H. Smith, Inc., in the northern part of California.

\* \* \*

**ACA SOUND BOOK**

A 24-page booklet describing essentials for perfect amplification has been written by A. C. Shaney, chief engineer of the Amplifier Corp. of America, 396-15 Broadway, New York 13, New York.

Features covered include direct-coupling, scratch-suppression, increased musical range, signal-expansion, power requirements, noise, higher fidelity, extended dynamic range, *presence*, hum elimination, distortion reduction, microphonics, response control, grid-current, delayed plate-voltage, fixed-bias, balanced audio signals, voice accentuation, reduction of thermal agitation, and cross modulation.

Available upon receipt of a 3c stamp to cover postage.

\* \* \*

**NEWS OF THE REPRESENTATIVES**

Four new members have been added to the Los Angeles chapter of The Representatives: John C. Van Groos, 1406 S. Grand Ave., Los Angeles; Ernest V. Roberts, 6516 Selma Ave., Hollywood. Associates elected are: Norman J. Marshank, 672 S. Lafayette Park Pl. and Bruce Detsch, 2627 Santa Fe Ave., both of Los Angeles, Calif.

The California chapter has added an associate, Ira N. Edmondson, 530 Gough St., San Francisco, Calif.

The New York chapter recently reported four new members: Jules J. Bressler, 341 Madison Ave.; Seymour Erde, 6 E. 46th St.; Samuel A. Shaw, 1123 Broadway; Milton C. Snyder, 205 E. 42nd St. Four associates have also been named: Milliard A. Harris, 220 E. 23rd St.; Norman Leeb, 53 Park Place; Max D. Weinberg, 250 W. 57th St.; Frederick Spellman, 220 E. 23rd St.

Mae Strauss, 425 Surf St., Chicago, Ill., is now a member of the Chicago-land chapter. Harry W. Densham, Silver Springs, Md., has become an associate of the Mid-Lantic chapter. Full membership in this chapter has been awarded to: Richard F. Brookfield, Daniel J. Connor, Howard J. Fairbanks, John F. Orsi, William Stewart and Robert L. Wilkinson.

The Missouri Valley chapter has added E. L. Polsinelli, 210 W. Eighth, Kansas City, Mo., and granted full membership to J. O. Schmitz and A. R. Thibau, formerly associates. To the Buckeye chapter have been added: Curtis R. Stoutenburg, 3648 Euclid Ave.; Ray M. Howard, Hanna Bldg.; E. S. Percival, Hanna Bldg., all of Cleveland, Ohio.

William S. Lee, 2033 Park Ave., Detroit, Mich., has become a member of the Wolverine chapter. The Dixie Chapter has elected Loren B. Harrell, Greensboro, N. C. and J. E. Joyner, Jr., 1000 Peachtree St., Atlanta, Ga., members.

Members at large now include: Moncrieff Smith, Wood & Anderson Co., 915 Olive St., St. Louis, Mo.; William Borghoff, 4018 Greer Ave., St. Louis, Mo.; Merrill K. Franklin, 712 Sixth

Ave., Minneapolis, Minn.; Harry G. Hurd, 303 N. Jefferson, St. Louis, Mo.; L. E. Jaquez, 352 N. Forsythe, University City, Mo.; W. N. Wellman, Jules Beneke Co., 5175 Arcade Bldg., St. Louis, Mo., and associate, Edward L. Young, Wood & Anderson Co., 915 Olive St., St. Louis, Mo.

The southwestern chapter has elected J. Y. Schonmaker, president, and Edward F. Aymond, vice president. Hal F. Corry has been reelected secretary-treasurer.

\* \* \*

### PARTS COORDINATING COMMITTEE HOLD MEETING

A Service Man's "Code of Ethics" program was studied at a recent meeting of the Radio Industry Parts Coordinating Committee. Herb Clough is chairman of the committee; Robert W. Buggs is chairman of sub-committee on merchandising. The program will be used to build public confidence in the Service Man. A series of service-dealer clinics is also expected to be sponsored by local NEDA distributors.

Four groups are sponsoring the Parts Coordinating Committee: RMA, NEDA, EPEM of Chicago and the Sales Manager Club of New York.



At the meeting of the merchandising and research sub-committee of the Radio Industry Parts Coordinating Committee (left to right): Jack Berman, EPEM; Harry Kalker, RMA; Bob Baggs, Sales Managers' Club; Bill Schoning, NEDA, and Lou Calamaras, NEDA.

\* \* \*

### SIMPSON ELECTRIC INSTRUMENT MANUALS

An operator's manual for the 260 volt-ohm-milliammeter has been published by the Simpson Electric Company, Chicago, Ill.

Manuals on other Simpson instruments will soon be published.

\* \* \*

### WELLS SALES IN NEW SHOWROOM

General offices and showroom of Wells Sales have been moved to 320 N. LaSalle Street, Chicago. The showroom contains a large display of radio parts and accessories arranged in self-service racks.

\* \* \*

### IRC RESISTOR BULLETIN

A 6-page bulletin, C-2, covering power wire-wound resistors has been issued by International Resistance Company, 401 N. Broad Street, Philadelphia 8, Pennsylvania. Presented are specifications, characteristics and dimensions for fixed and adjustable power wire-wound resistors, ferrule and bracket types.

\* \* \*

### GUARDIAN RELAY CATALOG

A relay catalog, 10-A, illustrating and describing basic type (standard) a-c and d-c relays including sensitive, multiple-contact, dual-contact power types, locking relays, and stepping relays has been issued

(Continued on page 45)

# Lick any RADIO REPAIR JOB



Written by Alfred A. Ghirardi, servicing expert and author of the most widely used books in radio training history.

## ... in LESS TIME ... with LESS WORK!

## and a lot MORE PROFITABLY!

Ghirardi's **RADIO TROUBLESHOOTER'S HANDBOOK** quickly helps you diagnose and repair common troubles in over 4800 receiver models and automatic record changers of 202 manufacturers.

