

Radio
**SERVICE
DEALER**

NOVEMBER, 1949



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The Scope As A Modern Service Tool, Part I
A Wide Range Impedance Bridge
Tone Controls
A New Aid To Rapid Servicing
High Quality Analysis Series
Ladders, Their Care and Use

AM-FM-TV-SOUND

The Professional Radioman's Magazine



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is Tough
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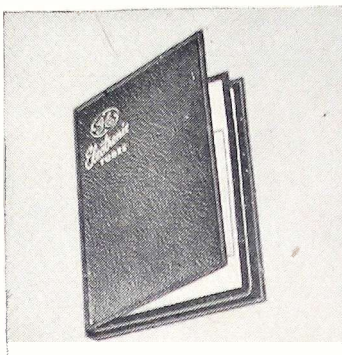
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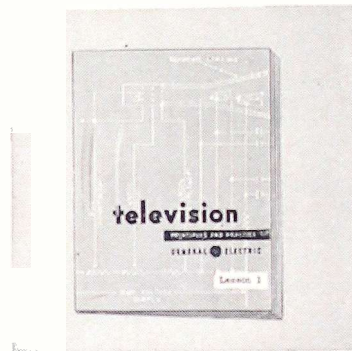
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and now... THE HANDY G-E TUBE PULLER!



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RADIO SERVICE DEALER • NOVEMBER, 1949

EDITORIAL

by S. R. COWAN

Color Television -- Forget It

Between October 5th and 20th we spoke to the top management and policy-making men associated with 19 of the largest and most important firms engaged in manufacturing television receivers. Each of these executives were asked these questions: "What is your firm planning to do about color television?" and "How soon do you expect to make color TV sets available to the set-buying public?"

Without exception the answers were identical. Every executive stated that "Commercial color television is still only in the earliest experimental stages of development. When it becomes practical we'll have it. Unless some absolutely unforeseeable event occurs color TV sets will not be put into mass production for some years to come." The average estimate in this regard was from 3 to 5 years, or around 1953 at the earliest. But most seem to feel that color TV is still so far away from commercial practicability it should be scoffed at now.

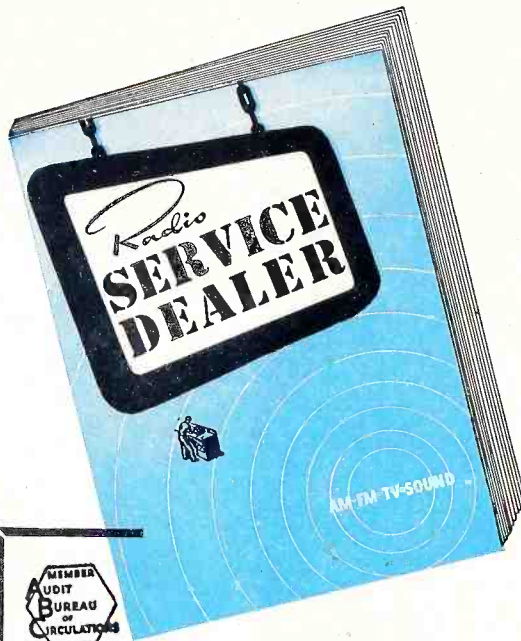
So, if any potential TV set buyer approaches you about the imminence of color TV, tell him to forget it as none will be available for an indefinite time to come.

Built-in TV Antennas

Many major TV set makers are producing sets having built-in antennas. Others will eventually do so too, purely as a competitive defensive measure. But the fact remains indisputably that TV sets operating with built-in antennas do not, will not, and can not give as good results as TV sets having a properly installed external antenna. This will be true until TV transmitters increase their signal output at least ten or more times greater than what is now being telecast.

The TV set buying public must be educated to this fact by the servicing trade, for TV set makers and radio retailers will not do the job as it is not to their best interests to do so. Thus, a condition exists that makes it necessary for technicians to become sales minded. TV installers must learn how to educate and sell their customers on having the proper type of external antenna installed, even if at considerable expense, if that TV set owner wants to obtain maximum results and benefits from his TV investment, and even if he owns a TV set having a so-called built-in antenna.

Time and cost-study records indicate that to date the servicing trade has not made any appreciable profits from the TV antenna installation jobs they have obtained. A technician's prime stock in trade is his know-how and ability to do a job quickly. Installing TV antennas is a dangerous and time-consuming occupation. Doing an installation quickly and correctly the first time is an art that only a few technicians have mastered so far.



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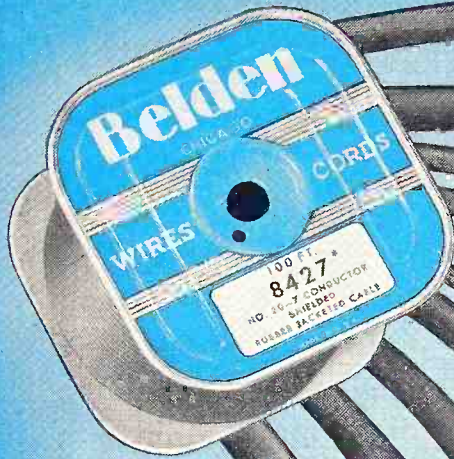
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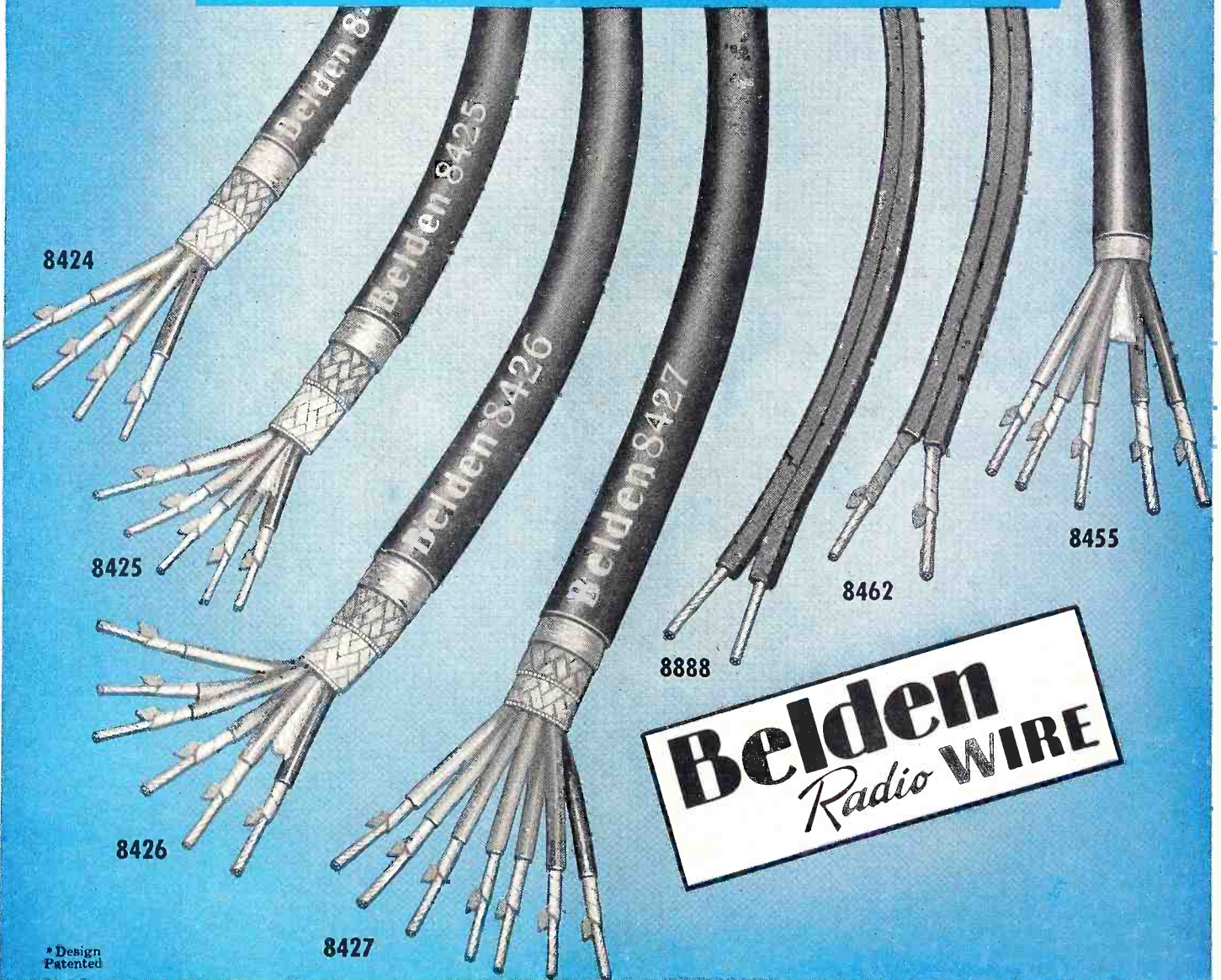
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Field Findings

A resume of Industry happenings here, there and everywhere

THIS past month yours truly has traveled almost 5,000 miles, making a complete swing around the East and Midwest, contacting receiver and parts and equipment manufacturers, to ascertain their plans for 1950, especially taking into consideration the current hearings by FCC on UHF and color TV. The facts about color TV, and how far away it still is, are reported in this issue's editorial. Don't miss it! You will want to paste this up and show it to potential TV set buyers for many months to come.

Winchell Errs On 45 RPM

In his syndicated column published in many newspapers on October 20th Walter Winchell opined that R.C.A. would soon abandon its 45-rpm record player and line of 45-rpm records in favor of 33 $\frac{1}{3}$. On the next day, Oct. 21st, the reliable *New York Times* carried an item stating that "Sales of RCA Victor 45-rpm phonograph records have increased 260% within the past 90 days according to Frank M. Folsom, president of the Radio Corporation of America." Further checking with top-brass executives of RCA brings forth a categorical denial of Winchell's claim. They very emphatically say RCA is going to stick with 45-rpm records and playing equipment. Thought this worth reporting.

Call in the BBB

A large display advertisement which appeared in the Buffalo (N.Y.) *Evening News* on October 5th, in my opinion typifies the very worst kind of TV advertising possible, and further, should be scrutinized most carefully by Buffalo's Better Business Bureau.

The advertisement in question, by a radio retail store, offers immediate delivery on several types of TV sets, and boldly proclaims: "Walk in tonight, walk out in 15 minutes with a TV set for tomorrow's (World Series) game. No money down . . . meter plan . . . as little as 15¢ a day . . . the 36-Month Way." Then the advertisement continues: "Five Years' Service Without Charge." Yes, let

by **S. R. COWAN**

me repeat, as does the advertisement in another part of it . . . the advertiser claims to offer "5 years service on TV with Absolutely NO CHARGE."

Being an advertising man, I am of the opinion that this display advertisement violates several fundamental legal requirements regarding fair trade practices and honesty of advertising claims; and I believe the BBB of Buffalo should take necessary steps to prevent its repetition. For example, if this retail radio firm is absolutely reliable and financially sound, as we must assume it is, what is their



"I MIGHT HAVE TO CHARGE YOU EXTRA, MISTER, ON SUCH A BIG RADIO."

method of guaranteeing to TV set buyers that five years of service will be given absolutely without charge? None whatever! To be permitted to make such blatant claims a retailer is by law required to furnish bond or some similar guaranteed collateral that is held in escrow until the contract is consummated.

But, I don't want to base my case purely upon technicalities. My real object in calling this matter to attention is the fact that it is basically bad to misrepresent or mislead customers because you simply can't get away with it.

The Slump Has Ended

The radio-TV business was in a bad way during the summer months. TV

reasons were given by various phases set sales dropped alarmingly. Many of the industry. But, the fact is, TV is a 10-months a year business. Tele-viewing will always drop off during the summertime when star-studded programs go "on vacation." This is more true of TV than conventional AM, for AM audiences will not slough off as appreciably during the summer because as more auto radios and portables go into use they offset to some extent the drop in home listening. From a Service Dealer's point of view, this information should prove helpful. Hereafter Service Dealers can be prepared to take the line of least resistance during the summer periods. They should start their efforts to sell battery portables, and to get customers to repair their old portable and auto radio sets early in the Spring of the year and take it for granted that less effort need be expended on TV, as a drop off in TV transactions is to be a normal and seasonal expectancy. Having the correct mental and merchandising slant will eliminate much price-cutting and frenzied summer slack "dumping" in the future. Meanwhile, all present business indices point to a boom period ahead. What with new TV stations going into operation, opening new markets constantly, and with prices stabilized and now close to where they will remain for many moons to come, the outlook is exceedingly bright.

Retailers Abandoning Service

Just as they did during the lush prewar period, a great many retail radio stores are giving up their own service departments, preferring instead, to farm out their installation and service work to non-competitive radio service organizations.

Records and history show that unless a firm is willing to specialize in radio and TV service work it cannot make profits from its own service department. Service is too competitive and complex. Be that as it may, from Coast to Coast the service profession is in the main having a pros-

[Continued on page 33]

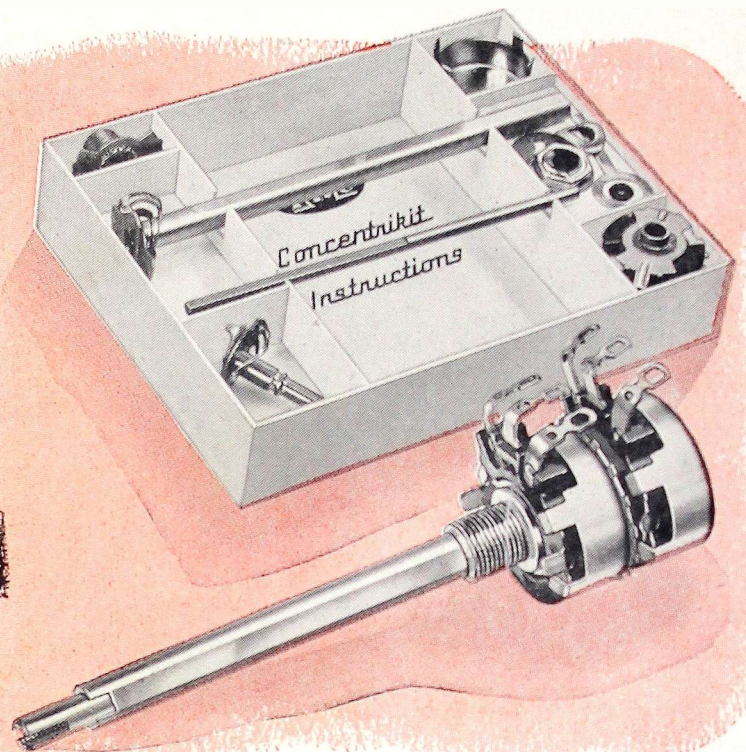
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Here is the for-sure answer to your concentric dual problems. The new IRC CONCENTRIKIT is a set of specially designed parts with which you can assemble a great variety of concentric dual controls. With CONCENTRIKIT on the job you entirely eliminate long searches and waits for exact duplicates. Instead, you quickly and easily assemble the exact concentric dual replacement you need... saving time and inventory investment.

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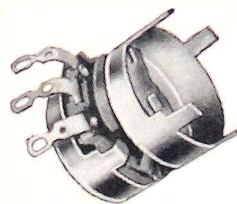
NEW IRC CONCENTRIC DUAL REPLACEMENT MANUAL

With CONCENTRIKIT you'll build concentric duals quickly and easily. Step-by-step instructions are included with each kit. New comprehensive Concentric Dual Manual gives you full replacement data on concentrics for every-

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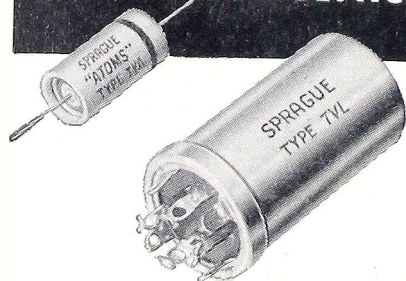
Television requires the most durable, heat-and-moisture-resistant components you can get. In capacitors, that means Sprague. You'll have no profitless call-backs with extra-dependable Sprague TV capacitors.

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Write for Sprague Bulletin M-429

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NORTH ADAMS, MASS.

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TRADE FLASHES

A "press-time" digest of production, distribution & merchandising activities

Alliance Sells With TV

Sales and Advertising Executives Plan Fall Campaign for Alliance Tenna-Rotor consisting of Spot Demonstrations with sound film in more than 25 key television cities.

Standing, from left to right, Miles C. McKearney, Account Executive, Foster & Davies, Inc., Advertising Agency, Cleveland, Ohio; "Jack" Treacy, N.B.C. Division Manager of



Spot Sales. Sitting, from left to right: John Bentia, Sales Manager, Alliance Manufacturing Company; Harold Gallagher, Sales Manager, WNBK, Cleveland, Ohio; Hal Sweitzer, Sales Department, Alliance Manufacturing Co.

Using television to sell their Alliance Tenna-Rotor—a television antenna rotating device—the Alliance Manufacturing Company is appearing with a regularly scheduled series of six television sound films over most of the major television stations. Each film is an actual demonstration of the product. The opener starts right out with a typical action of an Alliance Tenna-Rotor, turning a television antenna on a housetop. Then the scene shifts to the living room where a close-up of a television screen, together with a viewer who is operating the Tenna-Rotor is shown. The demonstration is clear and convincing—it shows fuzzy reproduction of a television picture and how the image comes up sharp and clear with the simple flick of a lever located at the set.

New Short 16-inch Tube Announced by RCA

A new 16-inch metal television picture tube, five and a half inches shorter than present kinescopes for 16-inch television sets, was announced recently by the Tube Department of the Radio Corporation of America.

The new kinescope, which will for the first time utilize an RCA "Filter-glass" face plate for greater picture contrast, is expected to make possible more compact chassis and more flexible cabinet design in future television receivers that will be available next year.

The new picture tube, designated the RCA-16GP4, will be supplied in very limited quantities to makers of



New RCA-16GP4, short 16-inch metal television picture tube is only 17 1/8" long. The new kinescope utilizes for the first time an RCA "Filter-glass" face plate for greater picture contrast. Here it is being compared in size with the standard RCA 10", 12 1/2", and 16" picture tubes. The RCA-16GP4 is shorter than even the 10" tube.

television receivers in December. Appreciable quantities will be available early next year, company officials revealed.

