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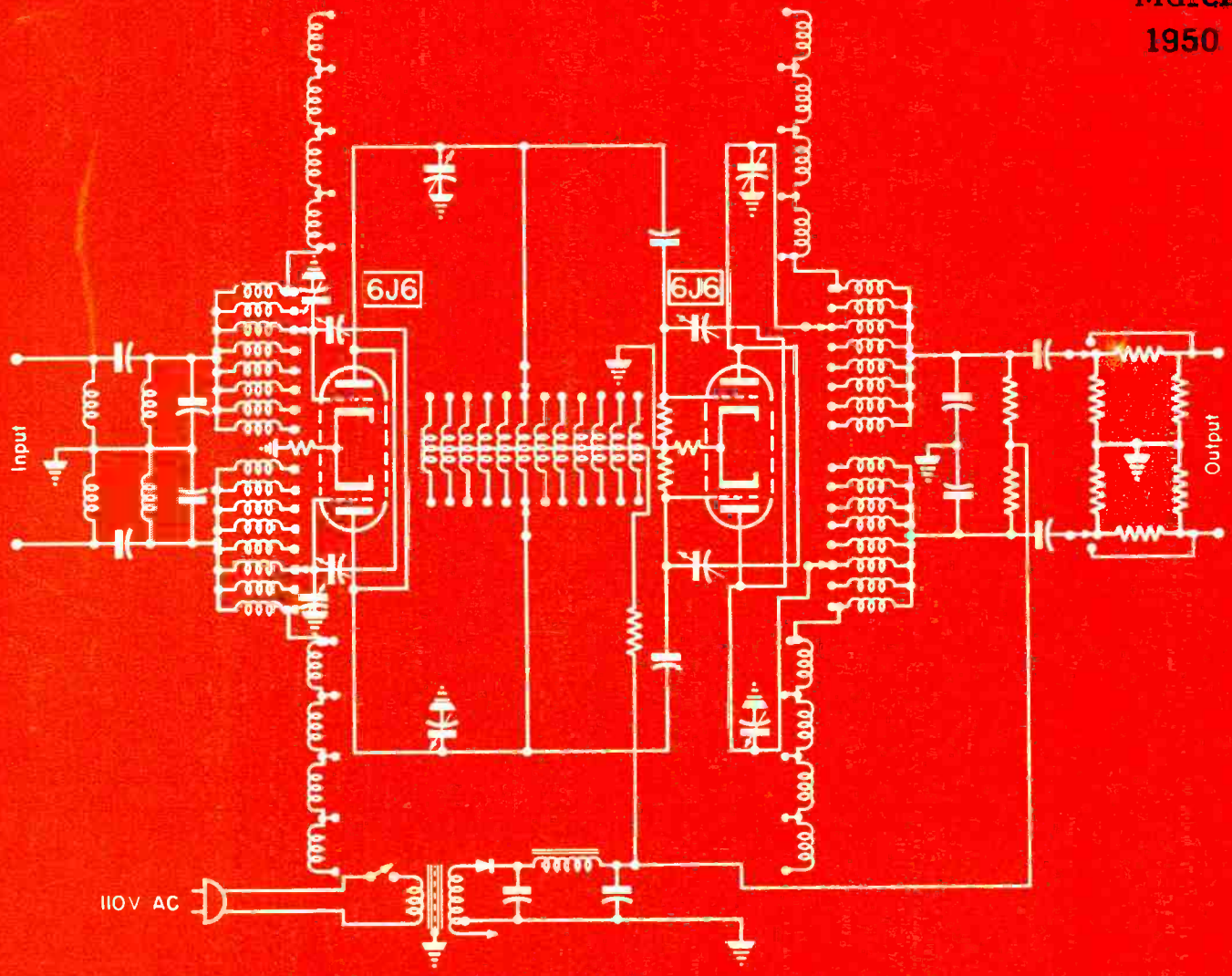
SERVICE

March
1950



Balanced-input two-stage push-pull type TV preamp with a high-pass filter at input.

[See page 2]

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Vol. 19, No. 3

RADIO · TELEVISION · ELECTRONIC
SERVICE

March, 1950

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Advisory Editor

ABC

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Sylvania's NEW

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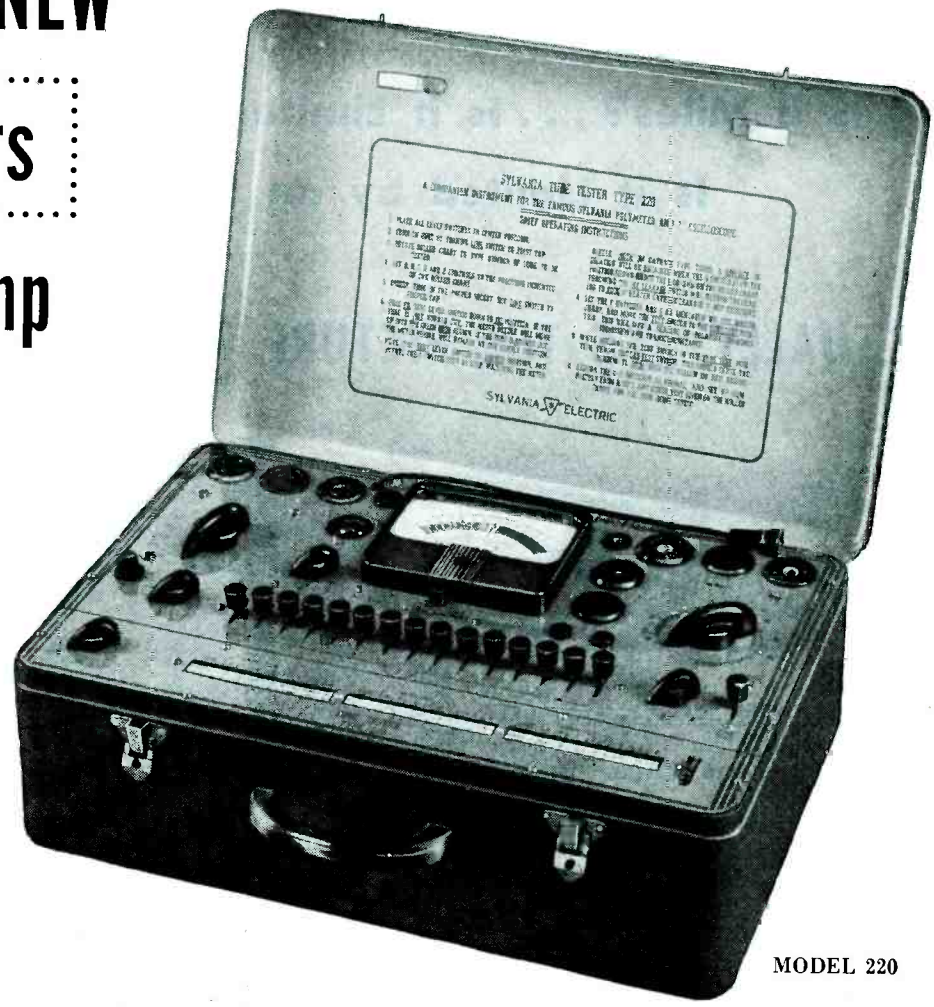
are one jump ahead of tomorrow!



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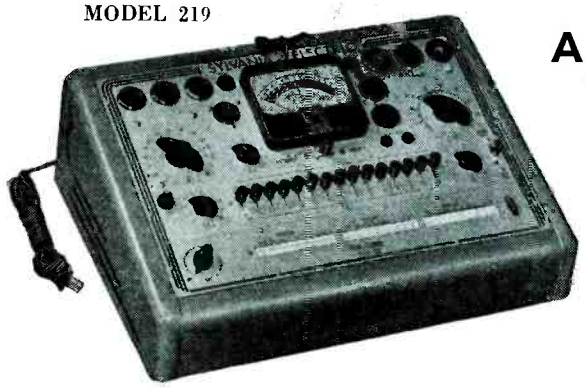
Modern styling of both models tells even the layman that your up-to-the-minute service is one jump ahead of tomorrow!

MODEL 219



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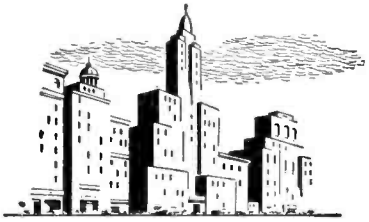

FRINGE area reception also exists within a few miles of a transmitter. Natural or unnatural obstacles found in cities frequently cause fringe area conditions. "The Standard Booster" sweeps aside obstructions and gives your set the ideal picture.

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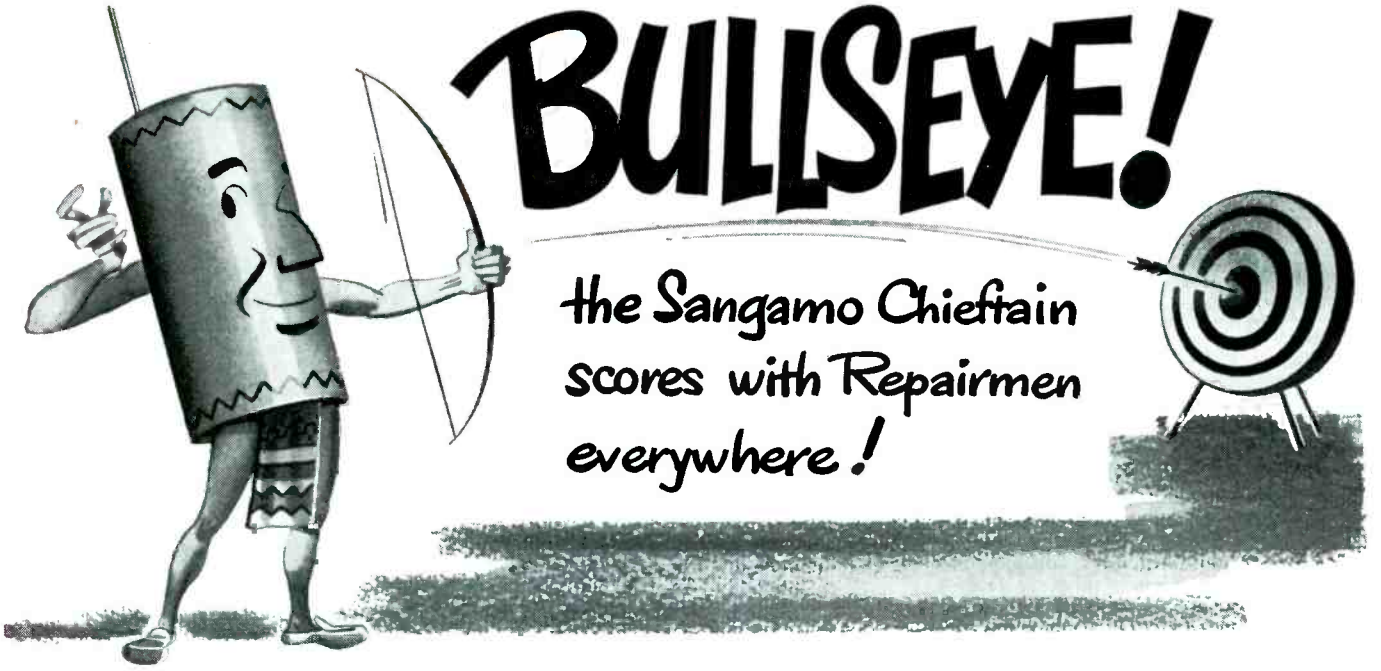

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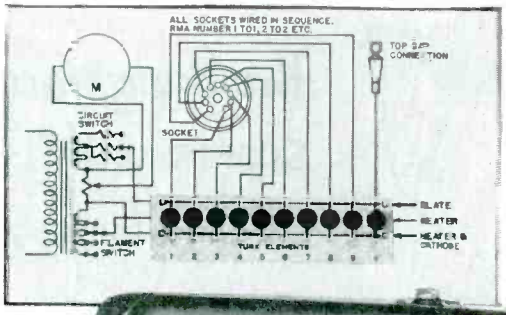

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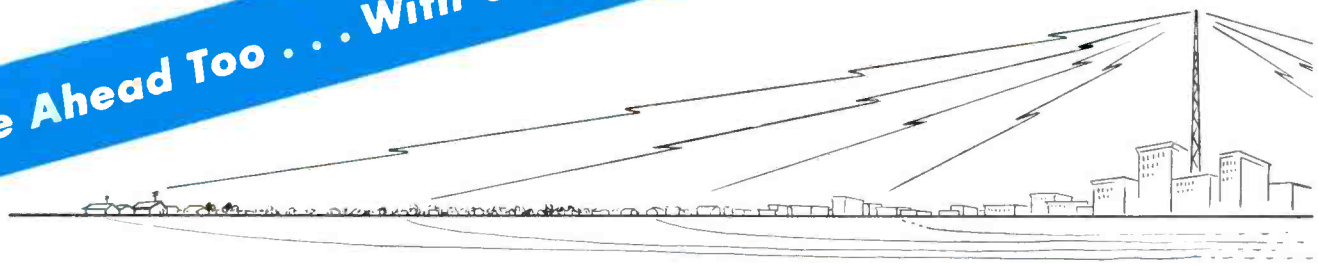

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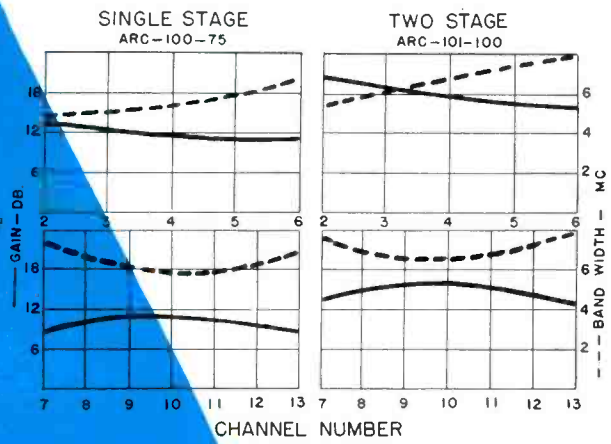

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SERVICE

Chaos in the Picture Tube

THE DOMINANT NEED for a constant voltage input to the TV receiver, often stressed in these columns and in the field and on the production line as the key to a well-balanced picture, in brightness, contrast and size, received quite a bizarre demonstration during the recent coal strike, a demonstration which in some areas, where the voltages dipped low because of emptying fuel bins, was called a picture-tube nightmare.

Commenting on the reports of several companies, serving over fifty-thousand set owners, a spokesman said that pictures were losing brightness, shrinking, expanding, going out of focus, and generally going wacky.

Manufacturers and service companies were so besieged by 'phone calls that they pleaded with set owners to refrain from calling in Service Men until the coal strike had been called off.

While the line conditions during the paralyzing days of the strike were more severe than usual, tests have shown that power variations of some substance are quite common, and as a result are often the cause of a variety of picture-reproduction problems, which are blamed on other sources in the receiver or elsewhere.

Probes* of the relative effects of fluctuations in the line have revealed that there are two types of variations which contribute to the difficulty. There are those line voltages that change over a long period of time, and those with fluctuations which are rapid in their nature. The long-term changes, occurring over a period of minutes or hours, can be caused by the load on the various circuits of the system, while the rapid fluctuations are normally caused by the starting of motors, refrigerators and other household appliances. It has been found that in some instances these collective fluctuations occur quite rapidly, frequently as often as six cycles-per-second, constituting what might be termed a modulation of the line voltage. And, oddly enough, these observed line-voltage fluctuations have not been greater than one or two volts.

*Based on analyses made by Hans U. Hjermstad of Sola Electric.

A gradual change in line voltage often results in a variation of the picture size. It has also been found that the horizontal and width controls may have to be altered, brightness and contrast controls might require readjustment and, in some instances, the vertical controls can become critical. Readjustment of tuning might be required, too, because of a change in the local oscillator frequency.

When the line voltage changes rapidly, the dimension of the picture might appear to change rapidly, too. On certain types of receivers it has been found that a line modulation involving but 1½ volts can cause as much as ⅛" to ¼" deflection of the outer circle of a test pattern.

As Many Service Men have learned, there is an effective way to solve the problem, and this is through the use of a constant-voltage transformer in the line input. Such a transformer can correct line-voltage variation to better than 3%, with a 15% input voltage variation.

If there's chaos in that picture tube, check that line voltage!

TV Radiation

THE PROBLEM OF RADIATION from the local oscillator and sweep circuit, a severe problem since the earliest days of set production, has become, with the increased distribution of receivers, even more acute.

While it is true than many manufacturers are making every effort to curb the nuisance by such procedures as encasement of the tuners in double-shielded compartments and isolation of the control shafts with bakelite insets, many are dismissing the problem too lightly.

RMA has prepared a series of standards on local oscillator and sweep circuit radiation which should be followed by everyone, and not just a few.

Service Men, who are called in on radiation problems, do face a knotty situation. They can, if they are very careful, provide tuner and input shielding and shaft isolation. But the term, *careful,* cannot be emphasized too strongly here, for improper placement of the shield, perhaps too close or too far away from the coils or capacitors, can impair receiver efficiency through absorption.

Here is one problem for the manufacturers, and we hope that they all agree to take it in hand immediately.

Component Ratings

THE TREND to the use of high-rating components, such as capacitors, resistors and transformers, is on the march, fortunately.

Producers are, in the main, employing parts which are rated at anywhere from 50% to 100% beyond the normal load.

There are, however, many manufacturers who insist on using low-rating components and running the risk of causing burnout of the parts and eventual destruction of the complete receiver.

If, during a call, it appears that the problem is an overloaded component, the circuit diagram can be found to be quite a handy guide. A careful study of the circuit will disclose just how a component is being used, and whether or not the component which appears to be in trouble, or perhaps others in the circuit through which higher voltages might be traveling, could be the source of the difficulty.

Here, again, we have a situation which can be eased on the production line. Should, however, a Service Man encounter the under-rated receiver component condition there are many tools, particularly that circuit diagram, which can come to the rescue.

Small TV Chassis

DESIGN INGENUITY must be considered carefully when evaluating TV receivers which feature quite a reduction in their tube complement, when compared with the original 30-tube type models. Commenting on this point, during a recent informal meeting, C. O. Caulton, of RCA, said that: "Engineers knew in the early days that they could take out some tubes and obtain the same performance, but they weren't certain which types could be eliminated."

These engineers have now found, according to Caulton, that they can use multiple-functioning tubes in highly effective streamlined circuits to provide an efficiency equivalent to the older rambling circuits which used many more tubes for the same purpose. It was pointed out that there are, of course, models which do employ too few tubes, according to present standards, but in the main the popular 20 to 24 tube-type chassis have been found extremely satisfactory for most receiving areas.—L. W.

Factors Influencing

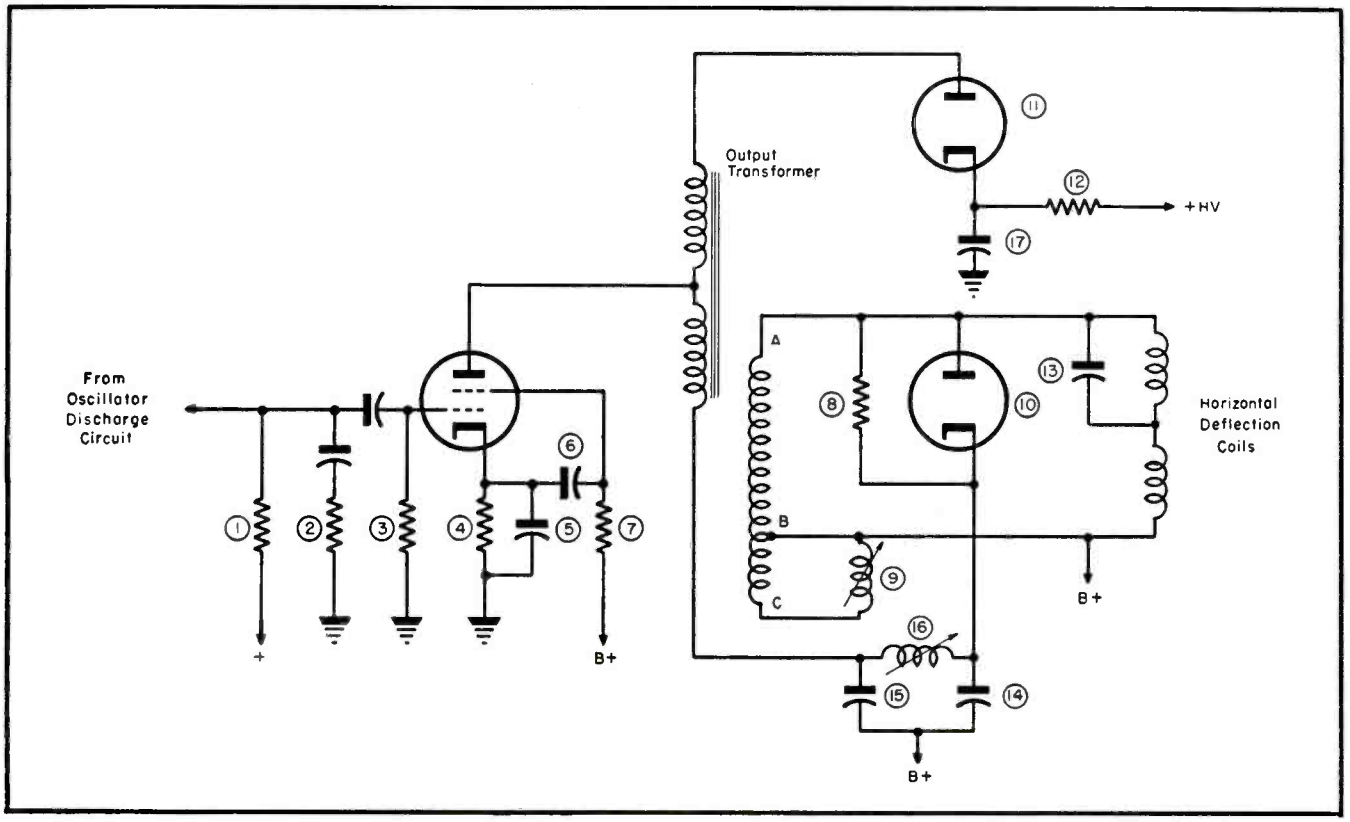


Fig. 1
Typical horizontal output circuit (less transformer and yoke) with which a Service Man must be familiar to determine solutions to linearity problems. The circled numbers indicate the components which are involved in controlling horizontal size and linearity. The specific function of each of these components is described in the text.

