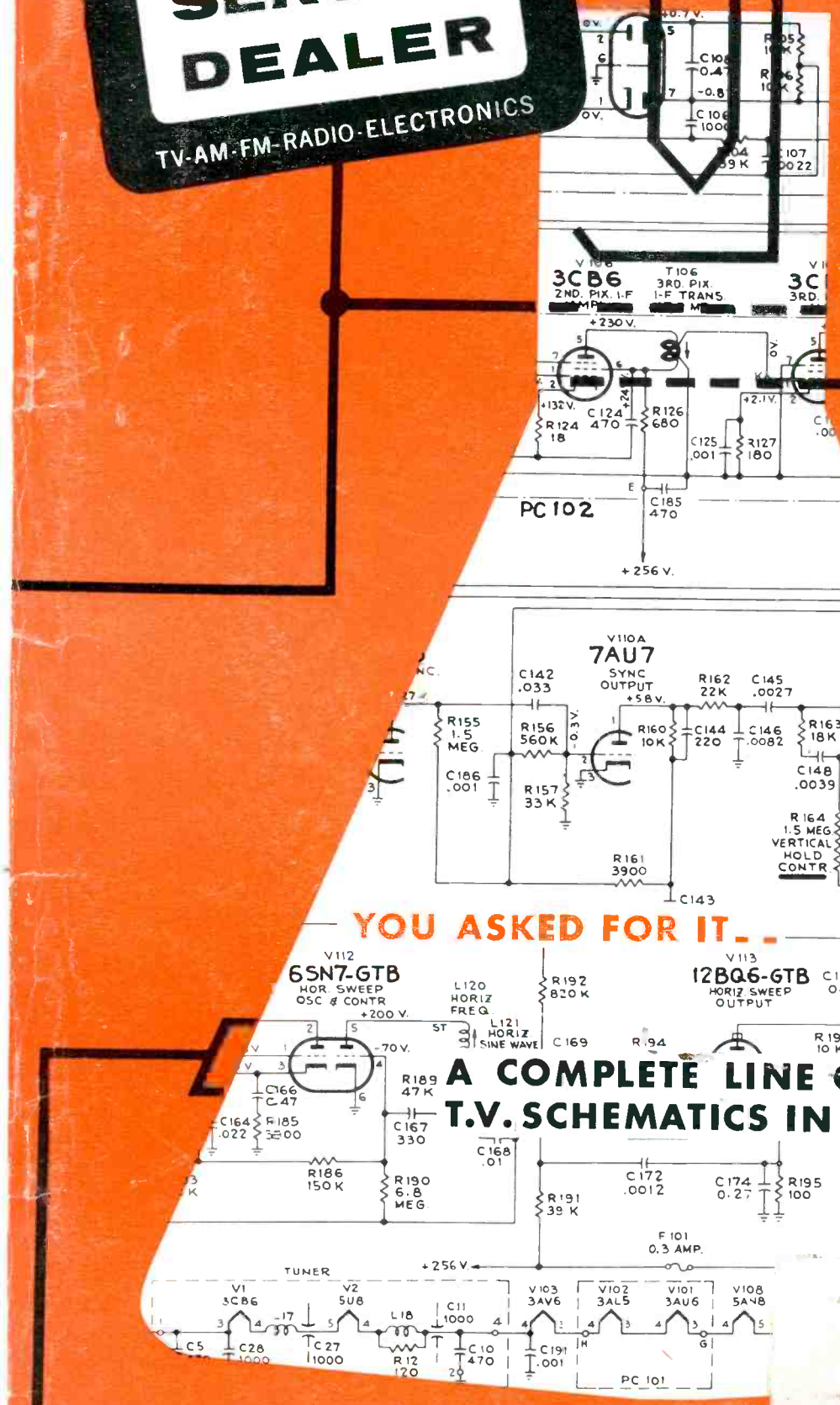
NOVEMBER 1955
25 C

Radio-Television SERVICE DEALER

TV-AM-FM-RADIO-ELECTRONICS



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The handsome professional appearance of IRC Q Controls lets you point to your work with pride.

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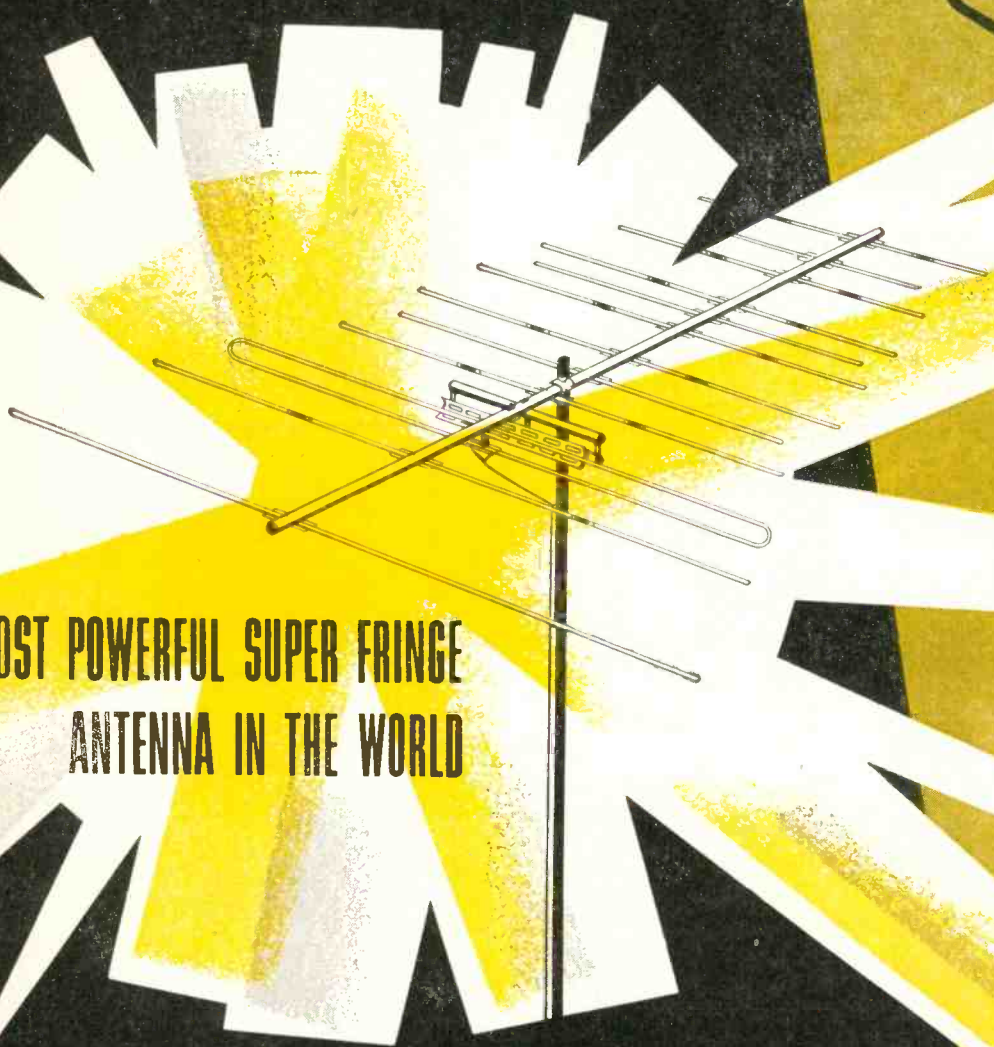

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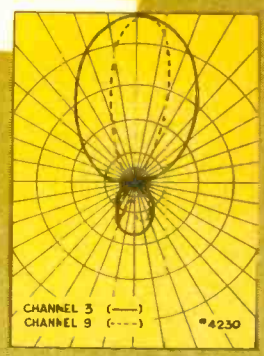

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Walsco Wizard Imperial	6.1	6.9	8.2	11.9	11.6	10.8	12.6
Antenna "A" With 3 Phase Reversing Dipoles	6.3	6.6	8.1	10.5	10.2	10.6	12.4
Antenna "B" Yagi Type with Phasing Loops	5.1	5.5	6.8	7.5	9.6	8.8	11.2
Antenna "C" Yagi Type with Loading Coils	5.9	6.9	8.6	9.1	8.6	9.6	7.8

Walsco
ELECTRONICS CORPORATION
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Los Angeles 16, California

Model	Price
Wizardette #4210	$14.90 list
Wizard #4220	19.50 list
Wizard Imperial #4230	34.90 list

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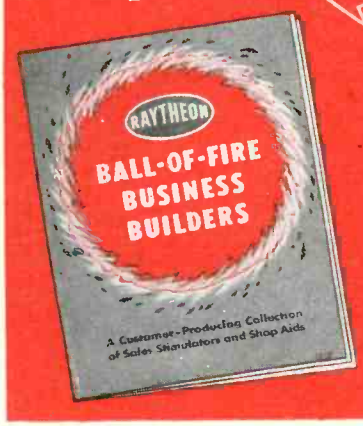

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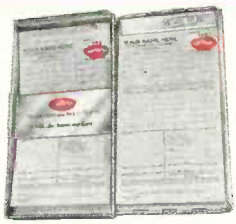

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Many items are free, the rest are 'way below normal cost. Ask your Raytheon Tube Distributor for a free copy of the new Raytheon Booklet or write to Department G, Raytheon Manufacturing Company, Receiving and Cathode Ray Tube Operations, Newton 58, Mass.

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Receiving and Cathode Ray Tube Operations
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VOL. 16, NO. 11 NOVEMBER, 1955

FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

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EDITORIAL...

by S. R. COWAN, PUBLISHER

The Readers Write

Last month, editorially, I asked service shop owners to tell me whether or not parts jobbers influence their selection of brands more than trade magazine advertising. It's too early to report to you what the consensus is.

Now I'd like to ask service shop owners their opinion on a somewhat relevant matter, to wit, how much do you depend upon the suggestions of your employed technicians in selecting brands? This question is asked for a very good reason. Some of our clients believe that shop owners are so busy maintaining bookkeeping records and supervising the overall operation of their shops that they relegate the selection of Brands and the purchases of components, etc., to their employed technicians. I don't agree. A publisher must not rely solely upon his own opinions on an important matter such as this. Thus your replies are awaited with great interest.

Color TV Here At Last

A fairly substantial number of key TV network programs since this Fall Season opened have been in color.

A few key city stations are also featuring an occasional color test-pattern during station breaks. It all adds up—color TV is here—at long last! (Remember the razzing we got in 1950 and 1951 when we alone of the service magazines were pessimistic and had the temerity to warn editorially: "Color TV probably will not arrive until Christmas 1955 or Spring of 1956.")

The advent of color TV poses a genuine competitive threat to Independent Servicemen and Service Dealers from TV set Distributors. Because the average serviceman has had but little practical experience installing and servicing color sets—not that Distributors have had much more—it is to be expected that: 1) to protect their own equity and, 2) the buyer of an expensive color set—several TV set manufacturers will try to divert as much of the early color set service and installation work as possible to their own Distributors' service departments.

This is competition that Independents must buck to the hilt. All color service work should be handled by professional servicemen and service firms. Distributors should be kept out of it entirely. The surest way to insure this is for you to know as much, if not more, about color TV set installation and service work as Distributors' servicemen. How to get this knowledge?—Attend as many manufacturers' Color TV clinics as possible. Lay your hands on a color TV set if you can, and go through its adjustments over and over again. Refer to the many excellent Color TV manuals and texts. And keep reading "SERVICE DEALER" articles on Color TV and you'll enjoy that status.

New Items To Service and Sell

Our current series of articles on servicing radiation detection devices such as Geiger and Scintillation Counters has created quite a stir. Our mail has been heavy on the subject.

Many readers wrote saying that frequently during the past year they have been asked to "check up" or repair such radiation devices. Most admitted that they had declined the jobs, or had accepted them with reluctance, because, knowing so little about the units, they were afraid they'd be "booby-trapped."

It is our opinion that the selling and servicing of radiation detection devices is here to stay and will become ever-increasing business for years to come. From a sales point of view, a very small cash investment for inventory is justified and will pay nice dividends. From the professional serviceman's viewpoint—the picture is just as bright. Rest assured no "tinkerer" will be asked to repair, nor will he be qualified or equipped to service Geiger or Scintillation Counters.

Stated another way — radiation detection devices are new electronic items that are "naturals" for Service Dealers to sell and service. Look into the matter quickly regardless of where you are located. Talk to your Parts Distributor. He probably has most of the answers.

GUIDE

AUTRONIC-EYE®

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Courses for experienced service technicians provide latest repair information—enable you to do the job faster and more efficiently.

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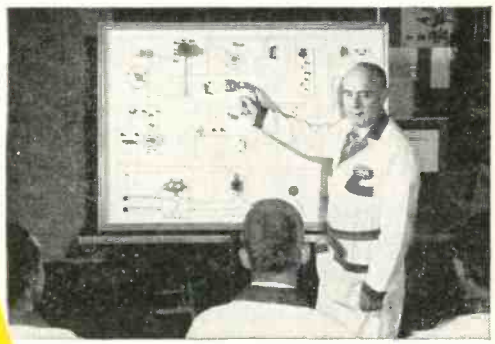
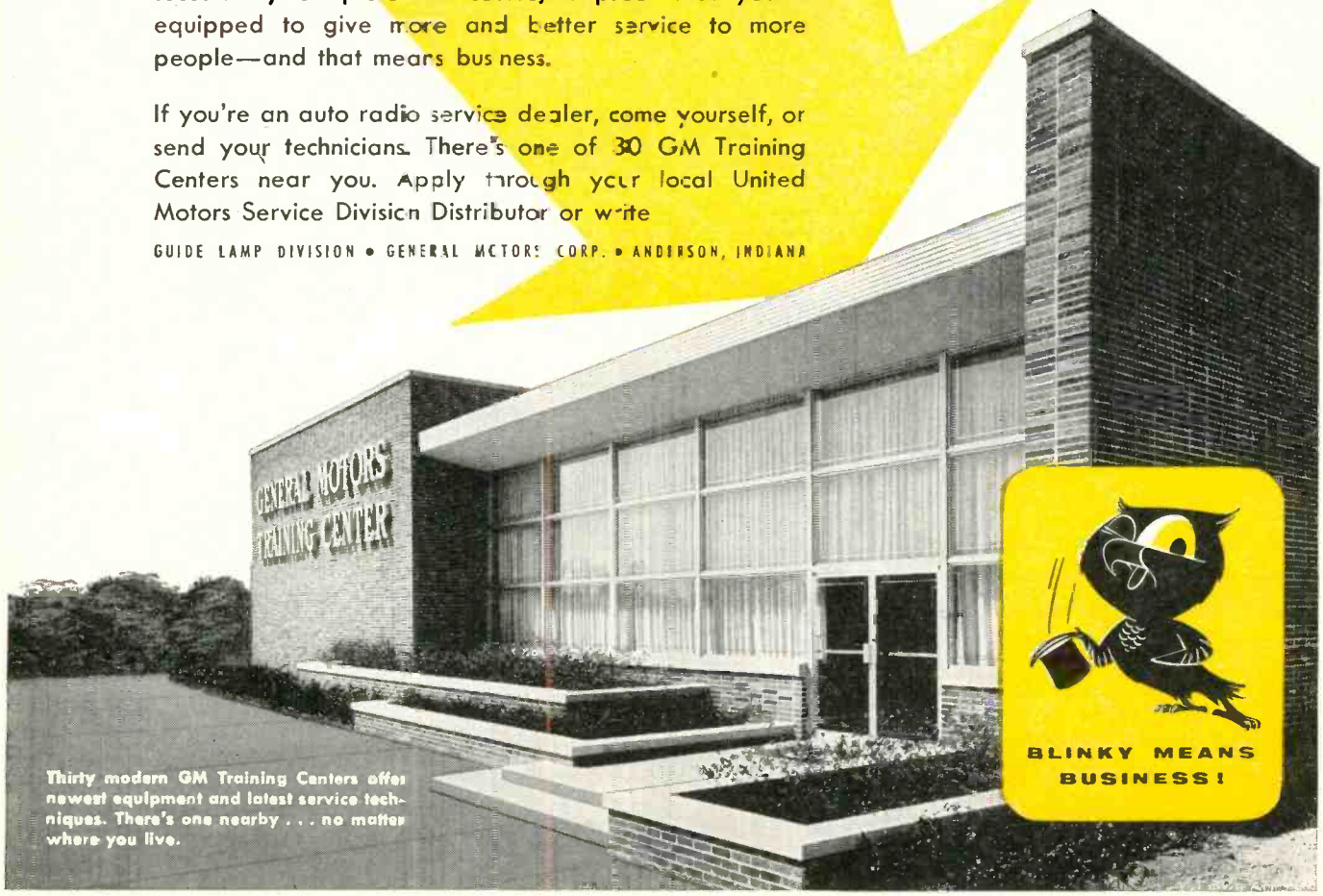
If you're an auto radio service dealer, come yourself, or send your technicians. There's one of 30 GM Training Centers near you. Apply through your local United Motors Service Division Distributor or write

GUIDE LAMP DIVISION • GENERAL MOTORS CORP. • ANDERSON, INDIANA



Jumbo-size operational panel of Guide's Autronic-Eye Circuit puts all parts out front for better, more efficient instruction.



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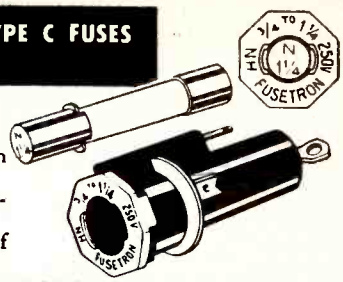
FUSETRON TYPE N and TYPE C FUSES and FUSEHOLDERS



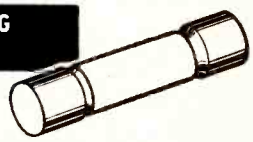
Especially suitable for protection of TV

Ears on fuses match slots in holder.

Marking on fuse and fuseholder in direct view.

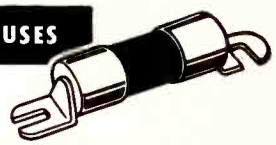
Safeguard against use of wrong size and type of fuse.

BUSS KLM HIGH INTERRUPTING CAPACITY FUSES



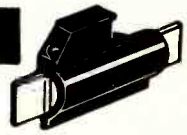
13/32 x 1 1/2 inch. Capable of safely interrupting 68,000 amps.

FUSETRON ACK CLAMP TYPE FUSES



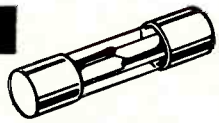
20 to 300 amp., *Dual-element type.*

BUSS ACO AIRCRAFT FUSES



Mechanical Indicating — Limiter type 1 to 75 amp.

BUSS AGX FAST ACTING FUSES

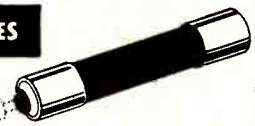


1/4 x 1 in. Glass tube 1/500 to 2 amp.

BUSS Series HJ and HK Non-Indicating FUSEHOLDERS

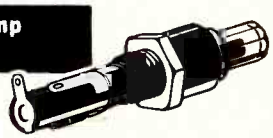
Panel mounted for 1/4 x 1 inch and 1/4 x 1 1/4 in. fuses.

BUSS IBM SIGNAL ACTIVATING FUSES



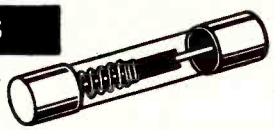
1/4 x 1 1/4 inch. Silverplated pin pops out when fuse is blown and activates signal or alarm.

BUSS Series HJ and HK Lamp Indicating FUSEHOLDERS



Panel mounted for 1/4 x 1 inch and 1/4 x 1 1/4 inch fuses.

FUSETRON MDL FUSES



1/4 x 1 1/4 inch. *Dual-element — slow blowing type 1/100 to 30 amp.*

BUSS No. 4051 ONE-PIECE CLIP and TERMINAL

Solder type terminal for 1/4 inch fuses.

BUSS ABC CERAMIC TUBE FUSES

1/4 x 1 1/4 inch. High interrupting capacity fuses 1/4 to 30 amp

BUSS No. 4409 FUSE BLOCKS

Small Base, solder type Side Terminals.

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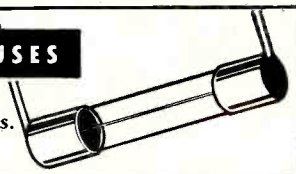
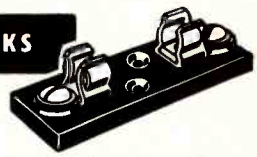


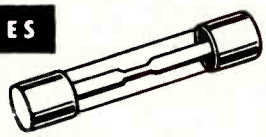
1/8 to 6 amp. Solder into circuit wires.

BUSS No. 4512 FUSE BLOCKS



Full Base, Screw type Terminals.

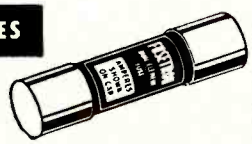
BUSS SFE STANDARD FUSES



Fuses of different amperages are different lengths — to make it impossible to insert too large a size.

And in sales and service — it's just good business to handle only genuine BUSS fuses. The BUSS trademark has been firmly established by millions and millions of installations in home, farm and industry. That's why you should specify and insist on getting only BUSS fuses.

FUSETRON FNM FIBRE TUBE FUSES



13/32 x 1 1/2 inch. *Dual-element — slow blowing type.*

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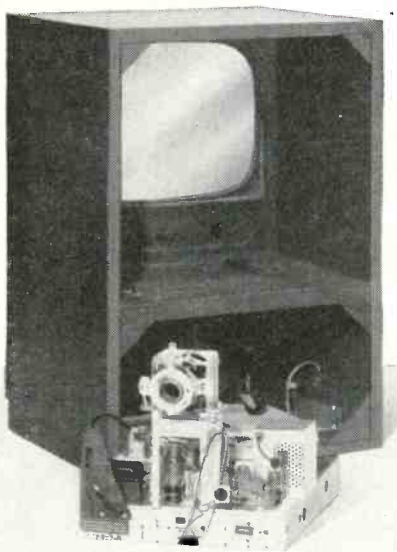

Show her the CBS carton with the Good Housekeeping Guaranty Seal.