Like its predecessor—the 16AP4, first 16-inch metal kinescope—the new

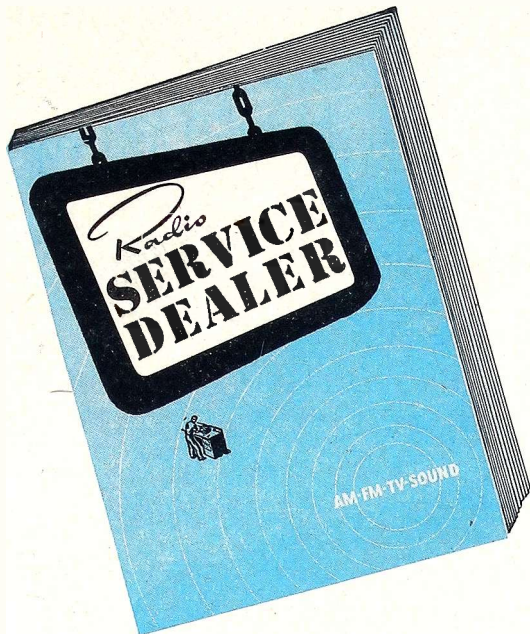
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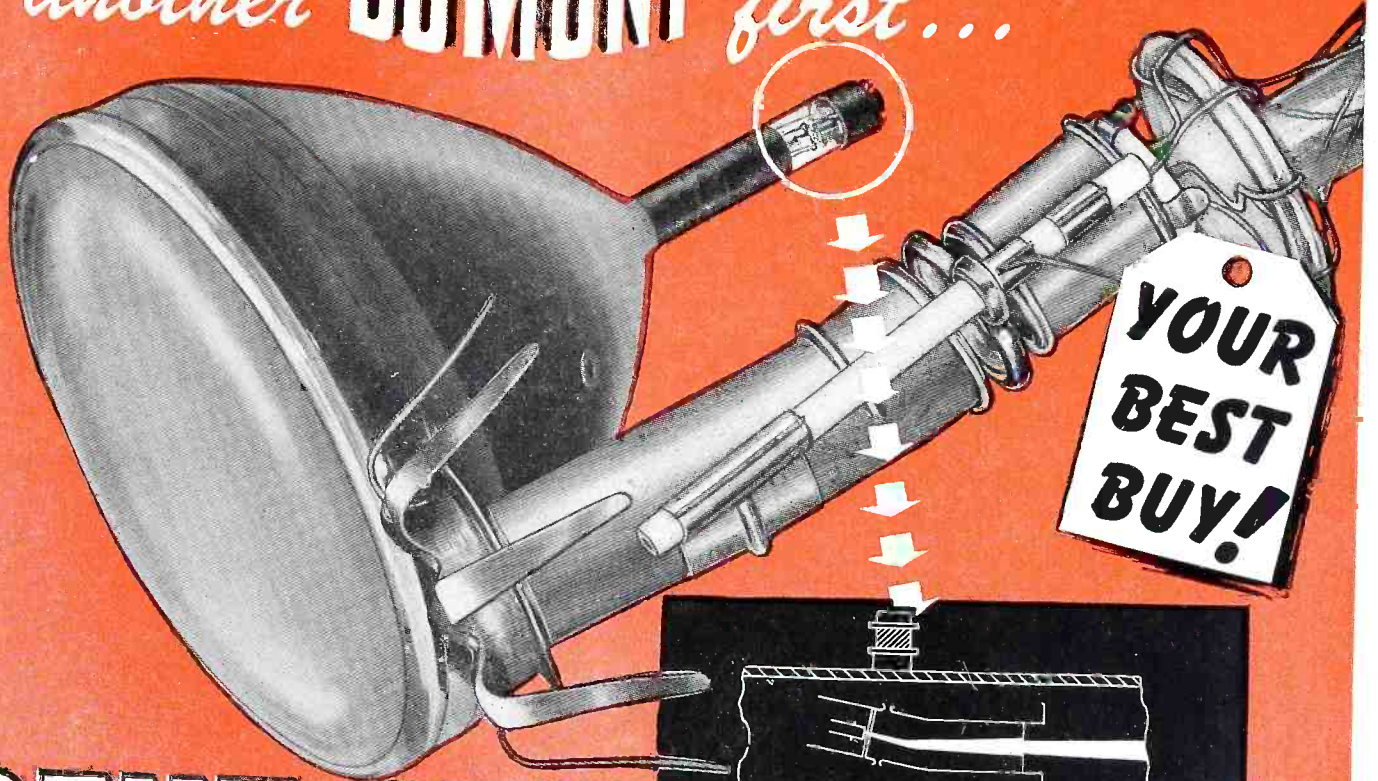
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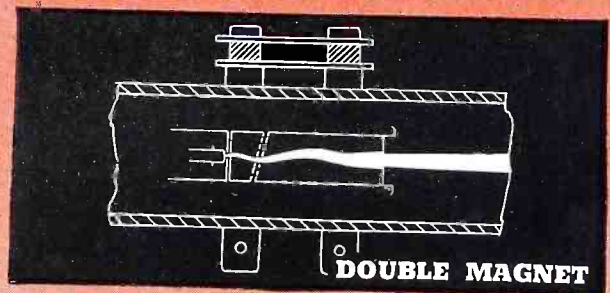
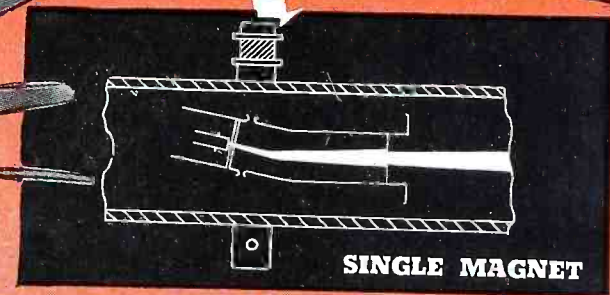


BENT-GUN

Teletrons*

 The new Du Mont Types 12RP4 and 15DP4 (replacing respectively Types 12JP4 and 15AP4) feature the exclusive Du Mont bent-gun. This ion-trap design eliminates ion-spot blemishes while maintaining an undistorted spot for maximum pictorial resolution. Meanwhile, lead-free glass reduces tube weight considerably. Five-pin duodecal base permits using the new half-socket for a significant saving, although old-type full-socket also accommodates these new tubes without modification.

Definitely "Your best buy!" For initial-equipment or replacement purposes — for superlative performance and longest service — insist on Du Mont Teletrons!



Above: Du Mont bent-gun principle, utilizing single ion-trap magnet. Space saved by eliminating double beam-bending magnet results in shorter neck length. Focussed-spot distortion eliminated by use of electrode parts designed to form symmetrical electrostatic fields in G_2 space. Lower-cost magnet.

Below: Conventional straight-gun design. Ion and electron beam is twisted by slanting electrostatic field between second grid and anode, requiring TWO bending magnetic fields. More costly beam-bender. Longer neck. Focussed-spot distortion.

Write for latest literature.

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ALLEN B. DU MONT LABORATORIES, INC. • TUBE DIVISION • PASSAIC, NEW JERSEY

THE 'SCOPE

as a modern

SERVICE TOOL

by MATTHEW MANDL

Part 1

SINCE the advent of television the oscilloscope has taken its rightful place on the service bench as a useful and informative instrument for wide-band i-f alignment, signal tracing, trouble-shooting and as a means for getting visual indications of circuit signals. The technician who is familiar with its application and operation is enabled to save hours in servicing television and frequency modulation receivers.

To get the most from an oscilloscope, however, the serviceman must be thoroughly familiar with the controls and have a reasonable knowledge of the meaning of patterns which appear on the screen. This first article, therefore, will deal with the makeup of the scope and the manner in which it functions. In the next article the practical applications of the scope in servicing will be treated, so that the technician will better understand where and when to connect it into circuits under test. It is only when the repairman is fortified with such know-how, that the scope becomes a tool that gives him enviable facility over his competitors in terms of time saved and in the turning out of superior work.

How the 'Scope Functions

Details of the internal construction of a cathode-ray tube such as used in an oscilloscope are shown in *Fig. 1*. The filament heats the cathode, which in turn emits electrons. The control grid regulates the intensity of the electron stream in the same way that the control grid of an ordinary vacuum tubes regulate current flow. Anode #1 and #2 have plus voltages impressed on them and have

Beginning a 2-part article on the theory and applications of the cathode ray oscilloscope. At this time, with TV, a thorough knowledge of this instrument is a must.

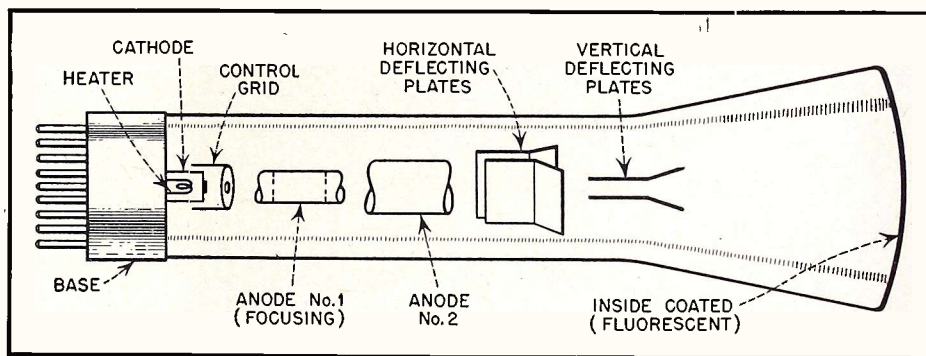


Fig. 1—Internal construction of cathode ray tube such as used in oscilloscope.

the dual function of accelerating electron flow and forming the stream into a beam.

A variable means of controlling the voltage applied to anode #1 permits focusing of the beam into a sharp pin-point of light. Actually the two anodes can be considered comparable to a regular lens, because they bring the electron stream to a sharp focus at the face of the tube. The second anode has a high voltage on it because this gives great velocity to the electron stream, thus permitting sharper focusing. Additional acceleration of the electron stream is sometimes accomplished by use of an extra grid after the control grid. The assembly that forms the electrons into a fast moving beam is called an "electron gun."

After the electron stream leaves the "gun" it enters between two sets of plates. The first set of plates is for moving the electron stream horizontally, and for this reason are called horizontal deflecting plates. The next set, for vertical deflection, have a relative position as indicated in *Fig. 1*. A potential applied to these plates will set up an electrostatic field and this will influence the electron stream in proportion to the potential and characteristic of the voltage applied to the plates. This is the type of deflection commonly encountered with the smaller tubes, both in oscilloscopes and television receivers.

Larger cathode-ray tubes (10" or larger television tubes included) usually employ magnetic deflection. This consists of a coil placed around the

RMA Designation	Fluorescent Color	Persistence
P1	Green	Medium
P2	Blue-green	Long
P3	Yellow-green	Medium
P4	White	Medium
P5	Blue	Very short
P6	White	Medium
P7	Blue	Long
P11	Blue	Very short

Table 1—RMA designation of cathode ray tube screen materials.

neck of the tube. When current flows through the coil it sets up magnetic fields which are also capable of influencing the movement of the electron stream.

Chemical Coating

The inner side of the face of the tube has a chemical coating which "fluoresces" when struck by electrons. This in turn produces light and makes the action of the stream visible. The chemical coating can be of a composition so that the light trace persists for a fairly long time or a comparatively short time. For oscilloscope use, the time duration must be sufficient so that the rapidly moving beam will leave a complete trace of the waveform under observation.

The RMA designation of cathode-ray tubes screen materials gives useful information for those who need to replace a tube, or want to substitute one which will give different results. Cathode-ray tubes have a standard numbering system which is used by almost all manufacturers. For instance, the 3AP1 tube (used in the DuMont Type 164E and other scopes) may be analyzed as follows from its numerical designation: The "3" stands for a three inch tube and the P1 means it has a green, medium-persistence screen. Thus, the first number relates to screen size, and the last letter and the number following it, indicates the type screen. Letters between the first number and the last letter (P) refer to manufacturing changes and internal construction. The "A" in the 3AP1 means that this particular tube has some internal differences from the regular 3P1 tubes.

The Controls

When the 'scope is turned on, its internal power supply furnishes voltages for the tube elements and deflecting plates. These various voltages can be controlled by the knobs on the panel of the 'scope so that we can adjust the visual information secured by focusing as well as positioning it.

Figure 2 shows a typical front panel layout of an ordinary oscilloscope. Some manufacturers may change the position of the various control knob, but all the representative ones will be on the front panel of any 'scope, and the usual arrangement is about as shown.

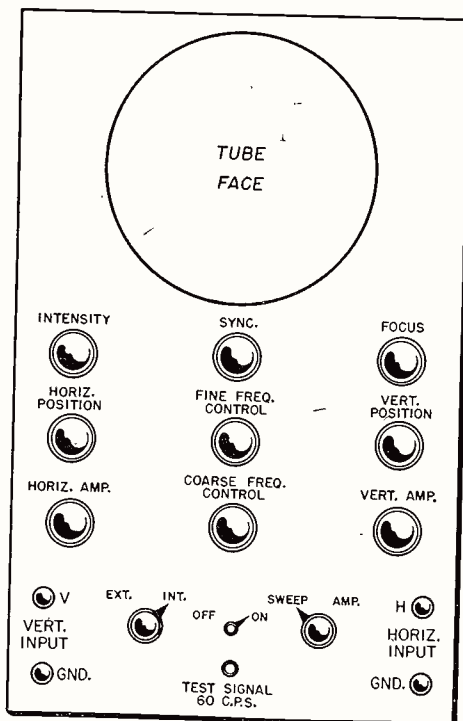


Fig. 2—Typical 'scope layout.

The intensity control permits regulation of the voltage on the grid 1 of the cathode-ray tubes and gives us a dimmer or brighter trace. The focus control, by regulating first anode potential, brings the beam to a sharp point on the screen. The

horizontal positioning control regulates the d-c voltage on the horizontal plates, and allows us to move the image on the screen either to the left or right, as may be desired.

The vertical position control permits voltage adjustment on the vertical plates and thus enables the operator to move the image up or down. The horizontal and vertical position controls, therefore, can be used to correctly position the image on the screen for proper observation.

Before undertaking a description of the other controls, it would be well to find out how the electron beam is made to trace out the information on the screen. In Fig. 3a is shown the screen face, with the vertical and horizontal deflecting plates. The electron stream has been properly focused and it shows up as a pin-point of light at the center of the screen. If d-c voltage is applied to the vertical plates as shown in Fig. 3b, the positive polarity at the top will attract the negative electrons (unlike poles attract) and the beam will move upward. The negative charge on the bottom vertical plate also helps move the beam upward, because it will repel the negative electrons comprising the beam (alike poles repel).

If the polarity is reversed, making the top minus and the bottom plus, the beam will move downward and remain in this position as long as the voltage remains on the plates, as shown in Fig. 3c. The same thing can be done to the electron stream with the horizontal plates. Applying a voltage as shown in Fig. 3d will

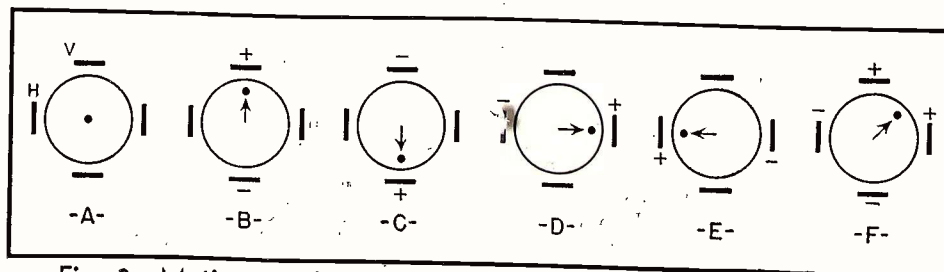


Fig. 3—Motion of electron beam under influence of various emfs.

cause the beam to move to the right. Reversing the polarity, as at Fig. 3e, will move the beam to the left. By applying voltages to both sets of plates as shown in Fig. 3f, the beam will move at an angle. Thus, it can readily be seen that the beam can be moved around anywhere on the screen, depending on the voltages applied to the plates. Increasing the voltage moves the beam to a greater extent—in fact too large a voltage on the plates can move the beam so far over that it will no longer be visible on the screen.

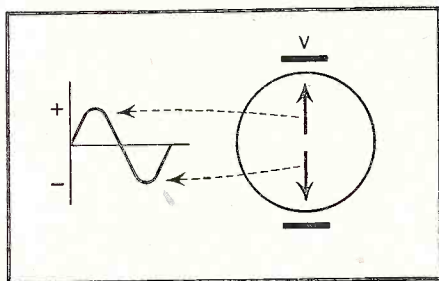


Fig. 4—Peak to peak a-c signal.

Going back to Fig. 3a, if we apply an a-c voltage to the vertical plates it will alternately pull the beam up during the first half of the cycle, then pull it down during the second half, as shown in Fig. 4. If this is a 60 cycle a-c, or an audio voltage (also a-c) of any frequency up to the limits of the audible range, the rapid rate of change will cause the spot to move up and down so quickly that a trace is left on the screen in the form of a vertical line.

This vertical line represents the peak to peak voltage of the a-c wave, and as detailed in the next article, such a set-up converts the oscilloscope into a sensitive vacuum-tube voltmeter which puts little load on any circuit under measurement.

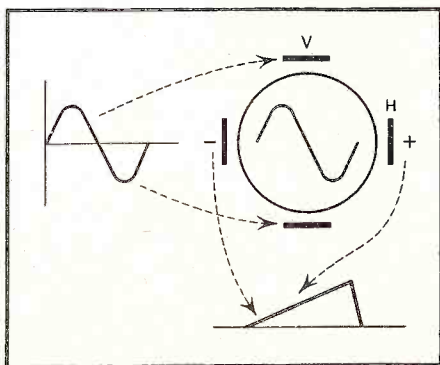


Fig. 5—Sine wave reproduction.

Figure 5 shows the screen having an image representative of the a-c voltage which is on the vertical plates. This is done by sweeping the beam

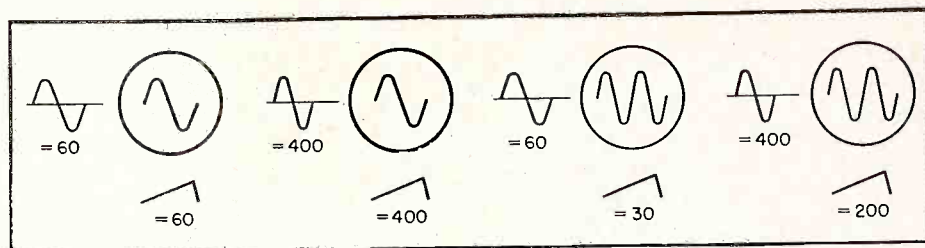


Fig. 6—Effect of sweep frequency on number of cycles on screen.

across the tube face in time with the frequency of the wave on the vertical plates. If the a-c voltage on the vertical plates moves up and down in time with the polarity change of the alternating current: then if we put an increasingly greater voltage on the horizontal plate, the beam will be pulled to the right. As the beam is pulled to the right, however, the vertical plates still cause it to move up and down. This up and down motion while the beam is being pulled to the right, leaves a trace which shows exactly what type of waveform is being impressed on the vertical plates.

Saw-Tooth Voltage

The voltage on the horizontal plates, however, must be gradually

Frequency Considerations

If the frequency of the saw-tooth horizontal sweep is the same as the frequency of the wave being put on the vertical plates, one pattern (or cycle) will appear on the screen. If the a-c wave on the vertical plates is twice the frequency of the saw-tooth, two cycles will appear on the screen. This means that the number of cycles on the screen will depend on the ratio of the two frequencies on vertical and horizontal plates—regardless of respective voltages. This can be more clearly understood by a study of Fig. 6.

If the horizontal sweep is calibrated, then the frequency of the waveform under observation can be found

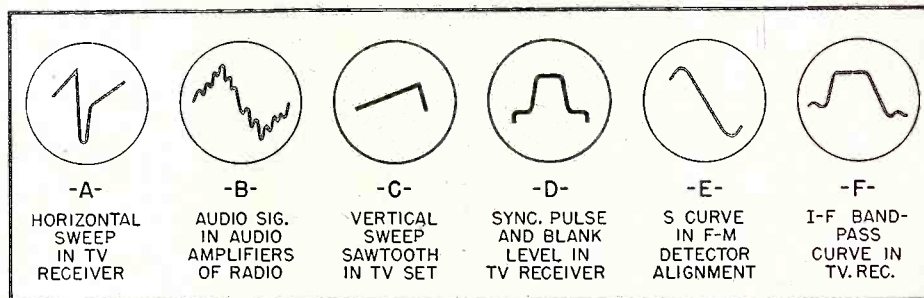


Fig. 7—Various types of waveforms that may be observed.

increased until the waveform is almost traced out; then it must drop rapidly to zero so that the beam will return to the left and start the trace all over again. The type of voltage which will do this looks like a sawtooth as shown in Fig. 5.

This saw-tooth voltage is generated within the oscilloscope by a special oscillator (saw-tooth oscillator) the frequency of which can be controlled from the front of the 'scope. By properly adjusting the frequency we can keep this saw-tooth oscillator in step with the frequency we want to observe (the frequency we put on the vertical plates). If the saw-tooth oscillator is not keeping time with the a-c voltage on the vertical plates, then the beam will not return to trace over the same pattern at the proper time, giving false images difficult to interpret.

easily. Thus, if three cycles appear on the screen and the saw-tooth generator is set for 100 cycles, the frequency on the vertical plates is 300 cps.

In the foregoing manner the oscilloscope gives a visual indication of the type signal being applied to the vertical plates. In this capacity we can observe waveforms to see whether or not distortion is present; we can signal trace to see where a defective stage is causing signal loss; we can observe the band-pass characteristics of the i-f stages we are aligning, and can also calibrate test instruments and measure voltages.