ONE OF THE MOST persistent problems encountered by the Service Man has been found to be linearity and, to a lesser degree, size control in the horizontal direction of the picture.

It must be presumed that the receiver may never evidence linearity which is nearly perfect, short of extensive redesign, for there are a great many interleaving factors within the output transformer and yoke coils which must be taken as fixed. There are, in fact, so many of these factors that an accurate prediction of the operation of any combination of these elements simply cannot be made despite the appplication of any amount of engineering technique and knowledge; it is mostly a matter of cut-and-try.

In preparing a routine for corrective-measure checking, a typical horizontal output circuit (Fig. 1) can be used as a basis of planning, with consideration for such factors as size and linearity which are interdependent and thus it is usually not possible to change one without effecting the other. It is also important to remember that some elements can cause a serious change on high-voltage results, while others do not. To check such changes the vertical picture dimension and brightness should be watched; an increase of the vertical size when working with horizontal circuits means that the high voltage is decreasing, as does a reduction of brightness and probably change of focus.

Additional factors[1] which have been found to merit consideration are:

(*1*) The *width* or *drive control* of some receivers; in other models a fixed resistor is used for this purpose. This control produces a large stretch on the right, and some influence on left. No great change in high voltage will be noted within the useful range.

(*2*) The *peaking* resistor which adds a spike to the sawtooth of voltage. This component very materially affects high voltage. It elongates left side of picture over a portion of its useful range, right side over the other; compresses extreme left.

(*3*) The *grid resistor*. In this instance, an increase of resistance pulls in an elongated left side to a moderate degree. In correcting, the resistance should not be increased to over 1 or 1.5 megohms or instability may result. If this resistance is changed, the receiver should be tested at all ranges of line voltage which will be encountered.

(*4*) The *cathode resistor*. Here an increase of resistance can pull in the right side slightly more than the left. As a rule, if the unit is bypassed with a capacitor, both sides will be

[1]Refer to Fig. 1 for numerical identities.

Horizontal Size and Linearity

How to Control Picture Width and Linearity Through Circuitry and Component Applications, and Correct Picture Size Through High-Voltage Regulation.

by J. F. BIGELOW

affected. Sometimes this component is placed in a receiver as a safety device or as a protection against loss of negative grid bias (grid current flow through grid resistor) if excitation is lost.

(5) The *cathode bypass,* which in most circuits, increases size and stretches right, and reduces left-hand side of picture.

(6) The *screen-grid bypass.* This capacitor may be connected to the cathode or ground for a slight change in linearity and stretching of the right-hand side.

(7) The *screen-grid resistor.* This part has little effect on the right but a large effect on the left to the center-left, and some effect on the high voltage. In correcting, its resistance should not be reduced to the extent that there is excessive screen grid dissipation (screen current times cathode-screen voltage) which is 3.2 watts for the 6BG6G.

(8) The *damping resistor.* A decrease of resistance here improves damping and overcomes stretch at extreme left, but changes the overall size to some extent and reduces high voltage.

(9) The *width coil,* which provides slightly more effect on the left-hand side than on right.

(10) The *damping tube.* A low emission from this tube results in a small picture size and a poor regulation of the high-voltage supply; picture enlargement depends upon increase of beam current.

(11) The *high-voltage rectifier.* Here, too, a low emission or the presence of gas affects high voltage and regulation of the *hv* supply.

(12) The *high-voltage filter resistor.* An increased resistance results in a poor *hv* regulation.

(13) The *horizontal yoke* capacitor, which removes transients (ripples) at left side of picture. To correct it must be connected to the proper coil of the two.

(14-15) The *linearity control capacitors.* In some models a single capacitor is used without the linearity coil. These parts affect particularly the right side of the picture. Within normal capacity values, the capacitors have little effect on the *hv.* Changing their value causes the linearity control to affect either the left or the right side. The value change can also produce or cause the linearity control coil to inject bright vertical bar(s) moving across the picture starting at the right.

(16) The *linearity controls,* some of which have a center tap. These controls often produce a *ripple* on the output tube plate voltage and affect the wave form of the reproduced deflection signal. The phase of the ripple can be changed by the constants of the circuit.

(17) The *high-voltage filter* capacitor, which is charged by a deflection pulse through the high-voltage resistor.

Increasing Picture Width

Should trouble be encountered with picture size, the following corrective measures are suggested:

(1) Removal of the width coil from the circuit to provide an increase of about ¾" to 1" in width, and an increase of high voltage by perhaps ½ kv.

(2) An increase in the drive at output tube grid which can be provided by reducing the value of the width or drive control.

The Screen-Grid Resistor

(3) A change in the size of the screen-grid resistor. This may require either an increase or decrease of the resistance to increase size.

(4) An increase in the size of the damping resistor, producing some stretch at the extreme left, which may be slight and tolerable in view of increased size.

(5) A change in the size of the grid resistor.

Yoke Connections

(6) Change of the connection of the yoke to the transformer (from tap *B* to tap *C*, for example).

(7) Bypassing of the cathode resistor, if not already bypassed. Sizes, in the order of .05 to 2 mfd, can be tried.

Series Resistor Change

(8) If the screen or other parts of the circuit (except the output tube plate) are connected to a *boosted B* terminal, connection to *B+* may help. This modification can be made by changing the series resistor, as necessary, to reestablish proper screen or other potential, providing an increase in boosted *B* and greater deflection. This may result in a saturation of the transformer core and compression of

the extreme right-hand side of the picture. Also, the linearity at the extreme right may change with the horizontal centering control. Such a reduction of *dc* through the transformer coil will then not be tolerable.

High-Voltage Decrease

(*9*) A decrease of the high voltage by the following two steps: (*a*)—Placement of a small capacitor across a portion of the transformer secondary coil, observing voltage ratings if across the whole secondary. If placed between *b* and *c* in the circuit, the values can be from about .01 to .03 mfd (600 volts). If the capacitor is placed across a greater number of turns, the capacity will be reduced and voltage increased. It must be remembered that peak potential across the secondary approximates 1,000 to 1,500 volts. (*b*)—If the bottom connection of the *hv* filter capacitor is connected to the yoke, it might be connected instead to ground (conversely, connection from ground to the *high* side of the secondary will increase high voltage).

Increasing Deflection

(*10*) Replacement of the 6BG6G with a 6CD6, which will afford an increased deflection, probably higher voltage and better regulation of the *hv* supply. Improved damping and linearity of the picture may also result from this change. Socket connections of the two tubes are identical, but the 6CD6 draws more filament current than the 6BG6G. If excessive scan is thus obtained, the converse of some of the foregoing suggestions should be applied.

Peaking Resistor Effects

(*11*) Proper use of the correct peaking resistor which has great influence upon high voltage and upon size. This, in fact, is the most effective element in influencing horizontal deflection.

Tube Selection Import

(*12*) Selection of the best tube. Some tubes are better than others. This is only a makeshift, and probably temporary suggestion, for the tube will age and deflection again will be insufficient.

Meter Applications

(*13*) Application of higher voltage to the discharge tube (width or drive resistor should be connected to higher supply voltage) or to oscillator plate.

Some of the items have a large effect upon damper tube current. Therefore a meter should be placed in series with the damper cathode, and tube ratings not materially exceeded.

Changing Linearity

Trouble on the right-hand side, the most common complaint, can be cured by installation of properly-valued capacitors (associated with linearity coil). Since a difference of .01 mfd may produce outstanding results, only one or two sizes need be tried. A capacity decade is the most reliable tool here. It's also been found wise to experiment with the screen and control grid resistors, peaking resistor, etc.

In the resistor tests, it is best to employ potentiometers and replace with fixed resistors, when the proper sizes have been determined.

High-Voltage Regulation

With a poor regulation of the *hv* supply, and an increase of beam current (brightness), the picture size will be altered materially. With the *kick-back* type of supply, the regulation has been found to be weak at times and size changes have been prevalent.

Regulation Accuracy Check

In determining the accuracy of the regulation the following evaluation can be used: If the picture does not disappear entirely or decrease in brightness under an advance of the brightness control, operation can be considered satisfactory. To improve a condition of poor regulation the following corrective steps can be tried:

Improving Regulation

(*1*) Change tubes, particularly the *hv* rectifier.

(*2*) Replacement of the *hv* filter; the resistance of this component usually increases. Drawing an arc to the chassis from the *hv* anode connector will reveal this difficulty.

(*3*) Picture tube may have gas and require replacement.

Ion-Trap Adjustments

(*4*) Correction of improperly adjusted ion trap; improper adjustment results in excessive advancement of brightness control for desired brightness. An improperly adjusted trap magnet may also ruin the tube through vaporization of the gun elements.

Importance of Series Resistor

(*5*) Removal of the series-resistor or reduction of resistance to improve regulation, if the *hv* rectifier tube heater is not sufficiently bright when the brightness control is advanced. If there is no series resistor, an added half turn on the transformer is prescribed, although tampering with this winding even to the extent of one turn can seriously affect scanning. (To determine the proper brightness of the rectifier filament (1B3/8016 tube), apply measured 1¼ volts from a battery; the filament will be but dull-bright. Excessive voltage to the point of bright incandescence will surely result in ruin of the tube and poor *hv* regulation after a short time. Increased series-resistance or a reduction of coil turns is then necessary.)

(*6*) Change in the size of the screen-grid resistor associated with the output tube.

Grid-Bias Voltage Effects

(*7*) Increase in the available power from the output tube using an increased *boosted B*. This can be achieved by changing the tube type or decreasing grid bias voltage, as previously outlined, and then reducing the scan, if necessary.

In short, poor *hv* regulation can be caused by a high-internal resistance of the supply, either an actual lumped resistance such as the filter resistor or low tube emission, or by the inability of the supply to furnish the increased power demanded by increased beam current.

If the system has to be strained to supply sufficient power for adequate deflection, it cannot provide the added power demanded.

MARINE RADIO

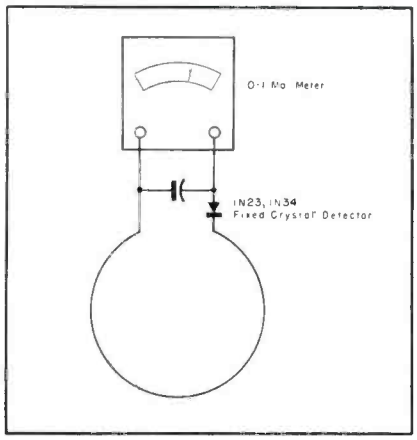


Fig. 1
Setup for a *rf* probe. Length of probe loop can be 4" to 5".

Fig. 2
A package type shield in place over an ignition system. The spark plugs are under the metal cans.

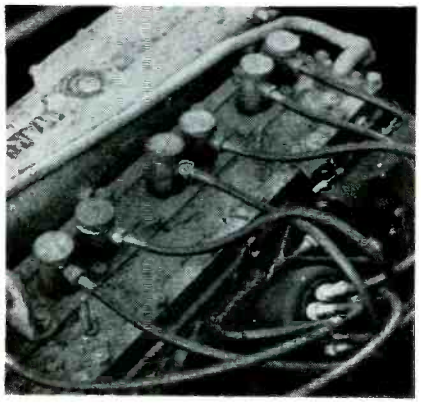
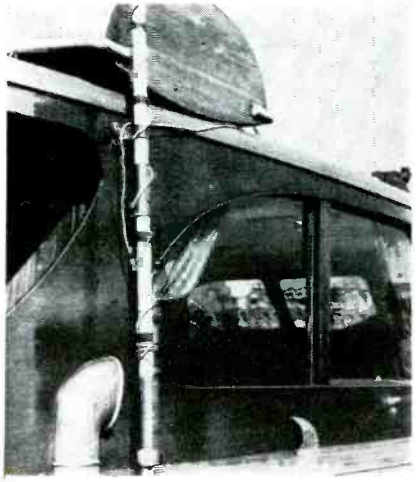


Fig. 3
A spiral antenna. The leadin position along the top of the cabin, as illustrated in this view is, of course, not a recommended practice.



THE SERVICE MAN who lives near water and who has a working knowledge of transmitters can expand his operations substantially, and in a very profitable manner, by installing and servicing marine radio equipment.

Any one can install and service a marine equipment. However, only a holder of a second class commercial radiophone license[1] can tune the transmitter on the air. Ham licenses or lower grade licenses do not permit such operation.

All boats that carry passengers for hire are regularly inspected by the Federal Maritime Commission, and all craft that carry insurance are inspected by insurance underwriters. Therefore, all work performed on marine radio equipment must come up to current standards of safety.

Safety Standards

These standards are, for the most part, obvious: Good, honest, careful workmanship; sufficiently heavy leads, well insulated, frequently fastened, etc. When in doubt as to what wire to use it is usually a safe practice to study the wiring used in other portions of the boat and proceed accordingly.

The radio equipment used on small boats falls into three general categories; broadcast receiver for entertainment purposes alone, trans-receiver for ship-to-ship, ship-to-shore communication, and the manually-operated direction finder or loop. This equipment is supplied separately or as a combination unit.

Power-Supply Requirements

Boat power supplies run from 6 to 32 volts *dc*, and 110 volts *ac* or *dc*. For the 6 to 32-volt range, the generators are usually driven by the main engine. The 110-volt generators are usually driven by individual engines, and are normally found only on the larger boats.

[1]Complete details on the requirements which must be met to obtain a license are available from the local FCC offices or from FCC headquarters, Washington 25, D. C.

The selection of the particular radio receiver and transmitter must be predicated upon the need, cost, voltage and total current available, and the possibilities of ignition interference.

The need, cost and voltage considerations are obvious. However, the current situation demands rather careful study.

It is common practice to run a boat a few hours, drop anchor and remain there for the weekend. On a small boat, where the generator is driven by the main engine and thus generating current only when the boat is in motion, the storage batteries are subjected to quite a current drain over the weekend. Therefore, the storage battery capacity must be evaluated carefully.

Dead Battery Problems

A dead battery at sea is a very serious affair. A dead battery usually means a tow, particularly when located on a ship with a larger marine engine which cannot be cranked by hand. And a marine tow runs into hundreds of dollars, in addition to inconvenience and risk.

The problem involves the receiver only, since the transmitter, compass or loop are used only for short intervals. Therefore, the anticipated current drain over an expected time interval must be calculated, and added to the already existing drain of parking lights, blowers, some pumps, refrigerators, mooring lights, etc.

Solutions to Problem

The problem is not always solved by simply increasing the generator output, or by adding additional storage batteries. Batteries of any size are heavy and costly. Their weight makes a load that has to be considered in the small boat. The required battery capacity may be found to overload the boat.

It is possible, too, that the existing generator may be operating at its maximum, and therefore a larger generator may be needed.

In some cases it will be found that it's impractical to install a trans-re-

Installation and Service

Detailed Review of Problems and Solutions Which the Service Man Can Apply in Installing and Servicing Portable Receivers, Transmitter-Receivers, Direction Finders, As Well As Power Systems and Antennas Aboard Small Boats. Analysis Also Covers Curbs for Interference from Gasoline Generators, Electrolytic Action, etc.

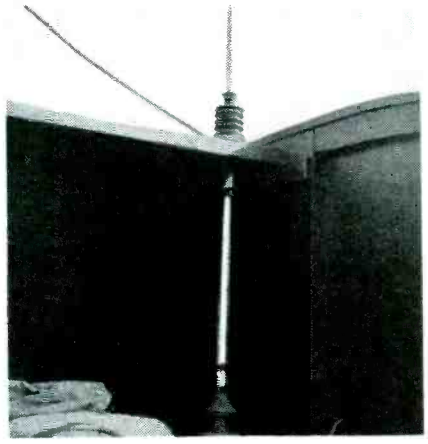


Fig. 4
Lower end of a folding whip antenna, which rests on top of the cabin.

by MAX ALTH

ceiver without first disconnecting other existing electrical loads, and in other instances provision must be made to prevent the use of the equipment when the generator is not running.

In one recent installation, a second, heavy-duty generator was installed and coupled by a belt to the ship's engine and its own storage battery. This setup prevented drain of the starter battery which thus served as an emergency to start the engine and light the emergency lamps.

Transmitter Needs

Transmitter power needs must be considered from a peak current point of view, since the sending unit is not used continuously. Therefore, it is only necessary to make certain that the batteries can supply the current needed, and that the leads are heavy enough to carry the current without an excessive voltage drop.

Some of the power systems have poor regulation, voltages having been found to vary from thirty to forty volts. If a battery connector works loose the voltage can go quite high from a 32-volt generator.

Corrective steps must be taken to avoid these problems. Replacement of the old-type third brush generator with an automatic voltage-regulating type of generator has been found to be an effective solution.

Reviewing these difficulties we find that the self-powered battery operated receiver designed for broadcast. reception, has many advantages. They do not drain the ship's vital electric supply, and can be simply carried aboard.

Marine Receivers

However, the especially-built marine portable receivers do have several distinct advantages. For instance, they have non-directional antennas which are extremely important at sea, where a small boat may be turning all the time, causing a directional loop to fade. By the way, inland waterways have many dead spots which shift with season and time of day.

The marine portables also feature a marine band over which weather reports, time signals, etc., can be heard.

These receivers are also protected against salt-water corrosion. The regular portable can be protected

(*Continued on page* 44)

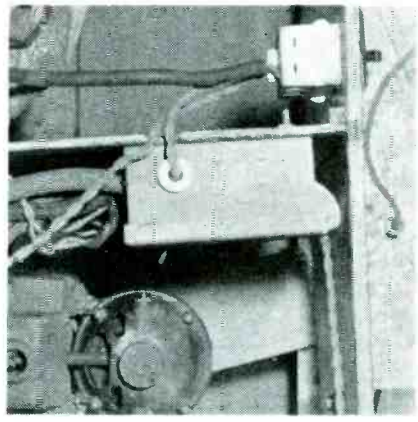


Fig. 5 (above)
Beneath a shelf holding a transmitter-receiver. The rotary converter (right compartment) converts 12 volts *dc* to 110 v *ac*. This is an oversize unit and provides power for electric tools, in addition to powering the trans-receiver. A toggle switch, in the primary circuit of the converter, serves to keep the converter from drawing idling current when not in use.

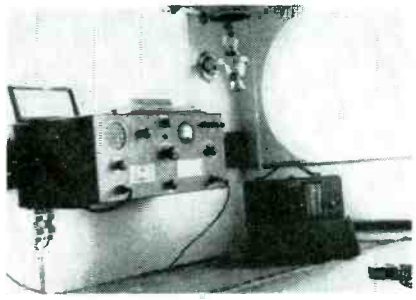


Fig. 6 (right)
A straight trans-receiver installation. The portable receiver, to the right, provides broadcast reception. The trans-receiver is only used for communication. The telephone type mike hangs from a cradle.

ANOTHER *HYTRON FIRST* YOU'LL BE BUYING SOON

new HYTRON 12BH7 does more for less

- *Ideal Sweep Amplifier*
- *Higher-Perveance Twin Triode*
- *Designed for TV*
- *Permits Lower-Cost TV Sets*
- *Another Hytron TV First*

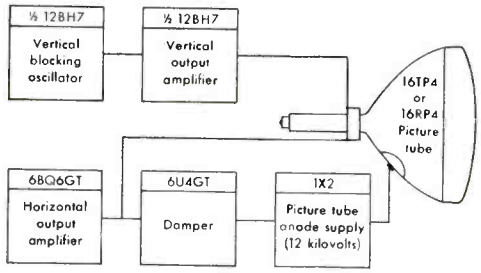
Here's another Hytron original you'll be buying soon. New 12BH7 twin triode is enthusiastically hailed as tops for sweep circuits by leading makers of TV sets. One half 12BH7 sweeps wide-angle 16-inch picture tube at 14 kilovolts. One section alone matches performance of: Paralleled 6SN7GT. Or equivalent single triode. Or triode-connected beam pentode. Other half of 12BH7 is free for other uses—such as blocking oscillator.

How does Hytron do it? Higher perveance (lower tube loss)? Yes. Also the Hytron 12BH7 is: designed for TV. Rated for TV. Tested for TV. Again a Hytron TV first. Again a Hytron contribution to lower-cost TV for the mass market. Watch for the 12BH7. Write for Bulletin E-149.

AND NOW THE HYTRON 16TP4 Another Hytron 16-inch rectangular picture tube. Follows closely on heels of original Hytron rectangular tube, the 16RP4. Write for Bulletin E-150 for complete data. Watch also for early announcements of new Hytron 14-inch and 19-inch rectangular tubes.

MODERN LOW-COST 16-IN. DESIGN

A Hytron contribution to lower TV costs. All-Hytron: 1X2, 6BQ6GT, 6U4GT, 12BH7, 16TP4 or 16RP4. For application and circuit details, write for Bulletin E-151.



OLDEST MANUFACTURER OF RECEIVING TUBES

HYTRON

RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

A 2-Stage TV Preamp*

[*See Front Cover*]

IN PROVIDING amplification for TV signals, two factors must be considered. It is necessary, for instance, to evaluate the bandwidth requirements which are 1,000 times greater than for voice transmission. In the second point, we are confronted with the fact that the presentation is visual, not aural, and since the eye is more critical than the ear, control is more acute. Phase distortion in audio, for instance, is practically undetectable. In television, it can cause black lines to be white, or create artificial shadows before or after an object.

The amount of gain and the uniformity of the gain afforded in an amplifying device, such as a preamp, are thus important factors. If either gain or bandwidth is too small or too large, detriment to the picture results. If the useful gain of a preamplifier is small, it is too weak to do the job required in most fringe locations. If the useful gain is too large, it may overload sensitive receivers and cause the noise level to increase.

If the bandwidth is too small, detail may be lost and pictures can be fuzzy. It has been found that the sound might disappear when the picture is best, and vice versa. If the bandwidth is too large, gain may be sacrificed. This provision has also, on occasion, introduced additional noise and spurious off-channel signals to interfere with the desired signal.

A preamplifier should provide sufficient gain for the poorest set, but not too much for the best set. It should have sufficient *flat* bandwidth to include the whole television channel, but cut off sharply outside the channel.

Although a well-amplified signal is vital, it is also essential that the preamp system reject noise and other spurious signals. Noisy interference has been found in three main sources: The antenna and leadin; the power line; the amplifier tube or tubes used in the preamp.