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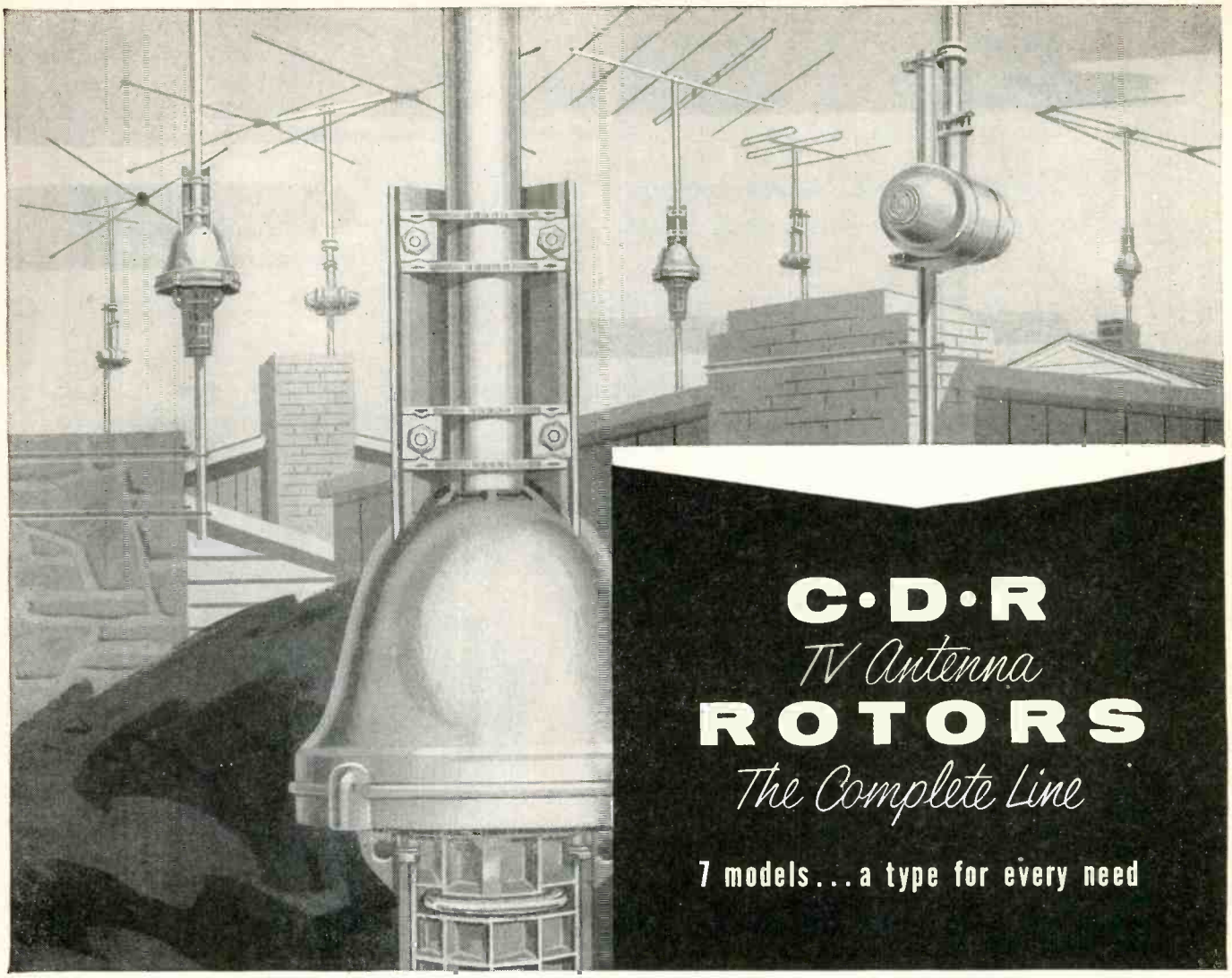

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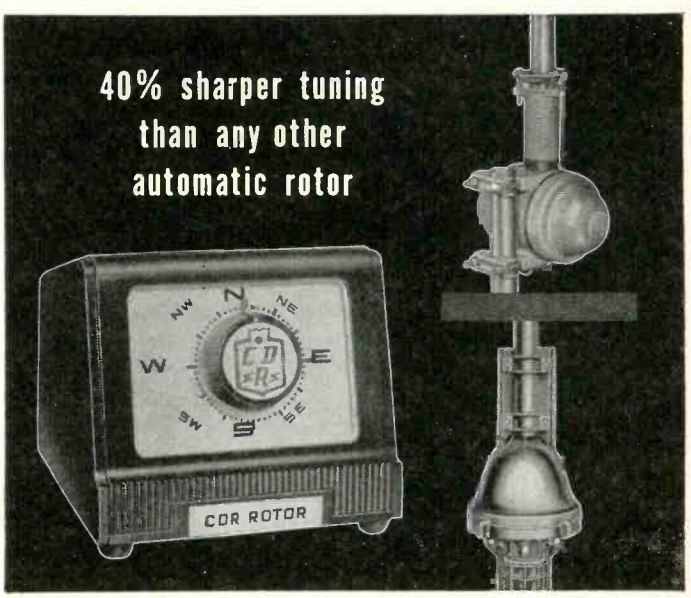
TR-11 Same as model TR-12 without thrust bearing.



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TESTING FLYBACK TRANSFORMERS

Failures In Horizontal Output Transformers And Methods of Locating Them

by **Steve Travis**

IN a TV receiver the components that fail are generally those which operate with high potentials across them or are working under maximum operating conditions. The chief offender and most frequent component to break down aside from vacuum tubes and selenium rectifiers is the horizontal output transformer, commonly referred to as the "flyback."

Flyback Failures

Flyback transformers cause a variety of different symptoms, a few of which are low high voltage, narrow width, poor horizontal linearity, and foldover. These failures can be roughly classified into two groups, the shorts and the opens. The number of transformers that are shorted internally far exceed those that have a winding open up or develop other mechanical defects.

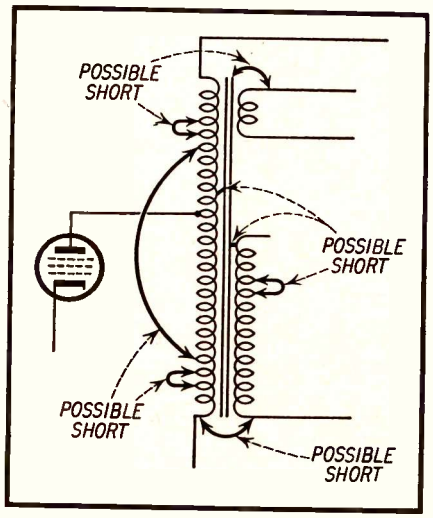

Fig. 1 — Various "short" possibilities between windings.

Serious shorts that develop in flybacks often occur from one coil winding to another, in a particular winding connecting together one turn or a whole layer of turns, or from the coil to the core. Some idea of the possibilities can be noted by examining *Fig. 1*. Most frequently the insulation breaks down at one wire or around a number of turns. This can be caused by dampness getting into and under the enamel or insulation coating of the wire and lifting it up. Cracks, fraying and peeling can develop in the insulation coating of the individual strands of wire contained in old dried up coils. Other breakdown of flybacks are often due to the kinks or twists in the wire which damage the coating. These defects were put there at the time of winding the coil or previous to it at the time of winding the spool by the wire manufacturer. Aside from this the insulation material inserted between the different windings may break down due to any number of reasons such as moisture collection, minute dirt particles and defects in the insulation material itself.

Of course, there are other types of failures such as broken leads and strands internally in the windings or even externally; but this is not the most commonly encountered reason for failures and is usually obvious. A visual inspection of a flyback transformer very often shows up defects such as loose leads, burned spots, etc. It is self-evident that the transformer is defective when it sputters, arcs and smokes. Also, in the majority of cases where wax has dripped down under the transformer it will be found to be defective.

In servicing, one of the first steps is to check for shorts between windings. In this test it is sometimes desirable to disconnect the B plus leads to prevent connection through the *dc* circuits which would render an erroneous indication.

In examining *Fig. 2* it can be noted that a short between primary and secondary can be measured by using an ohmmeter and checking from plate to cathode of the damper tube circuit. If a low resistance is found between these points it is due to an improper connection internally in the flyback, or a linearity condenser that is shorted to B plus. An easier check for this in circuits such as that shown in *Fig. 2* can be made by measuring for a positive voltage at the plate cap of the horizontal output tube with the damper tube removed. If a positive voltage is read here it indicates a primary to secondary short or a leaky linearity condenser, and it becomes only a matter of disconnecting the condensers at the linearity coil side to determine which is at fault.

Other possibilities of shorts are those

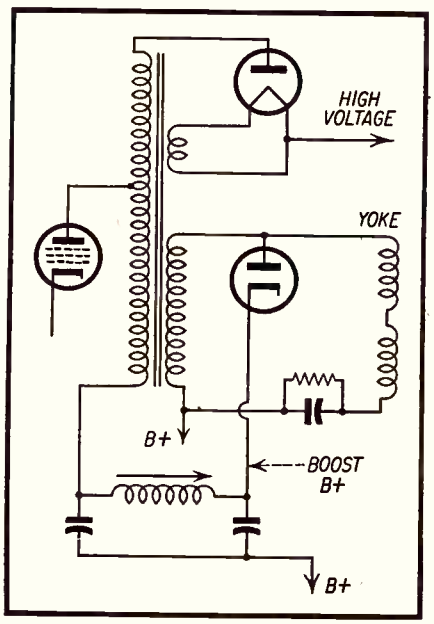

Fig. 2—Conventional horizontal output transformer circuit.

that occur to the core. A favorite breakdown point also is from the filament lead which has the high voltage on it to the core that it encircles. Naturally, this can often be seen or heard and is easily taken care of. The filament lead with the minute hole in it through which the high voltage is arcing can quickly be replaced without removing the transformer from the chassis. This filament lead is perhaps the first item to inspect if a hissing, snap or high voltage are can be heard occuring at the transformer.

Flybacks have a reasonably low resistance in their windings. If a few turns of wire should short it will have no appreciable effect in the resistance measured with an ohmmeter. But its effect as far as the sweep and high voltage operation of the receiver is concerned is enormous. Shorted turns react in the coil the same as placing a closed loop in the magnetic field. The field induces energy into the closed loop (shorted turns) and maximum current flows in the loop. In other words this means that the system is short-circuited as far as the energy distribution is concerned. It has the same action as placing a short across the secondary of a step-down transformer. A large *ac* current flows and considerable power is absorbed by the closed loop coupled to it through the magnetic field. When a short of a single turn or many turns occurs in a flyback absorbtion of power is so great that there is insufficient remaining for the deflection system and this results in reduced width, low high voltage or no deflection or high voltage.

Another reason flybacks burn open or short is that too much *dc* current is permitted to flow through the windings. This is commonly found when a substitute replacement transformer is installed and the drive at the grid of the horizontal output tube is not corrected or adjusted. Too much *dc* current through the windings permits the exceeding of the current rating of the fine wire composing the windings. The result is that the windings overheat and after a period of time burn open or short. It is very important to make sure that sufficient bias is maintained on the horizontal output tube to limit its current and thus the current through the transformer. Some transformer manufacturers consider this so important that they provide instructions as to the measuring of the *dc* current through the output tube to prevent this type of failure. Frequently, the tolerable current is 100 *ma*. If a subsitute transformer is employed it is most important to follow whatever precautions are pointed out by the manufacturer. Otherwise the receiver will be back in the shop for another transformer very shortly. Another point concerning this is to make sure that the drive adjustment is correct. This can preserve the life of the horizontal output tube and prevent premature failures.

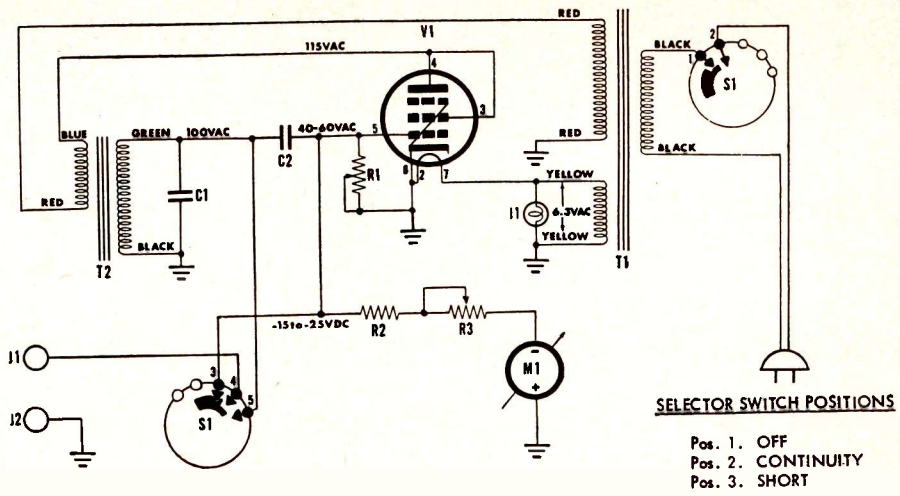

Fig. 3—Circuit diagram of Eico Model 944 Flyback transformer and yoke tester. See text for description of operational tests.

The Flyback Checker

Basically and in a few words the flyback checker determines two things about the transformer: whether it has an open winding or whether it has shorted turns or windings. *Fig.* 3 shows the schematic of one of a typical commercial model. Here, it can be noted that 115 volts, 60 cycle *ac* is applied directly to the plate of the tube through an isolation transformer. Flyback checkers such as this one contain a circuit between the grid to plate elements of the tube that oscillates due to the excitation of the positive going portion of the *ac* voltage.

When the oscillator is functioning a negative grid voltage is developed as a fundamental part of the process. This potential causes grid current to flow down through the grid leak resistors. It can be noted in *Fig.* 3 that the indication meter is connected at the bottom of the grid leak resistors, below the calibration resistor R3 and is activated by this current. Thus, the development of oscillations results in a *dc* grid current and an upscale meter movement.

When the switch S1 is placed in the position to connect terminals 3 and 4 together (for continuity tests), any coil connected to the test leads at points 11 and 12 shunts the grid leak resistors. Calls and transformers tested for continuity will be very low in resistance in comparison to the grid leak resistors. Thus, the coil will shunt off the grid leak current, stop the oscillator from functioning, and the meter needle will dip down scale indicating that continuity exists as the scale for continuity tests is labeled. Should the needle not move it is quite obvious that the coil or winding being tested is open.

Now, let us consider what occurs with respect to the short test. The switch, S1, is placed in the position that connects terminals 4 and 5 together. Any coil connected to the test terminals, #11 and #12 in *Fig.* 3 is shunted across the oscillator circuit. The transformer or coil under test, being mostly inductive, will alter the frequency of the oscillations by this addition of inductance to the oscillator circuit. If the transformer does not contain shorted turns or other types of internal shorts that will absorb power from the oscillator circuit the circuit will continue to function, the grid bias will continue to be developed and the meter needle will indicate in the GOOD section of the proper scale.

If a short exists in the coil it will so load the oscillator circuit that the oscillations will stop or be greatly reduced. This loading results in the reduction of grid current flow. Since the meter is connected in the grid leak path the reduction in grid current allows the meter needle to swing over to the side of the scale that indicates BAD.

One of the big advantages of the flyback checker is that in most cases the condition of the transformer can be determined as either GOOD or BAD without having to disconnect it or remove it from the chassis.

Calibration

Before the actual test is begun for shorts the unit must be calibrated for the type of component to be examined, whether a yoke, high impedance or low impedance flyback or other type of inductance. This involves adjusting a front control to a predetermined indication point on the meter scale. When the oscillator is working the meter needle shows a definite deflection whether a coil is connected to the leads or not. The calibration control is incorporated for adjustment of the grid

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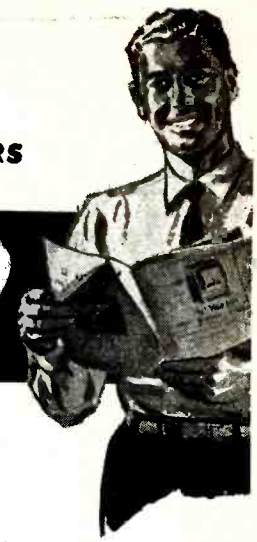

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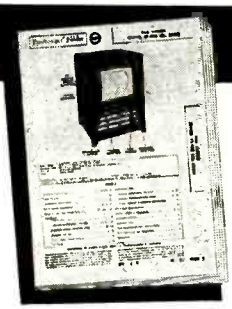

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current within the meter range under different line voltage conditions as well as for different types of coils. Several testers have two calibration points on the scale for the two basically different types of flybacks, the air core type and the iron core type. When checking yokes the calibration point is usually different, also. The calibration control is adjusted with the test leads open.

Additional Preliminaries

Before testing for shorts it is necessary to perform several additional small changes in the chassis such as unplugging the horizontal deflection coils or unsoldering one of their leads. Most flyback checker manufacturers recommend the disconnection of one lead of the width coil. It is important, also, to remove the high voltage rectifier tube as the tube filament will close the filament circuit and load the transformer.

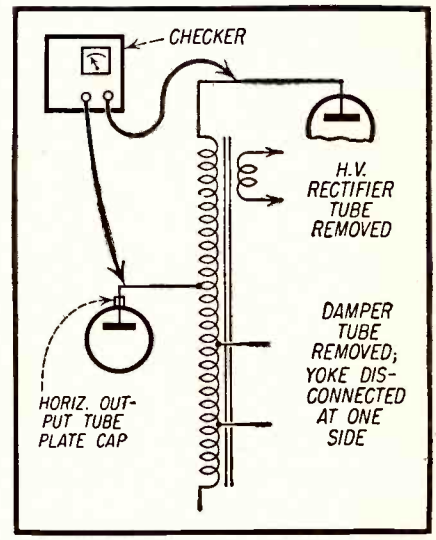


Fig. 4 — H.O.T. checker connections for transformers in which the deflection angle is less than 70°.

This could in certain cases cause an erroneous indication and most manufacturers request it in their instruction booklets. Flyback checkers are so accurate in their ability to determine loading and shorted turns that if the high voltage filament leads are connected together or a loop of wire is connected around the core of the transformer the checker will indicate the transformer as defective.

Another important precaution is that the receiver must be in the "off" position and it is very desirable, as a safety measure, to remove the receiver power cord from the *ac* outlet.

Continuity Checks

The continuity test is made by connecting the leads of the tester across the individual windings after placing the function switch in the continuity test position. It is not necessary to ob-

serve polarity with respect to the leads when making any of the checks.

As explained previously the oscillator grid voltage is shorted out by this connection if the coil is good and the meter needle swings to the position of the scale that indicates the continuity of the item tested to be good. If the meter pointer remains in the stationary position within the bad region for this test it reveals an open winding or a high resistance connection for that coil.

Short Tests

For 70 and 90 degree deflection systems the test leads are connected across the high voltage windings on the transformer at the tube caps. For those systems that deflect across the picture tube with an angle of less than 70 degrees the connection is at the extreme ends of the full primary as shown in *Fig. 4*. The connections for the autotransform-

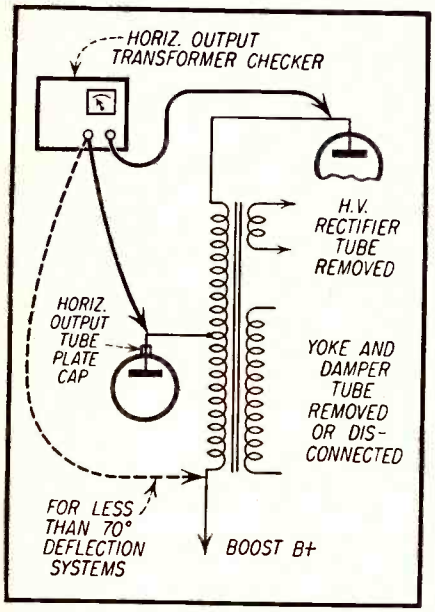


Fig. 5 — H.O.T. checker connections for autotransformers.

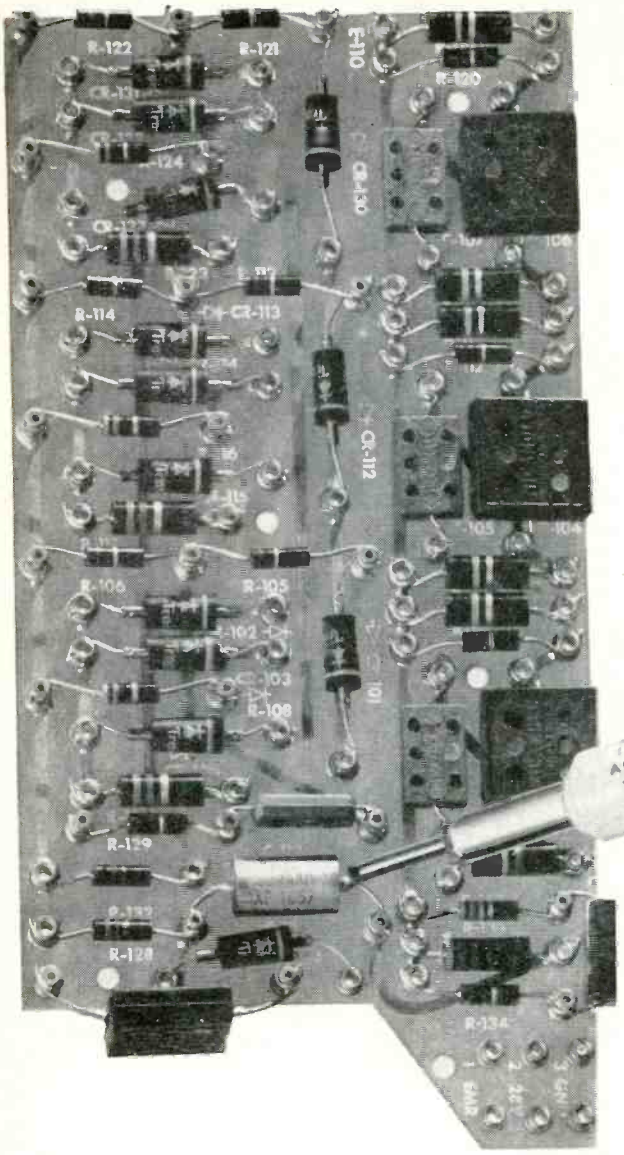
er which is used for deflection angles of 70 degrees or larger is made from the plate cap of the horizontal output tube to the plate cap of the high voltage rectifier tube the same as for the conventional transformers as mentioned above and shown in *Fig. 5*.

Once the short test has been made in the manner prescribed in the instruction manual for the particular instrument employed no other test is necessary as this is most generally conclusive.

