SERVICE DEALER and ELECTRONIC SERVICING

AUGUST 1956

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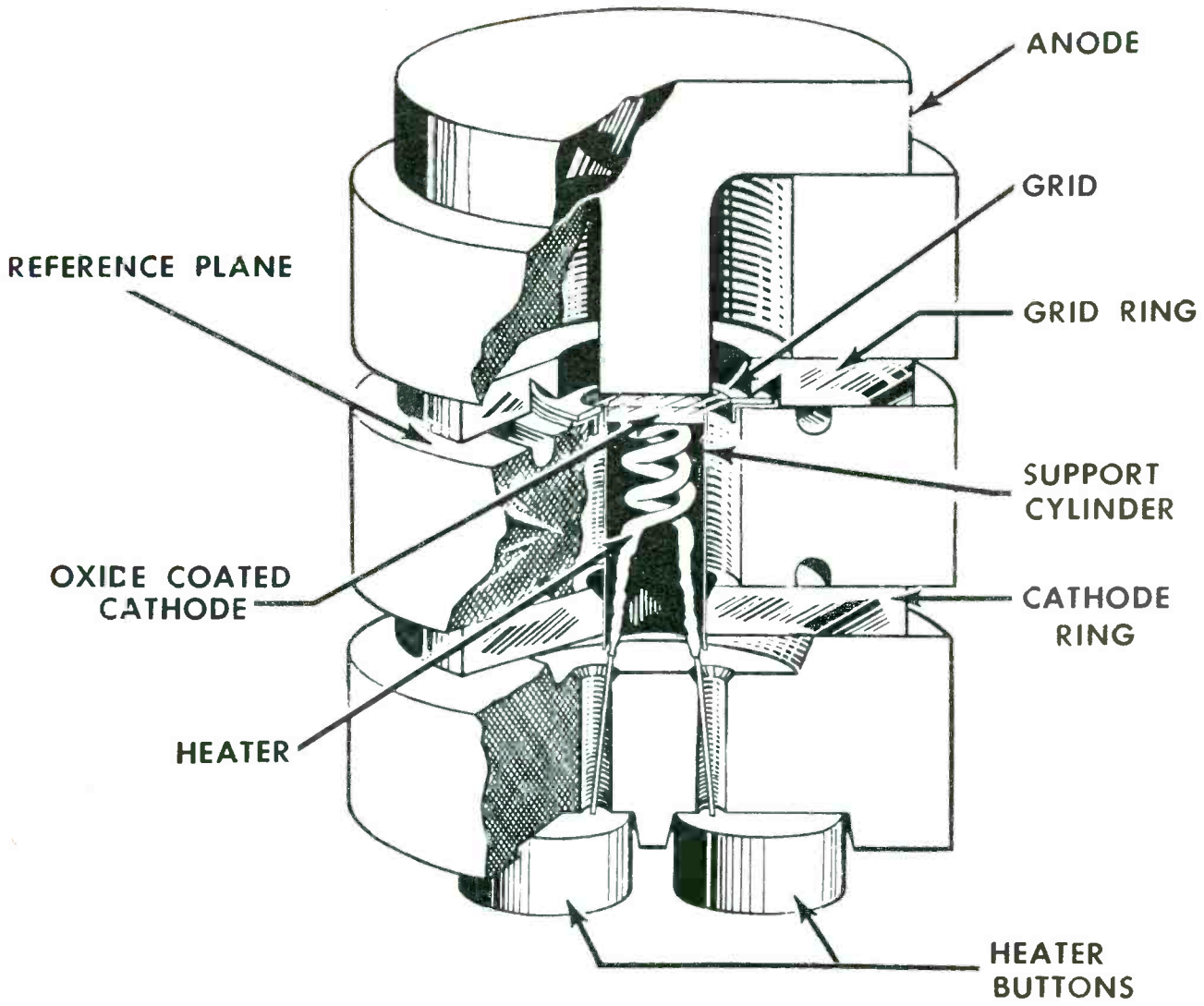

MICRO-MINIATURE CERAMIC TUBE

Photo explanation on page 1

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SERVICE DEALER and ELECTRONIC SERVICING

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FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

THIS MONTH'S FRONT COVER

The new G.E. "micro-miniature" ceramic triode 6BY4 for UHF TV sets.

COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.

S. R. COWAN

Ad Libs

The Votes Are In

You will recall that in April we announced that starting in May this magazine would go to "King-Size" and we explained in a superficial manner why that change would take place. Now, because so many subscribers have asked us to do so, we will give you fuller details as to the reasons for the change.

During the last quarter of 1955 we made a survey and asked every tenth reader of our magazine, (nearly 7,000 of the 70,000), a series of questions. For example, we asked the nation's servicemen what they liked about our magazine and other servicemen's magazines, what they disliked about our magazine and the other servicemen's magazines, and finally we asked for their suggestions as to what we could do as a publication to help them.

Almost 5,000 replies came in and strangely enough nearly 4,600 service shop owners remarked that the greatest contribution we

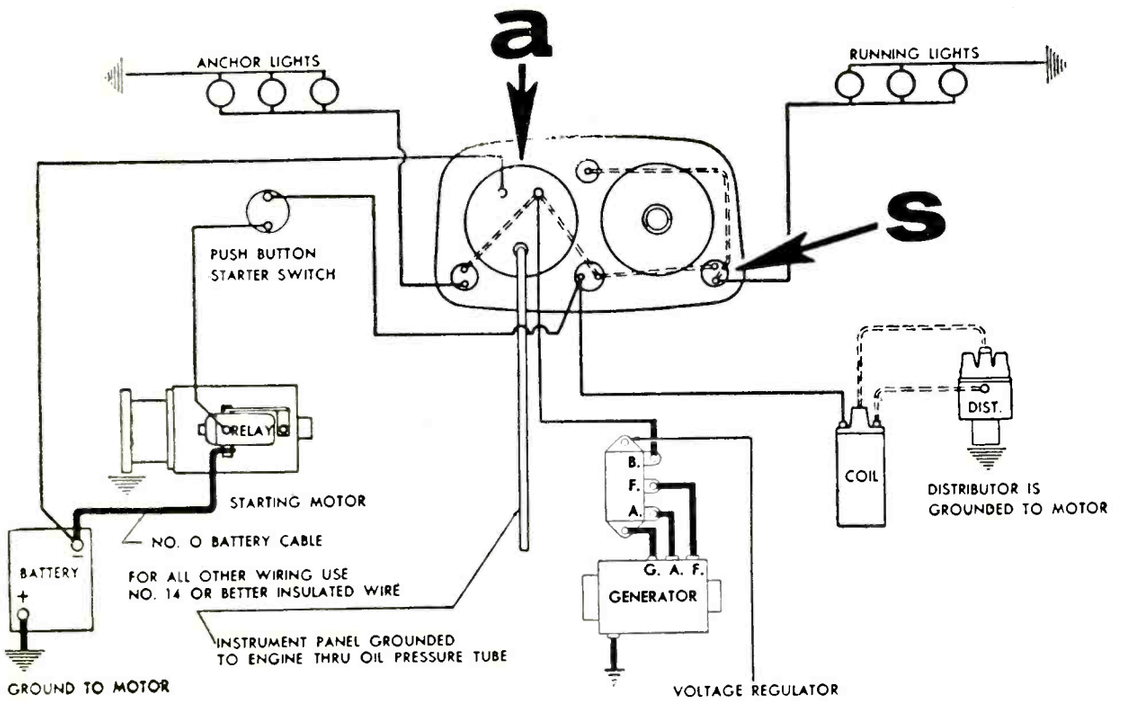
could make would be to show them how to make more money by opening new fields of endeavor for them. That overwhelming, simple and pointed request was the determining factor in our decision to open new service vistas for our readers.

Of course only 10% of our readership was involved in the survey and the other 90% did not know what was happening until our format - change announcement appeared in the April issue. Subsequently, since the May issue reached our subscribers. our mail has been rather heavy, and we feel that you are entitled to know what our readers' reaction has been.

The first 18 letters we received came from service shop owners who voiced strong indignation and objection to our new format. 17 of the 18 men stated that the new magazine was so big that it did not fit on their shelves. During the next few weeks scores of other letters arrived and amongst them was only an occasional letter of criticism, the bulk of the letters being congratulatory. Now, just two months later I am happy to report that a total of 31 letters of criticism about our new format have reached me while 179 unsolicited letters complimenting us on our new format and broadened editorial scope have also arrived.

Strangely enough, of the 31 critical letters received, only 2 were written on business letterheads; all the others being written on either postcards or plain paper. However, of the 179 letters favoring our new format, only 6 were on plain paper or postcards and 173 were on professional letter-

[*Continued on page 7*]



(*Courtesy Gray Marine Motor Co.*)

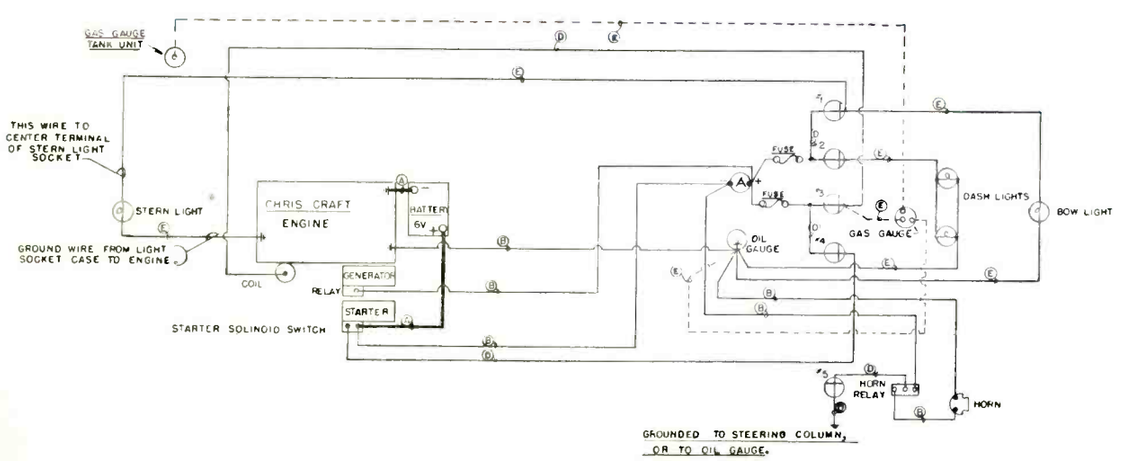
Fig. 1—Typical boat engine-battery system. (a) indicates ammeter, (s) switches.

Various electrical wiring systems used in typical boat installations are discussed in this installment. Precautions for the prevention of accidents are also discussed.

PART 3—BOAT ELECTRICAL SYSTEMS

by **ELBERT ROBBERSON**
Marine Electronics Consultant

The Marine Electronic Business



(*Courtesy Chris-Craft*)

Fig. 2—Circuit of more elaborate boat wiring system.

Tote a piece of electronic equipment into a man's home and nobody has the least trepidation about plugging it into an electrical outlet.

But step foot over the side of the same man's boat, and you're in a different world. To the person accustomed to shore circuits, where Underwriters' and power-company rules keeps things fairly well in order, the usual small-boat electric system will seem like chaos.

You'll find power feed lines for different devices hooked onto the engine battery, the electric starter, the dashboard ammeter and (of all places) *the engine oil gage!*

But once you know how these lashups are derived, you can safely connect your own contribution to the boat's equipment. In badly confused situations, you might suggest a little electrical reorganization to the owner, which will make for a more reliable system.

Following this thought a little further, a service

man who becomes an expert in this field may gain considerable extra business by taking care of the more complex electrical needs of a number of small shipyards and boat dealers. Usually, there just isn't enough electrical work at any one small yard to sustain a specialist. So one of the engine mechanics is called upon to double as electrician. The bad results of having electrical work performed by alumni of the corner gas station are evident wherever you find boats.

Simple Battery Systems

Aside from the personnel involved, most confusion in the boat electrical systems stems from the fact that the majority of today's boat engines are beefed-up automobile engines. In the interest of economy, automobile wiring practice is followed, with one side of the battery grounded to the engine, and the engine block and various other masses of metal connected to it acting as ground returns. The polarity of the battery ground varies between engine manufacturers, and may change from year to year. In practice, it does not matter which side is grounded, just as long as there are no cross-polarity connections.

Fig. 1 shows a typical boat engine-battery system. One pole of the battery (in this case positive) and the ground returns of the charging generators, engine starter, ignition system, etc., are all connected to the engine block. Note that this ground and the lead over to the starting-motor solenoid switch are the only heavy conductors from the battery. Because of the high starter current there are no fuses in this heavy line.

The "hot" power feed for auxiliary and lighting circuits is a single wire run from the ungrounded terminal of the battery, as shown, to the dashboard ammeter, or more often this wire is connected to the solenoid. The wire, and branches from here on out, may be as light as No. 14 gage. Load circuits, and the generator, are connected to the other side of the ammeter, so that current going into or out of the battery makes the meter register "charge" or "discharge."

The simplest installations have no fuses or circuit breakers other than a toggle switch on the control panel. Although the schematic shows only the hot wire running out to the lights, with the return to ground at that point, two wires are actually used. One of them is the hot wire and the other the ground return. And here is where some odd connections may be found, such as terminals on the oil gage (which on the surface seems to have nothing to do with electricity). It has been common practice to ground auxiliary return circuits to any piece of hardware that connects metallically to the engine. Thus, steering columns, clutch controls, pressure gages connected to the engine by a copper tubing, and whatnot will be found "doubling" as electrical conductors.

When a boat having such a system is originally delivered, it may be entirely bare of any other electrical gadgets. However, the new skipper invariably loads on the equipment. Windshield wipers, horns, cabin lights are the starting point. As circuits are added, they may be connected to the ammeter until the terminal is full, and not one more wire can be squeezed under the nut. Then wires begin doubling up on the ignition switch and any other "hot" points that can be found. Things installed in the engine compartment, such as an electric bilge pump, are usually connected to the "hot" solenoid terminal or the battery. Thus, the electrical system turns into quite an amazing growth.

Semi-Protected Battery Systems

Figure 2 shows the circuit of a somewhat more elaborate boat wiring system. Note that load circuits are protected by fuses as well as having "on"-"off" switches. Some boats have the fuses behind the dashboard wherever room is found—the better jobs have a switchboard, installed in a cabinet or provided with a protective cover.

Note that the electric horn is fed from the battery side of the ammeter, rather than on the "load" side used for other circuits. This is because horn current is so high it would damage the ammeter. And, as in the case of the engine-starting motor, the horn is not fused.

Two or three-engine boats have complete battery systems for each engine, along the lines of either of the preceding. Although boats large enough to have more than one engine usually carry an auxiliary battery system for lighting and power, some loads, such as the dashboard and navigating lights, will still be operated from the engine batteries. In this case, the circuits may be split up—for instance with the battery of one engine supplying dashlights, and the battery of the other furnishing electricity for running lights, etc.

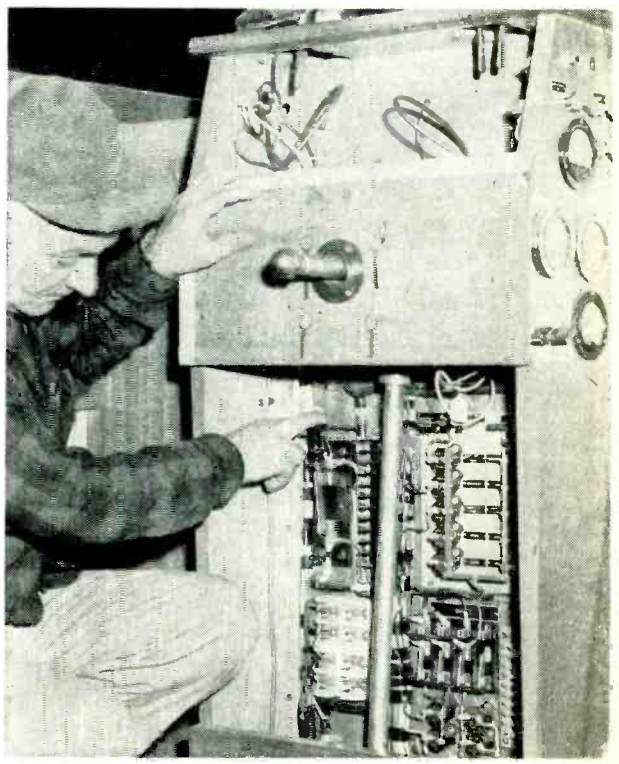
In the interests of safety, some boats are wired with heavy (100-ampere or more) knife or inclosed switches in the main battery leads to disconnect all load when the boat is not manned. And some have double-throw switches here, arranged so either battery can be used to start either engine in an emergency. Because of the voltage loss in lengthy high-current cables, such switches are as close to the engines as possible—sometimes directly at the batteries.

Great caution is, of course, necessary when working around open switches (and all of the other battery-circuit terminals, for that matter). Six or twelve volts may sound "tame" to the technician accustomed to working in the thousands—but a heavy short circuit can cause hundreds of amperes to flow in a hurry. This is enough to blow up a tool in your face, melt a ring on your finger, or a wrist-watch band on your arm: very unpleasant, not to mention fire danger.

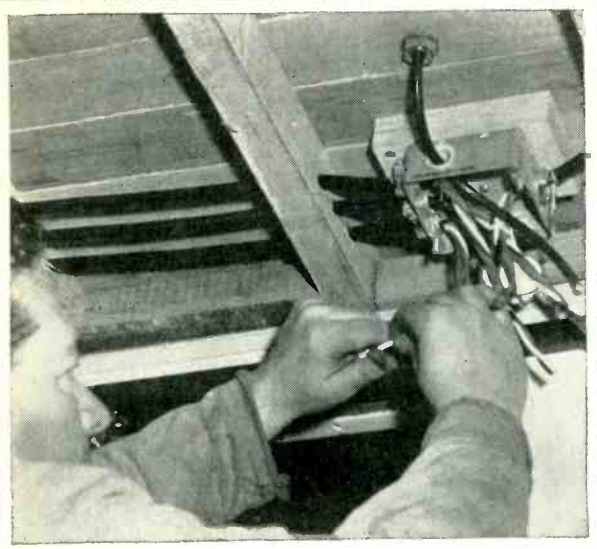
On small boats, heavy current equipment is connected directly to the battery.

Remember that gasoline fumes are terrifically explosive, and easy to ignite. The engine room of a boat is no place to test batteries or circuits by "sparking" wires together. When a boat starts to "blow" there are only milliseconds to get out, and very few people have made it without injury.

There have been a few twin-engine boats built



Example of panel on 50 foot boat. Not suitable for very heavy-current equipment.



Well-engineered boats have separate circuits and junction boxes as illustrated above.

with the battery for one engine positively grounded, and the other engine battery negatively grounded. This arrangement provides two separate six-volt sources of power, and 12 volts for higher-current equipment between the "hot" sides of the two batteries. Naturally, the 12-volt lines cannot be used to operate any device which is designed with one of its input legs grounded, since this would short-circuit one battery.

It is obvious that only equipment having very low current requirements can be tapped into the usual boat circuits because of the small wire used, and the fact that circuits are very likely overloaded by the time you get there. Standard practice is therefore to connect electronic gear directly to the battery with heavy cable or, better yet, to the solenoid "hot" terminal and to the same stud on the engine that the battery ground connects to. The latter connection is safer, since the person servicing the batteries cannot mis-connect the cables as easily as if four or more wires were involved.

On low-voltage feed lines, such as for radiotelephones, heavy motors, etc., fuses are almost never used. The reason is that at currents of 25 or 50 amperes, which are common, the voltage drop across the fuse is sufficient to affect operation of the equipment. This fact demands that all such circuits be most carefully designed, installed, and worked around, so there is no chance whatever of a short circuit. The bilge or behind the panelling of a boat is not the place for burning insulation and melting copper.

Auxiliary Battery Systems

Most boats over 35 feet or so in length have auxiliary battery systems, and generators, separate from the engine system. Voltages are 12 or 32 and on the largest vessels, 110 volts. The auxiliary generator may be run from one of the engines by a V-belt, or it may be a separate gasoline or diesel engine-driven unit. Conventional *dc* machines are most common, but some of the newer units have alternators and selenium rectifiers. Usually the negative side of the system is grounded, because the generators are built that way, but there are cases in which systems have been converted to positive ground to conform to the ground polarity used on the engine, or in the belief that this will give less electrolysis danger.

There should be no intermingling of engine and auxiliary electrical circuits, although the engine generating unit may be arranged to switch over and charge the propulsion engine batteries.

Although it is sometimes done as a matter of expedience, battery banks should not be partially tapped, to operate lower-voltage devices. This will overwork some of the batteries, leading to their possible failure earlier than the rest. Equipment put on a boat should be chosen for the full voltage of the bank from which it is to be operated.

Auxiliary battery systems are generally better engineered than engine systems, with switchboards and fuses for different branches. and very often reserve positions for future installations. Sometimes terminals will be reserved for radio equipment—however, it is quite common that the wire to these terminals is not heavy enough and will have to be replaced or ignored.

Even more care should be taken in working on auxiliary battery systems than in working on the engine batteries because of the danger of arcs. A high voltage arc will "draw" out quite a distance and may be difficult to extinguish before a lot of hardware has melted.

On any boat electrical system watch out for leakage current, which is indicative of insulation failure or a cross-ground connection. With everything aboard turned off, there should be no current flow from the battery—if there is, locate the source by disconnecting wires until flow stops. and correct the defect before doing anything else. Otherwise, there is danger of fire or electrolysis damage, a scourge which will be covered in detail later.

Alternating Current

A few years ago, *ac* on a boat was unheard of. But with more and more docks being equipped with shore power lines, and with the development of compact, efficient, quiet and reasonably priced *dc*-to-*ac* converters, it is becoming commonplace. The result is that many new boats are wired for *ac* as well as *dc*.

One simple arrangement is the installation of a converter unit which operates from 110-volt shore *ac*, changing it to the boat's normal voltage, such as 6, 12, or 32 volts, and rectifying it. This *dc*, is "floated across" the battery, to supply extra current and charge the batteries during "resting" periods.

A variation of this type of converter disconnects the batteries from the load and supplies low-voltage *ac* directly to the boat's lighting circuits. Naturally, *dc* devices cannot be used while the shore *ac* is in the boat lines.

Still other boats have two entirely separate lighting systems, one fitted with low-voltage *dc* fixtures, and the other having 110-volt *ac* lights and appliances. In fact, dual lighting fixtures for this kind of operation are often used.

But with these systems, leaving the dock means the end of such diversions as "hi-fi" and TV. For this reason some boats are coming around to generating their own *ac*.

Some have engine-driven alternators, but this requires operation of the engine to get electricity. The more popular means of getting alternating current is through use of a converter, operating from the boat's batteries.

There are two kinds. One, the rotary type, is simply a *dc* motor and an alternator on the same shaft. These are fairly efficient, and will handle any desired amount of power, but they are mechanically noisy, and without special filtering, cause electrical interference. On top of this, some of them require periodic lubrication; and brushes, commutators and slip rings all have to be kept in shape.

More recently developed, and becoming popular, is the vibrator-type converter. In these, an expendable chopper makes *ac* from battery current, and steps it up to 110 volts with a transformer. An example of this type of unit is the Cornell-Dubilier "Powercon," one series of which is engineered specifically for marine application, with capacity up to 375 VA.

Caution To Be Observed

Some conventional *ac* equipment can be operated from shore power, or from converters, on a boat.

[*Continued on page 42*]

Cornell-Dubilier Powercon converter supplying 110 V.A.C. household power from boat battery system to dictation machine.