Because of its symmetrical nature, a 300-ohm ribbon leadin is inherently balanced to ground throughout its length and when connected properly to an antenna, has the desired signal in *push-pull* across it. Much ignition noise, and spurious interference can be picked up by the leadin and appear as a voltage to ground from both sides of it. This interference can be said to be in *parallel* on the wires. A good input circuit should be balanced to kill all signal in *parallel* on the twin-lead, and at the same time provide an optimum match to all signals appearing in *push-pull*. The use of a high-pass filter has also been found desirable to wash out all signals below channel 2, thereby preventing intermodulation interference.

The power line is a large source of interference in many localities. Any sort of appliance or electrical apparatus in which sparking occurs is a possible source of trouble via the power line. Grounding through bypass capacitors to reduce the interference has not been found always satisfactory, because in many cases good grounds do not exist at television frequencies. The neutral of a balanced circuit has been found to be an effective solution.

Noise generated in the amplifying tubes sets the final limit of amplification possible. Every tube generates a certain amount of noise, but the proper choice of tube type and careful control of signal circuits can result in much greater than average performance.

The 6J6 has been found to fulfill the requirements of a good TV preamp tube. It is compact, has low capacitance and low inductance construction. It has a fairly high mutual conductance and small transit angle even at plate voltages of 125. Equally as important, the 6J6 has nearly zero cathode lead inductance when operating in push-pull. This eliminates degeneration and regeneration that would otherwise be troublesome. Due to push-pull operation, no bypassing is necessary.

For all these advantages a price must be paid. When a grid and plate of a triode are tuned to the same frequency, it has an overwhelming urge to oscillate. To discourage this persistent tendency, it is necessary to neutralize the tube. A push-pull circuit allows simple cross-neutralizing to be used, with about 1.5 mmfd per side.

When using a push-pull circuit, special attention must be paid to the circuit formed by the tubes singly or in parallel. The center-tap leads must include impedances of such a size as to prevent appreciable gain for this manner of operation at any frequency.

Cover Preamp Circuit

Since all television channels are the same width, the tuned circuits should be of a type which maintains a constant bandwidth regardless of the frequency of tuning. Inductance tuning has been found to provide this service. In a two-stage preamplifier with three tuned circuits, such as shown on the cover this month, each channel can be aligned to give a reasonably square band-pass for equal sound and picture amplification. To insure that this pass-

(*Continued on page 47*)

**DeciMeter Professional Preamplifier.*

PHONO installation and service

Phono Needle-Point Selection Hints*. . . Replacement Cartridges . . . Three-Speed Intermix Record Changer System and Accessory Design and Operation.

by KENNETH STEWART

THE STYLUS, which often has been defined as a key link in the phono system, possesses many unique physical and mechanical properties which have been found to contribute substantially to both reproduction and record-life control.

In the diamond-type needle, for instance, we have the case of a material that is the hardest and most wear-resistant known. It could logically follow that it would be the ideal needle point tip. The conflicting conditions under which the needle tip must function and the very hardness and wear-resistance of the diamond, however, has been found to create a paradox which limits its practical public usage. The long wear-in of the diamond sustains a very small contact area which results in rapid wear of phonograph records. Broadcasting stations and other professional installations, where the accent is on sound reproduction rather than record life, therefore, can use the highly polished diamond needle to advantage.

The Sapphire

The sapphire, in reality a substitute for the diamond for needle point material, has a high degree of hardness and resistance to wear. It is more fragile than the diamond and frequently fractures from shock in normal public use. The synthetic sapphire has substantially the same chemical and structural properties of the natural jewel except that it is more uniform. The wear-in of the sapphire needle point, while shorter than that of the diamond, sustains a very small contact area over a long number of record plays. The resultant wear on the record groove is further increased because the microscopic crystal fragments that have worn off the needle and deposited themselves in the groove create a phenomenon known as *secondary abrasion*. The sapphire point, riding in the groove in which the loosened crystal fragments have become deposited, thus can accelerate both needle and groove wear. The brittle nature of sapphire also can cause the leading and lagging edges of the contact areas of the needle point to become sharp, resulting in further breakdown of the record groove.

Webster Electric *replace-all* cartridge.

The Osmium Alloys

Osmium, in its elemental form, is dense, hard and wear-resistant. This rare, natural element has been alloyed with other metals to further increase its hardness and wear-resistance, providing an alloy which is quite effective for phono-needle point tips. These alloys are comparable to the diamond in toughness and resistance to fracture. They are self-polishing in use on phonograph records and are fine-grained, homogeneous and ductile enough to prevent sharp leading and lagging edges developing on the needle point.

It has been found that phono needle points made of osmium alloys wear-in rapidly and wear-out slowly. The quick wear-in increases the area of contact and reduces unit pressure and temperature. The gradual wear-out has been found to extend over a long period of record plays, resulting in prolonged record and needle life.

Summary

Long-life phono needle points, to resist high unit pressure and temperature, must have each and every one of the attributes of a high melting point, hardness and resistance to oxidation. The diamond, the sapphire and the osmium alloys possess these qualities. The osmium alloys, man-made exclusively for point tip material appear to possess the additional metallic properties of ductility, toughness and

*From notes appearing in the *Permo Reporter*, published by Arthur J. Olsen, president of Permo, Inc.

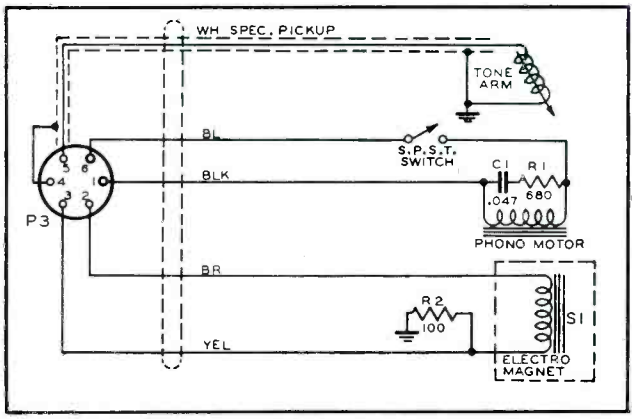
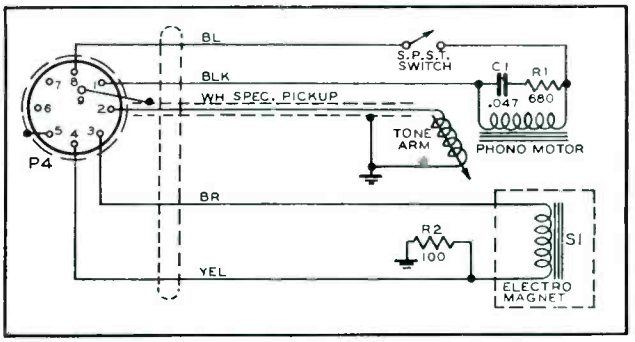


Fig. 1
Schematic of the Zenith intermix record changer (model S-14022) which features a solenoid reject mechanism.

Fig. 2
Schematic of another Zenith intermix record changer (model S-14024) which also has a solenoid reject mechanism.



frictional compatibility; that is, quick wear-in and slow wear-out.

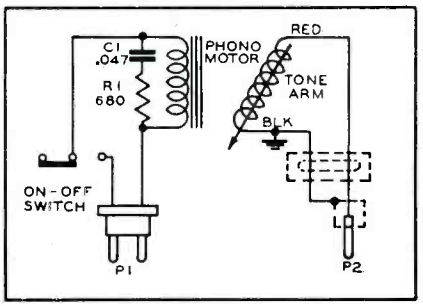
Zenith Intermix Record Changers

Four intermix record changers have been designed by Zenith (S-14022, S-14024, S-14025 and S-14027) to play standard 78, 45 and 33⅓ rpm records. With a few minor exceptions these four changers are alike, both electrically and mechanically. Models S-14022 and S-14024 have a solenoid reject mechanism, S-14022 has a 6-wire cable and socket, and S-14025 has a 9-wire cable and socket. Models S-14025 and S-14027 do not have the solenoid trip mechanism and they have separate phone and *ac* cables; the only difference between these two changers is the lead length. Features of these changers include playing and automatically changing as many as ten 12″ or ten 10″ records. Ten-inch and twelve-inch records of the same type can be intermixed, either standard (78) or long play (33⅓).

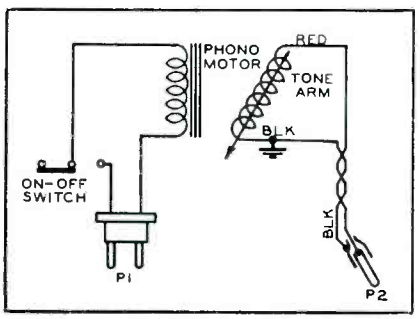
A full stack of ten 7″, 33⅓ records, or a full stack of ten 7″, 45 records, (with the adapter inserted in the record) will also play on this changer. The changer shuts off after the last record has been played.

Motor Drive Mechanism

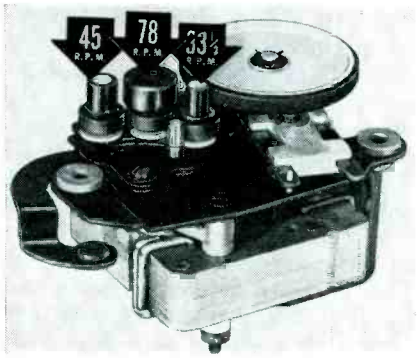
The 3-speed drive mechanism operates in a very simple manner. When the speed control lever is turned to the 78-rpm position, an idler wheel is driven directly from the phono motor shaft. When the speed control lever is turned to the 33⅓ position, the entire bushing assembly is rotated in a counter clockwise direction. This removes the phono motor shaft from the idler wheel and instead places the right-hand 33⅓ rpm speed reduction bushing in contact with the idler wheel. The phono motor shaft, through the media of a rubber drive belt, then drives the 33⅓ speed-reduction bushing which in turn drives the idler wheel. When the speed-control lever is turned to the 45-rpm position, the entire bushing assembly turns clockwise. The 45-rpm speed-reduction bushing is then in contact with the idler wheel. The phono motor shaft through the media of a rubber drive belt, then drives the 45-rpm speed reduction bushing which in turn drives the idler wheel.



Figs. 3 (above) and 4 (below)
Schematics of Zenith models S-14025 (above) and S-14027 (below) without the solenoid trip mechanism, but with separate phone and *ac* cables.



Turret-type phonomotor for 3-speed record changers. Speeds are secured through three separate pulleys mounted on a turret plate. By means of a lever, the desired pulley is brought into contact with the idler wheel. The two pulleys not in contact with the idler wheel remain stationary. Mechanism is powered with a dynamically-balanced two-pole shaded-pole motor. (*Courtesy General Industries*)



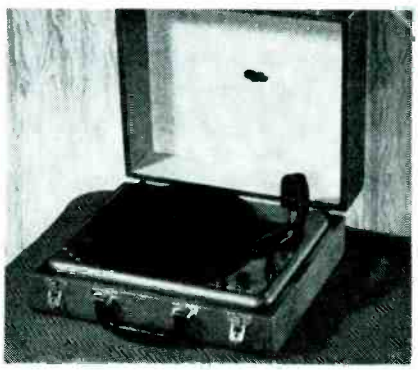
Three-Speed Portable Phono

A three-speed automatic record changer in a portable case, has been developed by the V-M Corp.

The portable has a model 406 *Tri-O-Matic* changer which provides operation at 33⅓, 45 and 78 rpm, automatic

(*Continued on page* 57)

V-M 3-way portable.



The RF Amplifier, Oscillator and Mixer, Video Section, Sound IF Amplifier, Sync Amplifier, Sync Separator, Sync Clipper, Vertical Oscillator, Horizontal-Oscillator Control Tube With Pulse-Width Modulation, Horizontal Oscillator and LV Rectifier of the Admiral 20X1 and 20Y1 Chassis. HV Supply, Damping Tube and Beam-Bending Circuit System of the Zenith 1950 Circular Screen Models.

PROVISION FOR built-in antennas, 10" and 12½" tubes on the same chassis, intercarrier sound and such novel system techniques as pulse-width modulation, has introduced several intriguing circuit patterns, an example of which appears in Fig. 1; p. 27.

This model (Admiral 20X1, 10" tube; and 20Y1, 12½" tube) with intercarrier sound, where the video and sound intermediate frequencies are amplified simultaneously by the *if* amplifiers, features a 21.25-mc *if* sound carrier and a video *if* carrier of 25.75 mc which mix at the video detector, so that a resultant beat frequency of 4.5 mc (intercarrier sound) is produced. This 4.5-mc beat frequency contains the FM sound modulation. The beat is amplified by the video amplifier, 4.5-mc sound *if* amplifier and then, detected by the ratio detector. Since the FM modulated 4.5-mc intercarrier sound signal results from beating the sound and video *if* carriers together, any difficulty in the *if* amplifiers or loss of one of the carriers, will result in no sound.

The *if* amplifiers are designed so that when they are properly aligned, the 21.25 mc sound *if* carrier is at least 26 db (95%) below the 25.75 mc video *if* carrier. Misalignment of the *if* amplifiers may cause excessive amplitude modulation of the FM sound signal, which might result in an audio *buzz*.[1]

The RF Section

The *rf* amplifier using a 6AG5 has a center-tapped primary which provides for a balanced 300-ohm and unbalanced 75-ohm input. A 3,900-ohm loading resistor is connected across a secondary winding to obtain the required bandpass. The secondary is tuned by the input capacity of the 6AG5, which is in series with a 5-mmfd/.5-3 mmfd parallel combination.

A primary coil is the plate load of the *rf* amplifier, and a 10,000-ohm resistor is used to broaden the response of the circuit. The parallel combination of a .5 to 3 mmfd plate capacitor and tube output capacity acts in series with a 120-mmfd unit to tune the primary.

A different set of coils is switched into the circuit for each television channel by means of a turret assembly.

One-half a 6J6 serves as a mixer, with the secondary coil feeding the *rf* and oscillator injection voltages to the grid of the mixer, one triode section of the tube. Two resistors are used in this circuit to permit bringing out the junction as an alignment test point. A test 'scope can be connected to this point without materially affecting the operation of the circuit. A .5 to 3 mmfd capacitor is used for alignment of the mixer.

To limit regenerative feedback in the mixer a 15,000-ohm plate-load resistor is bypassed by a 10-mmfd capacitor. The principal components of the resonant coupling network between the mixer and the first video and sound *if* amplifier are a 23.1-mc iron-coil and a 120-mmfd capacitor.

The other half of the 6J6 serves as a *hf* oscillator, with an oscillator coil inductively coupled to the mixer grid for oscillator injection. A 10-mmfd capacitor, in series with a parallel combination of a pair of .5 to 3 and 3 to 5 mmfd capacitors forms the split capacitor of a Colpitts oscillator, the .5 to 3 mmfd unit permitting oscillator alignment and the .3 to 5-mmfd variable dielectric type of capacitor serving as a sharp tuning control.

Video Section

The *if* amplifiers with 6AU6s, 6AL5 video detector, 6AU6 video amplifier and 4.5 mc sound *if* and ratio-detector circuits are all mounted on a subchassis. Bifilar-wound slug-tuned transformers are used for interstage coupling in the stagger-tuned *if* amplifier system. Only three stages have been found necessary for the required gain and bandwidth using this type of *if* amplifier design. The skirt steepness of this *if* bandpass has been found sufficient to make adjacent-channel trapping unnecessary. Because of this steepness, the 4.5 mc beat frequency is not of sufficient amplitude to warrant a 4.5-mc trap in the video amplifier plate circuit.

Since *agc* bias is applied to the *if* amplifiers as well as the 6AG5 *rf* amplifier, the 82-ohm cathode resistors are unbypassed to provide a stabilizing degenerative feedback.

One-half of the 6AL5 (video detector and *agc*) serves as a video detector and is connected so that it delivers a positive picture phase signal to the video amplifier grid.

This is the proper phase, since the signal applied to the cathode of the picture tube must have a negative picture phase. A load consisting of a pair of 5.5-ohm and 17.5-ohm coils, 33,000 and 4700-ohm resistors, is bypassed by a 5-mmfd capacitor to remove the *if* carrier component from the video signal. The video detector is operated at a potential of approximately 140 volts

(*Continued on page* 26)

[1]See Servicing Helps, this issue.

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The variable-frequency oscillator covers all commercial television bands and the FM rf bands. An internal 4.5-Mc crystal-controlled oscillator modulates the output of the vfo to provide marker "pips" spaced 4.5 Mc from the marker pip of the vfo. These markers are indispensable in the alignment of TV front ends. Similarly, a 0.25-Mc crystal-controlled oscillator may be used to provide marker "pips" spaced 0.25 Mc from the frequency of the vfo. Such markers are indispensable for determining the response characteristics of discriminator and ratio detectors. The fundamental 4.5-Mc output may be used by itself for alignment of television receivers employing intercarrier sound.

In addition to its function as a marker generator, the WR-39B can be used as a heterodyne frequency meter to identify unknown frequencies. The vfo, when tuned to any TV channel and modulated with the 0.25-Mc crystal oscillator, will put vertical bars on the raster; or when modulated with an external audio oscillator will put horizontal bars on the raster. Thus the instrument can be used for making linearity adjustments in the absence of a test pattern.

The WR-39B may also be modulated by the video signal from a television set, which makes it in effect a 12-channel miniature TV transmitter.

For the complete details on the WR-39B, see your RCA Test Equipment Distributor, or write RCA, Commercial Engineering, Section C56X, Harrison, New Jersey.

Available from your RCA Test Equipment Distributor

RADIO CORPORATION of AMERICA
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Ser-Cuits

(*Continued from page* 24)

since the video amplifier is also operated at approximately 140 volts above ground.

Although the *if* amplifier gain is quite low at 21.25 mc, both the audio and video *if* carriers appear at the video detector. The resulting 4.5 mc intercarrier beat signal contains the FM sound modulation. The small amount of AM video modulation is removed by ratio-detector limiter action. The video detector thus serves as a second mixer. The 4.5 mc sound *if* and the detected video signal are both amplified by the video amplifier.

The second section of the 6AL5 twin diode is used as an *agc* rectifier. Approximately 1.5 volts of delay bias is developed across a 150-ohm cathode resistor so that the *agc* is inoperative until the video signal reaches an amplitude greater than 1.5 volts. This rectified voltage is filtered and applied to the *rf* amplifier and the first and second video *if* stages. The 5-mmfd capacitor which shunts the 47,000-ohm resistor bypasses the video and sound carriers to ground.

The 6AU6 video amplifier is conventional, with a plate load consisting of a series peaking coil which is damped by a 22,000-ohm resistor, shunt peaking coil which is damped by a 10,000-ohm unit, and a load resistor of 5600 ohms. This network offers a constant impedance (constant *K*) over a wide frequency range. The video signal is coupled to the cathode of the picture tube by a .1-mmfd coupling capacitor. A 470,000-ohm shunting resistor is used to insure the proper bias on the picture tube.

The video signal from the video detector is capacitively coupled to the grid of the video amplifier by a .1-mfd coupling capacitor. A 2000-ohm contrast control varies the contrast by varying the gain of the video amplifier. Since this control is connected in series with the video amplifier plate resistance, plate voltage will be proportional to the contrast control setting; the cathode and control grid of the 6AU6 video amplifier operate approximately 140 volts above chassis ground.

The Sound Section

Coupling between the video amplifier plate and the grid circuit of the sound *if* amplifier is provided by a 2-mmfd capacitor, 4.5-mc slug-tuned coil and a shunt 75-mmfd capacitor. This resonant coupling network also serves as a trap to take the 4.5 mc intercarrier beat out of the video amplifier (and the picture). The sound *if* amplifier is a conventional grid-leak biased circuit and feeds the primary of the ratio detector transformer.

The ratio detector, used for FM sound detection, has a network between point Z (Fig. 1) and ground (deemphasis filter and volume control circuit) which serves as the *af* output load circuit.

Ratio-detector limiter action is provided by the filtering action of a 4-mfd capacitor, which is effectively connected across the tuned secondary of the 4.5-mc input transformer through the two diode sections of the 6AL5. This tends to hold the *if* signal amplitude at its average value and results in limiter action.

Since the 4-mfd capacitor unit charges to a value proportional to an average intermediate-frequency signal

(*Continued on page* 48)

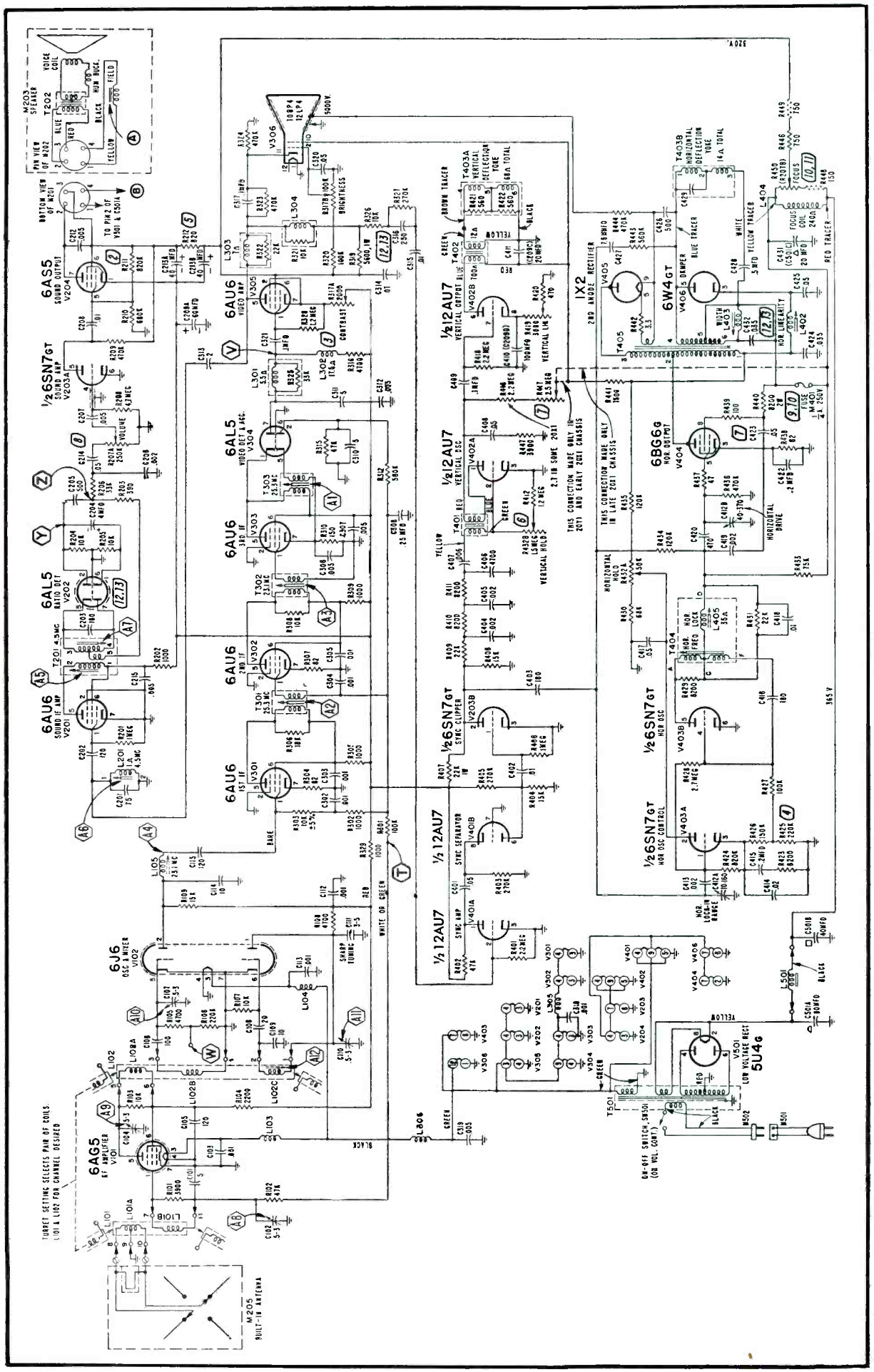


Fig. 1
Circuit of the Admiral 20X1 and 20Y1 chassis which provides for the use of a 10" or 12½" picture tube.