Air Core Flybacks

A flyback transformer which does not have a complete core, i.e. only an iron slug, is classified as an air core transformer. These transformers are

[*Continued on page 45*]



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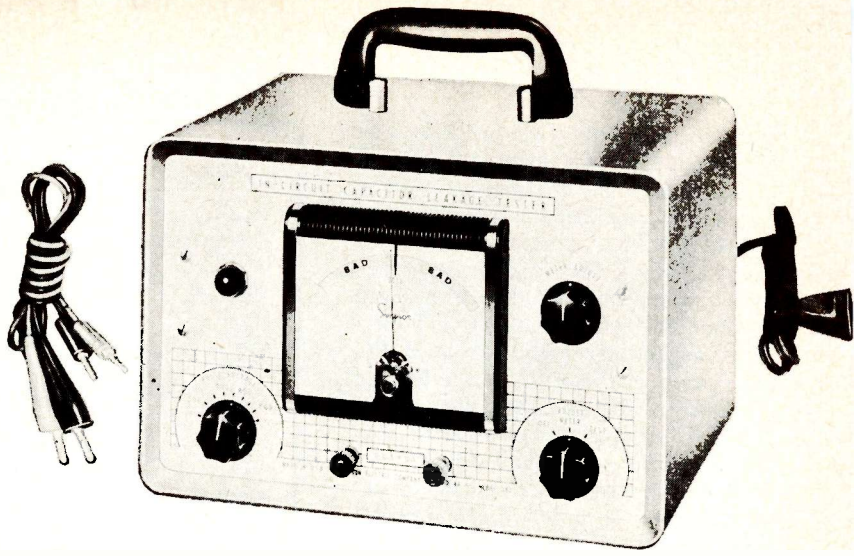

AN "IN-CIRCUIT" CONDENSER CHECKER

New Principles of Condenser Checking Are Employed In The "In-Circuit" Checker

by **GEORGE READE**

THE problem of checking the condition of condensers has always been a thorn in the side of most servicemen. The "open" condenser presents no great problem, since it may be detected by bridging with a similar condenser. The "shorted" condenser, unless it is shunted by a low resistance circuit, is also easy to find by ohmmeter tests. The headaches begin when we run into leaky condensers, intermittent condensers, and condensers which break down only when voltage is applied. The procedure at this point usually involves the tedious process of unsoldering or clipping one end, testing or substituting another condenser, resoldering, etc., etc. This can become exasperating, particularly when working where components are closely packed.

The Simpson Electric Company has recently developed a new test instrument called the Model 383 "In Circuit Capacitor Leakage Tester." As its name implies, it has been designed to check the condition of a condenser without disconnecting it in any way from the circuit in which it is used. As such, it should prove to be a boon to the trade. *Fig. 1* is a photograph of the instrument, and *Fig. 2* its schematic.

What It Can Do

According to the manufacturer, the instrument has the following capabilities:

1. Checks paper, mica, and ceramic fixed condensers for leakage, shorts, breakdown and intermittents. It does this with the capacitor in the circuit, without disconnecting either end.
2. Checks horizontal drive and similar trimmer condensers for leakage and breakdown at rated working voltage.
3. Checks variable tuning condensers for leakage and breakdown points.
4. Checks vertical oscillator transformers and similar transformers for interwinding leakage, winding to core leakage, and for interlayer arcing at voltages up to 900 peak volts.
5. Checks for leakage between wires in wiring harnesses.
6. Checks rotary and toggle switches for leakage and for voltage breakdown up to 900 peak volts.
7. Checks terminal boards, sockets, mike connectors etc., for leakage and breakdown.
8. Tests coaxial cable and twin lead for leakage and breakdown.
9. Checks resistors for instability.

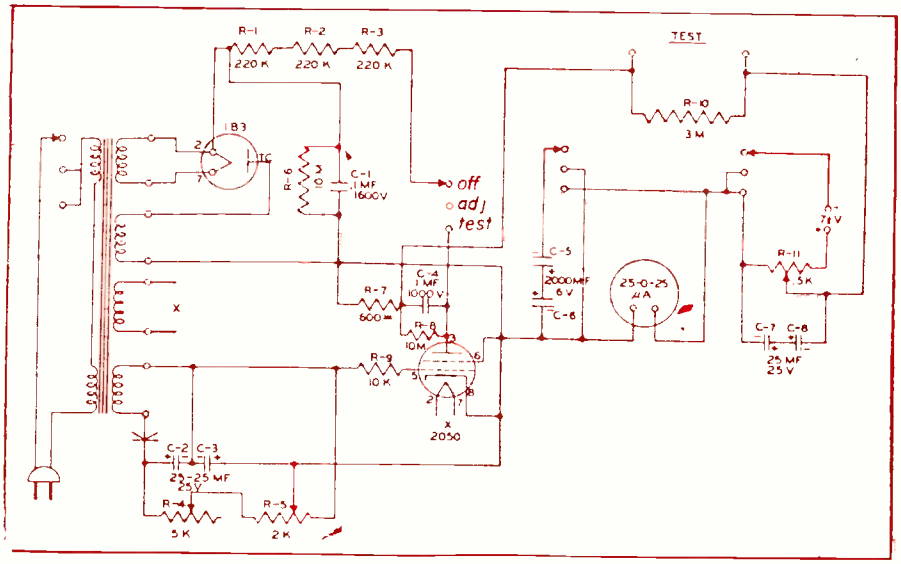

Fig. 2—Circuit diagram of Model 383 tester.

What It Cannot Do

1. It does not check the condition of electrolytic condensers.
2. It does not check an open condenser. Bridging a suspected open condenser is still a quick and sure test.
3. If a condenser is shunted by a circuit having a resistance of less than about 500 ohms, it cannot be checked in the circuit. One end of the condenser must then be freed before proceeding. This must also be done if the condenser is shunted by an electrolytic condenser or a low resistance circuit containing an electrolytic.

Principle of Operation

To illustrate the operation of this instrument refer to *Fig. 3*, which is a

schematic of a typical vertical integrator circuit. Suppose C4 were suspected of being leaky. An examination of the circuit indicates that the many resistors around C4 form a series chain which shunts C4 and any leakage resistance it may have. This amounts to a shunt resistance of from about 1 to 2.5 megohms, depending on the setting of R6, the vertical hold control. If the leakage resistance of the condenser were of the order of 10 megs, the *ordinary* condenser checker could not distinguish between leakage resistance and the circuit shunt resistance, unless one end of C4 were unsoldered. In a similar way, C1 is shunted by 24.2K and again one end would have to be disconnected to check for leakage.

This instrument however operates on a radically new principle, which enables it to distinguish between the leakage resistance and the circuit resistance, and because of this, the check may be made without disconnecting either condenser from the circuit.

Servicemen have probably long been aware of the erratic readings often obtained on an ohmmeter when checking a condenser for leakage. Simpson engineers have made a study of this leakage resistance, and have come up with findings showing that there are a number of important differences between ordinary circuit resistance and leakage resistance. These may be summarized as follows:

1. Leakage resistance usually varies with the applied voltage. In most instances as the voltage across the condenser increases, the leakage resistance decreases. This is indicated in *Fig. 4*. If the leakage resistance remained unchanged, the leakage current would follow the straight line (B). However, as indicated by (A), the leakage current exceeds the normally expected ohms law current by greater and greater

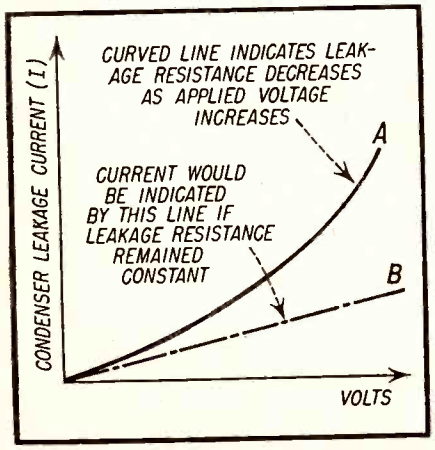

Fig. 4—Variation of leakage resistance with applied voltage is shown in the above illustration.

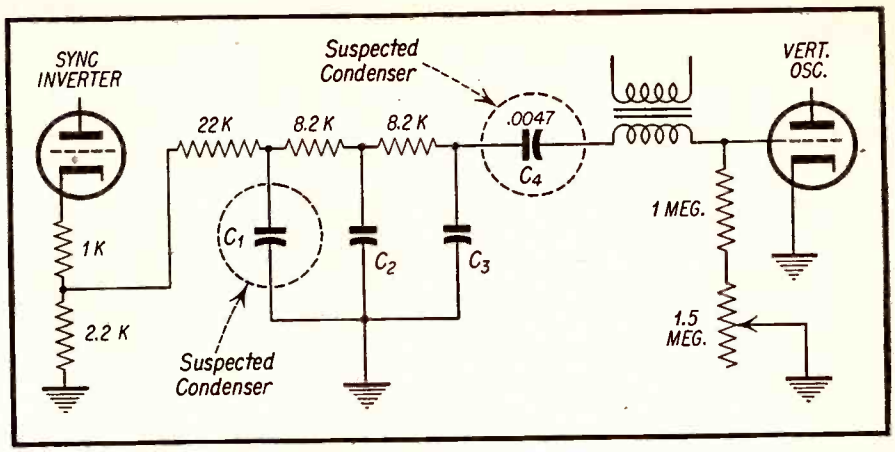

Fig. 3—Partial schematic of a typical vertical integrator circuit. Condenser C4 is shunted by the series string resistors comprising the 8.2K, 8.2K, 22K, 2.2K, 1.5 meg, and 1 meg resistors shown.

amounts as the applied voltage decreases. This indicates a lower and lower value of leakage resistance as the applied voltage increases. Less frequently, the change is in the opposite direction, and the leakage resistance increases with increased voltage.

2. Leakage resistance is usually unstable. It frequently acquires a new value after the passage of a heavy current.

3. When the polarity of the voltage applied to a condenser reverses, the leakage resistance is often much greater (even infinite) for one polarity than it is for the reverse polarity.

4. Leakage resistance is often least stable when the applied voltage is in the form of sharp pulses.

The Model 383 utilizes these characteristics in the "in circuit" testing of capacitors. By employing a pulsed voltage across the condenser, two purposes are accomplished. First, a condenser may be charged to its rated breakdown value without injuring other circuit components in parallel with it. Thus a short duration 600 volt pulse with a comparatively long interval between pulses could be used to check a condenser for breakdown at 600 volts without overloading a parallel circuit as would be the case if a steady 600 volt *dc* source were used.

Secondly, a weak or intermittent condenser will break down more readily when a pulsed voltage is applied than when the voltage is steady.

Basically the instrument provides both a steady *dc* and a pulsed voltage to the condenser under test. After the test clips are placed in position across the suspected condenser, the function switch (see photograph, *Fig. 1*) is placed in the "Adjust Meter" position. This applies *dc* from an internal 7½ volt battery to the circuit. The "Meter Adjust" control is then rotated to bring the needle to the center line or "Good" position. Next, after making sure that the "Pulse Voltage" control is set at minimum, the function switch is turned up to the rated working voltage of the condenser. A good condenser produces no movement of the needle, whereas a leaky condenser will cause the needle to move either to the left or right in the meter sections marked "Bad."

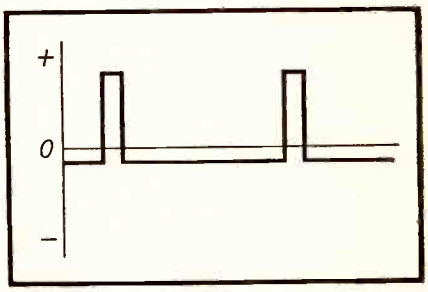

Fig. 5—The average value of the pulse is zero around the zero line.

If the pulse voltage is considered independently, it may be represented graphically by *Fig. 5*. Notice that the average value of such a pulse is zero, since the short duration high level pulse in the positive direction is balanced by the long duration low level pulse in the negative direction. If such a pulse were

[*Continued on page* 52]

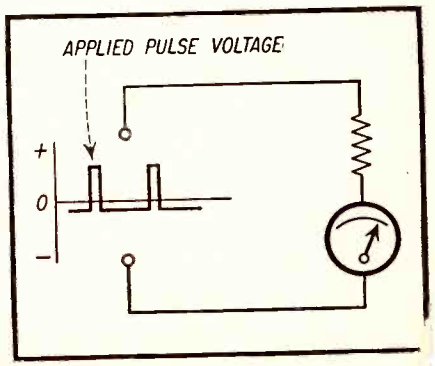

Fig. 6—Average current flow in r sistor due to pulse is zero.

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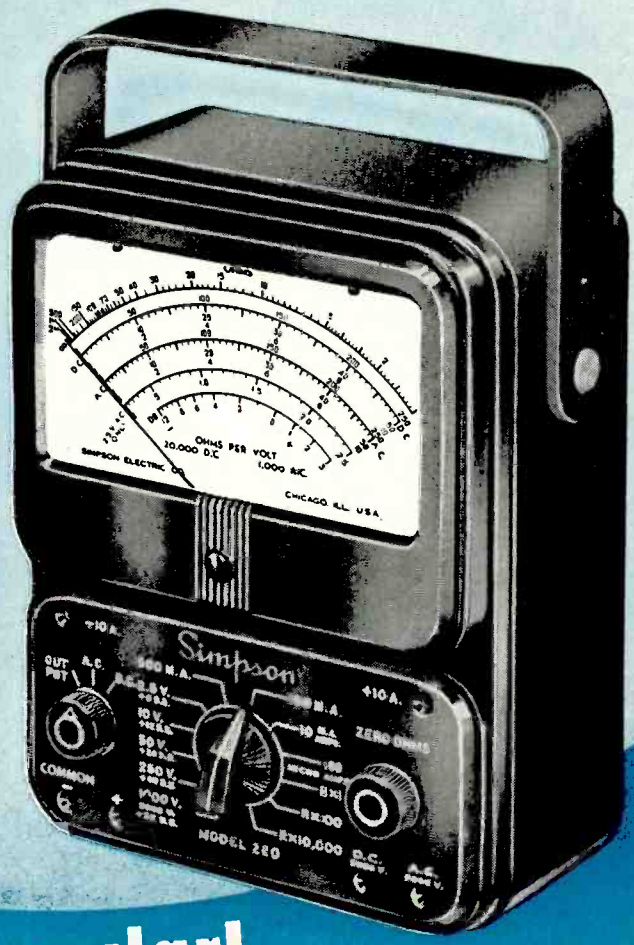

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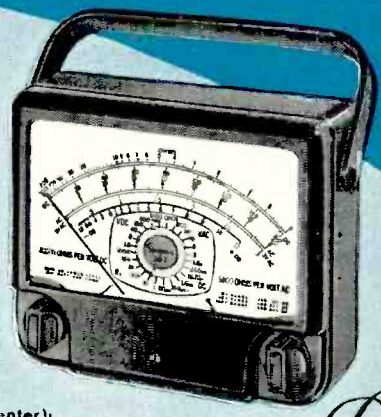

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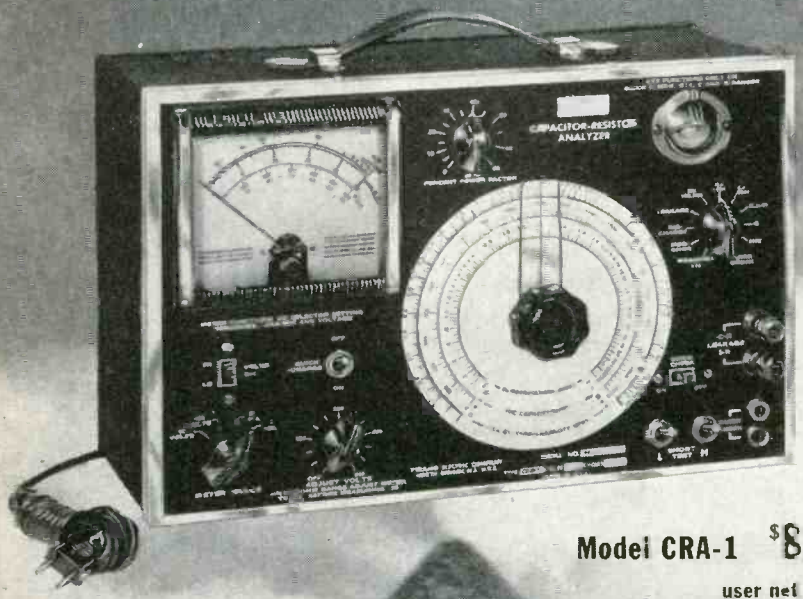

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JOHN F.

RIDER SPEAKS

A RECENT publicity release stated that the income of the TV servicing industry from the public during 1954 totaled about 1.5 billion dollars. In view of the general understanding that the TV servicing industry means the entire electronic servicing industry, this amount of money then represents the total income from all sorts of electronic service rendered to the public. Of course, the greatest portion by far stems from television activities.

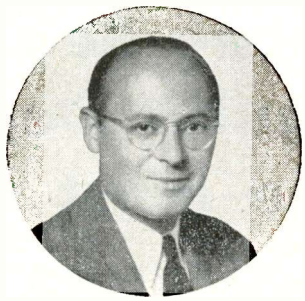
We have tried to determine how this total was reached by analysis of the parts jobbers' sales. After all, the parts jobber is the supplier to the servicing industry; the operations of one reflects the operations of the other. In doing this we must give or take 100 or 200 million dollars because of variances in prices charged for the items.

As we see it, assuming the sale of the parts and tubes involved at list, the income from these sales totaled about 650 million dollars and the charge for labor amounted to 800 to 900 million dollars. To say the least, the ratio of dollar income from parts to dollar income from labor is not as high as in the automotive industry. We can't say definitely, but if the parts were not sold at list, then the labor charge mounted close to one billion dollars, if not more.

A very interesting fact was disclosed by analysis of the parts jobber sales and correlation of these figures with the opening of new TV stations and the degree of saturation by TV receivers in different areas. Where saturation was relatively high in 1953 the sale of TV accessories (which means TV antennas and other items related to installation) showed a relatively small gain in 1954 over 1953. On the other hand, new TV areas showed very substantial gains in the sale of TV accessories.

We don't know the exact charges usually made for an installation, but it is evident that the income from installations made in the new areas represented a very substantial portion of the total income, because the value of the TV accessories sold in these areas amounted to almost as much as tube replacements in some cases, and about half as much in other cases.

This leads us to the conclusion that income from installation of TV receivers (inclusive of the antennas, towers, etc.) accounts for a significant amount of money, but once the installation is made, nothing less than hurricanes and tornadoes can result in repeat business.



Hence anything which tends to reduce the number of installations digs rather deeply into the service income.

By the end of 1955 about 45 million TV receivers will have been sold and installed. If we forget about the first three years of sales (because these receivers are aged) it means that about 41 million receivers have been installed. Owners of these receivers are prospects for new ones but income from installation will not keep pace with the new receiver sales. Service income in the future must come mainly from the sale of repair service.

1.5 billion dollars is a lot of money, but it doesn't represent a top for the service industry income per year. Whether or not it will be reached in 1955 is still to be seen. Analysis of available figures reveals that the frequency of failures per receiver per year fell slightly between 1953 and 1954, although the total number of failures in 1954 exceeded those in 1953, as shown by the increase in the sale of replacement components and replacement tubes.

The servicing industry should not depend entirely on the growth of TV to increase its annual income. We have said before and say again that the servicing industry must expand its activities in accordance with the expansion of the electronic industry in the production of products for John Q. Citizen. With most eyes focused on TV many other electronic devices owned by the nation's population are not getting the attention they deserve as income producing elements. High fidelity systems, tape records, record changers, garage door openers, portable and home radio receivers, auto radio receivers—all these warrant more service activity than they are getting.

We don't know if 1956 is going to be a color TV year. It looks like it, but who knows? One thing, however, is fairly well decided, and that is the entry of the receiver manufacturer into the servicing of color TV equipments. While this is planned for the first year of color TV receiver sales, the manufacturers are not likely to develop the information they are seeking within that period because of the limited sales anticipated. This means they will be in for more than one year. They plan to get out as rapidly as the servicing industry learns color TV servicing and can take over.

In the meantime we can't see how factory service organizations can refuse to install new black and white receivers made by their parent companies (or to service such receivers already in the hands of the public) when the public demands it. We think it is a safe bet to say that the future will be like the past—that some factories will remain in the servicing business, but most will not. As long as some of the factory service facilities are in business, they will take income from the servicing industry. It just can't be avoided.

The answer is obvious. The servicing industry must service every variety of electronic equipment that is within its capabilities. This is one way of offsetting the reduction in income that it faces for the first two years of color TV. It has been said that money cannot be made servicing radio receivers, at least not on a scale comparable to that in TV servicing. Maybe so, but radio receivers require service and the industry bears the responsibility of rendering this service. Portable receivers are a nuisance to work on, but service must be rendered. High fidelity is a hobby—an expensive hobby at that, and good service commands good prices, perhaps even better than those in TV. Tape recorders require service, as do auto radios. These activities can be promoted and profits realized. But even more important than that—the income is needed.

The second method of bolstering the service industry income is to participate in color servicing as rapidly as possible—by acquiring the necessary knowledge as rapidly as possible. This can be done in a year if the industry personnel make the effort.

As we see it the problem is not a fear of the subject. It is a lack of willingness to find time to acquire the knowledge in advance of the day when it will be needed. Every TV service technician knows that he'll have to learn color TV servicing, but he is putting it off day by day. This is a grave mistake.

Next month we'll deal with the effects of transistors and printed circuits.

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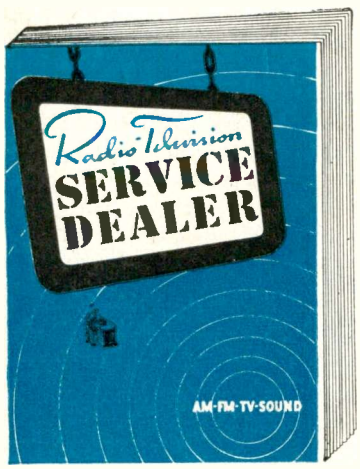

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A TYPICAL ISSUE COVERS

- Video Speed Servicing Systems
- Rider's "TV Field Service Manual" data sheets
- Latest TV Installation and Maintenance Techniques for VHF and UHF
- Auto Radio Installation and Service
- Advanced Data on New Circuitry
- Production Changes and field service data on receivers
- New Tubes
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ASSOCIATION NEWS

by Samuel L. Marshall

NATESA

As you know by now, the Electronic Service Council whose meeting at Indianapolis for the purpose of unity of independent service, held on October 9th, drew 72 delegates representing 37 associations, voted unanimously to urge upon all locals to Affiliate with NATESA. Present were delegates from TEA-Texas, FRSAP, NETSDA, NARDA, NATESA, and many unattached locals.

Material is being prepared by NATESA, such as its Constitution, geographical breakdown, etc. for distribution to all unaffiliated groups who are interested in affiliation.

Apparently happy over results of unity meeting are Max Liebowitz, Pres. NETSDA; Frank J. Moch, Pres. NATESA; Al Bernsohn, Exec. Dir. NARDA; Bert Bregenzer, Pres. FRSAP. Not shown was Forest Baker, TEA-Texas, the representative of the fourth major group, who just strolled off at time picture was taken.

Despite all of our efforts, however, there may be questions in the minds of some groups, which may have heretofore stood in the path of affiliation. We are sure that no problem exists which, if properly aired, could prevent unity. May we therefore, urge any association officer who may not fully understand the workings of NATESA, its policies or its government, submit his questions to this office? We will sincerely try to answer these questions frankly and to the best of our ability.

Frank J. Moch, President, NATESA

Radio & TV Guild of L. I., N. Y.

