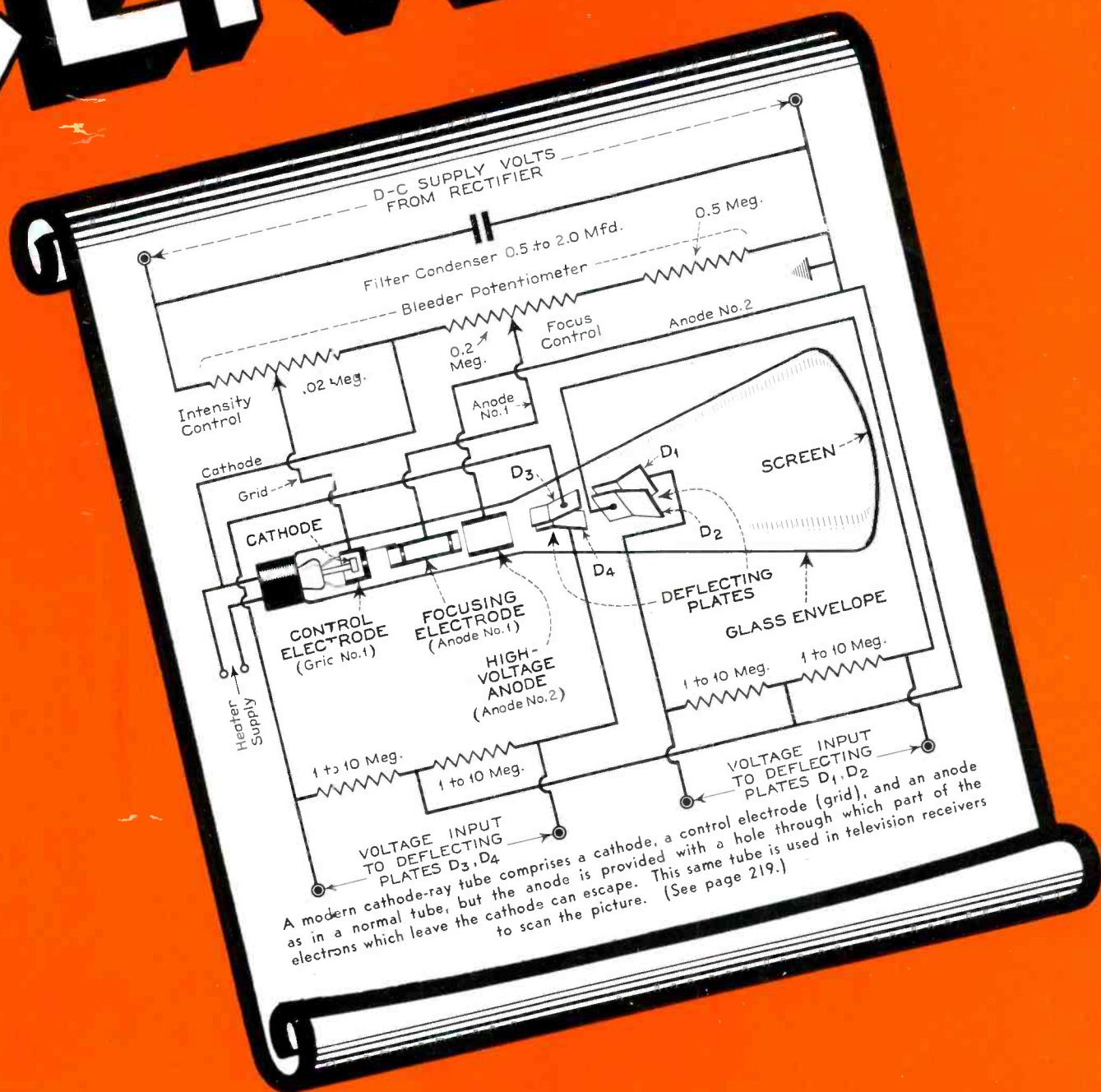


SERVICE



May
1939

ROLL CALL *of famous names*

The selection of Mallory Vibrators, as original equipment, by the set manufacturers who are the very tops in the industry is the best possible evidence of their fine performance. Mallory Replacement Vibrators offer the same outstanding performance that has won the manufacturer's acclaim. The millions in use testify to their trouble-free, long life.

FREE! New Mallory 20-Page Vibrator Guide



Just off the press this new, up-to-the-minute Replacement Vibrator Guide gives all the answers on auto radio installation and service.

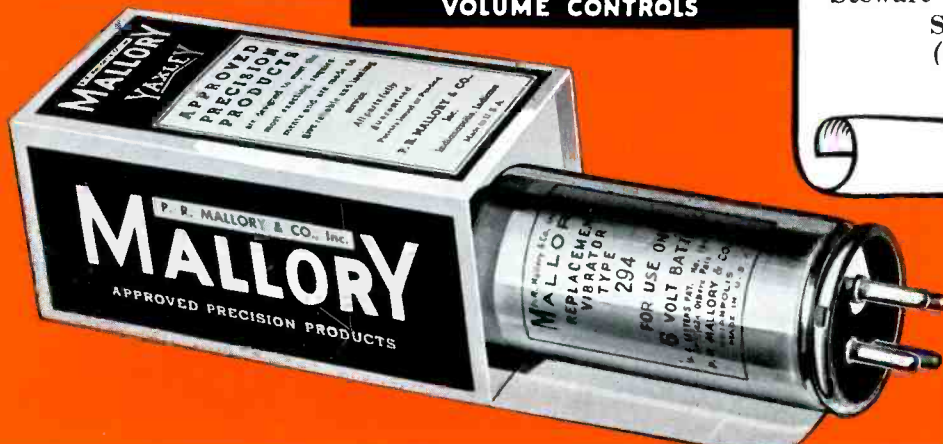
It includes complete replacement chart for all makes of auto radio and battery operated household receivers... practical vibrator servicing and testing information with scope pictures... installation and interference elimination in 1939 cars... vibrator connection charts and complete cross reference of Mallory Vibrators by receiver make and model.

See your distributor for a FREE copy today.

Use
P. R. MALLORY & CO. Inc.
MALLORY
REPLACEMENT
CONDENSERS... VIBRATORS

P. R. MALLORY & CO., Inc.
INDIANAPOLIS INDIANA
Cable Address—PELMALLO

Use
YAXLEY
REPLACEMENT
VOLUME CONTROLS



P. R. MALLORY & CO. Inc. **MALLORY** **VIBRATORS**

are Original Equipment
in Auto Radio Receivers
built for:

BUICK... CHEVROLET... FORD
HUDSON... NASH... OLDSMOBILE
PONTIAC... SEARS-ROEBUCK
WESTERN AUTO... FIRESTONE

and in Receivers made by:

Canadian Marconi
Colonial
Crosley
Detrola
Delco (Kokomo)
Fairbanks-Morse
Galvin (Motorola)
Gilfillian
Mission Bell
Noblitt Sparks (Arvin)
Northern Electric (Canada)
Packard Bell
Pilot
RCA
RCA-Victor, Ltd. (Canada)
Radio Products
Rogers-Majestic, Ltd.
Sparton (Canada)
Stewart-Warner
Stewart-Warner-Alemite (Canada)
Stromberg-Carlson
(U. S. and Canada)
Zenith

NEW *VIBRAPACKS!

Three new Vibrapack units have been added to the Mallory line of Vibrator Power supplies, designed to supply B voltage to operate portable and mobile radio transmitters and receivers, public address systems, and scientific apparatus.

Send for Vibrapack Booklet Form E-555-B

*TRADE MARK REG. U. S. PAT. OFF.



SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U. S. Patent Office

Edited by
ROBERT G. HERZOG

Published Monthly
by the

**Bryan Davis
Publishing Co.**
Inc.

19 East 47 Street
New York City

Telephone PLaza 3-0483

BRYAN S. DAVIS
President

JAS. A. WALKER
Secretary

SANFORD R. COWAN
Manager

PAUL S. WEIL
Advertising Manager

A. GOEBEL
Circulation Manager

Chicago Office:
608 S. Dearborn Street
C. O. Stimpson, Mgr.
Telephone Wabash 1903

Wellington, New Zealand:
Tearo Book Depot

Melbourne, Australia:
McGill's Agency

Entered as second-class
matter June 14, 1932, at
the Post Office at New
York, N. Y., under the
Act of March 3, 1879.
Subscription price: \$2.00
per year in the United
States of America and
Canada; 25 cents per
copy. \$3.00 per year in
foreign countries; 35
cents per copy.

Contents

Auto-Radio Data.....	252		
Battery Portables <i>By Henry Howard</i>	230		
Cathode-Ray Tube Characteristics.....	223		
Instantaneous Recording <i>By Maurice Apstein</i>	224		
Portable Receiver Battery Replacement Chart.....	234		
RCA TRK9, TRK12 Television Circuit.....	242		
Recorder Characteristics.....	226		
Show Program.....	257		
Specifications of 1939-40 Television Receivers.....	244		
Sync Motors on D-C <i>By M. E. Reslag</i>	229		
Technical Features of 1939-40 Portable Battery Receivers.....	236, 238		
Television.....	241		
Television Antennae <i>By Madison Carvein</i>	246		
Your Cathode-Ray Oscilloscope <i>By J. H. Reyner</i>	219		
Antenna	216		
Associations	255-257		
Auto Radio			
Auto-Radio Data.....	252		
Book Review	249		
Case Histories			
Wells-Gardner 62-403.....	249		
Circuits			
Cathode-Ray Deflecting Plate Circuit.....	219		
Cathode-Ray Oscilloscope..... Front Cover	220		
Deflection Amplifier.....	220		
Detrola 282, 286 Loop Amplifier.....	232		
Emerson CE259, -260, -263 Resistance I-F	232		
Garod BP5.....	240		
Oscillator for D-C Operation of Sync			
Motors.....	229		
Philco 39-72T.....	240		
RCA TRK9, TRK12 Television Chassis.....	242		
Rhombic Television Antenna.....	246		
Sentinel 170BL.....	240		
Setchell-Carlson 55.....	240		
Time-Base Circuit.....	220		
Two-Wire Electrodynamic.....	255		
Vibrator Circuit for D-C Operation of			
Sync Motors.....	229		
Cover Diagram			
Cathode-Ray Oscilloscope Circuit.....	219		
Highlights	250, 251		
Index to Advertisers	262		
Manufacturers	254, 259, 260		
Sound Facts			
Instantaneous Recording			
<i>By Maurice Apstein</i>	224		
Recentering Voice Coils			
<i>By J. N. Gotten</i>	240		
Recorder Characteristics.....	226		
Two Wire Electrodynamic.....	255		
Television			
Cathode-Ray Tube Characteristics.....	223		
RCA TRK9, TRK12 Television Circuit.....	234		
Specifications of 1939-40 Television Re-			
ceivers.....	244		
Television.....	241		
Television Antennae			
<i>By Madison Carvein</i>	246		
Your Cathode-Ray Oscilloscope			
<i>By J. H. Reyner</i>	219		
Test Equipment			
Cathode-Ray Tube Characteristics.....	223		
Your Cathode-Ray Oscilloscope			
<i>By J. H. Reyner</i>	219		

Copyright 1939 Bryan Davis Publishing Co., Inc.



A N T E N N A

• • • trade show

EACH year at this time we raise up our trumpets to herald the approach of the National Radio Parts Trade Show, to be held this year, at the Stevens Hotel, Chicago, Wednesday, Thursday, Friday and Saturday, June 14, 15, 16 and 17. Each year has brought a show which was bigger and better than all previous shows. This year's gathering promises to be no exception. The number of booths already taken and the indications of probable attendance point to a show which will easily exceed last year's record.

We can do no more than urge you to attend. The parts manufacturers are putting forth their best efforts to make their displays interesting and instructive . . . the exhibits will be well worth seeing, the lectures worth hearing.

Readers of *SERVICE* are invited. There is no admission charge.

Visit our booth on Steinmetz Avenue, Exhibition Floor, Stevens Hotel, Chicago.

• • • television

IN THE April issue of *SERVICE* we stated that "the public wants television". At that time we based that statement on our personal experiences and those of our friends and business acquaintances. We can now, however, present facts that prove this statement. At the New York World's Fair and at the Golden Gate International Exposition the television demonstrations are among the most popular of the many exhibits. At the New York Fair for the last few days special policemen have been required to keep the enormous crowds from tarrying too long in front of the television receivers.

RCA, General Electric and Westinghouse were very optimistic when they installed the demonstration equipment—yet the crowds exceed even their fondest hopes.

The same crowds, when discussing television with the booth attendants, show that they have followed developments very closely and are familiar with the state of the art.

It must be remembered that this audience is not composed of local residents who are in the immediate television service area. They represent a cross section of the entire country. Many will undoubtedly become pur-

chasers of television receivers as soon as transmissions spread to their locality.

• • • this month

WE PRESENT Mr. J. H. Reyner's article on the Cathode-Ray Oscilloscope on page 219. We believe that this article is timely, not only because of the importance of the cathode-ray oscilloscope in your everyday service work, but also because the same tube used in the oscilloscope is used as the picture tube in a television receiver. The technical description which Mr. Reyner gives applies to both tubes.

Television is definitely here. Even if you are not now in a service area, it will not be very long before you will be. The time to study up is now, before your competitors are able to take away your business because of superior knowledge. The cathode-ray oscilloscope is an important tool in the servicing of television receivers. Read Mr. Reyner's article and brush up on your oscilloscope technique!

ON PAGES 230 to 238, inclusive, we present the technical features and battery replacement numbers for practically every battery portable made. In future issues of *SERVICE* we will attempt to feature new receivers in this fashion in place of our previous General Data section.

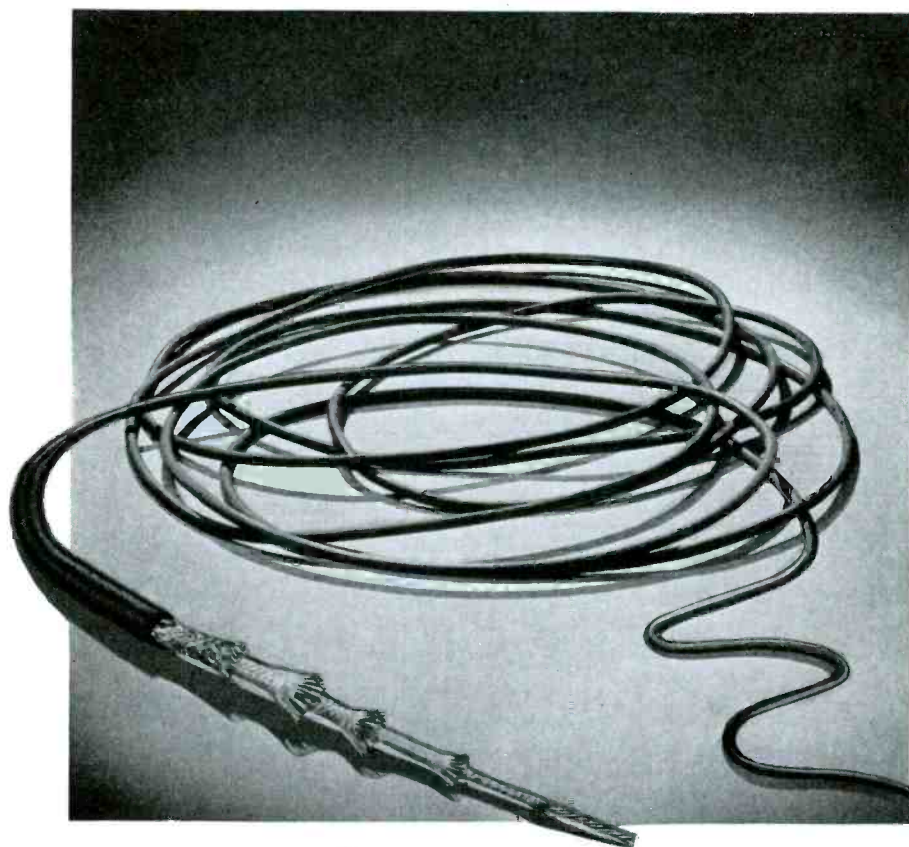
We can by this method cover the entire field and give more complete information.

Two methods are shown, on page 229, whereby small a-c motors can be operated on either a-c or d-c. This should present an extra avenue for profits to the enterprising Service Man. Low price record players are available for a-c operation . . . many, in fact, were distributed as circulation incentives by newspapers throughout the country. . . . The Service Man who can convert these to universal operation, inexpensively, should reap a good reward.

MADISON CAWEIN, recognized as one of the foremost television engineers in the country, discusses television antennae on page 246. His appointment to direct television receiver development for Farnsworth has just been announced. *SERVICE* will feature an exclusive series of articles on television fundamentals by Mr. Cawein starting in the next issue.

OVER A MILLION BENDS

Without Conductor Breakage!



New **LENZ** Super Flexible
CRYSTAL MICROPHONE CABLE

- Conductor of Super Flexible Construction and great mechanical strength.
- Non-Hygroscopic, high dielectric insulation.
- Close tinned copper electrostatic shield.
- Tough, wear-resisting, rubber jacket.

Mail Coupon for Free Sample

LENZ ELECTRIC MANUFACTURING CO.
 1751 NO. WESTERN AVE. CHICAGO, U. S. A.



"IN BUSINESS SINCE 1904"

MAIL COUPON FOR FREE SAMPLE!

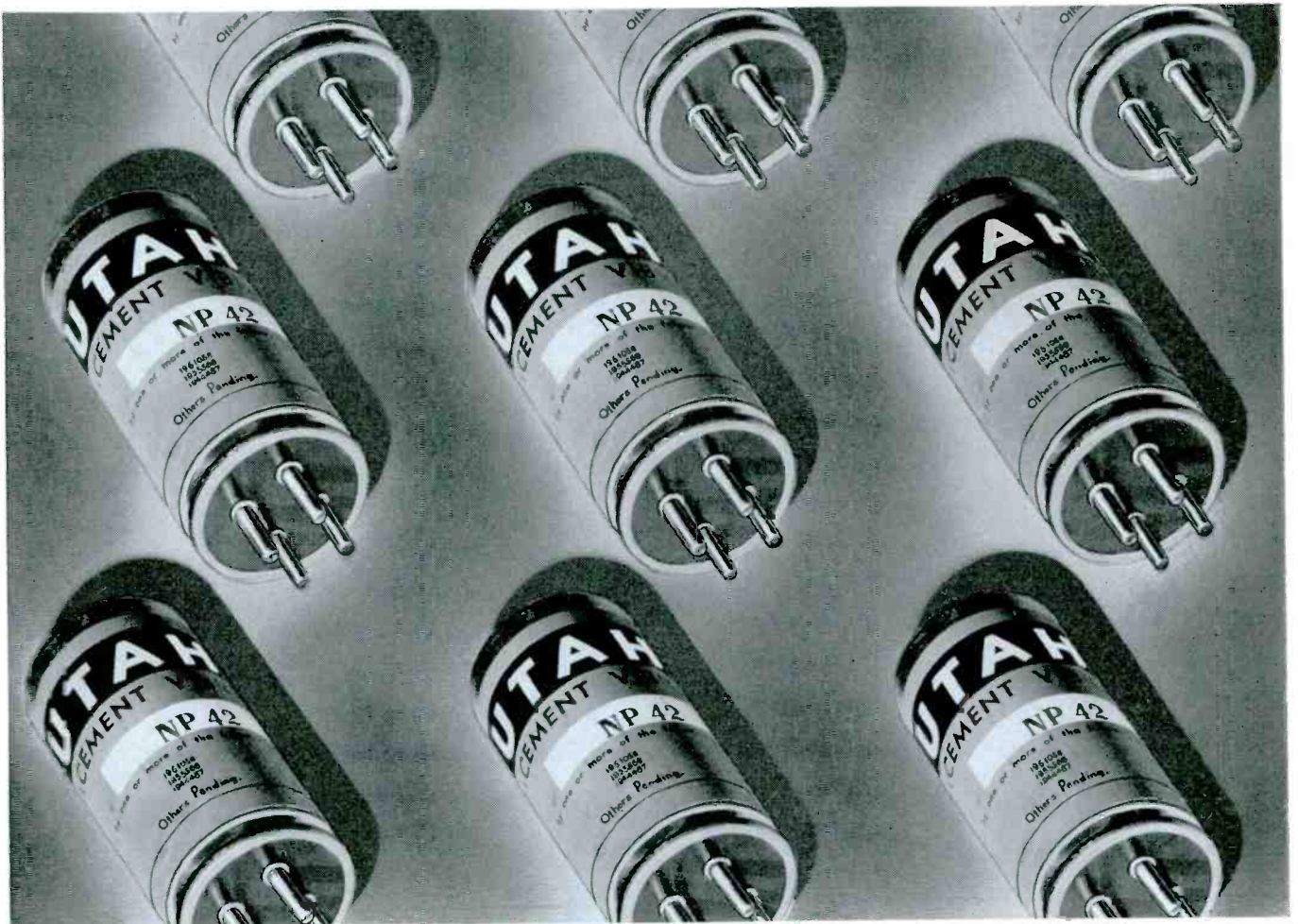
Lenz Electric Manufacturing Co.
 1751 No. Western Ave., Chicago, U. S. A.
 Please rush me sample of Lenz Super Flexible
 Crystal Mike Cable.

Name

Position

Company

Address



WHY THE PREFERENCE FOR UTAH VIBRATORS HAS GROWN WITH THE INDUSTRY

Utah Vibrators—the first to be used by automobile manufacturers in their auto radios—have maintained their leadership because of the outstanding design and advanced engineering which keep pace with modern radio development.

The most important vibrator developments have originated in the Utah laboratory. Some of them, which contributed largely to the 4-year, 900% increase in auto radio volume were the original introduction, by Utah, of:

- the FULL WAVE Auto Radio Vibrator
- the Vibrator with armature swinging ACROSS the pole-piece
- the double parallel side member frame
- the SHUNT starting vibrator
- the vibrator reed with REDUCED CROSS-SECTION for graduated flexibility.

These and many other improvements, *plus* Utah uniformity and dependability, have won the continued preference for Utah Vibrators as original equipment and for replacement requirements.

SPEAKERS • TRANSFORMERS • UTAH-CARTER PARTS

UTAH RADIO PRODUCTS CO.

CHICAGO, ILLINOIS

CABLE ADDRESS: UTARADIO—CHICAGO

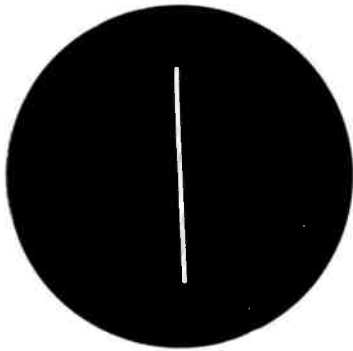


Fig. 5a. An alternating voltage applied across the Y (vertical) deflecting plates will cause the spot to move up and down.

YOUR Cathode Ray

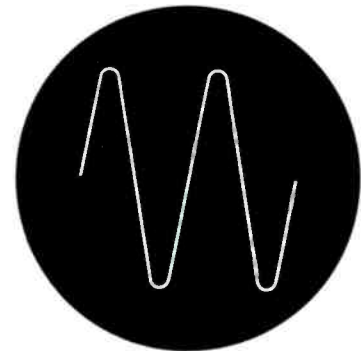


Fig. 5b. If a linear voltage is applied to the X (horizontal) plates at the same time, the spot will seem to trace a wave.

OSCILLOSCOPE

FOR many years our knowledge of the behavior of radio apparatus has been largely inferential, based on measurements made with static meters. Our methods of testing have had to be more or less blind. Considerable skill was often necessary in drawing the correct conclusion. This was particularly true in every-day service work.

The advent of the cathode-ray oscilloscope at a commercial price has enabled the actual variation of the currents to be observed and has thereby rendered testing technique many times speedier and more certain. It is, however, essential that the operation of such equipment be thoroughly understood.

• • • the tube

The general arrangement of a modern cathode-ray tube is shown on the front-cover. It comprises a cathode, a control electrode (grid), and an anode as in a normal tube, but the anode is provided with a hole through which a part of the electrons which leave the cathode can escape. These electrons travel down the tube in a compact beam or pencil until they reach the far end

where they impinge on a screen of fluorescent material and produce a spot of light.

This spot is used to trace the pattern required (by means which will be discussed shortly) and it is therefore nec-

By J. H. REYNER

essary that it shall be as sharp and brilliant as possible. Hence the tube is constructed so that the pencil of electrons which shoots through the hole in the anode shall be compact and rich in electrons since the brilliance of the spot is directly dependent on the number of electrons in the beam—i.e., on the beam current. The cathode is made very small, consisting of a small blob of emitting material mounted on the end of an indirectly heated cathode sheath. Additional focusing is necessary, how-

ever, to obtain a really sharp spot.

A modern tube incorporates several refinements. Instead of a simple plate for the anode two or more cylinders (see Fig. 1 and also front cover) are used. In order to produce a high velocity of the electrons, so that they have appreciable energy when they reach the screen and hence produce a brilliant spot, the voltage on the second anode is higher than that used in ordinary tubes, 800 to 1200 volts being usual. The first anode is maintained at a voltage somewhat lower than this and the control electrode (grid) is kept negative to the cathode just like the grid of a tube. This control electrode limits the emission from the cathode to a suitable value and concentrates the electrons into a narrow little bundle or pencil.

This concentrating or focusing action is continued by the two anodes. The electrostatic fields set up by the differing potentials cause any divergent electrons to return to the axis. This form of tube thus has two controls—the bias control on the control electrode, which controls the number of electrons in the beam (intensity control) and the first

Fig. 3. A positive potential applied to either deflecting plate will attract the electrons and deflect the beam.

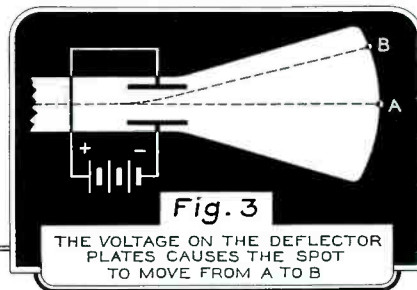
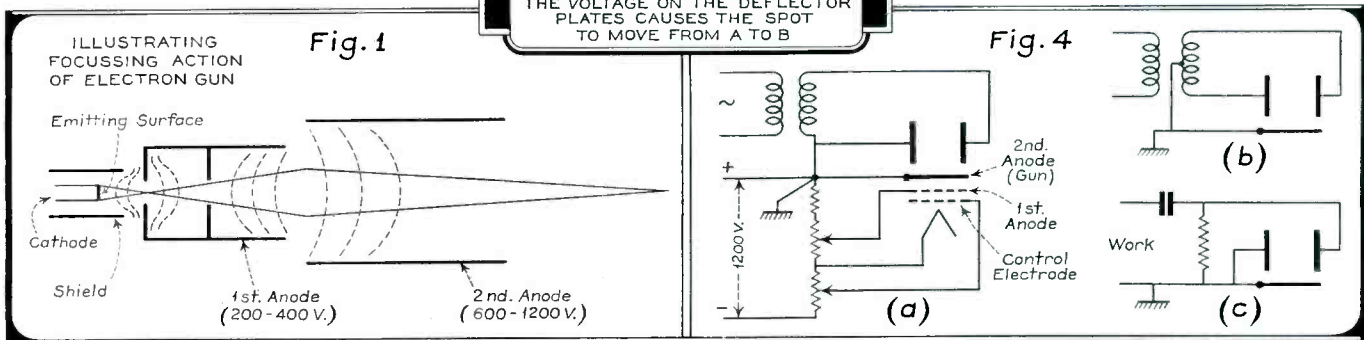


Fig. 1. Instead of a simple plate, the modern cathode-ray tube employs two or more cylinders.

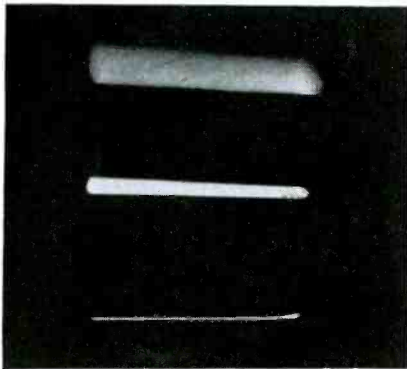
Fig. 4a, b, c. If the deflecting plate circuit is not connected to the second anode, the plates will collect electrons from the beam.



anode voltage control (focus control). For any setting of the control electrode bias there is an optimum setting of the first anode voltage. Proper focus is only obtained when *both* controls are correctly set.

This may be tested by setting the oscilloscope in operation which some suitable deflecting voltage on the horizontal scan (e. g., from the internal time base). Rotating the intensity control in the direction which reduces the negative bias will then cause the brilliance of the line to increase. The focus control is then adjusted and it will be found that it also alters the brilliance. Restore the brilliance to its original value with the intensity control. If the focus is better, continue the process until the line on the screen is sharp and clear. If the focus is worse the adjustment must be carried out in the reverse direction, using both controls as before. With practice the process only takes a few seconds and the photograph of Fig. 2 shows the type of result obtained.

Fig. 2. With practice, focusing takes only a few seconds. The focusing control should be adjusted so that the line on the oscilloscope screen is thin and bright.



• • • tracing a pattern

The electron beam will normally travel down the axis of the tube, but the value of the tube lies in the fact that we can deflect the beam by the application of electrical or magnetic forces. If the beam is deflected the spot on the screen changes its position and it is thus possible by the application of suitable deflecting forces to cause it to trace almost any desired pattern.

In the customary oscillograph tube the deflection is produced electrostatically. Two plates are located one on each side of the beam. A positive potential applied to either plate will attract the electrons and thus cause the beam to deflect as shown in Fig. 3. Similarly a negative potential will repel the beam and in fact the effective deflection is dependent on the potential difference across the plates. If they are both at the same potential no deflection will result.

It should be noted that the deflector plates must be connected to the anode of the tube. Fig. 4 shows several methods of connecting the deflector plates. In Fig. 4a one plate is grounded while the other is connected to the live side of the work. At (b) the circuit is symmetrically arranged, while (c) shows the system usually adopted in oscilloscopes to isolate any d-c potential in the work circuit so that the beam is only deflected by the alternating component. The connection to gun is then obtained through high resistance leaks.

If the deflector plates are not connected to the anode they will collect electrons from the beam, charge negatively and set up a space charge which may cut off the beam completely so that the spot disappears.

• • • visual persistence

Fig. 5 illustrates the way in which a pattern is built up on the screen. It is customary to provide two pairs of deflecting plates at right angles, one causing movement of the spot in the horizontal direction and the other in the vertical direction.

An alternating voltage applied across the vertical plates will cause the spot to move up and down. If the frequency is very low the movement can be observed, but if it is more than a few cycles per second (e.g., the 60-cycle power line frequency) the eye will be unable to follow the movement and the spot will appear to lengthen out into a line. This is due to the visual persistence of the eye which continues to see the spot after it has gone. Since visual persistence lasts for about 0.1 second at normal brilliance the spot has time, on a 60-cycle wave, to move up and down over its travel several times and the eye will see the spot in all its positions at once, giving the impression of a continuous line. It should always be remembered, however, that this apparently stationary line of light is really built up by a rapidly oscillating spot.