It makes no difference what type of signal we want to observe, for the 'scope will reproduce it, no matter what its shape. Figures 7a to 7f show some typical waveforms which can be observed during trouble-shooting,

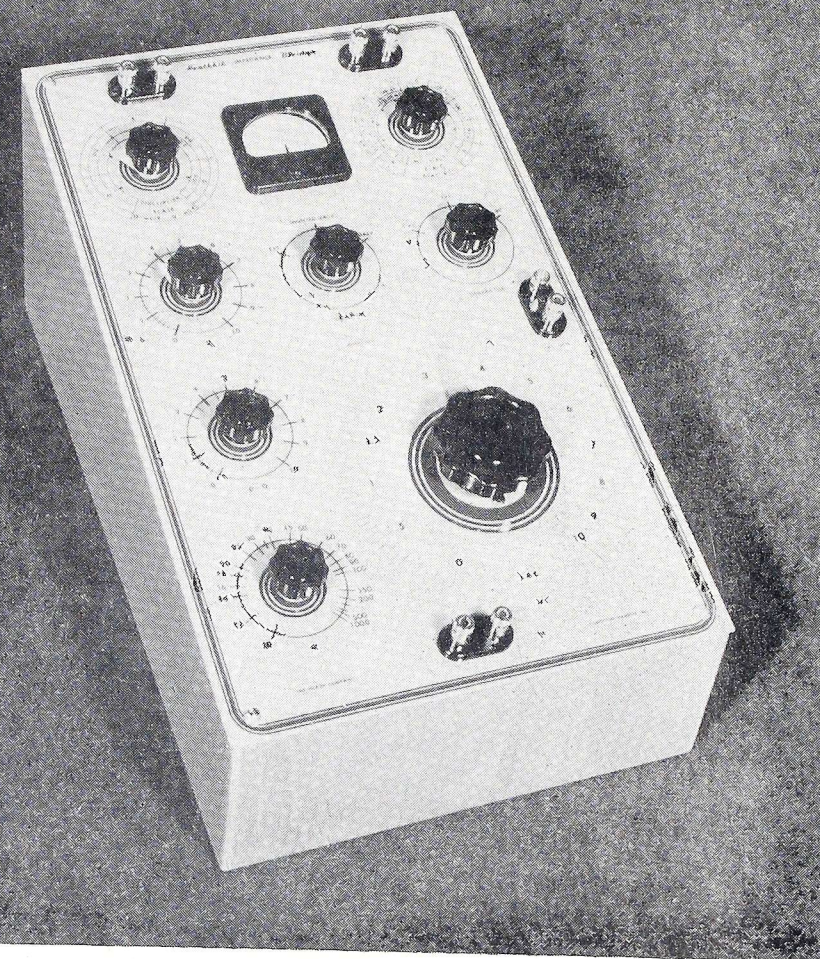
[Continued on page 29]

a *Wide-Range* **IMPEDANCE BRIDGE**

by **RUFUS P. TURNER**

Constructional details of an easily assembled impedance bridge. This instrument can prove to be a most valuable test aid in the service shop.

Completed view of Impedance Bridge.



EVERY piece of electronic equipment, whether it is as simple as a 1-tube radio receiver or as complicated as a 16-inch television console, has capacitors, coils, and resistors as basic components. Much of our trouble shooting is aimed toward finding out whether these components are functioning properly. Also; when the radio service dealer has before him a collection of unlabelled parts, he often must determine which are coils, capacitors, or resistors, and the value of each. Resistance, capacitance, and inductance measurements are at the foundation of electronic testing.

A single, direct-reading instrument, the *impedance bridge*, permits rapid measurement of R, C, and L values. This piece of equipment is to be found in all professional electronic laboratories. The measurement-conscious radio technician never has questioned the utility of such an instrument for his own shop, but the high price of accurate impedance bridges has placed these testers out of his reach. His attempts to build a satisfactory bridge often have been fouled up by disheartening stray reactances within the completed instrument and by the lack of satisfactory calibration sources.

The impedance bridge described in this article is a professional instrument which, in spite of superior design and precision of operation, is relatively inexpensive. Available in kit form, it may be assembled within a few hours with ordinary tools. No hard-to-get calibration equipment is required.

Ranges

This bridge measures inductance (L) from 10 microhenries to 100 henries, capacitance (C) from 10 micro-microfarads to 100 microfarads, resistance (R) from 1/100 ohm to 10 megohms, dissipation factor (D) from 0.001 to 1, and Q from 1 to 1000. Resistance, capacitance, and inductance units all are read directly on the same dial, graduated 0 to 10, and are multiplied by settings of a multiplier switch.

Six inductance ranges are provided: (A) 10 to 100 microhenries, (B) 50 microhenries to 10 millihenries, (C) 0.5 to 100 millihenries, (D) 5 millihenries to 1 henry, (E) 50 millihenries to 10 henries, (F) 1/2 henry to 100 henries. These ranges include all common inductances of short-wave, broadcast, and i. f. coils and transformers, r.f. chokes, filter chokes,

audio chokes, and audio transformers. All types of coils may be checked, included air-core, powdered iron core, and iron core varieties.

Eight resistance ranges are provided: (A) 0.01 to 1 ohm, (B) 0.05 to 10 ohms, (C) 0.5 to 100 ohms, (D) 5 to 1000 ohms, (E) 50 to 10,000 ohms, (F) 500 to 100,000 ohms, (G) 5000 ohms to 1 megohm, and (H) 50,000 ohms to 10 megohms. These resistance ranges include all common values of fixed and variable resistors, rheostats, potentiometers, etc. Resistance values higher than 10 megohms can be checked by connecting the unknown resistor in series with a resistor of accurately-known value, measuring the total, and subtracting the value of the known resistor. The resistance of coils, transformer windings, choke windings, and of some switches also may be measured by means of the bridge. Circuit continuity can be checked, as well.

Six capacitance ranges are provided: (F) 10 to 1000 micromicrofarads, (E) 50 micromicrofarads to 0.01 microfarad, (D) 0.0005 to 0.1 microfarad, (C) 0.005 to 1 microfarad, (B) 0.05 to 10 microfarads, and (A) 0.5 to 100 microfarads. These ranges include all common fixed and

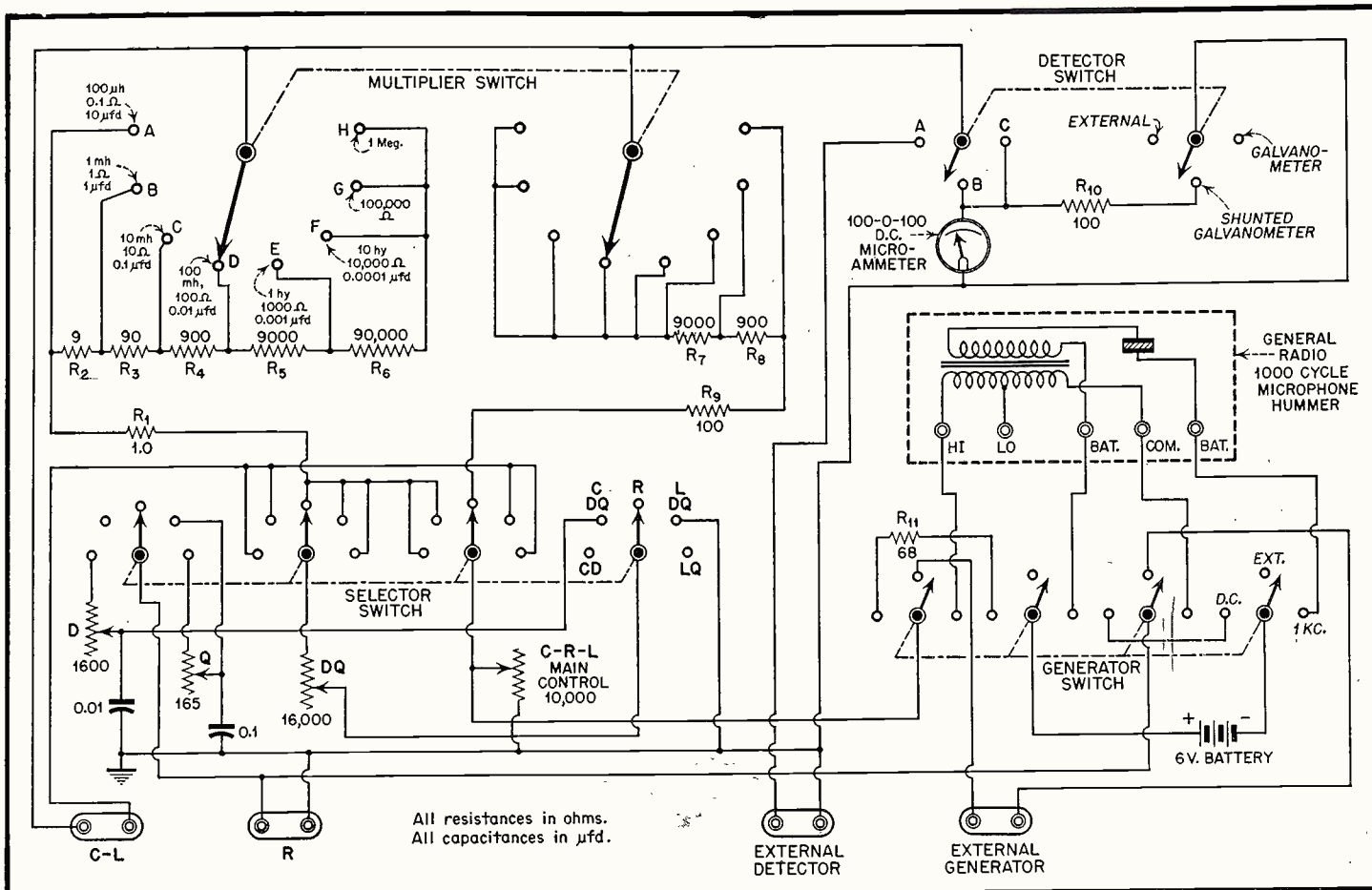


Fig. 2—Circuit diagram of wide-range impedance bridge.

variable air, mica, ceramic, and electrolytic capacitors of all types. Some large-capacitance units, such as motor starter capacitors, also may be measured. Capacitances higher than 100 microfarads may be measured in series with an accurately-known capacitor and the unknown determined by means of the familiar series-capacitance formula.

The letter symbols in parentheses in the preceding three paragraphs correspond to the similarly lettered positions of the MULTIPLIER SWITCH in the circuit diagram, Fig. 2. The complete circuit diagram of the impedance bridge is given in Fig. 2.

Circuit Diagram

The complete circuit diagram of the impedance bridge is given in Fig. 2.

The 2-pole, 8-position MULTIPLIER SWITCH sets the bridge to the desired R, C, or L range. This switch cuts in or out of the circuit the various precision resistors R_1 to R_9 . The dial settings of the MULTIPLIER SWITCH show the various R, C, and L factors by which the settings of the MAIN CONTROL dial must be multiplied to obtain the value of the unknown component under test. These factors are indicated

in Fig. 2 for each setting of the MULTIPLIER SWITCH. As an example; if the MAIN CONTROL is set to 9 for bridge balance and the MULTIPLIER SWITCH is set to position F (0.0001 μf) for capacitance, the value of the unknown component is equal to 0.0001 times 9, or 0.0009 μf .

The function of the DETECTOR SWITCH is to connect an appropriate null detector across the bridge-circuit output points. When this switch is thrown to its EXTERNAL position, the two terminals labelled EXTERNAL DETECTOR are connected across the bridge output and an external null detector may be connected to the EXTERNAL DETECTOR terminals. Satisfactory external detectors are high-impedance headphones, oscilloscope, magic-eye tube, a-c vacuum tube voltmeter, or a sensitive zero-center d-c galvanometer. The galvanometer is used only in resistance measurements when the internal 6-volt battery (or a higher-voltage external battery) is used to power the bridge. When the DETECTOR SWITCH is thrown to its GALVANOMETER position, the self-contained zero-center (100-0-100) d-c microammeter is connected, as a null

detector, across the bridge output points for d-c resistance measurements. When the DETECTOR SWITCH is thrown to its SHUNTED GALVANOMETER position, the microammeter is connected across the bridge output, but in parallel with the 100-ohm resistor, R_{10} . This resistor decreases the microammeter sensitivity and acts to prevent meter damage when first checking an unknown resistance.

Two self-contained bridge power (signal) sources are employed. One is a General Radio 1000-cycle hummer (an electromechanical type of oscillator) which supplies a 1000-cycle signal voltage for inductance or capacitance measurements. When the 1000-cycle signal is used, the null detector must be of the a-c type, that is high-impedance headphones, oscilloscope, magic-eye tube, or a-c vacuum tube voltmeter. The second source is a 6-volt dry battery, used only for direct powering of the bridge when d-c resistance measurements are to be made with the microammeter (or external d-c galvanometer) as a null detector. This battery is a small-sized unit (Burgess F4BP), being no larger

[Continued on page 34]

tone controls

by NOEL NAMTROW

DAILY service work includes the repair, alteration, planning and construction of the effective tone controls for p.a. systems and high fidelity radios. Separate bass and treble tone controls are becoming more and more popular with both professional sound equipment operators and the average listener. Separate bass and treble tone controls can be used to offset bad hall acoustic conditions requiring either accentuation of bass or treble frequencies. Separate bass and treble controls can also do much to make a bad recording sound more listenable by accentuating the band of frequencies containing the greatest sound energy; or, by supplying some of the higher frequencies missing in the recording; boosting the bass as well. A knowledge of bass and treble tone control circuits is a definite asset to the service man. Some typical circuits and an explanation of the principles involved are given here.

Discussion of Circuits

Expense of components, physical size, dangers of hum pickup and other factors often make the inductance-capacitor type of tone control im-

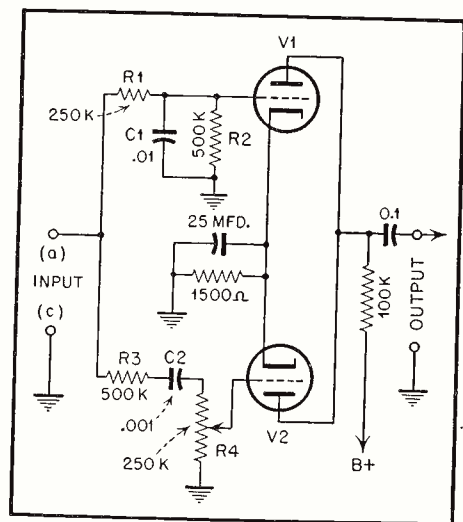


Fig. 1—Fixed bass re-inforcement.

practical. The control circuits discussed in this article are compact, use standard and inexpensive components, and are completely non-critical with respect to part values.

The author describes many types of tone control circuits which may be used to advantage in amplifiers of various requirements. Poor recordings may also be improved.

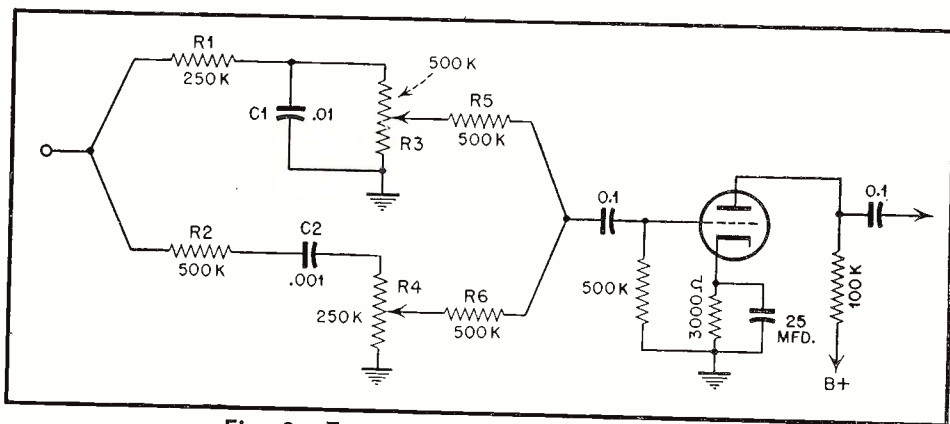


Fig. 3—Tone control using single diode.

Figure 1 provides fixed bass re-inforcement with variable control of treble. Bass re-inforcement is achieved through the series parallel arrangement of R_1 , R_2 and C_1 . R_1 is an electrical isolator between the bass and treble channels. R_2 is the standard grid resistor. Condenser C_1 offers very low impedance to the higher frequencies and comparatively high impedance to the bass notes. Thus, higher frequencies are by-passed to ground through C_1 while the bass notes reach the grid of V_1 and are amplified. R_3 and C_2 form a series circuit offering high impedance to the bass frequencies and comparatively low impedance to the treble. Thus, only the treble notes reach the grid of V_2 where they are amplified. R_4 is an ordinary potentiometer type of control used as a volume control for V_2 . By varying the input to the treble amplifier (V_2) and keeping the bass amplifier (V_1) at a constant level, the effect is that of a true treble control with full bass re-inforcement at all times. There is no audible interaction between the two tubes, V_1 and V_2 . A dual triode 6SN7 works very well with the part values given in Fig. 1.

Figure 2 is similar to Fig. 1, with the addition of a gain control in the grid of the bass amplifier. The excellent degree of tone control afforded by this circuit makes it a valuable addition to amplifiers operated under

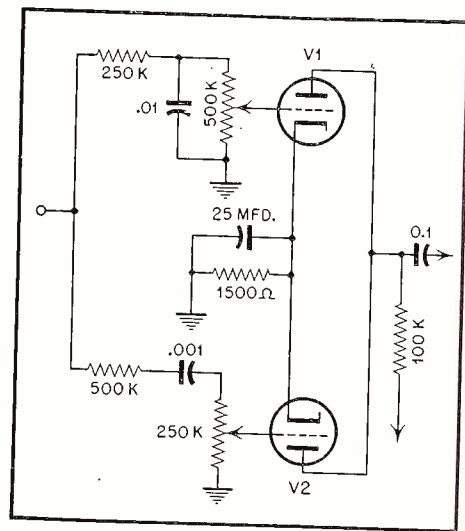


Fig. 2—Gain control added.

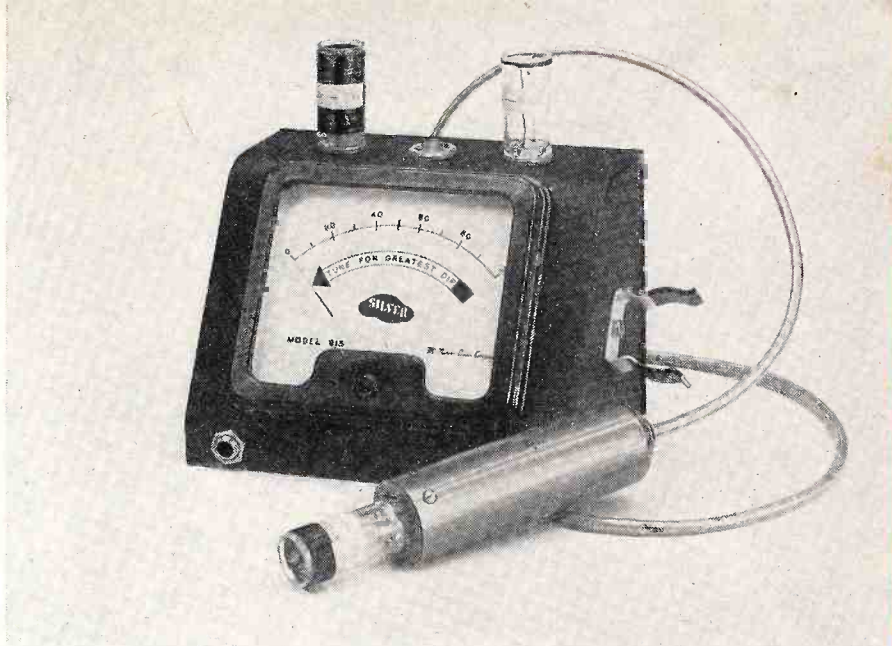
conditions requiring varied tonal responses. For example, the quality of many of the commercially manufactured cutterheads of the "home re-

[Continued on page 31]

A NEW AID TO *Rapid Servicing*

by **DOUGLAS H. CARPENTER**

Fig. 1—"Grid Dip" Adapter.



This new instrument provides quick answers to a variety of problems encountered in electronic manufacture and repair.

FOR several years there has been a need for a simple instrument that would qualify electronic circuits and components in a simple direct reading form. The nearest approach to this universal test unit is the grid dip oscillator. It is not intended to imply that the grid dip oscillator can make every electronic measurement required; on the other hand it will duplicate many of the functions of expensive laboratory equipment in addition to doing the work usually allocated to several separate pieces of measuring apparatus. From the standpoint of all around utility it would be hard to find another instrument capable of so many diversified applications.

G.D.O. Loading

Although the grid dip oscillator may be classified as practically a universal measuring instrument, certain inherent disadvantages have restricted its use to specialized applications in the design laboratory and production line rather than the service bench. Among the most objectionable of these is frequency shift under load. Since an oscillator is inherently a source of poor regulation, any external load (specimen circuit being measured) will unbalance the oscillator circuit to a degree depending directly upon the amount of coupling and load circuit Q . This rules out its use for

such measurements as aligning a selective i-f amplifier, or setting the trap circuit of a television receiver. Since the grid dip oscillator must be self contained it is bulky and inconvenient to use in *hand to get at* places. The indicating meter must be small because of the necessary miniature size of the total unit. Several coils must be used to cover any practical range; the *effective* top limit of which is in the neighborhood of 100 mc.

Tubeless G.D.O.

Conscious of these shortcomings modern engineering produced Model 915 Tubeless "Grid Dip" Adapter. This new device circumvents all of the disadvantages of the former g.d.o., and permits measurements at much higher indicating sensitivity over a greatly expanded frequency range.

Reference to the photograph of *Fig. 1* (heading) reveals that the small probe can and measuring coil are connected to the main instrument case by a long length of *special* shielded cable. This assembly is light weight and small, permitting measurements in even the most crowded chassis. The main case of the instrument itself houses the large meter, by-pass networks, phone jack and terminating loads. The three measuring coils are plugged into the top of the instrument case when not in use eliminating the need for a separate holder.