Outboard

TUNING INDICATORS

Characteristics of S-Meter and Magic-Eye Indicating Systems and Their Application Possibilities. How to Secure Wide-Angle Tuning. Use of Dual Magic-Eye Tubes to Tune Over Wide Range of Signal Strengths. How to Apply Phase-Reversal Tubes. Installation Precautions Which Must Be Followed to Avoid Power Drain When Using Separate Indicators.

by RONALD L. IVES

Indiana University

MANY RECEIVERS of otherwise modern design are not supplied with a tuning indicator, and tuning to exact resonance is either not attempted, or is attained by a hunting process. Slight detuning causes more than slight distortion of the received signal, with a marked loss in the intelligibility of the spoken word, more serious in some languages than in others. Such losses might not be too important when listening to soap operas or commercials, but become a matter of concern in many types of communications work.

Some manufacturers of communications receivers, while not equipping their receivers with tuning indicators, do install a plug, so that an external indicator can be attached. Recently, a number of such indicators have become unobtainable, although the receivers are still on the market, and in demand.

Construction of a tuning indicator to fit almost any need, and to operate from almost any reasonably good receiver now on the market, is not only relatively simple, but is also inexpensive, and requires little technical skill.

S Meter Indicators

The conventional *S* meter operates on the principle that a maximum signal level will be indicated when the receiver is tuned to resonance with the signal under consideration. With such an instrument, a slight detuning in either direction will cause a marked

(*Continued on page* 30)

Fig. 2 (right)
Connection of a *magic-eye* tuning indicator.

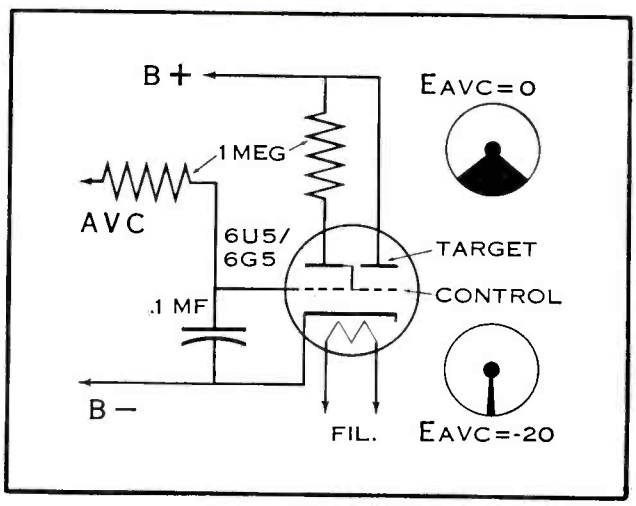
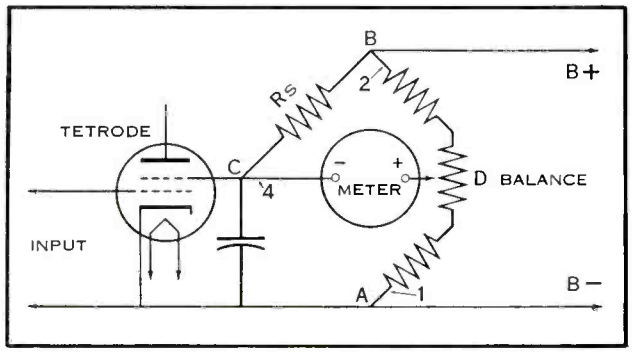


Fig. 1
Bridge connection of *S* meter in tetrode screen circuit.



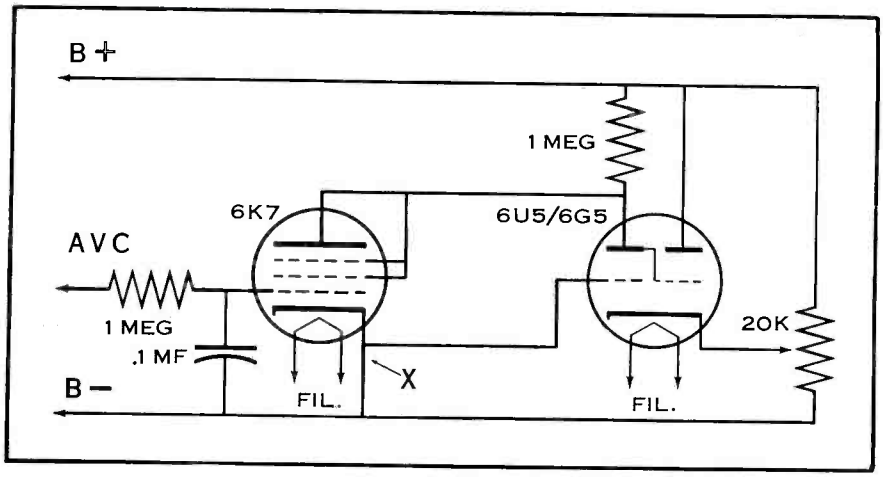


Fig. 3
Connections of an electron-ray tube and an external triode for *wide-angle* tuning indication.

decline in indicated signal level, even though the perceived signal strength, due to the operation of the *avc* remains substantially constant.

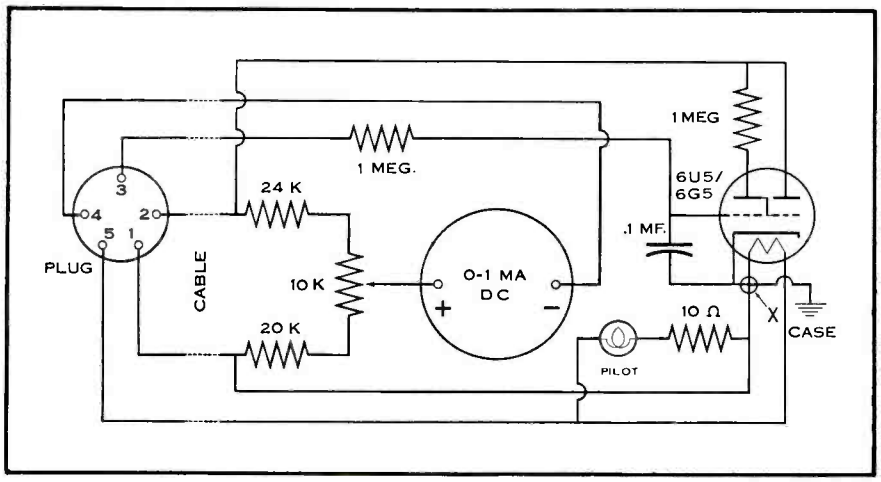
The simplest form of an *S* meter is probably a microammeter in series with the second detector cathode. This is also the least satisfactory form, as it will respond to the *af* components of the signal if undamped, and will be sluggish in operation if damped. In some instances, also, motion of the meter coil produces some wierd and unwanted sounds in the output.

As commonly constructed for commercial use, the *S* meter is operated by changes in the screen current of a tetrode or pentode, usually one or more of the *if* tubes. One very satisfactory type has been the bridge-circuit setup, as shown in Fig. 1. The bridge consists of four arms, of which three are fixed in value. The fourth is the screen-cathode resistance of the tetrode, which, under operating conditions, is an inverse function of the signal on the grid. That is, the stronger the incoming signal, the lower the screen—cathode resistance, and hence, the higher the screen current. In this circuit an incoming signal, by dropping the screen—cathode resistance, unbalances the bridge circuit (*ABCD*), and the unbalanced current operates the meter.

In receivers of conventional manufacture, two arms of the bridge (*AC* and *BC*) are already integral components, so that only the other two arms (*AD* and *BD*) and the meter need be added. With two stages of *if*, an 0-1 *dc* milliammeter is usually correct, and the total added resistance (*AD-DB*) should total about 50,000 ohms.

Because a change in the screen current is not exactly a linear function of signal strength, and unbalanced current does not vary directly as the resistance of the variable leg of a bridge, the calibration of an *S* meter is nonlinear. This does not impair its use as a resonance indicator, but makes measurement of actual signal strength difficult, even when all other circuit components have constant values.

Fig. 4
Circuit of a combination *S* meter and a magic-eye indicator for operation from a Hallicrafters S-40A receiver.



Magic-Eye Tuning Indicators

More than a decade ago, a simplified *crt*, designed to give a visual indication of the potential difference between its plate and a control electrode, was first used commercially as a resonance indicator. Today, usually combined with a triode, used as a variable resistor, this type of indicator is still useful, simple, and inexpensive.

The modern *magic-eye* indicator, complete with mounting bracket and leads, is commercially available as a unit, and is connected to measure the *avc* voltage of the receiver. When the signal is weak, the *avc* voltage is low, and the dark sector of the *eye* is large. When the signal is strong, the *avc voltage* is high, and the dark sector is small. Standard connections of a commercial *magic-eye* tuning indicator, and conventional appearance of the *eye* are shown in Fig. 2. The 1-megohm input resistor, and the .1-mfd capacitor from the grid of the triode section of the tube to its cathode, may be omitted in many instances, but are essential when the leads to the indicator are long.

In a standard installation, the grid of the triode portion of the 6U5/6G5 (left side) is biased by the *avc* voltage. Plate current in the triode section, in consequence, is a function of the *avc* voltage. Plate voltage of the triode section is less than the supply voltage by the amount of the drop due to plate current through the series resistor, and, in consequence, is highest when the *avc* voltage is at a maximum (*strong signal*), and least when the *avc* voltage is low (*weak signal*).

The cathode-ray section of the tube consists of a target, which is maintained at plate supply voltage; a control element, which is directly connected to the plate of the triode section; and the common cathode. When the control element is at lower voltage than the target, it casts a wide shadow on the target (*Eavc* = 0). As the voltage of the control element approaches that of the target, the shadow

(*Continued on page* 33)

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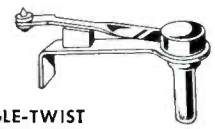

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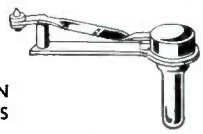

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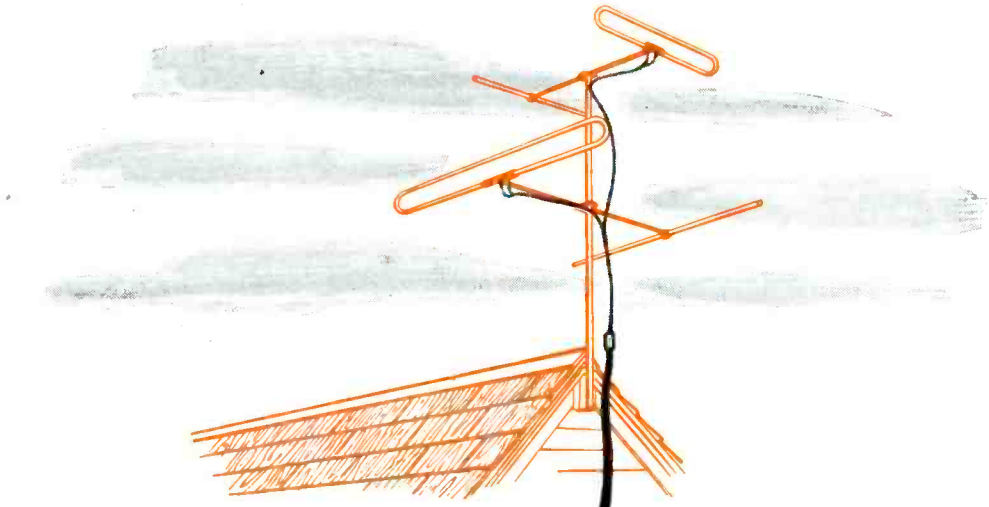

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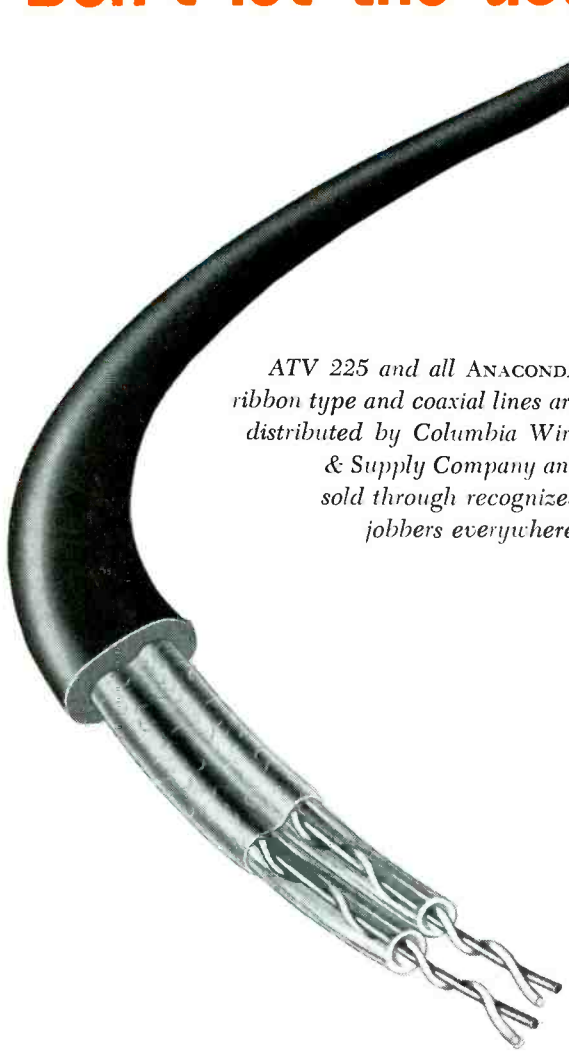

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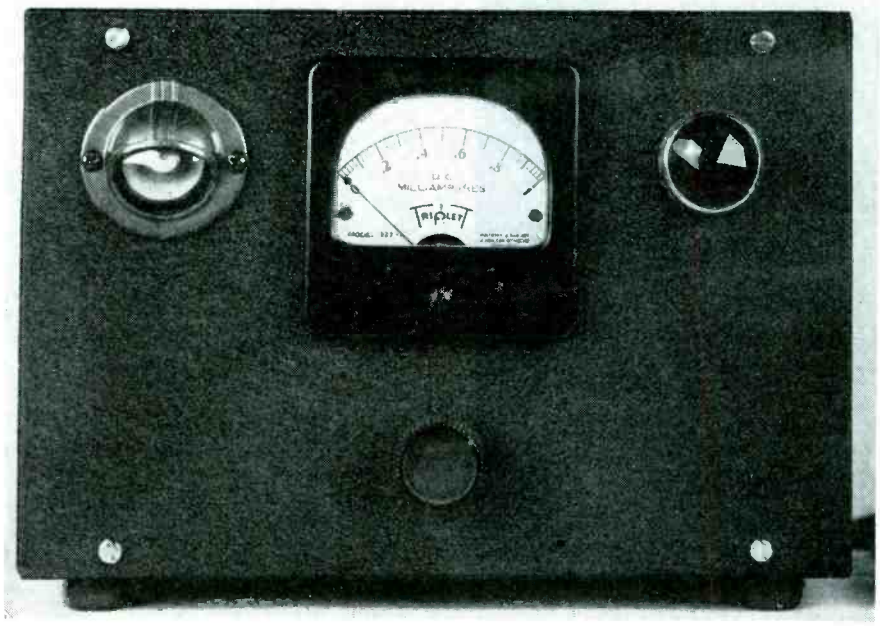

Fig. 5
Panel view of combination *S* meter and tuning indicator. Balancing knob for *S* meter is at lower center.

becomes smaller, and when the voltages are nearly equal ($Eavc = 20$), the *eye* is nearly closed.

The first condition (*eye* opened about 80°) occurs when the received signal is weak; the second (*eye* nearly closed) when the signal is strong. With extremely weak signals, the indicator may not respond at all. When incoming signals are very strong, the *eye* may not only close completely, but the two edges of the luminous portion may overlap.

It should be noted that this device is actually an indicator of signal strength, and that it indicates resonance only when the receiver gives maximum signal strength at resonance. If the tuned circuits of the receiver are *out of line*, producing a flat-topped or *saddleback* tuning curve, the indicator will not show the setting for resonance.

Wide Angle Tuning Indications

If the grid of the triode unit of an electron-ray tube, such as the 6U5/6G5, is grounded, and the cathode biased positively to roughly half the plate supply voltage, the *eye* of the indicator will close completely, or even overlap. If, now, an external resistive load is applied between the triode unit plate and ground, the *eye* can be made to open about 175°. By using a triode, such as a triode-connected 6K7, as the external resistive load, with its grid connected to the *avc* of the receiver, *wide angle* tuning indication is possible with the standard *magic eye* tube.

Connections of an electron-ray tube and external triode for *wide angle* tuning indication are shown in Fig. 3. Sensitivity can be varied by varying the bias of the electron-ray tube cathode.

Operation of *wide-angle* electron ray indicators is quite simple, and quite similar to standard angle operation. Normally, the indicator is set, by adjusting the cathode bias so that the *eye* just closes on the loudest signal received. As in the simpler standard angle device, the *avc* voltage controls the angle of opening of the *eye,* low *avc* voltage producing a wide shadow sector, and high *avc* voltage a narrow shadow sector. It will be noted that in this arrangement the external triode (6K7) takes over the function of the internal triode in the standard circuit, and that, whereas the external triode operates on full supply voltage, the electron-ray tube operates on the supply voltage less the cathode bias voltage.

Special Arrangements

Because the modern electron-ray tube, either alone, or in conjunction with an external triode, is an extremely versatile indicating device, many special arrangements, to fit special needs, are possible.

Insertion of a resistor at *X* (Fig. 3) causes the grid to function as a cathode follower, and modifies the action of the indicator, making its response greater through a narrower range of signal strengths.

By using a dual electron-ray tube, such as a 6AF6G, with two external triodes, one input adjusted to give a satisfactory indication on weak signals, and the other adjusted to operate only on strong signals, a wide range of signal strengths can be tuned to resonance easily.

With a *wide angle* electron-ray indicator, operation can be reversed, so that the *eye* is closed on no signal, and opens as the signal strength, as indicated by the *avc* voltage, increases, by a simple reversal of functions. This is brought about by connecting the plate of the triode to the target lead of the electron-ray tube, and insertion of a suitable series resistor, and then by changing the value of the resistor in series with the plate of the internal triode until satisfactory operation is secured. When so connected, insertion of a resistor at *X* (Fig. 3) tends to extend the range of operation of the indicator, instead of decreasing it, as in the case of the *forward* circuit. This reverse operation, despite its theoretical simplicity, works better on paper than it does in practice, and better results will be secured by use of a phase-reversal tube.

Installation Precautions

It is commonly believed that almost any kind of tuning indicator can be installed in, or operated from, almost any receiver having either screen-grid *if* tubes or *avc*. It would be nice if this were actually true. Insofar as drain on the screen circuit, or on the *avc* circuit, is concerned, almost any receiver can operate a tuning indicator; but power supply capacity is an entirely different and less happy situation.

An *S* meter of more or less conventional design draws a maximum of a little more than 1 ma from the receiver plate supply, and perhaps .15 ampere from the filament circuit if a pilot light is installed. This drain increment is such a small fraction of the total plate and filament drain of a standard receiver that it may safely be disregarded, and an *S* meter installed wherever desired without concern for added power drain.

A narrow-angle electron-ray indicator draws about .3 ampere from the filament supply, and about 5 ma (not constant) from the plate supply. Most receivers of conventional design, but not all of them, will stand the added

(*Continued on page* 34)

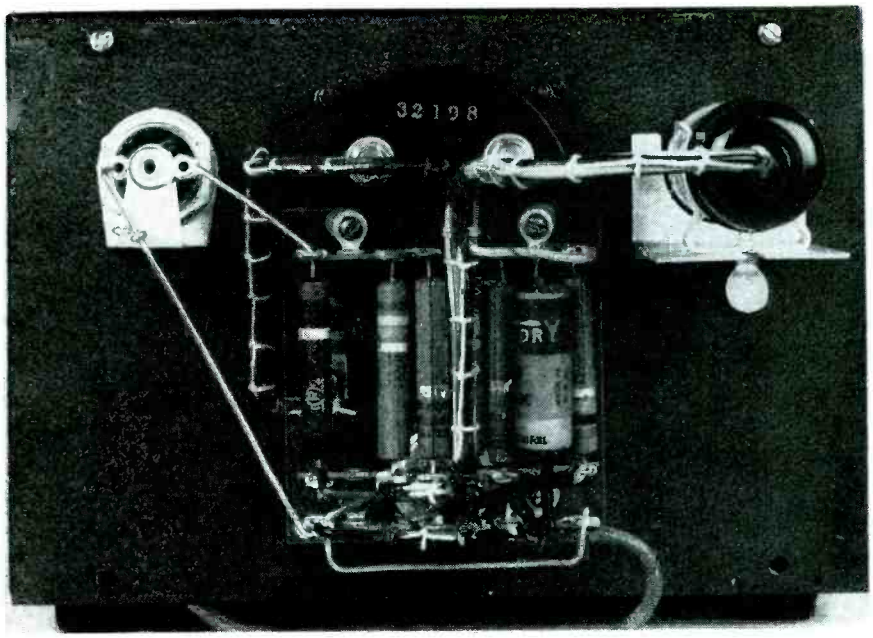

Fig. 6
Interior of tuning indicator setup.

drain of a standard electron-ray, or *magic-eye* tuning indicator.