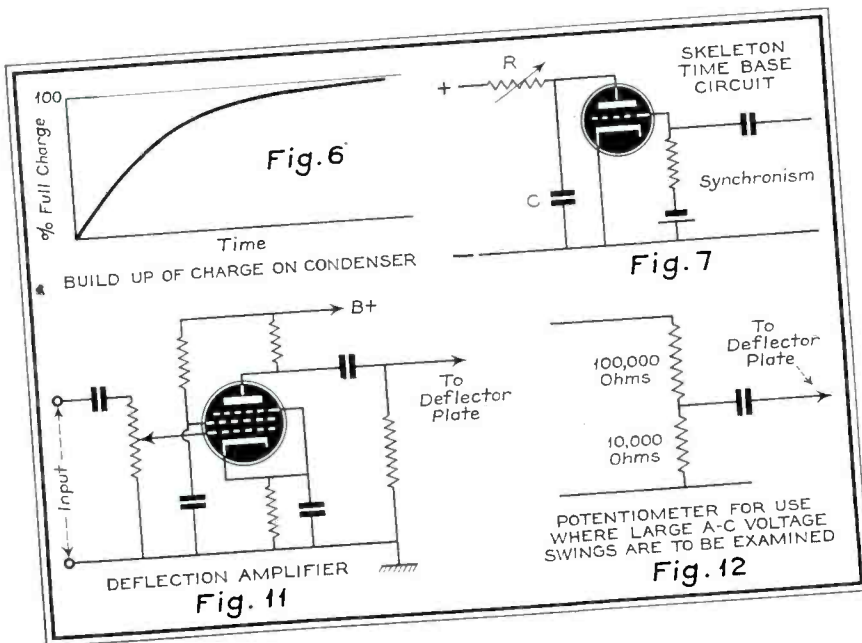
Bearing this in mind, let us see what happens if a second voltage is applied to the horizontal plates. We will make this voltage steadily increase at a uniform rate. As the spot moves up and down it will be deflected to one side and will therefore trace out a wave instead of a single line and from the shape of this wave we can see whether any distortion is occurring.

The speed of travel across the screen must be some small fraction of the vertical speed. For example, if the work is a 1000-cycle oscillation, then if we make the horizontal traverse 1/1000 second long we shall trace one complete wave. A traverse 1/100 second would show ten waves.

But 1/100 second is too short for the eye to follow, though visual persistence would result in some faint impression of waves as the spot flashed across the screen. If the waveform under examination is continuous, however, there is no reason why the process should not be repeated indefinitely. This is what is accomplished by means of the *time base* or horizontal sweep.

• • • time base

The spot is caused to move across the screen by applying to the horizontal (or X) plates the voltage across a condenser charged through a high resistance. The condenser does not build up its full charge at once, the voltage rising generally as shown in Fig. 6. By choosing the values of condenser and resistance the time of charge may be



arranged to suit the particular requirements.

A discharge tube which is normally non-conducting, but becomes a very good conductor when the voltage on the anode reaches a certain value, is connected across the condenser. At this point the tube fires, discharges the condenser and causes the spot on the cathode-ray tube screen to fly back to the starting point. The process then repeats indefinitely so that the spot continues to trace the same pattern over and over again giving the impression of a stationary image.

It is clearly necessary to insure that the various traces all lie exactly on top of one another. This requires the speed of the horizontal sweep to be very exactly a sub-multiple of the work speed. Fortunately, however, as we shall see, this does not involve any difficulty, for we can make the work hold the sweep in correct synchronism.

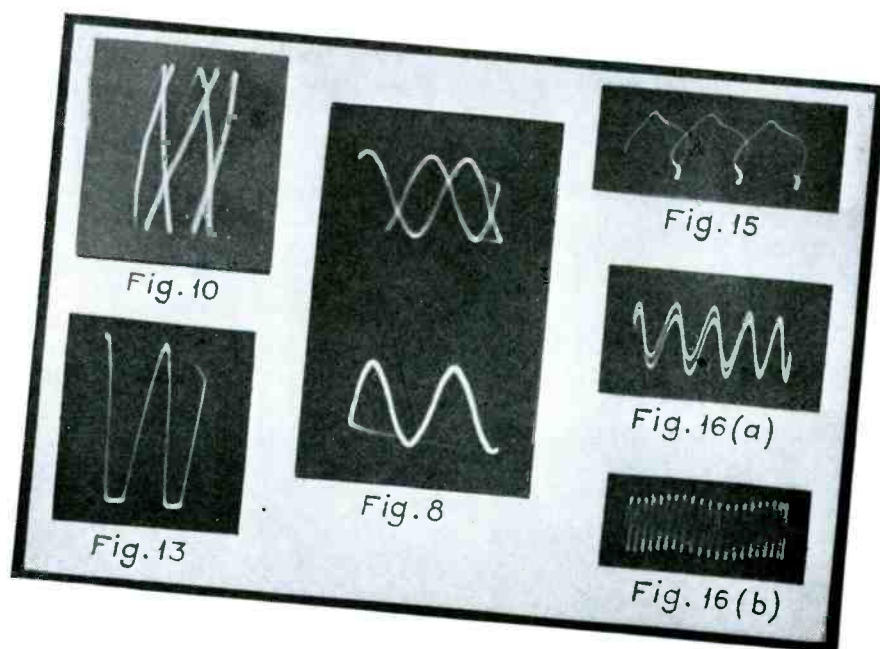
The sweep discharge tube is usually a gas-filled triode, though sometimes ordinary receiving tubes are employed in special circuits. The grid is biased beyond cut off so that no current flows. As the anode voltage rises, due to the build up of charge on the condenser (Fig. 6) a point is reached where current starts. As soon as this happens the gas in the tube is ionized and a very rapid increase of current follows, discharging the condenser instantaneously. The voltage on the anode falls to zero (or nearly so—actually to the ionizing potential of the particular gas) and the device resets itself.

The critical voltage at which the tube fires depends on the grid bias, the value of which is adjusted so that the tube discharges at a voltage just sufficient to sweep the spot over the screen of the c-r tube. The length and time of the sweep is controlled by the grid bias on the gas tube.

• • • synchronism

This enables us to control the horizontal sweep from the work by the simple expedient of feeding a small portion of the work on to the grid of the gas tube. Normally, if the sweep is running at the correct speed, the tube will fire at the end of a complete wave, when the work voltage is zero. If the sweep is running too fast, however, the spot will reach the end of its travel too soon and there will still be some work voltage left. This will momentarily increase the grid bias on the gas tube and delay the operation until the work voltage is zero—i. e., until the end of the wave.

Similarly if the sweep is too slow the small percentage of work voltage superimposed on the steady grid bias of the gas tube will cause it to trigger a little earlier. The action is quite automatic,



though the amount of synchronism required will obviously differ according to circumstances. In some instruments the synchronism is fixed while in others a variable control is provided.

In practice the action is as follows. The frequency of the sweep is varied by altering the value of the charging resistance R (Fig. 7). This gives a fine control while broad steps are obtained by changing the value of the condenser. With a little synchronism applied the fine control is altered *slowly*. When the speed of the time base becomes nearly correct the confused wave pattern on the screen of the c-r tube will suddenly resolve itself into a stationary pattern. Further alteration of the frequency control will then cause the position of the wave to shift slightly (due to synchronism occurring at different points of the wave) until the speed falls too far out and the pattern is lost.

Still further rotation will cause the wave to lock again, this time showing one more or one less wave, depending on which way the frequency is being varied, and so on. With strong synchronism the intervening step may not occur, the pattern jumping suddenly from one wave pattern to the next higher or lower, while with too much synchronism the wave may lock at two different points on successive traces giving the type of pattern illustrated in Fig. 8.

• • • incorrect adjustment

The sweep must be run at a suitable speed, preferably a half or a third of the work frequency. The same frequency will produce only a single wave whose extremities cannot be examined properly. Part of this wave will be

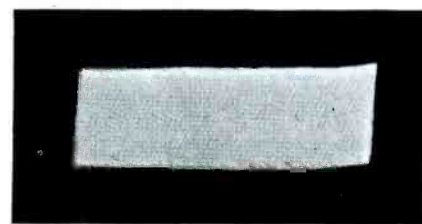


Fig. 9. If the frequency of the sweep (time base) is much too slow, the waves will be so close together as to be indistinguishable.

lost because the return trace is not infinitely short. It is therefore better to adjust the sweep to show at least two or three waves.

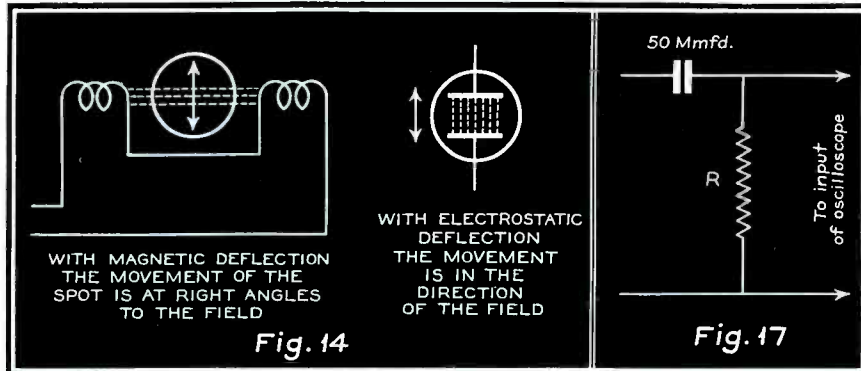
If the sweep is much too slow the waves will be so close together as to be indistinguishable and a pattern such as that shown in Fig. 9 results. On the other hand, if the sweep is too fast only a portion of the wave will be traced out at each sweep and a cat's cradle pattern like Fig. 10 will be obtained. A pattern like this will not synchronize and will weave through the screen continuously.

In an instrument having a fixed synchronizing adjustment it may be found that the pattern locks satisfactorily at large amplitudes but slips at lower values. This arises because the alteration of the amplitude control also varies the amount of work voltage fed to the sweep circuit. At smaller amplitudes the synchronizing voltage is therefore less, and the sweep has to be more accurately adjusted. It may also arise in the simpler types of instrument due to interaction between the sweep circuit and the amplifier. The remedy for this is to readjust the sweep frequency control very slightly.

• • • deflection amplifiers

The sensitivity of a cathode-ray tube, i. e. the deflection produced on the screen for a given voltage across the deflector plates, depends on the construction of the tube and its operating voltage. If the anode voltage is doubled the sensitivity is halved, the two are inversely proportional.

A given voltage on the deflector plates will produce a certain angular deflection of the beam. Hence the longer the tube the greater the actual movement of the spot for a given deflecting voltage. The designer thus has



to compromise between sensitivity and convenience.

The tube sensitivity is usually quoted in the form Deflection = k/V mm per volt, where V is the anode voltage. This is the d-c sensitivity and the results must be converted to rms values in most cases. For example, a typical tube would have a sensitivity of $250/V$. If V is 750, this means a deflection of 0.33 mm will be obtained for one volt on the plates, or alternatively that 3 volts would be required to produce a deflection of 1 mm.

If the tube has a 3-inch screen the maximum useful deflection will be about 50 mm, requiring 150-volts peak swing. The peak value of an ordinary sine wave, however, is 1.41 times the rms value in both directions. Hence the value of rms voltage required to fill the tube will be $150/2.82 = 53$.

Since in many cases the voltage to be examined is less than one volt, it is clear that some form of amplifier will be required. This is usually built into the instrument and may be either a triode or a pentode. The latter is obviously preferable on the score of higher gain and smaller input capacitance.

This latter point is important because it is necessary to include a gain control, which must obviously be on the input. If the resistance of this potentiometer is to be high, so that it will not shunt the circuit under test to any serious extent, the effective input capacity of the amplifier tube must be small or there will be a marked attenuation of the upper frequencies.

Apart from this the deflection amplifiers are straightforward. They must be designed to handle an anode swing at least equal to the peak swing required to fill the tube and they should have negligible distortion—certainly less than 1 percent. It is of little use to employ an oscilloscope to estimate distortion if the amplifier in the instrument itself is not above reproach.

• • • applications

Actually, after a little practice, distortion of sufficient severity to be audible can readily be detected on the c-r

tube and a few moments with the oscilloscope will quickly show the point at which the defect is introduced. The oscilloscope should be connected in turn to the output and then to various points progressively farther back in the amplifier.

Both the input to the amplifier and the direct feed to the Y plates should be isolated with condensers of adequate working voltage as shown in Fig. 4c. The lead may then be connected to grid or plate circuits indiscriminately. It should be noted, however, that in changing over from plate to grid or vice versa the charge or discharge of the isolating condenser will momentarily send the pattern off the screen. This will do no harm.

It should be possible to connect directly to the deflecting plates without going through the amplifier so that the high voltages in the plate circuit of the output stage may be examined. It may even be necessary to step down the voltage. This may be accomplished by a simple potentiometer arrangement as shown in Fig. 12. The values of the resistors should be high enough not to absorb appreciable power, but not too high or the stray capacities (including the capacity across the deflector plates of the oscilloscope) will shunt the upper frequencies.

• • • inverted image

It should be noted here that some ambiguity exists as to the sense of the image (i. e., which is top and bottom). For example, if a pattern of the type

shown in Fig. 13 is obtained one would be tempted to assume that the distortion was due to too much grid bias causing bottom bending. Actually it was due to grid current and the wave form is, in fact, upside down.

The same waveform applied directly to c-r plates and then to the input of the amplifier will appear inverted because of the phase change in the amplifier. An increase in potential, which would cause the spot to move upwards (say) when applied directly to the plate will, when applied to the amplifier grid, cause the plate potential to fall and cause the spot to move downwards. Similarly in running through an amplifier the sense of the image will reverse as one goes from plate to grid.

At first this may be a little confusing, but with a little thought the difficulties disappear. For example, it is always possible to make a tube distort in a known way. Short circuiting the cathode resistor will produce grid distortion and the effect on the waveform can be seen at a glance. If the top of the wave flattens the image is the right way up. If the bottom flattens the image is reversed and the results can be interpreted accordingly. There is no need to turn the image upside down again. It is just as easy to work with the inverted image.

• • • magnetic deflection

It is possible to deflect the beam with a magnetic field produced by two coils located one on either side of the tube. The deflection produced is at right angles to the direction of the field as shown in Fig. 14.

The figure also shows the direction of deflection with the customary deflector plates. It should be observed that the vertical plates (producing the up and down movement) are actually horizontal. To avoid ambiguity the plates are often spoken of as the X and Y plates, the X plates being those which produce the horizontal deflection.

Magnetic deflection is occasionally convenient for current measurements, but the resistance of the coils results in the loss of appreciable power (in comparison with the negligible consumption with electrostatic methods). The more usual method of measuring current is to insert a small resistance of 50 or 100 ohms in the circuit under test and to connect the oscilloscope across this.

The susceptibility of the tube to magnetic deflection means that any stray magnetic field must be avoided. The power transformer in the instrument itself must be carefully located; the best position is immediately behind the tube. Even heater wiring running close to the tube has been known to set up sufficient field to produce unauthorized deflection.

(Continued on page 248)

COMPILED FROM INFORMATION SUPPLIED BY MANUFACTURERS. — CATHODE-RAY TUBE CHARACTERISTICS — HIGH VACUUM TYPE

MANUFACTURER	TYPE	PRICE	DIA. OF FACE INCHES	TYPE OF DEFLECTION	DEFLECTION CONNECTION	DEFLECTION SENSITIVITY - VOLT PER MM. PER D-C PLATE	HEAT (WATT) (CATHODE)	H.C. (AMPERES)	No. 1 GRID VOLTAGE	No. 2 GRID VOLTAGE	GRID No. 1 VOLTAGE FOR CURRENT CUTOFF	No. 1 ANODE VOLTAGE	No. 2 ANODE VOLTAGE	MAX. PEAK VOLTAGE BETWEEN ANODES	DEFL. PLATE No. 2 & ANY OTHER ANODE	COLOR OF TUBES OR CENCL. PLATE	SCREEN RESISTANCE	FLUORESCENT SCREEN INPUT POWER PER CENTIMETER (No. 2) (WATT)	DIRECT INTERELECTRODE CAPACITANCE - (CONTR. (pF)) PLATE D ₁ DEFLECTING PLATE D ₂ DEFLECTING PLATE D ₃ DEFLECTING PLATE D ₄ ALL OTHER DEFLECTING PLATES (pF)	OVERALL LENGTH (Inches)	MAXIMUM DIAMETER (Inches)	INTENSIFIER ELECTRODE VOLTAGE	COMMENTS		
ALLEN B. DuMONT LABS Inc.	24-XH	7.50	3	ELECTRO-STATIC	TWO PLATES TO BE CONNECTED	0.47	0.19	0.8	NEVER POSITIVE		-60	300	600			GREEN	MEDIUM	10		7 5/8					
	34-XH	15.00	2	ELECTRO-STATIC	TWO PLATES TO BE CONNECTED	0.38	0.7	2.1				450	1500								11 5/32				
	34-8-HB	20.00	5	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED INTERNALLY	0.68	0.7														15 1/32				
	54-8-HB	40.00	5	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED INTERNALLY	0.68	0.7															21			
	54-8-H	65.00	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED INTERNALLY	0.85	0.7															21			
	54-7-T	17.50	3	ELECTRO-STATIC	INTERNAL CONNECTION	0.35	0.35															11 15/32			
	54-9-T	75.00	14	ELECTRO-STATIC	INTERNAL CONNECTION	0.68	0.7															15 17/32			
	54-9-T	75.00	14	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	1.3	1.3															26			
	54-11-T	30.00	5	ELECTRO-STATIC	INTERNAL CONNECTION	0.45	0.50	0.6														16 3/4			HAS INTENSIFIER WHICH INCREASES DEFLECTION SENSITIVITY
	94-11-T	65.00	9	ELECTRO-STATIC	INTERNAL CONNECTION	0.54	0.59															21			
	94-11-T	65.00	9	ELECTRO-STATIC	INTERNAL CONNECTION	0.16	0.20															9 3/8			
	906-P1			3	ELECTRO-STATIC	D ₂ & D ₄ TO BE CONNECTED SEPARATELY	0.22	0.23	2.1	NEVER POSITIVE			550	1500								11 7/8			
	906-P2			5	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.30	0.6	0.6				1000	2000								17 1/8			
	906-P3			2	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.33	0.6	0.6				400	600								7 1/8			
	906-P4			9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.22	0.23	2.1	NEVER POSITIVE			550	1500								11 1/2			
	903		86.00	9	MAGNETIC	ELECTRO-STATIC TO BE CONNECTED INTERNALLY	0.19	0.22	0.6	NEVER POSITIVE			150	400								2 1/16			
904		52.50	5	MAGNETIC	ELECTRO-STATIC TO BE CONNECTED INTERNALLY	0.10	0.10	2.1				380	3000								20 3/8				
905		45.00	5	MAGNETIC	ELECTRO-STATIC TO BE CONNECTED INTERNALLY	0.19	0.23					600	3000								16 1/4				
906-P1/906		13.50	3	ELECTRO-STATIC	D ₂ & D ₄ TO BE CONNECTED SEPARATELY	0.46	0.46					230	1800								16 1/2				
906-P4			3	ELECTRO-STATIC	D ₂ & D ₄ TO BE CONNECTED SEPARATELY	0.46	0.46					160	600								11 1/2				
907		48.75	5	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.48	0.48					325	1000								2 1/16				
908		18.00	3	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.32	0.32					170	600								16 1/2				
909		49.00	5	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.46	0.46					345	1800								4 1/2				
910		21.25	3	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.32	0.32					245	1000								16 1/2				
911		22.50	3	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.41	0.41					170	600								11 1/2				
912		163.40	5	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.021	0.021					1000	7000								17 15/16			GUN UNUSUALLY FROM MAGNETIC EFFECTS FOR SPECIAL OSCILLO-GRAPHIC USE	
913		4.00	1	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.01	0.01					100	250								4 3/4				
914		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.072	0.072					450	3000								21 1/2				
1800		9	9	MAGNETIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.073	0.073					100	200								21				
1801		9	9	MAGNETIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.073	0.073					100	200								21				
1802-P1		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.073	0.073					100	200								15 3/4				
1802-P4		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.073	0.073					100	200								16 3/4				
1803-P4		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.073	0.073					100	200								16 3/4				
1804-P4		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.073	0.073					100	200								16 3/4				
2001		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								4 3/4				
2002		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								6 3/4				
2003		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								4 1/2				
325 A		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								16 1/2				
325 B		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								16 1/2				
325 C		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								16 1/2				
326 A		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								22				
326 B		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								22				
330 A		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								23 1/8				
330 B		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								23 1/8				
330 C		9	9	ELECTRO-STATIC	EACH PLATE TO BE CONNECTED SEPARATELY	0.15	0.21	0.6	NEVER POSITIVE			100	500								23 1/8				

* WITH MAX. VOLTAGE APPLIED TO ANODE No. 1 AND ANODE No. 2.
 † APPROX. 30% OF GRID No. 2 VOLTAGE IS REQUIRED FOR CURRENT CUTOFF.
 ‡ FOR 1000 V.
 § FOR 400 V.
 ¶ WITH APPROX. 25% OF GRID No. 2 VOLTAGE IS REQUIRED FOR CURRENT CUTOFF.
 Ⓜ WITH APPROX. 450 V. ON ANODE No. 1 AND 3000 V. ON ANODE No. 2.
 Ⓝ BRIGHTNESS NEGLIGIBLE IN LESS THAN 30 MICROSECONDS.
 Ⓞ WITH MAXIMUM VOLTAGE ON ANODE No. 1 AND GRID No. 2.
 Ⓟ APPROX. 450 V. ON GRID No. 1 AND 2500 V. ON ANODE No. 2.
 Ⓠ WITH APPROX. 450 V. ON ANODE No. 1 AND 3000 V. ON ANODE No. 2.
 Ⓡ WITH APPROX. 20% OF ANODE No. 1 VOLTAGE.
 Ⓢ INFORMATION NOT SUPPLIED.
 Ⓣ THREE POSITIVE SIGNAL TRACES.

INSTANTANEOUS RECORDING

By MAURICE APSTEIN*

INSTANTANEOUS recording has come of age. One has only to make a comparison between a four or five year old aluminum disc and a modern high-fidelity acetate transcription to fully appreciate how far the industry has progressed in this period. This does not mean that aluminum has be-

*Morlen Electric Co.

come outmoded or that the only improvement has been in disc material. However, the recording engineer now has a wider variety of materials to choose from, which allows him to pick the material best suited for his particular purpose. Previously he had to take his aluminum and like it.

In addition to the increase in the types of materials available, there has been a concurrent increase in the types of equipment offered on the open market. We may lay this equipment improvement almost entirely at the feet of the acetate, or nitrocellulose blank. Recording on blanks of this type require definitely superior technique and equipment for satisfactory results. These requirements led to improvements in mechanism, materials, and experience which applied to the older aluminum blanks result in vastly improved performance, even from the latter.

The persistent demand by the broadcasting, moving picture, and theatrical training industries, for higher and higher fidelity instantaneous recordings contributed to a great degree in obtaining the present standards of performance in the industry. Instantaneous transcriptions are possible today, which are in every way the equal of and in some respects superior to, the best commercial pressings obtained from wax masters.

• • • aluminum

A few broad characteristics apply equally well to all recording equipment and it is perhaps desirable to comment upon them at the outset. The first question to be considered is the material to be recorded. Although it is unquestioned that higher fidelity recordings may be engraved upon nitrocellulose blanks than upon aluminum, the latter still retains a definite place in the instantaneous recording field. Where the ultimate operator may be unskilled, such as in non-technical schools, or where high fidelity results are not required, such as for strictly speech recording at a high pickup level, aluminum may be found to have decided advantages. The primary fault of the aluminum blank is its high needle scratch level. If the source of sound is close to the microphone, and more or less constant in level, and if clearness in enunciation

rather than naturalness of the voice is desired, the relative ruggedness, cheapness, and simpler recording technique of aluminum become important. This is especially so if a large quantity of blanks are to be made with minimum waste motion. In addition, if the blanks are to be played back by laymen, and no control can be exercised over the type of playback used, the soft wood or cactus needle used to reproduce from aluminum practically insures the record from damage due to a poor playback mechanism. Under the above conditions, constancy of turntable speed, and precision of grooving mechanism are not nearly so important as with acetate, with the result that in general, an inexpensive recorder may be entirely serviceable.

• • • acetate

For the vast majority of uses to which instantaneous recordings are put, the nitrocellulose, or acetate blank has many proven superiorities. Its low scratch level, its ability to be played back with a steel needle, and its superb reproduction capabilities, more than compensate for the increased care required in the design, manufacture and operation of every component in the entire recording system. Although the discs themselves are non-inflammable, it must be kept in mind that the thread which is cut from the blank is **HIGHLY INFLAMMABLE** and great care should be taken to dispose of this thread immediately, and to keep the machine free of stray shavings at all times.

Manufacturer's claims to the contrary, it has been the writer's experience that unrecorded blanks should be kept in airtight containers before cutting, to prevent hardening of the surface. The blank usually consists of a layer 0.004 to 0.006 in of nitrocellulose lacquer deposited evenly over the surface of an aluminum blank. Some makers deposit the film in several thin applications; others apply it in one operation. Regardless of method, the primary requisites seem to be smoothness of coat and absolute homogeneity of compound. Smoothness can be very readily detected by holding the blank up to oblique light and noting the presence or absence of waves in the surface. Hard spots are practically impossible to detect before recording, and are present to a greater or lesser degree in all materials. The presence of hard spots tends to score the cutting stylus and results in rapid stylus wear as well as detectable scoring of the groove after the stylus has cut through the hard spot. After recording, hard spots can be detected by a careful examination of the groove with a microscope. Unfortunately, the only constructive advice



Illustrations to the left show, from top to bottom, Allied, Port-O-Vox and Bogen portable recorders.

Illustrations to the right show, from top to bottom, RCA, Fairchild and Universal portable recorders.

which can be offered on this point is to try unrecorded grooving of several blanks of each available manufacture, and choose the material which shows the smallest average number of hard spots. By making this examination on a groove which carries no modulation the detection of irregularities in the groove is facilitated.

Hard spots are not to be confused with general hardness of material. Some cellulose blanks are considerably softer than others, take less power to cut, and give longer stylus life. They have the disadvantages of poor high frequency response due to swift erasure of these frequencies during playback, and somewhat reduced life in general. Highest fidelity will be obtained with the harder blanks in spite of accelerated stylus wear and the necessity of increased recording level.

• • • motor drive

With regard to the recording mechanism, a paramount question is the constancy of speed of the turntable and freedom from vibration of the motor drive. The quest for constant speed has been a long painstaking one, and no completely satisfactory solution has yet been evolved. Probably the closest approach to the ideal is the method of drive borrowed from the old lathe type wax recorders where a synchronous motor is mounted with its own gear box on a base separate from the recorder proper, and coupled to the turntable through an oil-damped vibration proof coupling. This method is both bulky and expensive, but due to its excellent performance is still used in one variation or another on a few of the higher priced studio type machines.

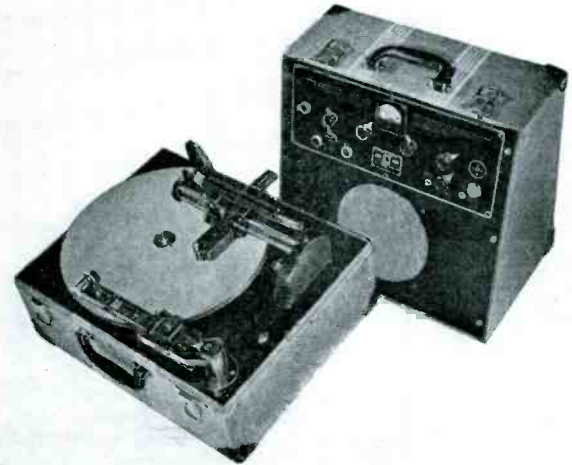
Another type of drive becoming increasingly popular is the so-called rim drive. This is a very simple system and quite effective, but its performance depends to a great degree upon the precision with which the parts have been machined. Being gearless, it leaves no gearmarks or chattering on the blank, but unless the turntable rim is very accurately machined there is some tendency to wow. One method of insuring that the center bearing hole and the rim of the turntable are concentric is to bore and ream the center hole, and turn down the driving surface of the turntable (either inner or outer surface of the rim) without removing the plate from the lathe. A disadvantage of rim drive in some designs is that when the machine is left idle, with pressure exerted on the rubber idler for some time, the idler develops a slight flat at the point of contact with the turntable. Users of this type machine who have found that after some time the drive has developed a wow will

almost certainly be able to trace it to this cause. If the design of the drive is such that this idler pressure when the machine is not in use cannot be avoided, the turntable should be removed from the machine if it is to be left idle for more than a day or so. Some machines with dual speed drive, have a neutral position on the speed change lever in which position neither idler is in contact with the turntable rim. The speed change lever should be moved to this position when the machine is not in use.

The simplicity, flexibility, economy, and compactness of the rim drive makes it worth while for the manufacturer to spend a little more time on the machining and assembly than on more complicated types, with the result that it has been almost universally adopted for portable machines, and with some variation, for some of the more popular studio machines.

A modification of the rim drive is used on some studio machines in the form of a belt drive in which the rim of the turntable is grooved to form a large pulley. This method has the definite advantage that irregularities in the turntable groove do not affect the speed nearly as much as in the direct rim drive, but due to its resiliency care must be exercised in the choice of the belt if wows due to whipping are to be avoided. Being more bulky than direct rim drive, belt drive is used mostly on studio type machines and usually requires a change in belt for shifting speed from 33 1/3 to 78 rpm. Advocates of this system claim that its smooth running characteristics far outweigh the disadvantages of bulk and somewhat awkward speed change.

In the final analysis, a smooth running turntable depends upon precision machining, and precision machining is expensive. Of necessity, therefore, those designs which use inherently few parts allow a greater amount of skilled time to be expended upon each part, with the result that a high degree of precision can be maintained at comparatively low cost on the simpler types of drives. If compactness is not necessary in a particular application, bulk may well be considered an advantage, since the greater the mass of any given component, the lower will be its natural frequency of vibration and there



will be less likelihood that the natural period will fall within the frequency range of the reproduction.

• • • groove

Much has been written about cutting styli and the desirable characteristics of various materials and dimensions as

IN ANY young and rapidly growing industry, one unfortunate result of so much activity in many quarters at the same time is a certain amount of confusion. New ideas, new methods, new materials, new claims, come so thick and fast that the recording engineer himself is at a loss to properly evaluate them.

It is in an attempt to assist those interested in making instantaneous recordings for any one of a variety of purposes that this article

is written. It is in no sense to be considered a theoretical discussion of the merits of different methods. Rather it should be looked upon as a broad survey of the better known mechanisms and materials available, and a correlation of the tremendous amount of printed information on the subject, presented in such fashion as to enable the prospective operator to decide the particular mechanism, technique and material best suited to his needs.