Model 915 unlike the grid dip oscillator does not require its own power supply, and employs no tubes. The only voltage required is that of the coupling signal source, which may be the test oscillator or signal generator that the serviceman now possesses. Full scale meter deflection can be obtained with as little as one twentieth of a volt over the majority of its effective range. The three coils provided cover all frequencies between 100 kc and 300 mc. Detuning of the coupling signal source is impossible as 915 acts as a buffer between the low impedance generator output, and the high impedance measuring load. We have therefore a compact little unit that may be used with existing equipment to allow accurate measurement of practically all electronic circuits within its range.

Resonance Indication

Probably the greatest claim to fame of this new device is in its application as a resonance indicator. It would be impossible to list all of the measurements that can be made in this category, but the following are representative of some of the more important divisions.

To use 915 as a resonance indicator it is first necessary to connect the terminal strip provided in the 915 back plate. The appropriate coil is inserted in the probe can socket, and

the generator output control adjusted for near to full-scale meter deflection. If the problem were that of aligning a FM-AM or TV i.f. the following procedure would apply. The probe coil of 915 is brought close to the i-f coil to be set, and the generator dial rotated to the specific intermediate frequency. The trimmer associated with this i-f transformer is adjusted until a pronounced meter dip is observed. The trimmer must be set so that maximum meter dip is realized. In the case of a TV i.f. the generator dial can be adjusted each side of center frequency and the actual selectivity response noted. The r-f section of any receiver can be set in a similar manner. Since the receiver itself does not have to be plugged in for such alignment many possibilities are readily apparent. Pre-alignment of r-f and i-f sections before assembly, transmitter, oscillator and amplifier tank circuit adjustment are just a few of the many quick measurements that can be made. Quality control of production components such as coils, variable condensers, etc., is still another function in this category. The resonance of any antenna system may be determined by simply coupling 915 to the antenna or associated transmission line. The selectivity response of any TV antenna can be quickly determined by this method, in turn revealing relative gain and band width of any array.

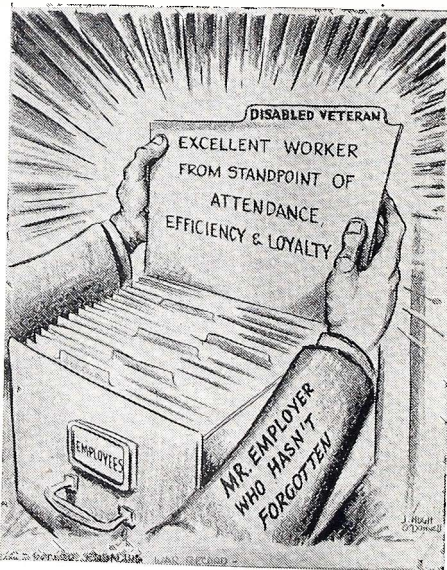
Detection

To be truly universal any resonance indicator must also be capable of establishing the frequency of all oscillators, check tracking, and do this without mechanical coupling and consequent detuning. If we plug a set of standard earphones in the jack provided in 915 we have a very sensitive energized detector. The instrument is still connected to the signal generator as in the case of the resonance indicator. If it is desired to preset any receiver oscillator the appropriate coil is inserted in the probe can, and the receiver turned on. The probe may be placed anywhere near the receiver (3 feet or so from the set) on the service bench. The earphones are inserted in the case jack. Set the generator dial to the exact frequency of the receiver oscillator. If the receiver oscillator is on frequency, a loud whistle will be heard in the phones. As the exact frequency of the oscillator is reached this whistle will diminish in frequency and "zero beat" with the generator. If the oscillator

is not operating at the proper frequency the trimmer must be adjusted for the preceding condition. The actual frequency may be rechecked throughout the entire receiver calibration, taking the guesswork out of location of soft spots and low frequency insensitivity.

In the same category we are able to check transmitter oscillators, localize harmonic radiation, and determine sources and frequencies of TVI. Spurious amplifier radiation, oscillator "squegging" and pulling are still other troubles that are simple to find. A signal from 915 may be substituted for the receiver oscillator itself if a little more coupling is employed between the probe coil and set making possible immediate qualification of weak or spotty receiver oscillators.

In the preceding discussion 915 has been coupled to a voltage source (test oscillator) and used as either a resonance indicator or energized detector.



There is still another method of using 915 to perform measurements *without* a coupling signal source. If the back plate terminals are shorted the instrument will act as a visual/aural detector. In this condition the meter will read upward, as we are taking energy from the circuit under test. Some of the functions in this classification are absorption type frequency meter, field strength meter and monitor and signal tracer. With an associated calibration chart, it may be used for a host of other applications in fixed line and r-f monitoring work. The fact that no power is required makes 915 ideal for portable applications.

Determining Values of L&C

It was mentioned earlier that this instrument can be used to qualify and measure several different elec-

tronic components. The 915 is connected to the signal generator as in the resonance indicator condition. If we wished to determine the capacity of any small variable or fixed condenser for instance, we would only require a standard variable condenser and rotation scale. Such a unit is readily available from any jobber, and the scale is simply a plot of the capacity change of the condenser vs. degrees rotation. An air wound coil is connected in parallel with this condenser, and resonance established by bringing the appropriate probe coil of 915 near this combination. The variable condenser should be set at its maximum capacity for this initial operation. The unknown condenser (variable or fixed) is now connected across the standard variable. The variable condenser is rotated until resonance is again indicated by the pronounced meter dip. The value of the unknown condenser is the difference between the two readings of the condenser scale. To illustrate this further let us assume that the maximum value of the test variable is 750 μmf . If we shunted an unknown across this condenser and retuned resonance at 702 μmf the value of the unknown would be the difference or 48 μmf . All that has actually happened is a substitution of capacity in the negative direction. We have increased the total capacity in the circuit by the addition of the unknown condenser, and equalized or re-resonated the combination by taking an equal amount out of the standard variable. Small variable condenser maximum and minimum values can be quickly checked by such a combination.

Coils of all types can be quickly evaluated by a similar process. If we utilize a standard capacitor, resonance may be established with a specimen coil, and its actual value determined. Reference to any L/C chart, formula figuration or fixed plots may be used as the qualifying medium for such measurements.

Frequency Calibration

In the energized detector category there is another application that should merit the attention of every serious service technician. Since model 915 consists of an inductive coupling circuit (probe coil), and a rectifier (crystal) we have a very efficient mixer and aural monitor. If it is desired for instance to calibrate a receiver or a shop built piece of test equipment such as a test oscil-

[Continued on page 30]

High Quality Analysis Series

by C. A. TUTHILL

PART 2

Audio Section

The audio voltage from the discriminator is fed through the second half of the AM-FM-Phono selector switch (*SW-1*) to a variable 1 megohm volume control shown as *R-17* in the schematic of *Fig. 1*. This affords common input level control to the following audio amplifier for any one of the three inputs chosen. This audio amplifier, employing a dual triode (12AU7) is the only section of the RJ-20 chassis under discussion which is common to more than one channel input. While serving either the FM, AM or Phonograph signal input this audio amplifier offers a rather elaborate yet highly essential equalization control prior to further amplification. However, if it is desired to feed a consistent spectrum to further amplification, we find at this point that the FM-Audio response is flat from 15 to 15,000 cycles ± 3 db. For a flat response the bass and treble knobs must be turned to a fully counterclockwise position.

Between the two cascaded audio stages a frequency selective type of equalization makes available controlled performances such as indicated by the curves of *Figs. 4 A, B, and C*. By means of these controls, which can amply counteract variations in recordings and the pre-emphasis of FM transmissions, a gradual treble or bass boost of as much as 20 db is at hand. Many owners do not know the value of, nor the need for, well engineered equalization. Dealers can proffer themselves and their customers a benefit through a bit of discreet campaigning in this direction. The playing of two records of widely different characteristics should be enough to sell most clients.

The necessary insertion loss due to equalization has, in this case, been well handled. The cascade audio stages compensate for that loss. The audio voltage from the detector-discrimina-

This unit in the "High Quality" series is continued from the Sept. issue of RSD. The purpose of these articles is to acquaint the reader with the technical details of the more carefully designed tuners and amplifiers marketed.

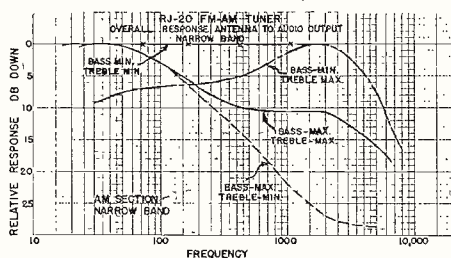


Fig. 4A. Overall response, antenna to audio output, narrow band.

tor tube is of the same magnitude as that from a crystal pickup cartridge. This eliminates the necessity for level compensation beyond that offered by the volume control *R-17*. (*Fig. 1*).

The 20,000 ohm output impedance of the audio amplifier-equalizer section minimizes the problem of matching following amplifiers. An internal

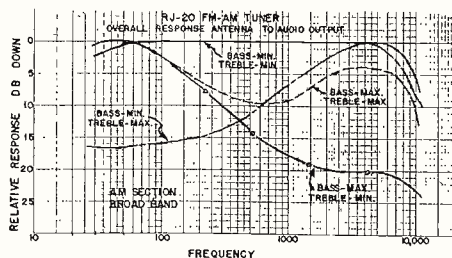


Fig. 4B. Overall response, antenna to audio output, broad band.

5Y3 rectifier provides heater and plate supply. The latter is isolated from the output jack by a 0.1 μ fd capacitor (*C44*) connected directly between the final plate and ground. The output of the audio section of this tuner chassis may be fed directly into any high quality amplifier and loudspeaker. The gain of this driving amplifier should be sufficient to provide the

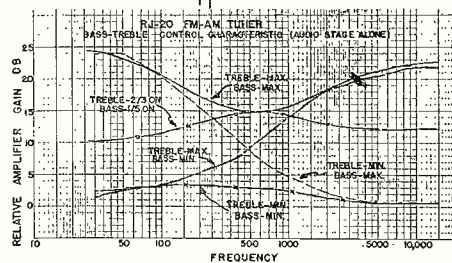


Fig. 4C. Bass-treble control characteristics, audio stage.

desired output when the input is as low as 0.5 volt RMS. It is obvious that the characteristics of the amplifier should, as nearly as possible, equal those of the tuner. Its response should be linear from at least 50 cycles to the upper activity limit of the loudspeaker system employed, and the latter should be the equivalent of the better two-way speaker systems.

The AM section of this tuner-chassis employs, basically, a superheterodyne circuit. One stage of r-f amplification is included to minimize image responses and improve sensitivity. The triple ganged tuning arrangement using 360 μ fd variables per section is detailed in *Fig. 1*. The incoming signal is fed through the 6SG7 r-f stage to the 6SA7 pentagrid converter for conversion to the 465 kc intermediate frequency.

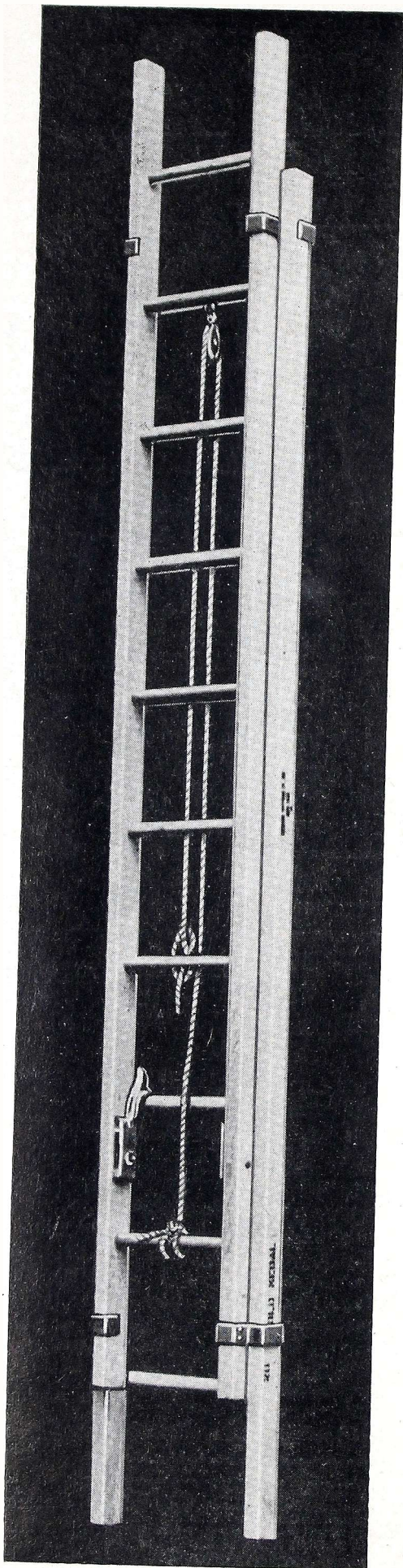
One feature of note is the variable bandwidth transformers used in the single i-f stage. A narrow interference-reducing position having a band pass of but 4 kc, either side of the carrier, may be chosen by means of a selector knob on the tuner panel. Or a broad high fidelity position with a bandwidth of 9 kc may normally be

[Continued on page 28]

RULES for LADDERS;

their safety, care, and use

by **OSCAR H. JUNGRENN**
The Patent Scaffolding Co.



Good extension ladders are equipped with automatic spring locks as well as a good grade of rope for raising the upper section.

Use of Ladders

1. Always place an extension or single ladder so that the distance from the wall to the base of the ladder is $\frac{1}{4}$ its extended length.
2. Always face a ladder when going up or coming down.
3. Do not attempt to carry bulky or heavy tools going up or down. Use a hand line.
4. Never splice together short sections to make a longer ladder.
5. Place a ladder so that it has a firm footing.
6. Use ladder feet to help make sure that a ladder does not slip.
7. Do not place a ladder in front of a door which opens towards it unless the door is blocked, locked or guarded by another person.
8. Immediately withdraw from use ladders found to have faulty or broken rungs or side rails.
9. Two-section extension ladders should have an overlap between sections of at least 3 feet for heights up to 36 feet; for ladders between 36 feet and 48 feet it should be 4 feet, and between 48 feet and 60 feet it should be 5 feet.
10. Avoid use of makeshift ladders.
11. With longer length extension ladders, use two men to raise. One man holds the bottom of the ladder on the ground while the other raises by pushing up from underneath. Extend the ladder only after it is in a vertical position.
12. Do not go higher than the third rung from the top.
13. Do not slide down a ladder.
14. Place all types of ladders so that it will not be necessary to reach too far to either side, and use a ladder of the proper length.
15. Do not use a ladder as a guy, skid or brace or for any other purposes foreign to which it was intended.

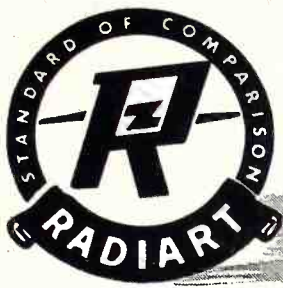
Care of Ladders

1. Upon receipt, inspect a ladder for defects. If serious faults are noted, withdraw it from use, mark it "Do Not Use," and return it to the seller if necessary.
2. Inspect ladders periodically for broken or damaged rungs, side rails, locks, rope, and pulleys.
3. Coat the ladder with linseed oil rather than paint. Oil will give as much protection as paint, but will not add to weight or stimulate dry rot. In addition, paint covers defects which may develop.
4. Keep rungs free of grease or oil.
5. Lubricate locks, wheels, and pulleys periodically.
6. Keep joints between rungs and side rails tight at all times.
7. Replace damaged or worn rope.
8. Store ladders in a well ventilated space free from excessive heat, dampness or cold.
9. Ladders should be stored in such a position, that they can be readily inspected. They should be supported to prevent sagging.

*Courtesy, Safety Engineering Magazine, June, 1949; "Four Steps To Ladder Safety," by Oscar H. Jungrenn.



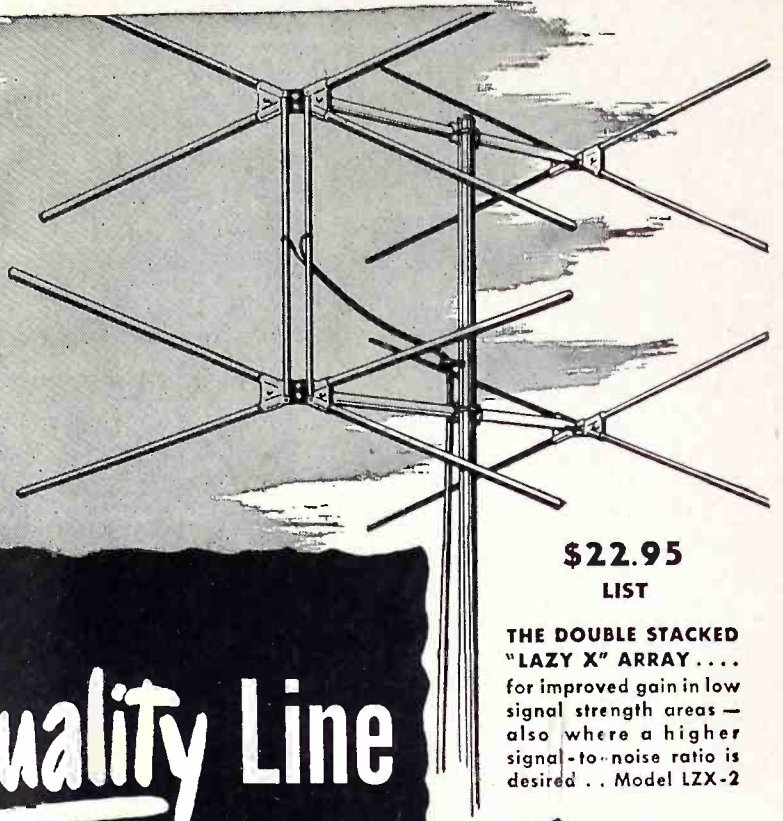
Here are just a few of the many kinds of ladder feet available for extension and single ladders, for use on various surfaces.



Radiart
features

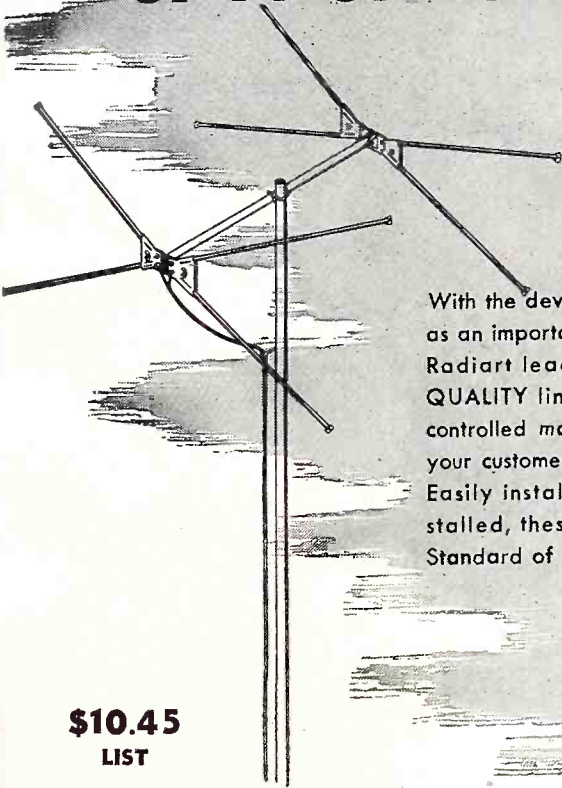
THE
Lowest Priced Quality Line

OF TV CONICAL ANTENNAS



\$22.95
LIST

THE DOUBLE STACKED "LAZY X" ARRAY . . .
for improved gain in low signal strength areas — also where a higher signal-to-noise ratio is desired . . . Model LZX-2

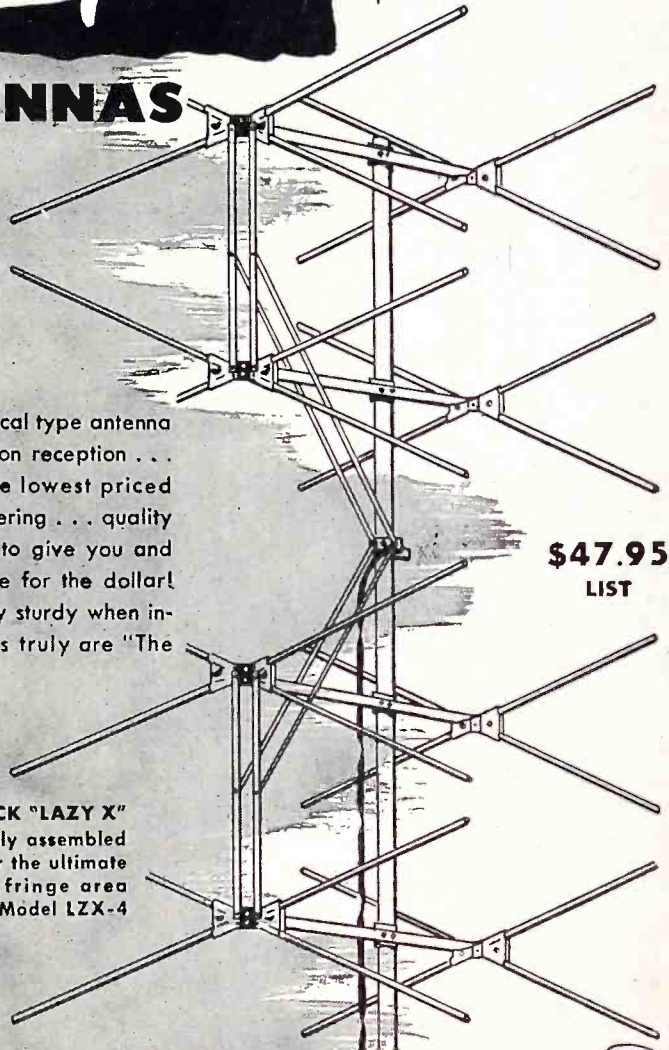


\$10.45
LIST

THE SINGLE BAY "LAZY X"
... for primary service areas
..... Model LZX

With the development of the conical type antenna as an important factor in television reception . . . Radiart leads the way with the lowest priced **QUALITY** line. Precision engineering . . . quality controlled manufacture combine to give you and your customers the greatest value for the dollar! Easily installed . . . and rigidly sturdy when installed, these Radiart products truly are "The Standard of Comparison."