ONLY \$5

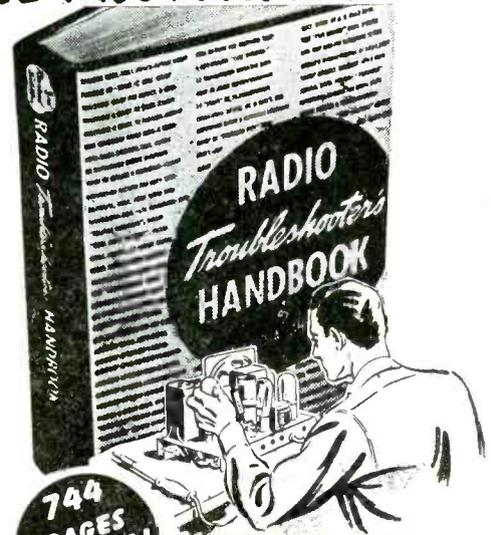
4 radio repair jobs out of every 5 can be handled as easily as falling off a log—without tedious testing. Try this servicing short cut that really works—the one that pays for itself in time saved on the very first job! There's no magic about it. Just common sense. In this big 4 lb., 744-page manual-size **TROUBLESHOOTER'S HANDBOOK**, Ghirardi supplies you with a carefully tabulated and indexed compilation of the common "Troubles (and their Remedies)" that occur in over 4800 models of home radios, auto radios and automatic record changers of 202 manufacturers—the sets that account for well over 90% of all service work today! Clear instructions tell you exactly **WHAT** the trouble is likely to be—exactly **HOW** to fix it. No guessing or lost time!

### NO OTHER HANDBOOK LIKE IT

This priceless Trouble Case History section of the **HANDBOOK** eliminates the need for all troubleshooting and laborious testing on 4 jobs out of 5. Tells you **HOW** to make the necessary repairs **QUICKLY . . . SIMPLY . . . DIRECTLY!** Ghirardi passes on to you the priceless experience from thousands of hours of tedious troubleshooting so you can save **MORE THAN HALF** your precious time and do your work Easier, Faster, more Profitably.

### NOT A STUDY BOOK!

Over 300 additional pages contain parts repair data, diagrams, tube charts, tuning alignment and i.f. transformer data for more than 20,000 receivers, complete RMA color codes, and dozens of graphs, diagrams and other service data, all designed to help you repair **ANY RADIO EVER MADE** easier and twice as fast! You get all this for only \$5 complete!



744 PAGES MANUAL SIZE

### GOODBYE TO TEDIOUS TESTING ON FOUR JOBS OUT OF 5

Trouble Case History repair instructions on over 4800 models of all these makes:

- |                |                 |
|----------------|-----------------|
| Admiral        | Howard          |
| Airline        | Majestic        |
| Arvin          | Motorola        |
| Belmont        | Philco          |
| Brunswick      | Pilot           |
| Capehart       | RCA             |
| Chevrolet      | Silver-Marshall |
| Clarion        | Silvertone      |
| Colonial       | Sonora          |
| Crosley        | Spartan         |
| Emerson        | Stewart Warner  |
| Fada           | Strom-Carlson   |
| Farnsworth     | Westinghouse    |
| G.E.           | Wilcox-Gay      |
| General Motors | Zenith          |

. . . and 172 more!

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**MODERN RADIO SERVICING** is A. A. Ghirardi's famous illustrated and simplified course in professional radio-electronic service work. 32 big chapters, 1300 pages and over 700 illustrations complete in 1 vol. — sold for only \$5! It explains the construction and operation of all types of test instruments—and how to use each one. Shows how to analyze circuits scientifically; how to test, repair and replace components; how to do every phase of home and auto-radio repair work from A to Z by expert, time-saving **MODERN** methods. Worth its weight in gold in giving you a real, honest-to-goodness complete course in the **KNOW HOW** of radio-electronic service work!

1300 pages  
706 illus.

only \$5

## MONEY-SAVING COMBINATION OFFER!

Let the **HANDBOOK** save you time on common service jobs. Let **MODERN RADIO SERVICING** train you for truly professional work. Get **BOTH** big books at special Money-Saving Combination price of only \$9.50 for the two by mailing coupon today.

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**AEROVOX**  
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Ask our distributor for your copy. Keep the Aerovox catalog handy so you can always pick out that type best fitted to the job. Or if you prefer, write us direct for your copy.



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INDUSTRIAL APPLICATIONS

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Export: 13 E. 40th St., New York 16, N. Y. • Cable: 'ARLAB'  
In Canada: AEROVOX CANADA LTD., Hamilton, Ont.

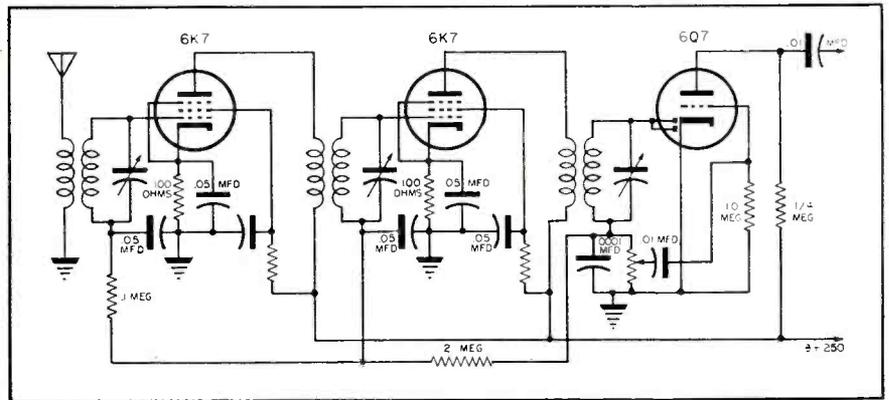


Fig. 4. Circuit of a t-r-f receiver employing avc and audio volume control. The use of a diode detector reduces both the sensitivity and selectivity, and is seldom employed in this type of receiver.

## Servicing Helps

(Continued from page 30)

the antenna terminal, the center lug to ground, and the high end to the r-f cathode, through a minimum resistor, which prevents the reduction of the tube bias voltage to zero. At zero bias, the tube may be damaged, through excessive plate current.

In receivers of t-r-f design employing the antenna-cathode type control, avc is unnecessary. However, if an audio-type control is desired, a diode-pentode or diode high-mu triode may be substituted for the conventional pentode. One such circuit is shown in Figure 4. This receiver employs two r-f stages, a diode detector, and two audio stages. Avc may then be incorporated into the circuit as shown.

It should be noted that this circuit, with the same r-f components, will not be as selective as one employing a plate-type pentode detector, due to the loading effect of the diode detector. However, the diode type of detector will usually give better tone, and will be less critical of adjustment.

In Fig. 4a appears a plate-type pentode detector circuit with the secondary of the second r-f transformer feeding the plate type pentode detector of conventional design. Component values for tubes will depend to a large extent on the B supply voltage and may be obtained from a tube handbook.