- RECORDER CHARACTERISTICS -
BY MAURICE APSTEIN

MANUFACTURER	MODEL	TYPE	TURNABLE	RECORD SIZE INCHES	RECORD INCHES	MOTOR SPEED	MOTOR SPEED	SPEED CHANGE SYSTEM	TYPE OF MOTOR	TURNTABLE DRIVE SYSTEM	PITCH INCH	CUTTER FEED SYSTEM	FEED DIRECTION	CUTTER TYPE	CUTTER IMPEDANCE	RECORD TYPES	MICRO-SCOPE	PICKUP	PICKUP TYPE	AMPLIFIER	AMPLIFIER GAIN, DB.	ADDITIONAL AMPL. INPUTS	AMP. INPUT LEVEL, DB.	INPUT IMPEDANCE OHMS	WATTAGE OUTPUT	SPEAKER DIA. INCHES	LEVEL INDICATOR	AMP. TUBE COMPLIMENT	RADIO	OTHER ACCESSORIES
ALLIED RECORDING CO.	12	Portable	12	13 1/2	17 1/4	Dual	Dual	Panel Control	Sync.	Rim	96-104 112-120	Overhead Lead Scr.	Either	Magnetic	500	Aluminum or Coated	Yes	Standard Equip.	Crystal or Magn.	Separate	110	Microphone and Line	⊗	2-500 2-6A3 1-5Z3	10	10	2-6C6 2-6A3 1-5Z3	Separate	—	
	16	"	"	17	17 1/4	"	"	"	"	"	"	"	"	"	"	"	"	"	Crystal	"	"	⊗	1-High 1-Int.	"	"	"	"	"	"	
	A	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	Crystal	Internal	115	Two-wire Three-wire Phone Line Phone Tuner	⊗	1-500 2-6B7 1-5Z3	6	8	1-500 2-6B7 1-5Z3	Separate	—	
DAVID BOGEN CO.	R12, 212R R12P, 212RP	Stationary	12 1/2	13 1/2	17 1/2	Dual	Dual	Wheeler Change	Self-start Constant Speed	Rim	100 Change-able Lead Screw	Overhead Lead Scr.	Either	Magnetic	500	Acetate	No	Standard Equip.	Magnetic	Separate	RA6 †	Photo Microphone	⊗	High or Low	10	10	1-500 2-6B7 1-5Z3	Separate	—	
	212 RC 16R, 16RC	Portable Stationary	17 1/2	17 1/2	17 1/2	"	"	Change-over Sw.	"	"	"	"	"	"	"	"	"	"	"	Separate 16RC, Int.	118	Photo Microphone	⊗	"	10	10	1-500 2-6B7 1-5Z3	"	—	
BRUNO LABORATORIES INC.	10R12	Portable	12 1/4	13 1/3	17 1/2	Dual	Dual	Reverse Pulley	Self-start Constant Speed	Inter-	90-100 110-120 130 Start-100	Overhead Lead Scr.	"	Mag. Start Stator Available	500	Aluminum or Acetate	No	"	Symphonic	⊗	100	Photo Microphone	⊗	High	10	10	1-500 2-6B7 1-5Z3	⊗	—	
	10R16	Stationary	17 1/4	17 1/4	17 1/2	Dual	Dual	Rebrly Sw.	Sync.	Rubber	80 to 150	Lathe Type	Either	Magnetic	22, 50, 100 400, 500, 700 2800-3800	Aluminum or Coated	Available	"	Crystal	Separate	AMRT 100 AMP-150	Photo Microphone	⊗	High	12	12	1-500 2-6B7 1-5Z3	AMR-77 AMR-112 AMP-100-30 6L6's	Amp. has separate controls for separate 16RC amp. drive	
CELLUTONE RECORD & MFG. CO.	RR13.5	Portable	12 3/8	13 1/2	17 1/2	Dual	Dual	Lever	Manual Starting	Rubber Pulley	96 to 132	Positive Drive Lead Scr.	"	Magnetic	5000	Aluminum and Acetate	No	"	"	No	"	105	Photo Microphone	⊗	50-500 150,000	12	10	4-6E6 1-6B7 1-5Z3	None	—
	RR16	Stationary	16	17	17 1/2	"	"	Single Control	Sync.	Gear & worm	96 to 132	Overhead Lead Scr.	"	Crystal	500	Aluminum and Acetate	No	"	"	Separate	105	Photo Microphone	⊗	50-500 150,000	12	10	4-6E6 1-6B7 1-5Z3	None	—	
CURLEY RECORDING DEVICES CO.	39-A	"	17	17 1/4	"	"	"	Press on one shaft	Sync.	"	96, 118, 141, 181	Overhead Lead Scr.	"	Crystal	500	Aluminum and Acetate	No	"	"	Separate	105	Photo Microphone	⊗	50-500 150,000	12	10	4-6E6 1-6B7 1-5Z3	None	—	
	F 29	Portable	16	17	17 1/2	"	"	Press on one shaft	Sync.	"	96, 118, 141, 181	Overhead Lead Scr.	"	Crystal	500	Aluminum and Acetate	No	"	"	Separate	105	Photo Microphone	⊗	50-500 150,000	12	10	4-6E6 1-6B7 1-5Z3	None	—	
FAIRCHILD CAMERA CORP.	F 29A	Portable	16	17	17 1/2	"	"	Press on one shaft	Sync.	"	96, 118, 141, 181	Overhead Lead Scr.	"	Crystal	500	Aluminum and Acetate	No	"	"	Separate	105	Photo Microphone	⊗	50-500 150,000	12	10	4-6E6 1-6B7 1-5Z3	None	—	
	F 29A	Portable	16	17	17 1/2	"	"	Press on one shaft	Sync.	"	96, 118, 141, 181	Overhead Lead Scr.	"	Crystal	500	Aluminum and Acetate	No	"	"	Separate	105	Photo Microphone	⊗	50-500 150,000	12	10	4-6E6 1-6B7 1-5Z3	None	—	
FEDERAL RECORDER CO.	P12, PR12 CR12	Portable Console	12	12	16	Dual	Dual	Lever	Induction	Rim	100 112	Lead Screw	Either	⊗	Aluminum	Aluminum	⊗	Yes	"	Internal	125	Photo Microphone	⊗	5 Meg (Mike)	15	8 12	6F5 6N7 5Y4G 504G	Yes	—	
	CR16	Portable Console	16	16	16	Dual	Dual	Lever	Induction	Rim	100 112	Lead Screw	Either	⊗	Aluminum	Aluminum	⊗	Yes	"	Internal	125	Photo Microphone	⊗	5 Meg (Mike)	15	8 12	6F5 6N7 5Y4G 504G	Yes	—	
PRESTO RECORDING CORR.	M1, MP	Portable	12	12	12	Dual	Dual	Pulley Change	Self-start Ind.	Rim	100	Worm & Gear	Optional	Magnetic	815, 500 250 & 500 Cellulose	Aluminum or Cellulose	No	Standard Equip.	Magnetic	Internal	M1, 120 MP, 150	Photo Microphone	⊗	100,000	5	None (Type)	2-6C6 2-6Z5 2-6Z5	None	—	
	G	"	12	12	12	"	"	"	"	"	80 to 160	Overhead Lead Scr.	"	"	"	"	Extra	"	"	Separate	125	Photo Microphone	⊗	50-200 or 500	8	8	4-6E6 2-6Z5 1-5Z3	"	—	
RCA MFG. CO. INC.	12-C	"	15	13 1/2	"	"	"	Lever	"	"	100 160	Overhead Lead Scr.	"	"	"	"	None	"	"	Internal	120	Photo Microphone	⊗	100,000	5	None (Type)	2-6C6 2-6Z5 1-5Z3	"	—	
	16-D	"	15	17 1/4	"	"	"	"	"	"	100 160	Overhead Lead Scr.	"	"	"	"	None	"	"	Internal	120	Photo Microphone	⊗	100,000	5	None (Type)	2-6C6 2-6Z5 1-5Z3	"	—	
RADIOTONE, INC.	16-X	"	12	12	12	"	"	"	"	"	100	Worm & Gear	"	"	"	"	None	"	"	Internal	105	Photo Microphone	⊗	100,000	3	6	2-6C6 2-6Z5 1-5Z3	"	—	
	12-D12-E	"	12	12	12	"	"	"	"	"	100	Worm & Gear	"	"	"	"	None	"	"	Internal	105	Photo Microphone	⊗	100,000	3	6	2-6C6 2-6Z5 1-5Z3	"	—	
SCULLY MACHINE CO.	5J, 6J	"	12	12	12	"	"	"	"	"	100	Worm & Gear	"	"	"	"	None	"	"	Internal	100	Photo Microphone	⊗	100,000	3	6	2-6C6 2-6Z5 1-5Z3	Separate	—	
	MI12701	Portable	12	12	12	"	"	"	"	"	112	Overhead Lead Scr.	⊗	Magnetic	⊗	Aluminum or Acetate	None	Standard Equip.	Magnetic	Internal	100	Photo Microphone	⊗	100,000	3	6	2-6C6 2-6Z5 1-5Z3	Separate	—	
SOUND APPARATUS CO.	MI12702	"	12	12	12	"	"	"	"	"	112	Overhead Lead Scr.	⊗	"	⊗	Aluminum or Acetate	None	"	"	"	"	Photo Microphone	⊗	100,000	3	6	2-6C6 2-6Z5 1-5Z3	"	—	
	MI12700	Console	16	16	16	Dual	Dual	"	"	"	"	"	Outside-in inside-out	"	⊗	Aluminum or Acetate	None	"	"	"	"	Photo Microphone	⊗	250	12	12	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	"	—	
UNIVERSAL MICROPHONE CO., LTD.	MI12700A	"	16	16	16	"	"	"	"	"	"	"	"	"	⊗	Aluminum or Acetate	None	"	"	"	"	Photo Microphone	⊗	250	12	12	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	"	—	
	PR 20	Stationary	16	17 1/4	17 1/4	Dual	Dual	Lever	Sync.	Rim	90 to 125	Overhead Lead Scr.	Either	Magnetic	500	Processed	Yes	Standard Equip.	Crystal	Separate	130	Photo Microphone	⊗	25	15	15	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	Separate	Line Spreader	
VIBRO-MASTER CO.	PR16	Portable	16	16	16	"	"	"	"	"	"	"	"	"	"	"	None	"	"	Internal	"	Photo Microphone	⊗	25	15	15	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	"	—	
	PR50	Console	16	16	16	"	"	"	"	"	"	"	"	"	"	"	None	"	"	Internal	"	Photo Microphone	⊗	25	15	15	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	"	—	
SCULLY MACHINE CO.	⊗	Stationary	16	16	16	"	"	"	"	"	"	"	"	"	"	"	None	"	"	Internal	"	Photo Microphone	⊗	25	15	15	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	"	—	
	A-1	"	16	16	16	Dual	Dual	"	"	"	80, 90, 112, 120, 128, 136	Lathe Type	Either	None	—	Aluminum	Yes	"	Crystal or Magnetic	None	—	Photo Microphone	⊗	25	15	15	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	"	—	
SOUND APPARATUS CO.	Professional	Portable	12 or 16	12 or 16	16	Dual	Dual	"	"	"	80, 90, 112, 120, 128, 136	Overhead Lead Scr.	"	Magnetic	15 or 500	Acetate & Wax	Yes	"	Magnetic	None	—	Photo Microphone	⊗	25	15	15	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	"	—	
	Port-O-Vox	"	12	12	12	78	78	"	"	"	90	Special	Optional	"	15	Aluminum or Acetate	None	"	Crystal	Separate	100	Photo Microphone	⊗	12	8	8	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	Internal	—	
UNIVERSAL MICROPHONE CO., LTD.	Portable	"	16	17	17	Dual	Dual	Shift	Self-start Sync.	Belt	90, 110, 130	Overhead Lead Scr.	Either	Magnetic	45	Aluminum	Yes	Optional	Crystal	Separate	90	Photo Microphone	⊗	12	None	None	None	—	—	
	Professional	Stationary	16	17	17	Dual	Dual	Shift	Self-start Sync.	Belt	90, 110, 130	Overhead Lead Scr.	Either	Magnetic	45	Aluminum	Yes	Optional	Crystal	Separate	90	Photo Microphone	⊗	12	None	None	None	—	—	
VIBRO-MASTER CO.	Master	"	16	17	17	Dual	Dual	Reset Belt	"	"	70 to 130	"	"	"	"	"	"	"	"	Internal	"	Photo Microphone	⊗	12	None	None	None	—	—	
	F	Portable	12	12	12	Dual	Dual	Reset Belt	Induction	Rim	96	⊗	⊗	Magnetic	500	Aluminum Acetate	⊗	Optional	Crystal	Internal	"	Photo Microphone	⊗	4	8	8	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	Separate	—	
NOT SUPPLIED.	H	"	16	16	16	Dual	Dual	"	"	"	"	⊗	⊗	Magnetic	500	Aluminum Acetate	⊗	Optional	Crystal	Internal	"	Photo Microphone	⊗	4	8	8	1-6C6 1-6C6 1-6F8G 2-6L6 1-5V4G	Separate	—	

* BY CHANGE OF FEED SCREW. † SEVERAL MODEL SEPARATE AMPLIFIERS AVAILABLE AS INDICATED. ‡ INFORMATION NOT SUPPLIED.

Even in far-off Iraq *they know* **RAYTHEON DEPENDABILITY!**

When the modern miracle of radio was added to the royal palace at Bagdad, of Arabian Nights fame, the genie of Aladdin's Lamp was of no help. But the genius of Raytheon engineers provided Raytheon Tubes, sturdily built for dependable service in any far-off corner of the world.

Dependability is a necessary requirement for this royal equipment—radio servicemen are few and far between in this kingdom of Arabia. So naturally, it is Raytheon-equipped—Raytheon offers the utmost in long life and dependability.

Even a king could find no better radio tubes than you can give your customers—yet they cost no more than the second best tubes. They are your safest and most profitable tube investment.



RAYTHEON

NEWTON, MASS. • NEW YORK • CHICAGO • SAN FRANCISCO • ATLANTA

"WORLD'S LARGEST EXCLUSIVE RADIO TUBE MANUFACTURERS"

SERVICE, MAY, 1939 • 227



Presto, Jr.

well as depth and width of cut.

In engraving aluminum, it is generally accepted that a broad shallow groove is most desirable, and that the shallowest groove that will track properly on playback will produce the least surface noise. Such a groove is obtainable over a wide range of angle and weight combinations with the result that almost any groove which is just deep enough to track with a cactus needle will produce satisfactory results.

Cellulose blanks present quite a different picture. The optimum groove depends upon a great number of conflicting factors and proper adjustment is very important. Moreover, different shapes of groove may be optimum for different applications. Some of the factors affecting the choice and adjustment of the cutting stylus are: shape of reproducing needle, stylus wear, heat generated during cutting, groove wear during playback, and adaptability to processing for pressings. Most playback needles are designed to be used in a 90 degree groove. Consequently, if pressings are to be made from the master, this angle is probably most preferable. If the master itself is to be played repeatedly, most recording engineers prefer a stylus ground to a slightly wider angle, claiming longer record wear and less scoring of the recording stylus during cutting. For general work a groove angle between 90 degrees and 105 degrees is perfectly satisfactory, providing the playback pickup has an unbalanced weight of less than 3 and preferably 1 to 2 ounces. Because optimum width of groove will vary with the number of lines per inch engraved, it is a bit difficult to recommend such width.

In the most popular lead screw pitch of 96 lines to the inch the groove should be about 0.005 in wide and half as deep with a maximum deviation in recording of 0.002 in to each side. A very sim-

ple method of approximating this adjustment is to make the width of the groove equal to the space, or land between grooves. This can quite easily be done with a glass or recording microscope, and it may be well to remark at this point that a recording microscope is unquestionably one of the most valuable adjuncts to a recording engineer's accessory equipment. Such things as width and depth of cut, stylus and record wear, scoring and overcutting, are all plainly visible and easily corrected with such an instrument available. Without one, the operator must rely solely upon aural evidence, by which it is extremely difficult to diagnose these defects.

• • • stylus

The advocates of various stylus materials have many pros and cons for each type. The various steels are good for about 15 minutes of recording, although



Cellutone.

some of special alloys like stellite may be used considerably longer. Sapphires are serviceable for at least several hours, sometimes as many as twelve or fifteen, depending upon the particular jewel and the tolerable surface noise. One objection to the sapphire is the tendency to economize by using the rather expensive stylus too long. Most recordists prefer to use steel, and change every fifteen minutes. The time required in properly setting up the stylus is very often an inconvenience in which case the sapphire becomes more desirable. A new sapphire is usually several db quieter than steel, growing gradually noisier as recording progresses.

• • • cutter

The cutting head has been the weakest link in the whole recording system. It is only recently that cutters have been sufficiently improved to take full ad-

vantage of the fidelity possibilities of acetate discs. A small mass in the moving system, and the absence of non-linear elements are important for distortionless engraving. The most probable further improvements in cutters will be in the development of moving coil cutting heads for acetate similar to the cutters used in wax recording in the larger studios.

• • • amplifier

Recording amplifier design has reached such a high degree of excellence that not much comment is necessary in this regard. It should be mentioned that the incorporation of negative feedback in the circuit is highly desirable for low distortion and good output regulation with variation in cutter impedance over the frequency spectrum. The proper treatment of amplifier response is to use an inherently flat amplifier and apply external equalizing networks to give the desired recording response. A word of caution with regard to this procedure may be helpful. Many equalizing networks introduce distortion which is more detrimental to the final recording than the poor frequency response which they correct. This effect is especially true when heavy equalization is resorted to at one point in the system. For this reason it is desirable to obtain the equalization at several different points in the system, obtaining partial equalization at each point.

Another important aspect of recording amplifiers is that of output level. It is well to have an amplifier whose output capabilities are far in excess of the level required for actual cutting.

Automatic volume compression is becoming increasingly popular with recording amplifier designers, but as yet these volume or peak limiters are not completely satisfactory for all types of work. A much needed amplifier is one which will incorporate a distortionless compressor. Such an amplifier would allow a higher average recording level with the resulting higher signal to surface ratio. It is hoped that a compressor of this type will soon be forthcoming.

The accompanying chart represents a compilation of the various features of most of the well-known recorders on the open market. With the above general remarks in mind, the prospective recordist should be able to evaluate their various characteristics and decide which particular machine will best meet his requirements. In conclusion, the writer wishes to express his appreciation to Robert G. Herzog, Editor of *SERVICE*, and to the various manufacturers of recording equipment for their cooperation in supplying much of the material upon which this chart is based.

SYNC MOTORS ON D-C

By M. E. RESLAG

VIBRATORS are continually invading new fields ever since the auto-radio manufacturers convinced the skeptical that these interrupters were practical. Some units are now being used, and others are in the design stage, for aircraft applications. This use demands the last word in reliability.

• • • sixty-cycle inverter

A non-synchronous vibrator unit was used to obtain the data for this article. Rated at 30 watts maximum input, it has an efficiency of 80 to 85 percent when used with a proper load circuit. With an inductive load such as that presented by an a-c phonograph motor, a power factor correcting condenser of a proper value must be used. Even with considerable variation in input voltage, a frequency of 60 cycles is maintained

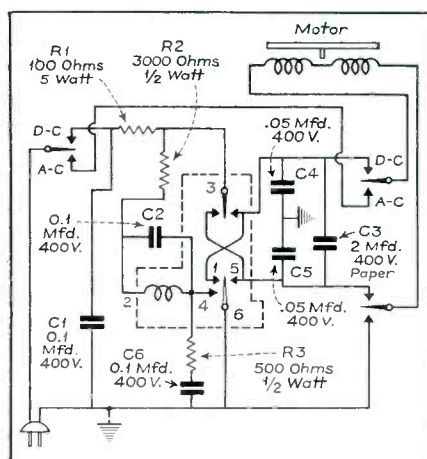


Fig. 1. A vibrator makes a reliable device for operating a synchronous motor from a d-c source. A-c operation is also possible, of course.

quite closely. The load may also vary within wide limits with little effect on frequency. This is important because the frequency is the determining factor in the speed of synchronous motors.

Making and breaking an inductive load of this order 120 times a second causes severe surges of current which set up transients of high amplitudes that are capable of spattering interference over a wide band of radio and audio frequencies if certain precautions are ignored. A hash filter to kill or

limit oscillations as they are produced and a line filter to keep interference out of the power line constitute the noise preventing devices. Because of the wide range of frequencies generated, noise would not only affect local radio sets but will be picked up in the phonograph amplifier as well.

• • • wave form

A smooth square wave, free of transients, is the goal of every decent vibrator. This type of wave gives the highest effective voltage. In fact, the effective voltage will be substantially equal to the peak voltage which, in turn, is the voltage of the d-c line feeding the vibrator. If the inverter could turn out a sine wave, the effective voltage would be only 0.707 of the d-c line voltage, necessitating a transformer, tapped windings or other expedient to provide a-c, d-c operation of the phonograph motor (or other load). However, more heat will be developed in the load with a square wave although, in most cases, this will be of no consequence. The accompanying table gives the voltage obtainable with several phonograph motors when using the constants shown in Fig. 1. The speed of these motors will be independent of the terminal voltage within reasonable limits. Only an abnormally low voltage will cause slippage.

• • • circuit

Fig. 1 shows the means of switching the motor from a-c to d-c operation with the vibrator inverter. A 3-pole double throw switch is used. Condenser C₁ is necessary to keep disturbances out of the power line. R₁, in combination with C₁, C₂ and C₃, limits surges or kick-backs resulting from inductive loads. C₃ is a 2-mfd paper condenser which gives optimum power factor when used with the motors in the accompanying table. R₂ is necessary because it is not feasible to wind the small exciting coil for the full 120 volts. R₃ and C₄ constitute a hash filter and C₂ is recommended by the manufacturer for best operation.

• • • another method

Another method of employing a-c motors on d-c is shown in Fig. 2. Two

25L6s in a simple push-pull oscillator circuit are capable of delivering 12 watts at 60 cycles. The a-f choke is important as attempts to run d-c through the motor by bringing out a center tap were unsuccessful. This converter will run an RCA synchronous motor taking 9 to 10 watts or any other motor of this rating. (Note: The other motors listed in the table require too much power and will not perform satisfactorily.)

• • • other applications

The utility of these inverters is not limited to phonograph motors, of course, as any other type of a-c motor or appliance within the wattage rating may be converted to d-c operation. Timers for use in photography and devices using electric clock motors, where exact time to the split second is not important, may be so operated. If Fig. 1 is used, the value of the power factor condenser, C₃, depends upon the motor. Connecting an oscillograph across the load, the proper value is that which gives the smoothest waveform; the wave with a minimum of transients. In general, for inductive loads, the heavier the load, the larger the value of C₃ required. Remember that the life of a vibrator depends somewhat on the waveform in that the presence of transients causes

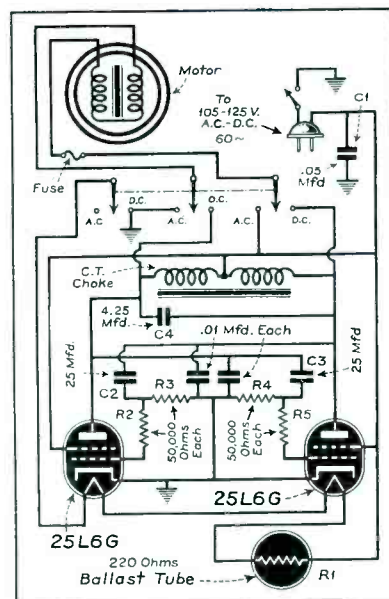


Fig. 2. A pair of 25L6Gs in a simple push-pull oscillator circuit is capable of delivering 12 watts at 60 cycles.

severe sparking which is tough on the contacts.

• • • output voltages

Motor	Input watts	Output volts
RCA synchronous	14	a-c 115
Alliance rim driven	18½	110
Webster rim driven	16½	111
D-C line voltage during the tests, 118 volts.		

BATTERY

By HENRY

PORTABLE battery sets are going strong this year due largely to the new 1.4-volt series of economical tubes. The big feature of the season is the self-contained loop antenna which permits operation of the receiver anywhere, even while walking along the street. Most models, however, provide a connection for an external antenna and ground to provide more satisfactory operation in spots remote from broadcast transmitters.

• • • circuit

The typical receiver is a 4-tube super-heterodyne with a 1A7G oscillator-converter, a 1N5G i-f stage, a 1H5G detector-avc-first audio and a 1C5G power pentode. Only one t-r-f set is noted (Sentinel Model 170BL). A number of sets have a fifth tube either employed as a second i-f amplifier or as a pre-amplifier in an r-f stage. In the latter case a 3-gang condenser is used. The Detrola Model 286 features an r-f stage.

The frequency range covered by these new portables contains only the broadcast band, extended in some cases at the high frequency end to include the police band. Only one receiver (Setchell-Carlson) has included a short wave band.

Most sets are colorful and attractively dressed. The most popular covering is a waterproof airplane fabric although there are a number of sets with cow-hide, rawhide and what-not-hide finishes, some real, many synthetic. A few manufacturers feature flexible carrying cases, some as standard equipment, some optional. Weights vary from 7 lbs for the "Pee Wee" models to about 17 lbs depending largely upon the selection of batteries. Phonograph models are an additional 4 or 5 lbs heavier. Several designs have included rectifier tubes and accessories adapting the sets for a-c or a-c, d-c line operation to save battery life when convenient. Garod, Lafayette, Port-O-Matic and Setchell-Carlson are a few featuring line operation. These sets, of course, are somewhat heavier than straight battery models. When line operation is contemplated for an extended period, it is advisable to remove the batteries from the



STEWART WARNER 02-411



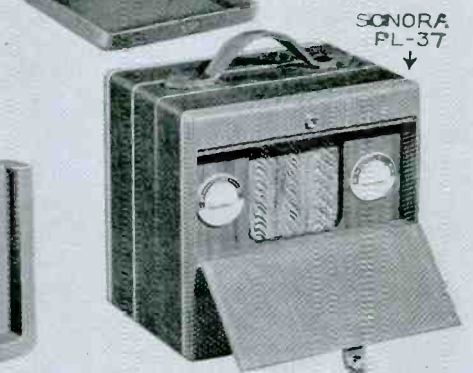
WESTINGHOUSE WR 674



ZENITH 4K40CL



3EAFS 985314



SONORA PL-37



KNIGHT E-10925



RCA-VICTOR 943P4



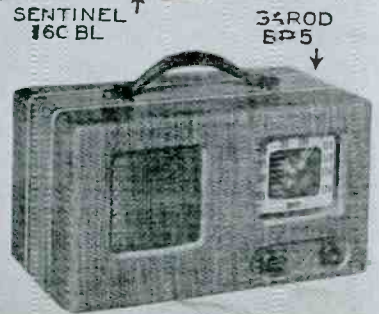
WESTINGHOUSE 500



SENTINEL 16C BL



MISSION BELL 500



GAROD 8P5

PORTABLES

HOWARD

cabinet as their life is shortened considerably when they are subjected to even moderately increased temperatures.

• • • battery drain

In the interest of low B drain, all sets use over-biased power tubes. This practise, while increasing the percentage of harmonics, seems justified as the quality is quite acceptable. Power outputs vary from 100 milliwatts for sets using the 1A5G pentode to 275 milliwatts developed by the new 1Q5G beam power tube. Most models are using the 1C5G, however, with an approximate output of 200 milliwatts. Practically all the sets draw between 9 and 12 milliamperes B current with no signal, the current increasing by a few ma with strong signals. The typical 4-tube set draws 250 ma for the filaments; the 5-tube sets, 300 ma. The low output models using the 1A5G draw 50 ma less.

• • • loop

Loop considerations are interesting despite their designation as "wavemagnets," "looptennas," etc. Loops wound on treated cross-sticks and those wound as self-supporting pancakes have the best Q; 185 to 225 out of the cabinet, and 80 to 100 mounted in place; depending largely on the frequency of measurement. Qs as high as 300-400 have been obtained in air with 80 strand Litz wire under ideal conditions. The grid is invariably connected to the center of the loop; i.e., the inside and smallest turn, with the outside turn going to the AVC bus or low potential input. Stray capacity is minimized by connecting the loop in this manner, making it easy to obtain tracking over the entire frequency range. Coupling between the loop and i-f stages must be held to an extremely low value as oscillation at the low frequency end (550 kc) is easily brought about by sloppy leads, improperly fitted tube shields and anything else tending toward coupling the loop to i-f elements. Some loops are completely enclosed, being wound over the cabinet and covered by the cloth finish. A few sets use a masonite back which is ideal



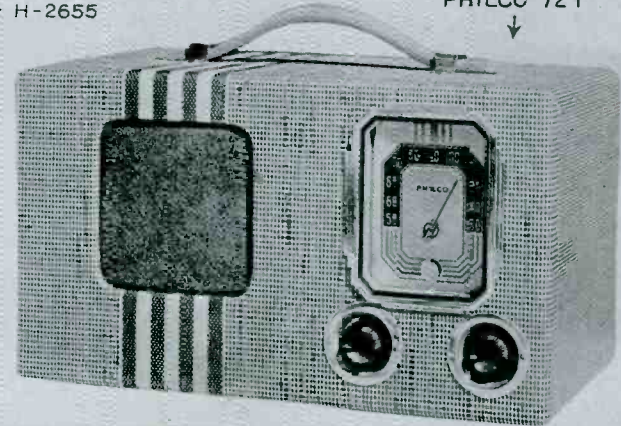
FADA
PD 44
↓



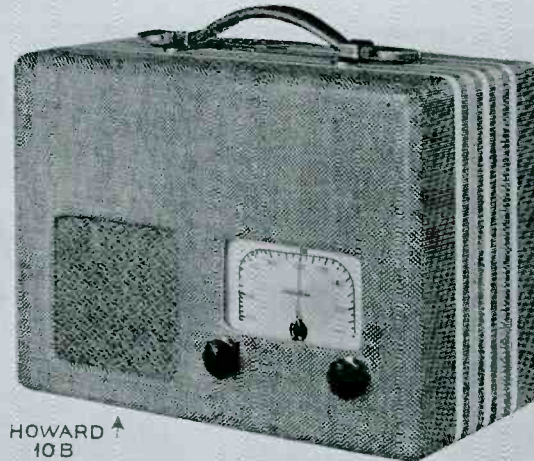
↑
G.E.
HB 408



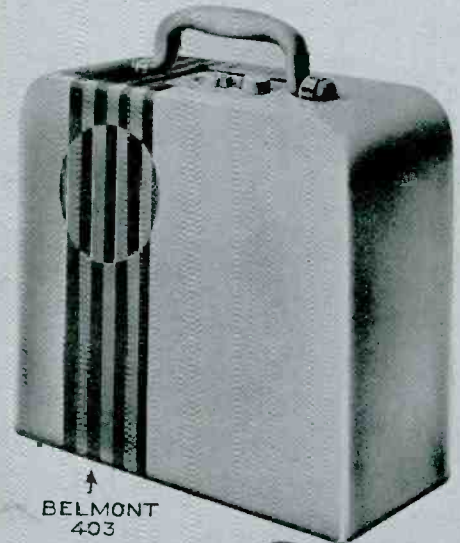
← DETROLA
H-2655



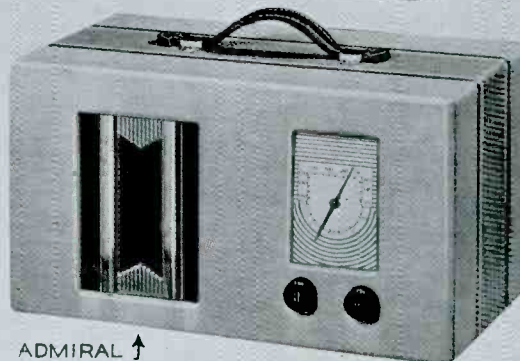
PHILCO 72 T
↓



↑
HOWARD
10B



↑
BELMONT
403



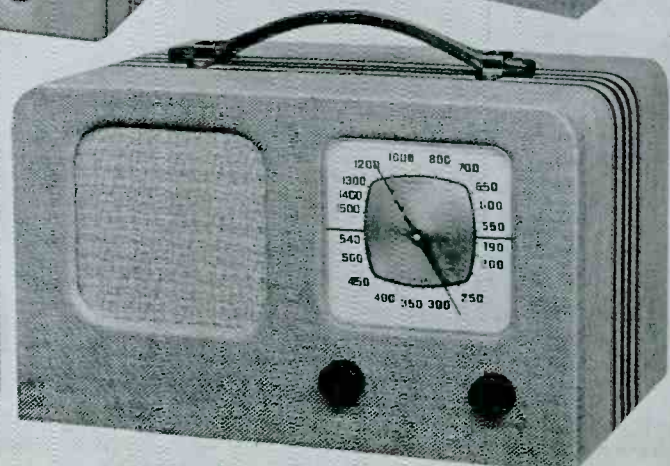
↑
ADMIRAL
164-4D



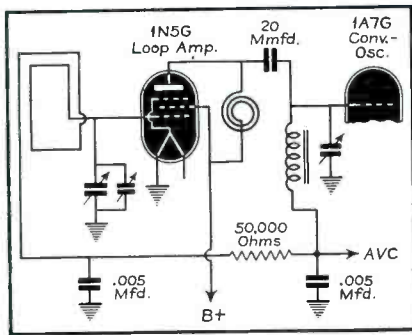
→
AIR-KING
3910



→
WELLS-GARDNER
44 E5-906



↑
ESPEY 942



Detrola Model 282, 286 features a r-f stage and a three-gang condenser.

in that it doesn't warp or change the Q of the loop.