AD LIBS

[*from page 3*]

heads. It would seem to me that the more progressive and businesslike type of service firm operator has recognized the efforts we are expending on behalf of all professional servicemen much more so than those servicemen who do not even deem it worthwhile to use professional letterheads. However, to the latter group, and to all those who at present still feel a little "put out" because of our magazine's larger size, may we suggest that they just keep reading it and see if they don't eventually agree that they are getting a better magazine than heretofore.

Moch Resigns From TESA

The Television Electronic Service Association of Chicagoland was established 8 years ago, largely through the efforts of Frank J. Moch who became its first President and who has held that position until recently when he resigned. In the meanwhile, Mr. Moch was very active in the formation of NATESA (National Alliance of Television & Electronic Service Associations) and he also assumed, and still retains, the presidency of that organization.

In the publicity release announcing Mr. Moch's relinquishment of his title with the local Chicago Servicemen's association he stated that as time passed the demands of the association work had become so overwhelming as to almost necessitate that the executive head devote his full time to it. We have noted that the same condition exists in several other parts of the country where the Presidents of

[*Continued on page 8*]

the respective servicemen's associations have out of the goodness of their hearts and with complete sincerity, almost lost their own businesses in their efforts to coordinate the efforts of the associations which they headed.

It thus becomes obvious that for an association to be truly effective it must find a way or means of paying its top men, call them the Coordinators or Presidents, as you will, some fee to reimburse them for the services they are rendering when taking losses from their normal business occupation.

Tube Developments

Hardly a day passes wherein some engineer does not conceive of the need for some new type of electronic tube. Only a few years ago tube manufacturers and radio-TV receiver equipment designers agreed that the 680-odd tube types then available would suffice to meet any need in the then forseeable future. In fact, there was a movement for a while to eliminate a great many tube types in the belief that many of those that were then available had already become obsolete.

Progress will not stand still and for that reason the idea of reducing the number of tube types in production was abandoned and from that day until this more and more new tubes have been conceived and put into production, and as this is written many other new ideas are in the drawing board stage.

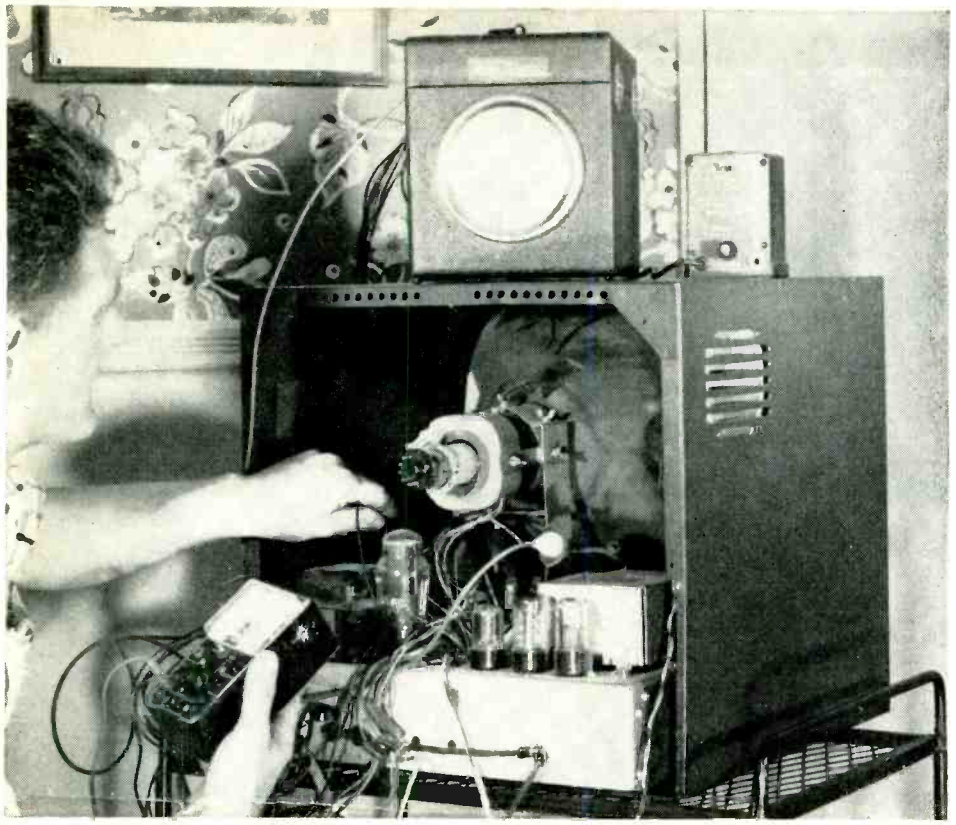
Late last Fall General Electric announced the release of a tiny "Micro-Miniature" Ceramic Triode for UHF television receivers. The new all-metal and ceramic tube, which is about

3/8" long and 5/16" in diameter, was given the type number 6BY4. This particular tube was rated to operate with a noise factor of approximately *8 db* and a power gain approximating 15 *db* when operated at 900 *mc*.

As one can see by glancing at our front cover this month the 6BY4 tube features micro spacing of elements and a grid of approximately 1,000 turns per inch. The simplified design permitted a relatively low list price.

The particular tube under discussion is simply the forerunner of an entirely new engineering concept and line of tiny electronic tubes from diodes to complex multi-element tubes, all of which will have application in mobile and industrial communications equipment, airborne and mobile radar, industrial controls, etc. Because of its ruggedness this type of design permits further exploration in the Guided Missile program, but even more important is the present day application of the tube in UHF circuits. Because at present the FCC is becoming more and more conscious of the potential of UHF in television, (not that we agree with their philosophy) it is incumbent upon all developmental engineers to reinvestigate and continue their research into the development of components that will be required for combination UHF-VHF television transmission and reception usage.

It is said that history repeats itself. How true! Not very long ago the entire industry was trying to meet the demands for UHF tuners. Then UHF came upon bad days and it was only recently that a revitalization program became mandatory.



Convenience of trouble shoooting receiver with a CRT and yoke substitution tester is illustrated above, showing instruments being used.

TROUBLE SHOOTING THE YOKE AND CRT

by B. Jarmalow
Chief Engineer Telematic Industries, Inc.

Yoke Network

Since there are different stray capacitances existing from different points of the horizontal yoke windings to ground, a balancing capacitor is connected across the high side to offset this condition and prevent ringing. The latter takes the form of light and dark vertical bars at the extreme left of the screen and which diminish gradually towards the center.

Typical balancing capacitors for 70 degree yokes are 47, 56, and 68 $\mu\mu f$. 90 degree yokes use capacitors of the order of 100 $\mu\mu f$. They also use a higher capacitance to offset the greater stray capacitance resulting from the use of a yoke with a wider flare and greater inductance.

A replacement yoke must have a balancing capacitor with the same capacitance as the original, if ringing is to be prevented. The two resistors connected across the vertical windings (generally, 560 or 1 K ohms) are used to prevent the vertical windings from breaking into oscillation. Although the size of these resistors is not critical, lower than normal ohmic values could result in reduced picture height.

Identifying Horizontal and Vertical Windings

When checking or replacing a yoke, the horizontal and vertical leads must be identified. One way of doing this is by identifying the horizontal and vertical *windings*. The relative positions of both windings are the same for all yokes and these are shown in *Fig. 4*. The horizontal and vertical windings lie in the vertical and horizontal planes, respectively. This is done since the CRT electron beam is deflected at right angles to the magnetic fields which are produced by the windings. Note also, from *Fig. 4*, that the horizontal windings are closer to the CRT neck, so that they have the greater effect on the electron beam. In some yokes, however, such as for G. E., the vertical windings are placed closer to the CRT neck.

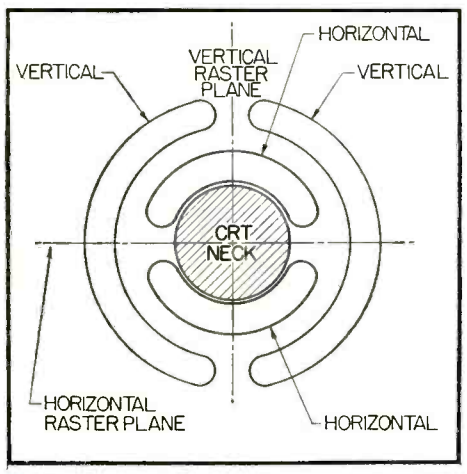


Fig. 4—Cross section of yoke and CRT neck showing windings only with relation to CRT neck.

The illustration in *Fig. 4* might very well represent the front-view of a yoke. A plastic spacer between each set of windings prevents shorting from the horizontal to the vertical windings. To identify the yoke windings, with the yoke back cover removed, refer to *Fig. 5*. The windings which are visible (inner ones) are the horizontal; the vertical windings are hidden by the plastic spacer. A schematic representation of the yoke is also shown in *Fig. 5*, so that the relationship between it and the rear view may be discussed.

The yoke has two terminal strips and each has four terminals. The terminals are either numbered on the strips or etched on the casing. The terminal numbers indicated in *Fig. 5* are typical of most yokes. Compare these numbers with those shown on the schematic representation. Capacitor *C1*, across terminals *1* and *2*, is the yoke balancing capacitor, which is connected across the horizontal winding on the high side. Many yokes have *C1* connected across terminals *3* and *7*. Resistors *R1* and *R2*, the damping resistors, are connected across each vertical winding (terminals *4-5* and *6-8*). The two horizontal windings are connected together by a jumper lead from terminal *2* to *7*; the vertical windings are connected by the jumper lead from terminals *5* to *8*.

The yoke lead which connects to capacitor *C1* is the horizontal winding high-side lead (terminal *1*). The two leads which connect to resistors *R1* and

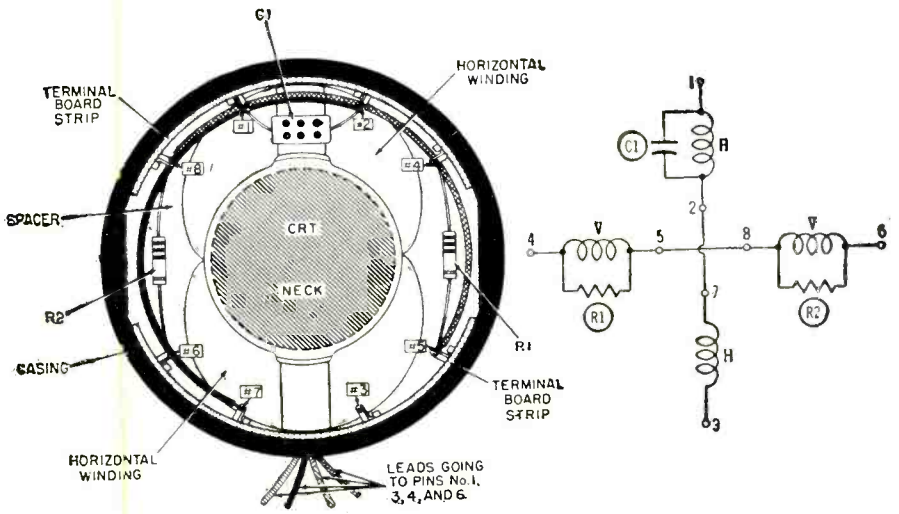
A thorough coverage of yoke construction, operation, and trouble shooting procedures. Chart is provided.

Part II

R2 are the vertical winding leads. The high and low sides of the yoke are difficult to determine, although terminal 4 is usually the high-side. The fourth remaining unidentified lead connects to the horizontal winding low side (terminal 3). Although set manufacturers do not follow any lead color code in particular, it will be found that many use blue (high side) and red (low side) for the horizontal and brown (high side) and green (low side) for the vertical.

Some yokes incorporate a resistor (about 1K) in series with the balancing capacitor. See *R3* in *Fig. 6A*. Still other yokes omit the damping resistors, *R1* and *R2*. In direct-drive yokes, resistors *R1* and *R2* are not used. Instead, a capacitor (about 270-$\mu\mu f$) is connected between the horizontal and vertical windings (*C2* in *Fig. 6B*) which minimizes yoke cross-talk. Cross-talk results in a moveable, dark horizontal hum bar(s) in the picture. Some direct-drive yokes, such as Motorola's have the vertical and horizontal windings jumped (terminals 3 and 8, in *Fig. 6C*) and capacitor *C2* is not used.

Many of the yokes used in newer sets have five leads. The fifth lead connects to the center point of the horizontal winding, through a resistor, about 1K, as shown in *Fig. 6D*. This lead connects to the flyback transformer to provide better yoke balancing. *To make the replacement yoke equivalent to the five-lead yoke, simply connect an additional lead to the horizontal winding center-tap.* In most cases, the balancing capacitor, *C1*, will be included. Some manufacturers, such as Magnavox and Philco, leave these capacitors out. Sylvania and G.E., among others, connect the two horiz. windings in parallel (*Fig. 6E*), which eliminates the need for a balancing capacitor. This yoke operates in the same way as two horizontal windings connected in series. Consequently, a replacement yoke, which has two horizontal windings in series, may replace this yoke by connecting it to the same taps on the flyback. In this case, a balancing capacitor must be connected across the high side of the horizontal winding to eliminate ringing. Several different values may have to be tried.



(Courtesy: Reprinted from Howard Sams "Servicing TV Sweep Systems," by J. Dines)

Fig. 5—Similar cross section as that of Fig. 4; in this case all parts are shown with corresponding schematic on the right.

Removing a "Frozen" Yoke

Yokes which are defective, or which have not been disturbed for a very long period of time, tend to adhere, or "freeze," to the CRT neck. They should not be forced, lest the CRT be broken. One way to loosen the yoke is to apply 115 volts *ac*, for about 10 seconds, across the horizontal windings after the yoke leads have all been disconnected. The yoke will become warm, and twisting it while pulling it away from the CRT should free it. If necessary, repeat this procedure several times.

Yoke Troubleshooting Chart

The chart on page 12 may be used as a reference to identify yoke troubles quickly. The causes and remedies of the various troubles are also indicated.

Using 5AXP4 for 24 or 27 inch CRTs

High voltages, of the order of 20 kv, are usually needed to operate 24 or 27 inch, 90-degree CRTs. When the 5AXP4 is used as a temporary substitute for such a tube, the high voltage may damage it permanently. Furthermore, it is necessary to properly load down the flyback circuit of the receiver. To satisfy these conditions, it has been found that a 150 megohm voltage divider network must be used, as shown in *Fig. 7*. Fifteen *10 meg, 1w,* resistors form the divider. Mounting the resistors on a terminal board will make the divider more compact and reduce the chances of arcing between resistors. An alligator clip is attached to each end of the string and a high voltage wire (with 2nd anode suction cap) is attached to the junction of the fifth and sixth resistors. The entire resistor string is then taped with high-voltage plastic, such as vinyl.

For a 24 inch CRT, whose high voltage requirement is less than that of a 27-inch CRT, alligator clips #1 and #2 are connected to the set *hv* lead and chassis ground, respectively. This de-

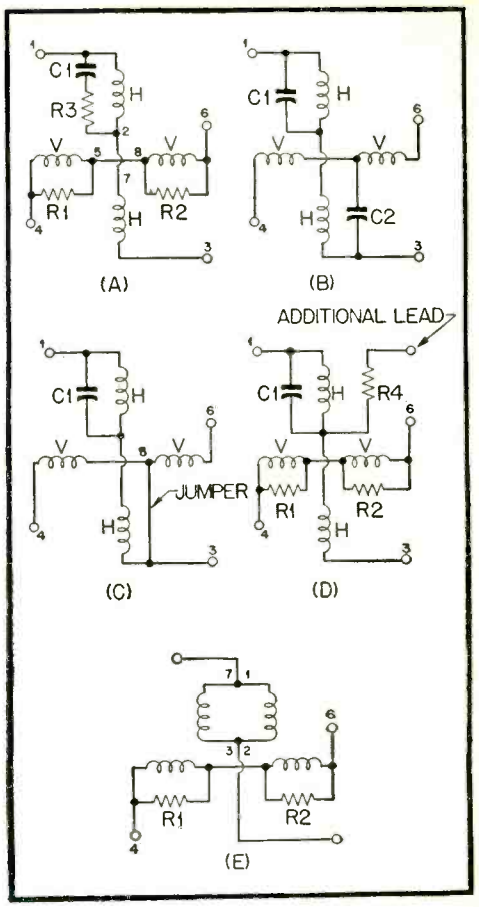


Fig. 6—Connections for different yoke types.

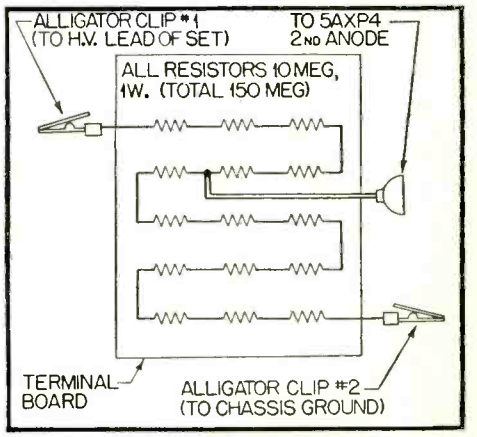


Fig. 7—Voltage divider for using 5AXP4 tube as a substitute for 24" and 27" high voltage tubes.

livers about 2/3 of the available voltage to the 5AXP4. For 27-inch CRTs, the connections to clips #1 and #2 are reversed. Now only about 1/3 of the available h-v from the set feeds the 5AXP4 2nd anode. In some cases, blooming (a poor focusing, low-brightness picture resulting from insufficient high-voltage) will occur, but this should not hinder the troubleshooting to any appreciable extent.

C.R.T. Troubles

A defective CRT is easy to detect where the fault is obvious, such as an open heater or a screen marred by an ion burn. Often, however, symptoms occur which, from both experience and reasoning, appear to be the result of trouble in the circuitry of the receiver, and do not seem to have any connection with the CRT at all.

When electrical leakages or shorts occur between elements of the CRT gun assembly, voltages are coupled from one circuit into another. This causes symptoms to appear which are similar to indications of defective blacking or bypass condensers or other components in the set. If the CRT seems to be in good condition, judging from the brightness and focus, one might start looking anywhere but there for trouble.

An example might be the case where 1st or 2nd anode voltages leak to the control grid, overcoming the normal bias and placing a positive potential thereon. In most sets the raster brightness would become excessive and irreducible to zero. In some older sets however, where the sync signal is taken from the CRT grid circuit, compression of the pulses would occur resulting in sync instability.

A CRT cathode-heater leak in some models would produce a 60-cycle hum pattern (horizontal half-shading) of the raster and in sets where the video is cathode fed to the CRT a loss of video could be expected.

In brightness control schemes where the CRT cathode is tied to the low voltage line and the heater is at ground, a cathode to heater short would knock out the front end and I.F. supply voltage, resulting in loss of both picture and sound.

Unless all indications definitely point elsewhere, a quick substitution of the CRT before proceeding further might save needless probing and much valuable time. ■■

TROUBLE	CAUSE	REMEDY
Ringing	No capacitor (or improper value) across horizontal winding; yoke mismatch	*Insert proper yoke balancing capacitor; use properly matched yoke*
Keystoning and reduced height (trapezoid)	Short in vertical windings or damping resistors	*Replace damping resistors or yoke*
Keystoning and reduced width (trapezoid)	Short in horizontal windings or balancing capacitor	*Replace balancing capacitor or yoke*
Upside-down picture	Vertical winding leads reversed	*Reverse vertical winding leads*
Horizontally reversed picture	Horizontal winding leads reversed	*Reverse horizontal winding leads*
Arcing in yoke	Short in a winding	*Replace yoke*
Barrelling (bulging raster)	Conventional wound yoke used in place of cosine or cosine-squared yoke	*Use cosine, or cosine-squared yoke*
Pincushioning (caved-in raster)	Cosine, or cosine-squared yoke used in place of conventional yoke	*Use conventional-wound yoke, or install anti-pincushion magnets*
Tilted, off-center picture	Yoke not properly oriented	*Reorient relative yoke position; readjust set controls*
Neck shadow	Yoke not snug against picture tube; incorrect angle yoke used	*Position yoke snug against picture tube; use proper angle yoke*
Bow-tie pattern	Yoke wired incorrectly internally	*Replace yoke*
Horizontal foldover and/or horizontal nonlinearity	Improperly-matched, or defective yoke	*Replace with properly matched yoke*
Horizontal line (usually wavy)	Open in vertical winding or connecting leads	*Repair open circuit or replace yoke*
Vertical line (usually wavy) or no raster	Open in horizontal winding or connecting leads	*Repair open circuit or replace yoke*
No raster	Short in yoke	*Replace yoke*

Trouble shooting chart that may be used for identifying yoke troubles.

RIDER

IT IS said that events occur in cycles. Let's begin early in July. I'm driving the family chariot, with my wife aboard, to Westchester to play with three golf sharks. Halfway to the club I notice that the ammeter does not indicate charge, nor does it indicate discharge when the engine is idling. However, the engine is running, so we continue on our way. I suspect that the generator is not functioning, but of even greater concern is the fear that perhaps this condition has existed long enough to run down the battery. Traffic isn't light and I have visions of the engine stopping when the car comes to a halt; there we'd sit, in the middle of the parkway with a hundred thousand cars lined up behind us.

So we get off the parkway at a point where I know a service station is not too far distant. I tell my tale of woe to a guy who is said to be the mechanic. He lifts the hood and asks to have the engine revved so that he can verify what I was watching for about 18 miles. The ammeter does not indicate charge or discharge, even with the unloaded engine turning over so rapidly that I am sure the fan belt will leave the pulley at any moment. The mechanic is now convinced that my eyesight is good.

He walks over to the front of the car, bangs the generator with the handle of a screwdriver and tells me to stop the engine. I suggest that maybe the battery is run down and that it may be a problem to start the engine again. "Don't worry about it," he says, so I don't. I turn off the ignition.

SPEAKS

by JOHN F. RIDER

"Dean of America's Radio Servicemen"

He removes the regulator box cover, peers at the relays and pushes one of them while I'm looking at the ammeter. It shows a momentary discharge. Now he says, "Start the engine." I try. A few weak grunts of the starter—then nothing. Now comes a profound comment from the genius. "The battery is dead" (as if I didn't know it). His next remark is even better. "I think you ruined the battery; you'll probably need a new one," says he. "You also need a new generator" is the inevitable follow-up.

After a few moments spent trying to recover my breath, I suggest that we substitute a charged battery for mine to get the engine started. He agrees and goes inside the shop. Shortly thereafter, he returns and calmly tells me he's fresh out of charged batteries, but he has one on the line that will be usable in about 30 minutes.

By this time I am 20 minutes late for my date and my wife is slightly perturbed, which is a polite way of saying it. But we wait, and finally the venture is crowned with success. He shunts the old battery with the charged one and the car is running, but the ammeter shows nothing. So I suggest that maybe it would be a good idea to measure the output from the generator to find out whether it is generating anything more than the wind from the ventilating fan. My mechanic friend doesn't think it is necessary; he insists that he knows his business. Anyway, he has no equipment for checking the voltage.