## SIGNAL TRACERS

SIGNAL TRACERS ARE EXTREMELY USEFUL Service-Shop instruments. They have been found so handy that many Service Men have provided themselves with two units, just in case one unit breaks down. In many cases, both are of the manufactured type, and in

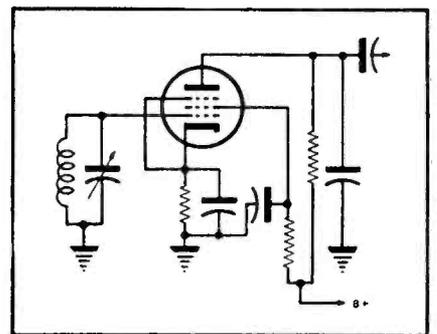
others, one of the tracers has been a home-made emergency type.

In Fig. 5 (page 55) appears a circuit of the home-made type which can serve as an emergency instrument. A 6SK7 is used for a resistance coupled r-f amplifier, and the amplified signal is fed into the diode section of a 6SQ7 for detection. A conventional audio amplifier is then used for further amplification. A single stage tuner may be switched into the circuit at the input to the r-f amplifier. In addition, connections are brought out to pin

(Continued on page 55)

<sup>1</sup>Submitted by F. H. Stewart.

Fig. 4a. A conventional plate-type pentode detector usually found in this type receiver.



## The New SOLAR Model CBB



## CAPACITOR ANALYZER

- Capacitance Range: 10 mmf. to 800 mf.
- Power Factor Range: 0 to 50 percent.
- "Quick as a Wink" C-R tube Wein bridge balancing.
- Built-in adjustable voltage Power Supply.
- Simplified leakage and I-R tests.
- Easy to read color-coded scales.
- Resistance range: 50 to 2,000,000 ohms. 115 V., 50-60 cycles, complete with tubes, \$39.30 (less 2% cash discount)

Other Solar models in stock. Send for Free catalog.

**ADSON RADIO CO.**

221 FULTON ST., NEW YORK 7, N. Y.

**FREE! Send for it NOW!**

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NEW CATALOG**



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in Radio for the  
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Send FREE 1947 ALLIED CATALOG.

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

**NEWS**

(Continued from page 43)

by the Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago 12, Ill.

Contact switches and switch parts are also described.

Presented are charts with operating data and contact data, as well as data on suggested applications.

Requests should be sent in on business letterhead.

\* \* \*

**RIDER MANUAL**

A 2000-page issue of the Rider Manual, Volume XV, with separate clarified schematic for every band of every multi-band set put out by manufacturers during 1946, has been prepared and will be available soon.

The manual will be supplemented by a 200-page handbook, "How It Works," that will explain the theory behind post-war technical features.

Other features of the new manual are data on new record players and changers, ham receivers, etc.



\* \* \*

**S. K. LACKOFF NOW EASTERN AMPLIFIER CHIEF ENGINEER**

S. K. Lackoff has become chief engineer of the Eastern Amplifier Corporation, 794 East 140th Street, New York 54, N. Y. Gerson Lewis has been named executive assistant to Leon Alpert, who is vice president and general manager.

\* \* \*

**ANNUAL N. Y. REP GATHERING, MAY 21**

The New York Chapter of The Representatives will hold its twelfth annual dinner festival on May 21st at the Hotel New Yorker.

\* \* \*

**G. E. RECEIVER KITS FOR SCHOOLS**

Five-tube receiver construction kits for radio education applications in schools and colleges are now available from the specialty division of the G. E. electronics department.

Further information on the kits may be obtained by writing the education section, GE, electronics department, Wolf Street Plant, Syracuse, N. Y.

\* \* \*

**STANCOR OFFICIALS AT SAMS PHOTOFACIT HEADQUARTERS**



Left to right: E. P. Ryan, engineer of the Standard Transformer Corp.; J. R. Ronk and W. D. Renner of Howard Sams; Earl Champion, sales manager of Standard Transformer, and Howard W. Sams

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Harrison, N. J.





# ATLAS

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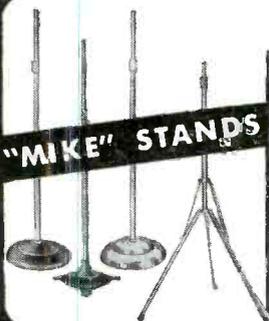
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transformer which have different  $L$  to  $C$  ratios. When channels are switched, an entire new antenna transformer is switched into the circuit and so far as the local oscillator frequency is concerned, another coil is shunted across the sixth coil of the oscillator. Inductor  $L_{16}$  represents the fixed coil of the local oscillator while other sections of coil are shunted across it in switching channels. The local oscillator is again an ultra-audion. Local oscillator signal is coupled to the grid of the mixer through the capacity between circular plates of the band switch.

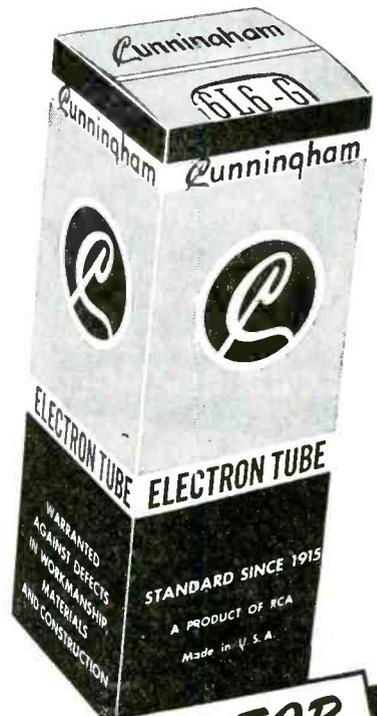
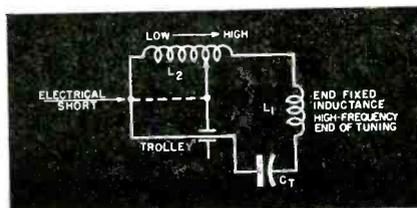
The mixer-oscillator combination of the 3-channel G. E. HM 171 receiver is shown in Fig. 6. The input circuit to this receiver appears rather complicated but is relatively simple when broken down to a series of functional components. For example, the four inductors and four capacitors, which constitute the antenna input circuit, are simply a high-pass filter which will pass the television frequencies onto the grid of the mixer, but will reject all the lower frequencies from approximately 40 mc down, and in particular those frequencies around the i-f range. This reduces interference from low-frequency signals. The secondary of the antenna coil is a tuned circuit in which a number of padders can be inserted, each padder representing one television channel.