• • • speaker

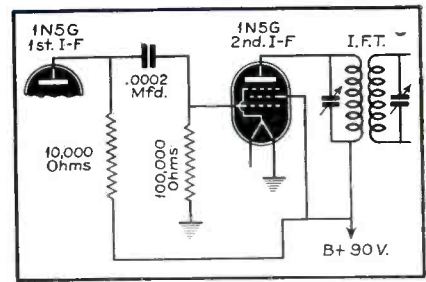
Dust-proof permanent magnet speakers are featured in all designs varying from 4 to 6½ inches with most sets using 5-inch speakers. A good magnet averaging 7 oz is necessary to produce satisfactory quality. A suppression of lows is noted which is necessary because of muffling in the cabinet. No air pumping can take place in these cabinets. It is important to replace the dust-proof cap when servicing these portables.

Since pilot lights are an unwarranted extravagance novel on-off indica-

tors are employed. Double-pole switches are used, one pole for the A battery; the second for the B battery. This is necessary because of the widespread use of electrolytic condensers which would slowly drain the B batteries. High quality electrolytics must nevertheless be used to minimize drain while in use. Interchangeable bantam tubes are now available and are standard equipment in one model (DeWald). Note that the different types power tubes 1A5G, 1C5G and 1Q5G are not interchangeable.

• • • i-f

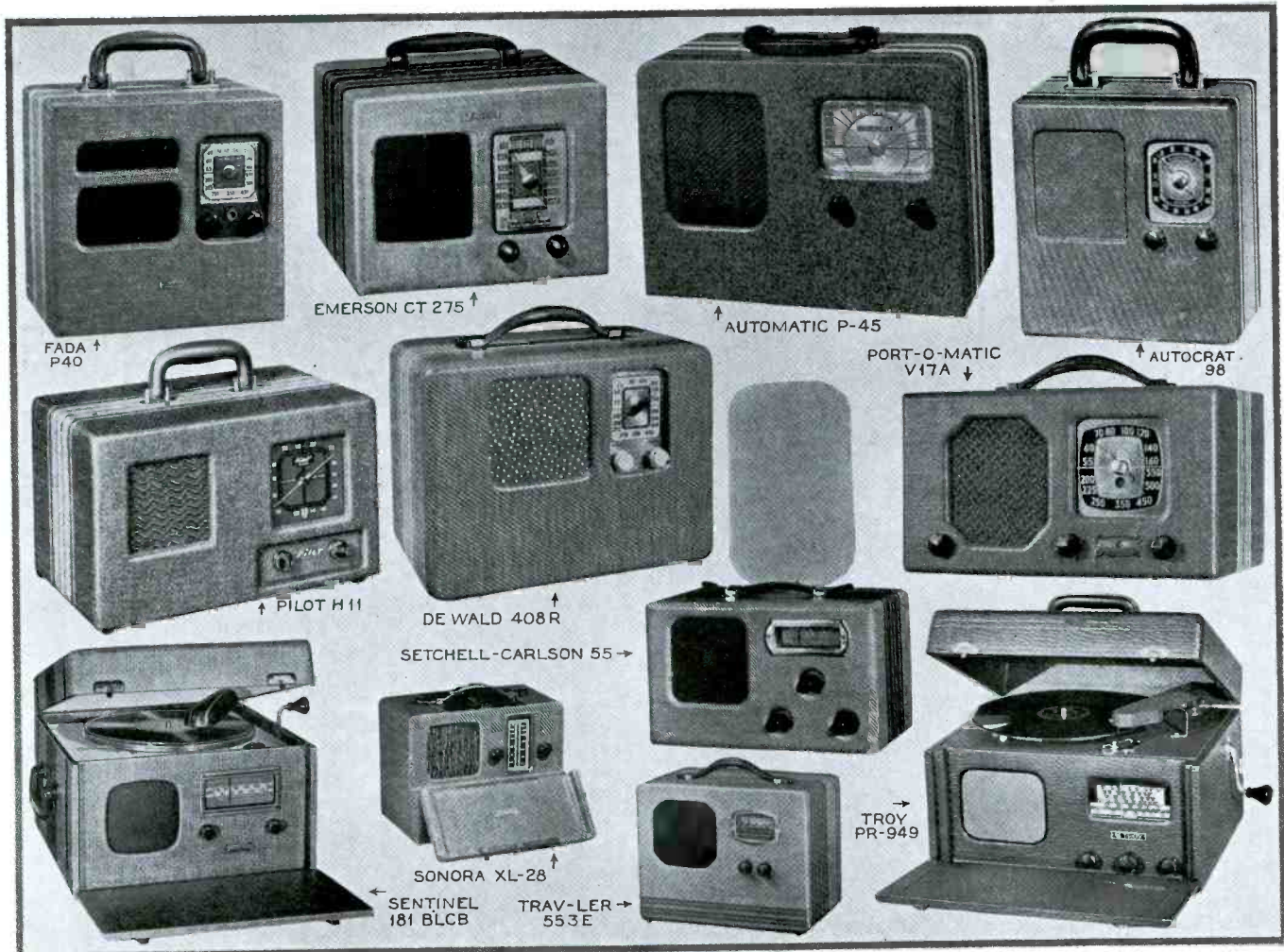
Iron core i-f transformers are common and a few sets use iron core oscillator coils. By making them moveable means are provided for i-f padding. Cut sections are noted in a few gang condensers. Don't look for padding condensers in these models. R-f calibration must be made in the cabinet with both the batteries and loop in position because the batteries and chassis cause absorption and add capacity to the loop. The i-f is peaked between 450 and 465 kc depending upon the location of the receiver and the frequency of probable interference. A resistance-coupled i-f by Emerson is unusual. I-f filters are



Emerson Models CE-259, -260, -263 employ an extra resistance coupled i-f stage.

used to isolate r-f and a-f circuits. A filament filter is noted on the converter tube of one 5-tube set. Shunt avc resistors are noted in some units, since it is necessary to pin down the avc bus when the i-f tubes have a high contact potential.

Selectivity of portables is not very critical because of limited pickup. When interference is bothersome it is preferable to turn the loop until the interfering station is at a minimum setting rather than to turn the loop for a maximum setting for the wanted station. Loops have a rather sharp minimum but a very broad maximum directivity. A majority of sets have provision for an external antenna and ground, one turn
(Continued on page 240)





*Sell the
Meissner*
TELEVISION KIT!

THERE'S a tidal wave of interest and enthusiasm about Television just getting started, a wave that will sweep extra profits into the pockets of the alert dealer! Be prepared for it with the first practical *Television Kit*—designed and offered by MEISSNER!

For years Meissner has worked with Television, just to be prepared when Real Television arrived. It's **HERE NOW**—and the MEISSNER Television Kit is Ready for your rapidly growing Television market, with Meissner quality at a moderate price!

Be prepared for the Television market! See it at your parts jobber or mail the coupon today for complete information and dealer prices!

SEE YOUR PARTS JOBBER OR WRITE

DEPT. S-5
MT. CARMEL,
ILLINOIS

Meissner

THE FIRST PRACTICAL TELEVISION KIT!

- *Sound as well as Video—both in one unit!*
- *New SHOCK PROOF Design!* ● *5-inch tube!*
- *Walnut Cabinet available at slight additional cost.*
- *Meissner Quality at a price any one can afford to pay!*

FOR COMPLETE DETAILS

MAIL COUPON!

MEISSNER MFG. CO., Dept. S-5, Mt. Carmel, Ill.

Please rush me complete information on Television Kits with dealer prices.

Name

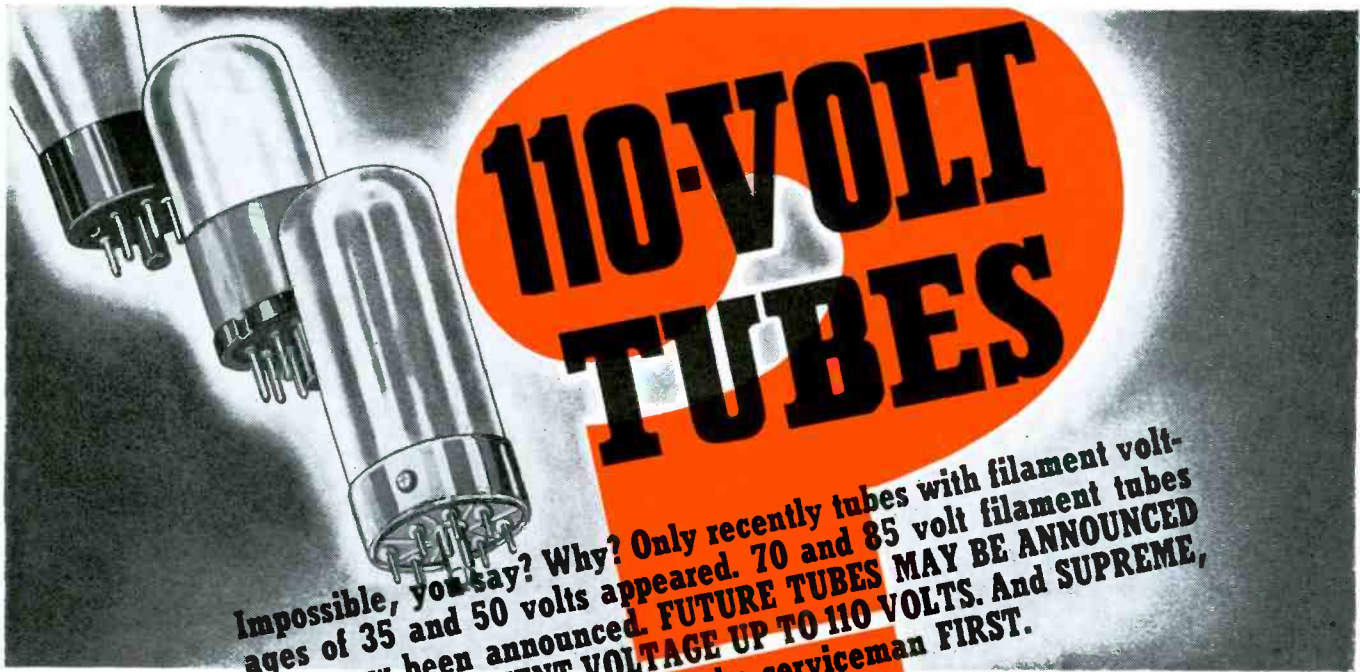
Address

City State

A F A M O U S N A M E F O R T W O D E C A D E S

PORTABLE RECEIVER BATTERY REPLACEMENT DATA

	Burgess	Eveready	General	Philco	Ray-O-Vac	Other
ADMIRAL 164-4D	2-B30 1-6F	2-762 1-741	2-V30B 1-6F1	2-P-305 -	2-P 5303 1-P96A	
AIR-KING 3905 3910	1-5DA60 2-B30 1-6F	2-762 1-741	2-V30B 1-6F1	2-P-305 -	2-P 5303 1-P96A	
AUTOCRAT 90 98	2-B30 1-4FA	2-762 1-742	2-V30B 1-6F1	2-P-305 1-P-94	2-P 5303 1-P96A BB-60-P 1-P94A	
AUTOMATIC P43;45	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
BELMONT 403	2-B30 1-8F	2-762 1-741	2-V30B 1-6F1	2-P-305 -	2-P5303 1-P96A	
COLONIAL	2-B30 •	2-762 •	2-V30B •	2-P-305 •	2-P5303 •	
DETROLA 286 282,288	2-B30 1-8F	2-762 1-741	2-V30B 1-6F1	2-P-305 -	2-P5303 1-P96A	
DE WALD 408 408R 409 415	2-B30 1-4F 2-B30 1-8F 2-B30 1-8F 1-5DA60	2-762 1-742 2-762 1-741 2-762 1-741	2-V30B 1-4F1 2-V30B 1-6F1 2-V30B 1-6F1	2-P-305 1-P-94 2-P-305 - 2-P-305 -	2-P5303 1-P49A 2-P5303 1-P96A 2-P5303 1-P96A	
EMERSON GE 259,260 GE263,CT275	2-B30 1-4F 2-B30 1-8F	2-762 1-742 2-762 1-741	2-V30B 1-4F1 2-V30B 1-6F1	2-P-305 1-P-94 2-P-305 -	2-P5303 1-P49A 2-P5303 1-P96A	
ESPEY 942	1-6TA60	-	-	-	-	
FADA {P49,PD49 P40	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
GALVIN 41D	2-B30 1-8F	2-762 1-741	2-V30B 1-6F1	2-P-305 -	2-P5303 1-P96A	
GAROD BP5	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
G.E. GB 400	2-B30 1-8F	2-762 1-741	2-V30B 1-6F1	2-P-305 -	2-P5303 1-P96A	
GREBE BP-5	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 -	2-P5303 1-P49A	
HOWARD 10B	2-B30 1-8F OR 6TA60	2-762 1-741	2-V30B 1-6F1	2-P-305 -	2-P5303 1-P96A	
KARADIO 905	2-B30 4-No.2 UNITS	2-762 4-No.2 UNITS	2-V30B 4-No.2 UNITS	2-P-305 4-No.2 UNITS	2-P5303 4-No.2 UNITS	
KNIGHT E 10925	1-6TA60	-	-	-	-	
LAFAYETTE CC55	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
L'TATRO 819	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
MAJESTIC {421 420PL	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
MISSION BELL 400	2-B30 1-4FA	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
PACKARD BELL "Travel-mate"	1-6TA60	-	-	-	-	
PHILCO 71T	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
PILOT H 11	2-B30 1-8F	2-762 1-741	2-V30B 1-6F1	2-P-305 -	2-P5303 1-P96A	
PORT-O-MATIC U17A-U17C	2-B30 1-4F	2-762 1-742 1-773	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
RCA 94BP1 94BP4	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
REMLER	2-B30 1-No.6 CELL	2-762 1-No.6 CELL	2-V30B 1-No.6 CELL	2-P-305 1-No.6 CELL	2-P5303 1-No.6 CELL	
SENTINEL {151 BL 178 BL	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
SETCHELL-CARLSON 55	2-B30 4-No.2 UNI-CELLS	2-762 4-No.2 CELLS	2-V30B 4-No.2 CELLS	2-P-305 4-No.2 CELLS	2-P5303 4-No.2 CELLS	
SKY CHIEF {A 213 A 212	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
SOLTER	2-5303 1-4FA	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
SONORA PL23 XL 23	1-5DA60 1-6TA60 OR 1-4F 2-B30	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
SPARTON 549-1	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
STEWART-WARNER 02-411	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
TRAV-LER	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
TRIANGLE	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
WARWICK	2-B30 1-6F	2-762 1-741	2-V30B 1-6F1	2-P-305 -	2-P5303 1-P96A	
WELLS-GARDNER 5B3	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
WESTINGHOUSE	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	
ZENITH 5416	2-B30 1-4F	2-762 1-742	2-V30B 1-4F1	2-P-305 1-P-94	2-P5303 1-P49A	



Impossible, you say? Why? Only recently tubes with filament voltages of 35 and 50 volts appeared. 70 and 85 volt filament tubes have now been announced. FUTURE TUBES MAY BE ANNOUNCED WITH ANY FILAMENT VOLTAGE UP TO 110 VOLTS. And SUPREME, as usual, comes to the aid of the serviceman FIRST.

A new SUPREME engineered circuit, known as the OBSOLESCENCE-FREE FILAMENT VARI-VOLT SELECTOR, WILL TAKE CARE OF ANY TUBE REGARDLESS OF ITS FILAMENT VOLTAGE FROM 1.5 TO THE FULL LINE VOLTAGE OF 110 VOLTS!

Thus with the new and improved SUPREME 504 Tube and Set Tester and the 503 Tube Tester, you have POSITIVE ASSURANCE AGAINST HI-VOLTAGE FILAMENT OBSOLESCENCE!

Remember "Roaming Filaments"? Remember how SUPREME warned its customers, at the outset of the octal tube announcement, that TUBE BASE TERMINATIONS (particularly filaments) WOULD "ROAM"?

SUPREME completely guarded against tube tester obsolescence due to roaming tube base terminations as soon as it was possible by including in every SUPREME tube tester an OBSOLESCENCE FREE FILAMENT RETURN SELECTOR—the first in the field with complete assurance against obsolescence due to roaming tube terminals.

Once more, SUPREME is the first in the field with positive assurance against obsolescence, this time, due to varying filament voltages.

To keep faith with past purchasers of SUPREME tube testers against their early obsolescence due to hi-voltage filament type tubes, we have arranged a modernization program available to every owner of a SUPREME tube tester which incorporates the SUPREME FILAMENT RETURN SELECTOR.

When you consider the purchase of a new tube tester, remember that SUPREME Tube Testers which are now over 4 years old are still not obsolete!

Join the SUPREME family of satisfied users TODAY! Your jobber can show you the many other advantages of the SUPREME 503 Tube Tester with its Roll Chart, Arrow-way testing system, 7 way tube test, dual sensitivity leakage test, fingertip operation and low cost. He will show you the many extra features of the SUPREME 504 Tube and Set Tester with its 31 functions and ranges on two rows of push buttons, its complete electrolytic and electrostatic leakage check, its guaranteed rectifier, its low per-range cost and a host of other features YOU NEED! And, remember, every SUPREME instrument can be purchased on easy S.I.C. Time Payments—no more daily than the cost of your cigarettes or your phone.



MODEL 504

WHAT IS THE NEW VEDOLYZER RADIO TESTING SYSTEM?

See it demonstrated at Booths 212-214 Chicago Radio Show—June 14th to 17th.

Hear it explained by B. O. Burlingame Saturday, June 17th, 4:30 P.M. at the Lecture Hall.

If you can't visit the Show, write us and we will send you FREE a copy of this lecture together with a complete set of illustrations and reference charts.

SUPREME

**SUPREME INSTRUMENTS CORP.
GREENWOOD, MISSISSIPPI, U. S. A.**

EXPORT DEPT., Associated Exporters Co., 145 W. 45th Street, New York
Cable Address: LOPREH. N. Y.

MAIL COUPON TODAY!

SUPREME INSTRUMENTS CORP., Dept. S-6
Greenwood, Miss.

Please RUSH me your newest information on SUPREME Instruments:

Name _____

Address _____

City _____ State _____

— TECHNICAL FEATURES OF 1939 PORTABLE BATTERY RECEIVERS —

Trade Name	ADMIRAL	AIR CHIEF	AIR-KING	AIRLINE	AUTOCRAT	AUTOMATIC	BELMONT	COLONIAL	DE WILD	DETROLA	EMERSON	ESPEY	FADA	GAROD	G.E.	GREBE	HOWARD
MANUFACTURERS	CONTINENTAL RADIO & TELEVISION CORP.	FIRESTONE TIRE & RUBBER CO.	AIR-KING PRODUCTS CO., INC.	MONTGOMERY-WARD	AUTOCRAT RADIO CO.	AUTOMATIC RADIO MFG. CO.	BELMONT RADIO CO.	COLONIAL RADIO CORP.	PIERCE-AIRO, INC.	DETROLA CORP.	EMERSON RADIO & PHONO. CO.	ESPEY MFG. CO., INC.	FADA RADIO & ELECTRIC CO.	GAROD RADIO CORP.	GENERAL ELECTRIC CO.	GREBE MFG. CO., INC.	HOWARD RADIO CO.
Name	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Model No.	64 31-40 4D	331-40 4F	S-7426-9	3905 3910	62-62-62-555 2558 557 2557	90 98 P43 P45 P57	403A	985514	408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500	—	—	—	—	—	—	—	—
Chassis No.	4D	4F	—	B3	—	P	—	—	—	6377 6447	CE	CT	P40 P49	—	—	—	
Covering	Airplane luggage fabric	•	•	•	Airplane luggage fabric	•	•	•	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric
Size (Inches)	L 13 1/2 14 1/2 9 1/2 H 7 1/2 8 9 D 7 10 1/2 5 1/2	8 3/4 9 6 1/2	7 13 1/2 7 7 1/2 9 7 1/2	• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •
Weight (Lbs.)	15 20 9	10 3/4 9 1/2	8 3/4	7 13 1/2	•	•	•	•	•	•	•	•	•	•	•	•	•
Range KC	535 to 1730	535 to 1610	540 to 1650	540 to 1600	535 to 1700	530 to 1700	545 to 1650	540 to 1650	535 to 1700	540 to 1580	530 to 1600	•	545 to 1700	540 to 1720	550 to 1600	550 to 1720	540 to 1650
Circuit	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet
Speaker (Inches)	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
R-F	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Conv.-Osc.	1A7G	•	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G
I-F	1N5G	•	1N5G	(2) 1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	(2) 1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G
Det.-AVC A-F	1H5G	•	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G
Power	1C5G	•	1Q5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1Q5G	1C5G	1C5G	1C5G	1Q5G	1C5G	1C5G
AVC	Yes	•	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Output Power (mw)	200	•	275	200	200	200	200	275	200	200	200	200	200	200	200	200	200
Drain (Ma)	250	150	250	300	250	250	250	250	250	250	300	250	250	250	250	250	250
Drain (Ma)	10	•	12 10	12	10	10	10	12	10	10	10	10	10	10	10	10	12
I-F Peak (Kc.)	456	•	455	456	456	456	465	455	455	455	455	•	456	456	455	456	465
Type Ant.	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop
Prov. for External Ant.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Vol. Cont. (Meg)	0.5	•	0.5	0.5	0.75	1.0	1.0	0.5	1.0	0.5	0.5	•	0.5	1.0	1.0	1.0	0.5
On-Off Indicator	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Phonograph	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No
Special Features	—	—	—	—	—	—	—	—	—	—	Resistance I-F Stage	—	—	—	—	—	—

• NO INFORMATION SUPPLIED



COME ON LET'S GO!

to the Mighty 1939

RADIO PARTS INDUSTRY SHOW

Grab that extra shirt—let's go—the show's the thing! It's the one and only big annual event of the year—everyone in Radio Parts will be there! You'll get a complete personal picture of your industry—you'll see with your own eyes what's what and what's new! You'll shake hands with Manufacturers, Jobbers, Engineers, Sound Specialists, Servicemen, Retailers, and Amateurs—from all parts of the world, in Radio Parts City. You'll get interesting "dope" that will tell you what's ahead for you. You'll really benefit!



1940's Product Parade

Up and down the streets of Radio Parts City—a deluge of new exhibits, new products, new ideas—latest developments and achievements in Service Apparatus, Ham Gear, P. A. Equipment, and other Radio Parts—all vitally important to your business. Be there! Don't Miss It!

Convention of Radio Servicemen of America opens Friday, June 16, with Special Lectures, Meetings and Exhibits.



Special Days For Everyone

It's all streamlined for you—Two days will be devoted to Jobbers—and two days to Servicemen, Retailers, Amateurs and others in the trade—that means fullest attention and maximum benefit for everyone at the show! (Look at the Calendar.) All Booths manned by technical men on Servicemen and Amateur Days.

1939 JUNE 1939			
WED	THU	FRI	SAT
14	15	16	17
<p>OPEN these two days to Jobbers, Manufacturers, Manufacturers' Agents, and Manufacturers' Engineers only.</p>		<p>OPEN on these two days to Servicemen, Amateurs, Retailers, Students and others in the trade.</p>	

Stevens Hotel-Chicago

National Radio Parts Trade Show

Sponsored by Radio Manufacturers Association and Sales Managers Club
 ★Executive Office—53 West Jackson Boulevard, Chicago, Illinois

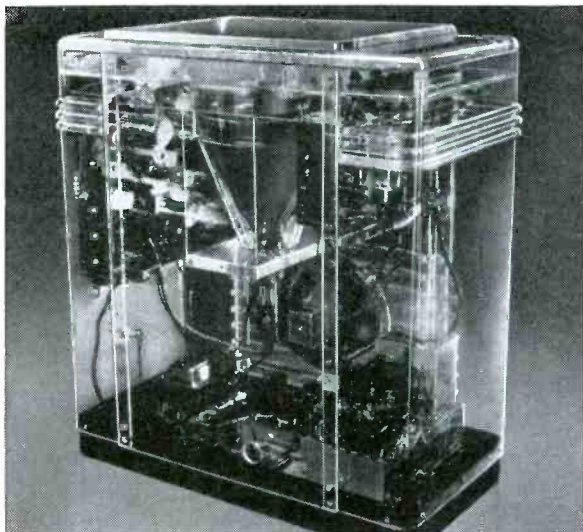


- TECHNICAL FEATURES OF 1939 PORTABLE BATTERY RECEIVERS -

Trade Name	MAUFACTURER	KNIGHT	LAFAYETTE	MAJESTIC	MISSION BELL	PHILCO	PILOT	PORT-MATIC	RCA VICTOR	REMLER	SENTINEL	SETHILL CARLSON	SILVERTONE	SONORA	SPARTON	STEWART WARNER	TRAVLER	TROY	WELLS-GARDNER	WESTING-HOUSE	ZENITH
Name	WHOLESALE RADIO SERVICE CO., Inc	CC E	BB	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Model No.	E10325	70 55 72	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Chassis No.		B3 B95																			
Covering	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric	Airplane luggage fabric
Size (Inches)		13 1/2 x 7 1/2 x 8 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2	14 x 9 x 7 1/2
Weight (Lbs)		17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2
Range (Kc.)	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700	550 to 1700
Circuit	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet	Superhet
Speaker (Inches)	6 1/2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
R-F																					
Conv.-Osc.	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G	1A7G
I-F	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G	1N5G
Det.-AVC A-F	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G	1H5G
Power	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G	1C5G
AVC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Output Power (mw)	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Drain (Ma)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
I-F Peak (Kc.)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Type Ant.	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop	Loop
Prov. for External Ant.	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Vol. Cont. (Meg.)	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5
On-Off Indicator	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Phonograph	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Special Features																					

Cunningham Radio Tubes Have the Advantage of RCA's TELEVISION Experience

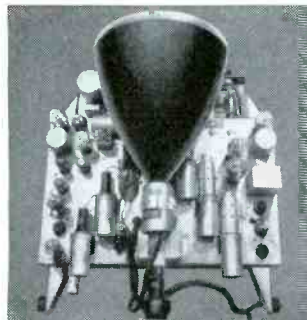
Let the radio owners in your neighborhood know you use and recommend Cunningham Radio Tubes—the tubes built by RCA—the company that brought television to America... the tubes that are backed by the same careful research and built with the same skill that made the television dream an actual fact. The public will be impressed with this story—will come to you for Cunningham Radio Tubes!



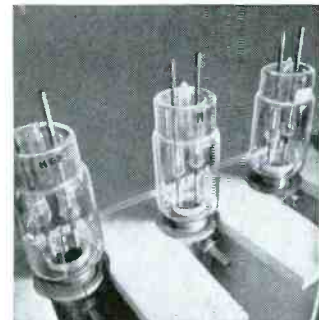
Above is shown a glass-enclosed interior of RCA Victor Television receiver on display at New York World's Fair. You can capitalize on the tremendous publicity that is being given RCA Victor Television if you feature Cunningham Radio Tubes.

Over 95 million Cunningham Radio Tubes have been sold for replacement service work.

Trademark "Cunningham" Reg. U. S. Pat. Off. by RCA Manufacturing Co., Inc.



Typical RCA Victor Television chassis shows large number of tubes used. This is going to help you boost your Cunningham Radio Tube business because eventually all of these tubes will have to be replaced.

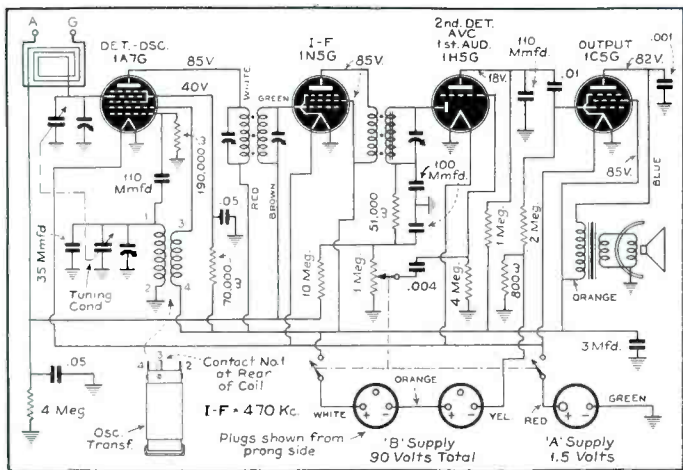


These are RCA High Frequency Television Tubes, built by the same men who build Cunningham Radio Tubes. The same research and skill that are responsible for these tubes are also incorporated in Cunningham Radio Tubes.