Now I'm one hour late for my date

[*Continued on page 47*]

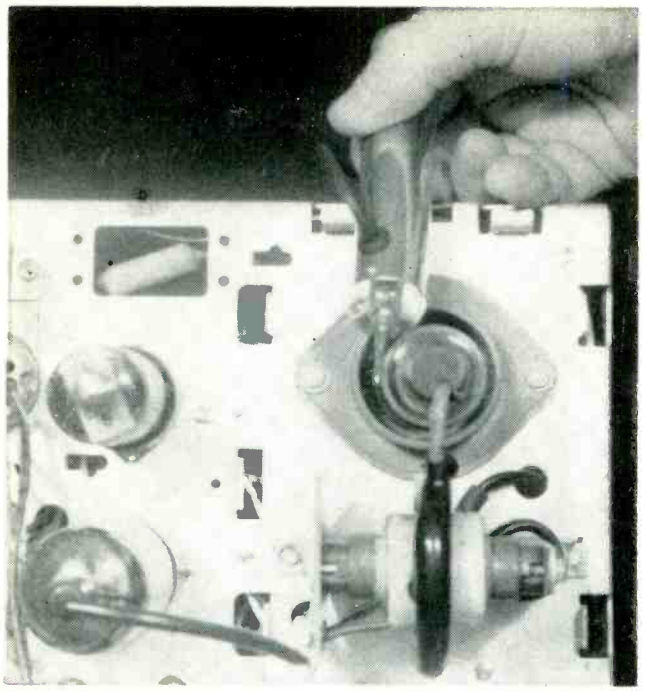


Fig. 1A—Checking level of flyback waveform with demodulator probe and voltmeter.

Construction, test applications, and limitations of the scope demodulator probe. Various examples and measurement techniques are discussed and illustrated.

Oscilloscope Probes

by Robert G. Middleton

Chief Field Engineer,
Simpson Electric Co.

MANUFACTURERS of oscilloscope probes receive many inquiries concerning the application of probes in radio and television service. Today, nearly all technicians have a complement of scope probes available, but the use of these probes is not always completely understood. It is the purpose of this article to outline the general techniques which find daily application at the bench.

Application of the Detector Or Demodulator Probe

Figure 1 shows applications of a detector probe of the demodulator type, which is used with an oscilloscope. This probe utilizes a voltage-doubler circuit arrangement, which effectively doubles the sensitivity of indication; the circuit is shown in *Fig. 2*.

A demodulator probe for scope use differs from a detector scope used with a VTVM in one essential respect: the demodulator probe is arranged to rectify and filter the *carrier* component of the signal, but passes the *modulation* component of the signal to the scope. A VTVM detector probe, on the other hand, rectifies and filters *both* the carrier component and the modulation component of the signal. The circuit arrangement of a VTVM detector probe is shown in *Fig. 3*.

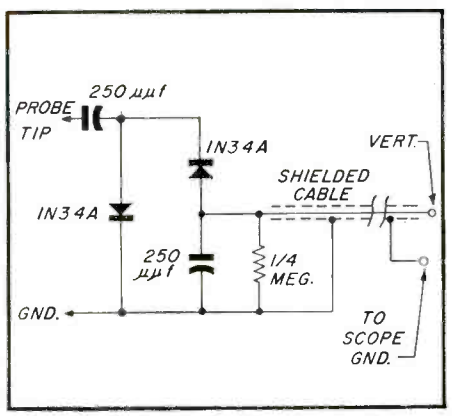


Fig. 2—Circuit arrangement of voltage-doubler demodulator probe.

A scope demodulator probe finds its most popular application in signal-tracing procedures. For example, with a fairly strong TV signal applied to the antenna-input terminals of a TV receiver, the demodulator probe can be used to check the progress of the signal from the output of the *rf* tuner up to the input of the picture detector. Thus, dead or weak *if* stages can be quickly localized.

There are some limitations in this signal-tracing procedure which should be recognized. First, the amount of scope deflection which is obtained is not necessarily an accurate measure of the stage gain, because the probe loads the *if* circuit substantially, and the value of signal voltage delivered by the probe is sometimes less, and sometimes more, than the true signal voltage. The probe has appreciable input capacitance, which detunes the stage under test to some extent. If the detuning happens to occur in a direction which peaks up the amplifier response, the apparent signal voltage is increased. But if the detuning occurs in a direction which broadens the over-all response, the apparent signal voltage is decreased.

Because of the detuning action of the probe, it is advisable to make a double check at each tube—one check at the grid terminal, and another check at the plate terminal. In a few cases, a satis-

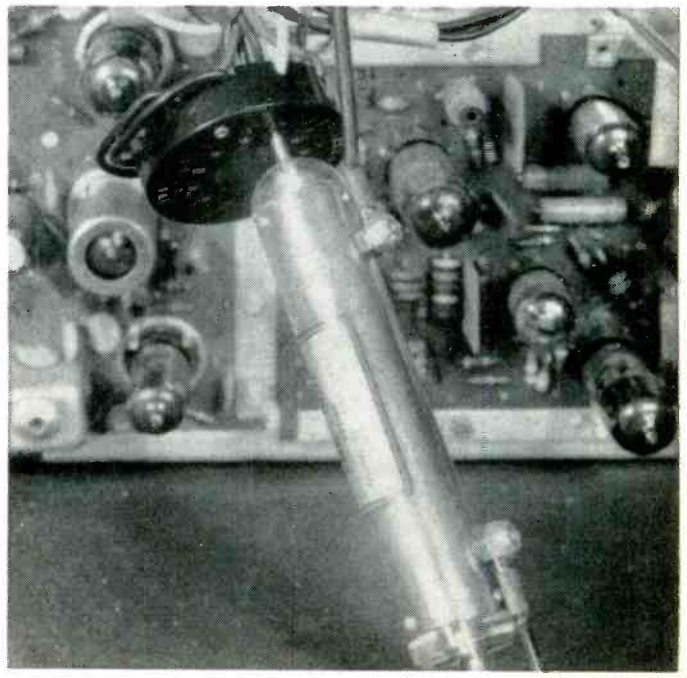


Fig. 1B — Checking video signal level to picture tube with probe.

factory test may be obtained at the grid, whereas at the plate the application of the probe causes the amplifier to break into oscillation. Oscillation has the same appearance on the scope screen as a dead stage, but a VTVM at the output of the picture detector will show a large jump in *dc* voltage when the probe is applied. Experience is the best teacher in this regard, and makes it possible to obtain satisfactory preliminary tests with a signal-tracing probe and scope.

Another limitation in the signal-tracing procedure is the attenuation of the high-frequency component of video signal which is incurred in its passage through the probe. It will be noted that the vertical sync pulse comes through and is displayed in reasonably undistorted form on the scope screen. But the horizontal sync pulse is both attenuated and integrated, and appears as a low-level sawtooth waveform. For this reason, signal-tracing procedures are accomplished to best advantage when the scope is deflected horizontally at a 60-cycle rate.

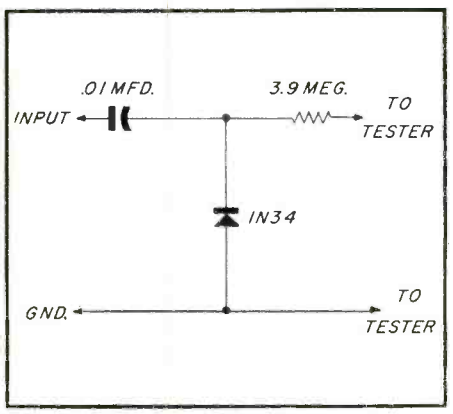


Fig. 3—Circuit arrangement of a typical VTVM detector probe.

A more satisfactory method of signal-tracing is realized when the receiver is energized by the output from an AM or FM generator. The signal level is then under the operator's control, and the modulation frequency does not exceed 400 cycles, so that the maximum efficiency of the demodulator probe is realized. If an AM generator is utilized, the modulated *rf* output (at the channel frequency) is applied to the antenna-input terminals of the receiver, and the output level is advanced until

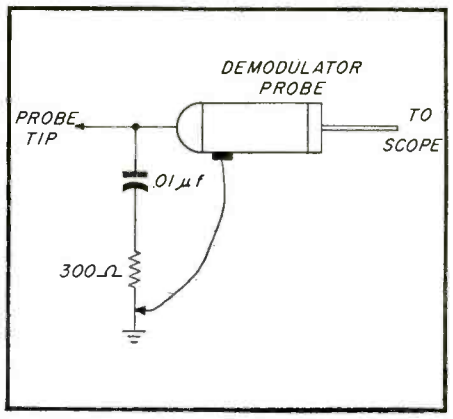


Fig. 4—Network across probe input permits response curve visualization on the scope screen.

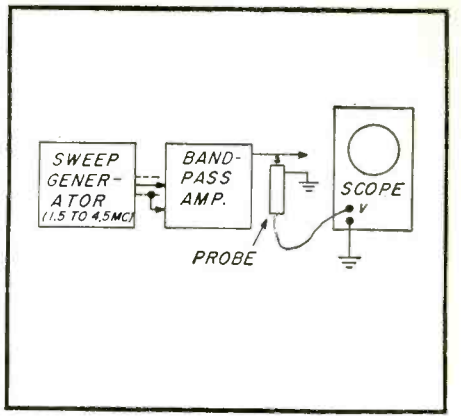


Fig. 5—Demodulator probe may be used to check the frequency response of bandpass amplifier.

an indication is obtained at the output of the *rf* tuner. Most AM generators utilize 400-cycle sine-wave modulation, so that the indication obtained on the scope screen is a sine waveform.

If an FM generator is utilized in the test, a sweep signal is applied to the antenna-input terminals of the receiver at channel frequency. The blanking control of the generator is turned on, to provide a zero-volt reference line. The *rf* output level is advanced, as before, until an indication is obtained with the probe at the output of the *rf* tuner. The display observed on the scope screen is that of the over-all frequency response of the circuits up to the point of test, wherever the probe may be applied in the *if* amplifier. Note, however, that the true response curve will not be obtained with the unaided probe, due to loading and detuning. To observe the true frequency response up to the test point, the input to the probe should be damped by a capacitor and resistor, as shown in *Fig. 4*.

A demodulator probe is also very useful when checking the frequency response of color-TV circuits, such as the chrominance bandpass amplifier, as shown in *Fig. 5*. In this application, the probe in combination with the scope will reveal the frequency response curve of the video-swept signal in the bandpass amplifier. Similar frequency response checks can be made of the color-difference detector circuits in a color-TV receiver.

A somewhat similar technique to determine the frequency response of a video amplifier is made possible by the demodulator probe. *Fig. 6* shows how the outputs from a sweep and a marker generator can be applied at the input of a video amplifier, with the demodulator probe at the output, to display the video-frequency response curve on a scope screen.

The preferred method of sweeping the video amplifier (illustrated in *Fig. 6*) is to apply an *if* sweep signal and an unmodulated *if* signal to the input of the picture detector, which beats a video-sweep voltage through the picture detector. A demodulator probe is applied at the output of the video amplifier, and the response curve is displayed on a scope. A puzzling characteristic of the display is that often a small notch only is observed at zero frequency, whereas when a video sweep signal is applied directly at the input of the video amplifier, a deep notch is seen at zero frequency. The reason that the notch is shallow for the set-up shown is that the demodulator probe cannot respond completely to the very sharp notch that is actually present.

The various frequency points along the video response curve can be determined by "walking" the curve along the base line of the scope. This is done by turning the AM generator dial in 0.5 or 1 *mc* steps, as shown in *Fig. 7*, which shows an example of how frequencies are determined accurately along the video response curve. At A is shown a video response curve in standard form, with the zero-frequency point at the end of the base line. If the dial of the instrument is rotated 2 *mc* to bring point "1" to the zero-frequency point, as shown at B, the frequency of point "1" in A is then 2 *mc*. Likewise,

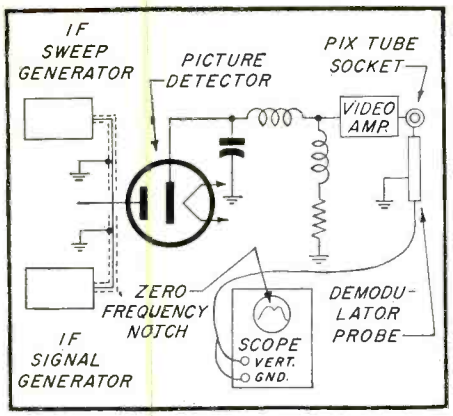


Fig. 6—Demodulator probe may be used to check frequency response curve of a video amplifier.

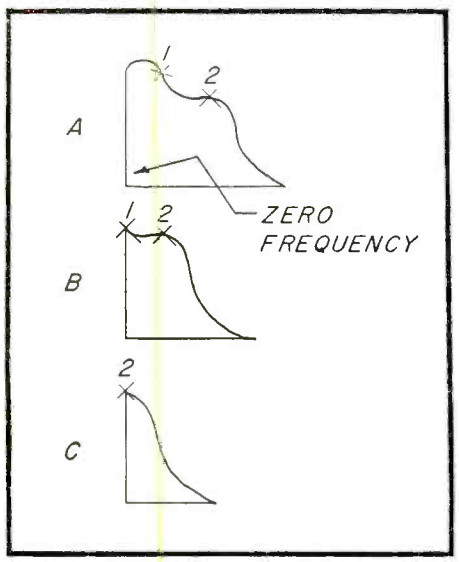


Fig. 7—Use of a video-frequency marker box is not necessary when "curve walking" technique is used to determine frequency points.

if the dial of the instrument is rotated 4 *mc* to bring point "2" to the zero-frequency point, as shown at C, the frequency of point "2" in A is 4 *mc*. This "trick" simplifies the marking problem in low-frequency signal circuits, and avoids the complication of external marker boxes. ■■

GUEST

by R. D. HERSHEY

THE field of electronics has made many tremendous strides in the past few years. We have seen television grow from an idea to one of the major industries of the United States. Along with television, the electronic service profession also has grown to major proportions and YOU, Mr. Service Technician, are a member of this important profession. Through self-improvement, attendance to lectures and schools and practicing good business ethics, YOU have raised the electronic service profession to its rightful place with the other leading professions in your community. With this rapid growth in the field of electronics and the development of new and more complex electronic devices, the electronic service profession has become a field only for highly skilled service technicians. There is no longer a place for just plain service men, tube jerkers or tinkerers. The electronic equipment of today and tomorrow requires—yes, demands the highest technically trained men to provide the necessary maintenance.

For the service profession to maintain and further its position, each service technician must become a well trained service engineer. He must be completely familiar with the use and application of test equipment and, of extreme importance, know how to interpret what the test equipment tells him. . . . He must be thoroughly familiar with all basic circuitry as used in radio and television receivers. . . . He must be able to apply this basic knowledge to

EDITORIAL

Service Manager
Receiver Division
Philco Corporation

new circuitry thereby gaining an understanding of its operation and purpose. . . . He must learn new servicing and trouble shooting techniques and be adept at using these newly learned skills.

How does a service technician achieve this goal? Not by being satisfied with his present knowledge and ability. Not by assuming that theory and application of circuit theory is unnecessary and a waste of time. Not by blaming a manufacturer for a component failure which he is incapable of locating and repairing; and certainly not by procrastinating as to when would be the right time to start furthering his education. I have many times heard the remark, "I can't take time during the day to study any new circuits or try new service procedures. I've got to keep on the job or we can't make money." I can agree with part of this statement. . . . "I've got to keep on the job or we can't make money." This is true. A service technician must take full advantage of his time since "time" is one of the major commodities which he is selling. However, has this man ever stopped to realize that by understanding the new circuitry which he is attempting to trouble shoot or by learning new and advanced servicing procedures he may very well double his daily work output thus making his time far more valuable?

A few minutes spent every day in furthering your technical knowledge and skill can result in hours of saved

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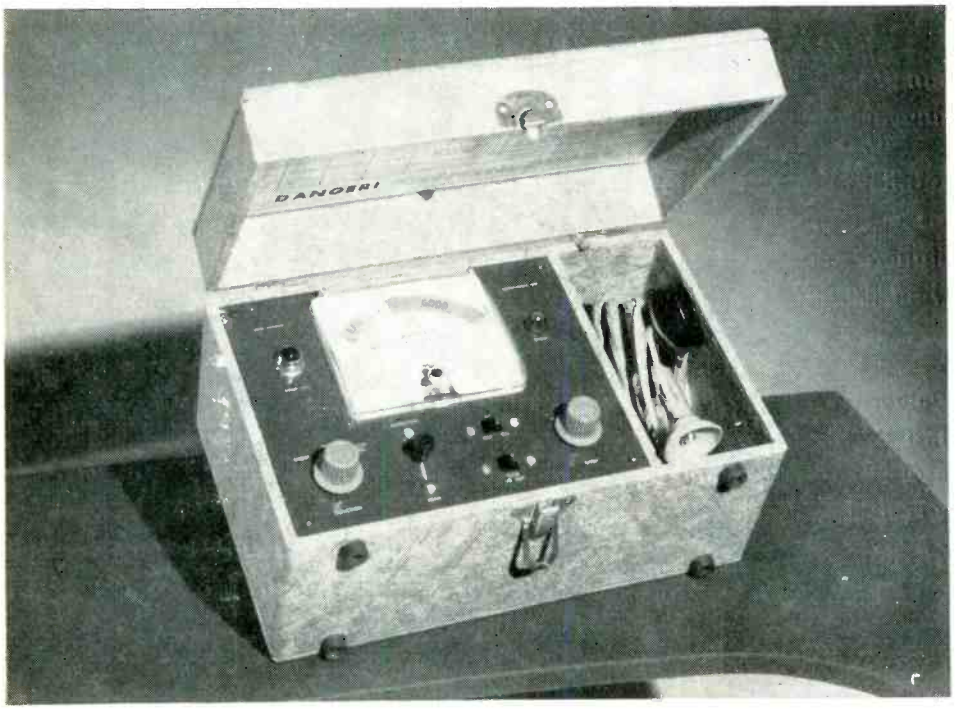


Heathkit Model CC-1 Cathode Ray Tube Tester

10 megohms, provides for magnified visual inspection of the gun aperture and enables examination of the relative condition of the phosphor coating on the screen. Completely self-contained in an attractive portable cabinet, it is *ac* operated and supplies all necessary voltages to the cathode ray tube being tested.

Theory of Operation

Referring to *Fig. 1,* the power transformer supplies *ac* voltages of 6.3, 450 and 1200 to the cathode ray tube being tested.

With the instrument connected to the tube to be tested, turned on and the FUNCTION switch in the SHORT position, the SHORT switch may be rotated. This applies 450 volts *ac* in series with the short test circuit between any element and all other elements. If a short exists between any two elements, the neon SHORT indicator will glow. Even a leakage path of as much as 10 megohms resistance will give a strong indication.

In the TEST position, the FUNCTION switch opens the short test circuit, ties the control grid to the cathode, applies 450 volts *ac* between these elements and all other elements and 1200 volts *ac* to the high voltage anode through current-limiting resistors and the SLIDE-TO-TEST switch. The SLIDE-TO-TEST switch must be activated to the right to complete the high voltage circuit for BEAM and SHADOW-GRAPH tests. This requires the simultaneous use of both hands and is designed as a safety factor to eliminate the possibility of inadvertent contact with the high voltage.

A Modern Cathode Ray Tube Checker

by J. FRANK BRUMBAUGH
Project Engineer
Heath Company
Benton Harbor, Michigan

Description and operation of a cathode ray tube tester with many unusual features.

THE service man has had available for some time a large assortment of cathode ray tube testers, adapters, rejuvenators, et al, ranging from the inexpensive—and ineffectual "gimmick" to the more elaborately designed—and priced—CRT "do-all." Many of these have fallen by the wayside and as many more have risen to take their place. The Heathkit Model CC-1 Cathode Ray Tube Tester is a recently developed instrument designed expressly to assist the television service man in rapidly locating weak or defective "picture" tubes, and is invaluable in convincing the customer of the advisability of purchasing a new tube when this is necessary.

In order to save much of the service man's valuable time, the instrument has been so designed as to allow testing of any cathode ray tube which the attached socket will fit, as long as deflection is electromagnetic, and all tests may be made without removing the tube from the set or the carton. Only enough warm-up time is necessary for the heater in the cathode ray tube to reach operating temperature, approximately 90 seconds or less, and all testing may easily be accomplished in less than a minute. The Model CC-1 provides an overall quality test, a beam current test, indicates shorted elements and leakages to in excess of

The BEAM-EMISSION switch, when activated to the BEAM position, inserts the meter in series with the supply voltage and the meter indicates the level of total cathode current.

In the EMISSION position, the BEAM-EMISSION switch removes the 1200 volts *ac* from the high voltage anode circuit and again inserts the meter in series with the supply voltage. The meter now indicates the level of cathode current *minus* the beam current.

In the SHADOW-GRAPH position, the FUNCTION switch applies 450 volts *ac* between the cathode-control grid and all other elements, shorts out a portion of the current limiting resistance, and applies 1200 volts *ac* to the high voltage anode through the SLIDE-TO-TEST switch. (The meter is not connected into the circuit for this test and observation of the face of the tube is required.) With the FUNCTION switch held in the SHADOW-GRAPH

position and the SLIDE-TO-TEST switch held to the right, a round or oval of light will appear on the face of the tube, usually near the center of the screen. This light area defines the limits of the gun aperture and will have clean, sharp edges if the aperture is not burned or rough. Irregularities are easily noted, since the shadow-graph is an electro-optical projection of the gun aperture.

The SHADOW-GRAPH test allows an excellent comparison demonstration between the customer's weak tube and the new tube the serviceman wishes to sell, since the shadow-graph will be fainter on a weak tube than on a new one. The customer may see the difference for himself and be more easily convinced of the necessity of a new picture tube. This test rapidly indicates whether the tube is at all capable of functioning and serves to indicate contrast and the density and light-giving quality of the fluorescent coating on the screen.

It would be advisable to conduct this portion of the test in subdued light, since the shadowgraph will be relatively faint. Too high an ambient light level will make the shadowgraph difficult to observe.

Gun aperture will be even more faintly delineated during shadowgraph test on aluminized-screen tubes, this being a normal indication, and this test should be conducted in near darkness.

Focus magnets, ion traps or any other strong magnetic field will cause beam deflection and interfere with the shadowgraph test. Ion traps *must* be removed. Focus magnets may be left in place but the shadowgraph may show only a portion of the gun aperture, since the electron beam will be deflected from its normal path by the field of the focus magnet.

Operation

If the cathode ray tube to be checked is in a television receiver or radar indicator, it will be necessary to remove the high voltage connector from the bell of the tube, the socket and the ion trap, if any. If it is in a carton, it will be necessary to open both ends of the carton, since access to the screen as well as the base is required, if a shadowgraph test is desired.

Open the cover of the Heathkit Cathode Ray Tube Checker and straighten out the cable and line cord. Connect the cable socket to the base of the tube and snap the high voltage anode connector into place on the bell of the tube.

It will be found that some tubes, metal tubes in particular, require a different type of high voltage anode connector than that supplied with the cable. In these few instances, it is suggested that a short clip lead be used to connect the HV anode socket on the tube with the HV anode connector on the cable.

After all these connections have been made to the cathode ray tube, plug the line cord into a 115 volt 60 cycle source and turn the instrument on. The SHORT test may be made while the CR tube is approaching operating temperature, unless a thermal short is suspected.

SHORT TEST: Place the FUNCTION switch in SHORT position, rotate the SHORT switch, pausing at each position. A strong glow indicates the existence of a short between two elements. A flash of the neon indicator as the SHORT switch is advanced is caused by a voltage surge during switching and is normal. It should not be construed as an indication of shorted elements. A bright, persistent glow is the normal indication of shorted elements. A dim but constant glow indicates a high resistance leakage path and does not necessarily prevent the tube from being used.

QUALITY TESTS: Advance the FUNCTION switch to TEST position. (It is assumed that at least 90 seconds have elapsed since turning the instrument on.) Move the BEAM-EMISSION switch to BEAM position and simultaneously with the other hand, move the SLIDE-TO-TEST switch to the right. Observe that the meter indicates toward full scale, well into the green area on meter face.