The desired signal which appears across a secondary in the G. E. model is coupled through a series resonant circuit to the grid of the mixer. This series-circuit provides a low impedance path for the desired signal and presents a high impedance path to any unwanted signal. Another series resonant circuit appears between the grid and ground. This series resonant circuit is tuned to the i-f range and prevents oscillation and interference at the i-f frequencies.

The local oscillator consists of a modified Hartley oscillator with inductive feedback. In switching channels another coil is added in series with the tuned coil of the oscillator. Local oscillations are coupled from the plate

(Continued on page 48)

Fig. 7. Basic inductuner circuit.



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Model 56

Shuts itself off after the last record has played! Plays "inside-out" or home recordings when in manual play position. Cushioned spindle protects records, Webster 4-pole, shaded pole motor, improved rim drive, feather-touch pickup, and simplified changer mechanism for long dependable service. All parts heavy gauge, copper or plated steel. Plays ten 12-inch or twelve 10-inch records. Dimensions: 14" x 14" x 9" overall (6½" above main plate, 2½" below.)



Model 50

Compact, Efficient, Model 50 is designed for use in smaller units where space is limited. It has the Webster two-tier bonded construction of changer mechanism, cushioned spindle, manual play position, improved rim drive, and feather-touch pickup. All parts are heavy gauge, copper-plated steel, and built for long dependable service. Plays ten 12-inch or twelve 10-inch records. Dimensions: 12" x 12½" x 9" overall (6½" above main plate, 2½" below.)



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of the oscillator to the grid of the mixer to a small fixed capacitor.

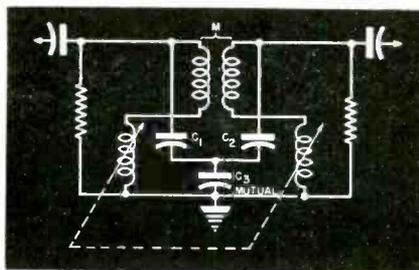
The Du Mont tv receivers feature the Paul Ware<sup>1</sup> variable-inductance system: inductuner. This system, consisting of a cathode-input stage, a mixer and local oscillator, is continuously tuneable from 44 to 216 megacycles. The inductuner consists of a three-section variable inductance arrangement mounted in a die-cast housing. The three coils are mounted on a ball-bearing shaft and trolley arrangement. The coil windings move through a trolley contact which divides each coil into a used and unused portion. An unusual and advantageous feature of the inductuner is that the Q of the tuned circuits per given bandwidth increases toward the high frequency end.

A simple, basic schematic of an inductuner is shown in Fig. 7. Coil L<sub>1</sub> is a variable inductor and the contact nib effectively moves from the low frequency to the high-frequency end of the coil. The contact is shorted to the low-frequency end of the coil so that the unused section of the coil is resonant at a very high frequency. The high-frequency limit of the tuner is set by the fixed end inductor L<sub>2</sub> and the circuit capacity. Consequently, the tuned circuit can be designed for maximum efficiency and proper bandwidth at the high-frequency end of the bandpass. At this high-frequency end of the desired bandpass the top resonant frequency of the unused portion of the coil is still high and does not interfere with the operation of the tuned circuit. Thus, the resonant circuit of the inductuner is varied by means of a tap along the coil and the unused portion of the coil does not affect the characteristics of the tuned circuit.

It is also possible to construct an over-coupled inductuner arrangement, as shown in Fig. 8. This over-coupled transformer consists of two variable coils and, of course, the two fixed coils. To obtain the proper degree of over-coupling over the bandwidth desired, it is necessary to use a combination of inductive and capacitive mutual coupling between tuned circuits. Consequently, as shown, over-coupling occurs between the two end inductors and also by means of the common capacitor C<sub>3</sub>.

<sup>1</sup>Proceedings of the Radio Club of America, Vol. 23, No. 5.

Fig. 8. Overcoupled inductuner.



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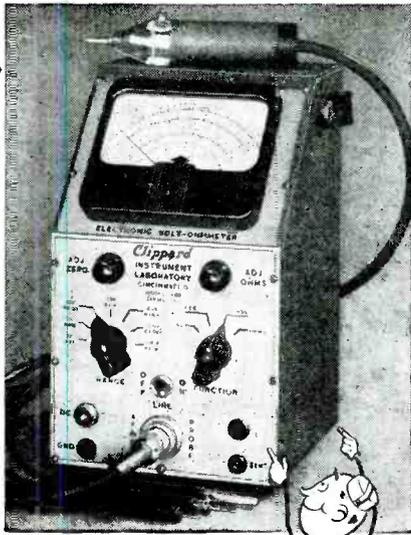
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## Motor Repair

(Continued from page 26)

the bearings fit too tightly on the rotor shaft.

(E) *Frozen bearings.* If oil is not supplied to that part of the rotor shaft which rotates in the bearing, the shaft may become so hot that it will expand sufficiently to prevent movement in the bearing. It is very important to make certain that there is sufficient oil on the shaft at all times.

(F) *Grounded winding.* This will produce a shock when the motor is touched. If the motor is grounded in more than one place, a short circuit will occur which will burn out the winding and perhaps blow a fuse. The test should be for a grounded winding with a test lamp; the repair is by re-winding or replacing the defective coil.

(G) *Wrong voltage or frequency.* This may cause the winding to burn or open. Always check the name plate for correct voltage.

(2) If the shaded pole does not run properly the trouble may be:

(A) *Worn bearings.* In this case the bearing may be slightly worn causing noisy operation and a slower speed.

(B) *Shorted coil.* This will also cause the motor to run noisily and produce smoke from the defective coil.

(C) *Grounded winding.* If grounded in two or more places, the motor may run slowly and smoke up. The remedy is to remove the ground or rewind the coils.

(3) If the motor runs slowly the trouble may be:

(A) *Shorted coils.*

(B) *Worn bearings.*

(C) *Overload.* This may be due to defects in the driven machinery. As a result the motor will run slowly and either burn out or blow a fuse after becoming excessively hot.

(D) *Lack of lubrication.*

(E) *Bearings out of line.* To remedy, the motor should be tapped while running until it runs freely.