The Guild has been trying for some time to set up a training program that

[*Continued on page* 42]

trade flashes

General Electric's color television efforts are being concentrated on a color picture tube that reportedly gives many times more brightness than the tubes in color sets now on the market. G-E officials emphasized that their tube is still in the development stage and "probably will miss the 1956 market." It is a 22-inch rectangular "three-gun" tube. The G-E tube is known technically as a "post acceleration" type tube because the electron beams directed at vertical color-phosphor stripes inside the face of the tube are accelerated after passing through a grille located in close proximity to the phosphor screen. This permits a type of operation and circuitry that "seems to point the way eventually toward the least expensive acceptable color television set."*

THE NUMBER OF RETAIL ESTABLISHMENTS handling radio and/or television receivers has increased by approximately three percent in the past fiscal year and by over 15 percent since mid-1952, the Radio-Electronics-Television Manufacturers Association reported recently. As of July 1 of this year, there were 110,200 retail radio-television dealers compared with 107,100 in 1954 and 95,400 such dealers in September 1952, the RETMA count showed. By geographic area, it was reported that 21,700 dealers were located in the North Atlantic states; 14,000 in the South Atlantic region; 35,000 in the Midwest; 22,850 in the Southwest, and 16,650 in the Far West.

The seasonal back-to-school movement *includes complete training seminars for CBS-Columbia distributor and dealer television service personnel at the home office headquarters building in Long Island City, New York. The first group of selected trainees from all parts of the United States are now being schooled in demonstrations and practical work covering new developments in the CBS color TV line. The program, covering five days, offers 40 hours of instruction under the direction of Daniel Newman, Product Service Director and personnel of the Product Service Department. It supplements training in black-and-white set servicing, held in the field at periodic service meetings in all sections of the country.*

THE BOARD OF DIRECTORS OF HOWARD W. SAMS & CO., INC., *Indianapolis, electronic engineering, research and technical publishing firm elected Howard W. Sams Chairman of the Board and J. A. (Shine) Milling President. Sams had been President of the company since he founded it in 1946 and Milling has been Executive Vice President and General Manager for the past three years. Today's action was taken at Sams' request to permit him as Board Chairman to devote more attention to long range planning for the company.*

Are Servicemen Honest? This item appeared in the St. Paul, Minn. Pioneer Press: "Joe was on a service call. He noticed a cardboard box lying in the street. Peeking inside, $41.25 in cash peeked back. Phone 'Honest' Joe Driscoll, Emerson 6115 and if you identify what else was in the box—it's yours" was one of the items that appeared in a newspaper column. Subsequently, a young lady, a senior at St. Catherine's College, phoned Joe at TV Trouble Shooters, and properly identified her property. It seems the money was for a Mother-Daughter breakfast. She got her money back! But Joe Driscoll also reports the sequel. It seems that just a month before this incident occurred he did a TV service job for the gal's uncle and when he submitted his bill the uncle bluntly expressed his opinion as to the "honesty of all TV servicemen." Since this later incident, we wonder if Uncle has changed his mind.

A COMPLETELY NEW LINE OF ALUMINIZED television picture tubes to be known as RCA "Silverama" tubes was announced recently by D. Y. Smith, Vice-President and General Manager, RCA Tube Division. A total of 25 different tube types—including 10, 12, 16, 17, 20, 21, 24, and 27-inch tube sizes—comprise the line which will be available immediately to television service technicians through RCA Tube Division distribution channels.

The number of households with television sets *in the United States was over six times as great in June 1955 as it was in April 1950, according to the results of a survey conducted by the Bureau of the Census. About 32 million, or 67 percent of the households enumerated in June, had one or more television sets, whereas in 1950, the first time that a question on television was included in a census, there were about 5,000,000 households with television sets, or 12 percent of the total. About 80 percent of the households located in standard metropolitan areas of the Nation had one or more sets. Only a little over a half of the households in urban places outside standard metropolitan areas and less than half of the households in rural territory outside standard metropolitan areas had television sets.*

Table 1.—HOUSEHOLDS WITH TELEVISION SETS FOR THE UNITED STATES, INSIDE AND OUSIDE STANDARD METROPOLITAN AREAS: JUNE 1955
(Percent distribution)

Area	Total households	Number of sets in households		
		None	1	2 or more
United States	100.0	32.8	64.9	2.3
Inside standard metropolitan areas	100.0	21.7	74.9	3.4
Outside standard metropolitan areas:				
Urban places	100.0	44.1	55.1	0.8
Rural territory	100.0	54.1	45.3	0.6

A STATEMENT REGARDING THE PROGRESS OF COLOR TV *was issued by Robert W. Galvin, Motorola Inc. executive vice president.*

"There has been sufficient recent activity of significance in the television studios, and at the market place, to warrant a re-examination of the color TV status to bring it into proper focus," Mr. Galvin said.

"The current facts are that some 212 stations are now equipped for color programs; two major networks in aggregate are providing better than an hour of color cast per day; and, some of the consumers we first sought to interest in a color receiver a year ago are now showing an interest.

"Engineering advances during the past year have made it possible for prices of most makes to be reduced about 20 per cent. Current prices of $700 to $1000 are still out of practical reach for a mass market, but these prices are not prohibitive for commercial enterprises such as taverns, hotels or advertising agencies where color TV is a piece of capital equipment. Nor, are the current prices prohibitive for the million or more individuals in the higher income brackets."

** Complete description of this tube will appear in the Dec. 1955 issue of RTSD.*

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All circulation figures quoted here are taken from the latest ABC and BPA Statements. Adv. Rates from Standard Rate & Data.

SERVICE FIELD COVERAGE (OR "EFFECTIVE" CIRCULATION) PROVIDED

CLASSIFICATION	RADIO TELEVISION SERVICE DEALER	TECHNICIAN	SERVICE
1a—Radio-TV service firm owners & independent servicemen.	27,488	23,378†	26,952†
1b—Service managers employed by service firms.	372	202	280
1c—Technicians employed by service firms.	4,380	2,417	1,400
2a—Owners & managers of retail firms that operate service depts.	19,096	10,370	3,633
2b—Service managers employed by above service dealer group.	686	1,356	513
2c—Technicians employed by above service dealers.	3,308	3,693	1,414
3 —Firms that do industrial electronic servicing only.	1,731	*	*
4 —Part-time servicemen.	3,361	57†	†
5 —Distributors and their personnel.	1,553	1,048	703
TOTAL SERVICE CATEGORY CIRCULATION	61,975	42,521	34,895

ADVERTISING COST COMPARISON

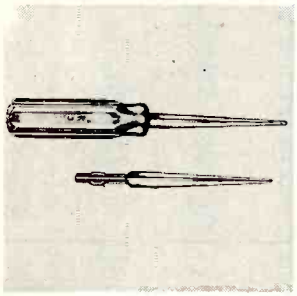
SERVICE FIELD OR "EFFECTIVE CIRCULATION"	FULL PAGE 1 X RATE	ADV. COST PER M
Radio Television Service Dealer 61,975	$670	$10.81
Technician 42,521	$650	$15.28
Service 34,895	$640	$18.34

† Both Technician and Service include in classification 1a all the part-time independent servicemen subscribers they serve. SERVICE DEALER shows them separately in Classification 5.
* Both Technician and Service include in classifications 1a-b-c the industrial electronic service firm subscribers served. SERVICE DEALER shows them separately in Classification 4.

The average total paid circulation for the 6 month period January-June 1955 of the respective publications was: SERVICE DEALER—46,218; SERVICE—50,271; TECHNICIAN—44,700. The average total monthly distribution for the same period was: SERVICE DEALER—70,832; SERVICE—56,191; TECHNICIAN—50,572. SERVICE DEALER leads SERVICE by 14,641 and TECHNICIAN by 20,260.

NEW COMPONENTS

In requesting more detailed information on these products, please check the code number of the product on the convenient coupon on page 55, and send it, along with your company letterhead or business card, to New Products Dept., SERVICE DEALER, Suite 510, 67 West 44th St., New York 36, N.Y.

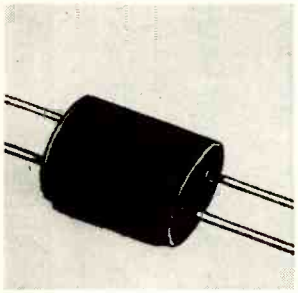


Xcelite Reamers

Xcelite, Inc., announces a new line of chrome plated hand reamers with ½" to ¾" capacity in wood, plastic and sheet metal. Reamer No. 38 (top) is fixed in a full-size 1" x 3⅞" Xcelite plastic handle. Reamer No. 99-38, (bottom) fits the equally large detachable handle in the No. 99 Multi-Purpose tool kit manufactured by Xcelite. A roll plastic kit, the No. 99 has 13 detachable nut driver and screwdriver bits, with an extra pocket for storing the No. 99-38 reamer. For details, check C105.

Littlefuse Dispenser

Through use of these Littlefuse dispensers in their shops, servicemen may save valuable time by having a convenient answer to their ever-present problem—fuse stocking. The dispenser can be mounted by screws in single, double or multiple channels over their work benches. The Littlefuse dispensers also facilitate ready stock control and servicemen can tell at a glance when any particular fuse needs replenishing. Single channel dispensers are available to servicemen in a package containing ten channels. For details, check C103.

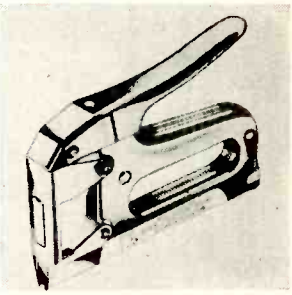


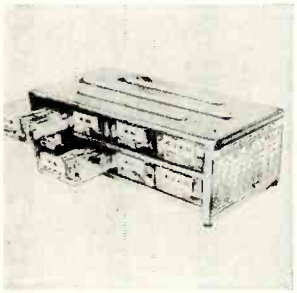
Clarostat Resistor Assembly

A method of encapsulating two precision deposited carbon resistors with nearly identical temperature coefficients, in a single enclosure in order to provide highly similar thermal conditions within the capsule as the ambient temperatures vary, is announced by Clarostat Mfg. Co. The resistor assembly has been designed to meet the needs of those applications requiring identical resistance change characteristics, such as in color TV. For details, check C107.

Arrow Staple Gun

Arrow Fastener Co. introduces their T-25 Staple Gun, for fastening low voltage wire automatically, safely and without danger of short circuits or wire damage. On jobs involving Bell wire, thermostat wire, communications wire, hollow tube lines, etc. The T-25 is said to be many times faster than any other fastening method. Its easy one-hand operation leaves one hand free to keep balance on ladders, etc. The stapler also eliminates snagging hands on nails or staples. For further details, check C102.



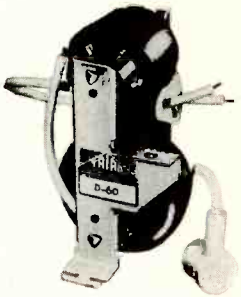


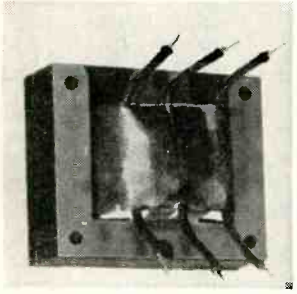
JFD Piston Capacitor Kit

JFD Electronics has designed a piston capacitor kit, PK85, offering an assortment of 85 quartz and glass precision piston capacitors of the 10 basic types now in use. All piston capacitors in the PK85 are individually packaged affording positive protection and swift easy selection. A rugged compact metal cabinet with a double row of compartment drawers encompasses the full number of piston capacitors. For further data, check C104.

Triad Flyback Transformers

Five new Correct Replacement Flyback transformers have just been added to the Triad Transformer Corp. line. Designed for use in RCA, Traveler and Zenith television receivers, they are electrically and mechanically interchangeable with the manufacturer's original equipment. Wherever possible they are composite replacement to fill a number of requirements where mechanical and electrical specifications are identical. For further data, check C108.



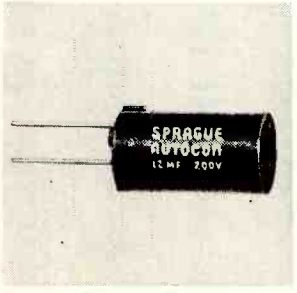


Merit Vibrator Transformers

Two 12 volt vibrator transformers, models P-2860 and P-2861, are now in production at the Merit Coil & Transformer Corp. Model P-2860, which lists for $5.00, is an exact replacement for 1955 Allstate and Chevrolet automobile radios. Also selling for $5.00, model P-2861, is an exact replacement for Chevrolet, Oldsmobile, Philco and Pontiac car radios. For details, check C100.

Cornell Dubilier "Tiger Cub"

Cornell - Duhilier announces its "Tiger Cub" type MGT, high temperature paper dielectric tubular capacitors. This new capacitor is designed to operate effectively at temperatures from −55°C to 100°C. The capacitance varies less than 10% over this entire temperature range. An external wax dip provides moisture protection that will withstand 250 hours of continuous exposure in 90% relative humidity at 40°C. For details, check C106.

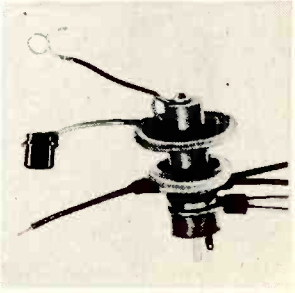


Sprague Autocon Capacitors

Typical of the new components designed for automatic production of TV receivers are Type SE Autocon Molded Paper Tubular Capacitors. Unlike preliminary single-ended capacitors, Autocons have tiny "standoff" feet, which eliminate dust and moisture traps under capacitors, and prevented printed chassis wiring shorts. Generous 1" lead lengths permit their use in *all* single-ended capacitor replacement applications. The units are available in 47 types, rated at 200, 400, and 600 volts, ranging from .001μF to .47μF. For details, check C109.

Ram H.O.T. Replacements

Ram Electronics Sales announces their latest Horizontal Output Transformer Replacements, the X124 and X125. The X124 replaces RCA 76154, 75519, 76381 and 75585 covering 28 chassis and 38 models; the X125 replaces RCA 76501 covering 9 chassis and 32 models. Both units are the direct-drive type designed to operate in 66 to 70 degree horizontal deflection angle systems, and are capable of delivering 12 kv and 16.4 kv respectively. For details, check C101.



The Work Bench

by Paul Goldberg

This Month: Troubles In Receivers In Which Audio Output Stages Is Used As B+ Voltage Divider.

THIS installment deals with the audio output tube when it is used as a voltage dropping device. Three problems have been chosen for discussion.

DuMont RA 164

The receiver was turned on and the picture and sound were O.K. After about 15 minutes however, the picture and sound went off and only the raster remained. Before any servicing was attempted the diagram was studied. It was noted that this receiver used a voltage dropping audio output tube, 6W6. This tube whose plate voltage was 250 volts dropped to 135 volts at the cathode. The drop is determined mainly by the plate resistance of the tube and the load. The 135 volt cathode supply in this receiver is used as a B+ voltage source for the sound video and sync circuits. See *Fig. 1.*

Knowing these facts, the 6W6 was immediately replaced but had no effect. Before replacing any other tubes, however, a few voltage checks were made. The cathode voltage of the 6W6 was measured at pin #8. It measured about 25 volts. This naturally was incorrect. The plate voltage was next measured at pin #3 at about 50 volts. Because the plate voltage was exceedingly low, the receiver was turned off and a resistance check was made from plate to ground of the 6W6. The meter measured 600 ohms. Thus, there was definite leakage to ground.

Resistor *R257* was next measured at about 220 ohms which was correct. The audio output transformer plug was next pulled out and a resistance measurement was again taken from plate to ground of the 6W6. Again the meter measured 600 ohms. *C250* was now resistance checked and was found to be leaking 600 ohms. *C250*, 470 $\mu\mu f$ was next replaced with a new one and the receiver was turned on. The television set now functioned normally.

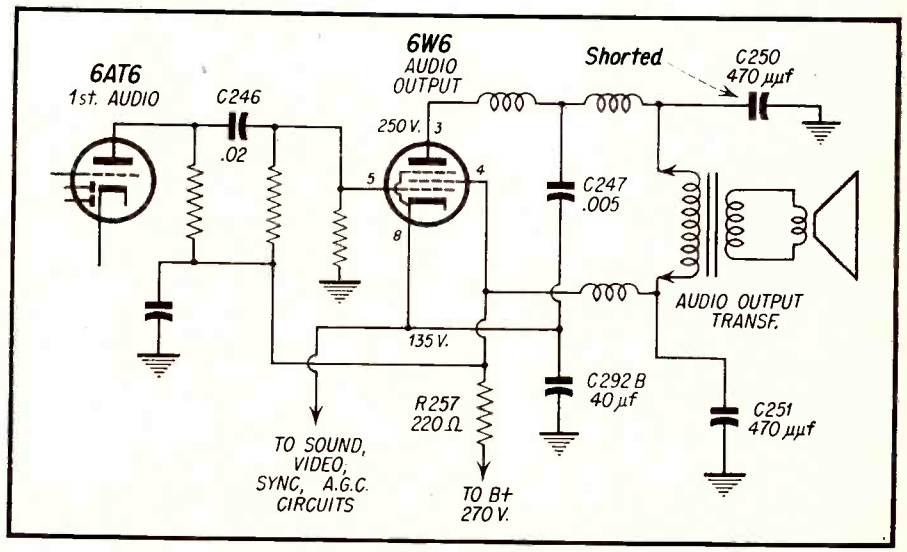


Fig. 1—Partial schematic of Du Mont RA 164 chassis.

Whenever a "no picture" and "no sound" condition prevails in a receiver using a voltage dropping tube, it is advisable to check this tube and its circuitry first, since it is a common trouble maker.

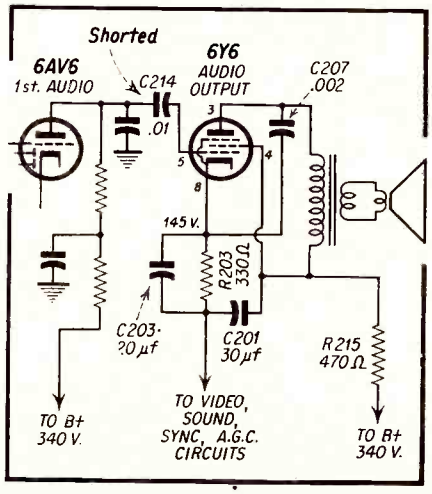


Fig. 2—Model H-606 audio.

Westinghouse Model H-606 K12

The receiver was turned on and it was noted that there was no sound and no video. The raster however, was OK. A burnt resistor odor was also prevalent. The chassis was immediately turned on its side and *R203*, 330 ohms, the cathode resistor of the audio output voltage dropping tube, was observed to be burnt. See *Fig. 2.*

The diagram was then studied and it was seen that the 6Y6 was a voltage dropping device and was the voltage source for the *age*, video, sound, and sync circuits. At this point, a voltage check was made at the cathode of the 6Y6, pin #8. The meter measured zero. At the plate, pin #3, the meter measured zero volts also. However, at the B+ side of *R215*, 470 ohms, the meter measured correctly at about 340 volts. *R215* was next measured and was found to be open. *R215* and *R203* were next replaced with new resistors of the proper value.

[*Continued on page* 55]

By popular demand, the serviceman's most-wanted book, Video *speed* Service Systems Vol. 1. is now also available in a low cost PAPER BOUND COVER EDITION

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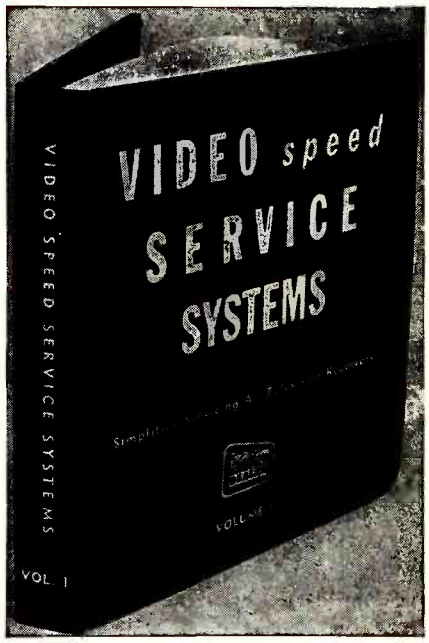

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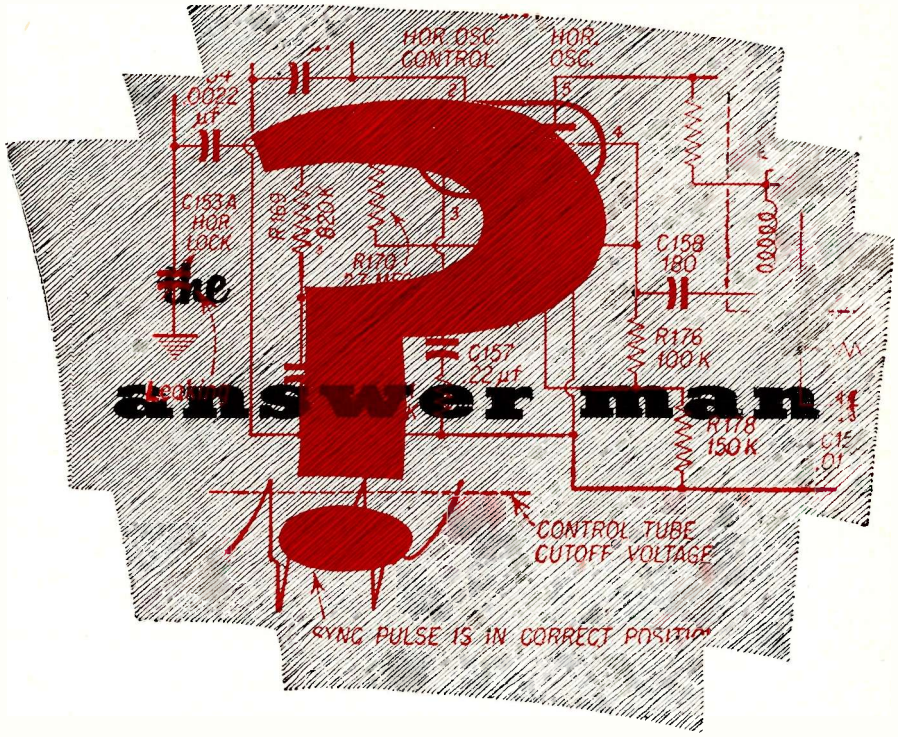


Mr. Answerman:

I thought I had an easy problem when I tackled a Crosley 431-2 chassis. After a period of up to two hours the picture shrank in height and width. It looked to me like a clear case of defective selenium rectifiers. I replaced the rectifiers and pushed the set aside to cook before buttoning it up. Low and behold an hour later I happened to glance at it only to find that the picture had shrank in on all four sides just as before. I didn't have time to do anything about it at that time so I let it go. An hour later it had shrunk even more. Evidently the usual cause, selenium rectifiers, was not the cause. Now what?