The **QUAD-STACK "LAZY X"** Array . . . easily assembled and installed for the ultimate in all channel fringe area reception Model LZX-4



\$47.95
LIST

IT'S RIGHT WHEN IT'S RADIART!

DEALERS:
For Special "Quantity Prices" . . . See Your Radiart Jobber About These **BULK PACKED** Models:

- Model LZX-6B — six unassembled LZX bays in one carton
- Model LZX-6BQ — same as above PLUS 3 pairs jumper bars
- ... a good DEAL—more for your money

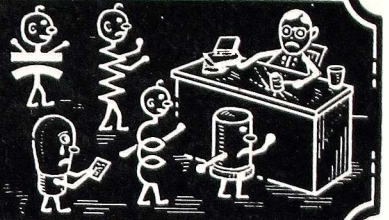


THE RADIART CORPORATION
CLEVELAND 2, OHIO

Manufacturers of the Famous Red Seal Vibrators



CIRCUIT COURT



Howard Model 482

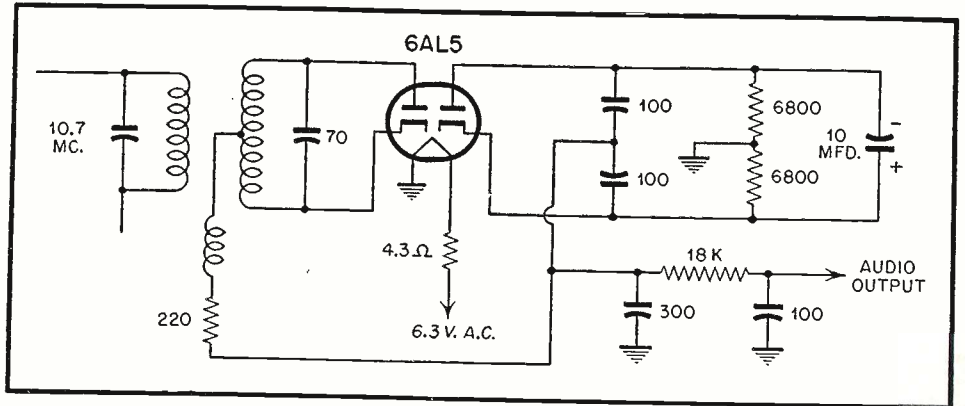
A feature which will probably be seen with increasing frequency is found in the Howard 482. This seven-tube a-c operated instrument is an FM converter providing audio output to an external amplifier system. A tuned r-f amplifier is followed by a dual-triode mixer-oscillator and two i-f stages operating at 10.7 mc. Detection takes place in a 6AL5 connected as a ratio detector. A 6J5 tube raises the audio output of the detector before it leaves the set.

The feature of interest is so simple that it may escape notice in a complicated schematic. It is shown in the partial diagram printed here, and consists of a 4.3 ohm resistor in the heater circuit of the 6AL5. Use of such a component serves to minimize, to a great extent, the tendency of tubes of this nature to modulate the output at 60 cycles. The actual voltage applied to the heater is about 4.7.

Recordio Models 7D42 and 7D44

Several interesting features appear in this home instrument designed for radio reception (AM and FM), phono reproduction and recording from radio or mike to disc records. The a-c chassis incorporates 14 tubes.

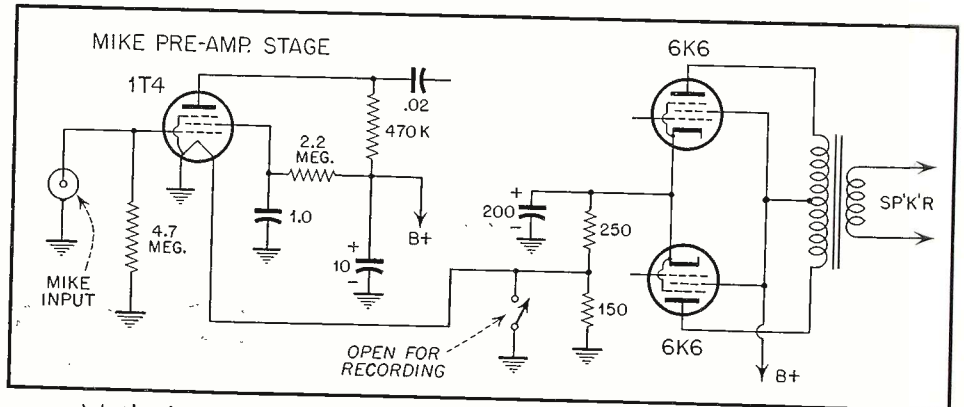
One problem always encountered when it is necessary to raise the output of a mike to the level of other input sources is that of hum development in the mike pre-amplifier stage. Of the several methods of minimizing the hum, one of the best is the use of d.c. on the heater or filament. One difficult source is thus eliminated and reasonable filtering and shielding is all that is needed.



Use of 4.3 ohm series filament resistor in Howard Model 482.

As shown in the partial schematic, in this case the tube used for mike amplification is a battery type 1T4 pentode. Voltage for lighting the filament, which takes a maximum of 1.4 volts at 50 ma, is derived from

audio notes handled and will assure that the filament will not be modulated by the output tube variations. During reception or reproduction the cathode voltage develops across a 250 ohm resistor.



Method of employing d.c. on filaments of 1T4 in Recordio 7D42.

the cathode circuit of the 6K6 output tubes.

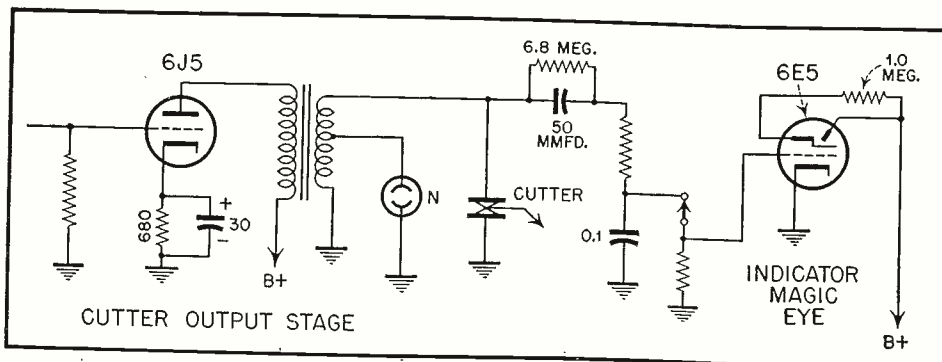
Note that there is an electrolytic capacitor of 200 μ f from the cathodes to ground. This large value is a virtual short circuit for the lowest

During recording from the mike, a separate tube is used to drive the cutter and no harm results from switching an additional 150 ohms in series with the bias resistor. The 1T4 filament is connected across this resistor and operated by the d.c. there.

Another partial schematic shows the 6J5 cutter-driving stage. A transformer is used to match the tube plate circuit to the crystal cutter. Some instruments of this type use a neon lamp for indicating recording level; others use a magic eye tube. Both are incorporated in this set.

The neon lamp is connected across a portion of the output transformer and actually will serve two purposes. When the voltage across the lamp

[Continued on page 28]



Cutter output stage circuit of Recordio 7D42 and 7D44.



What a show!

A recent intensive survey discloses that among the major television set manufacturers, more than 75% use Sylvania cathode ray tubes!

This impressive showing is a tribute to the research and quality production techniques employed by Sylvania.

You can take advantage of this ready acceptance by having a complete stock of the various types of these television picture tubes so widely used by set makers—who in turn, of course, sell to *your* regular customers. See your Sylvania Distributor about the complete line! For complete data write *Sylvania Electric Products Inc.*, Dept R-1811, Emporium, Pa.

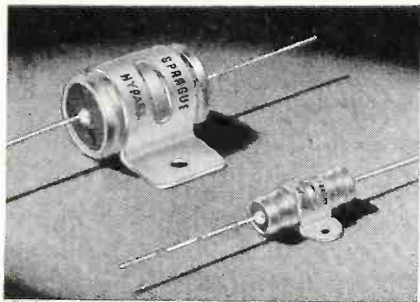
These leading television set manufacturers use Sylvania Television Picture Tubes

- Admiral • Air King • Andrea • Ansley • Automatic
- Bendix • Crosley • DeWald • Emerson • Fada
- Farnsworth • Garod • Hallicrafters • Hoffman
- Magnavox • Midwest • Motorola • National • Olympic
- Packard-Bell • Philco • Pilot • Raytheon-Belmont
- Regal • Scott • Sentinel • Silvertone • Sparton
- Stromberg-Carlson • Tele-King • Tele-tone • Temple
- Trav-ler • Westinghouse • Zenith

SYLVANIA ELECTRIC

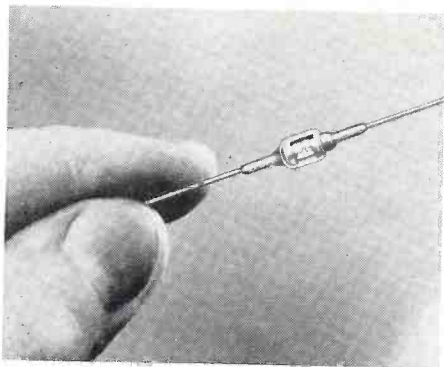
CATHODE RAY TUBES; RADIO TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, SIGN TUBING; LIGHT BULBS; PHOTOLAMPS

NEW PRODUCTS



TVI FILTERS

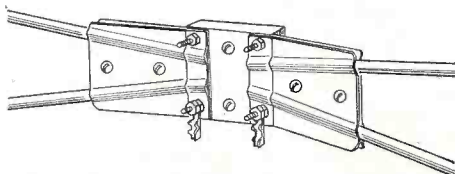
Thanks to an exclusive design developed for the armed services, Sprague Hypass 3-terminal network feed-through capacitors are ideally suited to minimizing television interference from amateur transmitters or for attenuating power line-conducted interference from diathermy machines, industrial electronic heating apparatus and other high-frequency signal sources. Sprague Hypass bulletin M-432 describing this development in detail will be sent on postcard request to Sprague Products Co., North Adams, Mass.



GERMANIUM DIODES

Germanium crystal diodes that are more compact, moisture-proof and enclosed in hermetically sealed glass cartridges have been announced by Sylvania Electric Products Inc. The new crystals are available in two types: 1N34A, a general purpose diode, and 1N58A, a 100-volt diode.

Electrical characteristics, ratings, and prices of the new "glass" type crystals are the same as those for corresponding "ceramic" types which have been marketed by Sylvania since the war. New terminal design permits units to be mounted side-by-side without danger of shorting.

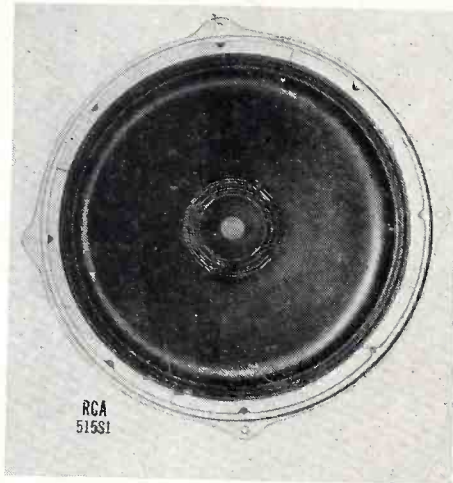


TV ANTENNAS

The new Telrex line, designated the Special Series by the manufacturer, retains all the reception ability of the Deluxe Series but is priced one third lower than the regular models.

The new economy list prices are made possible by a simplification of the element mounting assemblies. The resultant savings in materials, production, assembly, inspection, packing and shipping are passed along to the trade. For

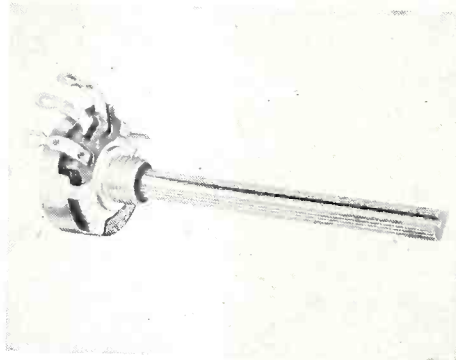
further information write: Telrex Inc., 26 Neptune Highway, Asbury Park, N. J.



DUO-CONE SPEAKER

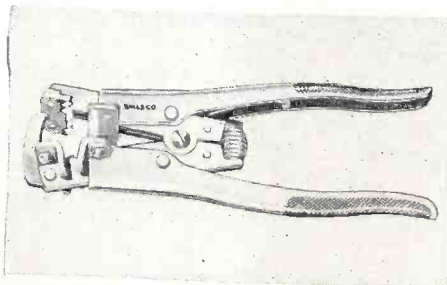
The new, 15-inch, duo-cone, high-fidelity speaker RCA-515S1 is designed to provide exceptionally fine tonal reproduction. It is particularly suited for high-quality radio and television receivers, low-distortion reproducing systems, and broadcast station monitoring applications.

Developed by Dr. H. F. Olson of the RCA Laboratories Division, this new speaker has a power-handling capability of 25 watts of audio power and a useful response range of 40 to 12000 cycles per second.



Q CONTROL

IRC's New 15/16" diameter Q Control. Knob Master Shaft, kurlled, flatted and slotted is 3" long, fitted with 1/4" long bushing. Can easily be replaced with any of 11 special Interchangeable Fixed Shafts—thus covering practically all replacement needs. Power rating is 1/2 watt.



WIRE STRIPPER

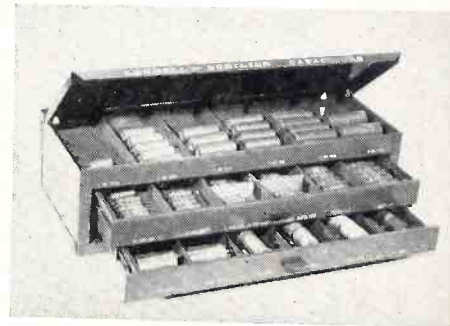
A husky, new all-purpose wire stripper has just been announced by the Walter L. Schott Co. of Beverly Hills, California. The Walsco

Wire Stripper incorporates all these features in one model: strips all wires from 16 to 22-gauge, strips 300 Ohm twin lead, has built-in wire cutter and automatic locking-device which prevents crushing of wires.



V-R PHONO CARTRIDGE

A twin stylus variable reluctance phono-graph cartridge, Model RPX-050, capable of playing conventional and micro-groove records, has been announced by the General Electric Company at Electronics Park, Syracuse, N. Y. Changing from one stylus to the other is accomplished by depressing and turning a knob on the top of the cartridge, which projects through the tone arm of the player. It is not necessary to disturb the cartridge itself.



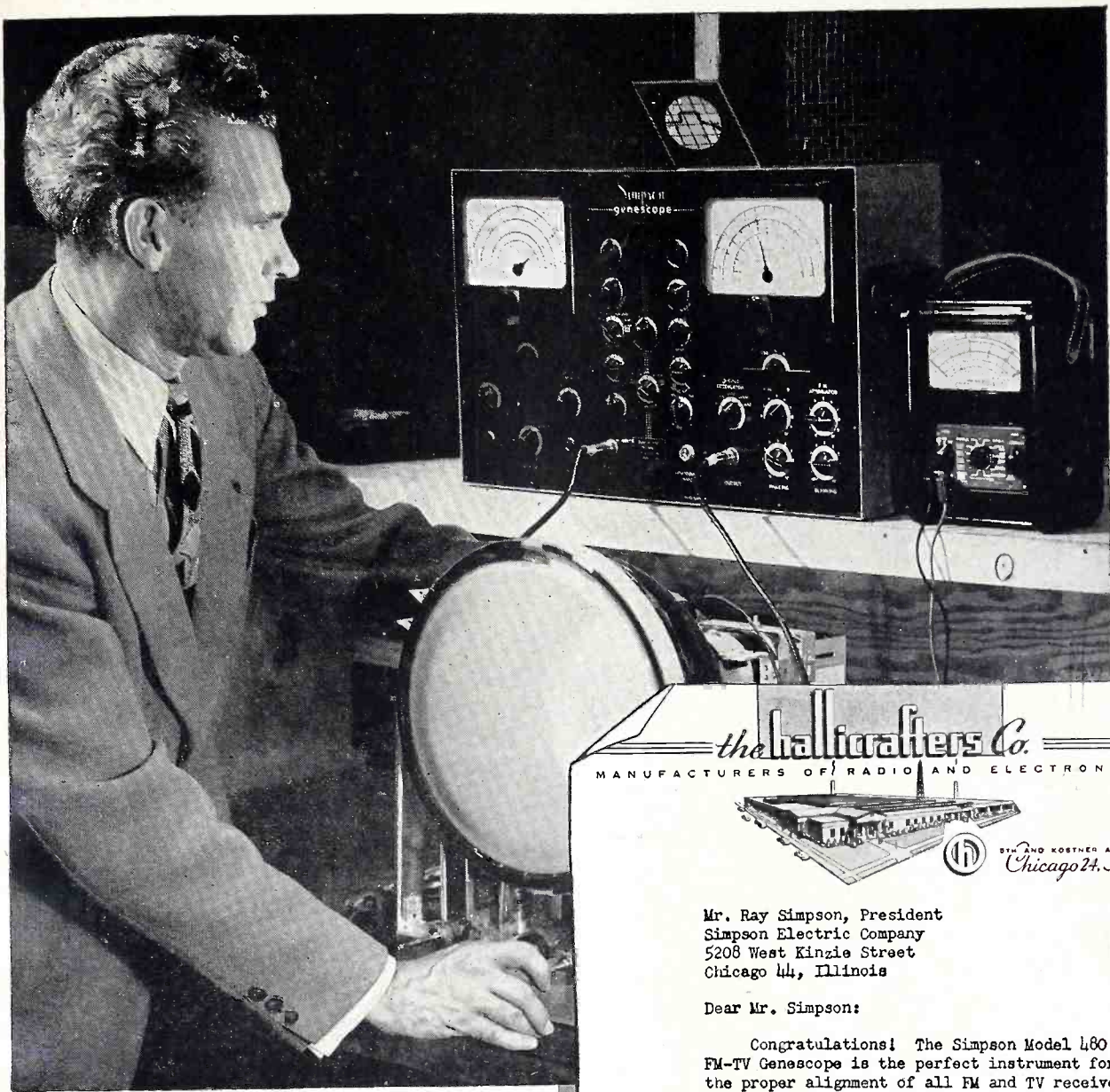
CAPACITOR CABINET

A three-drawer metal cabinet that is literally a complete capacitor department is announced by Cornell-Dubilier Electric Corporation South Plainfield, N. J. as a no-cost feature of its new capacitor kit. The kit pictured above includes an assortment of twenty different capacitors.

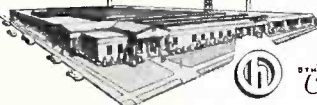


TV BOOSTER

Standard Coil Products Co., Inc., of Chicago and Los Angeles announces their new, high-
[Continued on page 24]



the Hallicrafters Co.
 MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT


 87th AND KOSTNER AVENUES
 Chicago 24, Ill.