(4) If the motor runs hot, the trouble may be:

(A) *Shorted winding.*

(B) *Grounded winding.*

(C) *Worn or tight bearings.*

(D) *Overload.*

(5) If the motor runs noisily the trouble may be:

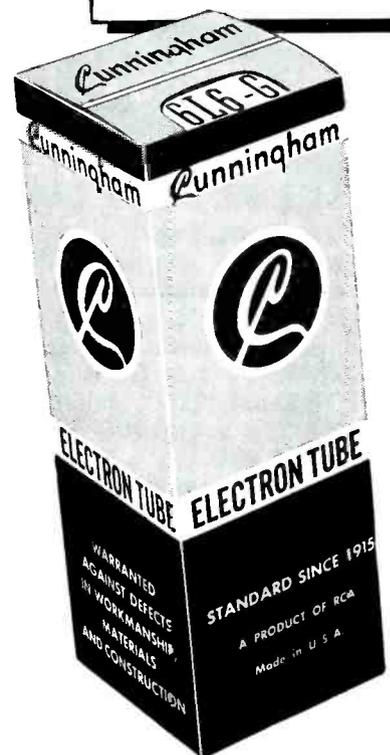
(A) *Shorted winding.*

(B) *Worn bearing.*

(C) *Grounded winding.*

(D) *Foreign material in motor.*

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## Ratio-Detector Circuit

(Continued from page 13)

tude modulation, except when the instantaneous frequency of the applied carrier is exactly equal to the resonant frequency of the discriminator transformer. This condition occurs only twice in every modulation cycle.

### Ratio Detector Operation

A schematic of the fundamental ratio detector is shown in Fig. 2a.  $C_7$  and  $C_4$  have very little reactance at the intermediate frequency, and thus the parallel resonant circuit,  $L_2 C_2$ , is the true load for the driver stage, this stage being shunt fed. A driver stage, in this case, is nothing more than a conventional i-f amplifier preceding the ratio detector.  $L_2$  is inductively coupled to  $L_1$ .

Since the two diodes are in series, they will conduct on the same half cycle, and the rectified current through  $R_3$  will cause a negative potential to appear at the plate of diode 1. The time constant of  $R_3 C_6$  is usually about 0.2 second, so that the negative potential of the plate of diode 1 will remain constant even at the lowest audio frequencies to be reproduced.

The voltages across  $C_3$  and  $C_4$  are additive and their sum is fixed by the constant potential across  $R_3$ . Therefore, while the ratio of these voltages will vary at an audio rate, their sum will always be constant and equal to the voltage across  $R_3$ . The potential at the junction of  $C_3$  and  $C_4$  will vary at an audio rate when an f-m carrier is applied to the detector, hence the audio voltage is extracted at this point and fed into the audio amplifier.

There is no direct d-c return path across either  $C_3$  or  $C_4$ ; the reason for this is twofold. First, a direct return path is not needed because whenever the potential of the junction of  $C_3$  and  $C_4$  is raised or lowered in accordance with the frequency of the voltage applied to the detector, there will be a point on  $R_3$  having a potential equal to the voltage across  $C_3$ . This point will shift up and down on  $R_3$  in synchronism with the audio voltage across  $C_4$ . If this point could be connected to the junction of  $C_3$  and  $C_4$ , a d-c return for each diode would be provided, but no current would flow through the connection because there would be no difference of potential between the

point on  $R_3$  and the junction of  $C_3$  and  $C_4$ . Since no current would flow through this connection, a direct return path would be useless.

### A-M Rejection in Ratio Detector

A rapid increase in the amplitude of the carrier applied to the ratio detector will tend to increase the d-c voltages across  $C_3$  and  $C_4$ . The sum of these voltages must always be equal to the voltage across  $C_6$ . The voltage across  $C_6$  cannot change with a rapid increase in the amplitude of the carrier, due to the large time constant of  $R_3$  and  $C_6$ . Therefore, this constant potential across  $C_6$  prevents the voltages across  $C_3$  and  $C_4$  from rising with an increase in the strength of the carrier. A reduction in carrier amplitude is prevented from appearing as a reduction in the voltages across  $C_3$  in the same way. The constant voltage across  $C_6$  can be considered to be a stabilizing voltage; i.e., it stabilizes the ratio detector output against amplitude modulation of the applied carrier.

The time constant of  $R_3 C_6$  is not too large to prevent average changes in carrier level from appearing as changes in voltage across  $R_3$ ; in other words the voltage across  $R_3$  is proportional to the average strength of the received carrier. Thus this voltage serves as an excellent avc voltage.

## Ser-Cuits

(Continued from page 37)

return spring may not be strong enough to operate tuner.

Power input of these models is 6 amp. at 6.3 v with p-m dynamic-type speaker; 7.5 amp. at 6.3 v with electrodynamic-type speaker.

### Motorola 8-Tube Car Models

An 8-tube superhet basic model is also made by Motorola. This unit has electric push-button tuning, self-contained power supply and external dynamic speaker for instrument panel or cowl installation, with custom-built control head designed for cars built from 1940 to 1946.

These models feature two 6SK7GT as r-f amplifier and first i-f; one 6SA7GT as osc.-mod.; two 6SO7GT as det. avc/and a-f, and audio inverter; two 6V6GT as push-pull power amplifier and one OZ4 or 6X5GT as a full-wave rectifier.

Vibrator is full-wave nonsynchronous. Circuit of the det./avc/a-f, audio inverter and power amplifier appears in Fig. 5 (page 36).

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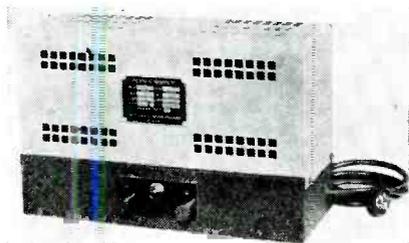
## NEW PRODUCTS

(Continued from page 41)

veloped by Federal Telephone and Radio Corporation, Clifton, New Jersey.

The unit, known as FTR 3246-BS, features an insulating type transformer; a single-phase, full-wave selenium metallic-plate type rectifier, with center-tap connection; an input choke and capacitor filter, and a bleeder resistor. In normal operation the output is said to contain a ripple factor of .3 volt, with regulation of approximately 6 volts at 10 amperes and 8 volts at 2.5 amperes.

Unit weighs 30 pounds and is 14" wide, 9" high and 6" deep.



\* \* \*

### BRUNO BORING BAR SET

A boring bar set and holder kit has been announced by Bruno Tools, Beverly Hills, California.

The kit, designated as No. 650, consists of adjustable boring bar holder No. 600 and boring bar set No. 559.