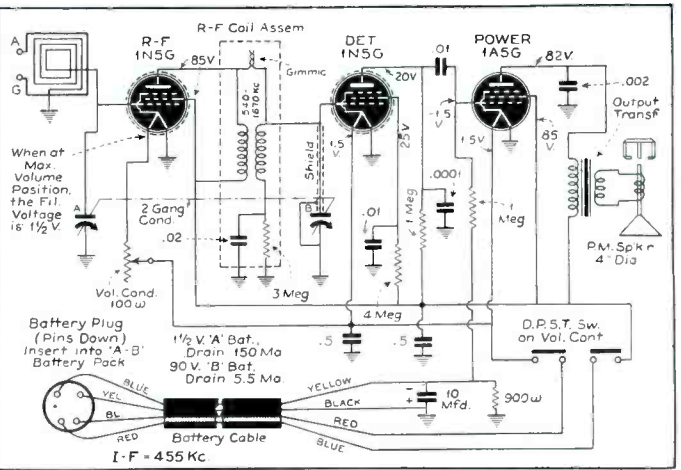
RCA invites you to visit its display at the National Radio Parts Trade Show, Stevens Hotel, Chicago, June 14-17.

Cunningham Radio Tubes

STANDARD SINCE 1915



The Philco Model 39-72T is typical of the 4-tube superheterodyne portable, with avc and a 1C5G output tube. It delivers 200 milliwatts of power to a 5-inch pm speaker.



Sentinel Model 170BL is a three-tube t-r-f. Its total A-battery drain is only 150 milliamperes and its B drain is 5.5 ma. Volume is controlled by means of varying the voltage on the r-f filament.

around the outside of the loop is the means of coupling.

• • • battery life

Battery life is the main servicing item. Figuring 3 hours daily use with a typical 250 ma, 4-tube set, the small A batteries (such as Eveready No. 742) will give only about 80 hours of service while the B batteries will last about 250 hours. Thus, one set of Bs will always outlast two A batteries and may get by with three A changes. The large A battery (Eveready No. 741 or equivalent), on the other hand, is designed for 250-hour operation, so that both batteries will run out together. In pack units, combining A and B batteries, it is urgent in the interest of economy that both run out together. The end-point of utility is considered to be 1.1 volts for the A and 66 volts for the B batteries. These voltages must be measured with the set running. It is interesting that, except in one case (Port-O-Matic), no C batteries whatever are used, bias is obtained in all cases from a drop resistor in the B circuit.

In conclusion, the writer wishes to express his appreciation to Robert G. Herzog, Editor of SERVICE and to Mark Glaser, chief engineer of DeWald Radio Co. for their help in securing much of the data contained in this article, and to the various manufacturers, for their cooperation in supplying the information on which this article is based.

RECENTERING VOICE COILS

THIS item applies only to those speakers in which the spider is cemented to the speaker frame. Even though this type of speaker does not seem to be adjustable, it is frequently possible to recentre the voice coil since the voice coil, spider and cone are fastened together by means of a thermoplastic cement which melts when heated, and hardens as soon as it cools.

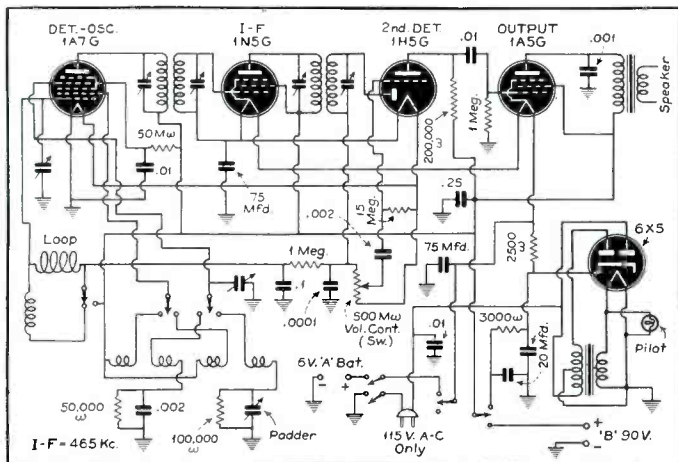
This first operation in recentring the voice coil is to insert at least 3 shims in the air gap to hold the voice coil in the proper position. Note: Do not use celluloid shims but use metal or paper ones. In place of 3 shims, it is often desirable to use a piece of stiff paper as

wide as the circumference of the pole piece so that it goes all around the pole piece. The shims will pull the voice coil to the proper place even though both the cone and spider are glued down. Then hold the speaker with the cone facing downward, and hold the tip of a very hot soldering iron against the end of the pole piece. The purpose of this is to soften the thermoplastic cement which holds the voice coil to the spider. The soldering iron should not actually touch any parts of the speaker except the pole piece. Keep the soldering iron in the position indicated until the thermoplastic cement is thoroughly soft. This will take a minute or two. Remove the iron, and let the speaker cool. When the shims are pulled out, the voice coil should be perfectly centered.

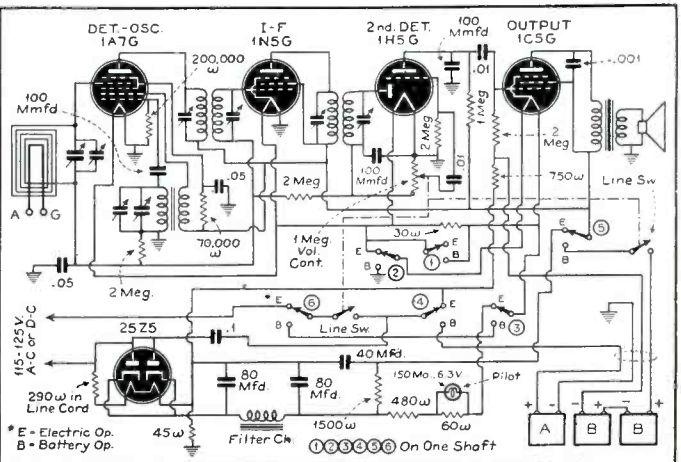
The above method will require a little practice before you can melt the cement just enough to permit the voice coil and spider to move slightly with respect to each other, but it is very effective where the difficulty is due only to an off-center voice coil.

J. N. Gollen
STEWART-WARNER CORP.

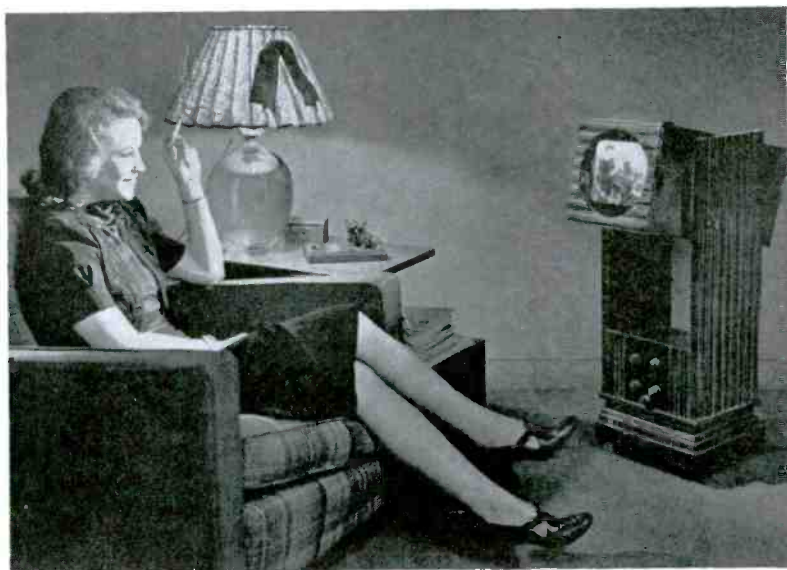
Setchell-Carlson Model 55 can be operated either from self-contained batteries or from the a-c line. It provides short-wave as well as broadcast band reception.



Garod Model BP5 also employs a rectifier and allows operation from either a-c or d-c lines or from self-contained batteries. 200-mfd of filter condensers are used.



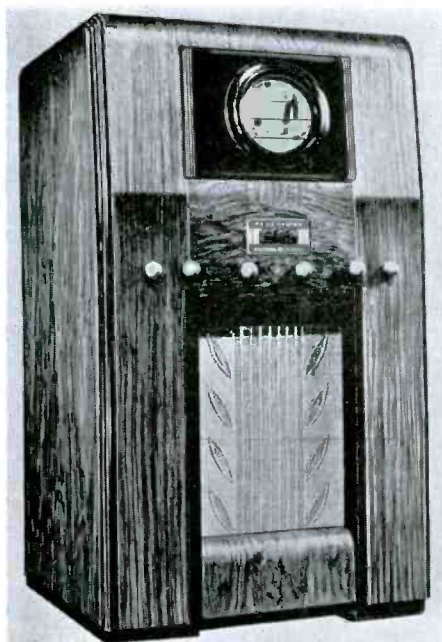
TELEVISION SERVICE



American Television Corporation Kinet. One or more of these can be connected to the Videor receiver for remote viewing of television pictures.

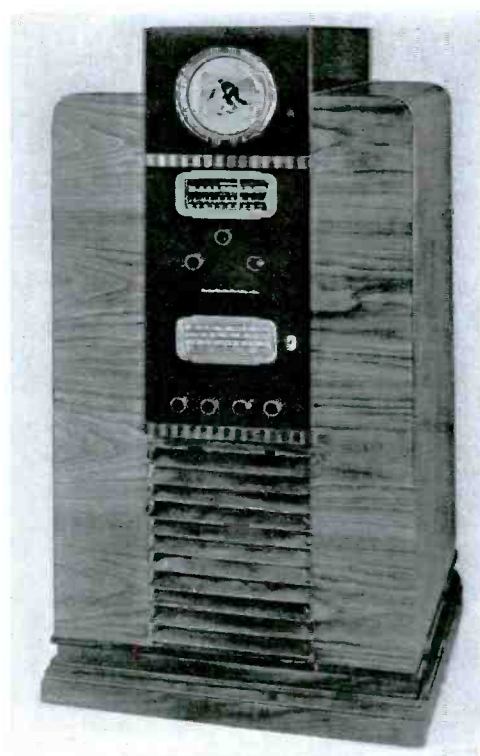
The specifications for these receivers are given in chart form on page 244. Additional pictures are shown on page 245. Others (whose specifications are included in the chart) were given on pages 179 and 185 of the April issue of SERVICE.

General Electric HM-185 (below).



Westinghouse WRT700 (above).

American Television Corporation VA-5 (below).

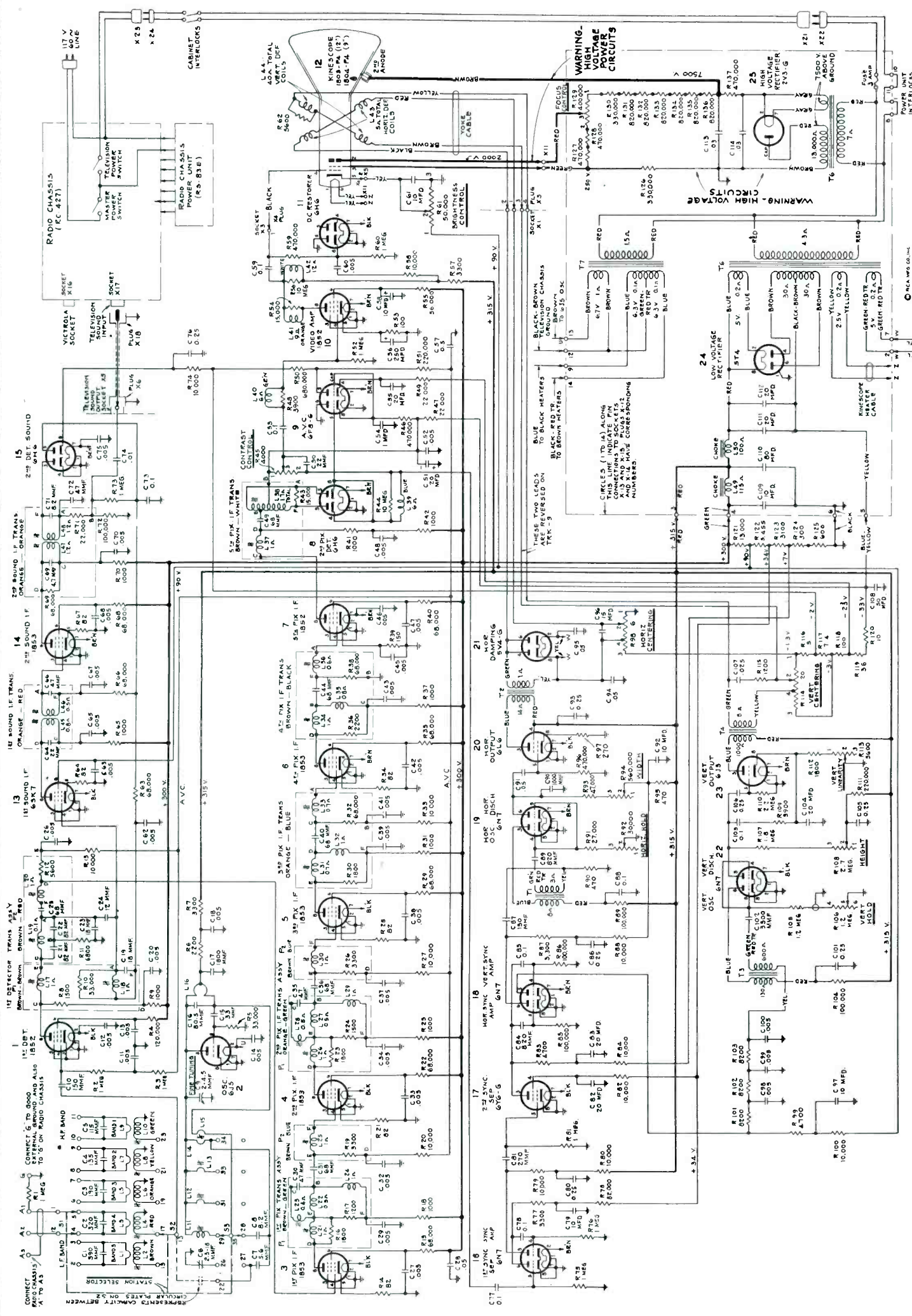


RCA Victor TRK-9 (below).

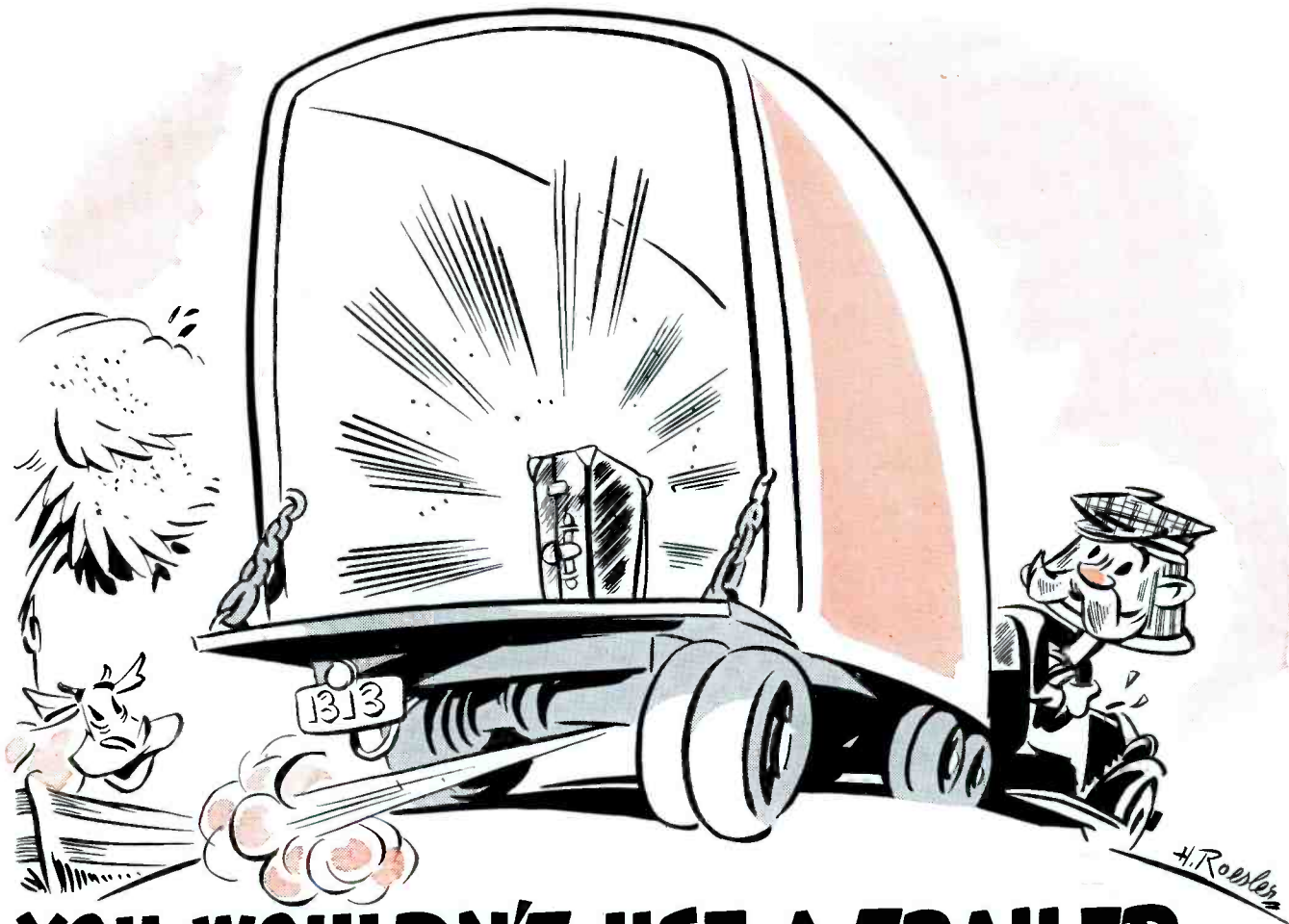


Westinghouse WRT 703 (above).





RCA Victor Models TRK-9 (9-inch) and TRK-12 (12-inch) Television Receiver Chassis

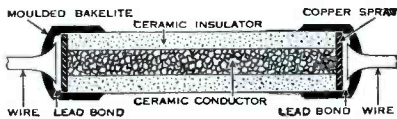


YOU WOULDN'T USE A TRAILER TRUCK TO TRANSPORT A TRUNK

Just doesn't make sense . . . just as little as it makes sense to use a large resistor when a small Centralab Axial Lead Resistor will do the trick. It isn't size that counts . . . for most resistors in radio sets actually carry less than 1/4 watt load. High chassis temperatures and humidity cause breakdown . . . not moderate overload. That is why inserting a LARGE resistor is NOT the answer to a replacement problem.

Centralab Ceramic Resistors ARE the answer. Type 710 is conveniently small, yet fully insulated. Modestly rated at 1/2 watt, it will carry normal overloads.

Baptized in fire at 2500 degrees . . . hard as stone. Center ceramic core, and ceramic jacket fired together to form a single shock-proof unit. Pure copper covers resistor end for wire lead contact.



Solid ceramic—humidity and temperature proof . . . priced so low you can well afford to keep a stock on hand.

2 THINGS
too good to miss

- ★ The 1939 National Radio Parts Trade Show
- ★ Our Display at the Show

1939		JUNE		1939	
WED	THU	FRI	SAT		
14	15	16	17		
FOR JOBBERS			GENERAL TRADE		

Stevens Hotel, Chicago

See your jobber, or write for Bulletin 647.

TYPE 710, rating 1/2 watt, size 1/8 x 3/8 inch. List price 60¢ for five.

TYPE 714, rating 1 watt, size 1/4 x 1 inch. List price \$1.00 for five.

Centralab

AXIAL LEAD RESISTORS

DIVISION OF GLOBE-UNION INC., MILWAUKEE, WIS.

OLD MAN CENTRALAB

SAYS: Smooth and Centralab are synonymous—hundreds of "ads" say so . . . and millions of Resistors, Volume Controls, Switches, etc., give evidence that the ads tell the truth.



- TELEVISION RECEIVER SPECIFICATIONS -

COMPILED FROM DATA SUPPLIED BY MANUFACTURERS

Trade Name	ANDREA		ATC				Du MONT				GAROD		G.E.					PILOT			RCA-VICTOR				STEWART-WARNER	WESTINGHOUSE																		
Manufacturer	ANDREA RADIO CORP.		AMERICAN TELEVISION CORP.				ALLEN B. DUMONT LABS, Inc.				GAROD RADIO CORP.		GENERAL ELECTRIC CO.					PILOT RADIO CORP.			RCA MFG. CO., Inc.				STEWART-WARNER CORP.	WESTINGHOUSE ELECTRIC SUPPLY CO.																		
Model No.	1F5	2F5	A35	VA5	V55	VK5	180	181	182	183	101	102C	HM 171	HM 185	HM 225	HM 226	HM 275	T909	TC 909	TC 1209	TT5	TRK5	TRK5	TRK 12	-				WRT 700	WRT 701	WRT 702	WRT 703												
Cabinet	Table	Console	Table	Console	Console	Console	Table				Table	Console	Table					Table	Console	Table			Console	Table				Table	Table															
Range	44-50 50-56 Mc		Variable Selector				4 Television Channels				44-50 50-56 66-72 Mc		.					5 Television Channels			5 Television Channels				7 Television Bands and 5rd B.C.				5 Television Bands															
Equipped for other than RMA standards	No		No				Yes				No		No					No			No				No																			
Sight and Sound	Both		Both				Both				Both		No†	Both					Both			No†	Both				Both				No†	Both												
All-Wave Receiver	No	Yes	No	Yes	No	Yes	No	Yes	.	.	No	BC Band Only	No	No	No	Yes	Yes	No	BC Band Only	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes									
Speaker (Inches)	6½	8 & 12	.	.	.	.	.	.	.	.	6	12	-	.	.	12	12	8	12	12	-	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
I-F Channels MC	.	.	.	.	.	.	7.4	7.4	7.4	7.4	11.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sight Sound	.	.	.	.	.	.	2.9	2.9	2.9	2.9	8.25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Deflection	Electrostatic		Electrostatic				Electrostatic				Electrostatic		Electrostatic					Magnetic			Magnetic				Magnetic				Magnetic															
Power Supply Voltage	110-115 V. 60~		110-120 V. 60~				110-115 V. 60~				110-120 V. 60~		110-115 V. 60~					110-115 V. 60~			110-120 V. 60~				110-120 V. 60~				110-120 V. 60~															
Power Consumption (Watts)	150		.				250				165		.					250			190				275				420				290											
Picture Size (Inches)	4X3		4 3/8 X 3 3/8				7X5				10 X 8		4 3/8 X 3 3/8					7 3/4 X 5 1/2			10 X 8				7 3/4 X 5 1/2				10 X 8				9 3/4 X 7 1/2				4 3/8 X 3 3/8				7 3/4 X 5 1/2			
Picture Color.	Block & White		Block & White				Block & White				Block & White		Block and White					Block & White			Block and White				Block and White				Block & White				Block and White											
Viewing	Direct	Indir.	Direct		Dir.	Direct				Direct	Direct	Direct	Indirect	Direct	Indir.	Direct	Indir.	Direct	Indir.	Direct	Indir.	Direct	Indir.	Direct	Indir.	Direct	Indir.	Direct	Indir.	Direct	Indir.	Direct	Indir.	Direct	Indir.									
Front Panel Controls	4	4	.	.	.	.	5	5	5	.	4 PB +4	4 PB +4	3 PB +4	3 PB +4	7 PB +4	.	.	5 PB +3	5 PB +3	5 PB +3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5					
Sight Sound	2	4	.	.	.	.	1	1	1	.	2	3*	-	2	2	.	.	1	1	1	-	4	4	4	4	4	4	4	4	4	4	4	4	4	4					
Other Controls - Sight	6		.				7				6		5					8			6				7				.															
Tubes	16	22	.	.	.	.	21	21+ Rec	21	.	16	16+ Rec	16	17	21	28	28	20	20+ B.C. SET	20+ B.C. SET	16	24	36	36	25										
Cathode-Ray Type (Dia. Inches)	1802-P4 5	1802-P1 5	1802-P4 5				114-9T 14				1802-P4 5		1802-P4 5					1804-P4 9			1803-P4 12				1804-P4 9				1803-P4 12				1802-P4 5				1804-P4 9							
Overall Dimensions (Inches)	.	.	24 W 46 H 18 D.	24 W 42 H 14 D.	13 1/2 W 42 H 14 D.	.	.	.	.	.	13 1/2 W 17 1/2 H 17 1/2 D.	20 W 14 1/2 H 18 D.	23 W 38 H 18 D.	.	.	.	.	.	.	.	19 1/2 W 16 1/2 H 19 1/2 D.	29 1/2 W 43 1/2 H 18 1/2 D.	31 1/2 W 47 1/2 H 24 1/2 D.	34 1/2 W 47 1/2 H 19 1/2 D.	36 W 36 H 18 D.										
List Price (\$)	189.50	289.50	160.00	.	.	395.00	395.00	540.00	445.00	.	.	.	.	.	.	.	.	250.00	295.00	475.00	199.50	295.00	450.00	600.00										
Special Features	ALSO KIP FORM	-	-	-	-	-	-	-	-	-	-	SOUND CONV.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

* INFORMATION NOT SUPPLIED.

† SEPARATE CATHODE-RAY TUBE CABINET.

* TENTATIVE; MAY BE CHANGED TO 3-BAND RECEIVER.



Jim tells Joe...

About Sylvania's New Characteristics Sheet

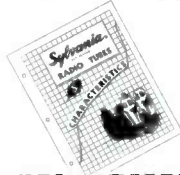
JIM: Say, Joe—look at this new Tube Characteristics Sheet! Isn't it a honey?

JOE: Hm-mm. This is good! Here's complete operating characteristics for *all* Sylvania tubes—even data on the Loktal, Cathode-ray and other new tubes.

JIM: Yep. And in the back here are base and bulb diagrams for all types—and complete dope on Sylvania panel lamps, too!

JOE: Sa-ay—this would be a *big* help to my business! Where can I get it and how much does it cost?

JIM: It's *free*—one of Sylvania's many serviceman helps. All you have to do is send to Hygrade Sylvania Corporation, Emporium, Pa. I'm telling you, Joe—better do it today!



Clip the coupon below for your FREE COPY of the new Sylvania Characteristics Sheet!

HYGRADE SYLVANIA CORP. S-59
Emporium, Pa.

Please send me the new Sylvania Characteristics Sheet.

Name

Address

City State

Serviceman Dealer
 Amateur Experimenter

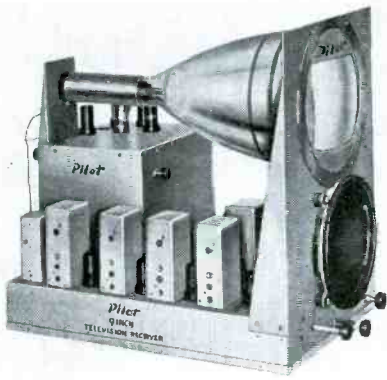
Name of Jobber

SYLVANIA

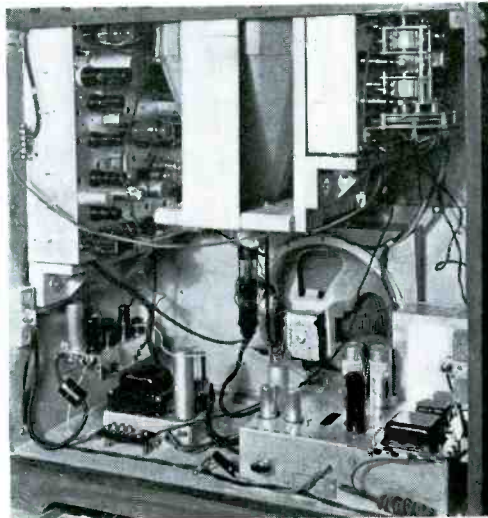
SET-TESTED RADIO TUBES
ALSO MAKERS OF HYGRADE LAMP BULBS

TELEVISION SERVICE

(Continued from page 241)



The illustrations on this page show (counterclockwise) the Pilot T-90 9-in. chassis; the T-90 table model television receiver; an inside or chassis view of the RCA Victor TRK-12 12-in. console, and the Pilot 12-in. console model receiver. Specifications are given in chart form on the opposite page.



THORDARSON AMPLIFIERS *for* 1939

Let your EYE and EAR decide—

NEW 20-WATT
A Jewel in Steel

- Quality at . . . \$
 - Beauty at . . . \$
 - Performance at . . .
 - Compactness at . . .
- 75⁰⁰ LIST



Model T-25W20

Controls: Two microphone, one phono, one treble and one bass.

See your parts distributor or write factory direct for free Catalog No. 600-D on the full line. Lists eight models including a new 28-watt mobile unit.

THORDARSON
ELECTRIC MANUFACTURING COMPANY
AMPLIFIER DIVISION
500 W. HURON STREET CHICAGO, ILLINOIS

TELEVISION ANTENNAE

By MADISON CAWEIN

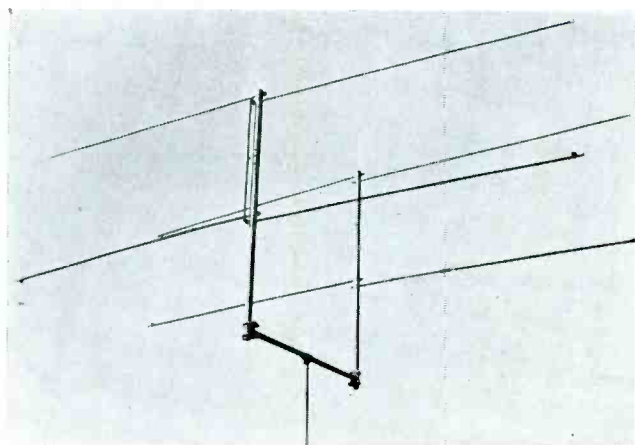


Fig. 1a. RCA television receiving antenna.

IT is extremely important that the Service Man acquaint himself with the various features of a television antenna and its installation. These antennae must be of a special type—no ordinary antenna will suffice.

The input transformer of a television receiver is of the balanced type and must be matched approximately to the impedance of the feeders from the antennae. Any mismatch of impedance at the input to the television receiver will produce reflections of the ultra-short waves along the feeder. These reflected images will be delayed by one or more picture elements and produce "ghosts" on the cathode-ray screen. This gives the picture the appearance of having shadows, or of being a bass-relief. Thus, mismatching must be avoided.

Ordinary twisted a-c line cord has a surge impedance of approximately 100 ohms, which is closely matched to the center impedance of a dipole television

antenna and also to the input impedance of a television receiver. Unless such a line with 100-ohm impedance is utilized to connect the input terminals of the receiver to a dipole antenna, undesirable reflections which cause shadows in the picture may occur.

Examples of commercially available dipole antennas are shown in Fig. 1, a, b, etc.