Mr. Ray Simpson, President
 Simpson Electric Company
 5208 West Kinzie Street
 Chicago 44, Illinois

Dear Mr. Simpson:

Congratulations! The Simpson Model 480
 FM-TV Genescope is the perfect instrument for
 the proper alignment of all FM and TV receivers.

In addition to providing all necessary signal
 sources, the new Simpson Genescope includes a **step**

says EDWARD CROXEN

General Service Manager of Hallicrafters

In addition to providing all necessary signal sources, the new Simpson Genescope includes a high sensitivity oscilloscope of unique advanced design, complete in every detail. Sensitivity 25 millivolts per inch. Wide band response to 3 megacycles or more. Equipped with a high frequency crystal probe for signal tracing. AM and FM oscillator sections provided with large, easy to read dials with 20-1 vernier control and 1000 division logging scale. *Revolutionary, Ingenious, Exclusive* output termination provides for various receiver impedances, either direct or through an isolating condenser.

Step attenuator for control of output.

Size: 22"x14"x7 1/2". Weight 45 lbs. Shipping Weight 54 lbs.

DEALER'S NET PRICE complete with Test Leads and Operator's Manual \$375.00

**CHECK THESE RANGES AND YOU WILL SEE HOW MUCH THE
 SIMPSON GENESCOPE CAN DO FOR YOU**

RANGES
FREQUENCY MODULATED OSCILLATOR
 Band A—2-120 megacycles
 Band B—140-260 megacycles
 Sweep width variable from zero to 15 megacycles
 Sweep rate 60 cycles per second
 Specially designed frequency sweep motor
 Continuously variable attenuator
 Crystal calibrator—5 megacycles ± .05%
 Audio Oscillator 400 cycles

AMPLITUDE MODULATED OSCILLATOR
 Band A—3.2-16 megacycles
 Band B—15-75 megacycles
 Band C—75-250 megacycles
 30% modulation at 400 cycles or unmodulated
 Continuously variable attenuator
 Visual method of beat frequency indication

Modern FM and TV development and servicing requires the use of test equipment made to exacting standards. With this in mind Simpson offers you the Genescope with the assurance that everything possible has been done to make it the most accurate, flexible and convenient instrument available. The Genescope will render many years of uninterrupted service and always produce accurate results.

**HERE'S THE SIMPSON—MODEL 479
 TV-FM SIGNAL GENERATOR**

Exactly the same circuits, ranges and functions as the Model 480, described above, with the exception of the oscilloscope.

Size 17"x14"x7 1/2". Weight 34 lbs.
 Shipping Weight 40 lbs.

DEALER'S NET PRICE with Test Leads and Operator's Manual \$245.00



Simpson

INSTRUMENTS THAT STAY ACCURATE

SIMPSON ELECTRIC COMPANY
 5200-5218 WEST KINZIE STREET • CHICAGO 44, ILLINOIS
 In Canada: Bach-Simpson, Ltd., London, Ont.

AMPHENOL

COMPARE

the DB GAIN
 the DIRECTIONAL PATTERN
 the BROAD BANDING
 the MECHANICAL DURABILITY
 the STREAMLINE DESIGN

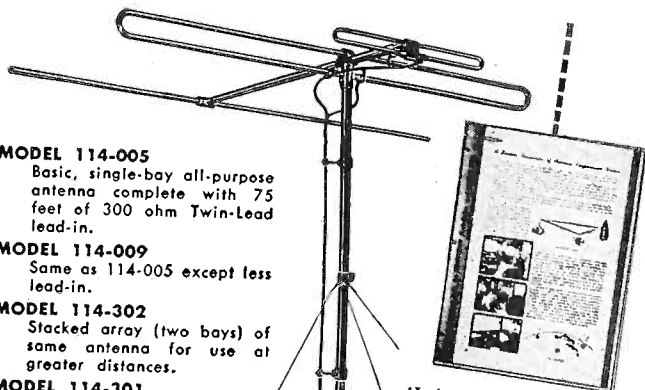
AMPHENOL **INLINE** ANTENNA

-Best by every comparison

• Dealers in television sets must depend upon the installer to uphold his reputation as well as that of the set manufacturer. The materials used in the installation and the quality of the installation are paramount in determining the customer's satisfaction with "the picture."

• The rapidity of expansion of the television industry has brought forth some rather fuzzy information and hasty claims that definitely tend to confuse and mislead the customer and many dealers. Accuracy and honesty of information are of such importance at Amphenol that we want all to know our technical information is based on laboratory findings, determined by competent personnel, precision laboratory facilities and exhaustive techniques.

• Be sure of the best performance of the sets you sell by specifying Amphenol INLINE Antennas.



MODEL 114-005
 Basic, single-bay all-purpose antenna complete with 75 feet of 300 ohm Twin-Lead lead-in.

MODEL 114-009
 Same as 114-005 except less lead-in.

MODEL 114-302
 Stacked array (two bays) of same antenna for use at greater distances.

MODEL 114-301
 Conversion kit. Provides parts necessary to build single-bay (114-005) into two-bay (114-302).

"Informative Data for Television Installation and Service Men"—13 pages of specific, scientific, authoritative information. Send for your copy on your business letterhead — today.

AMERICAN PHENOLIC CORPORATION
 1830 SO. 54TH AVENUE • CHICAGO 50, ILLINOIS

AMPHENOL

NEW PRODUCTS

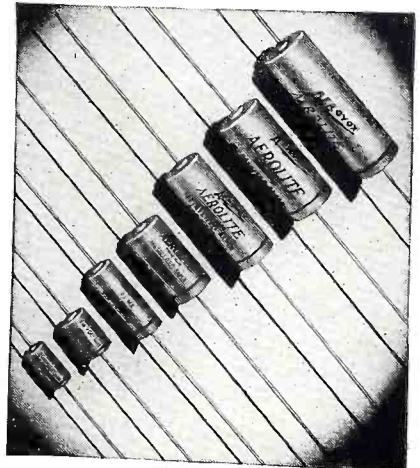
[from page 22]

gain, all-channel TV booster, which features: high gain; low signal to noise ratio; simplified 2-knob control; turning off the booster automatically turns off the TV set; continuous tuning, fully shielded; adaptable to either a 300 or 75 ohm line with ease; printed circuit; single stage—one tube; minimum service problems.



FUSE-CASE MERCHANDISER

Littlefuse, Inc., 4757 N. Ravenswood Ave., Chicago 44, Ill., has developed a unique merchandising idea, in the form of a handsome plastic case to display the Littlefuse electronic assortment of fuses and holders.



MINIATURE CONDENSERS

Marked size reduction is one of several advantages featured by the new Aerolite or metallized-paper tubular capacitors in cardboard tubes announced by Aerovox Corporation, New Bedford, Mass. Also identified as the Type P'82, these tubulars mean lower R-F impedance, protection against surge voltages, reliability and good capacitance stability with temperature change.

Available to manufacturers and jobbing trade alike, Aerolites in paper tubes are listed in standard capacitances from .01 to 2 mfd., and voltages of 200, 400 and 600 D.C.W. at the start.

TRADE FLASHES

[from page 6]

television receiver tube has a funnel-shaped metal cone, with a glass face plate sealed to the large end and a tubular glass neck containing the electron gun fused to the smaller end. The new tube, however, is but 17 $\frac{1}{8}$ inches long, which compares to 22 $\frac{1}{2}$ inches for the present 16-inch tube, and 18-inches for the widely used 10-inch television picture tube.

The new kinescope utilizes a wider deflection angle, 70 degrees as compared to about 55 degrees for the present tube, to make possible its shorter length. Performance characteristics remain essentially the same.

The new RCA "Filterglass" face plate has a special material incorporated in the glass, which greatly increases picture contrast. Lightening of black areas in the television picture by reflected room light is greatly reduced. Contrast is further improved by reduction of reflections within the face plate itself.

New receiving tubes, deflection yokes, transformers and other associated components, all designed specifically for the most economical operation of the new 16GP4, were also announced by the Tube Department. These are now ready for production and will be made available at the same time as the picture tube.

As with all major developments of the Radio Corporation of America, the new 16-inch kinescope is being made available to the entire electronics industry.

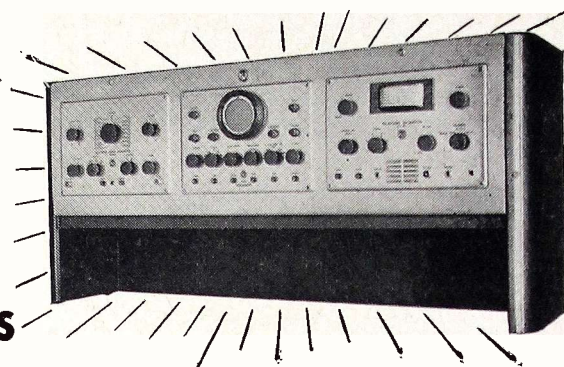
RMA Town Meeting

The seventh Town Meeting of Radio Technicians sponsored by the Radio Manufacturers Association was held in the U. S. Chamber of Commerce Auditorium, Washington, D. C., on the evenings of November 1, 2, and 3, Robert C. Sprague, chairman of the RMA Town Meeting Committee, announced.

The first evening saw the return of John A. Meagher, television specialist, RCA Tube Department, who was one of the headliners at the first Town Meeting in Philadelphia. Mr. Meagher spoke on the Composite Television Signal.

At the second meeting Ringland W. Kreuger, of American Phenolic Corporation, discussed phases of antennas, from their theory to imped-

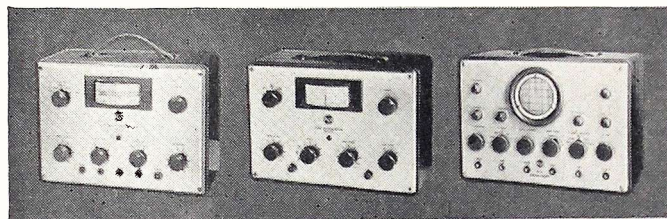
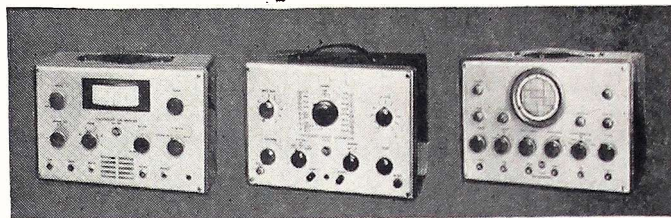
Choose
packaged
test equipment
with matched units



—for every servicing need

FOR TV SERVICING

WR-39A
Television Calibrator
WR-59A
TV Sweep Generator
WO-55A
Oscilloscope

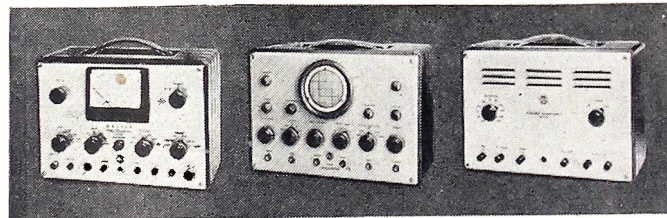
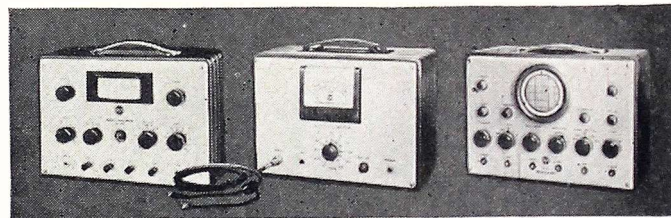


FOR AM-FM SERVICING

WR-53A
FM Sweep Generator
WR-67A
Test Oscillator
WO-55A
Oscilloscope

FOR SOUND (Public Address)

WA-54A
Audio Oscillator
WV-73A
Audio Voltmeter
WO-55A
Oscilloscope



FOR INDUSTRIAL WORK

WV-95A
Master VoltOhmyst*
WO-55A
Oscilloscope
WP-23A
Regulated Power Supply

*Reg. Trade Mark U. S. Pat. Office

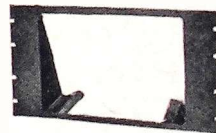
● Here's convenience, utility and appearance never before achieved in the test and measuring equipment field . . . a single, compact, all-steel rack that will accommodate any three of the nine RCA matched instruments.

The RCA WS-17A Test-Equipment Rack provides test and measuring combinations to meet virtually every requirement in the service shop, laboratory or industrial plant. Individual instruments can be quickly removed for use in locations remote from the shop or laboratory.

The nine matched instruments incorporate advanced design features reflecting the wide experience of RCA engineers in the fields of radio, tele-

vision and electronics. Best for the job —they are the best that money can buy.

Where mounting of any RCA matched test instrument in a standard 19-inch relay rack is desired, the WS-18A Rack Adapter Panel is available on separate order.



For full details and technical specifications on the rack and the nine instruments, ask your RCA Test and Measuring Equipment Distributor for Bulletin 2F719—or write RCA, Commercial Engineering, Section 55KX, Harrison, N. J.

Available from your RCA Test and Measuring Equipment Distributor



RADIO CORPORATION of AMERICA
TEST AND MEASURING EQUIPMENT

HARRISON, N. J.

ance matching, as he had done previously in Atlanta and Chicago.

On the third evening, John F. Rider, of John F. Rider Publications, talked on Television Service in the Shop and the Necessary Test Equipment. Mr. Rider previously has appeared in Philadelphia, New York, and Los Angeles Town Meetings.

Another outstanding attraction on the program was the appearance of one of television's outstanding, designing engineers, Anthony "Tony" Wright, chief engineer of The Magnavox Company. He presented a talk on "Television Service in the Home with Existing Test Equipment," a subject on

which he is reported to have some novel ideas.

Du Mont Delivering 19 Inch TV

The first complete line of 19" television receivers, at prices as low as most 15" sets, is now being delivered to franchised Du Mont dealers, Ernest A. Marx, general manager of the receiver sales division, Allen B. Du Mont Laboratories, Inc., announced today.

Air King Orders Increase

Mr. D. H. Cogan, president of Air King Products Company, Inc., Brooklyn, New York, manufacturers of radios, wire recorders, and television

receivers announced that television orders on hand were in excess of \$12,000,000.

New G.E. Parts Catalog

A new catalog and price list of all receiver replacement parts for General Electric radio and television receivers is now available through all distributors of the G-E Receiver Division, according to R. S. Fenton, sales manager of the division's parts section.

This 52-page catalog is the first all-inclusive receiver parts list ever made available by the company, Fenton said. It lists all replacement parts for every G-E receiver manufactured prior to August 1, 1949.

New Antenna Control Cable

A new 4-conductor antenna control cable has been announced by Belden Manufacturing Company, Chicago, Illinois.

The new cable is designed primarily as a motor lead-in cable for antenna rotating devices requiring 4 conductors.

The Belden No. 8484—4-conductor antenna control cable is a #20 AWG, 4-conductor cable, 7 strands #28 tinned copper wire, .010" wall vinyl plastic insulation. The 4 conductors color coded black, green, red, and white parallel, .015" wall tubed jacket. Brown plastic O.D. .170".

It is furnished in standard spool lengths of 500 and 1,000 feet.

Television Ballast Replacements

Five new TV ballast replacement numbers are announced by Clarostat Mfg. Co., Inc., Dover, N. H., namely:

Emerson 397022 and 397023, Motorola 17A485459, Teletone TPR 102D, and Belmont B9M 16067. These numbers are in addition to Motorola 17A-47033 and Emerson 571-606 already listed in Clarostat literature. All numbers carry a list price of \$3.00.

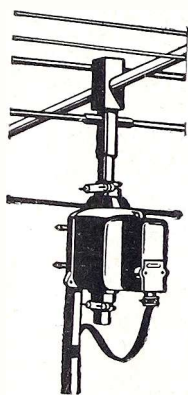
Sylvania TV Expands West

Sylvania Television expands to western video markets this month with appointments of distributors in six major cities. C. K. "Larry" Bagg, sales manager, Sylvania Television, starts a western business tour on October 17th to set up distributorships in Los Angeles, San Francisco, Denver, Salt Lake City, Portland and Seattle. More than 15 eastern cities already have Sylvania distributors.

Sylvania television sets are manufactured by Colonial Radio Corp., Buffalo, a wholly-owned subsidiary of Sylvania Electric Products, Inc., New York. Nine Sylvania models in 10", 12½" and 16" table, console and console combinations, the latter with three-speed record changers, all with

Alliance TENNA-ROTOR Sells with Television!

1,500,000 Demonstrations!
4,500,000 Viewers!
40 TV Stations
EACH WEEK!



● Compelling one-minute television films are doing a big selling job on the Alliance Tenna-Rotor! Viewers actually see how Tenna-Rotor makes a cloudy image come up sharp and clear. Every TV set owner wants to reach out—overcome interference—get more stations! Alliance films are timed with top programs to deliver a maximum TV audience!



CHECK YOUR STATION HERE!

Atlanta WAGA-TV WSB-TV	Cleveland WEWS WNBK	Houston KLEE-TV	Newark WATV	Richmond WTVR-TV
Baltimore WBAL WMAR-TV	Columbus WLW-C	Indianapolis WFBM-TV	New Haven WNHC	Rochester WHAM-TV
Boston WNAC	Dallas KBTB	Johnstown WJAC-TV	New York WNBT	St. Louis KSD-TV
Buffalo WBEN-TV	Dayton WLW-D	Kansas City WDAF-TV	Philadelphia WCAU WPTZ	Toledo WSPD-TV
Chicago WNBQ WBKB	Detroit WJBK-TV WWJ-TV	Lancaster WGAL	Pittsburgh WDTV	Washington, D.C. WMAL-TV WNBW
Cincinnati WKRC-TV WLW-T	Erie WICU	Los Angeles KFI-TV	Providence WJAR	Wilmington WDEL-TV
		Minneapolis KSTP-TV WTCN-TV		

The trend is to Tenna-Rotor. Tie in with this television advertising now!
Alliance Tenna-Rotor Comes with a One Year Guarantee!

ALLIANCE MANUFACTURING COMPANY • ALLIANCE, OHIO
Export Department: 401 Broadway, New York, N. Y., U. S. A.

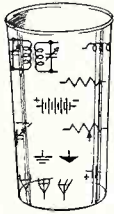
built-in antenna, were introduced in eastern markets last month.

Audio Fair

Many of the nation's leading manufacturers in the audio engineering field exhibited their products at the Audio Fair of the Audio Engineering Society. Loudspeakers and magnetic film and disc recording equipments were featured at the meeting, which took place on the sixth floor of the Hotel New Yorker October 27, 28 and 29. Admission to the exhibits was open to all who wished to attend.

Unique Radio Glass

A unique "Radio Glass" illustrated below is offered by Olson Radio Ware-



house, 73 E. Mill St., Akron 8, Ohio, as part of a sales drive. The glass contains a number of radio symbols etched around its surface.

Amphenol Sells a TV Picture

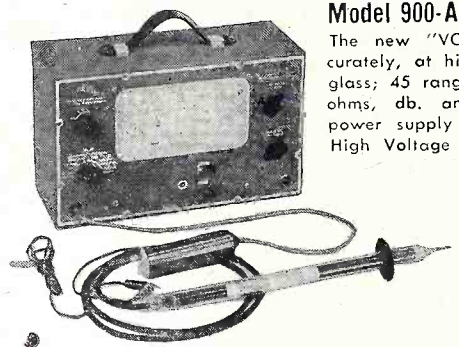
"Sell a TV picture . . . for customer satisfaction." That's the basis of a unique merchandising campaign now being undertaken by the American Phenolic Corporation, 1830 So. 54th Avenue, Chicago 50, Illinois, makers of the Amphenol Inline television antenna.

The campaign to sell a television picture is a threefold one. There is a salesman's booklet of 16 pages—extensively illustrated and written in a non-technical, easily understood manner. Opening on the theme of customer satisfaction, it shows how great a part the antenna plays in obtaining the best possible TV picture. Snow, ghosts and fuzziness—three common examples of poor reception—are then explained, and the salesman is shown how an inadequate antenna causes them. The features of the Amphenol Inline antenna are described with particular emphasis on the satisfaction it brings the customer and the way that satisfaction increases the salesman's business.

This threefold campaign—the salesman's booklet, the customer folder and the newspaper mats—is being offered to dealers throughout the country. It represents the mutual interest the television dealer and the antenna manufacturer have in improving the quality of TV reception.

Your **BEST BUY** is TV TEST EQUIPMENT by **McMurdo SILVER**

Originally designed by McMurdo Silver . . . developed and constantly being improved by McMurdo Silver's staff of engineers. Manufactured of the highest quality, tested components by the trained electronic technicians in McMurdo Silver's modern factory. Compact! Low-priced! You can't beat the value that is built into every McMurdo Silver Laboratory Caliber Test Instrument!