NOTE: Certain tubes, notably those with aluminized screens, will give a very high indication on this test when new and will occasionally pin the meter. This is normal for these tubes and after two or three weeks of use in a television set, the activity will fall off slightly and give more normal meter indications.

Release the SLIDE-TO-TEST switch and move the BEAM-EMISSION switch to the EMISSION position. The meter reading will be lower and may fall into the upper half of the "?" on yellow area on the meter scale. This is normal and does not necessarily indicate a weak tube, *if the previous meter indication was relatively high.*

SHADOW-GRAPH TEST: Advance the FUNCTION switch to the SHADOW-GRAPH position and with the other hand, move the SLIDE-TO-TEST switch to the right. Observe the oval or circular disc of light on the face of the cathode ray tube. The edges of this disc should be clean and sharp, as it is a projection of the gun aperture. Increasing familiarity with this test will enable the rapid determination of quality of the screen phosphor by inspection of the disc of light. After these tests, or as many as it is desired to effect, are complete, turn the instrument off before removing the connections to the cathode ray tube. Do not touch the HV socket on the bell of the tube, as the capacity of the inner and outer coatings will hold a charge for a long period.

Considering the normal customer reluctance to purchase a new picture tube while his old one still works, even though dimly, it is of definite value to show the customer exactly how much better picture he could have with a new tube. Allowing the customer to observe the spot of light on the screen on his old tube, and to compare it with the brighter spot evident upon a new tube makes the shadowgraph test your most potent salesman, and will result in more picture tube sales than before. ■■

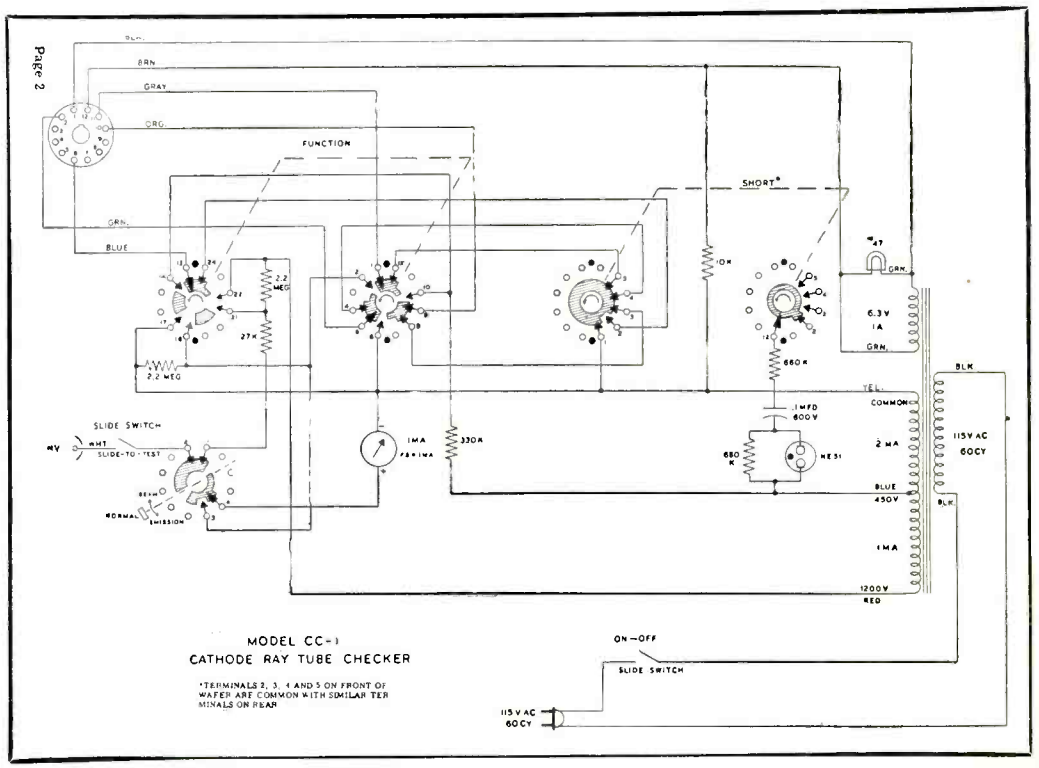


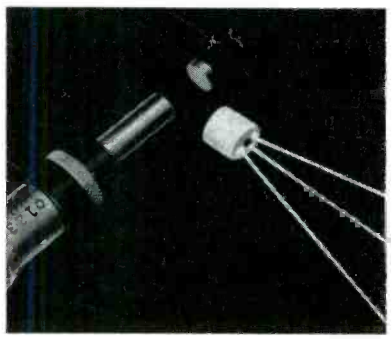
Fig. 1—Circuit diagram of Model CC-1 CRT tester.

SERVICE DEALER and ELECTRONIC SERVICING

NEW SEMI-CONDUCTORS

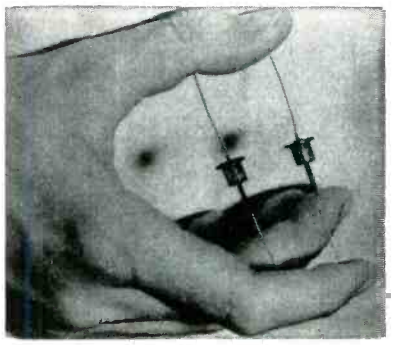
SUB-MINIATURE RELAY RECTIFIER

A new versatile sub-miniature selenium relay rectifier to energize *dc* relay coils is now in production at International Rectifier Corporation. This new Unit, type 60-9267, is a full wave center tap rectifier and may be used either as a center tap full wave rectifier or as a half wave and "back wave" rectifier combination. The unit is rated for 66 volts maximum *ac* input and will deliver 22 *ma dc* as center tap or 11 *ma dc* as a half wave rectifier.
(Check 807 on inquiry card for more information)



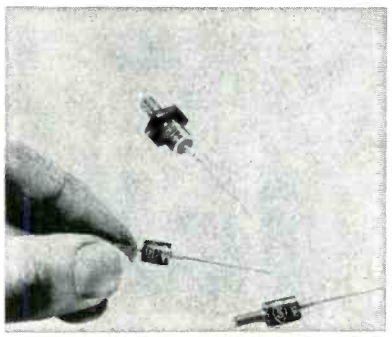
G.E. SILICON RECTIFIERS

The General Electric Company has announced two new silicon rectifiers designed to meet stringent military requirements. The new rectifiers, designated as 1N537 and 1N538, are rated at a maximum *dc* output current of 250 milliamperes at 150°C. The devices may be designed into circuits for outputs of up to 750 milliamperes where lower temperatures are encountered. Maximum leakage over the temperature range is 0.5 milliamperes.
(Check 802 on inquiry card for more information)



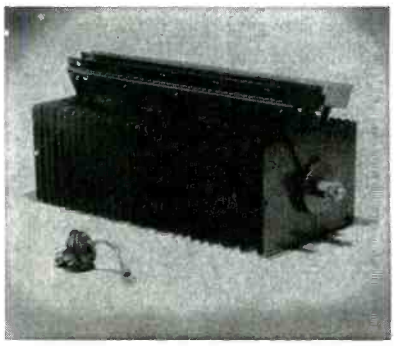
CBS-HYTRON POWER RECTIFIERS

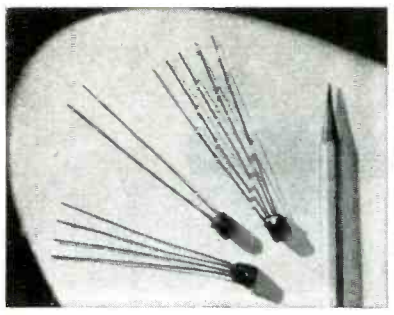
A new series of silicon power rectifiers, CBS types 1N503 through 1N526, featuring an exceptionally large handling capacity for their size has been developed by CBS-Hytron. These new silicon rectifiers are capable of operating with extremely high reverse voltages and accompanying low reverse currents. This feature, together with a very low forward voltage drop, enables the rectifier to deliver large power to the load with relatively little dissipation.
(Check 804 on inquiry card for more information)



G.E. SILICON RECTIFIER

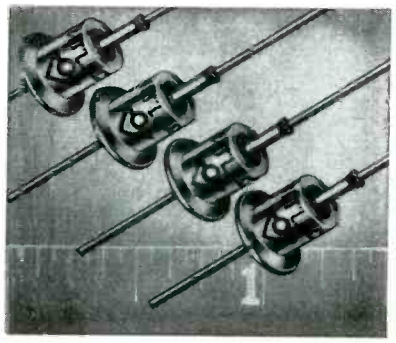
The new G.E. high current silicon rectifier, designated ZJ 15, is a compact device occupying a total volume of 1.0 cubic inches including mounting stud. It is capable of operating at 50 amperes forward current per cell at 200 volts, peak inverse voltage. Depending on whether the rectifier is connected in a single phase, three phase or six phase circuit, maximum forward current is rated at 50 amperes, 46 amperes, or 35 amperes, respectively.
(Check 809 on inquiry card for more information)





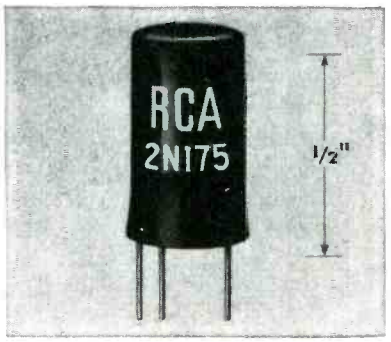
MINIATURE RECTIFIERS

A new line of sub-miniature selenium rectifiers has been announced by Bradley Laboratories of New Haven, Conn. These rectifiers will find wide application in portable and airborne communications and other electronic equipment where space and weight limitations are major factors. Important features are low forward drop, low reverse leakage, uniformity of electrical characteristics and the ability to perform as rated at high ambient temperatures.
(Check 805 on inquiry card for more information)



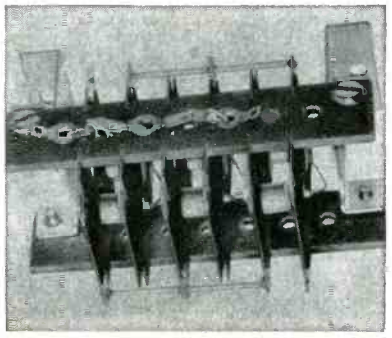
SILICON POWER DIODES

The International Rectifier silicon power diodes are rated for 300 *ma dc* rectified output current when mounted by leads in free air at ambient temperatures up to 100°C. The rectifying barrier of this silicon diode is formed by the fused junction principle, which results in excellent electrical and mechanical stability. This junction is hermetically sealed in an all-welded, shockproof housing with pigtail leads firmly welded to the terminals.
(Check 803 on inquiry card for more information)



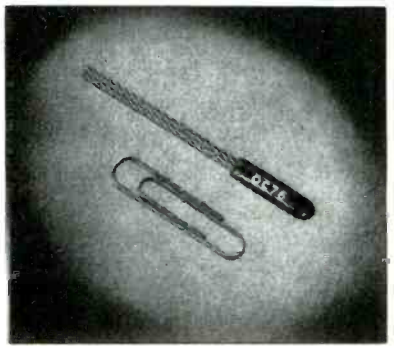
R.C.A. JUNCTION TRANSISTOR

The RCA 2N175—a hermetically sealed, germanium alloy junction transistor of the p-n-p type—is designed especially for use in the preamplifier or input stages of transistorized audio equipment operating from extremely small input signals. Because of its extremely low noise factor of 6 *db* maximum, and its freedom from microphonism and hum, the 2N175 makes possible higher small-signal sensitivity of transistorized audio equipment.
(Check 808 on inquiry card for more information)



POWER RECTIFIER STACKS

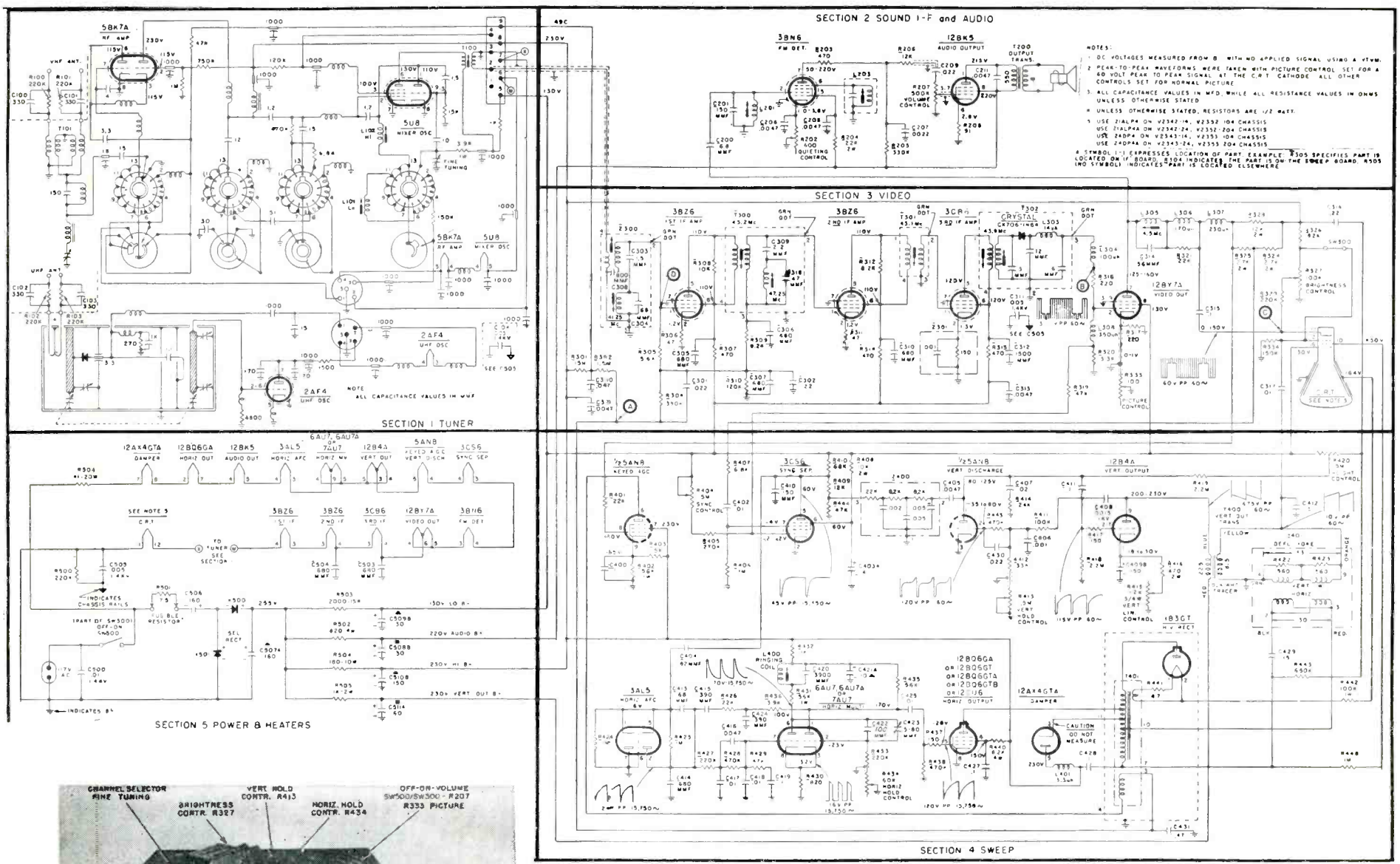
A line of germanium rectifier power stacks, with a new design which results in better heat dissipation while combining light weight and superior rigidity, has been developed by Federal Telephone and Radio Co. The new Federal germanium stacks are smaller than previous designs by an estimated one-third, as a result of improved convection and cooling. A special base plate design makes the stacks mechanically interchangeable with types now on the market.
(Check 806 on inquiry card for more information)



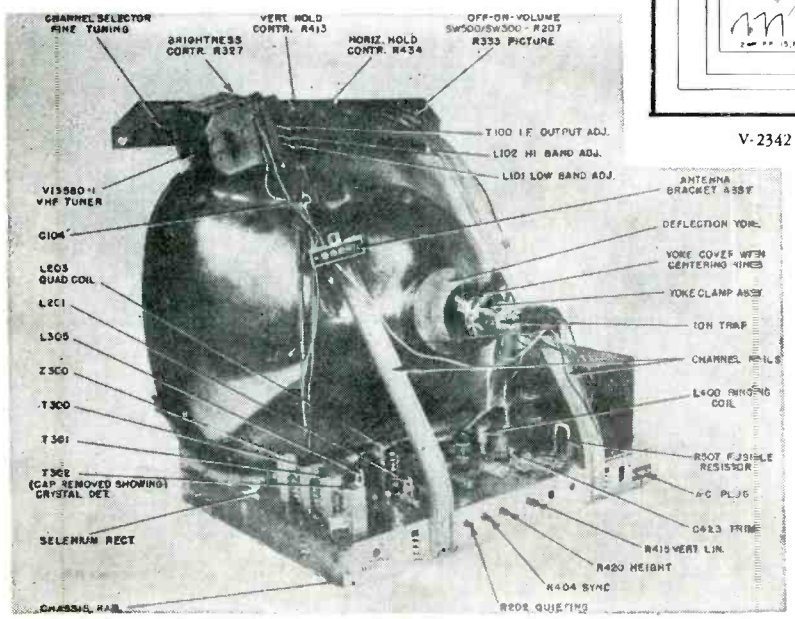
DC CONVERTER TRANSISTOR

The Amperex Electronic Corporation has announced the addition of a new switching-type transistor to their extensive semi-conductor line. Designated as type *OC76*, the new transistor was developed particularly for *dc* converter applications. Some of the important uses of the new *OC76* as a *dc* converter will be in high voltage supplies of portable and mobile radio sets, transistorized photoflash units and Geiger counters.
(Check 801 on inquiry card for more information)

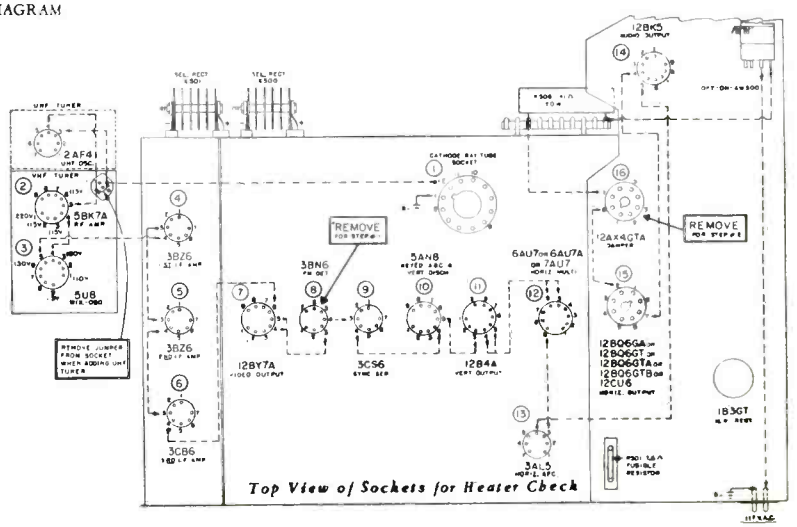
WESTINGHOUSE MODELS H-916T17A, -919T17A, -920T17A, -921T17A, CHASSIS V-2340, -2350; -934T21, -935T21, -938K21, -939K21, -941K21, -942K21, CH. V-2342, -2352; -950T24, -951T24, -954K24, -955K24, -956K24, CHASSIS V-2342, -2343. NOTE: FOR ADDITIONAL SERVICE DATA SEE PAGE 24.