The adjustable boring bar holder has a capacity of 3/16" to 3/4". Grip is adjustable and grips round, hex, square

and out-of-shape bars as well as drills, reamers and chucks. Centering height is 1 3/16".

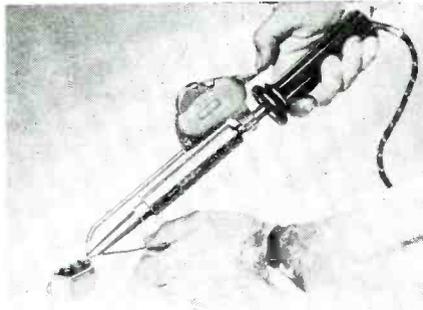
Boring bar set consists of 1/4", 3/8" and 1/2" boring bars. Each bar has one ground high-speed steel threading bit and one blank high-speed steel bit.

\* \* \*

### SOUND EQUIPMENT CORP. SOLDER DISPENSER

A solder dispenser, Kwikfeed, operated by thumb or finger pressure of the hand holding the iron, has been announced by Sound Equipment Corp., 3903 San Fernando Road, Glendale 4, Calif.

Can be attached to electric soldering iron by means of an adjustable adapter leaf. Has positive ratchet feed. Tube which feeds the solder is adjustable.



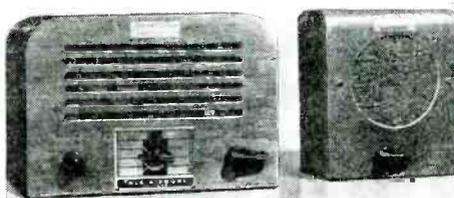
\* \* \*

### TALK-A-PHONE INTERCOM

A line of inter-communication systems, KR-4010, has been announced by Talk-A-Phone Co., Chicago 23, Ill.

Master station system consists of one master station working with up to a total of ten sub-stations. Master stations can call any one or all sub-stations. Sub-stations can also originate calls to master.

Features include Alnico 5 speakers, Insta-Action selector switch and a high-gain amplifier.



\* \* \*

### G. E. VOLT-OHMMETER

An electronic voltmeter, type PM-17, measuring audio and r-f voltages has been announced by the specialty division of the G. E. electronics department.

An ohmmeter circuit is included for measuring high and low values of resistance. Weighs 15 pounds.

\* \* \*

### BELL 10-WATT PORTABLE SOUND SYSTEM

A portable sound system, PA3710-P, featuring a 10-watt amplifier, two 10" speakers (alnico 5) and a phono assembly for 12" records, has been announced by Bell Sound Systems, Inc., 1183 Essex Avenue, Columbus 3, Ohio.

Unit has a microphone input, musical instrument jack, two separate volume controls, tone control, and a crystal microphone.

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(Well-known publisher of radio service data)

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## Built for Service



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- Milliamperes A. C. . . . . 0-2.5/25/250
- Ohms Full Scale 1000/200,000/2,000,000
- Ohms Center Scale . . . . . 50/2250/22,500
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The world is still deceived with ornament."

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CONTINUING OUR DISCUSSION of resistive networks and the problem of determining the total resistance of two 10-ohm resistors in parallel and, in turn, in series with a 20-ohm resistance, we can substitute values for the equation

$$R_{total} = \frac{R_1 \times R_2}{R_1 + R_2} + R_3$$

and we have

$$R_t = \frac{10 \times 10}{10 + 10} + 20; \text{ or } R_t = \frac{100}{20} + 20$$

$$= 5 + 20 = 25 \text{ ohms}$$

Given a problem where three 30-ohm resistors were in parallel, and in turn in series with two 10-ohm resistors in parallel, to determine the total resistance in the circuit, the following combination of formulas would be used.

$$R_{total} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}} + \frac{R_4 \times R_5}{R_4 + R_5}$$

where:  $R_1, R_2, R_3$  are 30 ohms each, and  $R_4, R_5$  are 10 ohms each

Therefore,

$$R_t = \frac{1}{\frac{1}{30} + \frac{1}{30} + \frac{1}{30}} + \frac{10 \times 10}{10 + 10} = \frac{1}{\frac{3}{30}} + \frac{100}{20}$$

But,

$$\frac{1}{\frac{3}{30}} = 1 \times \frac{30}{3} = 10$$

Then,

$$R_1 = 10 + \frac{100}{20} = 10 + 5 = 15 \text{ ohms}$$

Sometimes a problem is presented in different form. For example, suppose we wanted to place a resistance in parallel with a 30-ohm resistor to create a total resistance of 12 ohms. The formula used would be

$$R_{\text{total}} = \frac{R_1 \times R_2}{R_1 + R_2}$$

where,

$$R_{\text{total}} = 12 \text{ and } R_1 = 30.$$

Then,

$$12 = \frac{30 \times R_2}{30 + R_2} \text{ or, } 12(30 + R_2) = 30R_2$$

$$\text{or } 360 + 12R_2 = 30R_2$$

Then,

$$2R_2 - 30R_2 = -360$$

$$-18R_2 = -360$$

$$-360$$

$$R_2 = \frac{-360}{-18} = 20 \text{ ohms}$$

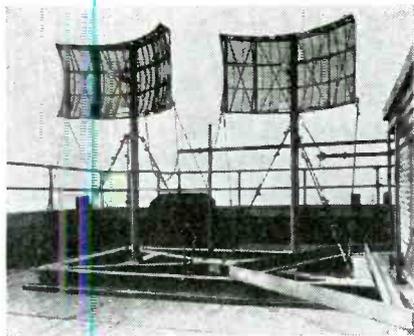
## F-M Alignment

(Continued from page 17)

erator should be high enough so that the limiter is functioning.

[Data courtesy Technical Service Section, Electronics Dept., General Electric.]

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Transmitting and receiving antennas at New York City terminal of 4000-mc relay system operating between N. Y. and Webster and Wabun Hill, Mass.