Model 900-A "Vomax"

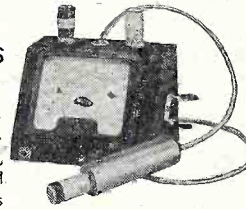
The new "VOMAX" makes TV, FM, and AM measurements accurately, at highest meter resistance. Giant meter, non-breakable glass; 45 ranges, new single probe for a.c., d.c., a.f., r.f., volts, ohms, db. and current measurements. "VOMAX" measures TV power supply potentials up to 30 Kilovolts when used with the High Voltage Adaptor Probe. A world-beater at only \$68.50 net.

Model 918 Multiplier Probe

Built for long life and hard usage, each probe has been thoroughly tested: assuring safety of operation on voltages up to 30,000 volts d.c. Plug-in tips make it readily attached to your VOMAX VTVM, Model 900 or 900A, on which direct meter readings can now be made from 1/10 volt to 30,000 volts c.c. Only \$9.95 net.

Model 915 Tubeless Grid Dip Adapter

Checks oscillators, antenna systems, transmitters, trap circuits, without mechanical coupling. Determines value of all coils and condensers. Requires no power supply or tubes; connects to any signal generator. Three calibrated plug-in coils cover 100 kc. to 300 mc. Equipped with phone jack for easy identification of oscillator frequencies. Model 915 is only \$34.95 net, including coils.



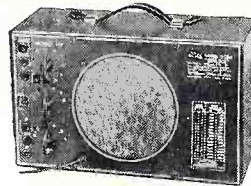
Model 906 FM-AM Signal Generator

Choice of the big engineering laboratories plus thousands of service technicians, 906 stands out as maximum value. 90 kc thru 210 mc. in 8 ranges, 1% accuracy; less than 1/2 microvolt, including strays to over 1 volt v.t.v.m.-metered output; multiple shielding; adjustable 0 to 100% amplitude modulation, adjustable 0 to 1000 kc. FM sweep. Price only \$116.50 net.



Model 905-A "SPARX"

Combining signal-tracer and universal test speaker, 905-A is amazingly sensitive yet free of usual tracer hum. Vacuum-tube prod with r.f. - a.f. switching; high-gain high-fidelity amplifier, 6" PM speaker; 18-watt output transformer gives wide choice of impedances. Two essential instruments in one, 905-A is a value far exceeding \$44.50 net



Model 911 TV/FM Sweep Generator

Here is an all-in-one TV service center. Continuous range of 2 thru 226 mc. Output from 0-1/2 volt, 1 and 5 mc. precision crystal markers insure pin-point setting of TV i.f. band width, and trap circuits. Phased 60 cycle sine and 120 cycle saw-tooth voltages for direct scope control. Sweep from 0-10 mc. An outstanding buy at only \$78.50 net.



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1249A Main Street, Hartford 3, Conn.

Date.....1949

Please send me — and bill through my jobber — the instruments I have checked below:

- 900-A "VOMAX" @ \$68.50
- 918 Multiplier Probe @ \$9.95
- 915 Tubeless Grid Dip Adapter @ \$34.95
- 906 FM-AM Signal Generator @ \$116.50
- 905-A "SPARX" @ \$44.50
- 911 TV/FM Sweep Generator @ \$78.50
- Send Free catalog of Laboratory Caliber Test Instruments

MY JOBBER IS:

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City.....
Address.....

Name.....
City.....
Address.....

McMurdo Silver Co., Inc.

Build YOUR OWN Heathkit TEST EQUIPMENT

Heathkit AUDIO GEN. KIT \$34.50

Heathkit TELEVISION GENERATOR KIT \$39.50

Heathkit CONDENSER CHECKER KIT \$19.50

NEW Heathkit HANDITESTER KIT \$13.50

Heathkit TUBE CHECKER KIT \$29.50

Heathkit SIGNAL TRACER KIT \$19.50

NEW Heathkit IMPEDANCE BRIDGE SET \$69.50

Heathkit R.F. SIGNAL GEN. KIT \$19.50

Heathkit 5" OSCILLOSCOPE KIT \$39.50

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Heathkit ELECTRONIC SWITCH KIT \$34.50

Heathkit VACUUM TUBE VOLT METER KIT \$24.50

Heathkits are beautiful factory engineered quality service instruments supplied unassembled. The builder not only saves the assembly labor cost but learns a great deal about the construction and features of the instrument. This knowledge aids materially in the use and maintenance of the equipment. Heathkits are ideal for and used by leading universities and schools throughout the United States. Each kit is complete with cabinet, 110V 60 cycle transformer (except Handi-Tester), all tubes, coils assembled and calibrated, panel already printed, chassis all punched, formed and plated, every part supplied. Each kit is provided with detailed instruction manual for assembly and use. Heathkits provide the perfect solution to the problem of affording complete service equipment on a limited budget. Write for complete catalog.

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EXPORT DEPARTMENT
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NEW YORK 16, N.Y.
CABLE - ARIAB - N.Y.

CIRCUIT COURT

[from page 20]

builds up to the value required for breakdown, the bulb will flash instantaneously and show that the peaks are too high. The bulb will also act as a partial short circuit on part of the transformer secondary and tend to limit the effect of the overload, at least enough to protect the cutter.

HIGH QUALITY

[from page 17]

used. The choice is obtained through switch *SW-3* in the AM section of *Fig. 1*. Tuning may be done in the *Narrow* position and when completed the *Broad* position may be used for strong clear signals. The *Narrow* position is best for the reception of weak stations or for those in crowded sectors of the broadcast band. The 6AL7 Tuning Eye aids these procedures.

Demodulation of the signal and AVC is achieved, as shown through the use of the 6AL5 diode detector. Through the audio portion of switch *SW-1* the signal is passed forward to the same 12AU7 cascade amplifier previously described under the FM Section.

Phono Pickup

Provision is made for phonograph pickup through a jack at the rear of the chassis. A third contact on switch *SW-1 Fig. 1* connects this jack (*J-1*) to the same audio stage previously discussed. Benefit is thus derived from the volume control as well as from the wide choice of equalization offered in the final audio circuit of the tuner.

A shielded lead from the actual phono pickup to its jack (*J-1*) should be held in length to an absolute minimum as discussed under "Installation".

Installation

Regardless of how or where this tuner chassis is mounted due consideration must be paid to ventilation. The position in which it is mounted is not important, but, heed must be given to radiation of 100 watts of dissipated heat, a price which attends dual independent channel construction.

Isolation mounts of rubber or other padding must be provided where the tuner is installed within the same cabinet housing the loudspeaker. Otherwise directly transmitted mechanical or acoustical feedback or *both* will result.

Shielded leads from the tuner to a following amplifier or from a phono-

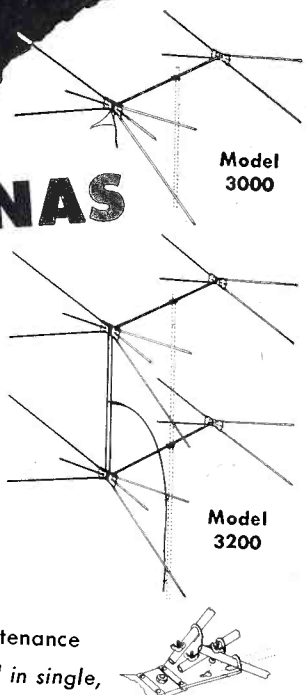
NEW Tricraft "3000" Series

"X" ANTENNAS

(Hi-Lo Conical Type)

- PRE-ASSEMBLED AT FACTORY, READY TO INSTALL (no loose parts)
- Matches 72, 150 and 300 ohm impedance
- All-wave, high gain on all channels
- Durable construction of finest aluminum (will not rust)
- Quality at the right price
- Excellent all-around performance eliminates constant servicing and maintenance

Tricraft "X" ANTENNAS are furnished in single, double or quad element assembly, with or without masts.



Unique clamp simplifies installation—just push in and tighten.

Available at leading jobbers.

Write for technical information, literature and prices.



Tricraft Products Co.

1535 North Ashland Ave., Chicago 22, Ill.

Manufacturers of complete line of Television, FM and AM antennas and accessories.

graph pickup to connectors provided at the chassis rear are essential. The length of these leads should be held to a minimum so as not to retard high frequency response. When these runs must be lengthy, some form of coaxial cable should be installed. The central conductor of the ordinary shielded type should be tinned and flowed into the female contact provided while the shield braid should be brought up and over the shell of the plug and then soldered well to it. In some cases it may be necessary to effect a grounded bond between the tuner chassis and that of the following amplifier. Copper braid or large wire may be used for this purpose.

THE SCOPE

[from page 11]

signal tracing or aligning of various radio and television circuits.

Front panel controls for adjusting the internal sweep of the 'scope usually consist of the coarse frequency control, the fine frequency control, and the sync adjustment. The basic sweep frequency is sound by the coarse frequency control, and the pattern is adjusted for hold and lock-in by the other frequency controls.

A multiple cross-section of lines such as shown in Fig. 8 denotes improper setting of frequency controls and are meaningless to the observer until controls are properly adjusted to bring in a single-line pattern.

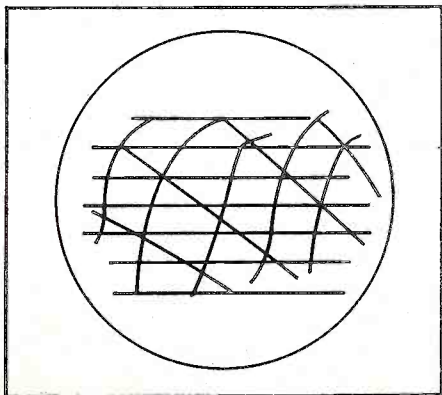


Fig. 8. Improper frequency setting.

Waveform frequencies up to the limits of the saw-tooth generator can be observed on the screen. Frequencies higher than the range of the saw-tooth oscillator can also be observed, depending on the frequency response of the 'scope. Thus, if the highest frequency of the 'scope sweep is 30,000 cps, we can observe a 30,000 cps waveform on the screen, getting a single pattern if the two frequencies are equal. We could, however, observe

a 60,000 cps waveform by getting two patterns (cycles) on the screen. By the same reasoning, 120 kilocycles or even more can be observed, though several cycles would be visible, because we cannot get a single cycle unless both sweep and observed pattern are of the same frequency. The viewing of the higher frequencies depends on how much of a signal can get through the 'scope at these frequencies, for most of the inexpensive 'scopes do not amplify much more than 30 kc flat.

As will be shown later, however, even the inexpensive 'scopes are extremely useful tools in TV and FM alignment and trouble-shooting, and can perform almost all the tasks essential during normal servicing.

The signal to be observed is placed on the posts marked V on the front of the 'scope. This connects the signal to the input of the vertical amplifying system within the 'scope. This amplifier is useful in "blowing up" signals of low voltage so that they can be observed on the screen. Within

ANOTHER DUOTONE HIT!

A service Aid Kit for the record dealer or the serviceman which contains an assortment of replacement needles for all the popular cartridges.

Replacement jobs effected without delay! This practical assortment, neatly arranged, will fit all your needle needs.

It's an automatic inventory-taker! Simply replace the needles you sell by re-ordering immediately.

DUOTONE needles are famous the world over for their superior performance and workmanship. ORDER TODAY!

Replacement Needle Cabinet	
No. 700 AND . . . an assortment	
of 14 DUOTONE NEEDLES.	
LIST PRICE	\$38.00
INTRODUCTORY DISCOUNT	50/10%
YOUR COST	\$17.10
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DUOTONE

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MERIT HAS

COMPLETE - EXACT TV REPLACEMENTS

★

When MERIT says it, it's News!

Merit jobbers can now offer exact replacements for RCA and other popular makes. All independent servicemen will welcome this news. Merit's TV Replacements fully maintain Merit's famous standards of quality. Buy them with complete confidence.

New MERIT CATALOG No. 4911 is now ready. Shows all TV Replacements in regular line. Write for your copy. All catalog items in stock.

POWER TRANSFORMERS

Type No.	List Price	H Volts	V Secondary	I C	W A	Volts	Amp	Wdgs	Mtg. Center
P-3061	\$25.00	362-362	295	5	6	6.3	5	3 3/16 x 4 1/16	
P-3063	\$20.00	360-360	250	6	3	6.3	9	3 3/16 x 4 1/16	
RCA Repl						6.3	8		

Dimensions

Type No.	H	W	D	Mtg. Type
P-3061	6 1/16	3 27/32	4 2 3/32	C
P-3063	5 1/16	3 27/32	4 2 3/32	C

VERTICAL OUTPUT TRANSFORMER

Type No.	List Price	Turns	Ratio	Pri	to Sec	Mtg	Centers	Mtg	Type
A-3035	\$5.25	10	1			1 1/2	x2		EV

Dimensions

H	W	D
3 3/8	2 1/16	2 1/2

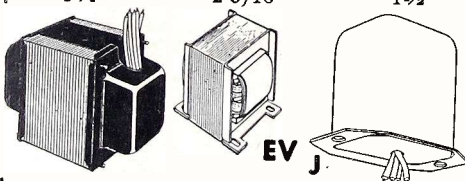
VERTICAL BLOCKING OSCILLATOR TRANSFORMER

(A highly popular unit of outstanding efficiency)

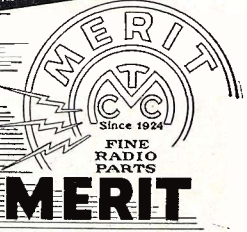
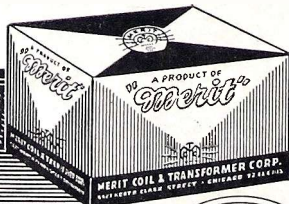
Type No.	List Price	Turns	Ratio	Pri	to Sec	Mtg	Centers	Mtg	Type
C-4000	\$2.75	1	4.2			1 1/2			J

DIMENSIONS

H	W	D
1 3/4	2-5/16	1 1/2



PRODUCTS OF MERIT



COIL & TRANSFORMER CORP.

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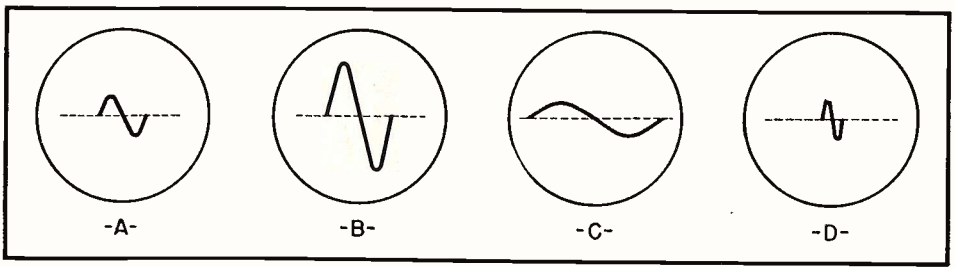


Fig. 9. Appearance of sine wave with various settings of V and H amp. control.

the 'scope there is also a horizontal sweep amplifier, so that the sweep can be amplified when necessary. This allows the user to spread out horizontally the signal under observation.

Figure 9a shows a sine-wave under observation which has a low voltage

ation horizontally is the "Horizontal Amplifier" control.

The positioning controls mentioned earlier, will act on the image as shown in Fig. 10a to 10e. In this fashion we can regulate the image appearing on the screen to suit our needs during

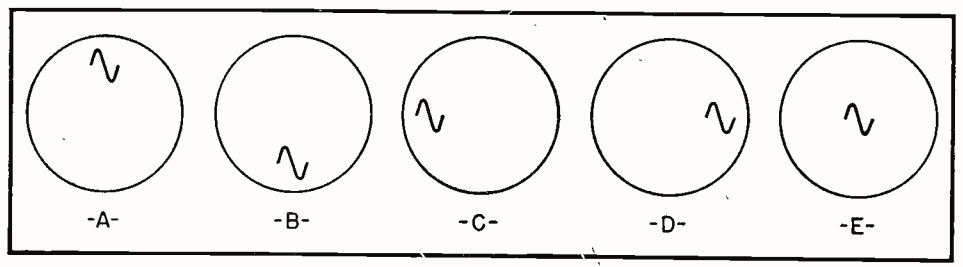


Fig. 10. Effect of positioning control on image.

and shows up very small on the screen. By adjusting the Vertical Amplifier Control, the image can be enlarged vertically as shown in Fig. 9b. Fig. 9c shows the same waveform Figure 9d shows the waveform with very little horizontal amplification. The control which adjust the ampli-

servicing. We can focus it, amplify it vertically or horizontally, position it to the right or left, and within limits adjust it so we can observe one pattern or a number of consecutive patterns or cycles.

[To Be Continued]

A NEW AID TO RAPID SERVICING

[from page 16]

lator, or sweep generator, it is only necessary to bring the probe coil of 915 somewhere near the piece of equipment under test. The standard signal source (generator coupled to 915) is set at the frequency required for the test circuit. The test instrument is next tuned until it is at the exact frequency of the standard by the "zero beat" method previously described. The entire scale of the instrument is then calibrated by this same procedure. All single frequency units such as crystal oscillators may be "beat" against the signal generator, or against a third oscillator by this unique mixing method. At no time can any of the oscillators be detuned or upset as the degree of coupling required is extremely small.

Production Aid

Field experience with model 915 has indicated its extreme importance in production and electronic manufacturing. Among the problems which beset the present day electronic manufacturing company is the complete

and rigid control of the quality of components employed in finished apparatus. It has been standard practice to set up special circuits to determine both tolerance and rating of individual parts. If a faulty component were incorporated in an instrument ready for final test, the loss of time involved in localizing the trouble would be prohibitive from a cost standpoint. This means that all critical components must be tested prior to installation in any high quality piece of electronic equipment.

If the particular component under consideration were a coil of any variety, model 915 will immediately qualify any number, with no more special circuit than that of a coupling signal generator. Since a coil is strictly an L/C circuit (due to various capacities-turn adjacency, etc.) the self resonance of the standard sample can be established in a matter of seconds. Once this has been determined any number of similar coils can be quickly checked by simply

bringing the 915 probe coil close to the individual coils and observing the resonance pointed. Fixed and variable condensers can be quickly checked in a similar manner.

Many electronic instruments are assembled in separate sections, inspected, and then incorporated and tested in the final working circuit. If such an assembly should be an r-f/i-f strip or a TV tuner, pre-alignment and consequent saving of time is made possible by the use of 915. Repetitive checking of tracking and quick checking of oscillators is simplified by this positive means. Many tedious and touchy production jobs such as signal generator alignment, speedy localizing of intermittents, etc., are greatly simplified by utilizing this unique instrument.

Since the introduction of model 915 a few months ago several comments from the industrial field have indicated its extreme versatility, and should suggest to the reader several additional applications along similar lines that should provide quick answers to otherwise difficult problems.

One manufacturer who is presently using model 915 in the resonance indicator application to pre-set a highly critical all-band transmitter, effected a considerable saving of time in the final testing position. In another plant both quality control and pre-setting of television r-f and i-f sections are being done at greater efficiency due to the use of this instrument.

There are many more cases that we could cite to emphasize the deserved position that this new instrument now occupies in the electronic world. Fundamentally it is a serious piece of service equipment and should be incorporated in every shop where time is a prime factor in determining the amount of service income. It is our firm belief that once you have used this instrument you will find it indispensable, both from the standpoint of time saved, assurance of absolute accuracy and consequent greater profit.

TONE CONTROLS

[from page 14]

cordist" variety can be improved by the emphasis of high frequencies and bass boost. Playback pickups, amplifiers, and loudspeakers' responses can be given a tonal quality that goes beyond that usually expected.

Figure 3 is another arrangement of dual tone control; but using a single

triode instead of the dual triode. The bass and treble are mixed and amplified in the one stage. Resistors $R5$ and $R6$ serve the purpose of isolating the bass and treble circuits and limiting the interaction of the two potenti-

meters $R3$ and $R4$. The gain in this circuit is appreciably less than that of the two previous circuits due to the use of $R5$ and $R6$.

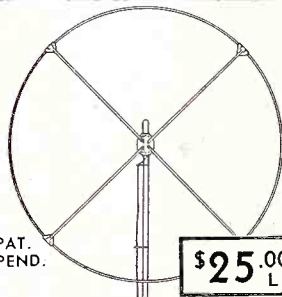
Figure 4 is an interesting combination of the three previous circuits.

Compare...

CIRCLE-X TV ANTENNA TO ANY OTHER TV ANTENNA

The mechanical and electrical construction of Circle-X antenna is unsurpassed. No other type of antenna combines all the features that are engineered into the Circle-X.