Since then I have gone over everything that I can think of—tubes such as the horizontal oscillator and output and damper—and still haven't found the cause. The only bit of information I know definitely is that the B plus voltage of 260 volts decreases during this period.

S. F.
Los Angeles, Cal.

From your description of the trouble it is evident that the shrinking on all four sides is being caused by a decrease in B plus voltage as you have noted. In other words if the B plus of 260 volts to the horizontal oscillator is reduced the developed sawtooth is smaller with the result that the width is decreased. Also, the boost voltage is lowered from the damper circuit as a result of this. This brings about a reduction of voltage to the vertical deflection system and a shrinkage in height.

As you mention this is very typical of selenium rectifiers that are going bad. But since in this case the seleniums have been replaced and the trouble still exists they were not the cause. It is very unlikely that the new pair could also be defective.

From an examination of the partial schematic for the Crosley 431-2 chassis, *Fig. 1*, it can be noted that there is another component that if leaky can introduce the same results, a lowering of the 260 volt B plus and a shrinkage of all sides of the picture. This component is the 5 μf condenser, *C132A*. It is in the same can as the 200 μf filter condenser, *C132B*, and is located near the flyback transformer. Undoubtedly, it is developing a leak, bringing about the lowering of the 260 volt B plus and picture shrinkage.

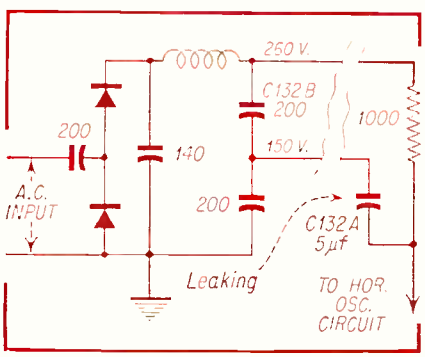


Fig. 1—Partial schematic of Crosley 431-2 chassis.

This type of condenser failure is easily located with the commercially available condenser checkers. A condenser checker, and there are some excellent ones available now, is almost indispensable in the well equipped shop. However, there is one stipulation concerning this. Service personnel must be acquainted with its operation in order to make the most of it. All too often valuable pieces of test equipment sit idly by while a technician searches in vain for a defective component, which very frequently turns out to be a condenser.

Another example of a condenser failure was recently encountered in a General Electric 21T6 series chassis as shown partially in *Fig. 2*. In this case the symptoms were the exact opposite of those noted in the above case. In this case it took about 20 minutes to half an hour for the set to come into operation.

The difficulty was localized to the 300 μf condenser in the input of the power supply. The condenser displayed the characteristics of being able to heal itself enough to furnish sufficient B plus to operate the horizontal oscillator and other circuits and provide normal pix and sound. The customer's only complaint was that it took so long for the receiver to begin operating.

Naturally, the B plus voltages were low when the receiver commenced operation and slowly crept up to normal. A condenser checker quickly located and showed the 300 μf condenser to be defective. Ordinarily, when this condenser develops this type of leak it does not heal itself but remains bad and even can cause the fuse to blow.

Dear Sir:

I have a Westinghouse V2313 chassis in which I have no picture and no sound. I know the tuner is good and

[*Continued on page 43*]

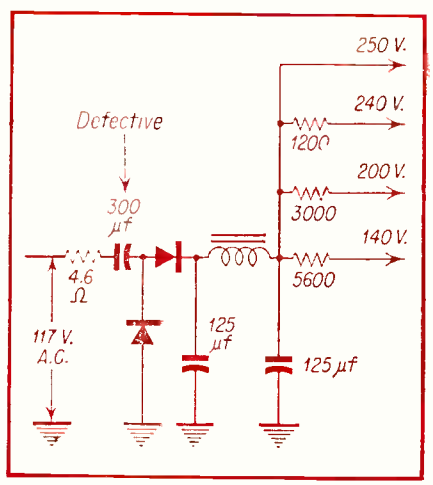


Fig. 2—Partial schematic of General Electric 21T6 chassis.

COLOR DISPLAY ANALYSIS

The Use of The Color-Bar Display in Checking Color-TV Receivers

by **Bob Dargan and Sam Marshall**

from a forthcoming book entitled "Fundamentals of Color Television"

IN a previous installment (November RTSD 1954 p. 16) relative phase and amplitude relationships of color video signals were first introduced. Further development of these topics are now in order.

Understanding the various waveforms of the color video signal as it progresses through a receiver goes a long way in effecting intelligent and straightforward servicing of color sets. One of the devices that helps a serviceman in this understanding is a color-bar display which consists essentially of a number of parallel vertical color bars such as shown in *Fig. 1A*. This display signal may be obtained from commercial color-bar generators manufactured for this purpose. A somewhat similar signal is the Standard Color Bar pattern used in colorcasts for test purposes, as shown in *Fig. 1B*. Other types of displays may be used with equal effectiveness. Once a serviceman becomes accustomed to a particular type of display he knows exactly what to look for.

In the actual servicing of color receivers the color-bar generator is an indispensable aid in tracing the progress of a color signal through a receiver. By injecting a color-bar signal at the *input* terminals of a stage or stages under test, and observing the *output* waveforms obtained with a wideband scope, color circuits can be quickly and effectively checked.

In the following pages we are going to analyze a color-bar signal with a view towards establishing the relative values of R, G, B, Y, B-Y, R-Y, G-Y, I, Q, and chroma for the various colors contained in a color-bar display. Waveform patterns corresponding to these color relationships will also be developed. These values will then provide us with representative waveform patterns encountered in various sections of a typical transmitter and receiver.

Color Signal Chart

Let us assume that a color-bar pattern of saturated color signals is available as shown in *Fig. 1A*. It will be recalled that saturated color signals correspond to colors containing no white or gray. We will now set up a chart of these colors and their respective signal values as shown in *Fig. 2*. Formulas for Y, I,

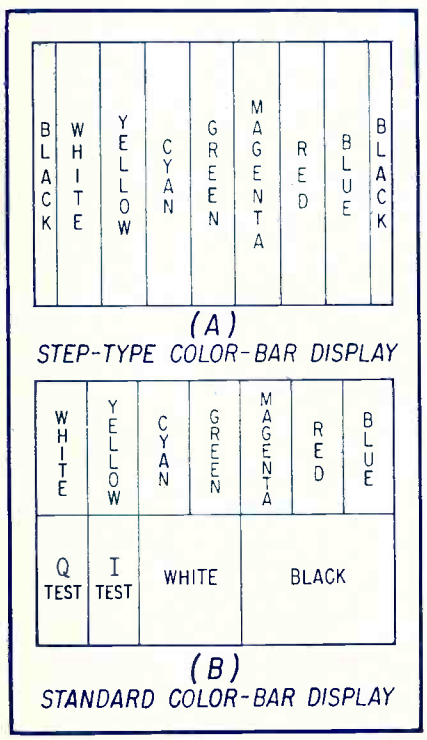


Fig. 1 — Color bar patterns made available for testing color TV systems. Other types are available depending on the color-bar generator used. Many commercial models are now on the market.

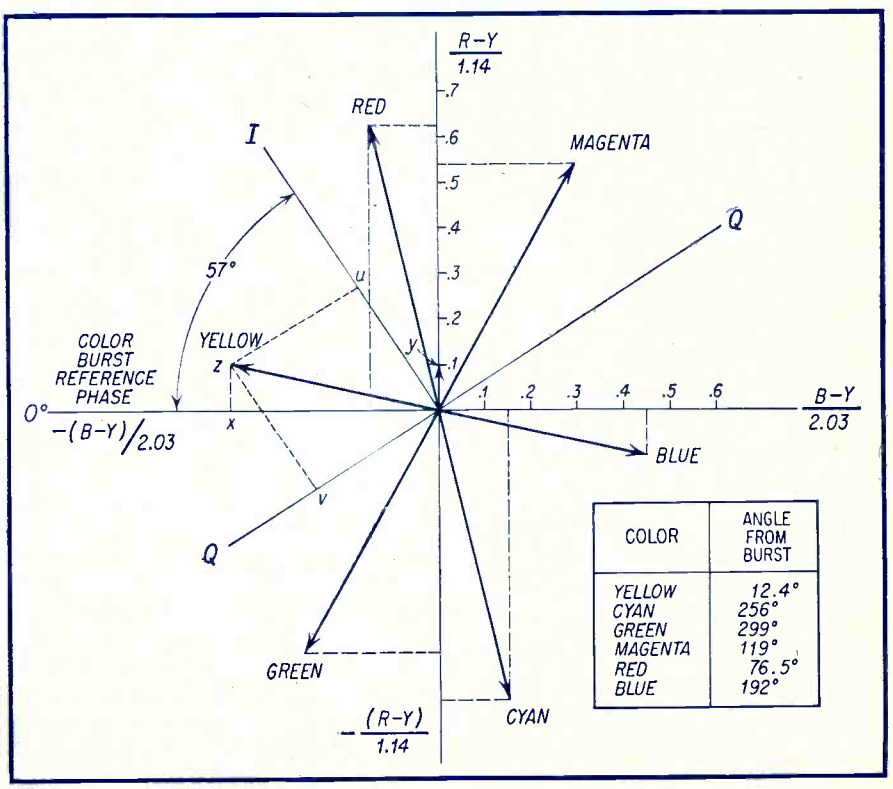


Fig. 3—Chroma signal amplitudes for saturated colors producing unity output camera signals. Relative color signal angles are also indicated.

Q, and chroma, previously derived, are included in *Fig. 2* for purposes of checking the results obtained. We will also assume that the maximum signal that can be developed in each of the camera tubes has a *relative* amplitude of 1.

The amplitude of the various signals derived from the individual camera color signals are shown adjacent to their respective colors scanned in the following sequence:

1) *Color*—the color scanned by the camera tube.
2) *Amplitude* of signal at green camera output.
3) *Amplitude* of signal at red camera output.
4) *Amplitude* of signal at blue camera output.
5) *Y*—the amplitude of the luminance component of the scanned color.
6) *B-Y*—the amplitude of the blue color-difference component of the color signal.
7) *B-Y/2.03*—the amplitude of the reduced blue color-difference signal.
8) *R-Y*—the amplitude of the red color-difference component of the color signal.
9) *R-Y/1.14*—the amplitude of the reduced red color-difference signal.
10) *G-Y*—the value of the green color-difference signal.
11) *I*—the value of B-Y/2.03 and R-Y/1.14 along the I axis.
12) *Q*—the value of B-Y/2.03 and R-Y/1.13 along the Q axis.
13) *Chroma*—the resultant I and Q sideband signals of the suppressed 3.58 mc subcarrier.

Black

A black signal has zero G, R, B, Y, B-Y, R-Y, G-Y, I, Q, and chroma values because it contains neither brightness nor chrominance information. We include "black" in our analysis because its effect on the developed color signal should be readily visualized, and because it provides us with a convenient reference level. In the following analysis we indicate that black and blanking are at the same level. Actually blanking is at a somewhat lower level than black.

White

A white signal produces 100% red, green, and blue color camera signal outputs. Therefore:

$Y = [.59 \times 1]_G + [.3 \times 1]_R + [.11 \times 1]_B = 1$

Thus, the Y signal corresponding to a white scene has a relative amplitude of 1. Recalling that the blue signal also has an amplitude of 1, we find that:

B-Y = 1–1 = 0
B-Y/2.03 = 0

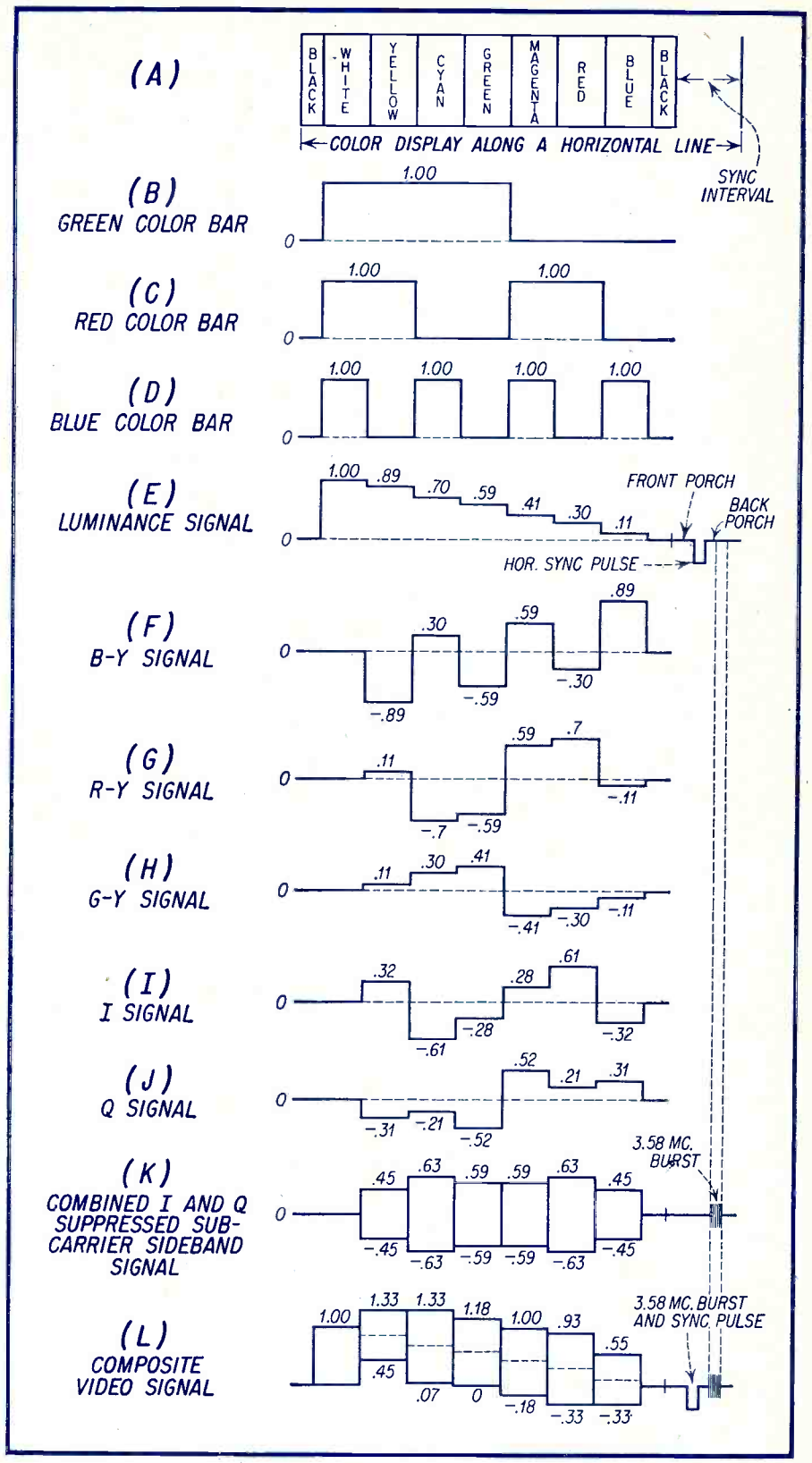


Fig. 4—Color-bar signal produced in transmitter and receiver circuits. (A) represents the color display appearing along a horizontal line of the camera tube, and which if properly reproduced will appear along a horizontal line of the picture tube. If a color-bar generator is used this signal is produced electronically in the generator and will be reproduced in the picture tube if all circuits are functioning properly. Notice that a small interval occurs immediately after the black bar along the horizontal line. This interval is to accommodate the sync pulse and the 3.58 mc burst signal which is positioned on the back porch of the sync pulse. This can be observed by reference to (E) and (K) where the sync pulse and the 3.58 mc burst are respectively added.

The red signal also has an amplitude of 1, therefore:

R-Y = 1 − 1 = 0

R-Y/1.14 = 0

G-Y = 1 − 1 = 0

Since I, Q, and chroma are derived from B-Y and R-Y which are equal to zero, I, Q, and chroma are also equal to zero. These values are appropriately entered in the table.

Yellow

Yellow produces 100% red and 100% green color camera signal output. Therefore:

$Y = [.59 \times 1]_G + [.3 \times 1]_R = .89$

B-Y = 0 − .89 = −.89

B-Y/2.03 = .89/2.03 = −.45

R-Y = 1 − .89 = .11

R-Y/1.14 = .1

G-Y = 1 − .89 = .11

I = .74 × .11 − .27 × (−.89) = +.32

Q = .48 × .11 + .41 × (−.89) = −.31

Chroma = $\sqrt{I^2 + Q^2}$ =

$\sqrt{(.32)^2 \times (-.31)^2} = .45$

The various Y, color-difference, I/Q and chroma signals for cyan, green, magenta, red, and blue may be obtained by a similar analysis. These values are entered in the table of *Fig.* 2 which will be referred to quite often in this analysis.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Color Scanned	Camera Color Amplitude * G	R	B	Y	B-Y	B-Y/2.03	R-Y	R-Y/1.14	G-Y	I	Q	Chroma
(A) Black	0	0	0	0	0	0	0	0	0	0	0	0
(B) White	1	1	1	1	0	0	0	0	0	0	0	0
(C) Yellow	1	1	0	.89	.89	.45	.11	.10	.11	.32	-.31	.45
(D) Cyan	1	0	1	.7	.3	.15	-.7	-.63	.3	.61	-.21	.63
(E) Green	1	0	0	.59	-.59	-.3	-.59	-.53	.41	-.28	-.52	.59
(F) Magenta	0	1	1	.41	.59	.3	.59	.54	-.41	.28	.52	.59
(G) Red	0	1	0	.3	-.3	-.15	.7	.63	-.3	.61	.21	.63
(H) Blue	0	0	1	.11	.89	.45	-.11	-.1	-.11	-.32	.31	.45
(I) Black	0	0	0	0	0	0	0	0	0	0	0	0

* Gamma Corrected

$Y = .59G + .3R + .11B$

$I = .74 (R-Y) - .27 (B-Y)$

$Q = .48 (R-Y) + .41 (B-Y)$

$CHROMA = \sqrt{I^2 + Q^2}$

Fig. 2—Table of relative color signal values produced by scanning various saturated colors. Equations for obtaining Y, I, Q, and chroma are included in the above illustration.

Color Circle Diagram

The chart shown in *Fig.* 2 is a very valuable tool for many reasons. To begin with, by using the values obtained for (R-Y)/1.14 and (B-Y)/2.03, we can construct the diagram shown in *Fig.* 3. This diagram illustrates the relative angles and amplitudes of the color signals corresponding to fully saturated yellow, red magenta, blue, cyan, and green.

The amplitude and direction of each color signal is obtained by laying off the (R-Y)/1.14 and (B-Y)/2.03 values shown in columns 9 and 7 on the R-Y and B-Y axes. Each chroma signal is the resultant of each pair of (B-Y/2.03 and (R-Y)/1.14 signals for the particular color involved.

As an example of the above technique let us determine the chroma signal corresponding to yellow. The sequence of operations is as follows:

1) Line O-x representing (B-Y)/2.03 is −.45 units long.
2) Line O-y representing R-Y is .1 unit long.
3) Line O-z represents the chroma signal value of yellow and is .46 unit long.

The chroma signal O-z for yellow may also be obtained from the I/Q axes by laying off .32 units (obtained from *Fig.* 2) on the I axes (O-u), and .31 units on the Q axis (O-v). The diagonal of the corresponding rectangle should coincide with o-z as shown. The value of chroma obtained by using the equation for chroma given in *Fig.* 2 should check closely with the value obtained graphically above.

Color Signal Waveforms

An equally important application to which this table can be put is to use the information contained therein to derive the waveform patterns for the picture signals developed in various sections of a transmitter and receiver. This is most effectively accomplished when the signals produced correspond to a color-bar display.

In *Fig.* 4 we do just that. Thus, (A) may either represent a color display picked up by the camera tube at the transmitter, or an image produced on a picture tube by means of the signals fed from and produced in a color-bar generator. The particular sequence of colors chosen for this analysis provides certain advantages of symmetry which lends itself to easy recognition and memorization.

The waveform in (B) indicates the amplitudes of the color signal at the output of the green camera tube for

[*Continued on page 45*]

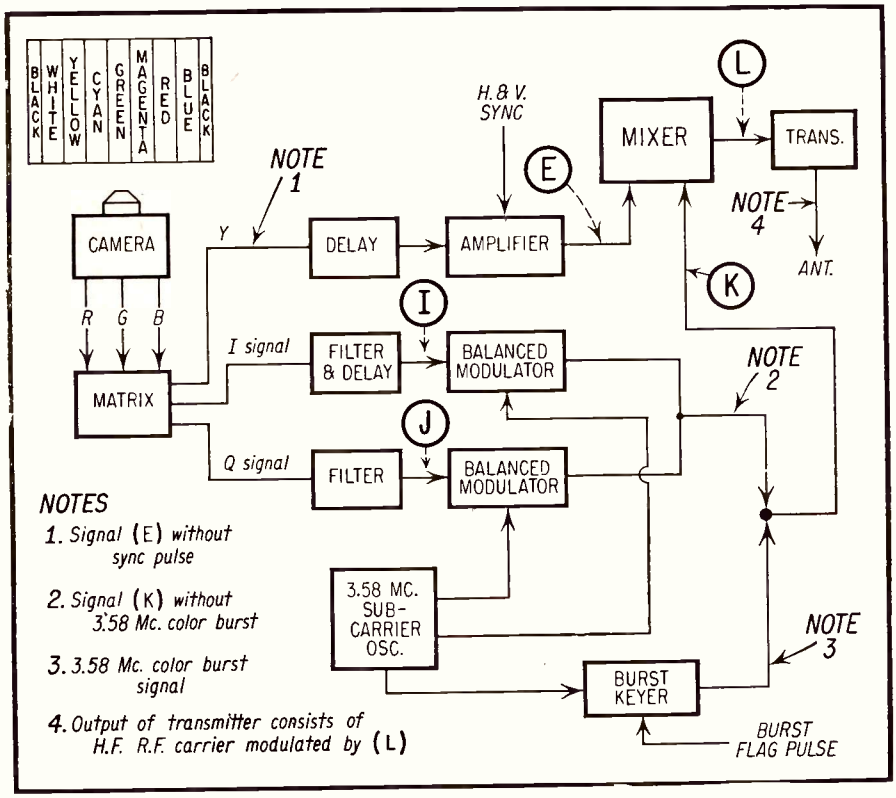
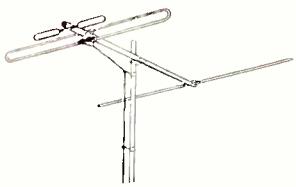


Fig. 5—Partial block diagram of theoretical transmitter showing signal waveforms at different points in transmitter. Departure is made from conventional block diagram presentation in order to show up developed waveforms more effectively.