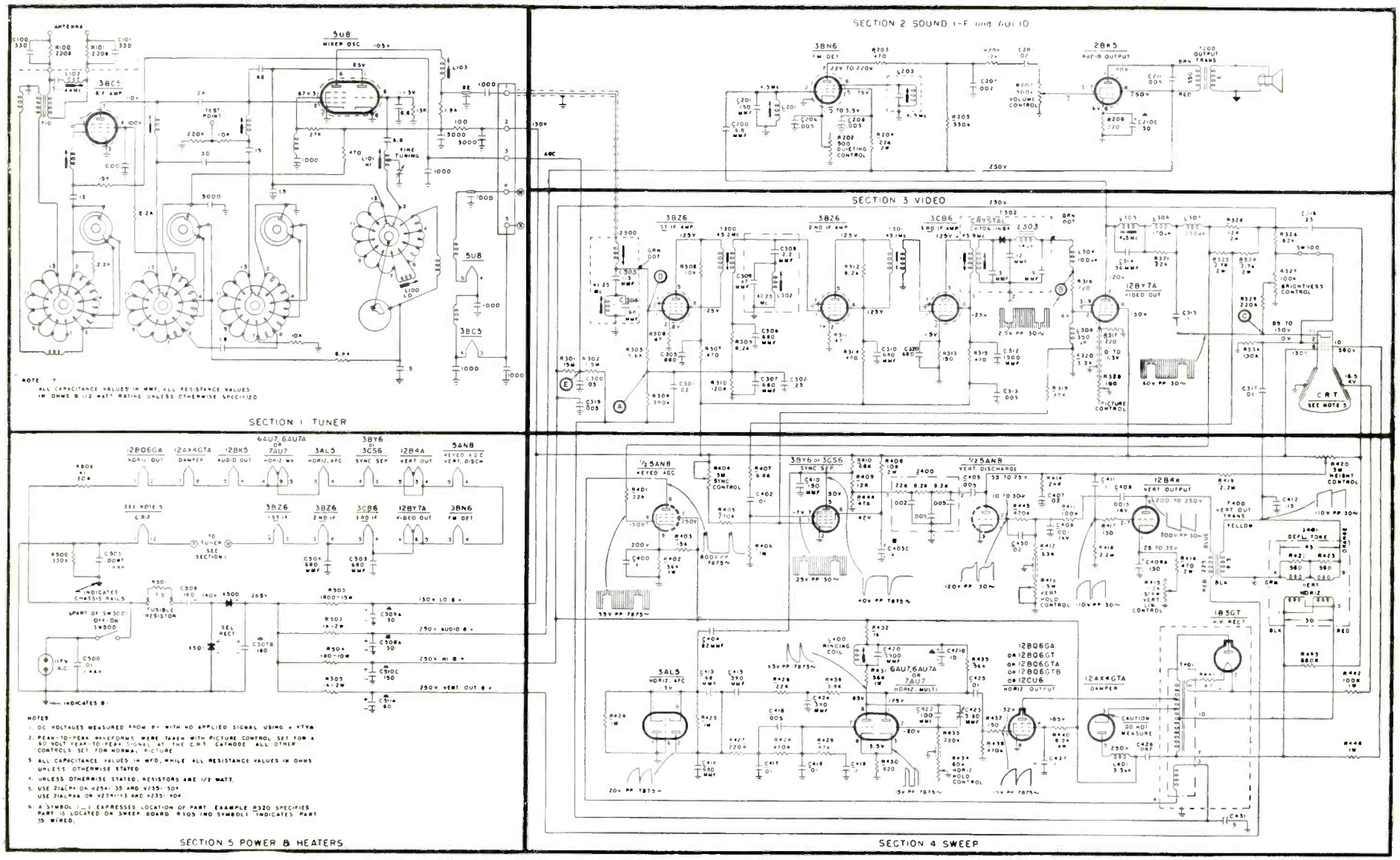


V-2342 AND V-2343 SCHEMATIC DIAGRAM

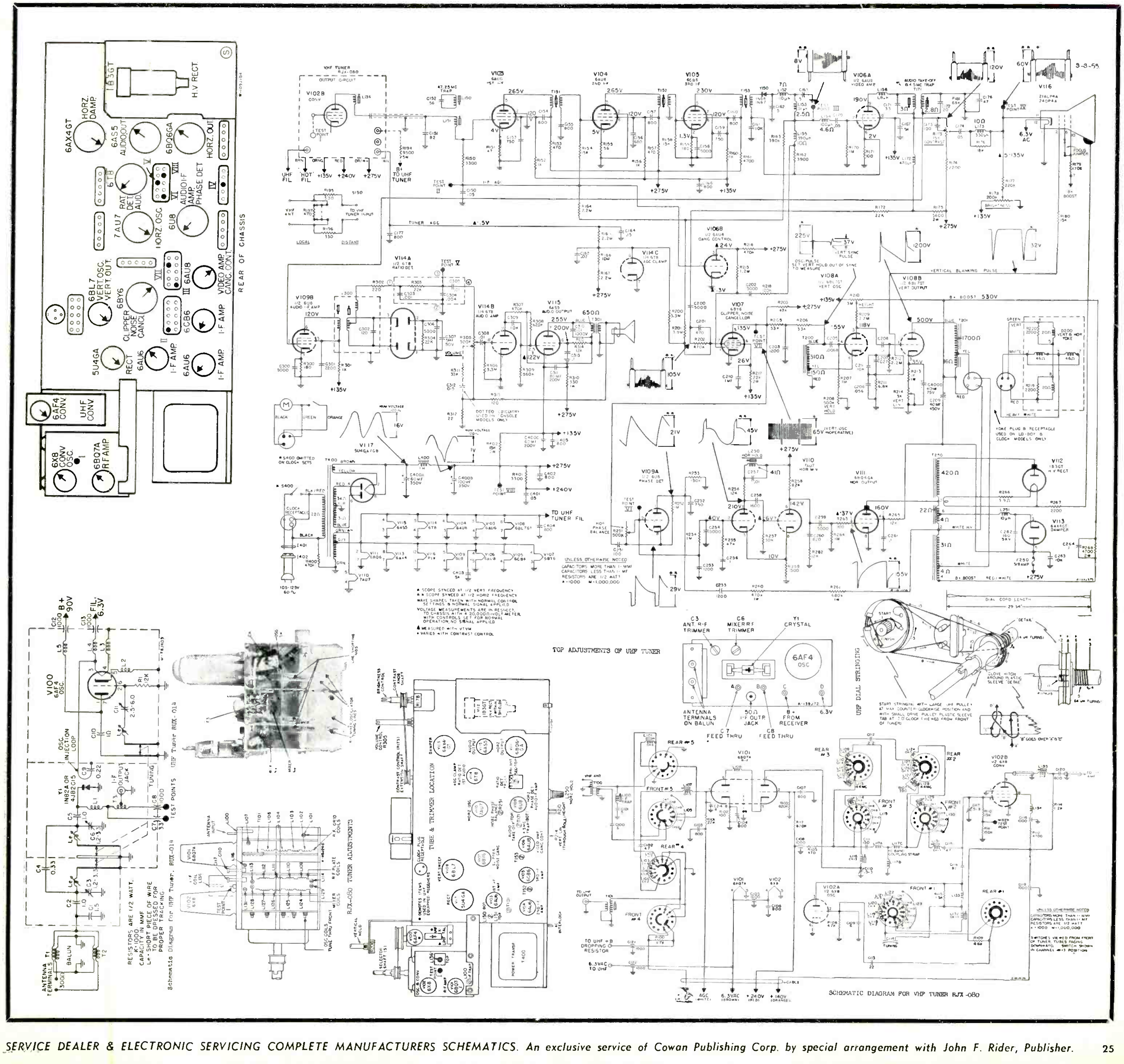


Rear View of Chassis





Schematic Diagram for Chassis Assemblies V-2341-35, V-2341-45, V-2351-304 and V-2351-404



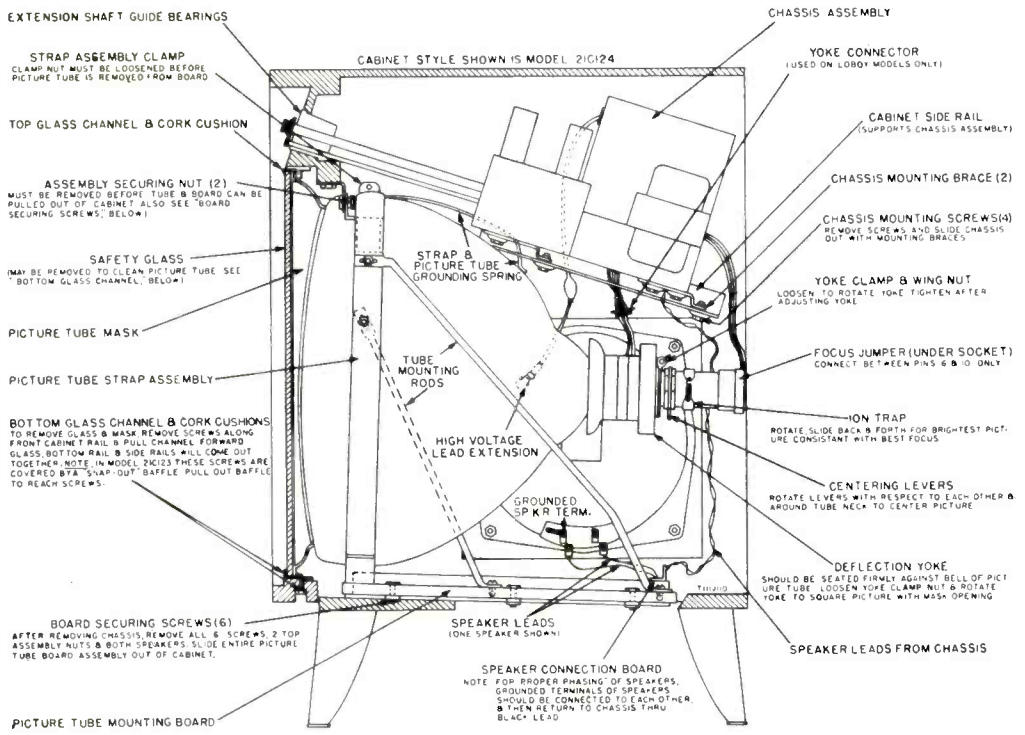


FIGURE 1. CUT-AWAY VIEW OF LOBOY MODELS

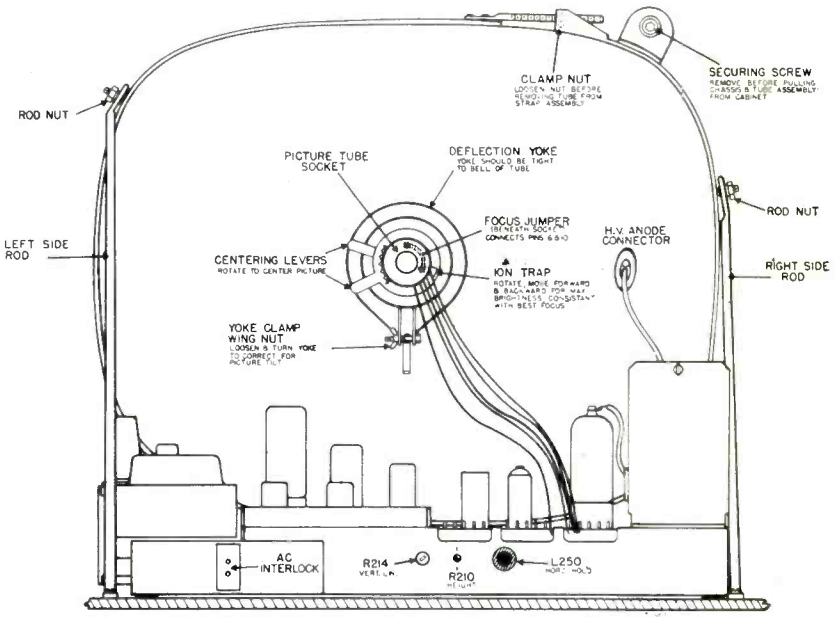


FIGURE 2. REAR VIEW, PICTURE TUBE AND CHASSIS BOARD ASSEMBLY

INSTALLATION ADJUSTMENTS

GENERAL: These receivers are shipped from the factory with the picture tube installed and all controls pre-adjusted for normal operation. It is necessary, therefore, to merely plug in the receiver and, where required, connect it to a suitable antenna system. The various operating controls should then be checked for proper operation.

On the rear of the receiver immediately above the antenna terminals is located a local-distant switch. This switch is normally left in the distant position except in cases of severe cross modulation caused by one or more strong stations interfering with the signal received. It may be necessary, therefore, to switch from distant to local in these areas.

As shown in figure 1, the chassis of Models 21C123 and 21C124 is mounted above the picture tube. The chassis, in all other models in the "S" line, is mounted beneath the picture tube, as shown in Figure 2.

If it becomes evident that one or more of the preset controls are out of adjustment due to handling, adjust the necessary controls according to the following information.

It is recommended that the receiver be permitted to operate for at least 15 minutes before the final raster adjustments are made. Refer to Figures 1 and 2.

ION TRAP:

Power should not be applied to the receiver for any great length of time without the ion trap being properly adjusted. Rotate and slide the ion trap on the tube neck for position of maximum picture brightness consistent with best focus. As maximum brightness with trap is approached, re-adjust the brightness control as required, to keep picture brightness moderate during trap adjustment.

YOKE POSITION (Picture Tilt):

Loosen yoke clamp wing nut and push deflection yoke to seat firmly against bell of picture tube. Rotate yoke and clamp to correct picture tilt (squaring of picture within picture mask). Tighten wing nut after adjustment.

PICTURE CENTERING:

A lever and ring assembly used for picture centering, rests behind the deflection yoke. Move the levers toward or away from each other until picture is centered within picture mask. The centering assembly should rest up against rear of yoke clamp.

FOCUS:

On the base of the picture tube is located a focus jumper. This jumper should be placed between picture tube pins 6 and 10 and the ion trap should be adjusted for best focus per above.

HEIGHT & VERTICAL LINEARITY:

These controls (R210 & R214), see Fig. 2, should be adjusted simultaneously to provide proper picture height consistent with good vertical linearity. The final adjustment should extend the picture approximately 1/8 inch beyond the mask limits.

REMOVAL AND REPLACEMENT OF PICTURE TUBE (LOBOY MODELS)

If it becomes necessary to remove the picture tube, adhere to the following procedure. Refer to Figure 1.

1. Disconnect and remove speakers.
2. Disconnect chassis speaker leads, picture tube socket, yoke connector and high voltage anode connector.
3. Remove front control knobs and four chassis mounting screws.
4. Slide out chassis, together with both mounting braces.
5. Loosen and remove both securing nuts above picture tube assembly.
6. Remove six screws arranged along edge of picture tube mounting board and slide entire tube assembly from cabinet. Remove yoke, centering assembly and ion trap, loosen clamp nut and remove tube.

When replacing tube, reverse above procedure. Be sure to "phase" speakers properly according to note in Figure 2, or according to label affixed to cabinet.

To clean picture tube without removing it:-

1. Remove screws arranged along cabinet front rail. (For Model 21C123, first remove "snap-out" baffle.)
2. Pull out bottom glass channel and glass. Mask and side rails will also come out, leaving tube face exposed.

REMOVAL AND REPLACEMENT OF PICTURE TUBE (STANDARD MODELS)

Refer to Figure 2 during this procedure.

1. Remove knobs. Disconnect and remove speaker.
2. Remove six screws arranged along edges of board assembly.
3. Remove securing screw atop tube assembly.
4. Remove entire tube and chassis board assembly.
5. Disconnect high voltage lead and picture tube socket. Remove ion trap, centering assembly, and yoke.
6. Loosen clamp nut and remove tube.

To clean picture tube, use LOBOY procedure above, or remove entire chassis and tube assembly board.

NOTE: When replacing chassis on braces or board after removal for service work, do not tighten chassis screws more than necessary. Excessive tightening of screws may damage bottom chassis screw clip projections.

CAUTION: DO NOT REMOVE 7AU7 HORIZONTAL OSCILLATOR WITH SET TURNED ON. DAMAGE TO 6BQ6 TUBE WILL RESULT. BEFORE REPLACING 6BQ6, FIRST CHECK 7AU7 TO PREVENT DAMAGE TO NEW TUBE.

HORIZONTAL PHASE BALANCE ADJUSTMENT:

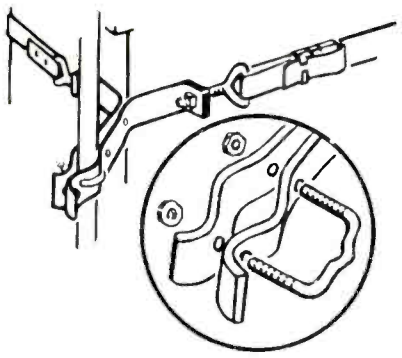
This is not considered an installation adjustment but should be performed whenever the horizontal phase detector, oscillator or output tubes are changed. Use bar barely visible signal.

1. Turn L250 horizontal hold control counter-clockwise so that picture is out of sync by 8 bars. Using VTVM, set R251 on top of chassis, Figure 11, so that voltage at Test Point V1 reads - .5 volt. (Maintain 8 bar condition by additional adjustment of L250).
2. Turn L250 clockwise until picture just pulls in and then continue knob rotation 45 degrees further clockwise. Check lock-in stability on normal signal.

SERVICE DEALER and ELECTRONIC SERVICING

NEW ANTENNAS

SOUTH RIVER CHIMNEY MOUNTS



In keeping with South River Metal Products Co.'s policy of manufacturing products that permit maximum safety when working in precarious positions, they have recently redesigned the entire SNAP-IN line of chimney mounts and wall brackets. A specially designed "U" bolt is now used with all SNAP-IN antenna mountings which permits one hand spintite fastening. The installer inserts the special U bolts instead of the customary nuts and screws.

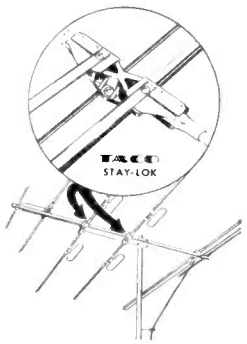
(Check 816 on inquiry card for more information)

R-COLUMBIA COUPLER

In line with the trend to "do-it-yourself" departments in radio and television stores, R-Columbia Products Co. Inc., has developed a new two set coupler that can be sold by the Service Dealer. Available in three models, HK 1 for normal signal gain with normal interference rejection; HK 2 for exceptional signal gain with normal interference rejection; HK 3 for maximum interference rejection with normal signal gain. It can be installed on the antenna mast.

(Check 818 on inquiry card for more information)

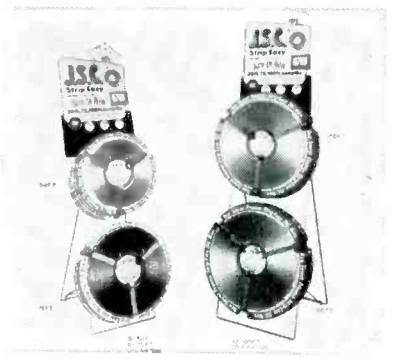
TACO TRAPPERS



Technical Appliance Corporation, in announcing their new Stay-Lok assembly, stated that Taco Trappers and Super Trappers were now available to the trade in two designs. The original models employing the tension booster design are continued in the line, being supplemented by Models 2880, 2885 and 2890 which utilize the new element design. With these new models elements are automatically locked in without using any tools.

(Check 811 on inquiry card for more information)

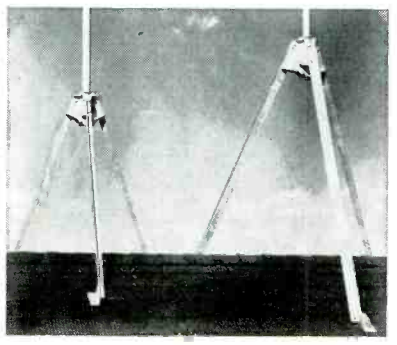
JERSEY SPECIALTY COLORED WIRE



Jersey Specialty has announced to the trade that they are now in production on all colors—300 ohm twin lead television wire (red-white-blue-green-pink-yellow-gold-silver-brown-clear). Installers can now match the outside color paint on homes or can match woodwork, wallpaper or even the rug on the floor. It even brightens the appearance of the room in place of the usual brown twinex. The color price is the same as for the brown twinex.

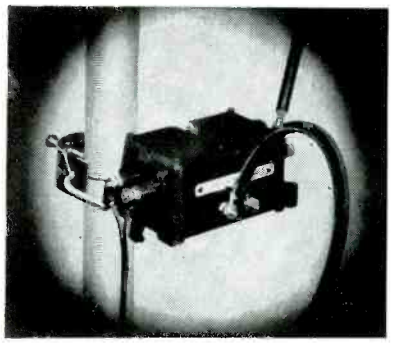
(Check 814 on inquiry card for more information)

BAKER "YUG"



A new 5′ tower has been announced by the Baker Manufacturing Co., as an answer to the dealer's desire to eliminate guy wires on antenna installations up to 20′ above the roof. It resembles, but is much larger than the successful 3′ tower introduced previously which permits antenna mountings up to 12′ without guys. Both towers are now nicknamed YUGS, a letter reversal of the word *guy*. The absence of guys means safer, faster roof installations.

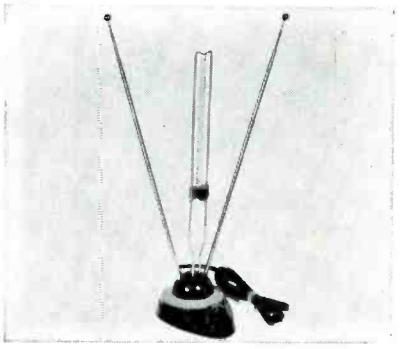
(Check 815 on inquiry card for more information)



CHANNEL MASTER FILTER

Introduction of a completely re-designed model of its UHF-VHF inter-action filter, the "Ultra-Tie," has been announced by Channel Master Corp. The filter joins together VHF and UHF antennas of all types for use with a single transmission line to the set. The "New Ultra-Tie" performs this function with leads of any length. Transmission wires between the two antennas and the filter need not be cut to a specifically prescribed measurement.

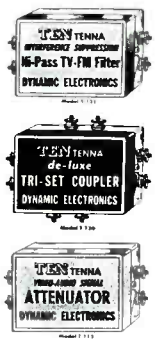
(Check 817 on inquiry card for more information)



TELCO ANTENNA

"Switch-O-Matic" is the name of a new high gain indoor TV antenna just developed by Telco Electronics Mfg. Co. It's a refinement on the basic "rabbit ears" style and said to provide new sensitivity on all viewing channels from 2 to 83. The "Telco Golden Switch-O-Matic" has two features that give it unusual power—six-phase tuning and a slide adjustment. The six-phase switch on the antenna's base provides improved reception.

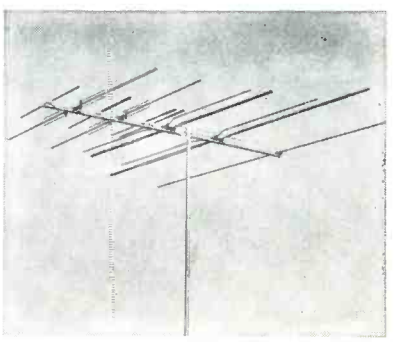
(Check 813 on inquiry card for more information)



DYNAMIC ELECTRONICS ACCESSORIES

Dynamic Electronic's complete new line of accessories in the tentenna series for fm-uhf, vhf and color TV are to be sold through electronic parts jobbers and distributors as service aids to improve reception where problems exist even when the receiver is operating to the accepted standards of its manufacturer. In such cases reception can be improved by using a properly designed accessory.

(Check 812 on inquiry card for more information)



WELCO ZEE-X

The Welco Mfg. Co., of Burlington, Iowa, has recently presented the Zee-X Model Z-4 television antenna which is said to exhibit exceptional low and high band antenna response patterns. Welco's arrangement of its exclusive Zee-X elements offers an efficient Direction System—full half-wave director action on both VHF bands, the low channels up to 6 and the high channels from 7 to 13. This permits excellent VHF reception.

(Check 819 on inquiry card for more information)

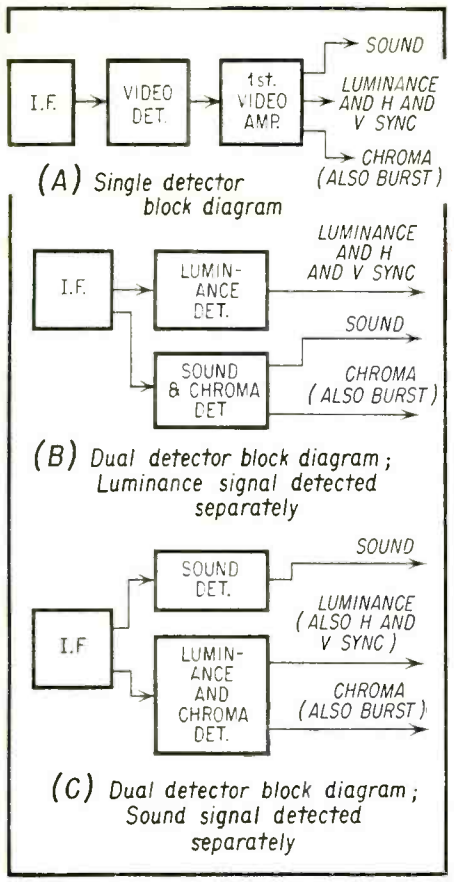


Fig. 1—Block diagrams of various types of color detector circuits.

Discussion and analysis of the various types of detectors used in color TV receivers. Several circuits are illustrated.

COLOR DETECTORS

by BOB DARGAN and SAM MARSHALL

From a forthcoming book entitled "Fundamentals of Color Television"

Five different signals are contained in the composite video signal presented to the video detection circuit. These signals are the chroma, luminance, color burst, sound, and horizontal and vertical sync signals. If we were to consider the horizontal and vertical sync signals separately we would have six signals. These signals have the frequency ranges shown below.

Signal	Center Frequency	Upper Limit	Lower Limit
Chroma	3.58 mc	4.08 mc	2.08 mc* or 3.08 mc
Luminance	—	3.2 mc**	0
Color Burst	3.579545 mc***	—	—
Sound	4.5 mc	4.5 mc + 25 kc	4.5 mc — 25 kc
Horizontal Sync Pulse	15.734 cps	—	—
Vertical Sync Pulse	59.94 cps	—	—

*For I/Q receivers the lower limit is 2.08 *mc.*, and for R-Y/B-Y receivers the lower limit is 3.08 *mc.*

**The response at the higher frequencies falls off considerably as compared to the lower video frequencies. The luminance signal must be sufficiently attenuated at 3.58 *mc.* to reduce dot pattern and the resultant moiré effect.

***Consists of 8 to 11 cycles on the back porch of each horizontal sync pulse.

Signal Takeoff Systems

Three signal takeoff systems are employed for extracting the individual signals listed above. These systems are shown in rather simple block diagram form in Fig. 1 and were introduced to the reader originally at the beginning of this chapter (*see May Service Dealer & Electronic Servicing Pg. 16*). Referring to *Fig. 1:*

Figure 1 (A) shows a block diagram of a Single Video Detector type where the entire composite video *if* signal is demodulated in a single detector. The output of this detector feeds the first video amplifier tube following which the various signals are processed in succeeding circuits.