The *wide-angle* tuning indicators, however, present a drain problem. These tubes drain about .6 ampere of filament current, and up to about 35 ma of plate current. Many receivers of conventional design, skilfully engineered and of entirely workmanlike construction, will not stand this added power drain without overheating or humming. When the filament load is too great, a *wide-angle* tuning indicator may still be used if a small *helper* filament transformer is installed. When the plate drain is too much for the transformer and filter, so that it causes heating, humming, or low voltages, an external power supply will be needed for the indicator, and this must be designed so that *B*— can be grounded. When the added filter load causes hum, without lowering plate voltage or overheating the transformer, an added capacitor of about 8 mfd. from *B*+ to ground, will sometimes cure the trouble. Some *RC* filter systems are so sensitive to load changes that a complete redesign will be needed to eliminate the hum caused by increased drain.

The above factors suggest that an *S* meter can be installed in almost any receiver if cabinet space permits; that a narrow angle electron-ray indicator can be installed in, or operated from the integral power supply of, most standard receivers; but that *wide-angle* indicators can be installed only in those few receivers that not only have ample cabinet space, but also ample reserve power supply capacity. In consequence, because of either space or power limitations or both, most tuning indicators must be *outboard* devices, suitably connected to the receiver.

Necessary Connections

To operate an external tuning indicator from a receiver, certain connections with the receiver are necessary. These connections, most conveniently made with a multi-wire cord and plug, are:

For the *S* meter . . . *B*+, *B*—, and screen end of screen dropping resistor of *if* or *rf*. For the *magic-eye* indicator (either type). . . . *B*— (or ground), *avc*, and either 6.3-volt filament (2 wires) *B*+, or supply line of set side of switch (for auxiliary supply).

This calls for a minimum of 3 wires in the case of an *S* meter, five if a pilot light is installed, and of four or five wires for an electron-ray indicator.

Before any work is done on the receiver to install an outlet for the necessary connections, a careful check of the circuit is in order to make certain that installation of the type of meter desired will not alter circuit constants to the detriment of receiver performance.

Indicator in Hallicrafters S-40 Model

In Fig. 4 appears a circuit of an *outboard* tuning indicator, containing an *S* meter and a narrow-angle electron-ray indicator, designed to operate from a Hallicrafters S-40A receiver. This receiver is already supplied with a five-wire socket for the *S* meter. Connection for the *magic-eye* tube was obtained by wiring the unused No. 3 position of the socket to the *avc* line in the chassis. Checking of component specifications of this receiver indicated that the integral power supply would carry the added drain of a narrow-angle electron-ray indicator continuously, but that a *wide-angle* indicator would crowd the factor of safety, and might alter the filter characteristics, causing hum.

For use with similar receivers, of other manufacture, in which the *B*— is not connected to one side of the filament circuit, a six-wire cable will be necessary for an indicator of this type, and the wire junction *X* in Fig. 4 will become a crossover, with the *low* end of the 20,000-ohm resistor in the *S* meter bridge disconnected from the filament circuit and connected to ground.

Electrically, construction of an indicator of this type is simple. Balance adjustment of the *S* meter can be set once on *no signal* (short antenna and ground), and it will be found to hold its setting indefinitely. The 1-megohm resistor in the triode grid of the 6U5/6G5 is desirable here, as is the .1-mfd capacitor from grid to ground. If these components are omitted, a *ghost image*, due to *ac* pickup in the connecting cable, will be visible in the shadowed sector of the *magic-eye* tube. Response lag due to this *RC* circuit is less than 0.3 second for a 20:1 change in *Eavc*, and hence is negligible in this application.

Mechanical construction of the system, shown in Figs. 5 and 6, is equally simple. A conventional 5 inch by 6 inch by 9 inch utility cabinet supplies ample component space, and enough radiating surface so that the indicator does not imitate a cookstove after a few hours of operation. Because there are no high-frequency circuits, and no very high voltages in this indicator, mechanical arrangement of the components is not critical, and almost any form of construction can be used. However, current trade practices to the contrary, there is no law requiring that the interior of an electronic device look like an ill-kept nest. About twenty cents' worth of tie-strips will not only permit orderly arrangement of resistors and wiring, but will expedite maintenance. Choice of components, likewise, is not critical, but the price difference between the cheapest parts available, and standard parts having

(*Continued on page* 58)

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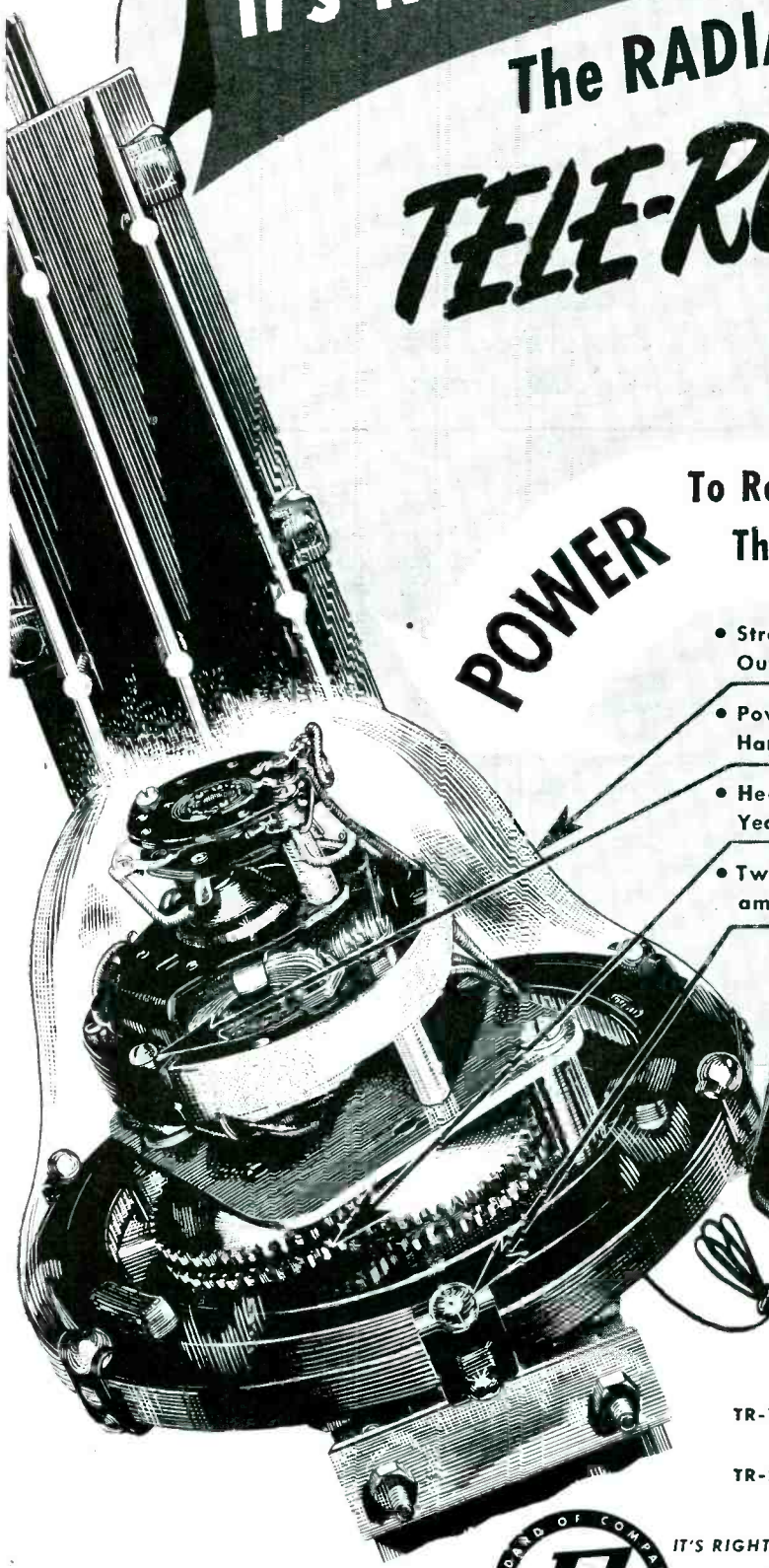

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TR-2... Compass Control Rotator with illuminated "Perfect Pattern" dial (uses 8 wire cable) $44.95

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Servicing Helps

TV Antenna Orientation Meter Circuitry . . . TV Channel Traps... Elimination of Audio Buzz in TV Receivers . . . TV Component Constructional Features: Converter Transformer, Picture IF Transformer and Cathode-Circuit Traps.

by M. A. MARWELL

IN TV-ANTENNA installation work, there is often need for some means of checking orientation. It has been found that a 20,000 ohms-per-volt multi-range tester, inserted in a circuit of the type shown in Fig. 1,* can serve the purpose in a very effective way.

In connecting up the instrument, a twin lead is run from the meter, placed at the antenna site, down to the television receiver. Then the twin lead is connected to the grid (or cathode) lead of the picture tube, and to the chassis, through the network illustrated. This network has not been found to degrade picture quality.

Connection to the video input lead of the picture tube can be made by pushing a pin through the lead, or the edges of an alligator clip can be filed sharp to bite through the lead insulation.

To operate, the meter is set to the 2.5, 3, 5 or 6-volt range, and the desired station is tuned in as well as possible. The meter reading will initially deflect anywhere from a small fraction of a volt to as high as 2 volts, or more. When the antenna is beamed properly, the meter reading will rise to a maximum value. Even with snow in the picture, approximately ½ volt will be available when the antenna is correctly oriented.

In ghost-free areas, the best picture is obtained at maximum indication on the meter. Minor lobes and wide-angle ghosts will show up as secondary maxima on the meter.

*Channel Traps***

TV interference, caused by adjacent or cochannel problems, can often be eliminated with a channel trap, which consists of a piece of 300-ohm line and some resistors.

In constructing the trap, a piece of 300-ohm transmission line is selected and shorted on one end to serve as a ½ wavelength shorting stub. A piece of line, slightly longer and detailed in Fig. 2 (p. 54) is cut and two leads of one end are connected across the receiver antenna terminals.

Using diagonal cutters or a razor blade, the transmission line should be shorted at a place slightly longer than the calculated length. Care should be taken when *shorting* the line to cut through the plastic covering only; do not cut the conductors. If the interference is not *trapped out*, the line should be shorted in ⅛" intervals (working toward the terminals) until the critical point is reached. Then the transmission line should be cut and a carbon resistor placed across the line. The resistor should be approximately 60 ohms. For strong interference, it may be necessary to drop the resistance to 20 ohms, and for weak interference it may be possible to use 150 ohms. Do not use a lower value resistor than necessary to minimize the interference.

If the interference frequency being eliminated or *trapped-out* is that of some other television station operating in the vicinity, the interfering frequency will also be attenuated on its own channel. If the interference frequency is so strong that it can not be attenuated enough using a resistor across the line, it will be necessary to install a double-pole, single-throw switch to open the trap leads when the receiver is switched to this channel. Recheck trap length after installing switch.

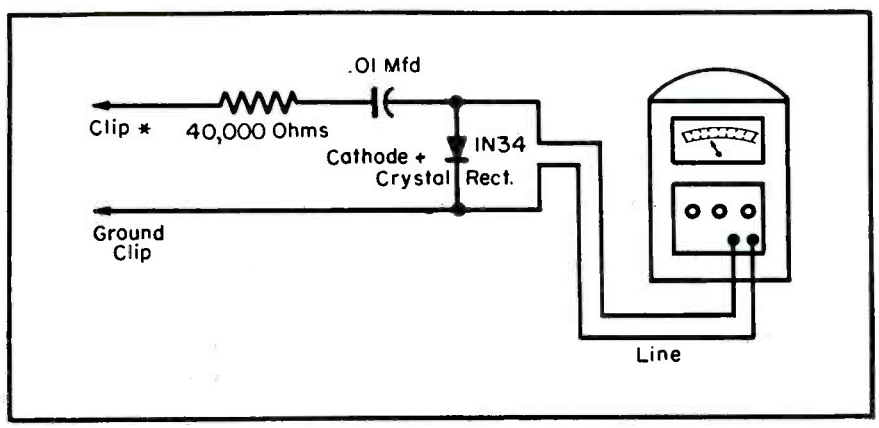
If the interference frequency is

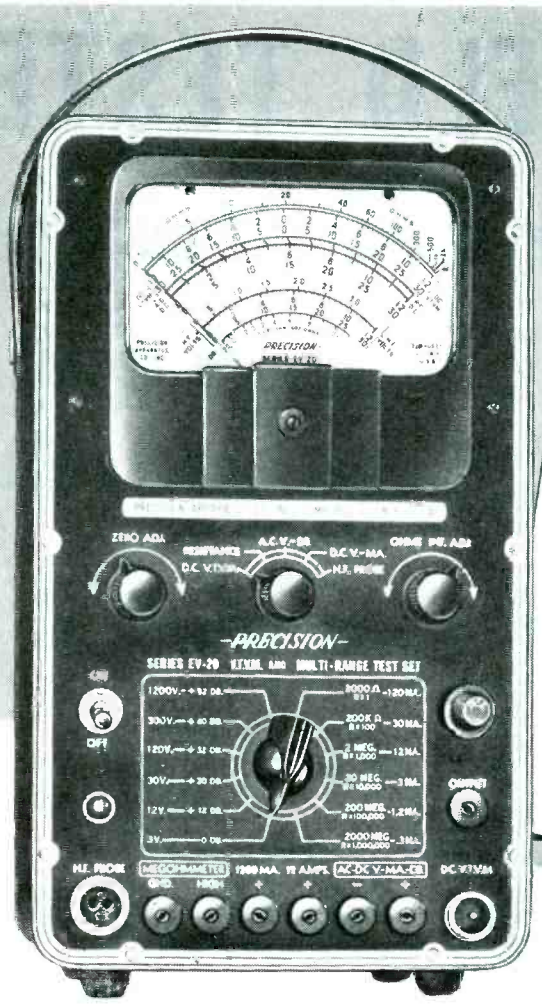
(*Continued on page* 54)

*From data prepared by Precision Apparatus Co., Inc.

**From notes prepared by Admiral.

Fig. 1
Circuit of a TV antenna orientation system. The clip contact is connected to the video signal grid lead of the picture tube in most receivers. In some models it might have to be connected to the cathode.





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PLUS Direct Reading High Frequency Scales
ALSO, complete, standard 1000 ohms per volt functions
48 RANGES TO
1200 Volts*, 2000 Megohms, 12 Amperes, +63DB

* D.C.-VTVM ranges to 12,000 and 30,000 Volts when used with Series TV Super-High Voltage Test Probe.

Range Specifications

- ★ SIX ALL-ZERO CENTER VTVM RANGES —13⅓ Megs. Constant Input Resistance. ±3, ±12, ±30, ±120, ±300, ±1200 volts. Direct Reading to ±12 KV and ±30 KV with Series TV Super-High Voltage Test Probe
- ★ SIX SELF-CONTAINED OHMMETER-MEGOHMMETER RANGES: 0-2000 - 200,000 ohms. 0-2-20-200-2000 Megohms.
- ★ FOUR DIRECT READING HIGH FREQUENCY VTVM RANGES: 0-3-12-30-120 volts. *(When used with RF-10A High Frequency Vacuum Tube Probe, Net Price $14.40. No crystal rectifiers employed.)*
- ★ SIX AC-DC AND OUTPUT VOLTAGE RANGES at 1000 ohms/volt. 0-3-12-30-120-300-1200 volts.
- ★ EIGHT D.C. CURRENT RANGES: 0-300 microamps. 0-1.2-3-12-30-120-1200 milliamps. 0-12 Amperes.
- ★ SIX DECIBEL RANGES from −20 to +63DB. Calibrated for 600 ohm, 1 mw., zero DB reference level.

IMPORTANT FEATURES

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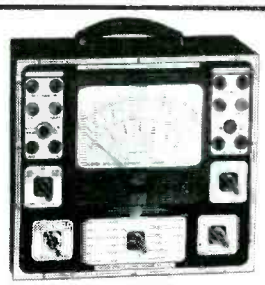

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Installation Information on

TV and FM

RECEIVING ANTENNAS

TV . . . FM Antenna Installation

by IRA KAMEN

Manager, Antenaplex and TV Dept., Commercial Radio Sound Corp.

and LEWIS WINNER

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√√ "Will recommend it to all the Service Men and technical people I meet."—*Charles Cahn, Feld Service Engineer, Bendix Radio.*

√√ "Well organized and illustrated, very complete and up-to-date, carefully detailed. It will definitely improve the ability of the man who studies it and therefore is mighty useful to a firm like ours."—*Hamilton Hoge, President, United States Television Mfg. Corp.*

√√ "Will certainly fill a long-felt need for some practical information . . . sincerest congratulations."—*George P. Adair, Former Chief Engineer, FCC, and now Consultant in Washington, D. C.*

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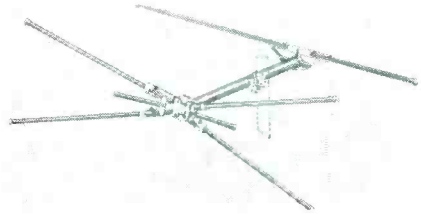
SNYDER HEAD-LINE TV ANTENNAS

A *head-line* type of TV antenna has been announced by the Snyder Manufacturing Co., 22nd and Ontario Streets, Philadelphia 40, Pa.

Incorporated in the line is the XA-44, a conical type, which features eight interchangeable elements.

Another feature is the *Hi-Paq* insulator, which is said to have high tensile strength, not affected by weather or temperature, either mechanically or electrically.



Snyder XA-30 conical available in kit form, which features hi-band adapters and a mast clamp for use with poles up to 1½".

* * *

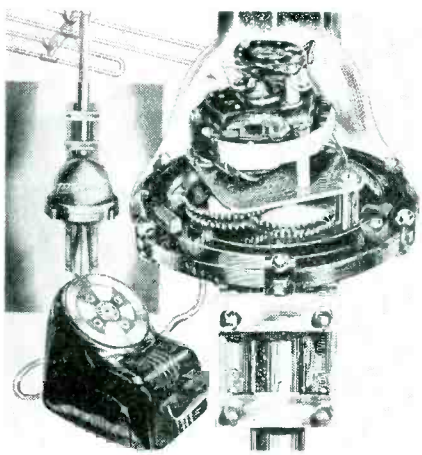
RADIART TELE-ROTOR

An antenna rotator unit, the *Tele-Rotor,* has been announced by the Radiart Corp., Cleveland, Ohio.

Features include a streamlined weatherproof housing that is said to keep out water, snow and ice, and a powerful heavy-duty motor which reverses instantly by a remote fingertrip control switch. Has twelve heavy-duty ball bearings in two oversize 6½" diameter races.

Basic design accommodates any type mounting, mast, tower or platform, and will handle any size mast from ⅞" up to and including 2" in diameter.

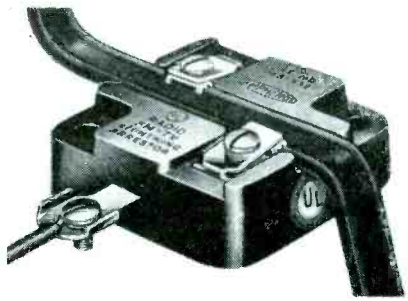
One model, TR-1, has a rotator with a control unit having *end of rotation* light, using a four-wire cable. Another model, TR-2, is a compass-control rotator with an illuminated *perfect-pattern* dial control unit. The face is two-tone, reproducing a TV test pattern that is illuminated and said to give instant indication of antenna position as it is rotated. Uses an eight-wire cable.



AMPENOL TV LIGHTNING ARRESTORS

A lightning arrestor has recently been developed by the American Phenolic Corp., Chicago, Ill., which is said to meet all requirements for indoor and outdoor installation and bears the Underwriters' Laboratories stamp of approval.

Arrestor is a combination of the gap and the shunt-resistance type. Can be used with all types of transmission lines, but is primarily designed for use with 300-ohm flat twin-lead. No stripping is said to be necessary as toothed clamps on the arrestor penetrate the insulation to make contact.



* * *

JFD INDOOR TV ANTENNA

An indoor TV antenna, the *Panorama,* has been announced by the JFD Manufacturing Co., Inc., 6101 Sixteenth Ave., Brooklyn 4, N. Y.

Features a base which is balanced and weighted, and three-section, triple-chrome plated brass telescopic dipoles which can be adjusted.

* * *

RCA REVERSIBLE-BEAM TV ANTENNA

A reversible-beam TV antenna array, designed to prevent the signal of one station from interfering with the signal of a station lying in the opposite direction, has been introduced by the RCA Tube Department.

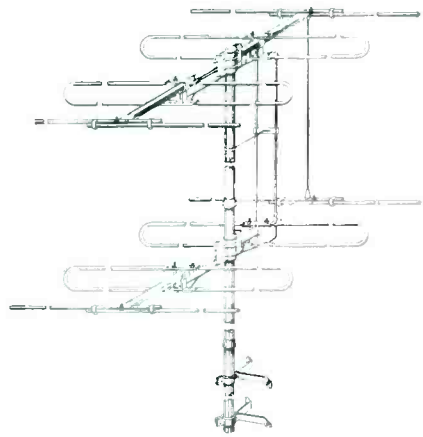
Antenna is said to have a high front-to-back ratio which provides maximum gain in one direction while *rejecting* signals arriving in the opposite direction. A diplexer is said to permit instantaneous reversal of the directivity of the antenna to provide reception from either station. This is accomplished by a switch which may be located near the receiver.

The diplexer is also said to eliminate adjacent-channel interference from stations in opposite directions, sometimes encountered in receivers having limited selectivity.

The array consists of four dipoles arranged in the form of a square and interconnected through the diplexer network to the television receiver. The diplexer is a phasing network consisting of four one-quarter wavelength lines, an absorbing resistor, and a switch to permit choice of dipole combinations.

TACO TWIN-DRIVEN STAGGER-TUNED YAGI

A twin-driven yagi, No. 985-4½, which is said to have performance peaks at both channels 4 and 5, has been announced by the Technical Appliance Corporation, Sherburne, N. Y.