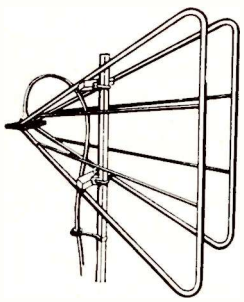
NEW ANTENNAS AND ACCESSORIES

In requesting more detailed information on these products, please check the code number of the product on the convenient coupon on page 55, and send it, along with your company letterhead or business card, to New Products Dept., SERVICE DEALER, Suite 510, 67 West 44th St., New York 36, N.Y.



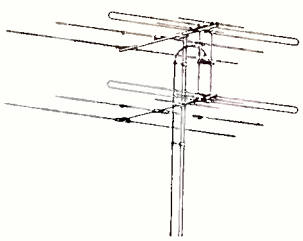
Finco Geomatics

The new Finco Geomatic Series for broad-band VHF reception consists of five models: B-1, through B-5. Antennas range from the metropolitan type antenna to the super-fringe area model for reception 200 miles or more from the station. They are of the boom-type aluminum construction, pre-assembled for quick installation. Every model can be 100% customized to any given locality regardless of the channels, terrain or distance from the station. For further data, check A108.



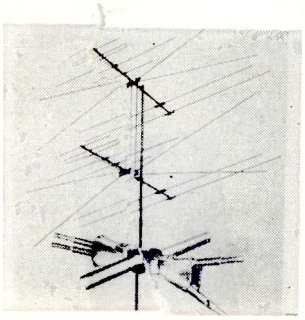
Telco "Sky-Wing"

A new UHF-VHF antenna design that opens up like a book is the "Telco Sky-Wing Antenna," product of the Television Hardware Mfg. Co. Claimed to have unusually high gain, the "Sky-Wing" (Catalog No. A-300) is all aluminum construction and comes assembled, ready for immediate installation. For further information, check A109.



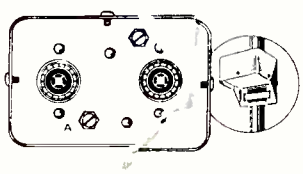
Amphenol Fringe Array

The American Phenolic Corp. announced their "Poweray" fringe antenna, which utilizes short antenna elements in series with a section of simulated three wire transmission line in conjunction with a reflector system, said to promote high gain and broad band characteristics. In addition, the sleeve dipole principle assures close centering of the impedance characteristic for optimum performance and match between antenna, lead-in and TV set. For further data, check A104.



Channel Master Yagi

Channel Master Corp. has announced a new Conical Yagi, Model 321-A, featuring a "Super-sembled" conical head that speeds assembly and completely nests the elements for a tight, sure grip. This new antenna supersedes the Globe Trotter, and is priced lower than previous models. The entire antenna is made of aluminum, and all elements have seamless sleeves where they join the bracket. For further data, check A102.

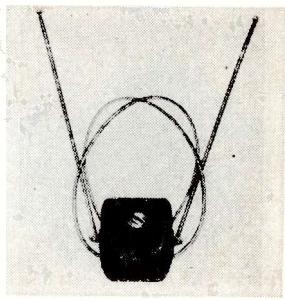


Blonder-Tongue Wave Trap

Blonder-Tongue Laboratories is now supplying a precision tunable trap to eliminate FM interference in Master TV Systems and individual sets. The weather protected unit, Model MWT-1, may be mounted on the antenna mast, at amplifier inputs or at TV set terminals. Any FM channel from 88 to 108 MC may be attenuated more than 20 db. Two trimmer screws tune out the interfering frequency. For further data, check A101.

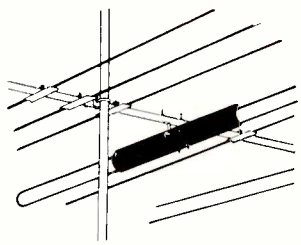
All Channel Array

The All Channel Antenna Corporation has just announced its "Rembrandt" indoor television antenna which will be available in nine decorator colors which purportedly match all of the 1956 colored TV sets now being manufactured by Emerson, Motorola, etc. A nine position orientation switch in most instances eliminates antenna orientation and ghostly reflections, and the new variable radar loop principle automatically brings in the clearest, sharpest, strongest signal on every channel. For further information, check A105.



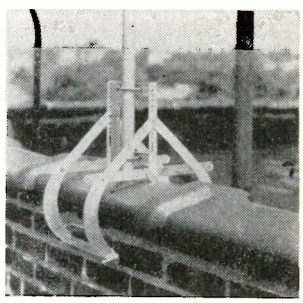
Walsco "Wizard"

The Walsco Wizard utilizes that company's "phase reverser," which is a shaped metallic shield which is mounted in front of the receiving element, and enables the array to function as 3 separate antennas in one. It is said to permit elimination of harnesses, phasing stubs, and extra dipoles, increasing electrical efficiency and decreasing assembly time. For more data, check A103.



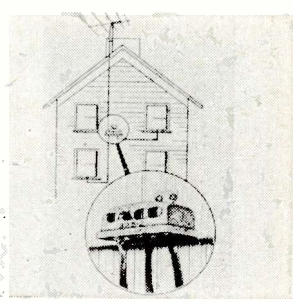
Kenwood Parapet Mount

Kenwood Engineering Co., Inc. is producing a mount known as Kenco Parapet Mount, Model 106, designed to take antenna masts up to 1½" in dia. and to be used on walls up to 13½" thick. It employs a sturdy frame and four clawlike members. At the end of each claw is a hardened cone point set screw which assures positive anchorage to the wall. At each side of the frame is a cam that can be adjusted to give positive vertical support on tile or stone copings regardless of contour. For further data, check A106.



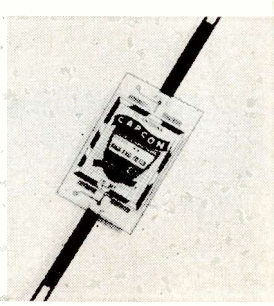
Taco Outdoor Coupler

The new Taco Model 825 couplers are available as two-way and three-way splitting devices. Housed in weatherproof cases, they are designed for exterior installation. These couplers are of the voltage-splitting type and do not require power line connections. In high signal strength areas, the units may be used in tandem to provide a trouble-free television signal distribution system. For further data, check A100.



Capcon Filter

The new Capcon "Printed-Circuit High-Pass Filter" eliminates or suppresses TV picture interference from ignition, diathermy—amateurs, industrial equipment, neon signs, electrical appliances and other extraneous signals. The printed circuit contains six precision coils and four condensers and will cut out all interfering signals below 51 megacycles, where we find most of the factors destroying good television reception, with an attenuation above 45 decibels. For further data, check A107.



HI-FI PA SOUND

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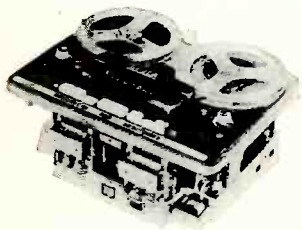
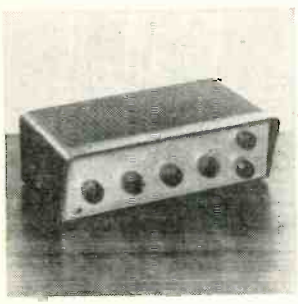


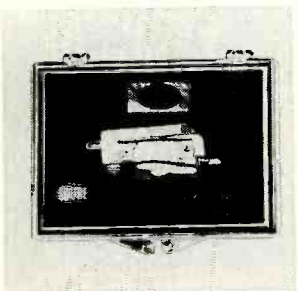
DeJUR Recorder Chassis

The DeJUR-Amsco Corp. has announced a tape-recorder chassis for custom installations featuring dual speed, dual track operation with push-button track reversal, and driven by a synchronous reversible hysteresis motor, with instantaneous acting clutches and brakes. A recording level indicator, loudness control, and four separate record-playback and erase heads are also featured. For more data, check S109.



Harmon-Kardon PC Amplifier

Employing printed circuits throughout, the Harmon-Kardon Prelude, Model PC-200, employs dip soldered, copper-clad laminated phenolic board, arranged so that mechanical disassembly can be made whenever necessary. This 10-watt amplifier includes a preamplifier with inputs for phono, tuner, and tape, and features tape output, unaffected by the tone controls. Included are equalization with separate roll-off and turnover, loudness, bass and treble controls and a rumble filter. For further information check S107.



Shure "Music Lovers" Cartridge

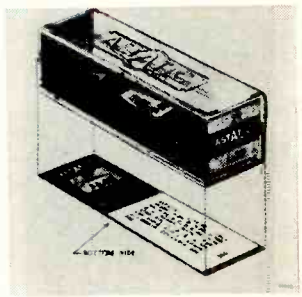
Shure Brothers, Inc., have developed a 3-speed barium-titanate cartridge. Called the "Music Lovers" cartridge, it purportedly is not susceptible to induced hum, or to cartridge drag caused by magnetic attraction to turntables. It is also immune to temperature and humidity variations, and its relative response is not affected by load resistance. For further information, check S102.

RCA Tape Attachment

A new high fidelity tape recorder attachment to serve as an accessory for the Mark II and Mark III models of the RCA New Orthophonic high fidelity series has been announced by RCA. The recorder has a mahogany cabinet styled along the lines of the high fidelity instruments, and is a duplicate of the recorder in the twin-cabinet Mark I. It features 2-speed operation record level tuning eye, 2-speed equalization control, and erase indicator. For further information, check S105.

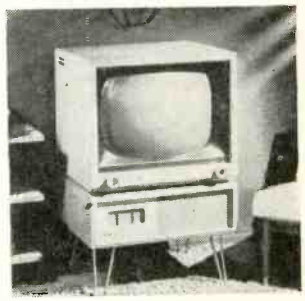
Bogen Hi-Fi Receiver

The RR550, exhibits an FM sensitivity of 2½ microvolts for 30 db quieting, AM sensitivity of 5 microvolts for 20 db signal-to-noise ratio. A tuning meter which works on both AM and FM is included along with an AFC defeat switch on the panel. The RR550 has magnetic and crystal inputs. Frequency response is 15 to 40,000 cycles with ½ a db distortion less than ½% at 25 watts. The Bogen variable damping factor circuit permits "Ultimate damping" of the speaker. A visual indicator for adjustment is provided. For more information, check S101.



Astatic Marking System

The Astatic Corp. has announced a revised system of easy-to-remember stock numbers which will be shown along with the old stock numbers. Stock numbers in color code tell at a glance fresh stock from the older stock. List price, dealer net price and cartridge replacement data are also included on the cartridge box. The new colored box liner adds sparkle to the package. For further information, check S106.

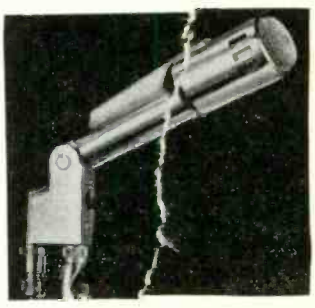


Jensen Duette Hi-Fi Line

Featuring a two-way Hi-Fi speaker system in table form, Jensen Manufacturing Co. is now producing a line of TV Duettes designed to increase the sound quality of TV table model sets. A three position switch at the front of the unit allows instant comparison with the original TV speaker, while the third position transfers the Duette to any other Hi-Fi source. Comparison switching makes every TV Duette a full-fleged demonstrator both in the dealer's store and in the purchaser's home. For further information, check S104.

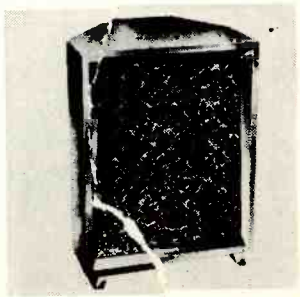
Audax Adapter

The Audak Co. has announced a new "Plug-In" adapter that instantly connects any Audax cartridge to any Garrard player. Designed specifically for the Garrard RC-80M and RC-90 record changers and for the Model "T" turntable. Provision is made in this precision device for maintaining stylus-to-groove alignment. No soldering, no wire handling. Simply plug in and the connection is accomplished. For further data, check S108.



Electro-Voice Variable D Mike

A Variable D Cardioid Dynamic Microphone for public address, recording, communications, etc., has been announced by Electro-Voice, Inc. It provides uniform cardioid polar pattern at *all* frequencies—gives high front-to-back discrimination and smooth, wide-range response, without close-talking boominess. More effectively cuts ambient noise, feedback and reverberation and gives distinct, natural reproduction of voice and music. Can be used on floor or desk stand or carried in the hand. For further information, check S103.



University 3-Way System

The "Senior", University's latest horn-loaded 3-way "Decor-Coustic" speaker system, uses the 12" model C12W as a basic woofer, the Model 4408 "reciprocating flares" horn speaker, and the HF-206 supertweeter. Acoustic balance is achieved with the built-in "brilliance" and "presence" controls in the N-3 L/C 3-way network. The design of this 30-watt system provides optimum performance when placed flat against a wall, in a corner, or even in the center of a room. For further information, check S100.

NEW CHASSIS DESIGN FEATURES

Ease of Servicing and Unitized Chassis Construction Featured in New Models

New CBS-Columbia TV Chassis

Getting at TV set components is a long standing headache for the service technician. It often takes more time to take a set apart than is needed to troubleshoot and replace the defective part.

The new CBS-Columbia 1611 chassis solves these problems with an ingenious tilt-out feature, making it one of the most serviceable chassis manufactured. The chassis is mounted vertically, with the tubes facing the front of the receiver, and the wiring and small components on the rear side of the chassis. All wiring etc. that is normally on the underside of a horizontal chassis is accessible simply by removing the receiver's back cover.

To replace tubes two wing screws are removed and the chassis tilts back to a 45 degree angle providing easy access to all tubes. All leads remain connected and the chassis may be operated in this position for test purposes.

The set can be completely adjusted and aligned, and most troubleshooting and parts replacement can be accomplished without removing the chassis from the cabinet.

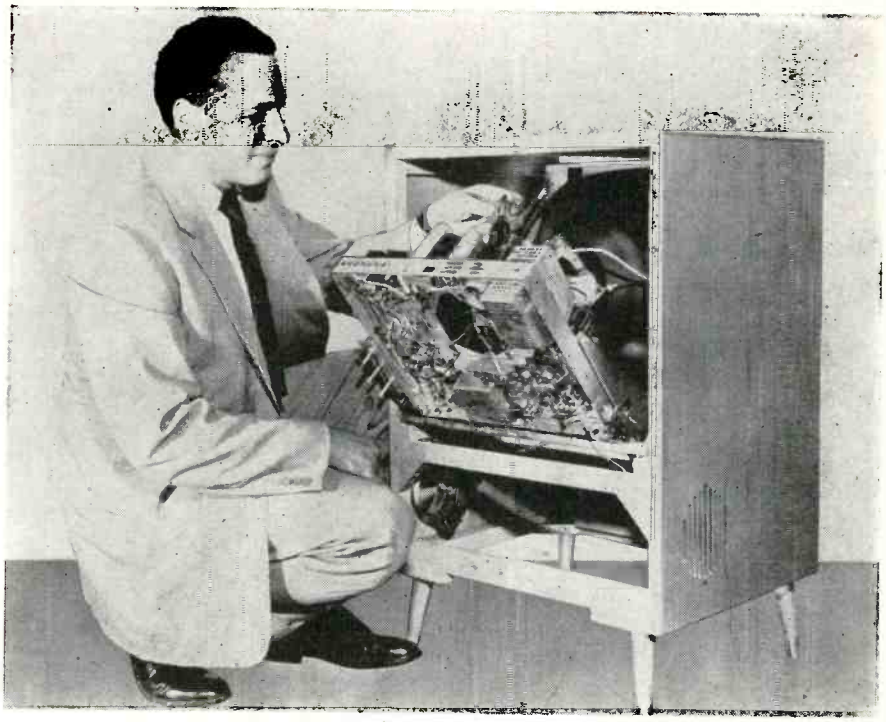


Fig. 1 — The new CBS-Columbia 1611 chassis includes a tilt-out feature which enables the serviceman to get at all the tubes and components.

Setchell-Carlson Unitized Chassis

Setchell-Carlson, Inc., announces a new unitized chassis used in its 1956 line. This chassis, Model 156-RP, provides the following removable units in its makeup.

Unit A—Newest Cascode Tuner

Improved over previous models by the use of a new mixer tube. Combined antenna, R.F., oscillator coils on single strip construction. Better signal-to-noise ratio for fringe reception with improved AGC characteristics for local reception.

Tubes: 1—6AT8 Pentrode Mixer, Triode Oscillator
1—6BQ7A R.F. Amplifier

Unit B—4 Stage 44 M.C. Amplifier

4 stages of double tuned I.F. amplification in conjunction with 4 traps for

[*Continued on page 51*]

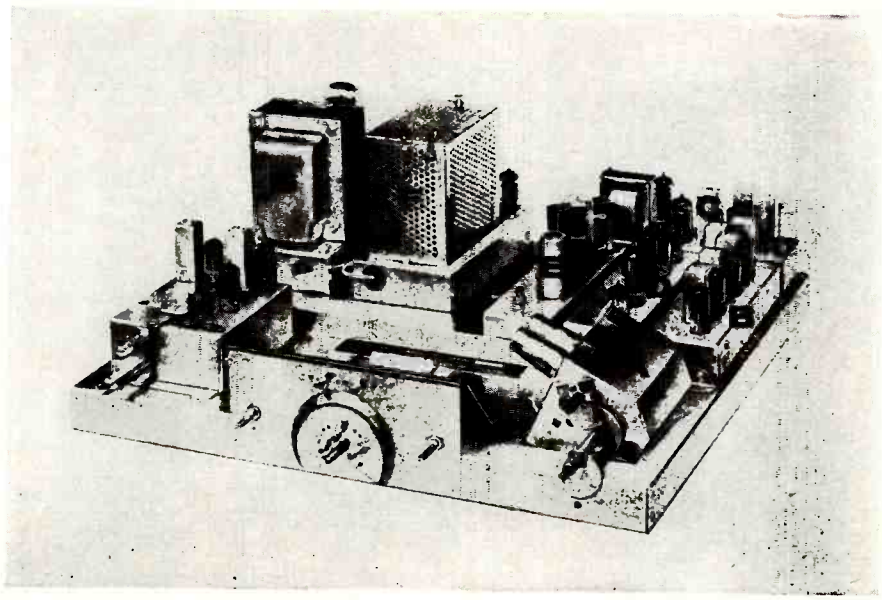


Fig. 2 — The Setchell-Carlson chassis Model 156-RP features a unitized construction whereby servicing is speeded up by replaceable units.

NEW TEST EQUIPMENT

In requesting more detailed information on these products, please check the code number of the product on the convenient coupon on page 55, and send it, along with your company letterhead or business card, to New Products Dept., SERVICE DEALER, Suite 510, 67 West 44th St., New York 36, N.Y.

EICO 5 mc 5" dc Oscilloscope Kit

EICO's model 460 oscilloscope kit features the following characteristics: reproduction of 3.58*mc* sync burst and 3.58*mc* oscillator signals in color sets; is flat for *dc* to 4.5*mc*; automatic sync circuit syncs any visible signal; has pre-set vert. and horiz. sweep positions; built-in voltage calibrator; p-p vertical amplifier with choice of *dc* or *ac* coupling, etc. For more data, check T107.

Hickock VOM

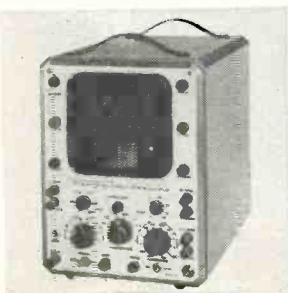
A new, portable multimeter is announced by Hickock which, in the event a dangerous over-load is applied, disconnects itself and raises a re-set button on the case. Actually, any high voltage may be applied directly across any function, including ohms, without any danger to the meter movement or associated components. For further information, check T100.

Senco Filament Checker

Service Instruments Company has announced their Model FC4 Filament Checker for quickly finding the open filament in new series filament TV sets. The new checker is pocket sized, automatically checks all octals, loctals, 7 and 9 pin miniature tubes and picture tubes, and can also be used as a continuity checker and neon voltage indicator by merely inserting standard test leads in pins 1 and 12 of the picture tube socket. For further data, check T109.

B&K CRT Testers

The B&K Model 400 has 4½ inch plastic meter, and replaces the B&K CRT 350. It checks and corrects most CRT troubles quickly in the home without removing tube. Finds and repairs inter-element shorts and open circuits—stops leakage—reactivates the cathode and restores emission. Checks gas content and also predicts probable useful life expectancy of the CRT. The Model 200 has a 3-inch meter and performs many of the functions of the former CRT 350. For further data, check T101.

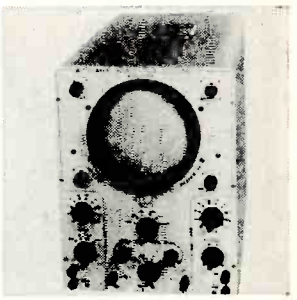


Weston Oscilloscope

The Weston model 983 oscilloscope has a bandwidth of 4 *mc* allowing accurate display of video frequencies, including pulse forms and color sync bursts. Its sensitivity of 17 *mv* per inch facilitates setting resonant traps, and use as a general null indicator, and for signal tracing in low level stages, as well as sweep frequency visual alignment. Has provisions for internal calibration, internal phased sine wave, and Z-axis modulation. For further data, check T104.

General Electronic Equipment Oscilloscope Kit

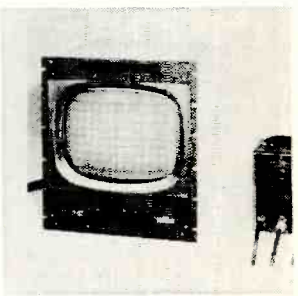
General Electronic Equipment Company's Model 555 wide range, 5" oscilloscope kit features a 3-stage vertical p-p amplifier with plate follower circuit, useful to 3.6 *mc*. Vert. sensitivity is 25 *mv* per RMS inch. Horiz. frequency response is useful up to 700 *kc*. Sweep range: 15 to 150,000 *cps*. Also features Z axis modulation, compensated step type attenuator, retrace blanking, etc. For further data, check T106.



Du Mont Large-Screen Scope

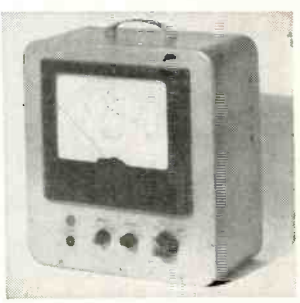
Large-size displays of electrical signals by means of two large-screen cathode-ray tube indicators are announced by Du Mont Laboratories, Inc. The 17- and 21-inch indicators, employ TV type cathode-ray tubes and are designed primarily for use in conjunction with low-frequency, laboratory-type oscillographs.

The coupling of the indicator to the master oscillograph is performed through a cathode-follower adapter for transmission over lines up to 100' in length. Check T102.



VI Video Probe Meter

The Research Inventions & Mfg. Co. has introduced a broadly tuned probe and absorption meter which facilitates the following measurements: Traces video signals from chassis top; tests RF, OSC., IF & video signals from tuner to CRT; checks most audio circuits before and after detector; tests RF or local osc.; tests horiz. osc.; used to adjust audio disc. and detecting audio, etc., etc. For complete data, check T103.