Figure 1 (B) shows a block diagram of a Dual Detector type where the luminance signal is demodulated in one detector and the combined sound and chroma signals are demodulated in another detector.

Figure 1 (C) shows a block diagram of a Dual Detector type where the combined luminance and chroma signals are demodulated in one detector, and the sound signal in another detector.

It will be observed, from a study of *Fig. 1*, that in all cases the color burst signal is fed along with the chroma signal following detection. In subsequent circuits these two signals are separated from each other. It will also be observed that following detection, the sync signal which contains the hori-

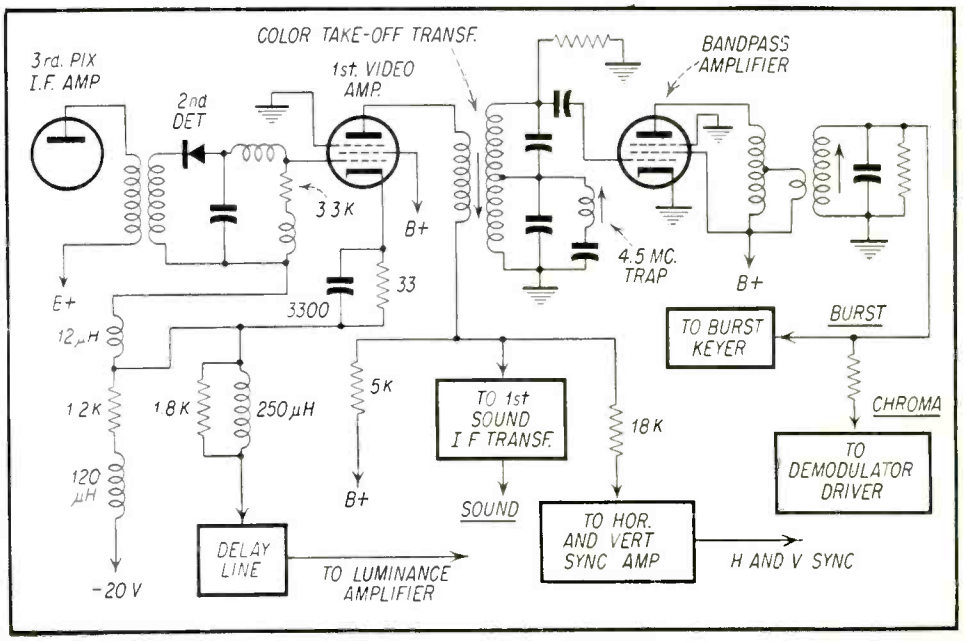


Fig. 2—Partial schematic of receiver using a single detector for the composite video I.F. signal. Separation of the various component signals is effected by employing selective circuits as shown in the above diagram.

zontal and vertical sync information is fed along with the luminance signal. These two sets of signals are duly processed in subsequent circuits wherever separation is required.

Single Detector Analysis

In *Fig. 2* we observe a simplified partial schematic of the RCA 21CT661-4 color TV receiver showing how the signal from the 3rd pix *if* is fed into the crystal 2nd detector. The demodulated output of this detector is then fed into a video amplifier tube where the process of extracting the various signals enumerated above are begun.

Notice that the luminance signal is taken off the cathode circuit of the video amplifier. The chroma signal is taken off the secondary of a Color-Takeoff transformer. The opposite end of the primary of this transformer, which is maintained at an *rf* potential above ground by a 5K resistor, provides the take-off point for the sound and sync (horizontal and vertical) signals. Separation of the sync signals from the sound signal is effected by means of a tuned 1st *if* sound transformer. The sound signal is subsequently removed from the sync signals in the sync amplifier circuits.

Dual Detector-Separate Luminance Detector Analysis

A circuit employing dual-detection in which one of the detectors is used for luminance and the other for chroma and sound is shown in *Fig. 3* which is a partial schematic of the Emerson Model C502A color receiver. Notice that the plate of the 4th *if* tube feeds parallel signals to T-7 and T-6. T-7 is a transformer which picks off the *if* signal preparatory to demodulation of the signal by crystal XTAL-2, the luminance detector. The output of this detestor provides the signals for the luminance section as well as the horizontal and vertical sync amplifier.

In T-6 we observe a transformer which provides the sound takeoff signal across terminal No. 3 and ground. The tap on the transformer (terminal No. 5) connects through a 6.8K resistor and a 3K control for variable sound rejection of the system. From terminal No. 2 we obtain the chroma signal

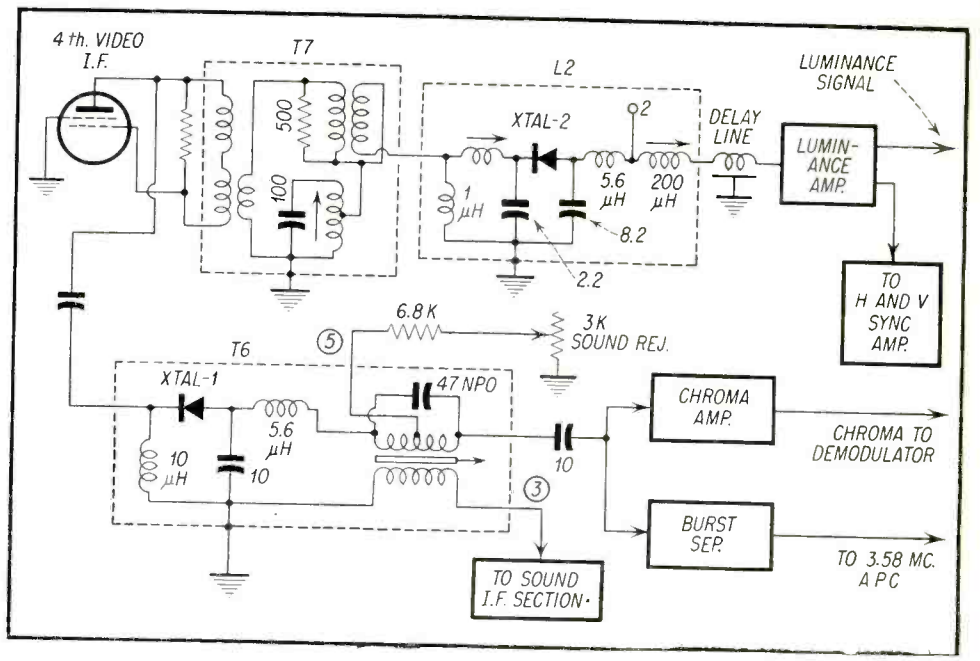


Fig. 3—Partial schematic of a dual detector receiver. The luminance signal is detected separately in one of the detectors. The sound and chrominance signals are detected together in another detector as shown above.

which is fed into the chroma section for further processing.

In the CBS-Columbia 205 receiver the video detector and signal takeoff circuit, as shown in *Fig. 4*, provides a separate crystal detector for the sound signal, and another for the chroma and luminance signals. Here we observe that the video *if* signal from the plate circuit of the 5th video *if* amplifier is divided into two paths. One path feeds the sound detector as shown, coil *L9* being tuned to 4.5 *mc*.

In the other branch of the detected signal the video *if* signal is sent through a sound trap of the "Sound Reject" type described in the May 1956 issue of Service Dealer and Electronic Servicing on page 32. The video *if* information comprising the chroma and luminance

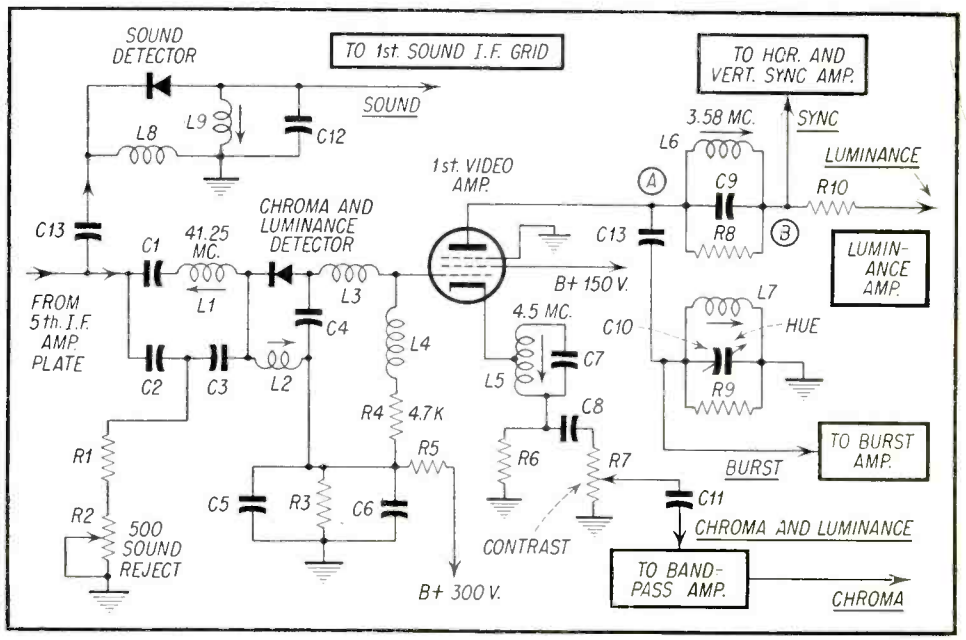


Fig. 4—Partial schematic of a color receiver using a separate detector for the sound signal and another detector for the chroma and luminance.

signals are demodulated together and fed into a video amplifier. The output of the latter provides three divisions of the detected signal. These divisions take place as follows:

The chroma signal is taken off at the cathode. Here a 4.5 *mc* trap provides further sound attenuation and the signal is sent into the bandpass amplifier via a contrast control. The bandpass amplifier which is tuned between 2.08 *mc* and 4.08 *mc* serves to attenuate the useful luminance signal, passing only the chroma information.

The plate circuit of the video amplifier feeds the video signal across *L6* and *C9* which is a parallel resonant circuit tuned to 3.58 *mc*. Because of its parallel resonant nature at 3.58 *mc* the color burst signal develops a high voltage at point A and is forced through *C13* to the Burst Amplifier where it is processed as described in previous installments.

Signal frequencies other than 3.58 *mc*, of which the luminance and sync signals are examples, find an easy path through *L6* and *C9* and are transferred on to point B. At point B the signal divides again, making its way into the luminance amplifier and into the horizontal and vertical sync amplifiers where appropriate signal processing extracts the desired signal.

Summary

Extraction of the various signals contained in the composite video *if* signal takes place in the section of the color receiver immediately preceding or immediately following detection.

Three detection systems are generally to be found. These consist of a single detector for all of the component signals; a dual detector in which one detector demodulates the sound *if* and the other the chroma and luminance *if* signals; and a dual detector in which one detector demodulates the luminance *if* signal and the other the chroma and sound *if* signals.

Methods used to separate one signal from another where they appear in a common circuit is generally accomplished by means of tuned coils or transformers which accept the desired signal and reject the undesired signal. ■■

trade flashes

A plaque honoring Ray R. Simpson's "leadership and inspiration" during his 50 years in the electronic instrument field was presented to the Chicago industrialist recently.

The presentation was made at a dinner sponsored by sales representatives of Simpson Electric Company, Chicago, founded by Simpson. The 35-pound copper and wood plaque was presented by John M. Forshay of New York City on behalf of the 100 sales representatives attending the affair at the Congress Hotel.

• • •

An unprecedented contract between General Electric Companys' Communication Equipment Section and Ryder System, Inc., one of the country's largest transport firms, calling for the widespread leasing of mobile radio units as regular trucking gear, was announced jointly by the two companies. Under the unique agreement, General Electric will lease two-way radio units for installation in trucks owned by Ryder Truck Rental Systems, a subsidiary of Ryder System. Ryder Truck Rental in turn will offer radio-controlled pickup and delivery to customers obtaining transport equipment from the Ryder organization on a lease basis.

• • •

The Washington County, Maryland Board of Education, with headquarters here, announced plans for installing the nation's first large scale closed-circuit television institutional program throughout an entire public school system.

Superintendent of Schools. William M. Brish, disclosed that the program will be instituted when school opens in September, with more than 6,000 pupils in two high schools and six elementary schools receiving an important part of their daily instruction by television. Present plans call for the extension of the program to the entire Washington County school system by September 1958, with all 47 schools supplied with closed-circuit equipment and approximately 20,000 benefitted from direct instruction by television.

Under the plan outlined by Mr. Brish all necessary equipments for school installations during the life of the project, presently planned for five years, will be contributed by the nation's leading electronic manufacturers through their official trade association, the Radio-Electronics-Television Manufacturers Association (RETMA). Funds to provide for the training of personnel and for supervising the program will be granted by the Fund for the Advancement of Education, an independent agency established by the Ford Foundation.

• • •

DOUGLAS H. CARPENTER, formerly chief engineer of JFD Mfg. Co. Inc., Brooklyn, New York, announces the opening of offices at 19 West 44th Street, New York City. Mr. Carpenter's firm will deal with various organizations in the electronic and electro mechanical industries on a consulting basis, in addition to public relations work in association with another New York organization.

• • •

The Hickok Electrical Instrument Company announces the opening of a new San Francisco Branch at 2585 Shattuck Avenue in Berkeley, California. George Ksander, Sales Engineer with Hickok for 10 years, has been appointed West Coast Manager for Hickok's complete line of electrical and electronic test equipment and electrical indicating instruments.

• • •

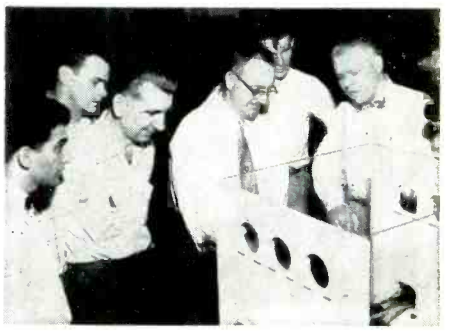
A 25th anniversary celebration in honor of the Snyder Mfg. Co., makers of auto radio and TV antennas and automobile accessories, will be held in the Beverley Hilton Hotel in Los Angeles. Key West Coast Snyder distributors will pay tribute to Ben and Gus Snyder, founders of the company. A supper party will be followed by an advance showing of all Snyder fall lines in the Presidential Suite of the hotel.

A new engineering development program has been added by Raytheon Manufacturing Company to encourage its employees to advance professionally by attending evening college classes and obtaining scientific training to qualify them for engineering positions. The program begins this fall.

Participants will be granted tuition, fees, and a stipend for books for study at accredited colleges and universities with evening divisions, such as Boston University and Northeastern University. Grants will be made on a yearly basis, renewable for a second year.

• • •

Dan Johns, Moses Radio-Electronics Co., Hartford, Conn.; William Osterhaut, Bob's Electric Co., Winsted, Conn.; John Hurchala, Stafford Electric Co., Stafford Springs, Conn.; Robert Kelly, Radio Service Laboratory, Hartford, and Dennis Dandara, Bob's Electric Co., are shown receiving pointers from Herbert Evander, Tung-Sol Electric Inc. commercial engineer, during groups' recent trip to three Tung-Sol tube plants in Newark, N. J. Mr. Johns escorted the four winners of the Moses Co. bonus plan contest. The one-day trip included an hour-long session with Louis Rieben, Tung-Sol president.



• • •

According to the Radio & TV Guild of Long Island News, the Detroit City Council passed unanimously an ordinance requiring a license to conduct a business of installing and servicing television equipment. The ordinance is aimed at "irresponsible sales methods," "inferior installation, maintenance, and repairs."

[*Continued on page 42*]

GUEST EDITORIAL

[from p. 19]

time and a higher quality of service work. When a new or unfamiliar receiver comes into your shop, stop for a few minutes before you begin to service the set. Take out the manufacturer's service information on the set. Study the overall circuitry of the receiver. If there are any new or unusual circuits, read the circuit description of that portion of the receiver. Glance through the scope wave forms illustrated and note from where they are taken. Observe any special notations as to voltage readings, alignment or servicing procedures. All this takes but a very few minutes out of each day and will reward the service technician with a full working knowledge of every receiver he may be called upon to service. In turn, he is then in position to provide his customers with the most complete, most competent and highest quality service available.

To supplement this self-improvement program of the service technician, most major Radio & Television Manufacturers have made available to the service profession: training courses, schools, home study material, and monthly technical publications. Avail yourself of these opportunities to broaden your education for, as with any other major profession, you must continually strive to increase your technical knowledge and improve your servicing ability. ■ ■

THE WORK BENCH

Unusual Service Problems And Their Solutions

by PAUL GOLDBERG
Service Manager

This Month's Problem:
Color Receivers

THIS month's installment concerns problems in color receivers. A knowledge of color receiver theory and circuity is necessary in solving these problems. This article has been written with the hope that the reader has been reading the very informative articles on color by Dargan and Marshall in this magazine.

CBS Color Chassis 205

The receiver was turned on and it was noted that the black and white picture was normal; however, during color transmission there was an absence of red and the picture seemed to be dominated by the colors green and purple. This usually indicates the malfunctioning of the I channel in the color section of the receiver. The absence of the color signal passed by the I channel usually gives this effect; in which case the Q and Y (luminance) signals are the only signals reaching the picture tube red, green, and blue control grids.

The diagram was now studied. It was observed that the 6BY6, V23, I demodulator, and the 6AN8, V24 A & B, I amplifier and phase splitter were the tubes that would affect only the I band of color signals. These two tubes were replaced individually, but had no effect.

The purpose of the demodulator is to separate the chrominance information into the I and Q signal voltages. This is accomplished in the I demodulator, V23, by applying the chrominance signal to the pin #1 grid and applying the I reference oscillator signal (3.58 megacycles) to the pin #7 grid. Synchronous detection then occurs.

The I signal then passes through the filter network *C23-4, L23-1, C23-3, R23-3*. The filter passes a band of frequencies

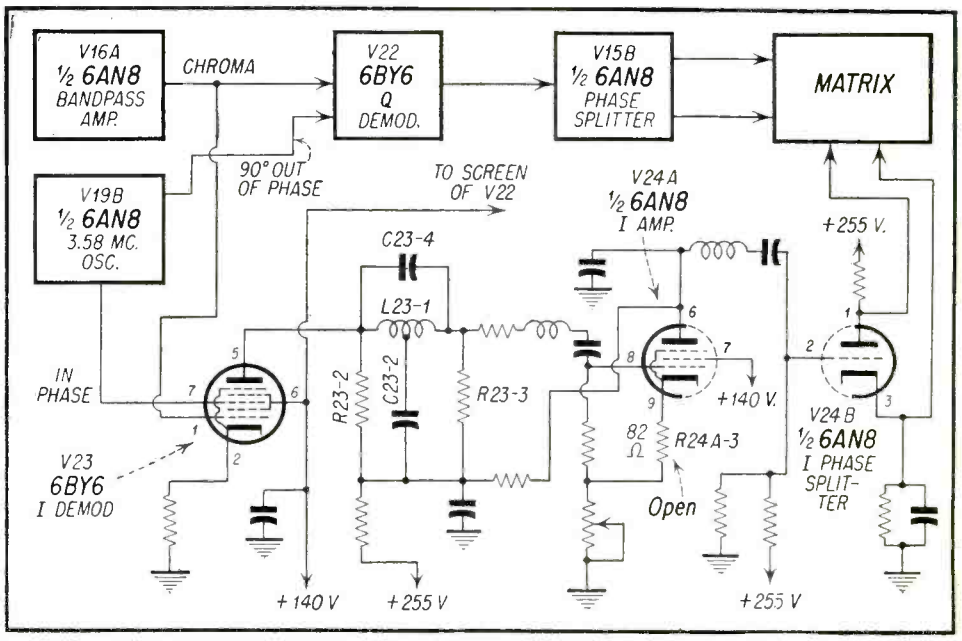


Fig. 1—Partial schematic of CBS 205 Color TV receiver.

from 0 to about 1.5 mc and eliminates any high frequency brightness information. The I signal then enters the I amplifier V24a, ½6AN8. The signal is here amplified to a value proportional to the Q signal voltage. This is necessary since only one sideband of I, between .5 and 1.5 mc., is transmitted as compared to Q which has two sidebands. (The Q sidebands add in the Q demodulator producing twice the amplitude of I in the I demodulator.) The signal then leaves the I amplifier and enters the I phase splitter stage, V24A, ½6AN8. This stage produces negative as well as positive I voltages at its plate and cathode which are coupled to the matrix section.

Aware of these facts, quick voltage checks were made at the plate, screen and cathode of V23, V24A and V24B. When a voltage measurement was taken at the cathode, pin #9, of V24A, the meter read about 60 volts positive instead of about 5 volts. Thinking that this cathode was open, a resistance measurement was made from cathode to ground of V24A. The meter read infinite. The circuitry was examined and *R24A-3*, 82 ohms was found to be burned open. Replacing *R24A-3*, the receiver was turned on and checked on a station transmitting color. It now operated normally with all colors being reproduced properly. As no other cause could be found for the open *R24A-3*, V24, 6AN8 was replaced as a precautionary measure.

Motorola Color Chassis— Model BP-902A-01

The receiver was turned on and it was observed that black and white pictures were being received properly; however, during color transmissions the picture had horizontal bands of color moving vertically. It was deduced therefore that there was no color synchronization; that is the 3.58 *mc* CW oscillator was not being synchronized with the transmitted burst signal.

The color sync section is made up of V24 A & B (color *afc*), V28A, ½12AT7 (reactance), and V28B, ½12AT7 (3.58 *mc* CW oscillator). V24 and V28 were replaced individually, but had no effect.

[*Continued on page* 46]

ASSOCIATION NEWS

by SAMUEL L. MARSHALL

Television Service Dealer Association of San Mateo County

Recently, celebrating its first year anniversary, the Television Service Dealers Association of San Mateo County had its annual dinner dance at Bob's Place on Broadway in Burlingame.

Headlining the distinguished guests that were present was Frank Moch, president of NATESA, who flew from Chicago to install the newly elected officers.

The new president of TSDA is Eddy Mitchell. W. D. Haines was elected vice-president. TSDA secretary is Jack Gardner, and treasurer is Jetti Hill.

Dick Dowlwig, California State Assemblyman, Rex Yeager, president of the San Francisco Service Guild and H. Lawrence Schmitt, president of the Radio and Television Association of Santa Clara Valley were among the honored guests.

As guest speaker, Frank Moch confined his comments to television service industry problems of a national character.

Over 150 people heard Moch say that factory service company competition is becoming more of a problem in the East. "The large companies are going to compete because they realize that the service industry can be profitable." Moch closed his talk with the thought that "only the local associations can handle the biggest problem of all; establishing good relations with the public."

Radio Television Guild of Long Island

With the organization of a full working committee, plans for the Long Island Electronics Fair swing into high gear.

The first task of the committee was the formation of a brochure. Included in the brochure will be the purpose of the Fair, the facilities that are available, the participation rate and other pertinent information to attract lectures and exhibitors.

The Long Island State Agricultural Institute, where the Fair will be held, has pledged full support. As an added attraction to visitors, the Institute intends to conduct guided tours through the University itself.

Exhibit facilities consist of a large building, 130 x 90', which will comfortably accommodate 50 to 75 booths. The Institute has also made available three lecture halls accommodating up to 150 people which will be used for the presentation of technical papers. Included in the facilities available are a cafeteria, a large parking lot, ample lighting, public address systems and motion picture equipment.

Of interest to both exhibitors and visitors will be the information that the Electronics Fair is to run as a non-profit venture. Charges both to visitors and exhibitors will be small and are only intended to cover expenses.