	One type Antenna for all jobs	Low Installation Cost	Light Weight	Rigidity	One Wire Lead-in	High Gain	Wide Angle Reception	No High Frequency Head	Eliminates Ghosts	Eliminates Service Calls
Circle X	X	X	X	X	X	X	X	X	X	X
Brand A		X		X		X				
Brand B				X	X	X	X			X
Brand C				X	X					
Brand D				X				X		
Brand E				X		X				
Brand F		X	X	X		X				



PAT. PEND.

\$25.00 LIST

DEALERS: Air Express or Parcel Post Special Delivery direct from factory to you through your jobber, if he cannot supply you with the Circle-X from his stock.

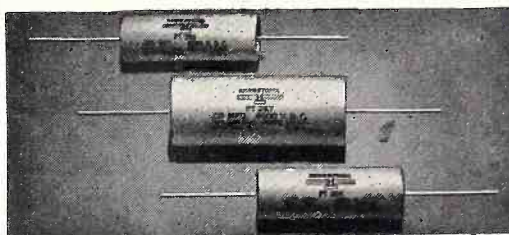
CIRCLE-X ANTENNA CORP.
506 MARKET ST., PERTH AMBOY, N. J.

The high gain of the Circle-X is equal to stacked arrays. It is made of the light weight corrosion resistant aluminum alloys that have been used for many years, exposed to salt spray and other adverse atmospheric conditions.

The Circle-X gives clearer, sharper pictures on all channels (no high frequency head needed). It eliminates the necessity of having a rotor or reflectors. It is perfectly matched to 72,150 and 300 ohm receiver input circuits.

CIRCLE X
ANTENNA CORPORATION

Insure BETTER Television Service to Your Customers! . . . Exclusively Designed



HIGH VOLTAGE AND ELECTROLYTIC TUBULAR

TELEVISION CAPACITORS

Especially Engineered for Television Circuits by INDUSTRIAL CONDENSER CORP.

The economical quality line for replacement. Industrial Condenser Corp., manufacturers of Capacitors exclusively brings you highest quality for the particular requirements of Television at exceptionally attractive prices! Special Capacitors are Pyroteen impregnated for low power factor, high insulation resistance, high operating temperatures. Oil, Pyroteen, Wax and Electrolytic Capacitors. Finest materials throughout.

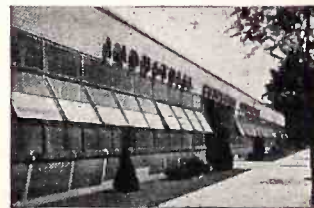
Ask Your Jobber for our Attractive Prices Today!

Or write for Bulletin 1095. Industrial makes quality Capacitors for Television, Radio, every electronic and industrial application—all types.

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Condenser $C1$ goes to the rotor connection of the potentiometer $R2$ and, as the potentiometer is rotated from the grid side to the ground side the tone response is varied from bass to treble. With the condenser at the ground side of $R2$ the circuit represents the bass channel of the circuits previously described; high notes are by-passed to ground due to the comparatively low

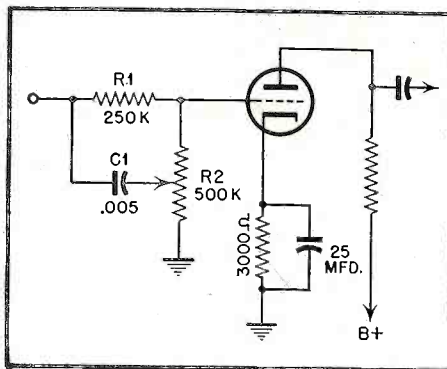


Fig. 4. Combination of 3 circuits.

reactance of $C1$. With the condenser $C1$ at the grid side of $R2$ the bass is attenuated by the comparatively high reactance of $C1$, and the circuit represents the treble channel of the circuits in Figs. 1, 2 and 3. Rotating the arm of potentiometer $R2$ gives a continuous and wide control of tonal quality to suit the ear of the individual listener. A 6C5 triode and the parts values are given. This circuit is particularly ideal when used with crystal pickups.

Figure 5 is the familiarly simple method of tone control used in most home receivers and public address systems. As $R1$ is varied, bringing $C1$ closer to ground, greater attenua-

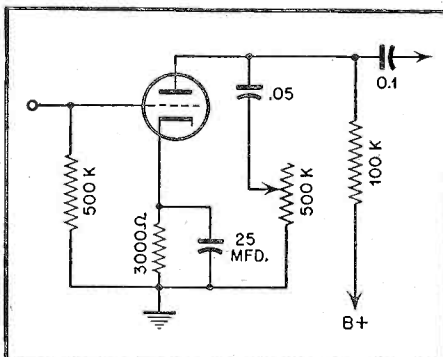


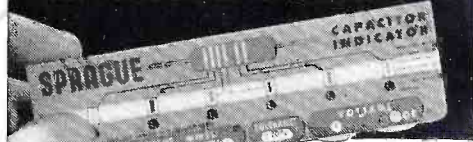
Fig. 5. Simple method of tone control

tion of the treble frequencies is afforded, effectively making the response more bass. The disadvantage is that no treble emphasis is possible simultaneously with bass boost. Its simplicity of installation and comparatively low cost make it quite popular.

All of these circuits, with the ex-

ception of E, cause some loss in overall gain. This is caused by the resistors necessary to isolate the treble and bass channels. However, the average radio and amplifier have enough spare gain to offset the loss introduced. The reason for the loss in overall gain becomes more apparent when considering $R1$ and $R2$ and their arrangement in Fig. 1. $R1$ and $R2$ in series are, in effect, a voltage divider. When a signal voltage appears

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across the input of the channel, a voltage drop appears across $R1$ and $R2$. This voltage drop can be computed by this simple formula and a little elementary algebra.

$$(1) E1 = \frac{R_g \times E2}{R_{total}}$$

$E1$ is the voltage at the grid.

R_g is the grid resistor.

$E2$ is the input voltage.

R total is the sum of R_g and the isolating resistor.

For example, if we consider a phonograph pickup having a voltage output of .85 volts and connect it across points a and c in *Fig. 1*, what voltage

will appear at the grid of $V1$ (ignoring the effect of $C1$)?

$$(1) E1 = ?$$

$$E2 = .85$$

$$R_g = 500K$$

$$R_{total} = 750K$$

$$(2) E1 = \frac{500,000 \times .85}{750,000} = .566 V.$$

However, the gain in tonal quality achieved by these simple arrangements more than compensate for the voltage loss.

FIELD FINDINGS

[from page 4]

parts, tubes and accessories is breaking all past records. There are shortages of all kinds, particularly tubes. Better test equipment and CROs are in demand, and happily, many service organizations are investing in new test equipment now knowing that their investment is justified because it will enable them to render more efficient service, faster, and thus provide a correspondingly larger percentage of operating profits. Likewise, the employment situation is "tight" for there is an acute shortage of competent technicians, and wage scales are close to record peaks. The one weak spot in the whole picture is, however, just the same now as it was one, two, five and ten years ago. Servicemen are not demanding and getting enough money for their services. Yes, the service profession is still giving the public much too much value.

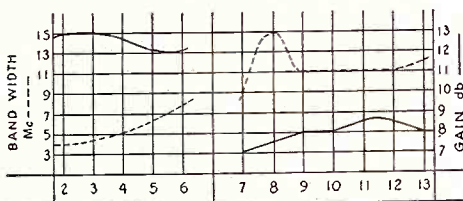
For example, we find many radio retailers, especially those not operating their own service departments, are selling TV sets with built-in antennas now-a-days, and in order to consummate the sale quickly, are happy to let the buyer rush out without a service policy, or without a contract that includes the installation of an external antenna should one be required for optimum reception. In other words, dealers like to grab a sale and forget any further dealings with a customer, especially when they know that the dealings are of a technical nature which surely involves call-backs and servicing. Then, when these built-in antenna type sets fail to give a customer complete satisfaction, the retailer complacently washes his hands of the matter by referring the set owner to his "service branch" — usually a firm in no way connected with the retailing establishment except through "working arrangements." Then when the set owner finds he is faced with the expense of buying an

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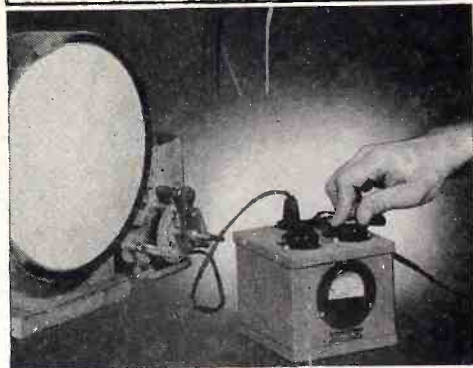
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outdoor antenna and having it installed, his (the set-owner's) ire is directed toward the service firm, and not toward the retailer—for it is human nature to yowl at the person with whom one is presently dealing rather than the one with whom the original transaction was made. Yes, now more than ever before, servicemen are coming into closer personal

contact with set owners, and the danger of there being unjustified friction and misunderstanding is mounting. That is why we urge Service Dealers (firms that sell at retail and also operate their own service department) to assiduously try to handle their own installation and service contract work rather than farm same out to a third party.

IMPEDANCE BRIDGE

[from page 13]

than a conventional "square"-type 1½-volt dry cell.

The function of the GENERATOR SWITCH is to connect an appropriate power (signal) source across the input points of the bridge circuit. When this switch is in its 1-KC. position, the output of the self-contained 1000-cycle hummer is connected to the bridge input, and the 6-volt battery is switched-in automatically to drive the hummer. When the switch is in its D.C. position, the self-contained 6-volt battery is switched across the bridge input points. When the GENERATOR SWITCH is in its EXTERNAL position, the bridge input points are connected to the two terminal posts labelled EXTERNAL GENERATOR. A suitable external generator may then be connected to these terminal posts. When an a-c type detector is used, a satisfactory external generator would be an audio-frequency oscillator having either superior waveform to that of the self-contained 1000-cycle hummer or having some frequency other than the 1000-cycle output of the hummer. When the self-contained microammeter or an external d-c galvanometer is used as the bridge detector, a battery would be employed as the external generator. When an external battery is employed, it usually is of higher voltage than the internal 6-volt unit and is employed to give a more accurate null indication after the bridge already has been balanced with 6 volts input.

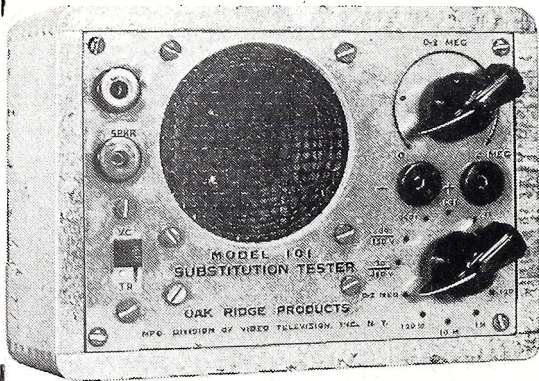
The MAIN CONTROL (See C-R-L in Fig. 2) is a General Radio Type 371 10,000-ohm instrument-type rheostat. This control has a logarithmic taper, as indicated in Fig. 2. The dial of this unit is graduated 0 to 10 and is read in micromicrofarads, microfarads, microhenries, ohms, or megohms, depending upon the setting of the MULTIPLIER SWITCH. Thus; the figure 4 on this dial is read as 4 millihenries if the bridge is set up for inductance measurement and the MULTIPLIER SWITCH is in its position B. But it would be read as 40,000 ohms if the bridge were set up for resistance measurement and the MULTIPLIER SWITCH were in its position F.

Two separate pairs of "unknown" terminals are provided. Resistors under test are connected to the pair labelled R; capacitors or inductors to the pair labelled C-L.

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of RADIO SERVICE DEALER, published monthly at New York, N. Y. for October 1, 1949.

State of New York } ss.:
County of New York }

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared Sanford R. Cowan, who, having been duly sworn according to law, deposes and says that he is the Publisher of RADIO SERVICE DEALER, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for dates shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, and July 2, 1946, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business manager are: Sanford R. Cowan, 1620 Ocean Ave., Brooklyn 30, N. Y., Editor & Publisher; Samuel Marshall, 262 Sullivan Pl., Brooklyn 25, Managing Editor.

2. That the owners are: Cowan Publishing Corp., 342 Madison Ave., New York 17, N. Y.; and Sanford R. Cowan, 1620 Ocean Ave., Brooklyn 30, N. Y.

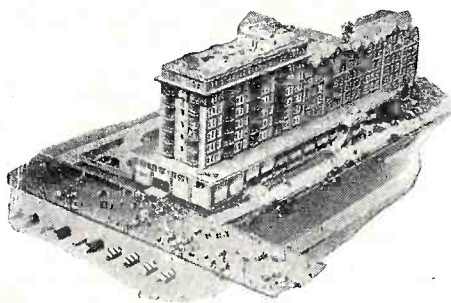
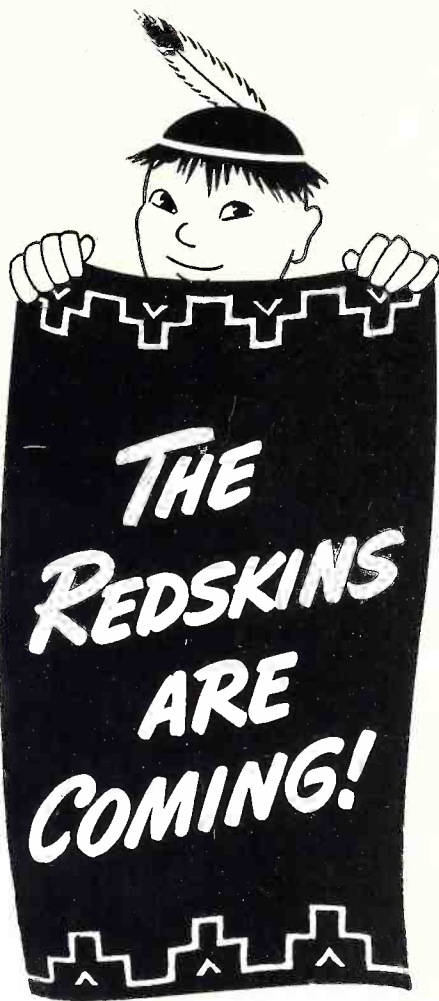
3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent, or more of total amount of bonds, mortgages, or other securities, are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiants full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock, and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) SANFORD R. COWAN, Publisher

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forms two functions. Its first function is to set up the bridge automatically for either resistance, capacitance, or inductance measurements. For resistance the circuit is a standard Wheatstone bridge, for capacitance it is a conventional 4-arm bridge with capacitances in two legs and resistance in the ratio arms. The Maxwell bridge circuit is employed for measuring inductors whose Q is 10 or less, and the Hay bridge circuit for measurement of inductors with Q 's higher than 10. The second function of the SELECTOR SWITCH is to select the proper rheostat for reading the dissipation factor of capacitors or Q of coils. When this switch is in its CD position, the bridge is set up for measuring capacitance, and the rheostat D is selected for dissipation factor readings from 0.001 to 0.1 (corresponding to capacitor power factor reads from 0.1 to 10%). When the switch is in its CDQ position, the bridge is set up for capacitance measurement, and the rheostat DQ is selected for dissipation factor readings from 0.01 to 1.

When the switch is in its LQ position, the bridge is set up for inductance measurement, and the rheostat Q is selected for Q readings from 10 to 1000. When the switch is in its LDQ position, the bridge is set up for inductance measurement, and the rheostat DQ is selected for Q readings from 1 to 10.

When the SELECTOR SWITCH is in its R position, the bridge is set up for resistance measurement only, and the rheostats D , Q , and DQ automatically are switched out of the circuit.

Rheostat Q has a logarithmic taper, as indicated in Fig. 2. Rheostats D and DQ have linear tapers.

The reactive standards are the self-contained 0.01- and 0.1-microfarad precision capacitors shown in Fig. 2. Both capacitance and inductance measurements are made against these capacitors as standards. Use of capacitor standards for inductance measurement (using the Maxwell and Hay bridge circuits) remove the necessity for standard inductors, greatly simplifying the bridge arrangement and reducing its cost.

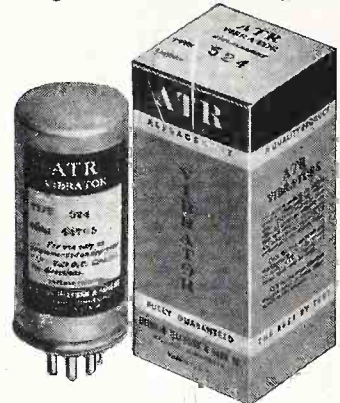
Mechanical Construction

Resistors R_1 to R_{10} inclusive are connected by means of their pigtailed directly between points of the MULTIPLIER SWITCH and DETECTOR SWITCH. Leads to and from the 1000-cycle hummer can be made with regular, insulated hookup wire. All other wiring must be made with



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solid bus bar and must be as short and direct as possible. Rigid wiring of this kind is employed to prevent changes in circuit capacitance resulting from shaking or vibrating leads.

All bridge components except the battery are mounted on the 10" x 16 1/4" metal panel. The instrument (See Fig. 1) is housed in a sloping-panel wooden cabinet.

Initial Calibration

After the bridge has been completely assembled and its wiring verified, the initial calibration may be performed in the following manner:

(1) Set the DETECTOR SWITCH to its SHUNTED GALVANOMETER position.

(2) Set the GENERATOR SWITCH to its D.C. position.

(3) Set the *D*, *Q*, and *DQ* rheostats to their zero or minimum readings.

(4) Set the MULTIPLIER SWITCH to its 1000-ohm position (position *D* in Fig. 2).

(5) Set the SELECTOR SWITCH to its *R* position.

(6) Connect an accurately-known 10,000-ohm resistor to the pair of "unknown" terminals labelled *R*.

(7) Adjust the MAIN CONTROL rheostat until the self-contained microammeter reads exactly zero.

(8) Set the DETECTOR SWITCH to its GALVANOMETER position, and readjust the MAIN CONTROL for a sharper null (zero) indication of the meter.

(9) The MAIN CONTROL should read exactly 10 (which is an indication of 10,000 ohms, the value of the resistor connected to the *R* terminals). If it does not, loosen the setscrew of the MAIN CONTROL knob without disturbing the setting of the rheostat, set the pointer exactly to 10, retighten the set-screw.

Since precision resistors are used in positions *R*₁ to *R*₉ and accurate capacitors are used for the 0.01- and 0.1-ufd. standards, this one-point calibration automatically calibrates all ranges of the bridge, for a.c. and d.c. The 10,000-ohm resistor used for the calibration must be a precision unit, since future accuracy of the bridge for resistance, capacitance, and inductance will depend upon the accuracy of this initial calibration. After this calibration is completed, the bridge will be ready for use.

The direct readings of the *D*, *Q*, and *DQ* rheostat dials are accurate only for 1000 cycles bridge frequency, such as is derived from the self-contained hummer. Their indications are only relative at other bridge signal frequencies.

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South River Chimney Mounts are patent protected. Imitations and infringements are being prosecuted.

See U. S. Patent No. 2482575.

**South River
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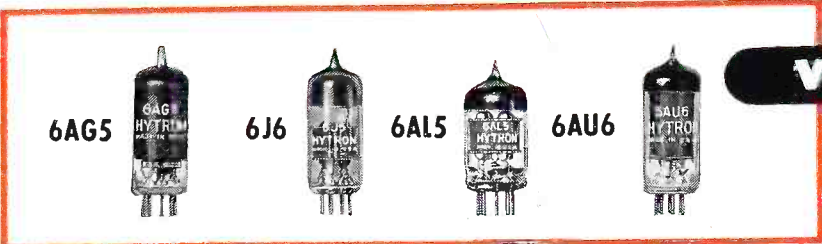
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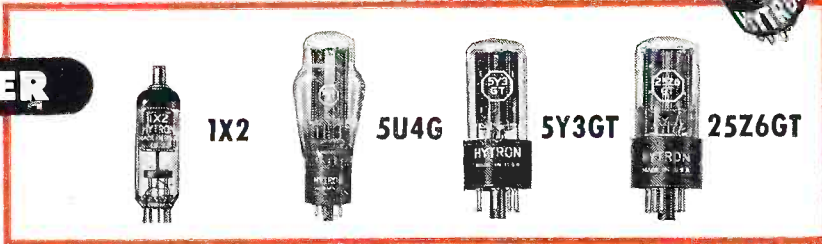


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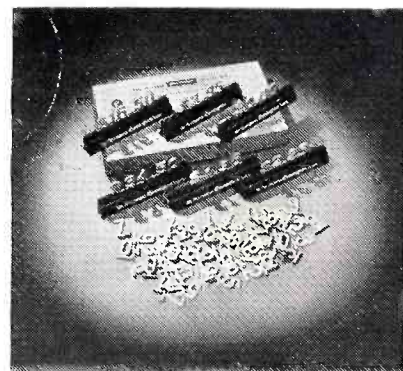
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