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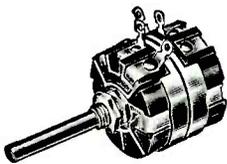






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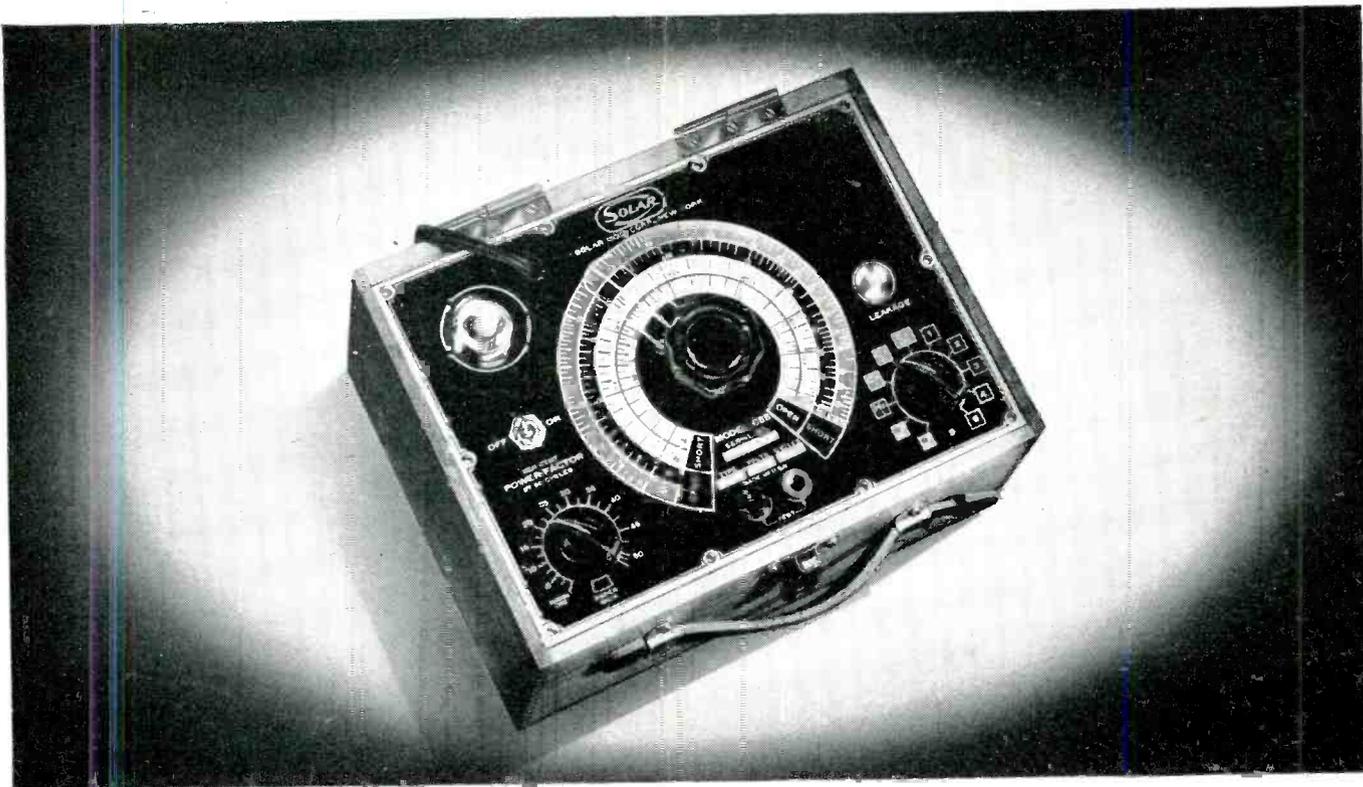
## JOTS AND FLASHES

A VARIETY OF BUSINESS-BUILDING sales aids are now being prepared for the Service Man. The aids will include very useful record material for the Shop and promotional material such as blotters, booklets, mats, etc. We'll be covering the application possibilities of these sales aids in a series of articles in SERVICE. Watch for this series. . . . George D. Barbey Co. has moved into a new building at 2nd and Penn Sts., Reading, Pa. Incidentally, this is the 30th anniversary of the George Barbey Company. . . . Stephen J. deBaun, formerly with the press department of NBC, has been named publicity director of the RCA showroom at 36 W. 49th Street, N.Y.C. . . . Leonard Carduner, vice president of the Garrard Sales Division of the British Industries Corporation, is now in London studying the technical and sales aspects of record changers. . . . The Medco Mfg. Co., now known as the Telesonic Corp. of America, will soon announce a table-model video receiver. The company located at 5 W. 45th Street, N.Y.C., is headed by Henry Schein. . . . Fred Ogilby has become sales manager of the radio division of Philco. Ogilby succeeds John M. Otter who is now Philco's general sales manager. . . . Mr. and Mrs. Harry J. Gold have become the parents of a little one, Richard David. Harry Gold is the advertising agent for such accounts as Amperite, Par-Metal Products, etc. . . . John K. Hilliard, chief engineer of Altec Lansing, delivered a paper and gave a demonstration on the intermodulation analyzer in a meeting sponsored by the Allied Radio Corporation, Chicago. Guests included representatives of many Chicago stations, plants and universities. . . . The current issue of the "Centralab Jobber Outlook" contains quite an interesting discussion of self-service Shops. . . . R. R. Huttmacher of Salescrafters, Inc., 510 N. Dearborn Street, Chicago, will represent Webster-Chicago in Wisconsin, Northern Illinois, Upper Michigan and the Lake and LaPorte counties in Indiana. . . . A new plant will be built by the Magnavox Co. in Paducah, Kentucky, where speakers, transformers, and household appliances will be made. . . . A branch plant at 9500 St. Lawrence Avenue, Montreal, Canada, has been opened by the Insuline Corporation of America. The plant, to be known as the Insuline Corporation of America (Canada) Limited, will produce a line similar to the American line. . . . United Speakers, Inc., 3120 East Pico Blvd., Los Angeles, is now producing a volume of speakers for the Pacific Coast manufacturers. Paul H. Tartak is president of the company, and Al M. Dresner is vice president and general manager. . . . Perry Saftler, 53 Park Place, N.Y.C., is now New York metropolitan area representative for the Astatic Corporation. . . . Dave Kubrick and Irv Brown have organized a representatives office, the Progressive Marketers, at 41 Union Square, N.Y.C. They'll handle Transvision Television, Adaptol, Premier Electronic Labs. and Oak Ridge TV and F-M Antenna lines. . . . Burke Hill and Robert Peel are now with the Morris F. Taylor Co., Silver Springs, Md., as sales engineers. . . . Harry Adelman of Scenic Radio and Electronics, 53 Park Pl., N.Y.C., is the proud daddy of a baby girl. . . . Chief Electronics has been incorporated.