Leitch VTVM

The Leitch "Meter-Matic" VTVM features completely automatic range switching. Application of the probes to check points gives an immediate reading on an 8½" meter. Scale to be read is indicated by a recessed red light. Each set of calibrations is complete without the need of adding zero multipliers. Measurement of *ac* and *dc* voltages is from .1 volt to 1500 volts. Unit is particularly valuable when dealing in unknown voltages. Similarly, in measuring resistance, automatic reading is possible from .5 ohm to one billion ohms in six ranges. For further data, check T108.

Heathkit Bar-Dot Generator

The new-design Model I.P-1 kit produces vertical or horizontal bar patterns, a cross-hatch pattern, or white dots on the screen of the TV set under test. No internal connections required. Special clip is attached to the TV antenna terminals. Instant selection of the pattern desired for adjustment of vertical and horizontal linearity, picture size, aspect ratio, and focus. Dot pattern presentation is a must for color convergence adjustments on color TV sets. For further data, check T105.

SELLING HI-FI

by Herbert Suesholtz
President, Transvision Inc.

Typical Hi-Fi combination. Cabinet on right contains phono and amplifier.

AMERICA, a land of television fans, is now becoming a land of music fans who spend many hours listening to popular, jazz or classical records. Ordinarily the service dealer would have received the tremendous play from this new business. He is the natural one to whom the customer would look for advice and for service concerning Hi-fi equipment, and he is the one best equipped to give the type of service that such equipment demands. Unfortunately, the Hi-fidelity business developed in such a way that the consumer is able to buy Hi-fi equipment at the same price as the service dealer. Of course this has excluded the service dealer from the entire Hi-fi picture.

A Place for the Service Dealer in the Hi-fi Business

A number of progressive companies recognize that it is the service dealer who has the contact with the potential Hi-fi purchaser, and have geared themselves to a Hi-fi sales program which protects the dealer's profit. The dealer is the only one who can buy his Hi-fi equipment at dealer price. In addition to this, by proper engineering and planning, these companies are able to supply the dealer with Hi-fi equipment at such a low price that the dealer can offer this equipment to his customers at prices considerably below the wholesale prices at which previously merchandised Hi-fi equipment has been sold.

The purpose of this article is to point out to the service dealer the technical and merchandising information which he requires to get into Hi-fidelity sales. No appreciable investment or inventory is necessary; just common sense, understanding and a knowledge of where to get and how to sell the merchandise.

Important Technical Details Concerning Hi-fi

The speaker system is by far the most important part of the Hi-fi system. Most of the emphasis should be placed on obtaining a good one. It is highly advised that a 12" or 15" speaker be used as the woofer. Any size less than this often results in a major sacrifice of the rich, vibrant, low notes which the consumer finds most pleasing. It is vital that the speaker system be in an enclosure which is separate from the other parts of the Hi-fi system, otherwise the vibration from the low notes would cause the phonograph needle to bounce and distort the sound. Even in the very expensive equipment, if the speaker enclosure has not been separated from the other equipment, it becomes necessary to cut down the frequency response of the amplifier on the very low notes. This markedly reduces the quality of the sound.

It is important for the separate speaker enclosure to have a minimum of 4 or 5 cubic feet since this large volume is greatly beneficial in improving sound quality.

Regarding the record changers, the average commercial changer is of only fair quality. It is better practice to use the heavier duty, which are now being mass produced for Hi-fidelity and which are not very expensive. A good changer should have no wow or rumble.

The pickup is also a very decisive factor in improving sound. Tests run with the G.E. reluctance pickup by the Transvision Engineering Staff indicate a very pronounced improvement in sound quality when compared to ceramic and crystal pickups. This applies to other reluctance pickups as well as the better make crystal and ceramic pickups. They retain quality over long periods and adverse weather conditions, and are not affected by high humidity. This point is important. The importance of the dia-

Speaker complement of Hi-Fi combination. A wide variety of woods and finishes are available.

Phono and amplifier cabinet which complements unit shown on left provides a pleasing appearance.

mond needle is most appreciated as time goes on. Comparison tests of performance between a diamond needle and a sapphire needle show no difference when both are new but after approximately 20 hours of use the sapphire needle suffers a marked depreciation in quality.

Worn out needles can not follow the minute micro-grooves in the record and do not faithfully reproduce. In addition to this, worn needles can permanently damage a record collection in a very short time.

Important Merchandising Requirements for Hi-Fidelity:

By studying the merchandising program of one of the companies, which offers the dealer an opportunity to establish himself in the Hi-fidelity field, the dealer will obtain good understanding of the factors required to properly merchandise Hi-fi equipment. For example: Transvision, Incorporated, has a dealer program typical of the two-step merchandising approach designed for the service dealer. After broadly surveying the Hi-fidelity field, it was recognized that three very basic problems which would have to be corrected in order to broaden the Hi-fi field into a mass market. These are:

1) Real Hi-fi in component form was rarely available in beautiful cabinets. Thus, the consumer was forced to either accept unsightly expensive cabinets or else build his units into a custom built cabinet. This placed a great restriction on the number of people who would purchase Hi-fi.

2) Since most people already have television it becomes a difficult problem to fit into an ordinary living room, the television set, the separate speaker enclosure and the housing for the amplifier and of course the record changer.

3) To get superb quality Hi-fi reproduction not only costs the consumer more than he generally could afford but also requires him to deal with Hi-fi outlets which are not locally situated and which could not offer good service or advice.

How the Service Dealer Can Promote and Sell Hi-fi:

The service dealer is a natural for promoting Hi-fi since he is already in the home of the customer and has his confidence. His first step should be to let all of his customers know that he is a Hi-fi expert, that he can install either completed units in package form in beautiful furniture, at low price, or can build in components. He can show the customer on black and white that he is offering the finest components such as diamond needle, reluctance pickup, separate speaker system, etc.

In addition he can offer his customer the equivalent of a radio worth at least $200. if his customer purchases a Hi-fi system from him. He does this by tapping off from the detector on his customer's table model radio and hooking it into the Hi-fi system. Results are astonishing because the quality of the radio is superior to anything the customer has ever heard and is as good as that obtained with even the finest AM-FM tuners.

The dealer should be sure to contact the companies in the field who have geared themselves to put him in the Hi-fi business and protect him. Most of these companies have very aggressive merchandising programs with dealers' catalogs, consumers' catalogs, window displays and other sales helps. They will give him a complete program which will get him started.

(See advertisement on page 26)

Mfr: Admiral **Chassis No.** 17XP3

Card No: AD 17XP3-1

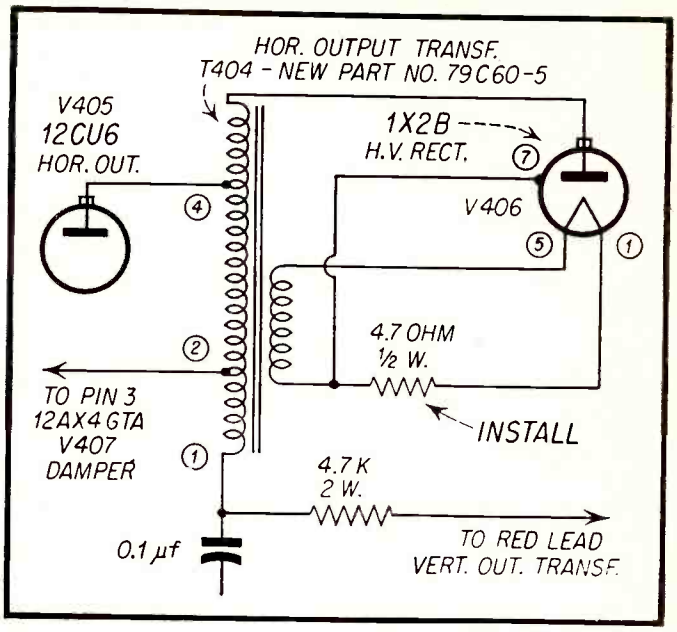
Section Affected: Pix

Symptom: Blooming when brightness control is advanced.

Reason for Change: To improve high voltage regulation.
Note: This change is included in all 17XP3 receivers starting with Run 2.

What to Do:
Replace: Horizontal Out. Trans. part No. 79C60-4, having a 1-turn filament winding for 1X2B with part No. 79C60-5 having a 2-turn winding.

Connect: 4.7 ohm, ½ W resistor in series with 1X2B filament leads.
Note: Before replacing transformer try another 1X2B.



Mfr: Admiral **Chassis No.** 17XP3

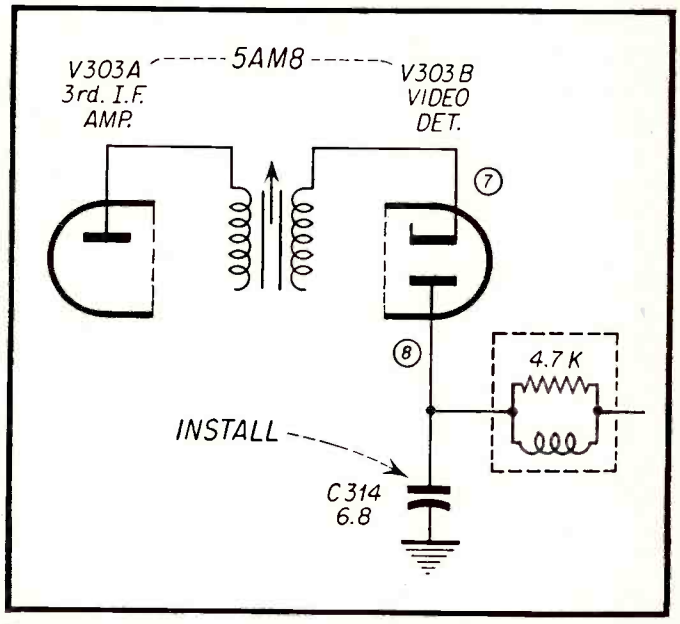
Card No: AD 17XP3-2

Section Affected: Pix

Symptom: *RF* interference (rotating "bars" on Channel 5).

Cause: 3rd harmonic *if* radiation at certain settings of fine tuning control usually under weak signal conditions.
Note: This change is included in all 17XP3 receivers starting with Run 2.

What to Do:
Connect: Capacitor—*C314* (6.8 *μμf* ceramic, part No. 65B28-068) from pin 8 of V303-5AM8 to chassis ground.



Mfr: Admiral **Chassis No.** 17XP3

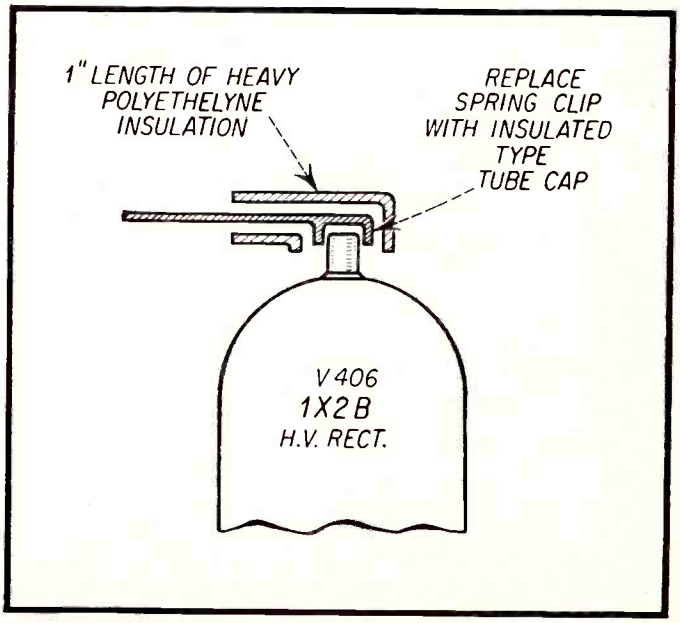
Card No: AD 17XP3-3

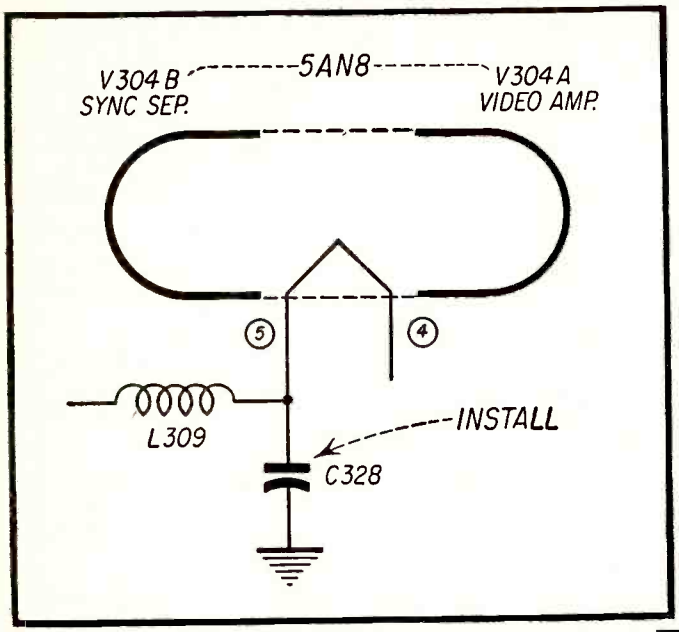
Section Affected: High voltage.

Symptom: Corona discharge present at cap of 1X2B.

Reason for Change: Reduce corona discharge.
Note: This change included in later production models.

What to Do:
Replace: Spring type clip with insulated type tube cap. Also, slip one inch length of heavy polyethelyne tube over tube cap.





Mfr: Admiral **Chassis No.** 17XP3

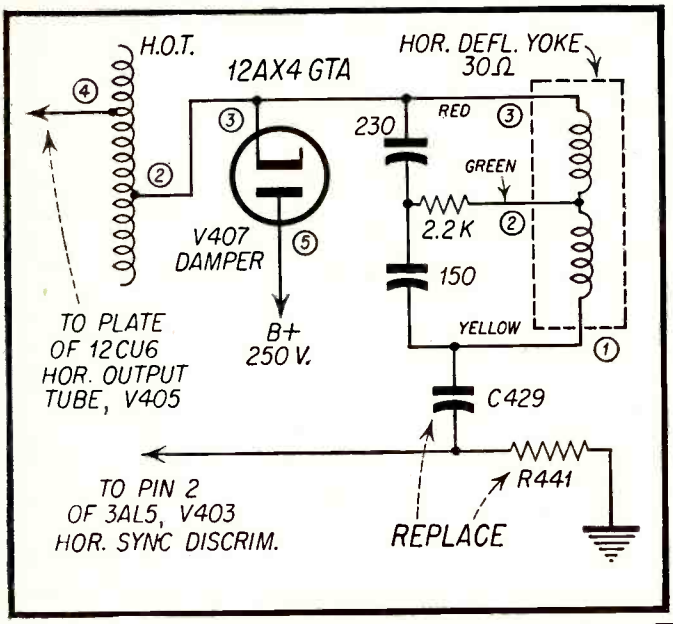
Card No: AD 17XP3-4

Section Affected: Pix

Symptom: Unstable Pix

Cause: *IF* Regeneration.
Note: This change is included in all 17XP3 receivers starting with Run 5.

What to Do:
Install: *C328* (.005 *μf*—450V ceramic—part number 65C10-5) between junction of pin 5 —V304 (5AN8) and chassis ground.



Mfr: Admiral **Chassis No.** 17XP3-17SX3

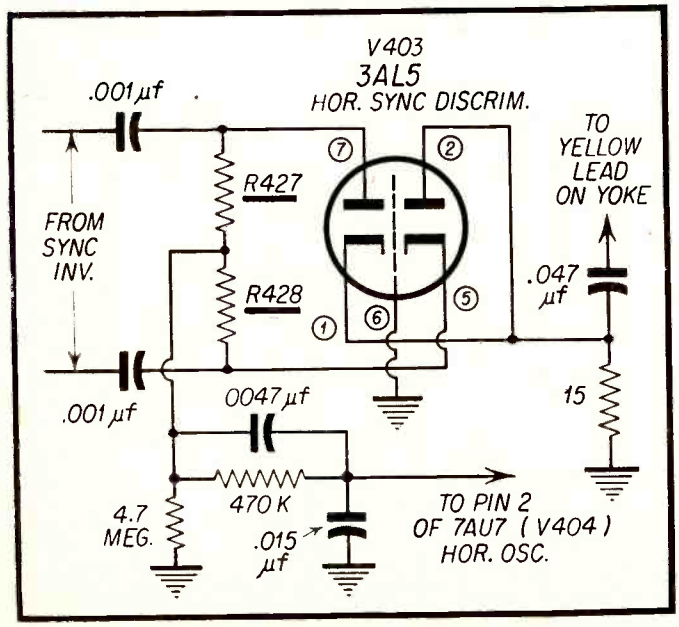
Card No: AD 17XP3-5

Section Affected: Raster and possibly sound.

Symptom: No raster, sound may or may not be present. 12AX46TA Damper gets red hot; *R441* burns up; horizontal deflection yoke overheats or burns up.

Cause: Shorted horizontal sweep by-pass condenser.
Note: This condenser was increased from a 600V to a 1000V rating in all 17XP3 chassis beginning with Run 9 and all 17SX3 chassis beginning with Run 5.

What to Do:
Replace: *C429* (.047 *μf*—600 V) with .047 *μf*—1000 V condenser. Also. *R441*—15 ohm 1 W with 15 ohm 2 W resistor.
Note: Some early production receivers employ two .1 *μf*—600 V condensers in series, which is OK.



Mfr: Admiral

Card No: AD 17XP3-6

Section Affected: Sync

Symptom: Horizontal frequency out of range. When V403-3AL5, the horizontal sync discriminator, is removed, horizontal frequency, though out of sync, comes back into range.

Cause: Discriminator load resistor changed in value.

What to Do:
Replace: *R427* or *R428* (100K—5%).

Mfr: Du Mont **Chassis No.** RA 312/313

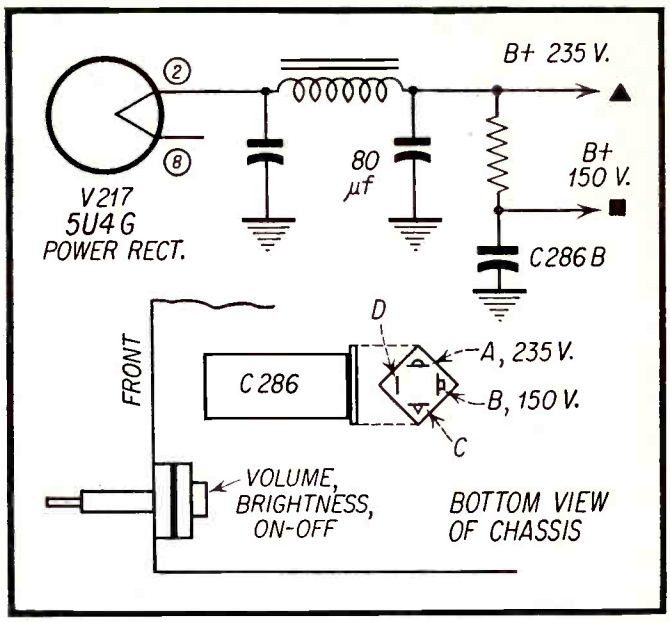
Card No: DM 312-1

Section Affected: Sync

Symptom: Critical vertical and horizontal hold. Picture jitters and pulls horizontally.

Cause: Open filter condenser in B+ 150 V line.

What to Do:
Replace: *C286B* (40 μf—350 V).



Mfr: Du Mont **Chassis No.** RA 312/313

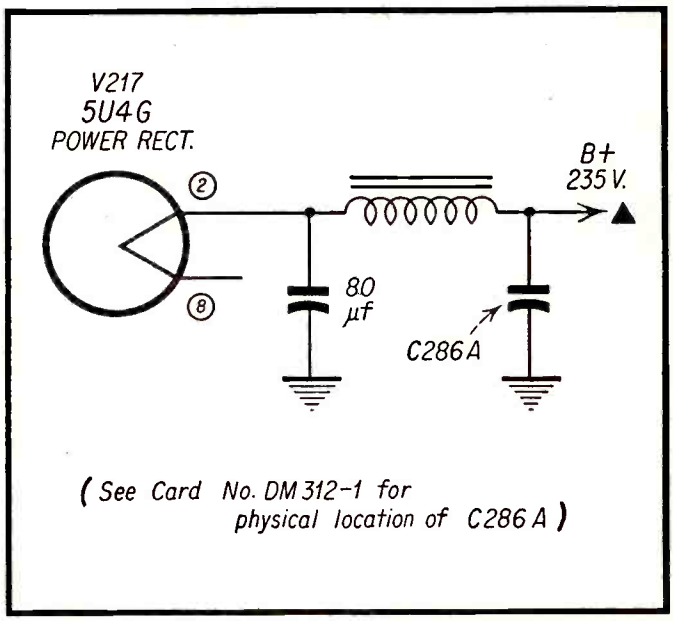
Card No: DM 312-2

Section Affected: Pix and sync.

Symptom: Dark vertical bars in raster (5 or 6), widest and most pronounced on left side. Contrast control adjustment changes intensity and width of bars.
Also, washed out pix.
Also, critical vertical and horizontal hold.

Cause: Open filter condenser in B+ 235 V line.

What to Do:
Replace: *C286A* (80 μf—350 V).



Mfr: Du Mont **Chassis No.** RA 312/313

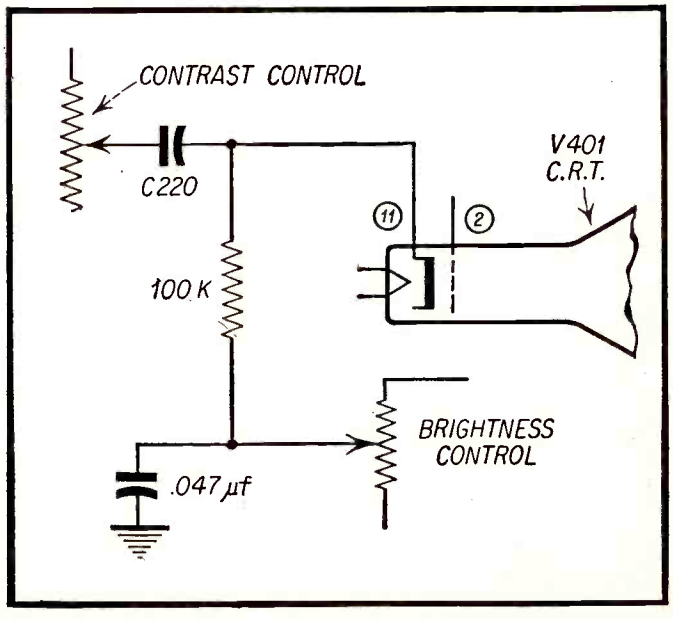
Card No: DM 312-3

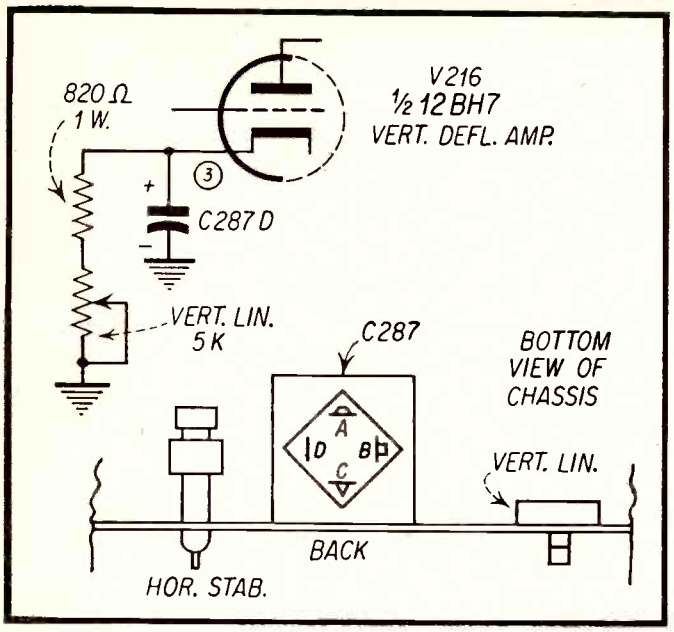
Section Affected: Pix

Symptom: No raster; sound-OK, HV-OK.