Association Radio-Television Servicemen of New York, Inc. (ARTSNY)

In addition to the ARTSNY Clinic Color Course, ARTSNY has obtained a series of technical lectures to be given by one of the finest lecturers in the field. Samuel Marshall, author, teacher, lecturer, and editor of SERVICE DEALER AND ELECTRONIC SERVICING MAGAZINE, will present a series of lectures on Color TV. This same course was presented to a teacher group in New York City and is to be given in its entirety over a period of ten months. The course will start from the theory and operation, and progress to the servicing of color TV and the instruments used, and will provide the necessary knowledge for servicing color sets. This course will be free to all members of ARTSNY,

[*Continued on page* 38]

Mfg: Motorola **Chassis No.** TS-326B

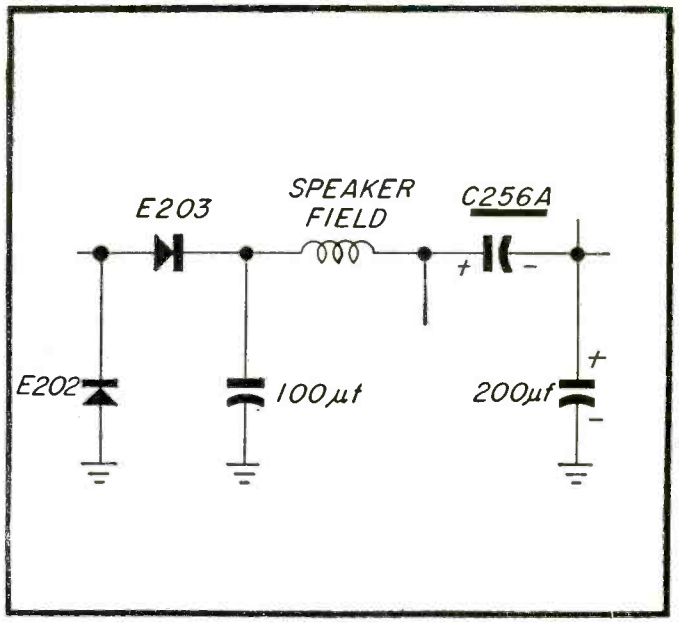
Card No. MO326-1

Section Affected: Raster

Symptom: Insufficient width, buzz, and vertical roll.

Cause: Defective component.

What To Do:
Replace: *C256A* (200), which is leaking.



Mfg: Motorola **Chassis No.** TS-326B

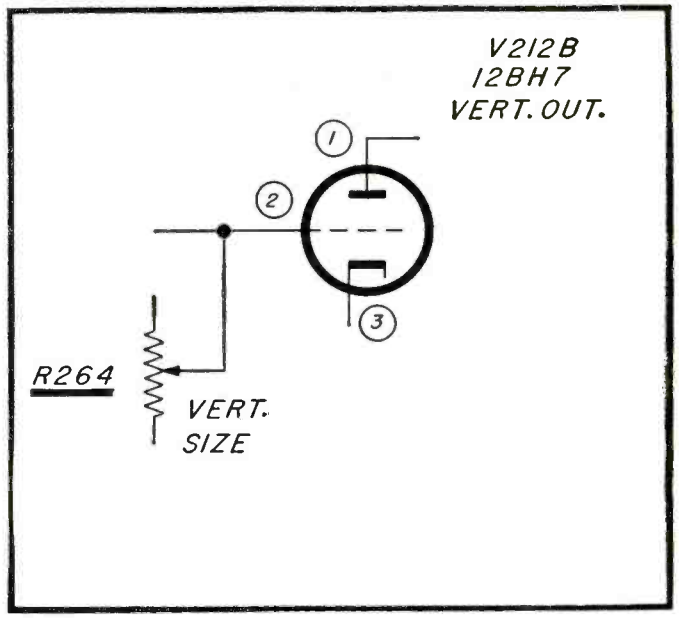
Card No. MO326-2

Section Affected: Raster

Symptom: Vertical jumps.

Cause: Defective component.

What To Do:
Replace: *R264* (5 meg.), vertical size control; arcing.



Mfg: Motorola **Chassis No.** TS-326B

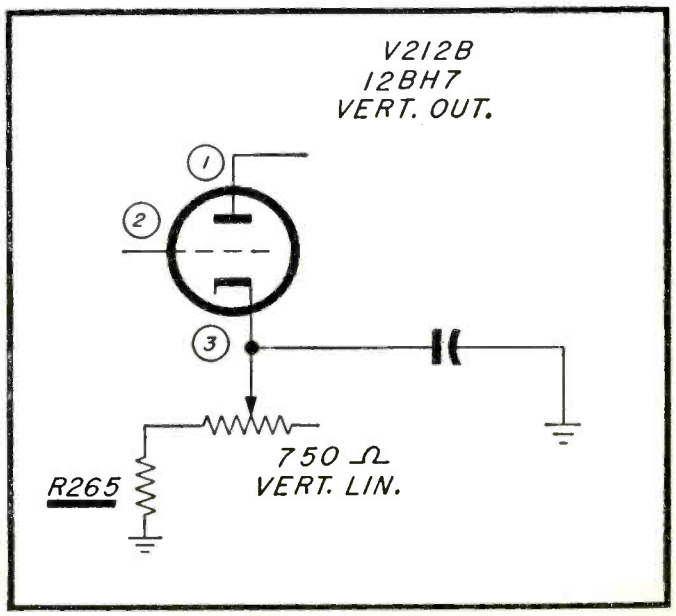
Card No. MO326-3

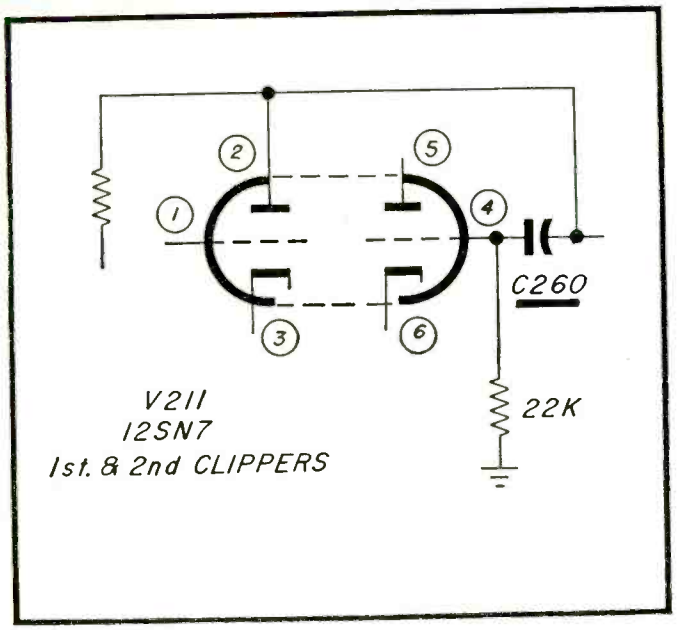
Section Affected: Raster

Symptom: Bad vertical sweep.

Cause: Defective component.

What To Do:
Replace: *R265* (8.7K), which is open.





Mfg: Motorola **Chassis No.** TS-326B

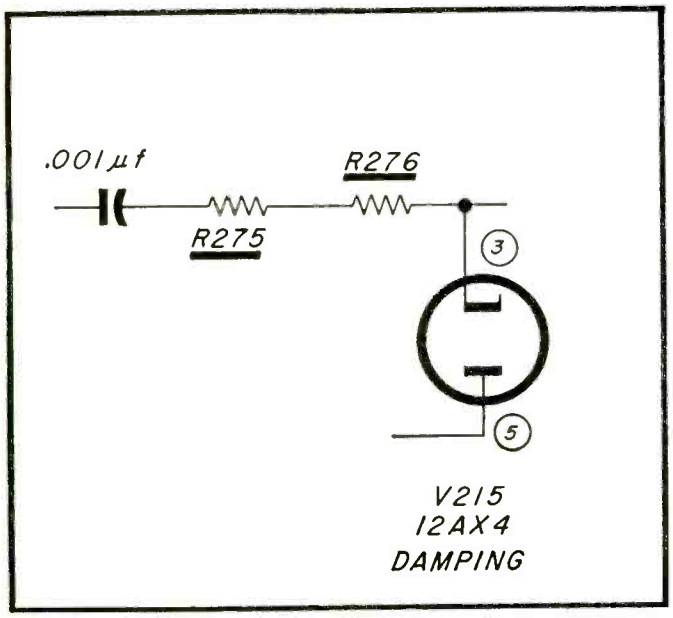
Card No. MO326-4

Section Affected: Sync.

Symptom: Critical vertical and horizontal hold.

Cause: Defective component.

What To Do:
Replace: *C260* (.05 μf), which is leaking.



Mfg: Motorola **Chassis No.** TS-326B

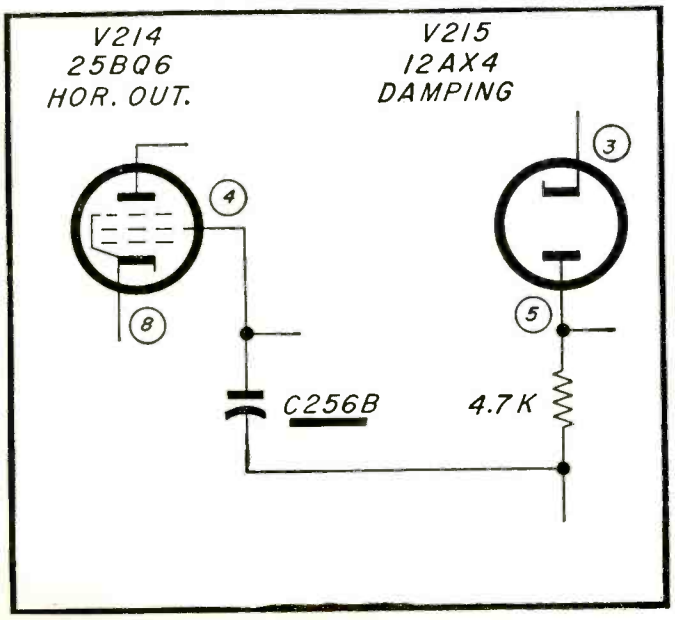
Card No. MO326-5

Section Affected: Sync.

Symptom: Critical horizontal sync.

Cause: Defective components.

What To Do:
Replace: *R275* (150K), *R276* (150K), which have increased in value.



Mfg: Motorola **Chassis No.** TS-326B

Card No. MO326-6

Section Affected: Raster

Symptom: Insufficient width and sound distorted

Cause: Defective component.

What To Do:
Replace: *C256B* (5 μf), which is shorted

ASSOCIATION NEWS

[*from page 36*]

A proposition was presented to the Associated Radio and Television Service of New York, Inc. by the Nationwide Insurance Co. It was a plan to help service the membership of the television association. It was by no means an insurance selling scheme, but rather a phase of the Brooklyn division of Nationwide to become part of the community it serves.

For the first time statistics of the industry which has numerous hazards will be compiled. The problem of one serviceman is the problem of hundreds of others. The Associated Radio and Television Servicemen of New York working with the Nationwide company has started a new vogue. The heavyweight working with the little fellow is a remarkable combination because it becomes a mutual service pact.

Associated Radio and Television Servicemen, Illinois (ARTS)

The ASSOCIATED RADIO & TELEVISION SERVICEMEN, Illinois, have created two new positions in their organization. One is that of Trade and Press Representative, and the other is that of Historian. Mr. Stephen (Steve) Jacyna, owner of Logan Square Radio has been appointed Trade and Press Representative. Mr. Anthony (Tony) Mallin, owner of Devon Radio Service has been appointed Historian. Because of the growth of the ARTS organization, the need for these positions has been recognized. Also they create the basis by which the members can share in the responsible work of the organization, and have the opportunity to assume work which will prepare them for more important administrative duties later.

High Point Radio & TV Technician's Association

The High Point (North Carolina) Radio & TV Technician's Ass'n. has been in operation for about three years. Major activity to date has been an opportunity for local shops to get to know

each other better and to exchange credit information. Meetings are held at local Y.M.C.A. on first & third Tuesday evenings, each month. First meeting is a business meeting, second a supper meeting.

Officers are Jim Hornaday, Pres., G. V. Fendor, V-Pres., Bob Baird, Sec.-Treas. Correspondence should be addressed to Bob Baird, 500 Mint St., High Point, North Carolina.

At a meeting in Greensboro, N. C. on June 14 the groundwork was laid for an association of TV-Radio service shops in the central part of the State. The meeting, called by the High Point Radio & TV Technician's Association, was attended by about 30 men from Greensboro, High Point and Winston-Salem. For the time being the group will be known as the Tri-City Technician's Ass'n.

Temporary officers to serve for three months were elected. These were Jim Hornaday, High Point, Pres.; Van Sickles, Winston-Salem, V-Pres.; Joe Woods, Greensboro, Sec.; and C. B. Steele, Greensboro, Treas. All full-time shops in the area are invited to join. Membership is not limited to the three cities mentioned. It is hoped that in the future this group may serve as a basis for a State-wide organization.

Houston Association of TV-Electronics Servicemen, Inc.

"The Houston Association of TV-Electronics Servicemen, Inc., an affiliate of the National Alliance of TV-Electronics Service Association has finally completed drafting of a Texas State Electronics Licensing Bill, which is now being incorporated into the platforms of several candidates for the new Legislature, and which will be considered for passage into law by the Texas Legislature," according to F. B. (Bob) Koepnick, President of the Houston Association, and a Director of the National Association. "The measure is not a control, nor regulatory bill, but provides that any person who engages in the servicing, or repairing of television or electronic equipment, will be required to take a State supervised Civil Service type examination. . . . Upon satisfactory passing he will be eligible to obtain a License, good anywhere in the State. . . . The law is designed to

Mfg: Silvertone **Chassis No.** 128-16

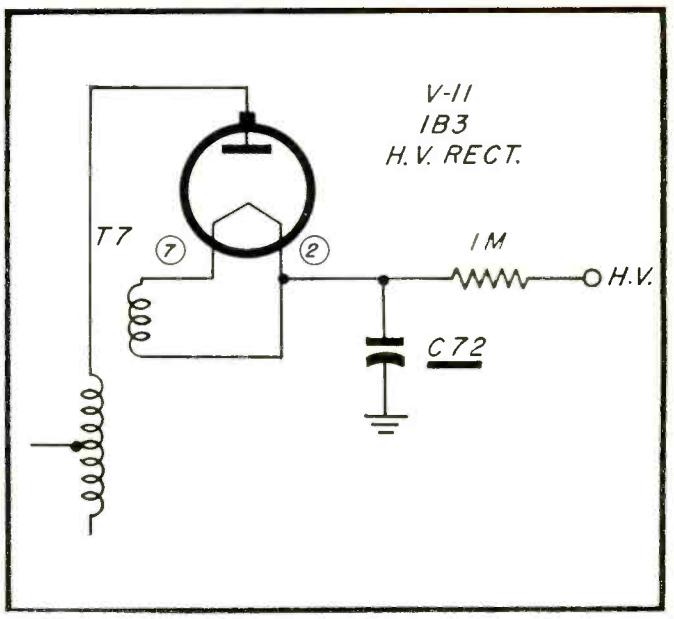
Card No. SI128-1

Section Affected: Raster

Symptom: Intermittent ticking noise in sound and in raster.

Cause: Defective component.

What To Do:
Replace: C72 (330 $\mu\mu f$, 12.5KV), which is breaking down.



Mfg: Silvertone **Chassis No.** 128-16

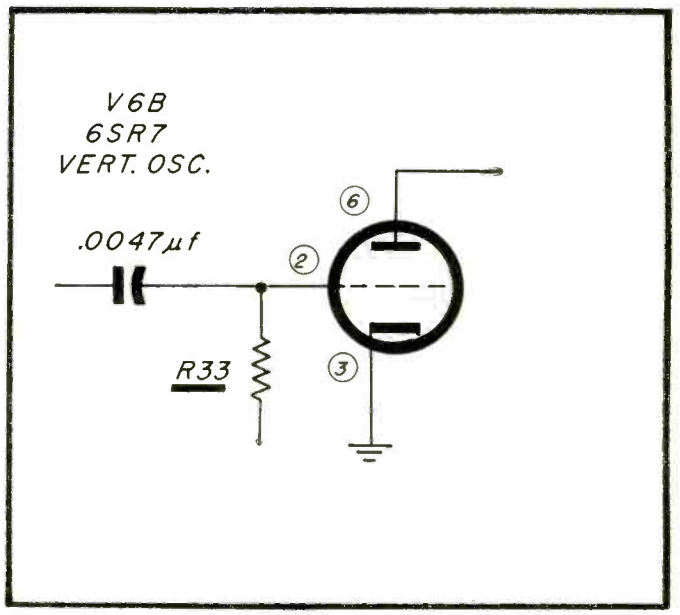
Card No. SI128-2

Section Affected: Sync.

Symptom: Vertical hold drifts out of range.

Cause: Defective component.

What To Do:
Replace: *R33* (1 meg.), which has increased in value.



Mfg: Silvertone **Chassis No.** 128-16

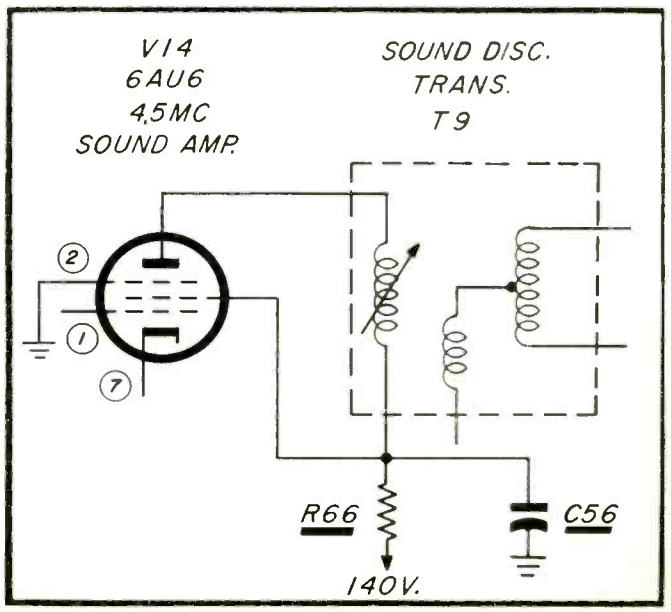
Card No. SI128-3

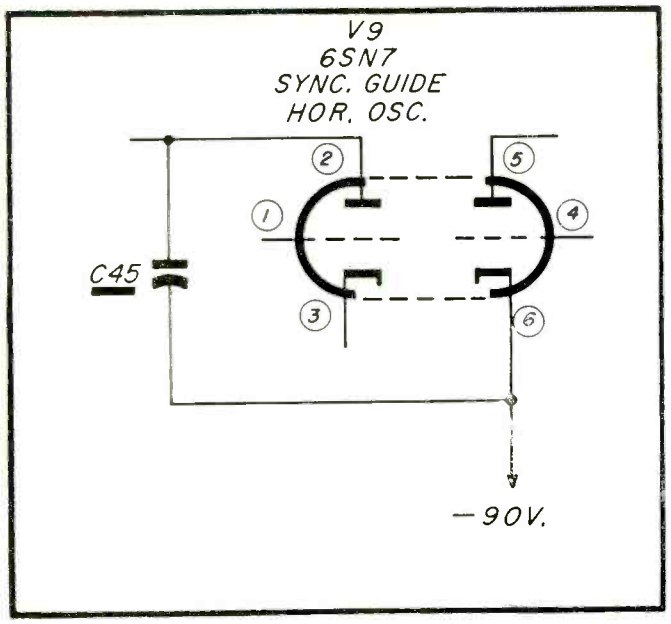
Section Affected: Sound

Symptom: No sound and *R66* is burned.

Cause: Defective component.

What To Do:
Replace: *C56* (.01 μf), which is shorted and *R66* (1K), which is burned.





Mfg: Silvertone **Chassis No.** 128-16

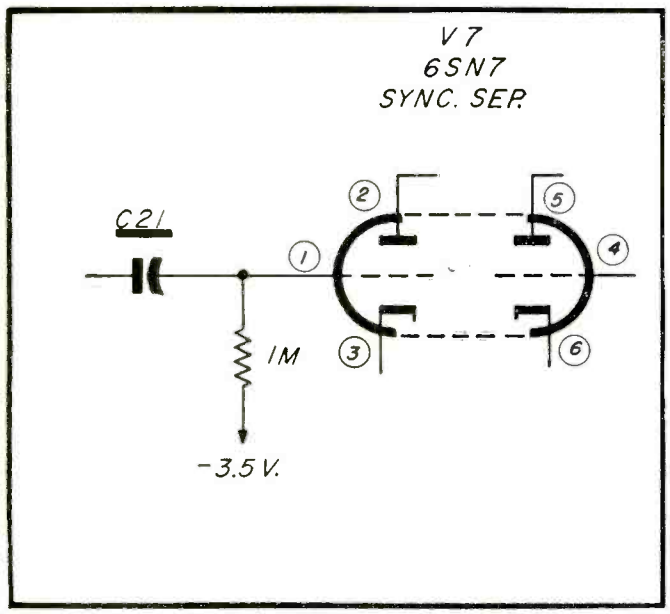
Card No. SI128-4

Section Affected: Sync.

Symptom: Horizontal frequency drifts intermittently.

Cause: Defective component.

What To Do:
Replace: *C45* (.047 μf), which is leaky.



Mfg: Silvertone **Chassis No.** 128-16

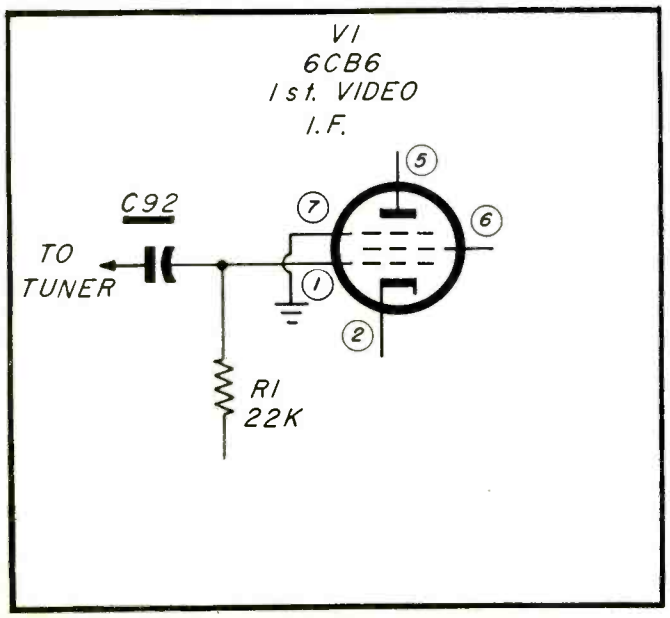
Card No. SI128-5

Section Affected: Sync.

Symptom: Poor vertical and horizontal hold.

Cause: Defective component.

What To Do:
Replace: *C21* (.047 μf), which is leaky.



Mfg: Silvertone **Chassis No.** 128-16

Card No. SI128-6

Section Affected: Pix

Symptom: Video overload.

Cause: Defective component.

What To Do:
Replace: *C92* (270 $\mu\mu f$), which is leaky.

assist the public in cleaning up a lot of mess now existing in the business, and will provide penalties for those found guilty of damage and fraud to consumers' property."

Television Electronic Service Association, Saint Louis (TESA)

Charles Luensmann and Vince Lutz of TESA made a trip to New Madrid, Mo., for the June meeting of the Radio Television Association of South East Missouri. Charlie and Vince were made to feel welcome by this new group, which has only been organized for three months.