## ADVERTISERS IN THIS ISSUE

### SERVICE INDEX—MAY, 1947

ADSON RADIO CO. . . . .	44
Agency: Bass & Weber Co., Inc.	
AEROVOX CORPORATION . . . . .	44
Agency: Austin C. Lescaubour & Staff	
ALLIED RADIO CORPORATION . . . . .	45
Agency: George Brodsky, Advertising	
THE ASTATIC CORPORATION . . . . .	41
Agency: Wearstler Advertising, Inc.	
ATLAS SOUND CORP. . . . .	47
Agency: Burke & Wayburn Adv. Co.	
BLACK INDUSTRIES . . . . .	36
Agency: G. M. Basford Co.	
CAPITOL RADIO ENGINEERING INSTITUTE . . . . .	36
Agency: Henry J. Kaufman & Associates	
CHICAGO INDUSTRIAL INSTRUMENT CO. . . . .	52
Agency: Turner Adv. Agency	
CHRISTY SUPPLY CO. . . . .	49
Agency: E. H. Brown Adv. Agency	
CLAROSTAT MFG. CO., INC. . . . .	56
Agency: Austin C. Lescaubour & Staff	
CLIPPARD INSTRUMENT LABORATORY . . . . .	49
Agency: Sarage & Talley	
CONCORD RADIO CORP. . . . .	53
Agency: E. H. Brown Adv. Agency	
CORNELL-DUBILIER ELECTRIC CORP. . . . .	Inside Front Cover
Agency: Reiss Advertising	
ALLEN B. DUMONT LABS., INC. . . . .	4
Agency: Austin C. Lescaubour & Staff	
ELECTRIC SOLDERING IRON CO., INC. . . . .	46
GENERAL CEMENT MFG. CO. . . . .	48
Agency: Sander Rodkin Adv. Agency	
GENERAL ELECTRIC CO. . . . .	1, 8, 40
Agency: Maxon, Inc.	
GENERAL ELECTRIC LAMP DEPT. . . . .	21
Agency: Batten, Barton, Durstine & Osborn, Inc.	
GUARDIAN ELECTRIC . . . . .	10
Agency: Kennedy & Co.	
INTERNATIONAL RESISTANCE CO. . . . .	11
Agency: John Falkner Arndt & Co., Inc.	
J. F. D. MFG. CO. . . . .	50
Agency: Bergman-Jarrett Co.	
LIFETIME SOUND EQUIPMENT CO. . . . .	48
Agency: The Miller Agency Co.	
THE McMURDO SILVER CO., INC. . . . .	39
Agency: Edward Owen & Co.	
MAGNA-METAL PRODUCTS CO. . . . .	54
Agency: Equi Adv. Agency	
MAGUIRE INDUSTRIES, INC. . . . .	31
Agency: City Adv. Agency	
P. R. MALLORY & CO., INC. . . . .	19
Agency: The Atkin-Kynett Co.	
M. V. MANSFIELD CO. . . . .	54
MUELLER ELECTRIC CO. . . . .	51
MURRAY HILL BOOKS, INC. . . . .	37, 43
Agency: The Harry P. Bridge Co.	
NEWCOMB AUDIO PRODUCTS CO. . . . .	42
Agency: Stevens-Hall Advertising	
OLSON RADIO WAREHOUSE . . . . .	55
Agency: The Jessop Adv. Co.	
PRECISION APPARATUS CO., INC. . . . .	48
Agency: Shappe-Wilkes, Inc.	
RADIO CORPORATION OF AMERICA . . . . .	9, 27, 45, 47, 49, 51, Back Cover
Agency: J. Walter Thompson Co.	
RADIONIC EQUIPMENT CO. . . . .	46
Agency: Republic Adv. Agency	
RAYTHEON MFG. CO. . . . .	23
Agency: Walter B. Snow & Staff	
JOHN F. RIDER PUBLISHER, INC. . . . .	6
Agency: Lansford F. King, Advertising	
HOWARD W. SAMS & CO., INC. . . . .	3
Agency: The Atkin-Kynett Co.	
SIMPSON ELECTRIC CO. . . . .	7
Agency: Kreiker & Melan, Inc.	
SOLAR CAPACITOR SALES CORP. . . . .	Inside Back Cover
Agency: O. S. Tyson & Co., Inc.	
SPRAGUE PRODUCTS COMPANY . . . . .	29
Agency: The Harry P. Bridge Co.	
STALLMAN OF ITHACA . . . . .	54
STANDARD TRANSFORMER CORP. . . . .	5
Agency: Burnett-Kuhn Adv. Co.	
SYLVANIA ELECTRIC PRODUCTS, INC. . . . .	12
Agency: Newell-Emmett Co.	
TUNG-SOL LAMP WORKS, INC. . . . .	35
Agency: E. M. Freystadt Associates, Inc.	
THE WARD PRODUCTS CORP. . . . .	53
Agency: Burton Browne, Advertising	
WEBSTER-CHICAGO CORPORATION . . . . .	48
Agency: William Hoffman & Associates	
WESTON ELECTRICAL INSTRUMENT CORP. . . . .	33
Agency: G. M. Basford Co.	
WRIGHT, INC. . . . .	52
Agency: Kay Advertising, Inc.	



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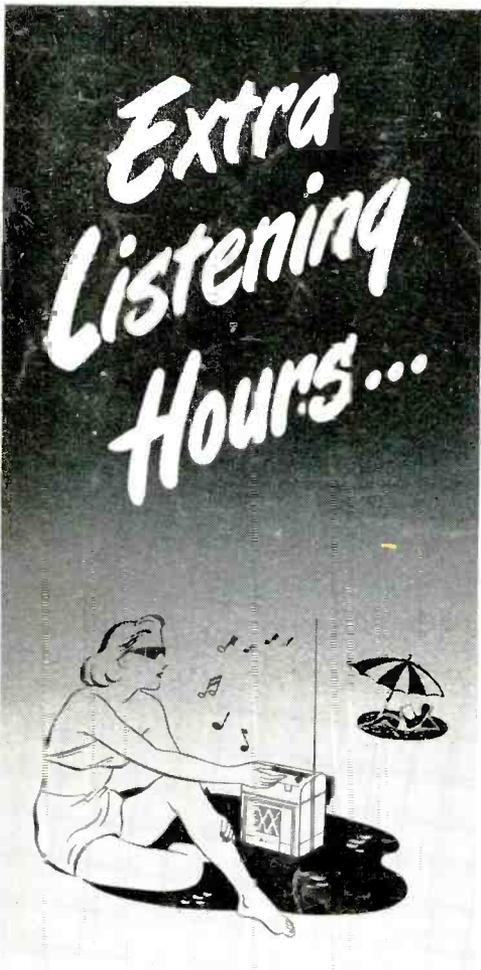
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