In regions of low signal strength one dipole may be mounted parallel to another and at a distance of approximately one-half wave-length behind it so that the current in the second dipole will be in phase with that in the first by the time it travels back along the line, or is reflected back through space. The second dipole signal will be delayed by the time of one wave-length, which is only of the order of 1/50 microseconds. The shadow thus introduced will be considerably less than a picture element wide and cannot be seen in television

pictures under present standards. An example of this mounting is shown in Fig. 2.

Sometimes a rhombic antenna (Fig. 3) may be used to advantage, to obtain greater signal-to-noise ratio. The surge impedance of the rhombic antenna is approximately 800 ohms. The far end of this antenna should be terminated in an 800-ohm resistor while the transmission line end should be terminated in an 8:1 impedance step-down balanced transformer to match the 100-ohm transmission line. A 5:1 step-up in signal strength over a dipole antenna may be anticipated by using a rhombic antenna.

Fig. 2. In regions of low signal strength one dipole may be mounted parallel to another and at a distance of approximately half wave length behind it, as shown in the Taco antenna below.

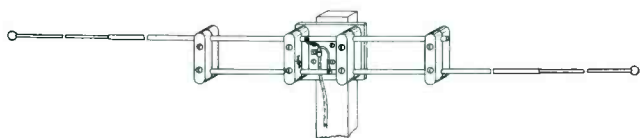
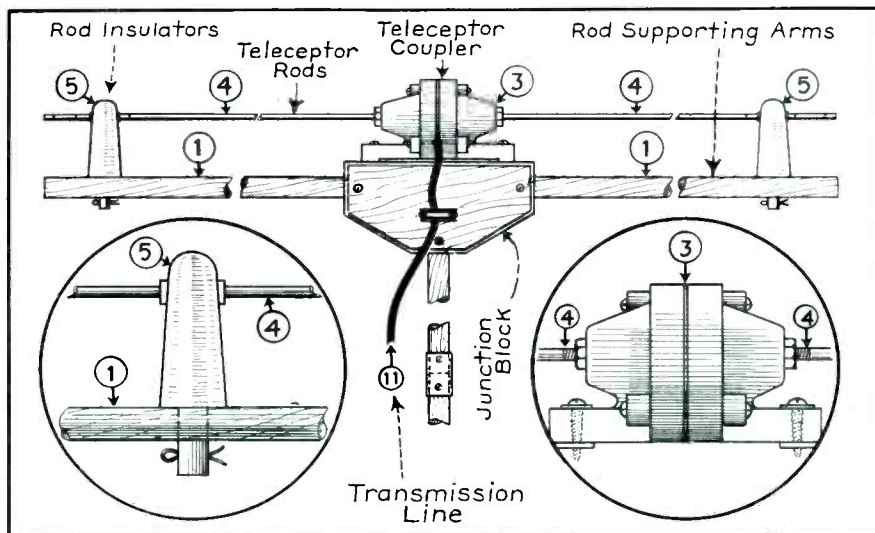
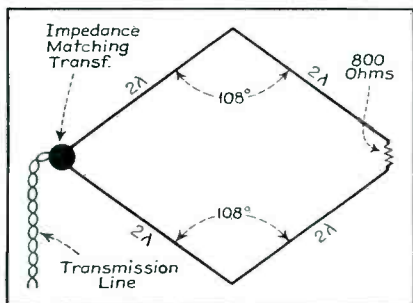


Fig. 1b. Taco television antenna (above).

Fig. 1c. Andrea Teleceptor (right).

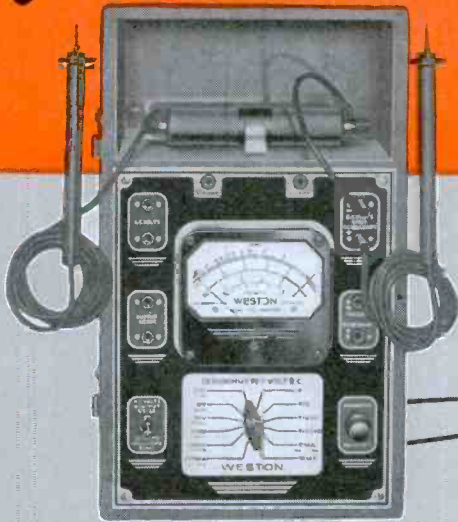
Fig. 3. A rhombic antenna may be used to advantage to obtain greater signal to noise ratio.



Get started
right

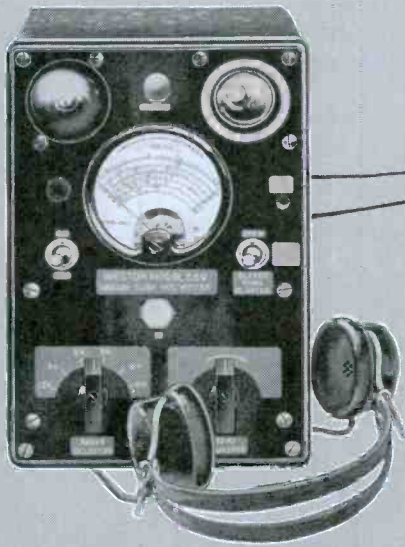
FOR TELEVISION PROFITS!

Here are the instruments engineered *specifically* for this new market...*soundly* designed and built to serve for years



Model 772 Television and Radio Analyzer

The 5000 Volt Analyzer, with sensitivity of 20,000 ohms-per-volt, input impedance 100 megohms on top range. Current readings down to $\frac{1}{2}$ microampere. Breakdown voltage 11,000 volts, in accordance with AIEE standards. Special safety test leads and prods for complete protection. Present owners of Model 772 can bring them up-to-date by purchasing the inexpensive multiplying unit and mounting it in the carrying case.



Model 669 Television and Radio Vacuum Tube Voltmeter and Signal Detector

Hear as well as *measure* the signal with this inexpensive instrument. Measures gain in video and sound amplifying channels — peak voltages in thyratron (saw-tooth) generators in oscillator circuits — grid potentials on cathode ray tubes — as well as other essential measurements in all sound receivers.



Model 787 Ultra High Frequency OSCILLATOR for Television

Essential for television. Frequency — continuous range 22 to 150 megacycles — no band switching. All frequencies fundamental. High order of stability and resetability over entire range. Equipped for television modulation. Battery operated (self contained). Used with rod antenna (included) or with standard output leads. Small size, light weight, provides extreme portability.

When buying radio test equipment from now on, be sure you buy equipment which *also* is good for television. Remember, too, that in television, you'll be dealing with *High Voltages*, and Ultra High Frequencies. You'll need *safe*, as well as precise equipment. Let us send you complete facts on the instruments you require. Return the coupon today.

WESTON

TELEVISION and RADIO INSTRUMENTS

Weston Electrical Instrument Corporation
604 Frelinghuysen Ave., Newark, N. J.
Send bulletin describing WESTON Radio and Television Instruments.

Name _____

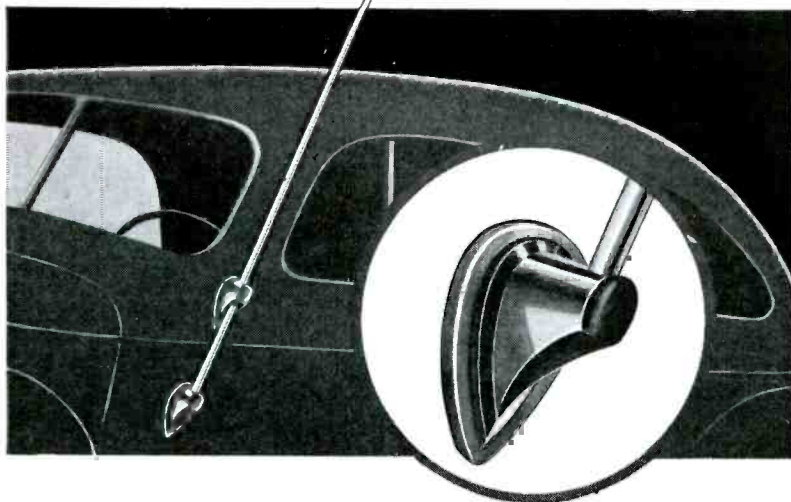
Address _____

City _____ State _____

*Brach
Introduces*

**RADIO'S SMARTEST
COWL AERIAL**

DESIGNED FOR BEAUTY AND EFFICIENCY



SPECIAL FEATURES

- ★ Beautiful new streamline design
- ★ Gleaming chrome plated — Admiralty Brass
- ★ Velvety smooth noiseless action—permanently lubricated
- ★ Vibrationless—exclusive anti-rattle design
- ★ Approved and recommended by leading car manufacturers

L. S. BRACH



**MANUFACTURING
CORP., NEWARK, N. J.**

For **REPEAT SALES
OUTSTANDING VALUES
FAST TURNOVER
AND LONG PROFITS**

*Standardize on
Cinaudagraph*

**PERMANENT MAGNET AND ELECTRO-DYNAMIC
SPEAKERS FOR**

every "replacement" and "sound
amplification" application.

Cinaudagraph Speakers are available from 5" to
27". Details on request. Also brochure on the
New York World's Fair Cinaudagraph instal-
lation.

**CINAUDAGRAPH
CORPORATION**
STAMFORD, CONNECTICUT

YOUR C-R OSCILLOSCOPE

(Continued from page 222)

tions. Often the tube itself is housed in a cylinder of mumetal which protects the tube from external fields as well as those from the instrument itself.

• • • hum

Any magnetic deflection due to power transformers will cause movement of the spot at power-line frequency superposed on the movement produced by the legitimate deflecting system. It may be horizontal, in which case it will cause the waveform to expand and contract concertina fashion, while if it is vertical it will cause the waveform to move up and down. The exact effect in this case depends on the frequency of the wave being examined. At low speeds a hump will pass through the wave from side to side while at high speeds blurred or double images will result. It is, however, quite possible for the deflection to be in some direction quite unrelated to the deflector plates, in which case very queer waveforms will result. Fig. 15 shows a pure 60 cycle sine wave as recorded by an oscilloscope subject to severe magnetic interference!

Hum pick up on the deflecting circuits themselves will produce similar effects. If there is hum in the sweep circuits the waves will exhibit concertina effect, while pick up on the vertical scan will cause superposed vertical ripples.

With a commercial oscilloscope most of these troubles, which are matters of design, will have been overcome. It is, however, quite easy in actual use for some hum to be introduced on the vertical scan. Fig. 16 shows a 1000-cycle double image produced by superposed hum. This pattern would not normally be stationary, the two images weaving in and out the whole time and becoming stationary when the work frequency was an exact multiple of the power line frequency.

The customary precautions should be taken therefore against hum pick up. When the work frequency is well above the line frequency a simple high pass filter such as is shown in Fig. 17 may be used to attenuate the hum. R may be the input potentiometer in the instrument itself.

So far we have only touched on some of the more usual applications involving the use of a sweep circuit. There are many other possibilities such as the use of the tube for phase angle measurements, alignment of receivers, modulation measurements and so forth.

It is proposed to discuss the more important of these further applications in a second article to appear in an early issue.

BOOK REVIEW

VAN NOSTRAND'S SCIENTIFIC ENCYCLOPEDIA, published by D. Van Nostrand Co. Inc., 250 Fourth Ave., New York City, 1938, 1234 pages, price \$10.00.

The ten thousand terms which are defined in this encyclopedia are taken from the following twelve fields: aeronautics, astronomy, botany, chemistry, engineering, geology, mathematics, medicine, mineralogy, navigation, physics, and zoology. These definitions are supplemented with 1,200 illustrations.

At first glance, ten thousand words appears to be quite a large number, but, when these are apportioned to twelve different subjects, it is seen that there are less than a thousand terms for each subject. Consequently, even a rapid survey of this encyclopedia reveals the absence of many terms, including those which have extensive usage.

The entire field of television is sketchily covered in slightly over two pages. In view of the fact that the same house also publishes the excellent "Television Cyclopaedia" by A. T. Witts, such an omission of television terminology appears inexcusable. It is, for example, quite annoying to find *aspect ratio* defined for aerodynamics but not for television.

The treatment of radio terminology has been rather poorly performed. Accompanying the word *triode* is a "characteristic curve for a typical triode" which, together with the accompanying text, indicates an abysmal ignorance on the part of the author. Nor is the situation much improved when the term *amplifier* is examined, for a variable air condenser is used to tune an audio frequency transformer. Such frequently used words as *tetrode*, *pentode*, *decibel*, *root-mean-square*, *vacuum-tube voltmeter*, or *coaxial cable*, do not even appear. *Tank* is defined as a vessel, but its implication in radio is omitted. Under the heading *band of frequencies* mention is made of the defunct *Federal Radio Commission* rather than to the Federal Communications Commission.

The field of chemistry is also not without its missing words. On the other hand, the reader's attention is particularly called to the summarized history of chemistry in tabular form given on pages 569-572.

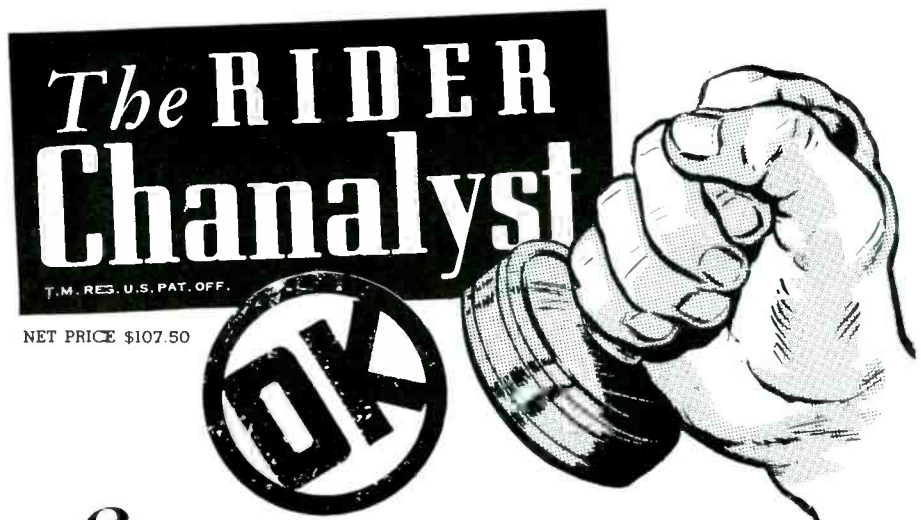
Regarding the general make-up of this encyclopedia, a great improvement would have resulted if the pronunciation of the various defined terms were given. A worse fault is the capitalization of all defined words, thereby resulting in confusion as to whether the word should be written with a capital or a small letter.

Despite its multiplicity of defects, *Scientific Encyclopedia* should prove of some value as a work of reference.

WELLS-GARDNER 62-403

Distortion which seems as though the receiver is being overloaded: If distortion occurs of a type which seems as if the radio is being overloaded and which cannot be accounted for in any other way, check the 5.0-mmfd i-f coupling condenser C33 for capacity. If this cannot be done replace with another one of known correct capacity.

This condenser has a tolerance of 5% and some cases have been encountered in which, due to internal short circuit, the capacity has been raised from 12 to 20 mmfd.

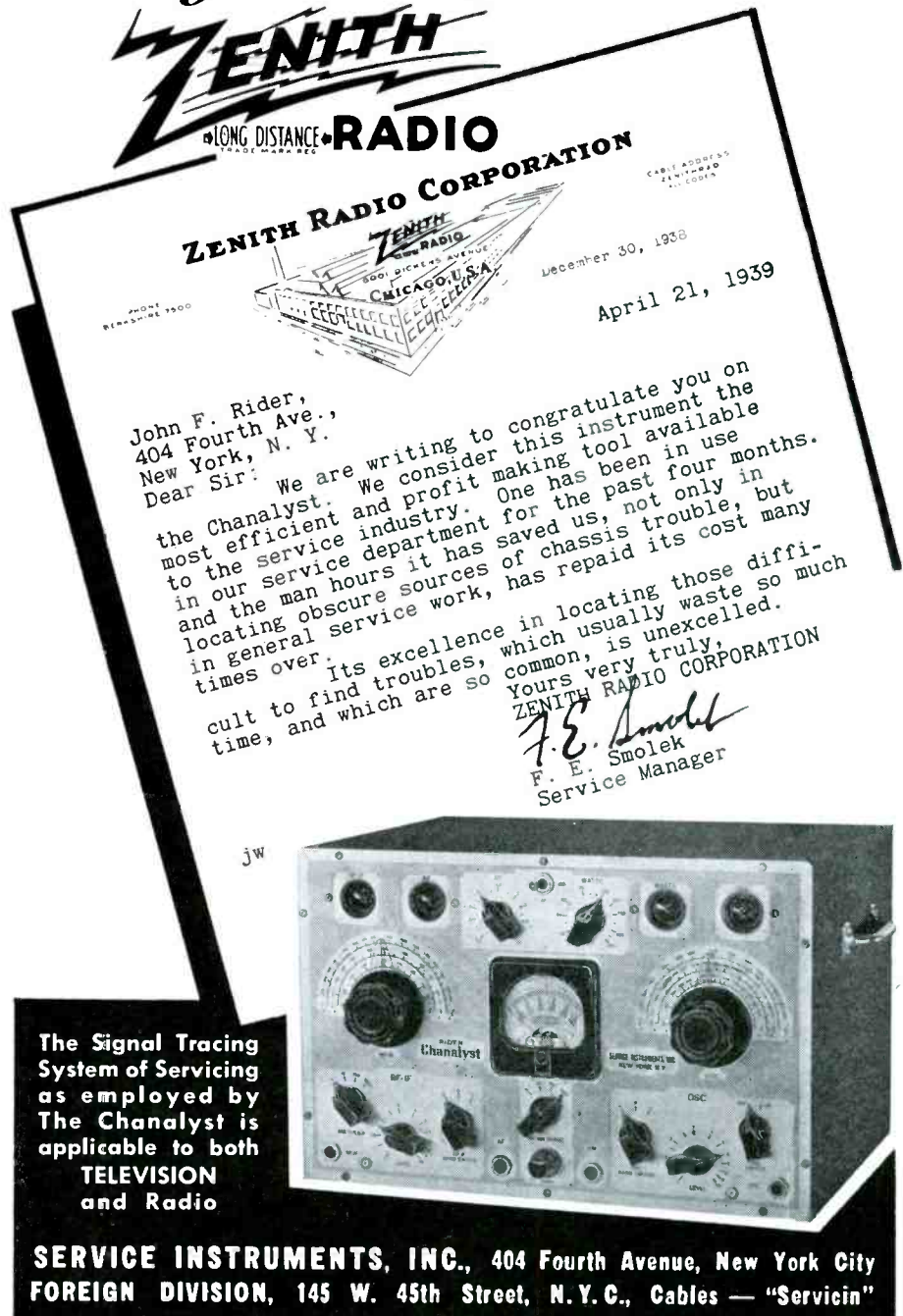


T.M. REG. U.S. PAT. OFF.

NET PRICE \$107.50

Says F. E. SMOLEK
Service Manager of

ZENITH
LONG DISTANCE RADIO



ZENITH RADIO CORPORATION

John F. Rider,
404 Fourth Ave.,
New York, N. Y.

Dear Sir:

We are writing to congratulate you on the Chanalyst. We consider this instrument the most efficient and profit making tool available to the service industry. One has been in use in our service department for the past four months and the man hours it has saved us, not only in locating obscure sources of chassis trouble, but in general service work, has repaid its cost many times over.

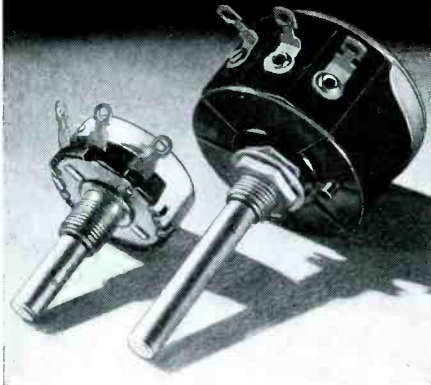
Its excellence in locating those difficult to find troubles, which usually waste so much time, and which are so common, is unexcelled.

Yours very truly,
F. E. Smolek
Service Manager

The Signal Tracing
System of Servicing
as employed by
The Chanalyst is
applicable to both
TELEVISION
and Radio

SERVICE INSTRUMENTS, INC., 404 Fourth Avenue, New York City
FOREIGN DIVISION, 145 W. 45th Street, N. Y. C., Cables — "Servicin"

CARBON or WIRE-WOUND



CLAROSTAT makes both

- ★ Count on your local CLAROSTAT jobber for both carbon- and wire-wound controls. It will save you a lot of time and trouble chasing around for one or the other.

Carbon Controls

- ★ New CLAROSTAT midget type is all that the ideal control should be. Remarkably quiet. Resistance values closely held. Choice of tapers. 1000 ohms to 5 megohms. Any shaft. Exceptionally long life. Ad-A-Switch feature.

Wire-Wound

- ★ Precise resistance values. 1 to 100,000 ohms. Quiet, smooth rotation due to design and special lubrication. Choice of tapers. Ad-A-Switch feature.
- ★ And that's not all. CLAROSTAT also provides such indispensable items as plug-in replacement resistors, voltage-dropping power cords, power resistors, etc. It's a complete line, indeed.

2 THINGS
too good to miss

- ★ The 1939 National Radio Parts Trade Show
- ★ Our Display at the Show

Ask your jobber for our new service manual. Or write us direct.

Visit us at Booth 620-22 Hertz Ave., at June show.

CLAROSTAT



MANUFACTURING CO.
Incorporated
285 North Sixth St.
Brooklyn, N. Y.

WESTON BOOKLET

A new 4-page bulletin just issued by the Weston Electrical Instruments Corp., Newark, N. J., deals with their Model 594, Types 1 and 2, photoelectric cells. Specifications are given. To secure a copy, write to the above organization.

HUTCHENS TO NATIONAL UNION

Henry A. Hutchens, formerly with Western Advertising Agency, has been appointed general sales manager of the National Union Radio Corp. His office will be located at the Newark headquarters of the company.

National Union manufactures a complete line of radio and cathode-ray tubes and also paper and electrolytic condensers.

DIAL LIGHT CATALOG

A catalog covering the pilot light assemblies and signal indicator jewels manufactured by the Dial Light Co., of America, Inc., has recently been made available. Considerable data is given. To secure a copy of this catalog write to F. Edwin Schmitt Sales Co., 136 Liberty St., New York, N. Y.

CORNELL-DUBILIER CATALOG

Catalog No. 162B, describing and listing in detail the C-D line of capacitors for a-c phase-splitting motor applications is being distributed by the Cornell-Dubilier Electric Corporation. Capacitors in this catalog are of the Dy-Kanol types for starting and continuous running duty. It can be obtained by writing to the above company at South Plainfield, N. J.

WARD LEONARD REPRESENTATIVE

Ward Leonard Electric Co. announces the appointment of Mr. C. B. Rogers, Zahner Bldg., 1000 Peachtree Street, N. E., Atlanta, Georgia, as their representative for the sale of Ward Leonard electric control devices. Mr. Rogers' territory will be the states of Georgia, South Carolina and North Carolina.

OXFORD-TARTAK PRODUCTION

Oxford-Tartak Radio Corporation, manufacturers of radio speakers, are again enlarging their factory. The announcement was made by P. H. Tartak, who stated that the additional laboratory and plant facilities were necessary to properly care for the increased volume of business his firm is enjoying.

UNIVERSAL MICROPHONE CATALOG

Universal Microphone Co., Inglewood, Calif., in April issued its "Second edition 'Add a Sheet' Catalog" for new microphone products. The former catalog was issued early in 1938.

CINAUDAGRAPH SPEAKER INSTALLATION

To fill extraordinary acoustic and engineering requirements Cinaudagraph engineers designed their Model WPE 27, a 27" electro-dynamic speaker, for installation at the New York World's Fair. This speaker is described and illustrated in detail in a Cinaudagraph brochure free on request.

CLOUGH-BRENGLE CO. MOVES

The Clough-Brengle Co., manufacturers of test equipment, have moved to 5501 N. Broadway, Chicago.

BIGGER PROFITS In C-D Capacitors



Type BR "Blue Beavers"

Fastest Moving Electrolytics on the Market

In twenty-nine years of capacitor engineering C-D has never compromised with quality—and never will. But there is more to making money than supplying your customers with product dependability.

You must also have a product that will lend itself to a majority of present-day servicing jobs. That is why the new improved Type BR "Blue Beavers" are the fastest selling electrolytics on the market today. Compact, scientifically vented, with flexible wire terminals the Type BR's satisfactorily combine quality and adaptability.

Standardize on C-D capacitors for bigger profits. Catalog No. 165A describing the complete line of C-D paper, mica, Dykanol, wet and dry electrolytics on request.

World's Largest Manufacturer of Capacitors



Always Kept UP-TO-DATE

Readrite
RANGER

only
\$21.60*

* Complete in Quartered-Oak Case



New Model 432

CHECKS ALL TYPES RADIO RECEIVING TUBES

- Tests New 1.5, 35 and 50-volt Series, Loctal Base Types, OZ4 and Other Gaseous Rectifiers.
- Separate Plate Tests on Diodes and Rectifiers.
- Neon Short and Leakage Tests.
- Ballast Tube Continuity Test.
- Uses Attractive Triplet Direct Reading Instrument, 3" Size. (GOOD-BAD) Scale.
- Line Voltage Adjustment.
- New Improved Low Loss Switch.

Model 431 \$15.90

Checks all receiving tubes. (No ballast or gaseous rectifier test.) Tester uses dependable Readrite meter. Quartered-Oak case same as for Model 432.

• COMPLETE SHOWING •
1939-40 METERS and TESTERS
BOOTH 920—JUNE NATIONAL RADIO PARTS TRADE SHOW

READRITE METER WORKS
Section 517, College Drive
Bluffton, Ohio
Please send me complete information on new Model 432.

Name

Address

City..... State.....

AMERICAN MIKE BULLETINS

American Microphone Co., Inc., 1915 S. Western Ave., Los Angeles, Cal., have issued a bulletin No. 29A, describing a new line of dynamic microphones. Copies may be obtained directly from the manufacturer.

ULRICH JOINS HYTRON

Vinton K. Ulrich, formerly managing editor of Radio Today, has become advertising and sales manager of the Hytronic Labs, the research and electronic division of Hytron Corp. The Laboratories manufacture amateur transmitting tubes, bantam Juniors for hearing aids and electronic tubes for industrial applications. Offices are maintained at 76 Lafayette St., Salem, Mass.

CORNISH MOVES OFFICES

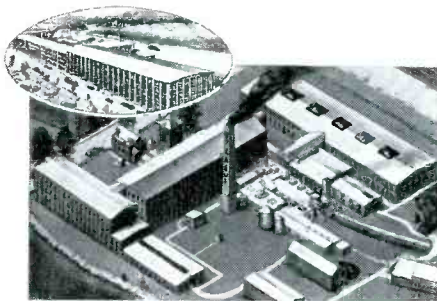
Cornish Wire Co., Inc., have moved to larger offices at 15 Park Row, New York City. Cornish manufactures a complete line of antenna wire, antenna kits and hook-up wire.

CRAMER AND MEZGER ADVANCED

With the expansion of activities from cathode-ray tubes, oscillographs and allied equipment, to include television receivers, studio and transmitting equipment, the Allen B. DuMont Labs., Inc., Passaic, N. J., have advanced Leonard F. Cramer to the post of general sales manager. G. Robert Mezger assists Len Cramer in the handling of industrial sales.

SPRAGUE INCREASES FACILITIES

The recent purchase by the Sprague Specialties Co. of a second set of factory buildings in North Adams, Mass., results in almost doubling the floor space now available in that city for the manufacture of Sprague condensers and Sprague Koolohm resistors. This expansion was made



advisable by steadily increasing business, both export and domestic, plus the recent introduction of wire wound resistors, push button tuners and many new condenser types.

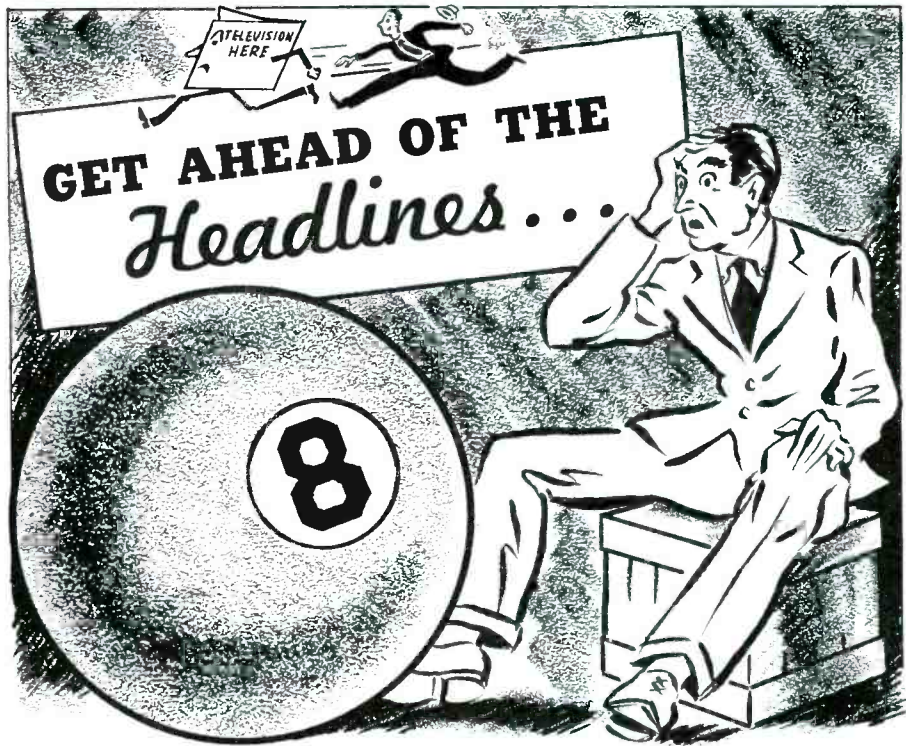
PRECISION APPARATUS MOVES

Precision Apparatus Corp. has expanded its facilities for the second time within the period of one year to meet a rapidly increasing demand for their new line of test equipment.

Both the executive offices and factory are now located at 647 Kent Ave., in Brooklyn, N. Y.

SOLAR TELEVISION STANDARD

Solar bulletin T-1 gives specifications and standards for the high voltage condensers necessary for television circuits. Copies may be obtained directly from Solar Mfg. Corp., 599 Broadway, New York City.



...OR END UP BEHIND THE EIGHT-BALL!

Television—radio facsimile—electronics in industry—these are but a few of the developments in radio which are ready to break in the headlines right now. They will begin to make their appearance in your shop in the coming months—IF you are ready for them. Otherwise, your customers will be forced to take their instruments to your competitor. Be ready for the things expected of you or be satisfied with the cheap jobs of your neighborhood. Get ahead of the headlines—prepare yourself with Rider books. Look over the list—AND order today.