* * *

CIRCLATRON INDOOR TV ANTENNA

An indoor TV antenna, the Circlatron, has been announced by Gadgets, Inc., 3269 North Dixie Drive, Dayton 5, Ohio.

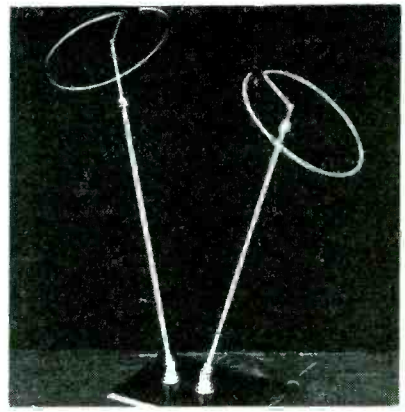
Antenna, which in its closed position is 17¼" high and extended 26⅝", features a ball swivel base joint, mounted on oak or gum bases.

Circular dipoles are said to allow for fine tuning in all planes. The dipoles act as top loading coils which is said to permit reduction of the length of the antenna without impairing its efficiency.

Antenna is also said to be omni-directional with a 20° black-out area or null.

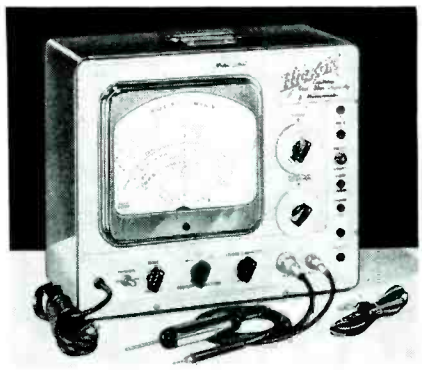
Constructed of steel, brass and aluminum with cadmium plate applied to all ferrous and non-ferrous parts.

Circlatron model 1140.



HICKOK TELEVISION VTVM

A volt - ohm - capacity milliammeter, model 209-A, which measure resistance as low as 1/10 ohm and capacitance of 1 mmfd has been announced by the Hickok Electrical Instrument Co., 10521 Dupont Avenue, Cleveland 8, Ohio. Permits peak-to-peak voltage measurements and contains zero-center *dc* scale. Has an *ac* range of 1200 volts, and features flat frequency response to 300 mc.



* * *

VEE-D-X TV ANTENNA SWITCH

A three-way antenna switch has been announced by the La Pointe Plascomold Corporation, Unionville, Conn.

A terminal strip, located at the rear, accommodates three separate leadins, as well as the output line to the receiver.

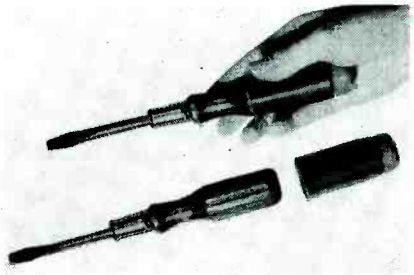
* * *

ROTO-GRIP TOOL HANDLE

A resilient rubber sleeve, the Roto-Grip, designed with a revolving rubber cap, which is said to cushion the palm of the hand, has been announced by the Indian Trails Industries, Oshkosh, Wisconsin.

A red rubber swivel top, riveted to black sleeve, is said to turn independently on two brass washers, thus permitting tool to be turned against swivel top rather than against the flesh.

Can be either stripped on or turned inside-out and rolled down on handles from 1" to 1¼" in diameter.



(Above)

Roto-Grip rubber sleeve.

CONSTANT-VOLTAGE TRANSFORMERS

Constant - voltage transformers, CVA 7202, which can correct line-voltage variation to better than 3%, with a 15% input-voltage variation, are now being produced by Sola Electric Co., 4633 W. 16 Street, Chicago 50, Ill.

Transformers, of the plug-in type, have been found effective in TV receiver inputs, eliminating fluctuations which are often the cause of flickers and picture distortion.

[Additional *New Product* news on page 59.]

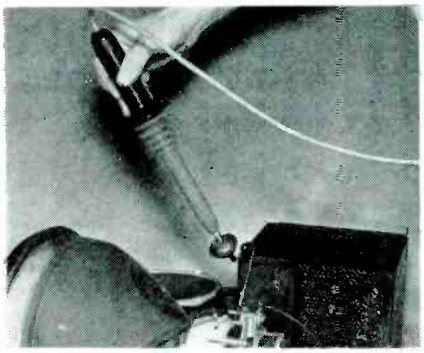
RCA HIGH-VOLTAGE PROBES

Two high-voltage probes, designed for use with low-current voltmeters, have been announced by the RCA Tube Department.

The new probes, types WG-289 and WG-290, are identical except for their connectors. The WG-289, designed for use with electronic voltmeters such as the VoltOhmyst meter, has a microphone-type connector. The WG-290, for use with non-electronic voltmeters, has phone-type connectors. To adapt the probes to various popularly used makes of voltmeters, five types of multiplier resistors are separately available.

The probes are said to be particularly useful in measuring the *dc* out-put voltage of pulse-operated and *rf* power supplies. Such power supplies are high-resistance voltage sources which can be measured only with very high-resistance instruments. The probes, when used with VoltOhmyst meters, provide an input resistance of at least 1000 megohms.

Incorporates safety features, such as a highly polished polystyrene probe head with five *petticoats* to increase to more than 8½" its surface leakage path from the high-voltage source to ground, a large-diameter channeled bakelite barrier guard and a guard ring which connects to an internal concentric metal shield, a cable shield, and a grounding terminal. The probe point is tapered and rounded to reduce corona.



* * *

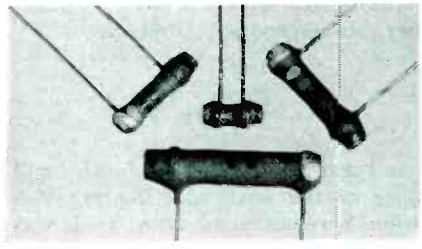
CRL CERAMIC CAPACITORS

The line of ceramic *BC Hi-Kap* capacitors has been expanded by the Centralab Division of Globe-Union, Inc., to include twenty-eight more values.

Formerly made in twenty values, the new Centralab capacitors are now available in forty-eight values and four sizes, with tolerances of 20% from 10 mmfd through 2,200 mmfd, and guaranteed minimum values from 2,500 through 10,000 mmfd.

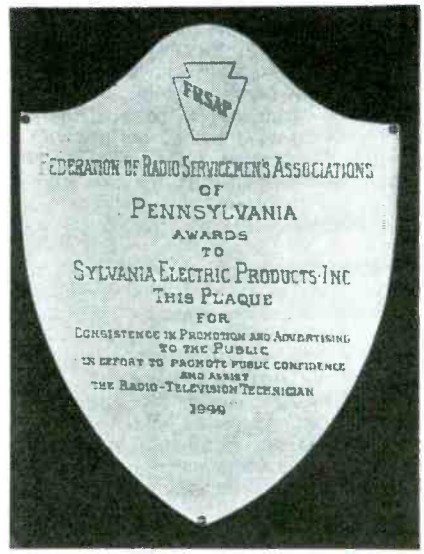
Capacitors are said to be moisture proof, have a low power factor and to withstand high temperatures. The ceramics use No. 22 tinned soft copper wire radial leads which are said to permit easy, close coupled connections and eliminate tricky bending and fitting.

All of the capacitors in the expanded line are rated at 600 working volts *dc*, and are flash tested at 1,000 volts.



ASSOCIATIONS

At the presentation of the FRSAP award to Sylvania, left to right: Robert Penfield, editor of *Sylvania News;* Robert H. Bishop, Sylvania vice prexy; Richard G. Devaney, Philadelphia FRSAP delegate, who presented the plaque; Terry P. Cunningham, Sylvania director of advertising, and David Krantz.



The FRSAP plaque which was awarded to Sylvania for . . . "consistence in promotion and advertising to the public in its effort to promote public confidence and to assist the radio-television technician during 1949".

FRSAP

THE ANNUAL FRSAP AWARD was presented to Sylvania Electric Products, Inc., during a luncheon-presentation meeting in Harrisburg, Pa., recently.

Robert H. Bishop, vice president in charge of sales for Sylvania, accepted the award.

David Krantz, chairman of FRSAP, who acted as host during the presentation, declared that the furnishing of technical speakers to local Service Men's groups, general assistance to Service Men in winning public approval and the merchandising of national campaigns, prompted FRSAP to reward Sylvania this year.

TCA

A STRIKING ADVERTISING campaign has been initiated by the Television Contractors Association, recently organized in Philadelphia, in an effort to *sell* the consumer on the advantages of contacting association members when in need of service. The advertisements list fifteen members and declare that . . . "Every TCA member . . . has qualified himself as one who is responsible, reliable and capable. When you place your service call or contract with a TCA member you can depend on his efficiency and integrity. . . . TCA means fair play." The advertisement also features a slogan . . . "Service is the keystone of the television industry."

Members of the association, of which Albert M. Haas is president, are: E. L. Bevan Television Co., J. F. Griffin, Albert M. Haas, Interstate Television Service Co., John C. Merman, Mitchal and Caplan, Philadelphia Television Service Co., Phillip's Service, Raymond Industries, Scotty's Television Service, Louis J. Smith, T and A Television, Television Facsimile, Weber's Television, and Whittingham Bros., Inc.

Members of FRSAP at the presentation luncheon in Harrisburg. Among the invited guests was Max Liebowitz, president of the Associated Radio-Television Servicemen of New York.

PRSMA

PAUL LAU has been elected president of the Philadelphia Radio Servicemen's Association, succeeding David Krantz, who has become a member of the PRSMA board of directors. George Greenberg is now vice president; Stanley W. Myers, treasurer; Frank Gerhard, Sr., secretary, and John Zagury, corresponding secretary.

ARTSNY

THE FIRST ANNUAL entertainment and dance of the Associated Radio Television Servicemen of New York was

TEN YEARS AGO

From the Association News Page of SERVICE, March, 1940

THE ANNUAL ELECTIONS were held by the Allentown chapter and Carl Williams was named president. Joe Frey was elected vice president; Bruno Haake, secretary; and J. A. Muthart, treasurer. Shortly after the election the Second Annual Banquet and Test Equipment Show was held at the Hotel Allen in Allentown, Pa. . . . Herb Snyder was reelected president of the Binghamton chapter. Herb Squires was elected secretary and Ross Baxter, treasurer. . . . The administrative board of the Radio Technicians Guild held a banquet at the Miles Standish Hotel, Boston. Among those present were G. Batt, J. R. Cabral, W. F. Staples, E. J. Maginot, A. C. W. Saunders, F. Kennes, N. Baratta, S. DiRusso and E. Glynn. . . . Ray Wilson of Zenith appeared at a meeting of the Boston chapter and discussed FM. . . . Roy Wright was elected president of the Bridgeport chapter. William Pollack was named vice president; H. C. Eiseman, treasurer; and J. T. Gomperts, secretary. . . . Rudy Trammell became chairman of the Cleveland chapter and A. L. Theriault was named vice chairman. Stanley Morse was elected secretary and Thomas B. Holmes, treasurer. . . . James Springer appeared in his new post as president of the first meeting of the Duluth chapter. . . . A. G. Mohaupt of Supreme Instruments gave a lecture and demonstration on the *Vedolyzer* before the Flint chapter. . . . Floyd Wenger became an honorary member of the Fremont chapter in Ohio. . . . C. Leonard Johnson was elected president of the Jamestown, New York chapter. Other elected officers were: Francis Samuelson, vice president; Frank Austin, secretary; and Percy Armstrong, treasurer.

held on March 3 at the Hotel Diplomat in New York City. A complete report on this event will be presented in the next issue of SERVICE.

Marine Radio

(*Continued from page* 19)

somewhat by dipping all of the coils and transformers in hot sealing compound, replacing the paper capacitors with plastic and metal-cased units, and painting of the chassis and solder joints with lacquer. This is quite a job and must necessarily be processed with utmost care.

Another advantage of the self-powered unit is the absence of ignition interference. In most cases, it is usually possible to position a portable, and its antenna, so that the ignition noise will not be picked up.

The Diesel Engine

Diesel enginees represent an effective solution to ignition-noise problems. Having no ignition their noise is confined to static generated by moving parts. This appears in the clutch plate revolving near a housing, which can set up an electrical charge, that will cause a noise, when it spills over. Bonding helps. Placing a sliding contact on the moving part, to collect the static charge, is another method which can be used to cure. A portable receiver is quite handy in tracking down this noise.

To solve the noise caused by a gas engine ignition system, a special filter harness is recommended. This filter has a metal enclosure in which are the required filtering circuits, and low and high-voltage leads. Simply running some shielded loom over the high-voltage leads will have little effect, and be a possible source of ignition shorts in wet weather.

Suppressors are never used in ignition-reduction work on a ship, since they prevent complete combustion at full load, on which marine engines are always run, and cause unused gasoline to accumulate in the crankcase, dilute the oil and eventually ruin the engine and bearings. Suppressors can be used on auto engines, since they are rarely operated at full power.

Grounding of the engine to the metal frame of the hull is not suggested. However, when the harness is not used it is wise to line the inside of the engine box with copper screening, and bond the screening to provide one solid cage. Placement of the receiver away from the engine room may minimize noise pickup, too.

Unfortunately, no two boats are

identical insofar as response to ignition-suppression treatment is concerned. Each job involves use of the cut and try practice.

Interference can also be eliminated by the use of a noise-bucking-circuit receiver. In this type of set, we have a noise antenna placed in the engine compartment to pick up ignition noise. The ignition signal is then fed into the bucking circuit, where it is mixed out of phase with the signal coming down the regular antenna. The two out-of-phase signals are adjusted to cancel each other out. This system, in many instances, has been found to eliminate the need of the filter harness.

The receiver needs no ground, but the transmitter does. This may be a copper plate, nine to sixteen square feet in size, fastened to the outside of the hull, with a bronze bolt brazed to its inner side, and brought into the ship.

Electrolysis

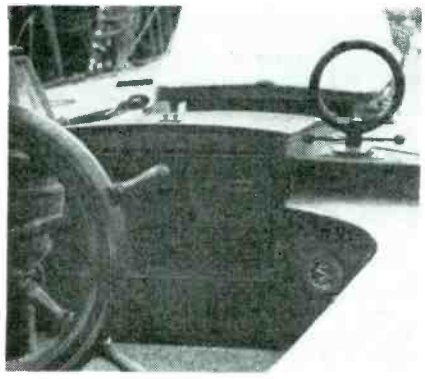
Electrolysis, the bugaboo of boat owners, can be traced by placement of a milliammeter in series with the ground lead. If there is any current flow, a fixed capacitor in series will be found to stop the disturbance caused by the corrosive action. To further reduce fears of corrosive electrical action, a bar or two of 2″ x 8″ zinc can be fastened to the hull of the ship. Zinc, being the base metal, will deteriorate, leaving the other metal intact.

Antennas

Because of the frequencies involved a quarter-wave Marconi type antenna is almost always used, 70′ being about the full length. On sailboats, metal stays or shrouds, insulated by means of strain insulators, have been used as antennas, which must be insulated high enough to prevent personal contact. If a straight line antenna of less than

(*Continued on page 46*)

Fig. 7
Direction finding loop which has been extended. The receiver unit is below decks.



Marine Radio

(*Continued from page 45*)

thirty feet is used a loading coil should, if possible, be placed somewhere above deck, near the physical end of the antenna, but not at the very end where it will not work properly.

The loading coil and the antenna can be made into one large radiating coil by winding the antenna in a spiral around a long bamboo pole. This makes a more effective radiator than a short line and a lumped inductance, although in wet weather it does suffer from detuning.

Sixteen-foot whips, of special design, have been found to be very effective. These are mounted permanently, as near to the transmitter as possible.

Compass—Loop Positions

The radio compass or loop can be mounted almost anywhere on the boat. However, the axis of its rotation must always be vertical. Its control point must be under cover, if possible, as the compass is most frequently used in dirty weather. For maximum pickup the loop should be as high as possible, and it should never be mounted near large metal objects which might act as antennas and thus pick up the incoming signal, reradiate it to the loop, causing a false fix.

Set	*Distance*	*6 V*	*12 V*	*32 V*	*110 V*
Up to 18 watts..	10′	12	14	14	14
	20′	10	12	14	14
	40′	6	10	12	14
Up to 80 watts..	15′	..	4	8	14
	30′	..	2	8	14
	40′	..	0	6	14

Table III
Recommended wire sizes

With Proper Antennas

Power	*Coverage*
12 *watts*	20- 50 miles
15 *watts*	50- 75 miles
50 *watts*	100-150 miles
100 *watts*	2-300 miles

Table IV
Approximate dependable transmission range during daylight. These are more or less ground wave coverage figures, for the open sea. A craft in a harbor could not expect to communicate inland from, say, New York to Buffalo with 100 watts.

	Ship Transmitter (Kc)	*Ship Receiver (Kc)*
Ship-to-Shore	2,738	2,738
Ship-to-Shore	2,638	2,638
Coast Guard	2,670	2,670
Harbor Stations		
Astoria	2,206	2,598
Boston	2,110	2,506
Charleston	2,174	2,566
Galveston	2,134	2,530
Kahuku, T. H.	2,134	2,530
Miami	2,118	2,514
New York	2,198	2,590
New York	2,126	2,522
Norfolk	2,142	2,538
Portland	2,206	2,598
New Orleans	2,206	2,598
San Francisco	2,110	2,506
San Pedro	2,174	2,566
Seattle	2,126	2,522
San Juan, P. R.	2,134	2,530
Tampa	2,158	2,550
Wilmington	2,166	2,558

Table I
Marine radio frequencies

	Channel	*Ship Transmitter*	*Ship Receiver*
Great Lakes			
Ship-to-Shore	40	2,738	2,738
Safety	51	2,182	2,182
Ship-to-Shore (under 1,000 tons)	39	2,118	2,514
Ship-to-Shore (over 1,000 tons)	30	2,158	2,550
Ship-to-Shore (Canadian Boats)	38	2,206	2,582
Ship-to-Shore	20	6,660	6,470
Ship-to-Shore	60	4,422.5	4,282.5
Ship-to-Shore	10	8,820	8,585
Mississippi Valley			
Ship-to-Shore	4	2,738	2,738
Ship-to-Shore	5	2,782	2,782
Ship-to-Shore	1	4,162.5	4,162.5
Ship-to-Shore	2	6,455	6,455
Ship-to-Shore	7	11,090	11,090
Ship-to-Shore	6	8,840	8,840

Table II
Marine radio frequencies for Great Lakes and Mississippi Valley areas.

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SIMPSON 260,000TH INSTRUMENT

Ray Simpson, chairman of the board of the Simpson Electric Company, receiving the 260,000th unit of the Simpson model 260 volt-ohm-milliammeter.

Gold plated, the instrument was graced by an engraved silver plaque on which was inscribed: "To Ray Simpson: Congratulations on the production of this 260,000th Simpson model 260 volt-ohm-milliammeter. We are all pleased and proud to have had a part in this record-breaking achievement. It is grand to work for such a fine boss. (Signed) Factory and Office Employees."

The gold-plated *260* was presented by Herb Bernreuter, executive vice president and general manager of Simpson Electric.

2-Stage Preamp

(*Continued from page 21*)

band remains, it is advisable to use separate coils for each channel. The complete unit therefore becomes a twelve-position switch, studded with tuning coils.

In an inductance-tuned system it is of advantage to make coupling circuits capacitive. This has been found to allow proper voltage transformations entirely independent of the varying inductance, and hence independent of frequency.

In the two-stage preamp circuit on the cover, there is a high-pass filter in the input terminals. Following that is a pi-type impedance transformer with the variable inductance for tuning the first grid circuit. The neutralizing capacitors are connected in the usual manner, and trimmers appear across each tuned circuit to compensate for tube capacities. The interstage push-pull coils are conventional, but have a resistor in the common center-tap lead to avoid parallel operation of the 6J6. The second 6J6 is similar to the first, and has the pi-coupler arrangement again in the output. The gain of the two stages has been found to be about 30 db on all channels, with provision for a pad on the output to drop the gain by 16 db. In the power supply is a shielded transformer feeding a brute-force filter through a selenium rectifier.

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3000-APARTMENT MULTIPLE-ANTENNA PROJECT

Reviewing plans for the installation of multiple-antenna systems* in eight suburban apartment projects in the New York metropolitan area, embracing about 3000 dwelling units: J. P. Lieberman (seated at right), head of the building corporations involved, and his associate, Harry Robbins (seated at left); standing, (left to right) Ira Kamen, manager of the TV department of Commercial Radio Sound Corp., which will install the systems, Alexander Fisher, president of CRSC, and A. C. Lindquist, RCA sales rep. (*Courtesy RCA*)

* See Kamen, Ira, *Connecting TV Receivers to Master Antenna Systems*; January, 1950

Ser-Cuits

(*Continued from page 26*)

amplitude and then limits at that level, the circuit will adjust itself to any signal level. As a result, limiter action is effective on weak as well as strong signals.

Normal operating bias for the sound amplifier is developed by a grid-leak bias resistor and capacitor. Static (no signal) plate current is limited by a 470,000-ohm plate load resistor and the negative contact potential developed across a 470,000-ohm resistor in the grid circuit. The *RC* coupled plate circuit of this stage is conventional.

The sound output as well as the video amplifier has a modified plate supply circuit to make the most efficient use of plate supply power.

The plate circuit of the 6AS5 sound output is a conventional transformer-coupled circuit. The plate and screen circuits are decoupled from the plate supply by the filtering action of a 820-ohm resistor and three capacitors; two 40-mfd units and a 20-mfd section. A cathode capacitor with a value of 60-mfd is used to prevent circuit interaction since several stages in the receiver obtain their plate supply from this circuit. Since the cathode of the 6AL5 is approximately 150 volts positive with respect to chassis ground, the grid must also be kept at a rather high positive potential. This is the function of a divider composed of 680,000 and 820,000-ohm resistors, the 680,000-ohm resistor also serving as the grid return of this stage.

The Sweep Section

Grid-leak bias is used on the *RC*-coupled 12AU7 sync-amplifier stage. An input coupling network, consisting of 10,000 and 270,000-ohm resistors, and 250-mmfd ceramic and .01-mfd paper capacitors, effectively increases

the source impedance and results in sync clipping at the grid of the tube. It also eliminates loading effects on the video amplifier plate circuit. Since sync limiting is not used in the video amplifier, clipper action in the sync amplifier is necessary to obtain the desired noise immunity in the sync circuits.