The story of how an individual shop owner could be represented on a local, state, regional and national level was explained and how small shops could benefit on advertising, educational, technical, credit and insurance problems through affiliation with TESA—Missouri and NATESA was described. Shop owners in outlying areas have much trouble setting up good technical meetings, purchasing insurance on group rates and being able to get high class advertising service at low cost. The present and future plans of NATESA to furnish these services to all affiliates was encouraging to the eighteen shop owners attending the meeting. Many of these men drove thirty or forty miles to attend. The association has a total of twenty-one members.

Radio Television Association of Santa Clara Valley (RTASCV)

Of news to the RTASCV membership is the fact that the new Westinghouse color receiver will be shown at the next general meeting to be held at the Napredak Hall in Cupertino. Don Johnson, Westinghouse dealer training supervisor will be present at the Aug. 14 meeting to describe the new Westinghouse color set.

Technical aspects and service procedures will be covered as well as set up and installation.

Business at the July 10 meeting included a report on the licensing bill that is proposed for the Santa Clara County. Members of the RTASCV will be asked to approve a bill that will be presented to the County Board of Supervisors. ■ ■

THE ANSWERMAN

Inquiries Sent To The Answerman Will Be Acknowledged Only If Accompanied By Radio-TV Service Firm Letterheads Or Similar Identification.

BY SERVICE DEALER & ELECTRONIC SERVICING TECHNICAL STAFF

Dear Sir:

I come across a job to add a VU meter to a tape recorder in connection with a mixer for a Hi-Fi fan. The recorder has a "Magic Eye" volume indicator only.

Maybe the "Answer Man" or Mr. Lawrence Fielding will mention a proper information in his "The Service Dealer and Hi-Fidelity."

W. R.
Brooklyn, N. Y.

Inserting a VU meter in a tape recorder may be accomplished in accordance with *Fig. 1.* A properly damped VU meter should be used, although so-called "power-level" meters will do a fair job. The former cost about $42.00 list, whereas the latter may be obtained at a list of about $17.00 or 18.00.

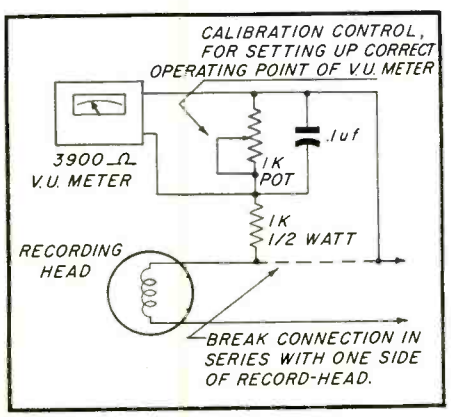


Fig. 1—How to connect a VU meter to tape recorders.

The potentiometer is suggested in the circuit because not all recording heads require the same energizing current. Since you did not specify the type of recorder in question, I am suggesting a value of potentiometer which will cover most commercially available units. Your job will be to CALIBRATE the meter so that it reads just below full scale at the point of tape overload, but since you have the eye indicator, this should prove to be fairly simple.

Dear Sir:

I have a problem that has mystified me and may interest some of your readers. The receiver is a Travler 46A3. The receiver was examined and it was found that the contrast control was burned open. This looked simple enough. There was no picture or sound.

The audio take-off is in the plate circuit of the video amplifier which explains the lack of audio. I thought at first the problem was only going to involve an open contrast control. I replaced the control and turned on the receiver. Still no sound and no picture. The new contrast control burned in a short time.

I referred to the schematic, looked it over, measured a couple of voltages and

[*Continued on page* 43]

TRADE FLASHES [*from page 23*]

Requirements for a service dealer's license are that he must have a certified technician's license or regularly employ a full-time certified technician.

It does not apply to any employee of a licensed service dealer under direction of a certified technician. That is to say, only one certified technician is required.

Students or apprentices accompanied and supervised by a certified technician are not required to have licenses but must carry identification cards.

As approved, the ordinance is a compromise between proposals made earlier requiring that all engaged in doing repair work or running a business be licensed and those proposals opposing licensing entirely. The television service association advocated the licensing proposal.

The requirements of a certified technician are that he must be over 21 years old, have four or more years of experience in servicing equipment, or have technical training (trade, college or correspondence school) equivalent to two years, with a minimum of one year's practical experience.

A service dealer's annual license fee is $25 and a certified technician's $10.

A board of examiners is to be selected and provision made for administration and enforcement of the ordinance. Members of the examining board will include three service dealers, an instructor of a TV school and an engineer from one of the local TV stations.

• • •

Industry-wide plans for the observance of National Television Week, Sept. 23-29, began to jell as manufacturers, dealers and broadcasters spelled out their individual and collective sales promotion campaigns.

Celebration of the Week again will be under the joint sponsorship of the Radio-Electronics-Television Manufacturers Association (RETMA), the National Association of Radio and Television Broadcasters (NARTB), the National Appliance and Radio-TV Dealers Association (NARDA), and the Television Advertising Bureau.

RETMA and the other sponsoring organizations adopted the following slogan for this year's promotion campaign: "National Television Week—Celebrating the Finest Home Entertainment in Sight".

• • •

With the termination of Capehart's Television-Radio and High Fidelity Production and Sales—Mr. F. B. "Ted" Ostman, Director of Capehart-Farnsworth Company Service Operations will join the Federal Electric Corporation, another I T & T Division. Mr. Ostman will be Staff Consultant to Major General Francis H. Lanahan, Executive Vice-President.

• • •

Robert C. Kocmoud is the new sales promotion manager of General Cement Mfg. Co., Rockford, Illinois, and all that firm's sales divisions. The appointment was made recently by Stanley B. Valiulis, G-C president. Mr. Kocmoud brings to his new position several years' work with the advertising department of a large mail order company.

• • •

The two-way radio communications industry, through the Radio-Electronics-Television Manufacturers Association, announced plans looking toward the inauguration of an extensive educational and liaison program for the industry.

In accordance with this program, Carroll M. White, who has had many years experience in military, municipal and industrial communications, has been employed as Manager of Mobile Radio Communications by RETMA. In his new position, Mr. White will conduct a varied and extensive campaign to acquaint the government, industry and the public with the contributions made by the land mobile communications industry to the over-all economy and safety of the country. He will be stationed in Washington at RETMA headquarters.

MARINE ELECTRONICS [*from page 6*]

However, unless it has been specifically engineered for marine use, no *ac* equipment should be grounded in any way, because of the danger of causing electrolysis. This applies especially to battery chargers, some of which employ auto-transformers. Connecting them to a boat's batteries (while the batteries are still connected to boat circuits) is an invitation to rapid electrolysis. More on this in a succeeding chapter.

CORRECTION

The reader's attention is called to two corrections that should be made in Fig. 1 of the June installment of "The Marine Electronic Business" on page 15. The rectifier protective resistor is 22 ohms, not 22K; and the filter resistor is 500 ohms, not 500K. These corrections will render the diagram correct in every detail.

found that instead of having, as the print called for, 135 volts at the cathode circuit of the 6V6 audio output tube I had nearly 400 volts. Tracing down the circuit I found that a large voltage was being applied to the contrast control when it should have been much less than 135 volts. I went back over the circuit diagram and found a condenser, EC-17B which was the filter condenser from the bottom of the audio output transformer to the cathode circuit of the audio output tube. Again, I thought, this is an easy one. The 40 μf condenser is shorted and putting too much B plus on the 135 volt line. I checked the condenser. Needless to say, it was good.

I still haven't found why the contrast control has such a high voltage on it or 400 volts exists at the cathode of the 6V6 audio output tube.

I hope you can help me in this.

P. C.
Philadelphia, Pa.

In examining the B plus system and the power supply circuit as shown in *Fig. 2* of the Travler 46A3 TV chassis it can be noted that there is another way in which 400 volts can appear at the cathode of the audio output tube besides with a shorted 40 μf condenser (not considering a shorted 6V6 audio output tube). That is, if a short occurs in the power transformer filament windings. If the 5 volt filament winding for the 5U4 tube should short to the 6 volt winding, as shown in *Fig. 2* the 400 volts on the 5 volt filament winding would also be applied to the 6 volt winding for the 6V6 tube and thus to its cathode circuitry. This is more than likely the cause of the difficulty.

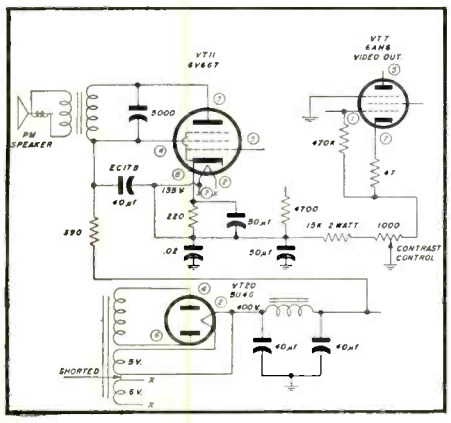


Fig. 2—Partial schematic of Travler 46A3 chassis showing power supply, audio, and audio output.

Mr. Answerman:

What can be causing the low hum in the audio output from a television receiver I have been servicing. When the volume control is turned down the hum is still present from the speaker. It is not very loud but could possibly be considered objectionable.

Naturally, the first thing checked was tubes, then B plus filters. They were all found to be normal. Now what?

I have noticed that when I bring my hand in near the audio circuits there is a change in amplitude of the hum depending upon the position of my hand. Some locations cause the hum to increase and others reduce the hum.

Would very much appreciate a suggestion as to what to try next.

T. R.
Dallas, Texas

More than likely your problem is due to lead dress. In some receivers the *ac* leads that run to the on-off switch on the volume control pass along side of the audio stages. These leads can very easily induce 60 cycle voltages into the grids, or across the grid leak resistors. Lead dress in this section is more important than many technicians believe. Fortunately, it is usually solved in the experimental models and the technician is not too often bothered with lead dress problems.

When a hum is present as stated, one of the first steps to locate its cause would be to examine the *ac* lines running near the volume control and most particularly near the grid leak resistors. Another possibility of this difficulty may be the vertical deflection leads, such as those that feed the vertical output transformer. These wires must definitely be placed away from audio stages.

Also, contrast control or video signal leads running near audio circuits

or leads to audio circuits should be considered as the possible cause of hum in audio systems. Of course this would only occur on channel. The large video voltages present can easily couple a buzz into audio leads. The amplitude of these video signals is easily demonstrated by bringing a scope probe in the vicinity of the video stages and observing the video pulses that will be picked up without making a direct connection. Large coupling condensers are particularly good radiators of video signals.

Most likely, a close examination of the leads from the volume control to the audio amplifier grid and audio output grid circuits will reveal the source of the induced hum voltage. It is frequently helpful to twist the *ac* leads that run to the on-off switch so that the fields radiated by these wires are more or less cancelled, or at least reduced to a minimum.

Dear Mr. Answerman:

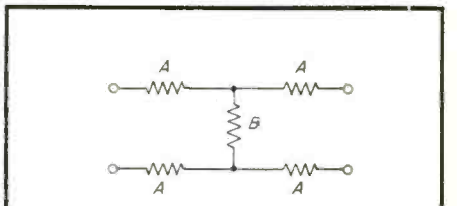
In certain areas of our city I have received many complaints in regard to reception of our local TV station which is Channel 2. Due to a recent changeover from one antenna to another, a decidedly ultra strong signal is now present in these areas. The symptoms clearly indicate an over-driven too great a signal being applied to the receivers. This is particularly of concern with new model receivers.

Could you suggest a means of rectifying this situation and would this corrective measure pertain to all types of sets.

J. J. S.
Allison Park, Pa.

Wtih the high amplification ability of present day receivers and the large amounts of power being radiated by some channels a problem is sometimes prevalent that was not experienced on the older receivers they are replacing. This overload problem comes into particular concern when the TV receiver is in an area where the transmitter signal strength is increased or is of a large magnitude.

Unfortunately, many technicians seem to be unfamiliar with the solution of this problem. Technicians feel that the set manufacturer should have designed a good *agc* system to handle the very strong signals. This is not always the situation. Some TV sets use only simplified *agc* circuits that are not capable of governing the amplification under very strong signal conditions. Most frequently they favor the weak signal reception conditions. Thus the problem arises. And the technician all too frequently does not recognize it as one to be corrected outside the receiver and often may consider it as a fault or a failure in the circuitry.



LOSS	OUTPUT VOLTAGE	A	B
20 db	1/10 INPUT VOLTAGE	120Ω	68Ω
10 db	1/3 " "	82Ω	220Ω
6 db	1/2 " "	47Ω	390Ω

Fig. 3—Attenuator pad values.

Fig. 3 shows a basic H pad and the values of resistors that will provide different amounts of attenuation. It is desirable to have a set of these pads to use for checking purposes when new antennas are installed in strong signal areas. The insertion of one of these attenuation pads can easily remove buzz from some receivers due to an over-driven condition as well as correct for over-driven pictures.

The unfortunate thing about this is that many technicians refuse to believe that in certain cases of antenna installations pads are necessary and required to reduce the signal as applied to the receiver. This is even more important when a channel puts up a new antenna or increases its radiating power. This problem is also very important when making antenna installations for color receivers. Excessive signals can cause considerable difficulty with color receivers. This is of such concern that color receiver manufacturers are providing attenuation pads at the rear of their receivers with switch arrangements for changing the insertion loss with different pads. ■■

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- This department is an additional service to our readers and advertisers. It is not intended to cover all products in all categories, nor is it intended to cover all products made by any manufacturer.
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Tarzian Inc., Sarkes	415 N. College Ave., Bloomington, Ind.
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Ungar Electric Tools, Inc.	P. O. Box 312, Venice, Calif.
Vaco Products Co.	317 E. Ontario St., Chicago 11, Ill.
Wall Mfg. Co.	Grove City, Pa.
Walsco Electronics Corp.	3602 Crenshaw Blvd., Los Angeles 16, Cal.
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General Electric Co.	Schenectady, N. Y.
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RCA, (Tube Div.)	Harrison, N. J.
Raytheon Mfg. Company	Newton, Mass.
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Delco Radio, Div. of General Motors Corp.	Kokomo, Indiana
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Vokar Corporation	Dexter 2, Michigan

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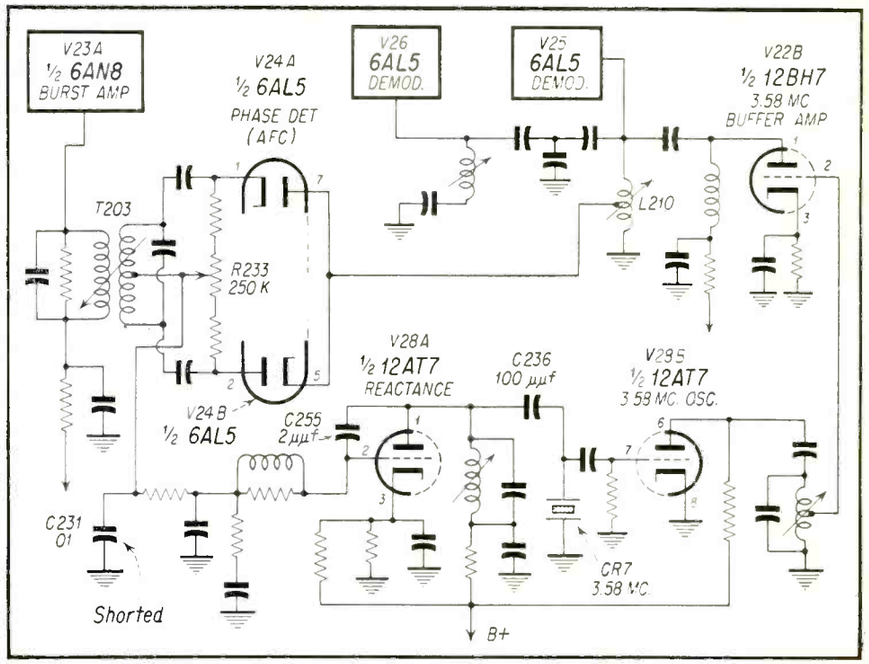
Eby Sales Co. of N. Y.	130 Lafayette St., New York 13, N. Y.
Federal Telephone & Radio Corp.	100 Kingsland Road, Clifton, N. J.
Jersey Specialty Co.	Burgess Place, Mountain View, N. J.

WORKBENCH [from page 35]



V28B is a shunt fed crystal stabilized 3.58 *mc* oscillator. The oscillator signal voltage is fed through *C236* to the plate of the reactance tube, V28A, and arrives at the grid, pin #2, through C255, 2 *μμf*. Due to capacitor action the oscillator signal voltage at the grid leads the oscillator signal applied at the plate. A leading plate current is thus produced which makes the entire reactance tube appear as a condenser to the crystal oscillator. A larger reactance tube plate current, for example, is caused by a more positive control grid voltage which causes the tube to act as a larger condenser and tunes the crystal oscillator to a lower frequency. The phase detector (*afc*), V24 produces a *dc* output voltage when the phase and/or frequency of the local 3.58 *mc* oscillator is not exactly that of the color burst synchronizing signal. The local oscillator signal is amplified by the buffer amplifier V22B and is fed by means of a tap on L210 to the phase detector V24A & B. (The output of the buffer amplifier is also fed to the demodulators V25 and V26.)

During the color transmission the burst signal is also fed to the phase detector through the tuned transformer T203. The simultaneous injection of the two *ac* signals creates resultant voltages (added vectorially) which affect the two diodes differently. The resultant *dc* output voltages is supplied to the control grid of the reactance tube whose tuning action pulls the oscillator into correct phase and frequency.

Knowing all these facts voltages were measured first at the plates and cathodes of V28A & B. The voltages measured correctly at these points. *R233*, 250K the *afc* balance potentiometer was adjusted, but would not bring the color picture into synchronization. It seemed to have no effect. *R233* was next resistance checked. A reading of zero ohms was measured on the meter from the center arm to ground. Condenser *C231* (.01 *μf*) was then clipped off the center arm connection. The center arm was again resistance checked to ground. The meter now read infinite. *C231* was measured and found to be shorted. This condenser obviously shorted the *dc* corrective voltage supplied by the phase detector, V24A & B to ground. *C231* was replaced with a new .01 *μf* condenser. *R233*, the *afc* balance control was adjusted for a normal color picture, (so that there were no horizontal bands of color moving vertically). The receiver now functioned properly.

RIDER SPEAKS

[*from page 13*]

and my wife is slightly more perturbed. I decide that maybe the best thing to do is to go to the club and call another mechanic after I get there. So we disconnect the charged battery and, lo and behold, the engine continues running and we go to the club.

Now I call another mechanic and describe my difficulty. Within 30 minutes he's at the car. After looking at the ammeter and banging the voltage regulator box cover, he declares the generator bad; it must come off. Being stubborn, I ask him if he would check the generator output. No, he has no measuring device, but he knows the generator is bad and must be replaced.

I remain stubborn. Two days later I get the car back to town and to my regular mechanic. I still have the same battery and the same generator, but a new set of brushes; the car runs like new.

Don't go away, there's more.

The day I get the car fixed my wife asks me to visit a watch repairman with her. (Several years ago I demonstrated my appreciation of her endurance in living with me for 25 years by buying her a watch from a very reliable establishment.)

Something had happened to the watch early in June and it needed repair. I suggested that she take it back to the store where I had purchased it. This she did but (unknown to me), when told the repairs would take two weeks, she took it to a watch repairman in the neighborhood. He operated on it, and within a brief period of four weeks she had made four separate visits to him, picking up the watch and returning it. It would run for about 48 hours, and then stop. Each time he got it started again he gave a one-year guarantee. She now owned four guarantees on a non-functioning watch that was

back for repair for the fifth time.

So I go with her and get the fifth guarantee. This time the watch runs for less than 24 hours. This is the last straw for her (for me too), and she takes the timepiece back to the place where I had bought it. They send it to the factory. She waits two weeks, and peace reigns at home once more.

Don't go away, there's more.

My married daughter just moved into a new home. She reads advertisements and has equipped the house with a well known brand of kitchen appliances. (You know, refrigerator, washing machine, dishwasher—everything.) But the dishwasher wasn't installed, so she called the dealer who had sold her the equipment. He sent the repairman pronto, but the repairman could do nothing because he had no equipment with him. Said he would be back the next day.

A new man came, but he could do nothing, because the first guy had told him nothing about what had to be done, and he had no tools with him. Now my daughter called me. Could I do something? Did I know someone who could do something?

I don't know anything about dishwashers, but I do know someone in the firm that made the equipment. So I call my friend and he gets in touch with their service department right away. The man arrives two days later, but can't install the dishwasher because he has no equipment with him! Yes, it's installed now—about five weeks after all this started.

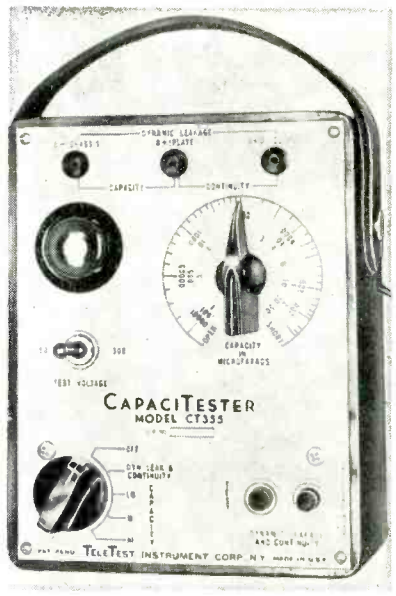
What's all this talk about incompetent TV service technicians? Sure, we have a few, but hardly enough to give *us* a monopoly.

Anyway, I'm glad July is coming to a close. ■ ■

Correction!

The June, 1956 issue of Service Dealer and Electronic Servicing on page 49 contained an erroneous description of the TeleTest Capaci-Tester in the article, "Condenser Checkers," Part 2, by Steve Travis. The correct description of this device appeared in the October, 1955 issue of this magazine in the article entitled, "The CapaciTester," by Sol Heller. The correct operation of the CapaciTester, quoted in part from this article, is as follows:

"The leakage testing section of CapaciTester employs a unique test set-up that is interesting enough to warrant description. This set-up is shown in simplified form in *Fig. 1*. A 'magic-eye' 6AF6 tube is used as an indicating device in conjunction with the condenser circuit under test. This circuit is shown in *Fig. 2*. Here point A corresponds to the B+ Jack Connection of *Fig. 1*; point B corresponds to the Grid Jack Connection; and ground corresponds to the B— Jack Connection. If the grid return of the stage does not go directly to the ground, the B— Jack lead connects to the 'low' side of the grid resistor. Changes in the shadow-angle of this eye-tube are produced when leakage exists in the component under test."



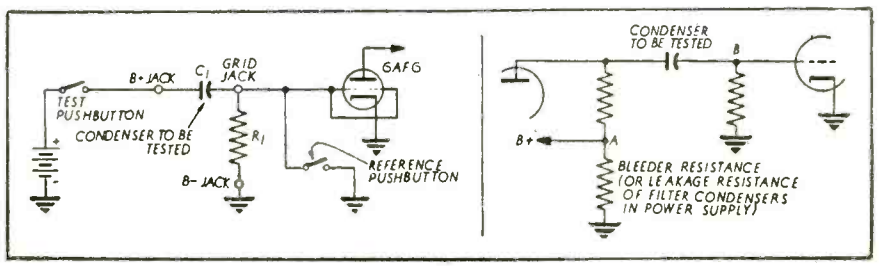


Fig. 1—Simplified circuit

Fig. 2—Equivalent circuit

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