**NEW—Out This Month
"SERVICING BY SIGNAL TRACING"**
by John F. Rider

Use the system of servicing which is fastest—most modern—the system you can apply to all receivers regardless of age, type or make—independent of the kind of circuit or tubes used—independent of every limiting factor heretofore encountered. In this new book you learn what happens to the signal currents—the development of control voltages—and how all receivers are brought to a common servicing level. There is one thing which is common to every radio set—the signal. Read this book and you will be able to service the most complicated set with greater speed and less effort, for "Servicing by Signal Tracing" is based upon the most fundamental thing in any and all receivers, the signal.

300 pages..... \$2.00

**Coming Soon! VOLUME II
THE CATHODE-RAY TUBE AT WORK**
by John F. Rider

New applications of the cathode-ray tube during the past five years require that the 1939 serviceman know more about its operation, its characteristics and its performance.

The cathode-ray tube as the principal factor in television receiving sets is but one of the applications with which you will soon be faced. The use of the Oscillograph in industry is increasing every day in the testing of vibration, strength, engine pressure, etc. These industrial users need servicemen to maintain their oscillographs. You must be up-to-date on this vital subject. Watch for date of publication.

**VOLUME I
THE CATHODE-RAY TUBE AT WORK**
by John F. Rider

This book has established itself as a standard work. It is the most complete and practical book ever written on the subject. If you want to be ready for television you must have the facts contained in this book. This is the only book on the subject written especially for servicemen. Get it today! 336 pages—Over 450 illustrations.....\$2.50

THE OSCILLATOR AT WORK
by John F. Rider

Eliminate guess work—KNOW! This new book tells all about oscillators that you use as a signal source—those in a receiver

or a wireless record player—in fact all oscillators. It not only explains the theory by means of simple illustrations, diagrams and curves, but gives you the practical facts—so you can combine theory and practice. Out in May—Place Your Order Now.

- "An Hour a Day With Rider" Books—60c Each
- On AUTOMATIC VOLUME CONTROL
 - On RESONANCE AND ALIGNMENT
 - On D-C VOLTAGE DISTRIBUTION IN RADIO RECEIVERS
 - On ALTERNATING CURRENTS IN RADIO RECEIVERS

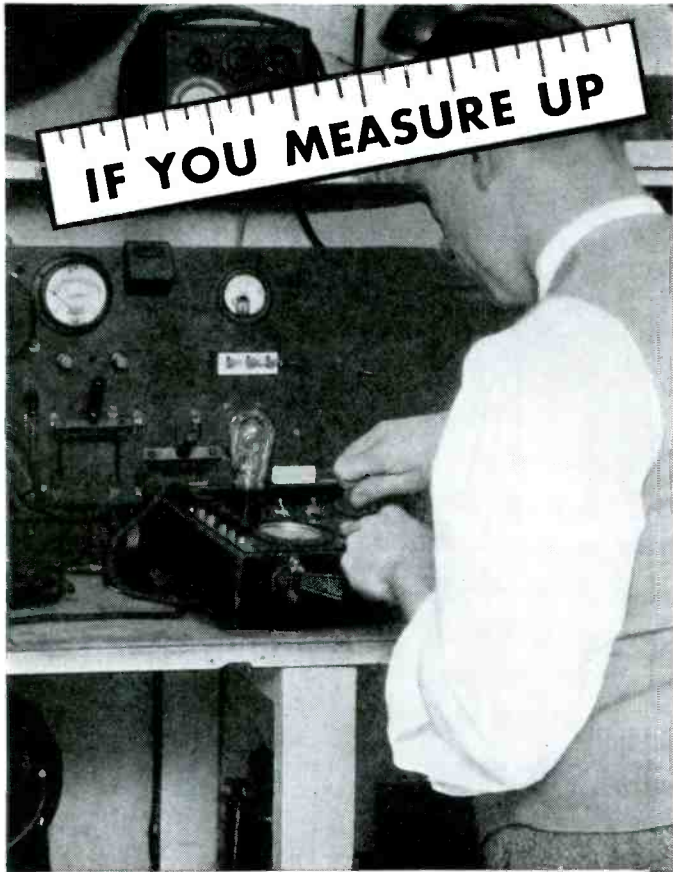
**AND DON'T FORGET
"You Need All Nine RIDER MANUALS"**

Stop tussling with baffling service problems. You need and will eventually buy Volume IX. Why wait! Get it and start benefiting from this vast storehouse of essential circuit data today.

Volume	Price	Covering
IX.....	\$10.00	1938-39
VIII.....	10.00	1937-38
VII.....	10.00	1936-37
VI.....	7.50	1935-36
V.....	7.50	1934-35
IV.....	7.50	1933-34
III.....	7.50	1932-33
II.....	7.50	1931-32
I.....	7.50	1920-31

RIDER BOOKS
For Servicemen who want to be "Ready"

JOHN F. RIDER, Publisher, 404 FOURTH AVE., NEW YORK CITY



you qualify

Tung-Sol could not offer their jobbers and dealers the advantages of selective distribution were they to sell just anyone. Read these questions carefully and "If you qualify," write today.

Is yours a representative service business?

Is your location free from interference with already established Tung-Sol Agents?

Can you compete in technical knowledge and service set-up?

Can you move a reasonable tube stock every three or four months?

Are your premises adapted to use sales-producing advertising displays to advantage?

Will you maintain Tung-Sol established retail prices?

Tung-Sol Lamp Works Inc. Dept. D. Radio Tube Division
 SALES OFFICES: Atlanta · Chicago · Dallas · Denver · Kansas City
 Los Angeles · New York · General Offices: Newark, New Jersey

TUNG-SOL RADIO TUBES

AUTO-RADIO DATA

(Continued from April)

G. E.
General Electric Co.

Model	Tubes	Year	Gear Ratio	Dial Direction ^b	I-F
A60	6	1932	20/1	CCW	175
A90	9	1932	10/1	CW	175
B40	4	1934	6/1	CW	175
B52	5	1935	10/1	CW	175
C41	4	1934	6/1	CCW	175
C60	6	1934	6/1	CCW	175
C61	6	1934	8/1	CCW	175
D50, 51, 52	5	1935	10/1	CW	175
D72	7	1935	10/1	CW	175
FA61	6	1937	12/1	CW	175
FA80	8	1937	12/1	CW	175
N60	6	1936	12/1	CCW	175

Gillfillan
Gillfillan Bros., Inc.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
X	5	1935	6/1	CCW	460
7A	7	1935	10/1	CW	175
8X	8	1936	8/1	CCW	265
67A, 67B	6	1937	12/1	CW	252.5
67R	6	1937	12/1	CW	252.5
77A, 77R	7	1937	12/1	CW	252.5
87A, 87R	8	1937	12/1	CW	252.5
700	7	*	*	*	175

Graham Paige

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
<i>Crosley Radio Corporation</i>					
A355	5	1936	*	*	262
A555	5	1936	*	*	262
<i>RCA Manufacturing Co.</i>					
101	5	1935	10/1	CW	175
<i>Philco Transitone Corporation</i>					
1418	6	1937	*	CW	260
1436	6	1937	*	CW	260
1528	7	1938	*	CW	260

Halson

Halson Radio Mfg. Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
Roadmaster	5	*	*	*	456
Roadmast. Sr.	6	*	*	*	456
56U	*	*	*	*	456
65	*	*	*	*	456

Harold Bell

Harold Bell Radio Company

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
25	5	*	*	*	465
44	4	*	*	*	TRF
44MG	4	*	*	*	465
44S	4	*	*	*	262
55MG	5	*	*	*	262
65	5	*	*	*	465

Gulbranson

Gulbranson Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
06W	6	*	*	*	262
062A	6	*	*	*	262
V6Z2	6	*	*	*	262
T6W1	6	*	*	*	262

Howard

Howard Radio Company

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
HA1	6	1933	12/1	CCW	175
HA2	6	1934	12/1	CCW	456
HA3	5	1935	12/1	CCW	456

^bCW denotes clockwise rotation. CCW, counterclockwise. By clockwise rotation is meant that receiver is being tuned to a higher frequency when the dial scale or pointer rotates in a clockwise direction when viewed from the front of the control head.

*No remote control is used.

*Information not readily available.

HA5	6	1936	12/1	CCW	175
HA6	6	1937	12/1	CCW	465
HA7	6	1938	12/1	CCW	465
HA8	8	1938	12/1	CCW	465
HA9	6	1938	12/1	CCW	465

Hudson
Hudson Motors

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
<i>Zenith Radio Corporation</i>					
650HD	6	*	*	*	252.5
651HE	6	*	*	*	252.5
660HE	6	*	*	*	252.5
661TE	6	*	*	*	252.5
A680	6	*	8/1	CW	252.5
<i>RCA Manufacturing Co.</i>					
CBC	5	1938	*	*	260
H6	5	1937	*	*	260

Kadette
International Industries, Inc.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
K60	6	1934	6/1	CCW	262.5

Karadio
Karadio Corporation

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
F6	6	1937	12/1	CCW	456
55	5	*	*	*	456
57	7	*	*	*	456
65	5	*	*	*	456
66	7	*	*	*	456
67	7	*	*	*	456
75, 76	*	1937	12/1	CCW	456
77, 78	*	1937	12/1	CCW	456
150	5	*	*	*	456
160	6	*	*	*	175
180	7	*	*	*	175

Knight
Allied Radio Corp.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
AS5	5	*	*	*	TRF
AU5	5	*	*	*	TRF
E9776	6	*	*	*	TRF
E9781	4	*	*	*	TRF
F9541	6	*	*	*	175
F9561	6	*	*	*	175
F9563	7	*	*	*	175
F9737	6	*	*	*	175
F9741	7	*	*	*	175
G9881	5	*	*	*	456
A9882	6	*	*	*	175
H9725	5	*	*	*	456
H9726	6	*	*	*	177.5
H9766	6	*	*	*	175

Larkin
Larkin Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
90	7	*	*	*	175
91	7	*	*	*	175
92	6	*	*	*	175

Lewol, Pacific
Lewol Mfg. Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
12A	*	*	*	*	*
101B	*	*	*	*	456
102B	*	*	*	*	177.5

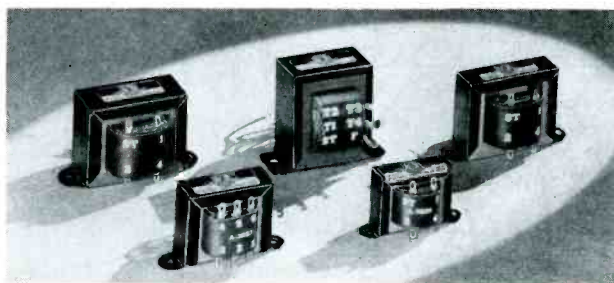
CORRECTION

In the Auto-Radio Data listings on page 202 of the April issue of SERVICE a slight error was made. The Emerson Models F122, F133, F141 and G127 are household receivers. There is no Model G135. The data ascribed to these models applies only to the Model E128 as listed.

(To be continued)

STANCOR

UNIVERSAL OUTPUT TRANSFORMERS ARE EASY TO USE



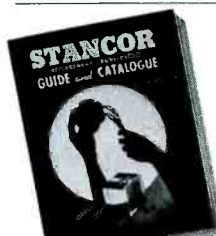
DESIGNED BY ENGINEERS FAMILIAR WITH SERVICE PROBLEMS

NOTE THESE FEATURES:

- ★ Excellent frequency response.
- ★ Well engineered.
- ★ Accurately made.
- ★ Carefully tested.
- ★ Vacuum impregnated the STANCOR way.
- ★ Wide choice of electrical characteristics.
- ★ Sizes ranging from midgets to large.
- ★ Easy to mount.
- ★ Long flexible coded primary leads.
- ★ Heavy, well-tinned secondary lugs.
- ★ Easy-to-read terminal markings.
- ★ Beautiful in appearance.
- ★ Best quality materials used throughout.
- ★ Fully guaranteed.

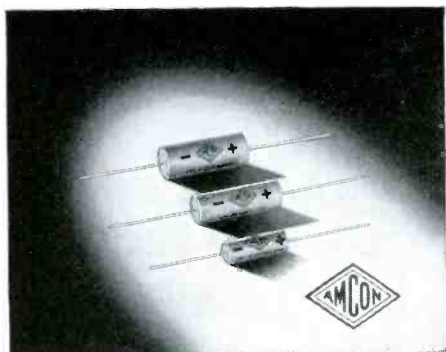
UNIVERSAL OUTPUT TRANSFORMERS —to Voice Coil and Line

Stancor Number	Impedance in Ohms			D.C. Pri. M.A.	Max. Audio Watts	Core Size	List Price
	Primary						
A-3856	4,000, 7,000, 8,000, 10,000, 14,000 C.T.	1 to 30	35	4	1/2" x 1/2"	\$1.20	
A-3849	1,500, 2,000, 4,000, 5,000, 7,000	1 to 30	55	10	3/8" x 3/8"	1.50	
A-3823	4,000, 7,000, 8,000, 10,000, 14,000 C.T.	1 to 30	40	8	5/8" x 5/8"	1.50	
A-3850	4,000, 7,000, 8,000, 10,000, 14,000 C.T.	1 to 30	40	8	5/8" x 5/8"	1.50	
A-3852	4,000, 7,000, 8,000, 10,000, 14,000 C.T.	1 to 30	40	18	3/4" x 1"	1.90	
A-3870	4,000, 7,000, 8,000, 10,000, 14,000 C.T.	1 to 30	50	18	3/4" x 1"	1.90	
A-2855	4,000, 7,000, 8,000, 10,000, 14,000 C.T.	1 to 30	50	15	3/4" x 3/4"	1.60	
A-3890	4,000, 7,000, 8,000, 10,000, 14,000 C.T.	1 to 30	50	15	3/4" x 3/4"	2.50	
A-3880	4,000, 7,000, 8,000, 10,000, 14,000 C.T.	1 to 30	40	15	3/8" x 3/8"	2.25	
A-3830	3,000, 5,000, 6,000, 7,000, 8,000, 10,000 C.T.	1 to 30	60	20	1" x 1"	3.00	



These and many other NEW features are incorporated in the NEW 1939 STANCOR SERVICE GUIDE. FREE at your STANCOR Distributor. Get one TODAY.

STANDARD TRANSFORMER CORPORATION
1500 NORTH HALSTED STREET, CHICAGO



Little Americans

THE SMALLEST MIDGET WITH THE BEST PERFORMANCE

•
ALL STANDARD CAPACITIES
ALL WORKING VOLTAGES

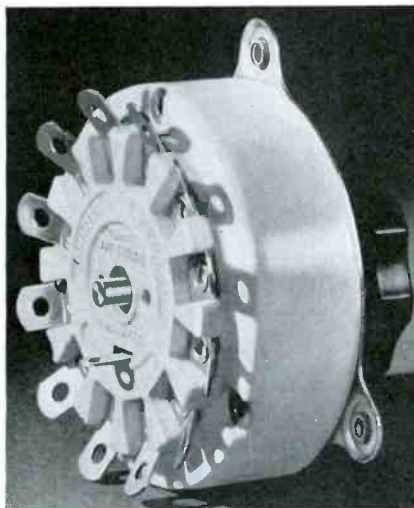
•
Literature and Price Lists on Request

•
AMERICAN
CONDENSER CORPORATION
2508 S. Michigan Avenue, Chicago, Ill.

TAP SWITCH

The new Ohmite Model 412, 40-ampere tap switch is one of a complete new series of high amperage heavy-duty rotary multi-point selector tap switches.

The tap switch is rated for 240-volt a-c non-inductive circuit—is 4" in diameter—and is equipped with a maximum of 12



contacts. For full details, write to the Ohmite Manufacturing Company, 4835 Flournoy St., Chicago.

IMPEDANCE METER

In the accompanying illustration is shown the Type LA-48 direct-reading audio-frequency impedance meter.

The instrument is self-contained for 115-

volt, 60-cycle operation. Impedance is read directly in ohms on the meter.

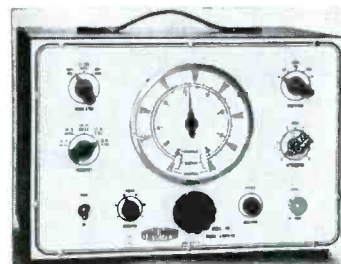
Literature may be secured from *Alfred*



W. Barber Laboratories, 35-33 172 St., Flushing, New York.

SIGNAL GENERATOR

A new signal generator, Model 130, is being manufactured by Triumph. It has a directly calibrated full vision dial. The



range is from 100 kc. to 96 mc. It is said to be factory calibrated to better than 1/2 of 1 percent. 400-cycle modulation is available. Complete information may be secured from *Triumph Mfg. Co.*, 4017-19 W. Lake St., Chicago.

RSA is YOUR Host

**Second Annual RSA Convention
JUNE 16 and 17, STEVENS HOTEL, CHICAGO**

YOU CAN'T AFFORD TO MISS:

★ **TELEVISION** Lectures for servicemen by outstanding television authorities.

- ★ **FACSIMILE**
- ★ **TEST EQUIPMENT**
- ★ **TUBES**
- ★ **NOISE ELIMINATION**

MAIL THIS COUPON FOR YOUR ADVANCE COPY OF RSA CONVENTION PROGRAM

RADIO SERVICEMEN OF AMERICA, Inc.
304 S. Dearborn St., Chicago, Ill.
Sure I'll be at the RSA Convention.

Name

Address

City..... State.....

Please send advance copy of Convention Program.....

I am interested in RSA Membership. Tell me about it....

I am enclosing \$4.00 for National dues and initiation.....

(Does not include Local Chapter dues where Local Chapters are organized.) S-539

Because we are the only NATIONAL organization of servicemen, we are able to arrange an outstanding program for RSA members. RSA invites YOU, Mr. Serviceman, to attend our Convention and see what RSA is doing for you.

The RSA Convention is only one of the benefits RSA is providing. You can get ALL the benefits by joining your fellow servicemen in RSA.

*Let's Grow Together
in 1939!*

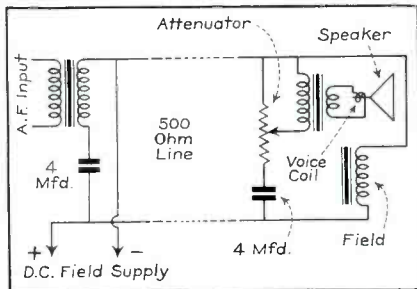


RADIO SERVICEMEN OF AMERICA, INC.

304 S. DEARBORN STREET, CHICAGO

TWO WIRE ELECTRODYNAMIC

IT IS quite often found impractical to run four wires to supply the a-f and the d-c field supply for dynamic speakers. It is possible, through the use of the accompanying circuit, to accomplish this with only two lines. No interfer-



ence results and practically no power is lost.

Two suitably matched line transformers are used. These are fed from the line through a pair of 4-mfd condensers. The relatively large capacity is used to prevent the attenuation of the low frequencies due to the low impedance of the line transformers. These condensers effectively block the d-c field supply from the transformer circuits but permit easy flow of the voice frequencies. The rather high impedance of the speaker field to these frequencies prevents appreciable dissipation of the latter in the field circuits.

To prevent hum from entering the transformer circuit the d-c field supply should be amply filtered.

ASSOCIATIONS

RSA

RESULTS of the annual election to the Board of Directors of RSA were announced by the Tellers of Election, Harold Cunningham, Winnetka, Ill.; Felix J. Grumann, Chicago, and Donald H. Stover, Freeport, Ill.

Directors were nominated in each sectional division of RSA holding an election this year, by chapters of the division, and every member of RSA in the division received a ballot.

Elected to serve until June 1, 1942: George D. Wooley, Rock Island, Ill., sectional division 5. Fred Olson, Green Bay, Wis., sectional division 7. Joseph A. Cole, Detroit, Mich. (reelected) sectional division 9.

Elected to serve until June 1, 1941: Frank L. Clark, Nashville, Tenn., sectional division 11. Winston B. Jones, Washington, D.C., sectional division 15. Carl A. Rauber, Somerville, N. J. (reelected) sectional division 15. George F. Duvall, Brooklyn, N. Y. (reelected) sectional division 17. Norman W. Smith, Jamestown, N. Y., sectional division 19.

Elected to serve until June 1, 1940: Carl Williams, Phillipsburg, N. J., sectional division 14. Ingvar Paulsen, Roxbury, Mass., sectional division 20.

Bridgeport, Conn. Chapter brought home the big prize—a sixty-dollar Clough-Brengle super-unimeter—in the RSA New Member campaign recently closed. An active campaign to explain RSA to Service Men of Bridgeport, its accomplishments, plans, and ideals, resulted in nearly doubling the membership of the Bridgeport Chapter.

Second prize, a Rider IX Service Manual, goes to Washington, D.C. Chapter for the excellent growth shown by that group during the period of the contest.

Springfield, Ill., and St. Paul, Minn., Chapters came up with a score that the closest scrutiny of the judges could decide only as a tie. So duplicate third prizes (three one-year subscriptions to choice of the radio trade magazines) will be awarded to both chapters.

Of all the chapters, the greatest number of new members obtained during the contest was scored

HICKOK OSCILLOGRAPH

Maintains Leadership with

New Built-in VISUAL

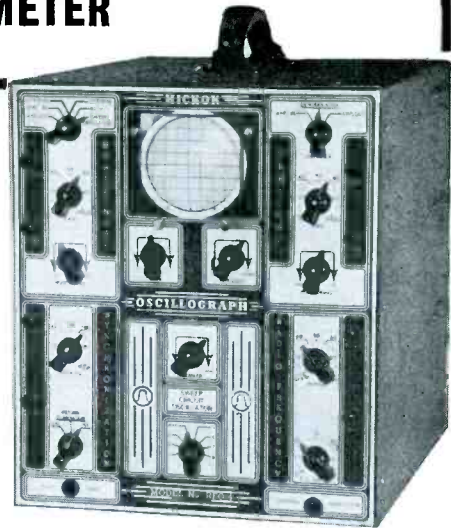
VACUUM TUBE VOLTMETER

Range .2 volt to 1000 volts

Now more complete than ever. This Model R F 0 — OSCILLOGRAPH tests all stages including R.F. and I.F.

Self-Contained Demodulator and Video Amplifiers—Use it for single or stage by stage trouble shooting from antenna post to speaker.

Self-Contained Dual Sweep Electronic Frequency Modulator—Visual alignment at 665 K.C. or any harmonic thereof to 5 megacycles without external oscillator.



BETTER OSCILLOGRAPH SERVICING

To better understand the many features of this wonderful instrument and to facilitate its easy use in radio and television servicing we have just issued Technical Bulletin No. 150 entitled, "Practical Application of the Oscillograph to Modern Radio Servicing."

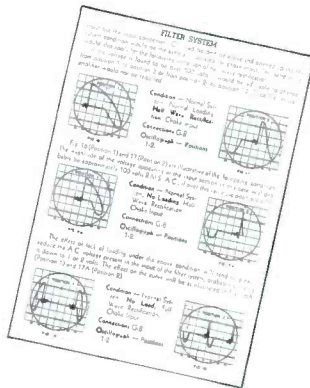
This book is fully illustrated as shown by the page reproduced herewith. It explains in simple language how to use an Oscillograph for adequate, profitable radio servicing.

Price is 25c. The book can be secured from all Hickok Jobbers or direct from the factory. (Use coupon below.)

It is included as part of the instructions with all new Hickok Oscillographs.

Mail the coupon for full information about all Hickok Radio Test Instruments.

The Hickok Electrical Instrument Co.
CLEVELAND, OHIO



See Hickok Test Instruments at the Radio Show, HOTEL STEVENS, CHICAGO, ILL. JUNE 14-17, Booths No. 615-617

Tube Testers
Set Testers
Signal Generators
Oscillographs
Volt Ohm Milliammeters
Test Speaker
Appliance Tester

THE HICKOK ELECTRICAL INSTRUMENT CO.,
10501 Dupont Ave., Cleveland, Ohio.
Gentlemen: Please send latest catalog.
 Enclosed find 25c for your Bulletin No. 150.

NAME
ADDRESS
CITY STATE

SAVE \$1.00 !!!

- The Group Subscription Plan for *Service* enables a group of service men, dealers or jobbers to subscribe at one-half the usual yearly rate.
- The regular individual rate is \$2.00 a year. In groups of 4 or more, the subscription rate is \$1.00 a year. (In foreign countries, \$2.00.)
- Each subscriber should print his name and address clearly and state his occupation—whether a dealer, jobber, independent service man, service organization, etc.

Remember this Group Plan when Your Subscription Expires




MU-2

ASTATIC

IT'S GRAND FOR BANDS

New MULTI-UNIT Crystal Microphones provide maximum amplification and cannot be acoustically overloaded. Performance, flexibility and beauty all combined. List price, MU-2, complete, \$29.50



New MIKE-LITE Gives Great Delight

This includes Model T-3 Crystal Microphone with two adjustable spotlights that throw a flattering halo of soft, warm light on entertaining artists and speakers. Complete, as described, with stand, transformer and cable. List Price, \$62.50



RADIO PARTS TRADE SHOW

We'll Be Seen' You

Astatic's complete line of quality crystal microphones and pickups will be on display at the Show. Don't miss this important exhibit.

ASTATIC MICROPHONE LABORATORY, Inc.
YOUNGSTOWN, OHIO
Licensed Under Brush Development Co. Patents
Astatic Patents Pending

by the New York Metropolitan Chapter, but their percentage increase in membership was not as great as that of the winners, and a prize was missed by a narrow margin.

The contest was a great success, every chapter gaining new strength from increased membership.

RSA announces the recent affiliation of Chapters in Pekin, Ill.; Scranton, Pa., and Stamford, Conn. This brings the total of active RSA Chapters to fifty-seven.

Correspondence with service groups in Coffeyville, Kan.; Jackson, Mich., and Wausau, Wis. regarding affiliation is being carried on by the National Office of RSA.

CHICAGO CHAPTER RSA

THE special RSA Television Service Course (at RCA Institutes) has increased chapter activity no end. The results: new members, better meeting attendance, and the name of RSA further enhanced with a new meaning of importance.

The social highlight of the month was a dinner and tour of Chicago Chinatown on Sunday, April 14. Almost a hundred attended, and enjoyed a swell time. A great deal of credit for the grand success of this social goes to The Ladies of RSA, our chapter ladies' auxiliary.

Charles Hirsch, chief engineer of Majestic, spoke on "Automatic Volume Expansion" at our meeting of April 12. His demonstration of volume expansion was especially startling.

"Something New and Different" read the announcement card for our April 26 meeting. The members of the executive committee of the chapter led a Round Table Discussion, answering prepared questions dealing with technical and business problems, such as "What was your toughest service problem?" and "How I sold a tough customer." The practical information thus obtained was very valuable. The chapter voted to have more meetings of this sort.

AL KILIAN, Publicity.

ROCHESTER RTG INFO-MEET

THE Radio Technicians Guild of Rochester have the plans all laid for Sunday, May 28, 1939. A great all day educational meeting of Radio Service Men within a three hundred mile radius of that city, also sections of New England.

This meeting, to be held at the Powers Hotel, Rochester, N. Y., and known as an "Info-Meet" (Information Meeting), has for its theme Good Fellowship and the Diffusion of Knowledge. There will be speakers of national reputation on radio service practice and theory.

Cities or Service Men's groups are urged to enter five men teams in a Technical Quizz, that will be in progress throughout the day.

Dinner will be served about 6:00 P. M. at \$1.50 per plate, this being the only expense connected with the "Info-Meet."

Although the "Info-Meet" is sponsored by RTG of Rochester, we are respectfully seeking the wholehearted co-operation of all Service Men and their chosen organizations. Registration at 10:30 A. M.

TRADE SHOW

FOLLOWING is a schedule of various group meetings being held in conjunction with the Radio Parts Industry Show at the Stevens Hotel, in Chicago:

National Association of Radio Parts Distributors, Tuesday, June 13, 2:30 P. M.
The Representatives, Friday, June 16, 10:30 A. M.

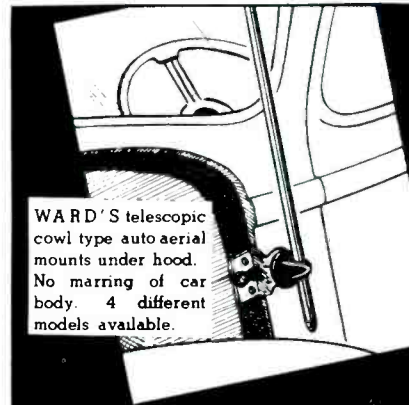
Sales Managers Club, joint session, Friday, June 16, 10:30 A. M.

Radio Parts Manufacturers National Trade Show, membership meeting, Friday, June 16, noon.

Radio Servicemen of America, Friday and Saturday, June 16 and 17, annual convention, and engineering lectures jointly with the Chicago Section of the Institute of Radio Engineers.

Attendance at the 1939 Trade Show is expected to top all previous records, as evidenced by advance registration interest.

More than 50% of the total number of parts jobbing firms registered at last year's Radio Parts Trade Show have already filed their registrations with the office of the Show Management. At the same time the number of sales agents firms is closely approaching the total of last year.



WARD'S telescopic cowl type auto aerial mounts under hood. No marring of car body. 4 different models available.

WARD'S new Concealed Mount **AERIALS**

Give You These **5**

Sales Advantages

- No drilling thru car body, mounts under hood
- Rattle-proof with Ward's patented anti-rattle feature
- Streamlined design, topped with "anti-static" ball tip
- Sturdy brass mounting brackets
- Gives better reception

WARD PRODUCTS Corp

WARD BUILDING CLEVELAND, OHIO

New "PRECISION" Automatic

PUSH-BUTTON A.C.-D.C. MULTI-RANGE TESTER
SERIES 870 — 29 RANGES Including a
3,000 VOLT A.C.-D.C. RANGE



★ D.C. VOLTAGE RANGES at 1000 ohms per volt; 0 to 6/30/300/600/1200 and 3000 V.

★ A.C. VOLTAGE RANGES at 500 ohms per volt: 0-12/60/600/1200 and 3000 volts.

★ D.C. CURRENT RANGES: 0-1.2/12 120/600/1200 milliamperes.

★ RESISTANCE RANGES: 0-5000 ohms (20 ohms at center of scale) 0-500,000 ohms (powered by self contained 3 volt battery) 0-5 meg-ohms (powered by external battery.)

★ FIVE DECIBEL RANGES: -10 to +64 DB.
★ OUTPUT METER INDICATIONS on Five A.C. voltage ranges.

Large size 3 inch square meter. Compact walnut finished case. Size 7 x 4 x 3. Wire wound shunts and metallized multipliers, both 1%. **\$16.95**
Net Price, with 3 volt battery

AVAILABLE AT LEADING DISTRIBUTORS



SEE THEM AT YOUR JOBBER

PRECISION APPARATUS CORP.
647 Kent Avenue, Brooklyn, N. Y.
Export Division—458 Broadway, New York City, U. S. A.
Cable Address: Morhanex

SHOW PROGRAM

Second Annual Convention RSA

Stevens Hotel, Chicago

June 14 to 17 Inclusive

• • • wednesday, june 14

10:00 A. M. Annual meeting of Board of Directors, election of national officers, reports and general business.

• • • thursday, june 15

10:00 A. M. Annual meeting continued.