Since the sync pulse input to the 12AU7(½) sync-separator stage is of negative polarity, a grounded-grid type of circuit is necessary to obtain separator action. (The signal is applied to the cathode rather than to the grid). A divider network consisting of 15,000 and 270,000-ohm resistors is used as a plate load to reduce the plate voltage to a value that results in normal separator action.

Since no phase inversion takes place in a grounded-grid stage, the input pulses applied to the grid of the sync clipper (½ of 6SN7GT) are negative. Pulse clipping takes place due to plate current cut-off. A voltage divider (22,000 and 15,000-ohms) is used to reduce the plate voltage of the stage to a suitable value for normal operation.

The output of the sync clipper is fed to an integrator filter consisting of three resistors (22,000 and two 8200-ohm units) and three capacitors (two .002-mfd units and a 4700-mmfd mica). The integrated vertical pulse is fed to the grid of the vertical oscillator (½ of a 12AU7) through a 7.5-mmfd ceramic coupling capacitor and the grid winding of a blocking-oscillator transformer. A 15,000-ohm vertical hold control adjusts the time constant of the blocking oscillator grid circuit, providing an adjustment for proper synchronization. A 25,000-ohm height control (variable resistor) is in the plate circuit of the vertical oscillator. Since the vertical oscillator also functions as a discharge tube, the 25,000-ohm unit provides height control by adjusting the charging current to the .05-mfd capacitor in this circuit.

The vertical output stage (½ 12AU7), is a conventional triode sweep amplifier. The vertical linearity control provides linearity adjustment by varying the cathode bias on the tube. The plate circuit is transformer-coupled to a vertical deflection coil and two damping resistors, each with a value of 560 ohms. Due to the waveshaping by the .05-mfd capacitor and 3900-ohm resistor the output waveform is of the correct waveshape to produce a saw-tooth current in the deflection yoke.

The horizontal oscillator control tube (½ of 6SN7GT) controls the

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horizontal oscillator frequency by a method called *pulse-width modulation.*

In this system, a positive saw-tooth voltage from the output of the horizontal oscillator is developed across a 120,000-ohm resistor and a 10-160-mmfd trimmer to ground. The voltage waveform appearing across the trimmer is partially integrated. Another voltage, from the deflection yoke, is developed across a 560,000-ohm resistor, a 7.5-mmfd ceramic and the trimmer. This waveform also appears across the trimmer partially integrated. These two waveforms add together on the grid of the tube as a saw-tooth with an upward sloping positive peak.

The positive sync pulse from the sync clipper, is also developed across the trimmer and if properly phased, will add on top of the positive peak of the self-generated waveshape from the horizontal oscillator output and the deflection yoke.

A pair of resistors (27,000 and 820,000 ohms), connected from the control grid of the horizontal oscillator to the cathode of the horizontal oscillator control tube form a voltage divider network to develop a negative potential at the horizontal oscillator control tube grid. This voltage biases the horizontal oscillator control tube sufficiently negative so that only the positive peak of the waveshape will allow the tube to draw plate current. Consequently, only this positive pulse, which consists primarily of the horizontal sync pulse, appears across the cathode resistors. This pulse, across the cathode resistors, is filtered by .02-mfd and .2-mfd papers and a 8200-ohm resistor, so that a *dc* voltage proportional to the average level of this pulse will be developed across the cathode resistors.

Since the positive sync pulses must be in the correct phase relation when added to the top of the self-generated waveshape, any shifting of phase due to oscillator drift will tend to make the sync pulse add either ahead or behind the peak of the self-generated pulse. This will tend to make the positive peaks of the waveform at the horizontal oscillator control tube grid narrower if the horizontal oscillator frequency increases and wider if the oscillator frequency decreases.

These variations will determine the amount of time that the 6SN7GT will draw plate current and consequently, the *dc* voltage developed across the cathode resistor (220,000 ohms). This voltage is injected into the grid of the horizontal oscillator through a 100,000-ohm resistor and thus controls the oscillator frequency.

A vernier control for this system is provided for by the horizontal hold control. The setting of this control, determines the plate voltage on the horizontal oscillator control tube, and thus the voltage across the cathode resistor.

The horizontal oscillator (½ of 6SN7GT) uses a blocking-oscillator circuit. Auto-transformer action is

employed to produce feedback at the control grid. In addition to the time constant of the grid circuit, the oscillator frequency is determined by the *dc* voltage developed across the cathode resistor. This voltage depends upon the plate current of the horizontal oscillator control tube. This tube also functions as a discharge tube for the wave-shaping capacitors.

A parallel *LC* circuit is in the plate circuit of the horizontal oscillator and resonated at approximately 17 kc. This *LC* circuit is shock excited and then damped by a 22,000-ohm resistor, so that a sine wave is produced. This sine wave adds with the instantaneous potentials on both the plate and grid of the oscillator, so that a steeper slope results on the portion of the sawtooth just before conduction of the oscillator tube. This results in improved oscillator stability. This *LC* circuit, called the *horizontal lock*, is located underneath the chassis.

A horizontal drive adjustment adjusts the sweep voltage applied to the grid of the horizontal output tube, a 6BG6G. A cathode-biased beam tetrode amplifier is used to develop the power required to drive the horizontal deflection coils of the magnetic deflection yoke and to provide the source for the kick-back type second anode supply. The output is transformer-coupled to horizontal deflection coils. A width control shunts a portion of the output transformer secondary, making the inductance variable for width control. A *dc* blocking capacitor (.5 mfd) prevents *dc* flow through the horizontal deflection coils.

Aside from its function of damping transients in the horizontal output circuit, a 6W4GT damper is connected in such a way as to give an effective increase in plate supply voltage for the horizontal output amplifier, and various other stages in the receiver. The plate current of the 6BG6G flows through the 6W4GT for the major portion of the trace. A pair of capacitors (.035 mfd and .05 mfd) are fully charged during this period and supply 6BG6G plate current during the time that the 6W4GT is not conducting. An average voltage is developed across the network consisting of the .035-.05 and horizontal linearity control components. This voltage is approximately 60 volts greater than the normal plate voltage source.

Since the linearity control is variable, the network provides linearity control by adjusting the cathode waveform (bias) of the damper tube.

A single 5U4G rectifier and pi-type filter provides all the plate and screen voltages required by the various stages

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of the receiver. The speaker field is used as a filter choke in the *television* only models. Chassis used in combination models have a filter choke mounted to the underside of the chassis, because the radio and sound output use a single *pm* speaker. Approximately 50 milliamperes of the plate supply load is drawn from the arm of the focus control. The amount of this load that passes through the focus coil is adjustable and provides the required focus control range. The remainder of the plate supply load flows through the focus control at all times.

Since several stages of the receiver require no more than half of the power supply output voltage for normal operation, these stages are connected in a series-parallel combination to eliminate dropping resistors and make the most efficient use of the power supply output.

The Zenith '50 Chassis

Continuing our analysis of the Zenith 24G22/23/24/25 series[2], there are several interesting features in the *hv* power supply which merit comment. Available, in this receiver, is a 10,000 volt *dc* supply for the second anode of the picture tube developed by a 19BG6 horizontal sweep amplifier, and its associated output transformer and high voltage rectifier. The power supply is the kick-back type in which the high voltage is developed during the 7-microsecond retrace of the horizontal sweep when the deflection coil current suddenly collapses.

The saw-tooth current which produces the sweep, flows for approximately 53 microseconds. This is the approximate time required to move the beam from the left to the right side of the picture tube. After the sweep reaches the right side of the tube, the current suddenly collapses and this sudden collapse of current through the deflection coils, generates a voltage which is *kicked back* into the output transformer and stepped up.

A two-turn low voltage winding supplies filament current for the 1BT3GT high-voltage rectifier, where rectification develops the 10,000 volts *dc* for the second anode of the picture tube. Because of the 15.75 kc frequency, very little filtering is necessary. A 500-mmfd 12-kv capacitor, 470,000-ohm resistor and the capacity formed by the picture tube metal cone and chassis have been found to filter adequately the high voltage.

When servicing the high-voltage

[2] SER-CUITS; February, 1950.

power supply, extreme care must be exercised to avoid contact with the second anode high potential. A well insulated vacuum tube voltmeter, which has a 10-kv range, or higher, may be used to measure the high potential. Failure in any section of the 15.75-kc horizontal sweep circuit may cause the supply to be inoperative. If the difficulty is not obvious, circuit tracing should begin at the 6SN7GT horizontal oscillator through the 12SN7GT horizontal discharge tube, and the 19BG6G horizontal amplifier. Voltage should not be measured at the plate of the tube because the voltage at this point is extremely high due to the inductive build-up through the transformer. The 25W4 damping tube, adds an additional 125 volts to the plate voltage of the 19BG6G horizontal amplifier. Failure of this tube will also cause the high voltage to be inoperative.

The Damping Tube

The linear rise of current through the horizontal deflection coils moves the electron beam from the left to the right side of the picture tube in approximately 53 microseconds. The current must then return to its starting value in approximately 7 microseconds. The sudden collapse of current through an inductance during the retrace produces an oscillatory condition. This oscillating condition would destroy the linearity of the sweep and must be removed by the damping tube. When the plate of the damping tube becomes more positive than the cathode, conduction occurs which loads the circuit and prevents the undesirable oscillation. As a result of the conduction, a *dc* potential of approximately 125 volts is developed and stored in a .22 mfd capacitor. This voltage is added to the plate voltage of the 19BG6G horizontal amplifier and raises its potential from 360 to 485 volts for greater output and better performance.

The Beam Bender

The electron gun of a picture tube emits both electrons and ions. The ions are much heavier than the electrons and if allowed to bombard the picture tube fluorescent screen, damage in the form of a burn could occur. To prevent this condition, the electron gun of the tube used in this model is slightly bent, via a beam bender, so that the ion and electron stream is directed at the neck rather than at the screen of the tube. The beam bender, which is a permanent magnet fitted around the neck of the tube, bends the

(*Continued on page* 54)

Servicing Helps

(*Continued from page* 36)

known, the transmission line can be cut by using the following formula:

Half-wave shorting stub (in inches)

$$= \frac{4841}{\text{Freq. (mc)}}$$

If the interference frequency is not that of a television station, the line may be cut and the leads shorted together without using the resistor. Generally, this will completely eliminate the interference frequency.

Channel Number	*Channel Frequency (mc)*	*Half-Wave Shorted Channel Trap*
2	54- 60	84"
3	60- 66	78"
4	66- 72	70"
5	76- 82	61"
6	82- 88	53"
7	174-180	25"
8	180-186	24"
9	186-192	24"
10	192-198	23"
11	198-204	22"
12	204-210	22"
13	210-216	21"

Fig. 2. Shorted channel-trap 300-ohm lead lengths.

*Elimination of Audio Buzz***

As is characteristic with all receivers using *intercarrier sound*, a 60-cycle station buzz may be heard in the sound. This will occur under certain conditions of non-standard picture transmission (over modulation or phase shift), misalignment, or improper tuning of receiver controls. Buzz in sound is

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Ser-Cuits

(*Continued from page* 53)

electrons back into their proper axis so that they strike the screen. The heavier ions are not affected by the magnetic field and do not reach the screen.

The beam bender has an identifying arrow stamped on it. When it is installed, the arrow must point towards the face of the picture tube. On a double-ring type beam bender the air gaps should be 180° out and the heavier ring must be nearest the picture tube socket. To make the adjustment, the beam bender should be moved and rotated along the neck of the tube until the brightest picture with least shadow appears. It may be necessary to readjust the focus and intensity controls during the adjustment.

(*Continued from page* 54)

the result of amplitude modulation (picture content) contained in the 4.5-mc beat FM *if* carrier to such high level that it is passed through the FM ratio detector without being completely eliminated.

Station buzz is most commonly due to improper tuning of the receiver controls. The sharp tuning control may be misadjusted or the contrast control may be turned too far (clockwise) thus overloading the video amplifier. The sharp tuning control must be tuned for the most clearly defined picture with best sound. If no definite sound peak is obtainable with rotation of the sharp tuning control, it may be necessary to make individual channel oscillator adjustments. Overloading caused by improper setting of the contrast control should normally disappear when this control is rotated slightly in a counter-clockwise direction.

Oscillator Misalignment Trouble

Misalignment of oscillator adjustments (overall or individual channel) may cause buzz. If the buzz still remains after checking oscillator alignment, remaining buzz may be due to misalignment of the ratio detector secondary tuning slug. It may be necessary to repeat the oscillator alignment and conclude with retouching the ratio detector secondary slug adjustment. If the oscillator adjustment is required for other channels it will not be necessary to readjust the FM ratio detector secondary slug adjustment after having correctly made this adjustment on one channel.

Buzz is also caused by overloading of the video stages due to a very strong television signal. Insertion of an attenuation pad between the transmission line and the receiver should decrease the incoming signal strength to normal level. Other faults in the receiver which may cause buzz are misalignment of the video *if* stages and changes in component values such as resistors and electrolytic capacitors.

Presence of station buzz may not always be an indication of fault in the receiver. The cause is often due to transmission of a non-standard picture signal (over modulation or phase shift) by the station. This condition is usually momentary and may be especially noticed when maximum white is transmitted. If more than one station is in operation at the time, tuning in another station will indicate where the fault lies. If only one channel is in operation the check should be made with another receiver known to be operating properly.

Receiver Component Design * **

Familiarity with component design is often a substantial aid in servicing. Three parts which demand this design attention are the converter transformer, picture-*if* transformer and cathode-circuit trap, which are normally designed for a picture *if* of 25.75 mc and a sound *if* of 21.25 mc.

Using these components, a typical stagger-tuned, picture-*if* amplifier can provide a voltage gain in excess of 20,000 times. The frequency response has been found to have a bandwidth of 3.75 mc measured at 6 db down and essentially linear over a major portion of the bandwidth. The double-tuned input provided assures substantial sensitivity, and the many tuned cir-

(*Continued on page* 56)

***From RCA tube department design notes.

(Continued from page 55)

cuits afford good selectivity with high attenuation of adjacent channels.

The converter transformer[1] is used in conjunction with the first picture *if* transformer[2] for coupling the output of a 6AG5 converter tube to the first picture-*if* amplifier.

The primary circuit of this transformer consists of a permeability-tuned inductance in parallel with tube and stray capacitances. The secondary winding, which is closely coupled to the primary winding can be link-coupled to the first picture-*if* transformer through a non-critical length of 110-ohm shielded transmission line. Primary and secondary are mounted in a shield can.

The primary winding of the first picture *if* transformer is closely coupled to the secondary winding which is permeability tuned from the bottom of the unit. The secondary winding is shunted by tube and stray capacitances. A tertiary winding shunted by a fixed capacitor constitutes a trap to attenuate the adjacent-channel picture-*if* carrier. This trap is tuned to 19.75 mc. The inductance of the tertiary winding is adjusted from the top of the unit.

The second picture-*if* transformer[3] is used between two 6AG5s in a stagger-tuned *if* system. It is designed to provide peak response at 25.5 mc and adjacent-channel sound-*if* carrier rejection at 27.25 mc.

This unit is also permeability tuned and consists of a primary winding and a high-Q trap circuit mounted on a moulded bakelite form. The inductance of the trap winding is shunted by a fixed capacitor and is adjusted from the top of the unit. The inductance of the primary winding is shunted by tube and stray capacitances and can be adjusted from the bottom of the unit.

The third picture-*if* transformer,[4] designed for use between two 6AG5s, affords peak response at 22 mc and provides rejection for the accompanying sound-*if* carrier at 21.25 mc.

This unit has a trap winding tapped to provide a 21.25 mc signal to the control grid of the first sound-*if* amplifier tube. The inductance of the trap winding is shunted by a fixed capacitor and is adjusted from the top of the unit.

The fourth picture-*if* transformer[5] provides peak response at 24.6 mc and

[1]RCA-202K5. [2]RCA-202K6.
[3]RCA-202K7. [4]RCA-202K8.
[5]RCA-202K9. [6]RCA-202K10.

adjacent-channel sound-*if* carrier rejection at 27.25 mc.

It is permeability tuned and consists of a primary winding and a trap circuit mounted in a shield can.

A fifth picture-*if* transformer[6] is also available for use between a 6AG5 amplifier tube and a 6AL5 second detector in a typical stagger-tuned *if* system. It is designed to provide peak response at 22.7 mc and adjacent-channel picture-*if* carrier rejection at 19.75 mc.

To serve as a cathode-circuit trap, there is an unshielded unit,[7] which consists of a primary or cathode inductance closely coupled to a high-Q resonant circuit. The trap inductance is permeability tuned, and is adjusted at the top of the unit.

The trap is intended to provide attenuation of the sound-*if* carrier in the picture-*if* amplifier circuit.

[7]RCA-202K11.

•

Phono

(*Continued from page 23*)

intermix playing of 10″ and 12″ records of the same speed, and automatic shut-off after last record has played. Uses a single needle *unipoint* cartridge.

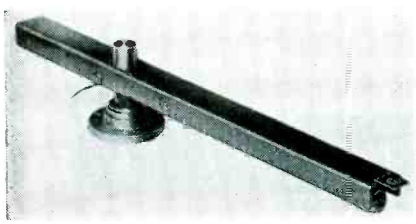
Amplifier used in system is a three-tube, including rectifier, model, with a 5″ Alnico speaker.

Replace-All Cartridge

A new *replace-all* cartridge which can be used to replace at least 45 current model crystal cartridges in radio-phono units has become available from the Webster Electric Company. Known as the *Featheride*, the cartridge may be installed in any tone arm which has a ½″ standard RMA mounting.

Cartridge will develop two voltages: 1½ volts at ¾-ounce tracking pressure, or 4 volts at ¾-ounce tracking pressure.

Microgroove-standard record pickup arm which features a low-as-possible vertical-to-lateral moment of inertia, minimized vertical mass to track any record without imposing extra vertical load on grooves, absence of spurious arm resonance at any frequency, lower than three-gram centimeters pivot friction, static balancing about the vertical axis to eliminate tendency to jump grooves when subjected to bumping or jarring, an offset head which is said to reduce tracking error to less than ±2½°, and protection of stylus point against contact with anything but the record grooves. (*Model 190; Pickering and Co.*)



Miniature Crystal Cartridges

A new development in miniature-sized crystal phono cartridges, the *AC* series, has been announced by Astatic.

Units have housings of molded bakelite and metal mounting brackets (which fit standard ½″ mounting centers) and needle guards. The cart-

(*Continued on page 58*)

Astatic cartridges: top, ACD turnover type and bottom, AC type.

Phono

(*Continued from page 57*)

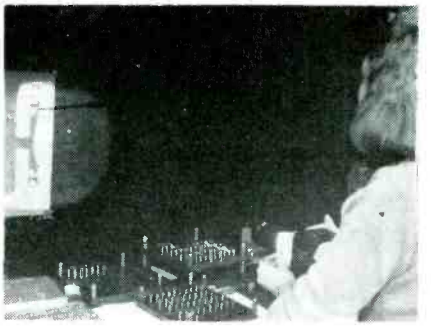
ridges use a special type *C taper-lock* needle, which features changeability without tools.

There are four models in the series: Model AC-78 has a three-mil radius stylus tip, either precious metal or sapphire, for standard 78 *rpm* records; model AC has a one-mil stylus for narrow-groove, slow-speed records; model AC-AG has an *all-groove* stylus tip, to play 33⅓, 45 and 78 rpm records; and model ACD is a turnover cartridge with dual needles to play narrow-groove records on one side and 78 rpm on the other.

Needle pressure of the *AC* model is five grams, while that of the others is six grams. Output of all, at approximately 1,000 cps, is 1 volt, using the Audiotone 78-1 and RCA 12-5-31V test records.

Webster-Electric tape recorder-play back unit, available with and without remote-control system; models 101-5 and 101-4, respectively.

Shadowgraph-method check of stylus assembly. The assembly is magnified fifteen times and its shadow thrown upon a screen which has an outline drawn on it to the exact specifications required. Another shadowgraph test is performed on the tip alone. Each tip is magnified 400 diameters and checked against an outline which detects flaws as minute as one ten-thousandth of an inch. (*Courtesy G. E.*)



Tuning Indicators

(*Continued from page 34*)

an ample margin of safety, is so small that it may be disregarded.

Cost of an indicator of this type, using standard components, conservatively rated, is about $15.00 and three hours of working time. The first cost may be shaved to about $8.00 and one hour by use of lower-grade components and less rugged construction, but this apparent saving is shortly eaten up by repair and replacement costs.

The same case may be used to house a *wide-angle* indicator in conjunction with an *S* meter. It also has ample space for an added filter capacitor, or a *helper* filament transformer, but not for an auxiliary plate supply of conventional design.

New Parts, Accessories

C-D CERAMIC CAPACITORS

A line of miniature ceramic disc capacitors, identified as the *Tiny Mike,* has been announced by Cornell-Dubilier Electric Corp., as the initial item in its newly organized ceramic capacitor manufacturing division, which will be housed in the New Bedford, Mass., plant.

The round disc ceramic, used principally in television, FM and *vhf* applications, has been designed for bypass and coupling in assemblies that are very compact and in various types of miniature electronic equipment.

Capacitor is 19/32" in diameter and 5/32" thick. It now is being made in 500 *v dcw* at capacities of 50 to 500 mmfd at ± 20 per cent and 500 to 5,000 mmfd sizes, guaranteed minimum capacity within a temperature range of + 10° C and + 65° C.

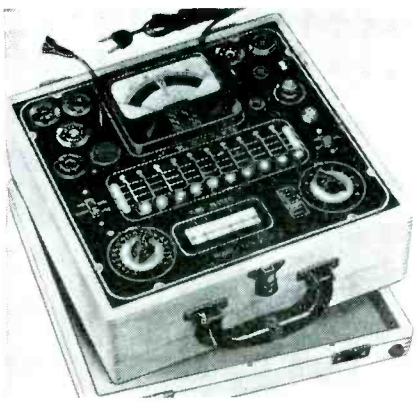
Easel display for four types of C-D miniature ceramic capacitors.

* * *

SUPERIOR INSTRUMENTS TUBE TESTER

A tube tester, model TV-10, for checking AM, FM and TV tubes has been introduced by Superior Instruments Co., 227 Fulton Street, New York 7, N. Y.

Uses self-cleaning type lever action switches for individual element testing. Individual sockets are used for each type of tube. Free-moving built-in roll chart provides complete data for all tubes.