• • • friday, june 16

3:00 P. M. "Facsimile", a lecture and demonstration of facsimile by engineers from radio station WGN.

4:00 P. M. "Test Equipment for Television", Western Electrical Instrument Corp.

7:00 P. M. Annual RSA meeting.

8:00 P. M. "Television", a theoretical discussion of installation and service problems. Albert Preissman, RCA Institutes.

Actual demonstration of television transmission and reception will be conducted following the lecture and continuing Saturday. (Television lecture and demonstration are cosponsored by RSA and Chicago section of the IRE.)

• • • saturday, june 17

2:00 P. M. "Peak Limiting Amplifiers", Douglas Fortune, Thordarson Electric and Mfg. Co.

3:00 P. M. "Radio Noise", demonstration and lecture, characteristics and cures. By an engineer from Tobe Deutschman Corp.

4:00 P. M. "Modern Service Instruments", Bruce O. Burlingame, Supreme Instruments Corp.

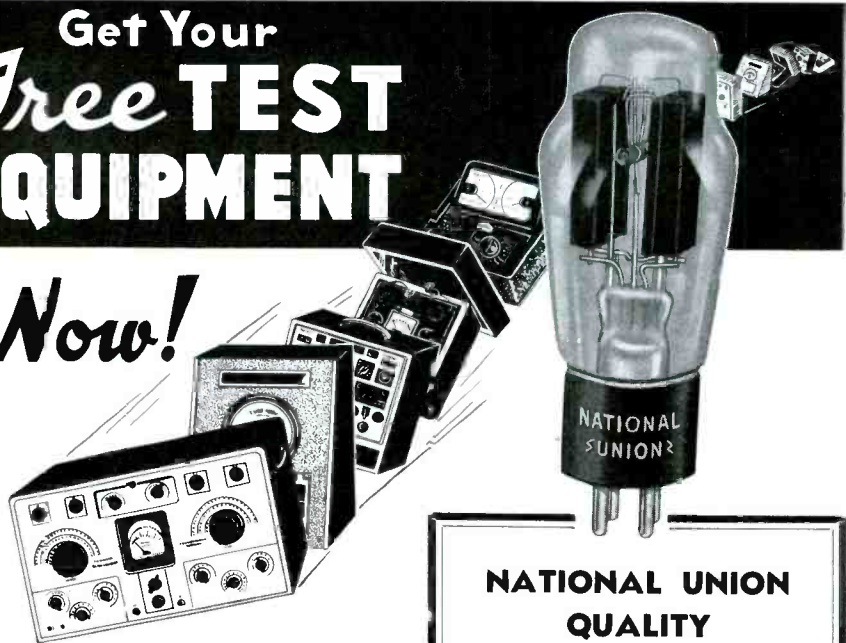
7:00 P. M. "What Television Will Mean to the Service Man." A discussion of the Service Man's position in the new art by Sanford R. Cowan, SERVICE magazine.

8:00 P. M. "Tube Developments", an Engineer from Hygrade Sylvania Corp.

A record crowd of over 1,200 Service Men attended a meeting on May 8 in the Capitol Hotel to hear discussions on television installation and service equipment. The speakers included: Norman Hall, television service manager, DuMont Laboratories; J. K. Whitteker, chief instructor, RCA Institutes; O. J. Morelock, television engineer, and V. E. Jenkins, manager of radio sales, both of Weston Electrical Instrument Corp.

Get Your
**Free TEST
EQUIPMENT**

Now!



**PURCHASE POINTS
GO UP JULY 1st!**

What test equipment do you need? A new tube tester, another volt-ohm-milliammeter, or one of the latest Television Testers—you'll find all the leading makes in National Union's Equipment Catalog—and now is the time to get it. Before the Purchase Point requirements go up on July 1st, 1939.

Remember, the National Union way requires only a small deposit and this is refunded as a merchandise credit when the required number of Points based on your purchases of N. U. tubes and Condensers has been reached. Thousands of completed deals tell the story of complete satisfaction and National Union help.

The raise in purchase points becomes effective July 1. This advance notice will permit all dealers to take advantage of the present level but there will be no extension after July 1, as the low nets recently established simply will not permit continuation on the present basis.

SEE US AT BOOTHS 1012-1014—
CHICAGO JUNE RADIO PARTS SHOW

NATIONAL UNION QUALITY

National Union radio tubes and condensers have the precision and performance that makes friends for you wherever they go. National Union is the logical choice of radio service engineers everywhere.

TEST EQUIPMENT AVAILABLE

Leading Makes of

- TUBE TESTERS
- SET TESTERS
- OSCILLOSCOPES
- VOLT-OHM-MILLIAMMETERS
- POCKET TESTERS
- SIGNAL GENERATORS
- NEW TELEVISION TESTERS
- VIBRATORS

Mail Coupon for More Information

National Union Radio Corporation
57 State St., Newark, N. J.

Please send me information on how I can get free (Test or Shop Equipment).

Name

Address

City..... State..... S-539

**"GET THE TEST EQUIP-
MENT YOU NEED NOW
...DON'T DELAY...ASK
YOUR N.U. JOBBER"**





**JUST 8 MODELS
FOR 90% OF ALL RADIO
SERVICE CALLS
Including...**

Both Power and Audio Transformers

**TRANSFORMERS
AVAILABLE
FOR
TELEVISION**

● For \$18.23 a service dealer can stock 8 models of Halldorson Transformers that will answer 90% of all radio service calls covering both power and audio requirements.

And remember, the design of each transformer covers the requirements of all the makes of sets for which it is intended. When the investment is so low, why not be prepared to give prompt transformer service with the outstanding Vacuum Sealed Transformer line.

Halldorson
Vacuum Sealed **Transformers**
THE HALLDORSON COMPANY
4500 Ravenswood Ave. Chicago, Ill.

FREE . . .

Vari-Volt Transformer . . . to Servicemen on Special Deal . . . Makes your test bench voltage exactly what you want it.

Write for details!



SIMPLIFIED

Receiver ALIGNMENT

The alignment of multi-band radio receivers is greatly simplified with a Crystal Calibrator. This inexpensive instrument not only minimizes time and effort, but also assures frequency accuracy. For a rapid over-all check of sensitivity and alignment, it has no equal.

Requiring only a few standard parts, a Crystal Calibrator can be easily constructed with a Bliley SMC100 Dual-Frequency Crystal Unit. Leading distributors will supply the Bliley SMC100 Unit for only \$7.75. Bliley Electric Co., Erie, Pa.

BLILEY DUAL FREQUENCY CRYSTAL

YOU SAVE \$1.00

by using the

**Group
Subscription Plan**

OUR GROUP SUBSCRIPTION PLAN enables you and three or more of your co-workers to subscribe to SERVICE at one-half the regular yearly rate. In other words it will cost you and your friends only \$1.00 each for twelve issues of SERVICE. The G-S-Plan low rate only applies when 4 or more subscriptions are ordered at one time. (Foreign \$2.00.)

Speak to three or more of your friends . . . let them sign up with you and then you can remit for the whole group. (Renewals or extended subscriptions are acceptable as part of a group.)

TEAR OUT AND MAIL

SERVICE—19 E. 47th St., N. Y. C.

Please enter annual subscriptions (12 issues) for each of the undersigned for which payment is enclosed at the rate of \$1.00 each; foreign \$2.00. (This rate applies only on 4 or more subscriptions when occupations are given.)

Name

Address

City-State

Occupation

Employed by

State whether Employer is a Service Organization, Dealer, Jobber or Manufacturer

Name

Address

City-State

Occupation

Employed by

State whether Employer is a Service Organization, Dealer, Jobber or Manufacturer

Name

Address

City-State

Occupation

Employed by

State whether Employer is a Service Organization, Dealer, Jobber or Manufacturer

Name

Address

City-State

Occupation

Employed by

State whether Employer is a Service Organization, Dealer, Jobber or Manufacturer

• Your best safeguard against obsolescence is a Triplett push-button tube tester because it permits individual connections for each element.

TRIPLETT

Model 1610



Dealer Net
\$39.00
carrying
case

Lifetime PUSH-BUTTON TUBE TESTER

- ★ Tests All Receiving Tubes Including the new 1.5 Volt and 50 Volt Series; the Small Loctal Base Tubes; and the 0Z4 and Other Gaseous Rectifiers.
- ★ Ballast Tube Continuity Test.
- ★ Separate Test for Diodes and Rectifiers.
- ★ Separate Gas Test and Conclusive Neon Shorts Test.
- ★ Illuminated Dial and GOOD-BAD Scale.
- ★ Chart Scroll . . . New Up-to-Date Scrolls Can Be Obtained at Any Time on Nominal Exchange Cost Basis, Easily Installed.
- ★ Uses Approved Emission Circuit Constructed to RMA Load Requirements.

Now is the time to study tube testers seriously—Triplett's Model 1610 contains sockets that will accommodate all type receiving tubes, including loctal (no adapters). Individual connections for each tube element permits push-button control to be set correctly regardless of what filament arrangement is used or at what pin point other elements are terminated. Why take a chance when this additional safeguard costs so little?

Model 1610 uses approved emission circuit constructed to RMA requirements. Dealer Net Price \$39.00

Model 1611—Combines push-button Volt-Ohm-Milliammeter with Tube Tester of Model 1610, in same type case. Uses plug-in type copper oxide rectifier. Dealer Net Price \$49.50

**SEE THE NEW TRIPLETT 1939-40
LINE AT THE JUNE NATIONAL
RADIO PARTS TRADE SHOW
BOOTHS 403-405**

The Triplett Electrical Instrument Co.
175 Harmon Ave., Bluffton, Ohio

Please send me more information on Model 1610;
 Model 1611.

Name

Address

City..... State.....

MALLORY VIBRAPACKS

Three new Vibrapacks, the VP-555, VP-557 and the VP-F558, have been added to the Mallory line of vibrator power supplies. These power supplies are designed to operate portable and mobile radio and

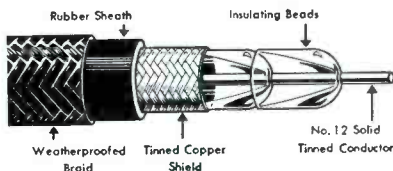


p-a equipment from 6-volt and 32-volt power sources.

A booklet containing complete descriptions of all of these Mallory units may be obtained from *P. R. Mallory & Co., Inc.*, Indianapolis, Ind.—SERVICE.

BELDEN COAXIAL CABLE

Belden 8215 consists of a No. 12 solid tinned copper conductor over which is threaded a low-loss insulating bead. Over the series of beads is a closely woven tinned copper shield braid. The braid in turn is sheathed in rubber and the whole cable is covered with a weatherproofed

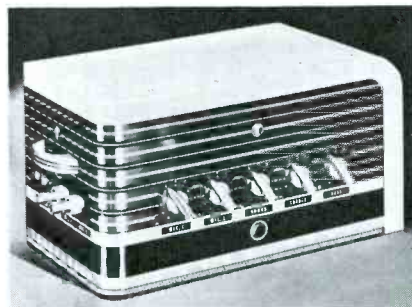


braid. Belden 8216 is similar but uses a No. 15 solid tinned copper conductor.

Additional information may be obtained directly from the *Belden Manufacturing Co.*, 4689 W. Van Buren St., Chicago.—SERVICE.

THORDARSON AMPLIFIER

Thordarson's streamlined 20-watt amplifier, illustrated, provides inputs for 2 mi-



crophones and 1 phono pickup or r-f tuner with independent mixing and control.

Catalog 600D describes this and 9 other Thordarson amplifiers, with outputs ranging from 8 to 75 watts. Copies may be obtained directly from *Thordarson Electric Mfg. Co.*, 500 West Huron St., Chicago.—SERVICE.

COMPACT!
but plenty of
**ELECTROLYTIC
CONDENSER**
for the
MONEY



• For all-round use, especially for rush jobs that cannot wait for an AEROVOX exact-duplicate replacement, your logical choice is the PBS line of electrolytics.

- Cardboard-case units of utmost compactness consistent with full rated capacity and working voltage, and economical life.
- Provided with Adjustimont metal flanges to fit any mounting-hole spacing, or for flat, upright, or stacked mounting.
- Single, dual and triple sections.
- In 25, 50, 100, 250, 450 and 600 v. D.C. working. Standard capacities.
- More for your money. More value for your customers. More good will for your future.

Ask Your Jobber for an assortment of PBS electrolytics. Have them on hand as "first-aid" units. Ask for latest catalog—or write us direct.





HERE'S REAL NEWS

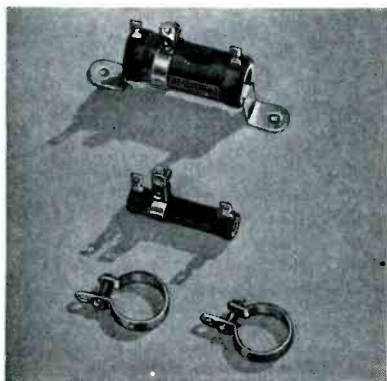
Our new line of "Tropicals" . . . weather proofed audios . . . are tops in staying power under most adverse humidity conditions . . . but priced low for the serviceman's pocket-book.

See us at the Radio Parts Show, Booth No. 630

UNITED TRANSFORMER CORP.

Write: SERVICE DIV. ★ 150 VARICK STREET ★ NEW YORK, N. Y.
EXPORT DIVISION: 100 VARICK STREET NEW YORK, N. Y. CABLES: "ARLAB"

LONG-LIVED



Wire Wound Resistors

A new high in resistor values! Both fixed and adjustable types. Wound on ceramic tubes and protected by a baked cement coating which is non-hygroscopic and non-absorbent. Four ratings in each type cover nearly all service, replacement, and experimental requirements for amplifiers, receivers, and transmitters. Design of movable bands for adjustable units allows setting for exact resistance requirement. One or more bands may be used. Ratings: Fixed—5, 10, 20 and 50 watts. Adjustable—10, 25, 50 and 75 watts.

See Them at Your Parts Jobber's Today!

CONSOLIDATED
WIRE AND
ASSOCIATED
CORPORATIONS

518 S. PEORIA ST. CHICAGO, ILL.

PARALLEL PRECISION CONTACTS INSURE QUALITY IN NAALD SOCKETS—ADAPTERS AND TEST EQUIPMENT



Note the contour of design which is engineered to the thousandth of an inch precision

—the material tested and developed to the exact thickness and temper to accommodate repeated flexing of the contact.

Parallel Precision Contacts are designed so that the flexing is microscopic—less than .003". In any other design or material, the flexing sets up crystallization causing contact to give out after short service.

Parallel Precision Contacts float—their shape prevents prongs going in at an angle—accommodate variations in tube prongs, insuring perfect contact under hard usage.

Make sure you have the best in dependable contacts by demanding NAALD quality in adapters, sockets and test equipment.

Order today from your jobber or write direct for bulletin.

ALDEN PRODUCTS CO.
Dept. SJ Brockton, Mass.

MEISSNER VIBRATORS

Meissner engineers have redesigned their vibrator line. The 74 units provided feature a special alloy Swedish spring steel center reed, designed to eliminate



breakage due to fatigue.

Additional information may be obtained from Meissner Mfg. Co., Mt. Carmel, Ill. SERVICE.

APPROVED GIANT ANALYZER

A giant shop model a-c, d-c analyzer with a remote control box and 9 ft. of cable has been announced by the Approved Technical Apparatus Co., 57½ Dey St., New York City. SERVICE.

CERAMIC-JACKETED RESISTORS

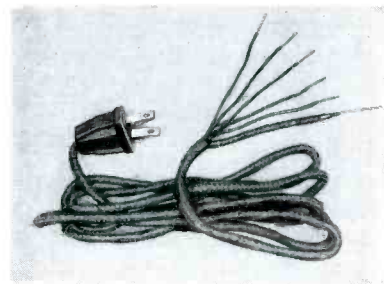
Ceramic-jacketed precision non-inductive wire-wound resistors in a wide range of values up to 3 megs, and in ½, 1,



1½ and 2 watt ratings are now offered by Clarostat Mfg. Co., Inc., 287 N. 6 St., Brooklyn, N. Y. SERVICE.

MICAMOLD UNICORD

The Micamold Unicord is a universal resistor cord that is designed as a replacement for practically all of those now in



use. The Unicord is of conventional appearance, except that there are 3 extra colored leads. By connecting together various combinations of the colored leads many different resistance values can be obtained, ranging from 22 to 330 ohms.

Additional information may be obtained from Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y.—SERVICE.

A pair of Aces!



BRUSH HL MIKES HM MIKES



• Here's a mike to remember on your next low gain amplifier problem—Brush Model HL. This diaphragm crystal type mike will please hams and professionals alike with its high level performance and good response from 100 to 5,000 c.p.s. plus or minus 5 db. Plenty of eye-appeal in its satin chrome finish, and flexible *Vari-Swiv* mounting.

You can specify this mike with confidence and be sure of a good profit for you.

• You can make your next low impedance job a better job with Brush HM Mike. It's a diaphragm crystal type, built into a handsome bullet shaped case containing the mike and a high grade transformer with taps for 50, 200, and 500 ohm lines. Gives low impedance operation, and high level (minus 46 db.). Comes complete with *Vari-Swiv* mounting. A dependable mike that will insure customer satisfaction.

THE BRUSH DEVELOPMENT CO.
3318 PERKINS AVE. CLEVELAND, OHIO

A GOOD NAME GOES A LONG WAY



Ken-Rad has the experience, the resources and the plant equipment to make dependable Ken-Rad Radio Tubes your best choice.

KEN-RAD TUBE & LAMP CORPORATION
Owensboro, Kentucky

KEN-RAD

DEPENDABLE RADIO TUBES

SAVE \$1.00!!!

- The Group Subscription Plan for *Service* enables a group of service men, dealers or jobbers to subscribe at one-half the usual yearly rate.
- The regular individual rate is \$2.00 a year. In groups of 4 or more, the subscription rate is \$1.00 a year. (In foreign countries, \$2.00.)
- Each subscriber should print his name and address clearly and state his occupation—whether a dealer, jobber, independent service man, service organization, etc.

Remember this Group Plan when Your Subscription Expires

it costs no more to test 50-75-100 volt tubes

MODEL 308 TUBE TESTER

Here's another big value for the serviceman! RCP's new Model 308 tube tester is designed to test all the newest tubes, including the 50-75-100 volt filament jobs, as well as loctals, single ends, OZ-4, and other cold cathode rectifiers, at RMA specified loads and voltages. Noise test. Hot interelement short and leakage check. Line voltage indicator on meter. And best of all, this new 308 instrument costs NO MORE than former RCP testers, and less than other obsolete tube testers. See Model 308 at your jobber's today or write for free catalog **\$16.95** that tells the complete story.....

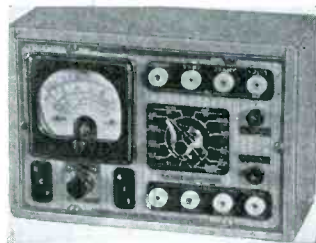


308 P Combination Portable Counter Model—\$18.95

ANNOUNCING a new Electronic Multitester! Engineers at RCP labs announce the new Electronic vacuum tube, volt-ohmmeter Model 660. Tests up to 5,000 V.D.C. and 0.1 ohm to 1,000 megohms. Ultra high impedance and operating simplicity. Write for complete details.

MODEL 411 SUPERTESTER

33 Individual Super Range Instruments in this one compact RCP SUPER-TESTER. 5 stage high AC-DC voltage range, to 5,000 volts. High voltage not applied to selector switch nor to general test circuits. 3" square meter with movement of 200 microamperes or 5000 ohms per volt. 3 stage, AC-DC current range to 25 amps . . . DC Milliamps 0/10/100 . . . DC Microamps 0-200. . . . Center of scale, of low ohmmeter range, only 5 ohms with each of first ten divisions measuring 0.1 ohm . . . AC Ma. 0/500, db meter shown —10 to 69 db in 5 stages. **\$16.25**



MODEL 701 SIGNAL GENERATOR

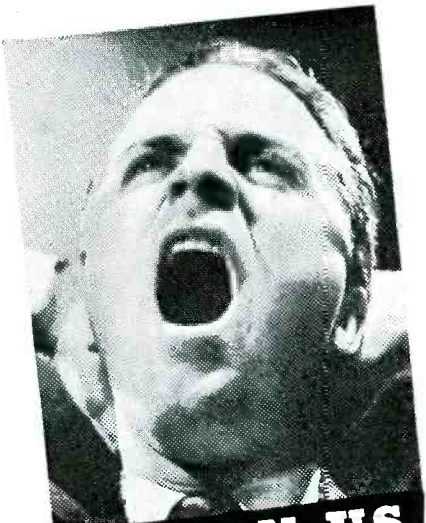
Now at new reduced prices—RCP's Model 701 Signal Generator. Direct reading, full vision AC all wave, 400 cycle sine wave modulation. Provides for unmodulated and externally modulated signal. Coil, attenuator and R. F. circuits individually triple shielded. Continuously variable from 25kc to 90 mc. **\$25.95**



RADIO CITY Products Co. INC.

88 PARK PLACE NEW YORK CITY

RADIO CITY PRODUCTS CO., INC. S-539
88 Park Place, New York City
Rush complete details on all R. C. P. instruments..... Give me address of nearest authorized RCP distributor..... Ship the following instrument(s).....
My jobber is
Name
Address
City..... State.....



PARDON US
 ... if we refuse to get excited about aerials with **ANTI-RATTLERS**. You see, anti-rattlers are rather old stuff to Radiart. We introduced ours way back in **DECEMBER, 1937**

... and REMEMBER! Last FEBRUARY, Radiart introduced Type CB-1, the **COWL BRACKET AERIAL** that requires **NO DRILLING** of finished body surface. Just remember the date when imitations come out as "revolutionary" discoveries!

And back in January, a little dash of color started a style sensation: **RADIART'S JEWEL TRIM COWL AERIALS** are sweeping the country. Watch for the imitations!



BUT, you'll make **MORE MONEY** with the Leader

THE RADIART CORPORATION
 CLEVELAND, OHIO
 • Get Bulletins 342 and 639-C •

Index to Advertisers

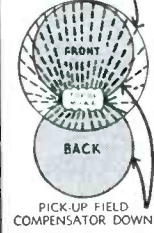
A	
Aerovox Corp.	259
Alden Mfg. Co.	260
American Condenser Corp.	254
Amperite Co.	262
Astatic Microphone Laboratory, Inc.	256
B	
Biley Electric Co.	258
Brach Mfg. Co., L. S.	260
Brush Development Co., The	261
C	
Centralab	243
Cinaudagraph Corp.	248
Clarostat Mfg. Co., Inc.	250
Consolidated Wire & Associated Corps.	260
Cornell-Dubilier Electric Corp.	250
H	
Halldorson Co., The	258
Hickok Electrical Instrument Corp., The	255
Hygrade Sylvania Corp.	244
K	
Ken-Rad Tube & Lamp Corp.	261
L	
Lenz Electric Mfg. Co.	217
M	
Mallory & Co., P. R.	Second Cover
Meissner Mfg. Co.	233
N	
National Radio Parts Trade Show	237
National Union Radio Corp.	257
P	
Precision Apparatus Corp.	256
R	
RCA Mfg. Co., Inc.	239, Fourth Cover
Radiart Corp., The	262
Radio Amateur Call Book, Inc.	262
Radio City Products Co., Inc.	261
Radio Servicemen of America, Inc.	254
Raytheon Production Corp.	227
Readrite Meter Works.	250
Rider, John F. Publisher.	251
S	
Service Instruments, Inc.	249
Solar Mfg. Corp.	Third Cover
Standard Transformer Corp.	253
Supreme Instruments Corp.	235
T	
Thordarson Elec. Mfg. Co.	244
Triplett Elec. Inst. Co., The	259
Tung-Sol Lamp Works, Inc.	252
U	
United Transformer Corp.	260
Utah Radio Products Co.	218
W	
Ward Products Corp.	256
Weston Electrical Instrument Corp.	247
Y	
Yaxley Mfg. Division.	Second Cover

Now... **5 VITAL FEATURES COMBINED IN AMPERITE VELOCITY WITH ACOUSTIC COMPENSATOR**



it's a VELOCITY
it's a DYNAMIC
UNI-DIRECTIONAL
NON-DIRECTIONAL
HIGH OR LOW PITCH

UNI-DIRECTIONAL PICK-UP FIELD COMPENSATOR UP



PICK-UP FIELD COMPENSATOR DOWN

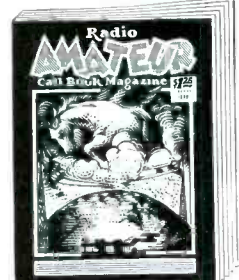
By moving up the Acoustic Compensator, you change the Amperite Velocity Microphone to dynamic operation — without peaks. At the same time you reduce the back pickup, making the microphone practically **UNI-DIRECTIONAL**.

With the Acoustic Compensator down, the microphone is **BI-DIRECTIONAL** ... 120 degrees front and back without frequency discrimination. Rotating the microphone until it parallels the ceiling makes the microphone **NON-DIRECTIONAL**.

THE ACOUSTIC COMPENSATOR is a regular feature of these models: RBHk (hi-imp); RBMk (200 ohms) LIST \$42.00. RSHk (hi-imp); RBSk (200 ohms) LIST \$32.00

Write for Complete Illustrated Bulletins and Valuable Sales Helps.

AMPERITE Co. 561 BROADWAY, N. Y.
 Cable Address: Alkem, New York
AMPERITE Velocity MICROPHONES



SERVICEMEN
 who are
RADIO AMATEURS
 buy a fresh copy today of the
RADIO AMATEUR CALL BOOK

The CALLBOOK is the only publication that lists all licensed radio amateurs in the United States and over a hundred and seventy-five different foreign countries. Each issue also contains a world map showing amateur prefixes, press time and weather schedules, amateur prefixes listed alphabetically and by countries and a world time conversion chart.

Complete . . . Accurate . . . Up-to-Date
 Issued Quarterly
 MARCH . . . JUNE . . . SEPTEMBER
 and DECEMBER
 Annual subscription \$4.00
 Single copies \$1.25

Buy your copy now from your radio jobber or direct from:
Radio Amateur Call Book, Inc.
 608 S. Dearborn St., Chicago, Ill., U. S. A.

especially in Television —

“A LITTLE KNOWLEDGE IS A DANGEROUS THING!”

For a new art, a new concept of standards and performance. New parts—engineered with full knowledge of Television's requirements. For higher voltages—wider safety margins.



SOLAR

TELEVISION CAPACITORS

The highest standards ever built into commercial condensers give absolute dependability. Engineers will be interested in a copy of Bulletin T-1 on Television Capacitor Standards, Types and Sizes. Free on request.

SOLAR MFG. CORP., 599-601 BROADWAY, NEW YORK, N. Y.



RCA 2-inch Cathode Ray Oscilloscope . . . offers you the new tilt mounted screen for easy reading plus other features — at a popular price. **\$49⁹⁵ NET**
Stock No. 151-2 . . .



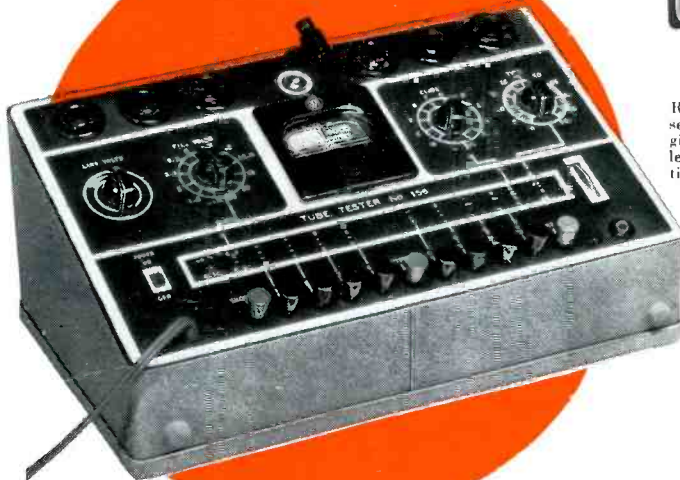
RCA 3-inch Cathode Ray Oscilloscope—RCA's newest for general use. Has many new features—at a new low price. Is smaller in size, lighter in weight—much easier to carry. **\$63⁹⁵ NET**
Stock No. 155 . . .



RCA 1-inch Cathode Ray Oscilloscope . . . this instrument is a *real* bargain. Excellent for radio servicing, it is also splendid for use in amateur transmitter, sound equipment, industrial and educational service work. Stock No. 151 . . . **\$39⁹⁵ NET**



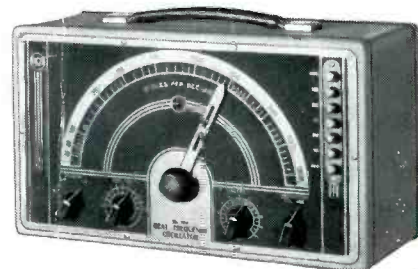
RCA AC operated Test Oscillator . . . a honey for servicing the most complex of receivers. Features giant 6-inch dial, over 50 inches in length to insure an easily read setting. Stock No. 153 . . . **\$29⁹⁵ NET**



New RCA Radio Tube Tester . . . combining accuracy in performance with simplicity of operation, this fine new tube tester offers ten features which stamp it a splendid value. Two types, Counter type (illustrated) — Stock No. 156-A—\$37.95 net. Also available in portable type, easy to carry. **\$39⁹⁵ NET**
Stock No. 156 . . .



RCA Electronic Sweep Test Oscillator . . . this fine instrument has its own internal frequency modulator for visual oscillograph alignment—permitting you to visually align receivers with any oscillograph. Or if you wish, you may use it with an output indicator or meter. Stock No. 150 . . . **\$64⁵⁰ NET**



RCA Beat Frequency Audio Oscillator . . . for testing loudspeakers, PA systems, for locating cabinet rattles and many other service applications. Excellent for amateur transmitter use. Provides choice of 3 output impedances, has 8 3/4" dial for accurate setting and other desirable features **\$49⁹⁵ NET**
Stock No. 154 . . .

They all score a *Bull's-eye!*

RCA offers you a variety of test equipment at surprisingly low cost . . . equipment that brings you the advantages of **REQUIRED QUALITY!**

Sure—you want modern Test Equipment. Any forward looking service man does. But you want to be sure that you're spending your money the smart way.

RCA's your answer! You'll get every penny's worth out of any of the test instruments in RCA's complete line. Because these instruments offer you **REQUIRED QUALITY**. What's that mean? Just this: RCA, as builder of millions

of radio sets each year naturally tests them. To do so, RCA builds Test Equipment. It *must* be good. It is—and this experience is included in the Test Equipment illustrated on this page. Moreover it's yours at surprisingly low cost. Visit your RCA Test Equipment Distributor and see these instruments. It will be a worthwhile visit for you.

Over 335 million RCA radio tubes have been purchased by radio users . . . in tubes, as in parts and test equipment, it pays to go RCA All the Way.



Test Equipment

RCA MANUFACTURING CO., INC., CAMDEN, N.J. • A Service of the Radio Corporation of America