* * *

INSULINE PHONE PLUG

A phone plug, PJ-055B, designed to meet the requirements of Joint Army-Air Force-Navy specification P-642, has been announced by the Insuline Corporation of America, 3602 35th Avenue, Long Island City 1, N. Y. Of the standard two-circuit type, it is suitable for all radio and telephone applications.

SYLVANIA TUBE TESTERS

Two tube testers have been announced by the Radio Tube Division of Sylvania Electric Products Inc.

Features of the testers, for portable and bench use, include an ohmmeter-type shorts and leakage test which indicates *replace* or *good* directly on the instrument's illuminated meter; direct meter indication for all other tests; gas test; and a combination emission and transconductance-test under dynamic operating conditions which takes relative tube life into account. Twelve sockets provide for testing 4, 5, 6, 7, 8 and 9-pin tubes, octal and lock-in, miniatures, sub-

(*Continued on page* 60)

Sylvania tube checker

(*Continued from page 59*)

miniature, acorn and hearing aid types, mobile and ruggedized tubes, and pilot lamps.

The ohmmeter-type shorts and leakage test applies about 55 volts through a high-resistance to prevent damage to tubes. High or low resistance leakage or shorts between elements may be detected. A separate test of heater-cathod leakage with all other elements removed from the circuit permits selection of tubes having lowest leakage for critical applications. Emission and transconductance are tested simultaneously under dynamic conditions with one of three available signal voltages applied to the grid.

Control switches select proper plate, screen and other element voltages, and an appropriate load for the tube under test. The gas test detects gassy tubes and open grids in a single operation by throwing one spring-loaded switch upon completion of all other tests.

One model, portable type 220, is housed in a pearl-grey steel case with a heavy-duty metal handle and removable cover which facilitates either portable or bench use. Another model, counter type 219, has identical electrical characteristics and is housed in a wood and metal cabinet.

The portable and counter types measure 6"x11¼"x17" and 5¾"x13"x18¾", respectively.

* * *

PERMUFLUX 8" SPEAKERS

A line of 8" pm speakers, model 8T8-1, has been announced by the Permoflux Corp., 4900 W. Grand Ave., Chicago 39, Ill.

Features include a cone which is soft-suspended from a basket and held at coil-end by an extra large spider.

* * *

N. E. AUTO ANTENNAS

An auto radio antenna, *Hot Rod*, (NP-80) has been announced by the National Electronic Manufacturing Corp., 3505 30th St., Long Island City, N. Y. Features a heavy mounting bracket, large standoff insulator and a chrome-plated whip extending to 96". Intended for rear mounting in the manner of police radio antennas. A shielded leadin eight-feet long is also provided.

Said to be applicable as a transmitting antenna for the 6- and 10-meter amateur bands.

LYNMAR MATCHING TRANSFORMER

An impedance-matching transformer has been developed by Lynmar Engineers, 1721 Delancy St., Philadelphia 3, Pa.

Transformer is said to match a 70-95 ohm coax line to 300-ohm inputs, or a 300-ohm lead to a 70-95 ohm line.

The unit has been designed for the 50 to 250-mc band.

* * *

EMC MUTUAL CONDUCTANCE TUBE TESTERS

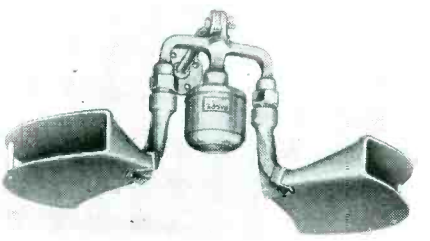
A mutual conductance tube tester that provides checking on a calibrated micromho scale as well as on a *reject-good* scale, has been introduced by Electronic Measurements Corp., 423 Broome Street, New York 13.

The tester, model 201, *also checks tubes for gas content* and checks all tubes operating on .75 to 117 filament volts, as well as all loctal, octal, 9-prong miniature and sub-miniature tubes. Testing can also be done on cold cathode, magic eye, voltage regulator and ballast resistors.

Tester comes with 4½" meter in either a sloping counter case or oak carrying-case.

* * *

COBRA SPEAKERS



Wide-angle cobra loudspeakers employing horns which are said to provide a sound field essentially uniform with respect to frequency and intensity over a horizontal angle of 120° and a vertical angle of 40°. Because re-entrant members with their attendant losses due to concellation effects have been eliminated, these speakers are said to deliver maximum acoustic output with virtually no losses throughout their entire transmission range and with a minimum of input power. Cutoff design point is 370 cycles.

Used back-to-back (as shown) the speakers become bi-directional. The horns may also be oriented and locked to simulate a single, wide-angle speaker.

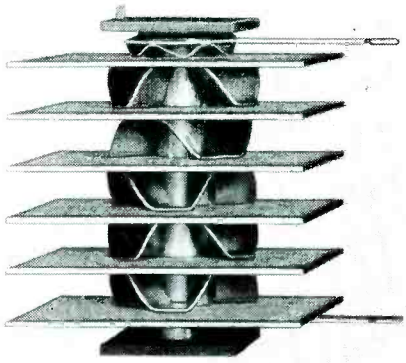
Additional specifications are: 25 watts operating capacity; 50 watts peak capacity; response 370-6,500 cycles; impedance 15 ohms; sensitivity as bi-directional speaker, 105 db at 4', 1 watt input; sensitivity as single wide-angle speaker, 108 db at 4', 1 watt input. (*Type COB; Racon Electric Co.*)

TARZIAN SELENIUM RECTIFIERS

A line of *center-kooled* type selenium rectifiers has been announced by Sarkes Tarzian, Inc., Bloomington, Indiana.

Rectifier's center cooling feature is provided by a special spacer between the cells which is said to insure lower overall operating temperatures by allowing air to reach the portions of the cells in which the current density is the greatest. Other features are said to be constant assembly pressure under all operating conditions, color coding, universal locating lug and a constant high resistance path to ground under all atmospheric conditions.

Sixteen models are available ranging from units rated at 65 milliamperes at 130 volts to units capable of handling 450 milliamperes at 130 volts.



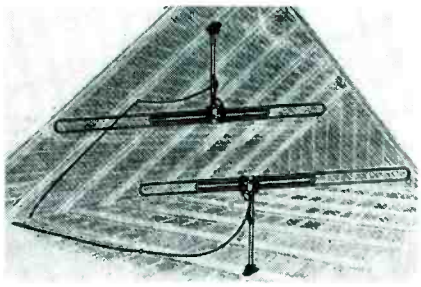
* * *

TRIO ATTIC ANTENNA

An all-channel antenna which can be installed in the attic, on rafters, the floor joist or the attic floor, has been announced by the Trio Manufacturing Co., Griggsville, Ill.

Mounting bracket design is said to permit erection of antenna without guy wires.

Mast is two-feet high. Supplied with sixty-feet of 300-ohm line.



* * *

OXFORD OUTDOOR SPEAKERS

Weatherproof speakers, for outdoor application, have been announced by the Oxford Electric Corp., 3911 S. Michigan Ave., Chicago 15, Ill.

Speakers incorporate Oxford patented *pressure pole* design. This type construction is said to protect the operator against slipping of the pole piece, buzzes and rattles and affords a greater amount of sensitivity. All metal parts are said to be plated per government export specifications to assure maximum protection against corrosion and rust.

Further details available from W. B. Barnes, assistant sales manager.

APPROVED ELECTRONIC FM-AM TUNER

An FM-AM tuner, A-710, has been introduced by Approved Electronic Instrument Corp., 142 Liberty Street, New York 6.

Said to be drift-free and afford fidelity reception. Can be mounted in either horizontal or vertical positions with the appropriate scale supplied.

Tubes used on FM are: 6AG5 *rf* amplifier, 6BE6 mixed-detector, 6J6 oscillator, two 6AU6 *if* amplifiers, 6AU6 limiter and 6AL5 discriminator. Tubes used on AM are: 6BA6 *rf* amplifier, 6BE6 converter, 6BA6 *if* amplifier and 6AT6 diode (audio amplifier common to AM-FM).

Power requirements: 170 volts *dc* 20 mils or 140 volts *dc* 37 mils; 6.3 volts, 4 amperes.

Size: 8¼ x 5⅜ x 8".

PLYMOUTH ELECTRONICS TRANSFER SWITCH

A TV and FM antenna channel-transfer switch for 300-ohm line application has been announced by the Plymouth Electronic Corp., 68 High St., Worcester 8, Mass.

Available for two or three-channel service and can be used with two or three receivers which might be operating from one antenna. Said to have low contact resistance, small capacity, low standing-wave ratio, positive contact and minimum leakage.

Also supplied with contacts for RG59U fittings.

Tube News

G.E. TV TUBES

Three receiving tubes (6AS5, 6BQ6GT and 25BQ6GT), designed mainly for television receivers, have been added to G. E.'s tube production lines.

The 6AS5 is a beam-power amplifier of miniature construction and it is intended for use as the audio power-output tube in TV and small radio receivers. The 6AS5 is similar to the 35C5. When operating class *A*1, with a plate voltage of 150 volts and an input signal of 8.5 volts peak, 2.2 watts of output power can be realized with 10 per cent distortion.

The 6BQ6GT and 25BQ6GT are beam-power amplifier tubes designed to withstand high-surge plate voltages for short periods of time, and intended for use as horizontal-deflection amplifiers in TV receivers.

Maximum ratings of the tubes include a plate dissipation of 10.9 watts, plate current of 100 milliamperes, and a peak-positive-surge plate voltage of 5,000 volts.

* * *

SYLVANIA TUBES

A line of miniature battery-type tubes for portable radio receivers has been announced by the Radio Tube Division of Sylvania Electric Products, Inc.

Tubes include 1U6, a heptode converter with oscillator anode as a separate element; 1AF5, a diode pentode; 1AF4, a sharp cutoff *rf* pentode; and 3E5, a beam power output tube. All tubes have 25 milliampere filaments and are supplied with 7-pin miniature button bases.

Power required for a complement of the tubes in a typical battery-operated superhet is 2.1 watts. Tubes will also operate satisfactorily over a range of 1.4 to 1.1 volts.

Two additional subminiature tube types, a medium-mu triode and a high-mu triode, have also been announced by the Radio Tube Division of Sylvania Electric.

One, type 5645, a medium-mu triode (T-2) is suitable for class *A* amplifier applications. It is 1.3" long and 0.31" in diameter. Under typical operating conditions the tube will have a transconductance of 2700 micromhos and an amplification factor of 20. Maximum rated plate dissipation is 1 watt and plate resistance is 7400 ohms. Another, type 5646, is a high-mu triode (T-2) suitable for class *A* amplifier or resistance-coupled amplifier applications. It is 1.3" long and 0.3" in diameter. Under typical operating conditions the tube will have a transconductance of 2400 micromhos, an amplification factor of 70 and a plate resistance of 29,000 ohms. Maximum rated plate dissipation is 0.3 watt.

Both types have 6.3-volt, 150-milliampere heaters and flexible leads for direct wiring to circuit.

A high-perveance beam-power amplifier, type 6U5GT, designed for use as a horizontal deflection amplifier in high-efficiency deflection circuits for television receivers, has also been announced by Sylvania.

Features include: low-mu, high plate current at low plate voltage and high operating ratio of plate current to number 2 grid current. These operating characteristics are said to make it possible to use the tube in circuits operating from a plate supply of 250 volts or less where the plate voltage is supplied partly by the circuit and partly by the low-voltage *dc* receiver supply.

One 6AU5GT, in a suitable circuit, will deflect 10BP4, 12LP4, or other picture tubes having electron beam deflection up to 60° and operating with an anode voltage up to 12 kv. The tube has a 6.3 volt, 1.25 ampere heater.

Also available from Sylvania is a miniature high-voltage half-wave rectifier, 1X2, designed for TV receiver pulse rectifying systems and voltage doubler circuits for magnetically deflected 10" and 12" viewing tubes. Has a peak inverse plate voltage of 7500, peak plate current of 10 milliamperes, and an average plate current of .5 milliampere.

A miniature tube, 6BW6, designed for combined limiter and FM discriminator applications in television receivers also has been produced by Sylvania.

Tube is also useful in limiter circuits; sync-clipper circuits; square wave generators; frequency multipliers; and phase-measuring devices.

A sixteen-inch metal picture tube, the 16GP4, which is said to be 5" shorter than the 16AP4 also has been announced by Sylvania.

Deflection angle is 70°. Tube is supplied with a neutral gray face pate.

* * *

DU MONT 12LP4A PICTURE TUBE

A type 12LP4A picture tube featuring a bent-gun ion-trap and a gray filter face plate, has been announced by Allen B. DuMont Laboratories, Inc.

Modification of the bent-gun design in the 12LP4A, permitting the use of either a single or double magnet beam-bender is said to insure direct interchangeability with all 12LP4s.

NEWS

G. V. BUREAU JOINS SYLVANIA

Gabriel V. Bureau has been appointed field engineer for the equipment sales department of the Radio Tube Division, Sylvania Electric Products Inc.

Bureau was formerly technical commercial manager for North American Philips and assistant sales manager for Amperex Electronics Corp.

* * *

RUSS FENTON NOW WITH PERMUFLUX

Russ S. Fenton has been appointed sales manager of the Loudspeaker Division of the Permoflux Corp., 4900 W. Grand Ave., Chicago 39.

Fenton was until recently sales manager of the components parts section of G. E.

Russ S. Fenton

* * *

R. D. HICKOK, JR., NOW HICKOK INSTRUMENT CO. PRESIDENT

Robert D. Hickok, Jr., has been elected president of the Hickok Instrument Co. and Walter Weiss has become vice-president in charge of engineering. These changes follow the recent death of Robert D. Hickok, Sr., president and founder of the company.

The new president has been vice-president and acting general manager the last 10 years.

Weiss started the electronic division at Hickok. Hickok has two plants in Cleveland: 10514 DuPont Avenue N. E. and 7209 St. Clair Avenue, N. E.

R. D. Hickok, Jr.

Walter Weiss

* * *

CONCORD RADIO AND RADIO WIRE TELEVISION SEPARATE

A severance of the joint ownership of stock in Concord Radio Corporation and Radio Wire Television, Inc., has been announced.

Samuel J. Novick has acquired all the stock and become the sole stockholder of Concord Radio Corporation, which operates stores under this name in Chicago and Atlanta, Ga.

Abraham Pletman has acquired all the stock and becomes the sole stockholder of Radio Wire Television, Inc., which operates stores in New York City, Newark, N. J., and Boston, Mass.

RIDER MANUAL VOLUME XX NOW AVAILABLE

Rider Manual Volume XX has been published by John F. Rider Publisher, Inc., 480 Canal Street, New York 13, N. Y.

The manual includes coverage on AM-FM receivers, auto radios, record changers, and tuners as of November, 1949. Factory-authorized data of 74 manufacturers comprises 1776 pages.

Priced at $18.00.

* * *

CENTRALAB ACQUIRES NEW PLANT

A new plant, in Denville, N. J., has been acquired by the Centralab Division of Globe-Union Inc., Milwaukee, Wisc., for the exclusive production of a full line of ceramic capacitors, from the raw material to the finished product.

The plant, which is expected to employ some 300 persons, will cover 46,000 square feet.

* * *

SIXTH ANNUAL PACIFIC ELECTRONIC EXHIBIT AT LONG BEACH, CALIF.

The sixth annual Pacific Electronic Exhibit will be held Sept. 13-15 at the Long Beach, Calif., municipal auditorium.

The coast annual convention of IRE will also be held there during the same dates with Loyd Sigmon as liaison chairman between IRE and the West Coast Electronic Manufacturers Association, sponsors of the exhibit.

Heckert Parker is general exhibit manager.

* * *

NEDA CONVENTION IN AUGUST

The first national convention and exhibition of NEDA will be held in Cleveland, August 27 to 31.

* * *

PLANET CATALOG

A catalog, No. C-1, describing dry electrolytic capacitors has been released by Planet Manufacturing Corp., 225 Belleville Ave., Bloomfield, N. J.

* * *

SYLVANIA TV RECEIVER TUBE COMPLEMENT BOOK

A 56-page TV receiver tube complement book listing by make and by model the number and type of receiving and picture tubes used in more than 620 sets, has been announced by Sylvania Electric Products, Inc.

The book also contains a chart showing the percentage of each of 136 receiving tube types used in TV sets distributed by 85 manufacturers. The reference material in the book also includes a list of 80 TV set manufacturers and their addresses for use in securing more service information on a particular set.

Another section of the book describes modifications required, if any, for 120 television picture tube replacement types, because of change of dimension, electrical characteristics, socketing and others specifications. Suggestions for safe handling of picture tubes is also included in the book, which measures 8"x5½" and is available through authorized Sylvania distributors.

JOTS AND FLASHES

INSTALLATION OF MULTIPLE-OUTLET antenna systems, a required procedure in many metropolitan areas, has introduced a new busy and profitable phase of installation work, packaged outlet-to-receiver service. While every outlet is identical, the receiver inputs do require connection-technique variations, as cited in the Ira Kamen paper in the January issue of SERVICE, and as a result Service Men must be called in to make the proper connection to the antenna outlet. Several types of setups for the outlet systems have been devised, some involving specific procedures for similar type receivers and others employing prefabricated outlet units to standardize the job in the home. And several types of group-installation methods have been used, too, to streamline activities and lower costs. The plans appear to have such intriguing possibilities, of interest to every Service Man, that we've asked the boys now involved in the work, to provide us with detailed data, which we hope to offer in an early issue of SERVICE. . . . GE has announced that its TV *if* have been moved up to the 45-mc band in an effort to minimize pickup of diathermy and industrial equipment radiation, and interference in other receivers. . . . George D. Norris, 3010 First Avenue, Seattle, Washington, is now a rep for Radio Merchandise Sales, Inc., 1165 Southern Boulevard, New York City. Norris will cover the Northwest territory of Washington and Oregon. . . . Ben Joseph has become a VEE-D-X rep and will cover the New York City, Long Island and Northern New Jersey areas. . . . Jack Weber Associates, 154 Nassau Street, New York City, have been appointed reps of the Odegaard Manufacturing Co., 5416 Eighth Avenue, Brooklyn 20, N. Y. and will cover New York State (excluding metropolitan New York City), New Jersey, Eastern Pennsylvania, Delaware, Maryland and Washington, D. C. . . . Advertising for the radio and TV components produced by the Loudspeaker Division of the Permoflux Corp., 4900 West Grand Avenue, Chicago, is now being handled by Symonds, MacKenzie and Co. . . . Herman H. Smith, Inc., is now located at 436 18th Street, Brooklyn 15, N. Y. . . . Nicholas J. Laub, 413 Merchandise Bldg., Minneapolis, Minnesota, has become a senior member of *The Representatives*. . . . R. W. Farris, 406 W. 34 St., Kansas City, Missouri, has become a Ward Products rep and will cover Missouri, Kansas, Nebraska and Iowa. . . . Radio Shack Corp., 167 Washington St., Boston 8, Mass., have published a 152-page catalog. . . . The Espey Manufacturing Co., 528 East 72 St., New York 21, have released an 8-page bulletin describing their AM-FM chassis and the associated wire recorder, record changer, speaker, TV and custom-made cabinets which can be used with the chassis. . . . Aero-Tone Manufacturing Co., Inc., 4836 Joy Road, Detroit 4, Michigan, have released a 4-page folder describing their line of auxiliary speakers for automobile rear-seat application. . . . Ray P. Krogh will represent the Sound and Intercom Division of Webster Electric Co., Racine, Wisconsin, in eastern and southern Wisconsin and the eastern upper peninsula of Michigan. Krogh will also serve as a rep for Ekotape, a Webster Electric product.

ADVERTISERS IN THIS ISSUE

SERVICE INDEX—MARCH, 1950

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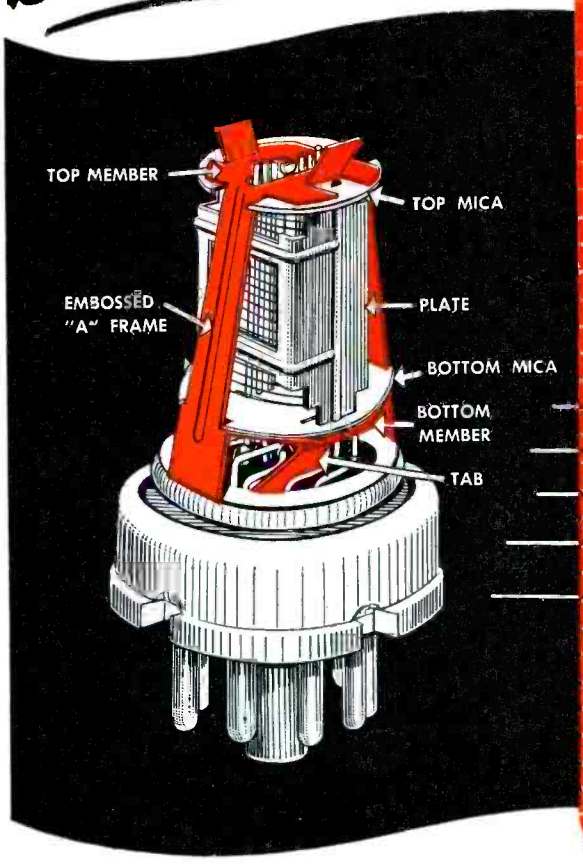

The inside story of Cunningham quality

2. **How the Cunningham "A" Frame Minimizes Vibration.** The unflagging search for ways to make Cunningham tubes ever better accounts for their *first-line* quality. A case in point is the RCA-developed "A" frame construction used in 6 of the metal-type r-f amplifier tubes.

The "A" frame—shown in color—consists of a top member, two vertical members, and a bottom cross member. The ribbed uprights are welded to the cross member; the feet of the uprights are welded to the grounded metal header. In effect a truss, this rigid "A" frame acts as the supporting member for the tube elements. Its increased resistance to vibration reduces the possibility of electrode displacement due to wear on the holes in the mica spacers . . . and thereby plays an important role in reducing microphonics and maintaining uniform tube characteristics.

In addition to imparting rigidity to the tube elements, the top and bottom members of the "A" frame serve as shields. The two ears on the top member add to its effectiveness in reducing grid-to-plate capacitance; the tab on the lower member—which extends down to the stem—provides additional shielding between grid and plate leads.

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The "A" frame construction is but one of many improvements that contribute to the dependability and long life of Cunningham tubes. Its use explains why more and more servicemen are placing their confidence in Cunningham.

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