Cause: Shorted video coupling condenser to CRT cathode.

What to Do:
Replace: *C220* (.22 μf—400 V).





Mfr: Du Mont **Chassis No.** RA 312-4

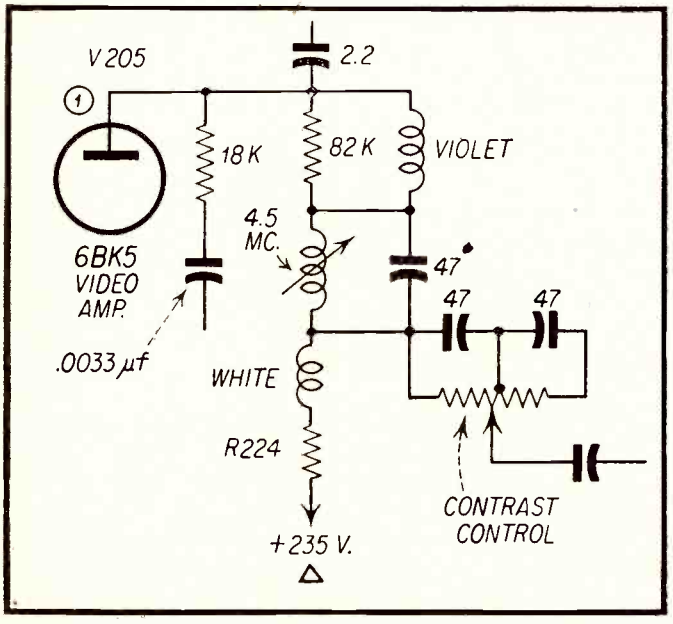
Card No: DM 312-4

Section Affected: Pix

Symptom: Poor vertical linearity and loss in size which cannot be properly adjusted with normal adjustment of vertical size and linearity controls.

Cause: Open condenser in cathode of vertical deflection amplifier.

What to Do:
Replace: *C287D* (10 *μf*—50 V).



Mfr: Du Mont **Chassis No.** RA 312/313

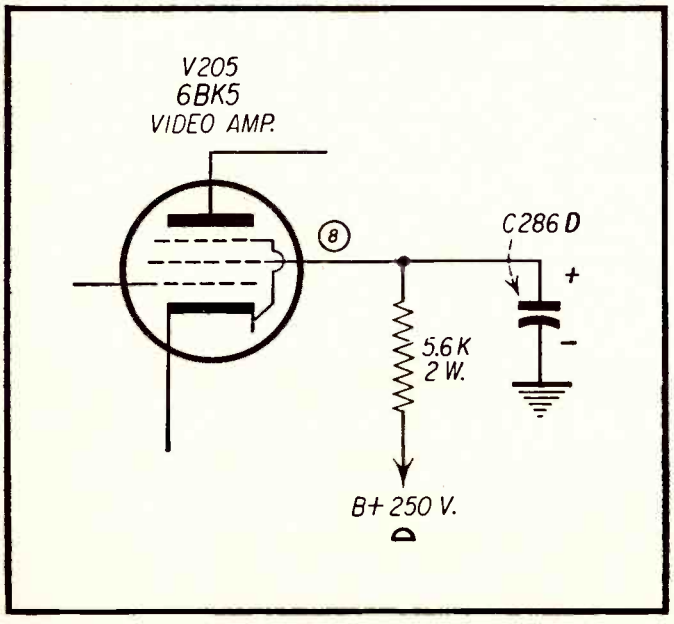
Card No: DM 312-5

Section Affected: Pix

Symptom: Weak and washed out pix. Sound normal except for strong buzz.

Cause: Open resistor in plate circuit of video amp.

What to Do:
Replace: *R224* (5K-10 W).



Mfr: Du Mont **Chassis No.** RA 312/313

Card No: DM 312-6

Section Affected: Pix and sync.

Symptom: Pix overload and loss of vertical and horizontal hold on strong or average signals. When weak signal is obtained overload does not occur but excessive loss of contrast occurs accompanied by severe horizontal pull and jitter.

Cause: Leaky screen bypass condenser in video amplifier.

What to Do:
Replace: *C286D* (4 *μf*—350 V).

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Why take this?

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PIONEER MANUFACTURER AND OUTSTANDING PRODUCER OF THE FINEST LINE OF ANTENNA MOUNTING ACCESSORIES

WRITE FOR OUR NEW 1955 CATALOG

ASSOCIATIONS

[*from page* 21]

would be slanted toward our type of business, a program that would provide this sorely needed training in easy to take doses. We feel we have such a program available now. Here are the details. We have arranged to have Mr. Harry J. Waters conduct a series of ten sessions on "Successful Television Service Management." Mr. Waters is particularly well qualified to present such a course. He has been a successful trainer of business people, with many years experience working for and running small businesses on Long Island. He is presently vice president of one of the larger electronics service outfits on Long Island. PLUS graduate degrees at the N.Y.U. Graduate School of Business Adiministration.

ATSCO (Cincinnati)

On Monday, October 10, 1955, ATSCO, Master Television Servicemen's Association, and other independent servicemen met with the Law Committee of City Council and discussed the proposed licensing ordinance. The Law Committee decided to defer action on this city ordinance until ATSCO has had an opportunity to try its present licensing plan.

P.R.S.M.A. (Penna.)

P.R.S.M.A. opened the 1955-1956 series of open service meetings at the Franklin Institute, September 6, 1955, presenting the Weston Electric Instrument Co., who had as their speaker W. W. Hartz, Test Equipment Engineer, speaking on "How to Save Time and Money on Television Alignment."

P.R.S.M.A. also presented the RCA Service Co. on October 4, 1955, at the Franklin Institute. Mr. Clinton Walter was the speaker with a talk on Color Television—How to set it up and trouble shooting color.

General Electric will announce a 6 months' credit plan for servicemen selling a picture tube along with a repair job including receiving tubes to their customers and he can make arrangements with his General Electric dealer for his customer to pay the bill on a monthly basis. See your G.E. distributor.

Stan Myers

Associated Radio & Television Servicemen (Chicago)

A schedule of Fall & Winter Lecture Series—1955-1956 includes the following excellent program:

Tuesday, October 25, 1955—Lecture I: Introductory talk—Mr. Al W. Bernsohn, Managing Director, NARDA, Chicago, Illinois. Mr. Emerson J. Morris, Vice-President, National Bank of Commerce of Chicago: Speaker of the evening. An introduction to instalment financing for the small radio and television service shop. What to know about selling on credit. What to watch out for: Sound and experienced knowledge from an expert in that field.

Tuesday, November 29, 1955—Lecture II: Mr. Richard Harasek, Radio Division, Motorola, Inc., Chicago. Printed circuits: How they are produced and pointers in the servicing and repair of such circuits in your shop.

Wednesday, December 14, 1955—Lecture III: Mr. Eugene Reichstetter, Manager, Dun & Bradstreet, Chicago. An introduction to credit and credit ratings: what they are and they are obtained. What a rating means to a business man. Credit and collections for the small shop man.

Tuesday, January 17, 1956—Lecture IV: Mr. L. J. Couch, Sales Service Engineer, Sylvania Electric Products, Inc., New York. The transistor story—

Howard Wolfson

ANSWER MAN

[*from page* 27]

the *if* strip will pass signals but for some reason these circuits are cut off with a very large negative bias preventing the signals from getting through. The *agc* line develops –65 volts which blocks the whole system.

Another point concerning this difficulty involves the horizontal circuit. When I remove the horizontal oscillator 12AU7 tube the raster and high voltage are killed but the sound comes through.

I have checked such tubes as the 6AU6 keyed *agc* tube and others. The normal keying pulse is being applied to the keyed *agc* tube plate but the horizontal sync pulse is not present at the control grid.

Can you shed any light on this problem?

H. W.
Pittsburgh, Pa.

It is quite evident, as you pointed out, that the *rf* circuit and *if* strip is being biased beyond cutoff by the heavy negative voltage applied to these circuits. Naturally, this bias is developed due to conduction of the 6AU6 keyed *agc* tube with the application of the positive going horizontal deflection spike. When this spike is removed by disabling the horizontal deflection sys-

tem in some manner such as removing the horizontal oscillator tube the high negative bias is no longer produced. Thus, the *rf* and *if* circuits open up and sound is heard as you experienced.

An examination of Fig. 3 shows that the tube is being run with a positive voltage at its grid, pin #1. This voltage is quite important and critical. If it should be different than what the circuit is designed to employ more or less negative *age* voltage will be produced.

Another difficulty in troubleshooting this condition is the fact that under the condition of no signals passing through the *rf* and *if* circuits no horizontal sync pulse is available to be applied to the control grid of the keyed *age* tube.

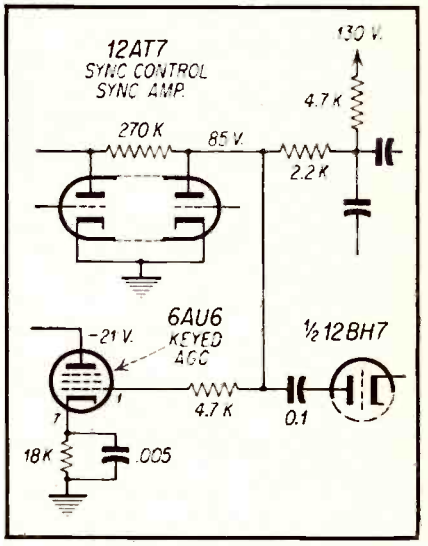

Fig. 3 — Partial schematic of Westinghouse V2313 chassis.

The important voltage at the 6AU6 keyed tube is the control grid bias. If this voltage should for some reason go higher more conduction would occur and a larger negative voltage would be generated in the plate circuit.

This is evidently the case here. The positive voltage at grid #1 is too large. This can be the result of several different causes such as shorted resistors (the 4.7K or 2.2K in Fig. 4). However, these resistors are not likely to short and most probably would reveal themselves through the physical evidence of discoloration, if they had done so. The most probable conclusion is that the sync amplifier side of the 12AT7 tube is not conducting. This would raise the voltage at its plate from the normal 85 volts to just about full B plus of 130 volts. This same voltage would be coupled to the grid #1 of the 6AU6 keyed *age* tube resulting in too much conduction and the heavy biasing voltage. It might be possible that the filament is open in this tube on the sync amplifier side.

TESTING FLYBACKS

[from page 13]

lower in inductance than any of the others and unless their inductance is increased generally do not test correctly. The inductance can be raised by slipping into the air core a broken half section of a core from a regular deflection transformer that has become defective. This will increase the inductance sufficiently to permit testing as indicated in *Fig. 6*.

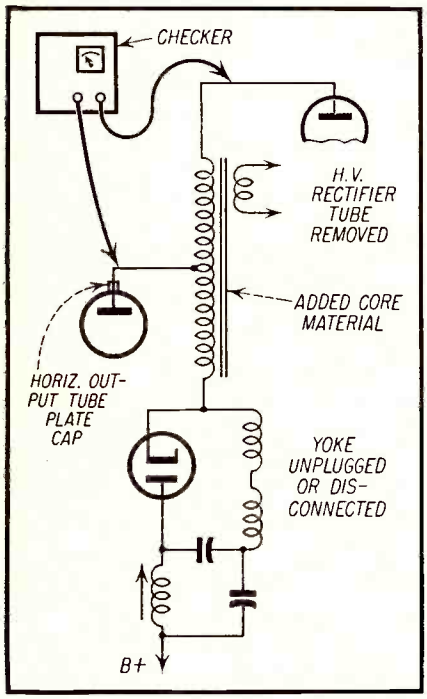

Fig. 6 — Flyback checker connections to "air-core" transformer.

This small change is not necessary with some models of flyback checkers as they are provided with a special calibration point which takes the lower inductance into consideration.

COLOR

[from page 30]

each of the signals in the color-bar display. These values correspond to column 2 in *Fig. 2*. Observe that the green camera tube output is 100% for white, yellow, cyan, and green, and zero for magenta, red and blue.

Proceeding to waveform (C) we observe the red camera tube output signal for the display. In this case the output is 100% for white, yellow, magenta and red, and zero for cyan, green and blue.

Finally in (D) which is the blue camera output signal, the output is 100% for white, cyan, magenta, and

blue, and zero for yellow, green and red.

The signal shown in (E) is the result of each of the Y signals of the color display. The amplitudes of Y for each of these signals correspond to the values of Y shown in the table of *Fig.* 2. A horizontal sync pulse, located in the sync pulse interval following the horizontal line, is also included in *Fig.* 4 (*E*). This is added to the Y signal at the transmitter.

In *Figs.* 4(*F*), (*G*), (*H*), (*I*) and (*J*) are shown the B-Y, R-Y, G-Y, I, and Q signals developed along a horizontal line. The amplitudes shown correspond to the values for these signals given in the table of *Fig.* 2.

In *Fig.* 4(*K*) we observe the effect of the 3.58 *mc* subcarrier signal modulated by the I and Q signals. This is the resultant chroma signal which consists of the resultant I and Q suppressed 3.58 *mc* subcarrier sidebands. As in the previous patterns the amplitudes shown correspond to the values for chroma obtained in *Fig.* 2. In this case, because the chroma signal modulates the 3.58 *mc* subcarrier, the curve is symmetrical around a zero axis asshown.

Also shown is a 3.58 *mc* color burst signal which is added to the chroma signal at the transmitter. This color burst is positioned so that it appears on the back porch of the sync pulse interval when the chroma and luminance signals are added together.

In (L) we see the composite video signal which is the result of adding the chroma and luminance signals. Observe that the 3.58 *mc* burst fits snugly on the back porch of the horizontal sync signal. Notice also that overmodulation in the white direction occurs for the yellow and cyan signals. However, transmitter overmodulation rarely occurs because colors which exist under ordinary scenic conditions are seldom saturated more than 50%. The only time overmodulation occurs is during the transmission of synthetically produced saturated color bars. The effect of the latter is a slight desaturation of yellow and cyan. As colors become less saturated (as will shortly be shown) the peaks of the composite signal are reduced.

In some color-bar generators modulation may be controlled electronically. Therefore, the observed waveform can be adjusted to provide any degree of modulation.

Transmitter Waveforms

A block diagram of a theoretical transmitter showing the signal waveforms that might be observed at various points in the transmitter is shown in *Fig.* 5. Beginning with the camera tube we notice that the scene scanned is the familiar color-bar display of *Fig.* 1. The red, green, and blue, signals at the output* of the camera tube are then fed into a matrix which develops the Y, I, and Q signals directly in accordance with relationships previously developed.**

The Y channel at the output of the matrix containing the luminance portion of the signal is fed into a delay network to compensate for the delay introduced by the narrow band filter in the Q section. Observe that the signal in the Y channel, before entering the delay network, corresponds to (E) in *Fig.* 4 *without the sync pulse* (see Note 1). Notice also that the horizontal and vertical sync pulses are inserted after the delay network so that the output waveform corresponds to (E) of *Fig.* 4.

The I signal at the output of the matrix is fed into a filter and delay network. Here the filter limits the bandpass to a prescribed 1.5 *mc* I channel bandwidth; and the delay network provides just enough delay to compensate for the delay present in the narrow band Q filter. The signal at the output of this filter and delay network has a waveform which corresponds to (I) in *Fig.* 4.

**This represents the gamma corrected signal.*
***See Nov. 1954 RTSD P. 13.*

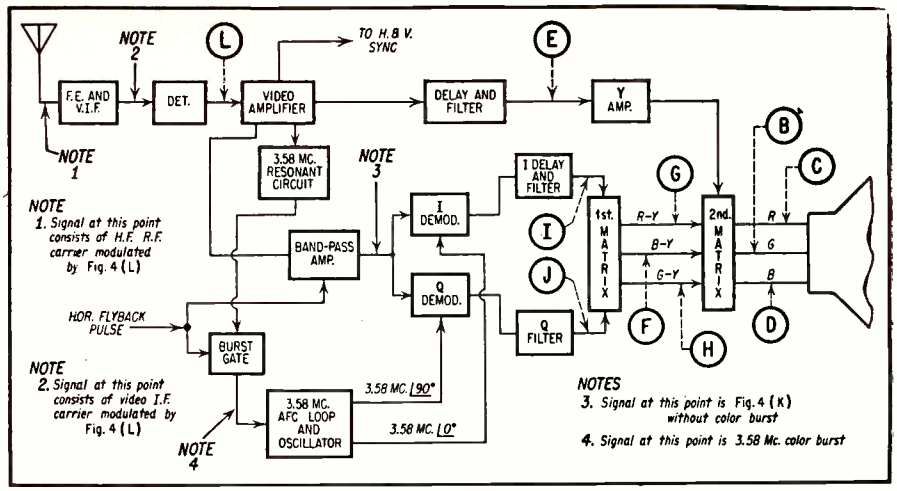

Fig. 6 — Partial block diagram of theoretical receiver showing waveforms of signal at different points in receiver. Availability of I/Q and/or color-difference check points, as well as signals in actual receivers, depends on type of demodulator-output circuit employed in receiver.

The Q signal at the output of the matrix is fed into a Q filter which limits the bandwidth of the Q signal to 0.5 *mc*. A certain amount of signal delay is present in this filter because of its narrow band characteristics. This delay is compensated for by including delay networks in the Y and I channels as described in the previous paragraphs. The output waveform of the Q channel filter corresponds to (J) in *Fig. 4*.

Notice that no R-Y, B-Y, or G-Y signals are present in the block diagram of *Fig. 4*. It will be recalled that these signals are recovered in the receiver by suitable demodulation and matrixing systems.

Following a filter and delay network the I signal is fed into a balanced modulator where it combines with the in-phase (I) component of the locally generated 3.58 *mc* subcarrier signal. Because of the balanced circuit employed, the output of this block contains only the sidebands of the I modulated 3.58 *mc* carrier, the carrier itself being suppressed in the output. In a similar manner, and utilizing the quadrature component of the 3.58 *mc* subcarrier in conjunction with the Q signal, the output of the Q balanced demodulator contains only the sidebands of the Q modulated 3.58 *mc* carrier.

The outputs of both modulators are then combined into a resultant signal (see Note 2) which corresponds to (K) of *Fig. 4*, but *without the* 3.58 *mc color burst* being present in the signal. The latter is added in the following manner. A portion of the 3.58 *mc* local oscillator signal is fed into a Burst Keyer which permits 8 to 11 cycles of this subcarrier to pass through the Keyer for a time duration somewhat less than the back porch of the sync pulse. This timing is controlled by a Burst Flag Pulse signal provided by the horizontal and vertical sync pulses. The output of the Burst Keyer (see Note 3

—*Fig.* 5) is then combined with the signal from the balanced modulators to produce the signal corresponding to (K) of *Fig.* 4 which includes the color burst.

The chroma signal (K) and the luminance signal (B) of *Fig.* 4 are then combined in a mixer to produce the composite video signal shown in *Fig.* 4 (L). This is the signal that modulates the *rf* carrier of the transmitter as indicated in Note 4 of *Fig.* 5.

Receiver Waveforms

A block diagram of a theoretical receiver showing waveforms of signals at different points in a receiver is shown in *Fig.* 6. We have purposely chosen an I/Q receiver with two matrix units so that I, Q, R-Y, B-Y and G-Y waveforms may be observed. Commercial I/Q receivers generally do not have test points for measuring the R-Y signal; nor do R-Y/B-Y receivers generally provide test points for measuring I/Q signals.

Tracing the signal from its source at the antenna we find that the signal at the antenna corresponds to the output signal of the transmitter. (See Note 1.) If we disregard the FM sound signal we find that the output of the block marked F.E. (Front End) and V.I.F. (Video I.F.) (See Note 2) contains a signal which corresponds to the *if* carrier modulated by the composite video signal *Fig.* 4 (L). *Fig.* 4 (L) itself may be observed at the output of the detector.

Following *if* detection the composite video signal enters the video amplifier where the signal is fed into four separate branches: the Y channel, the horizontal and vertical sync channel, the chroma channel, and the color sync channel.

Note that the Y channel contains a delay network and a filter. The delay network provides the required delay to the Y signal to compensate for the delay caused by a narrow band filter in the Q circuit. The Y filter has a "roll-off" characteristic that begins at 3.2 *mc* and gradually attenuates higher frequency signals beyond that which include the 3.58 *mc* burst and subcarrier color signals. Thus, the waveform of the signal appearing at the output of the Y section marked "Delay and Filter" corresponds to (E) of *Fig.* 4.

The chroma signal is taken off a 3.58 *mc* resonant circuit located in the output of the video amplifier which feeds the burst and subcarrier signal to a chroma bandpass amplifier and 3.58 *mc* burst gate. This resonant circuit is centered around 3.58 *mc* and substantially attenuates the lower frequency video signals which in this case include low frequency Y signals together with

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the horizontal sync pulses. Thus the waveform present at the output of the 3.58 *mc* resonant circuit corresponds to *Fig. 4K*.

The branch of this signal which enters the bandpass amplifier undergoes attenuation of its signal frequencies above 4 *mc* and below 2 *mc* thus insuring further removal of Y video frequencies below 2 *mc*. The effect of the Y video frequencies above 2 *mc* in the chrominance channel is minimized by an effect called "frequency interlace" which is explained in a later section.

Examination of the waveform at the output of the Band Pass Amplifier will reveal that the color burst signal is eliminated at this point (see *Fig. 6*—Note 3). The presence of color burst in the chrominance channel would disrupt the *dc* restorer action of the receiver. Removal of the color burst may be accomplished in a number of ways, one of which is to cut off the Band Pass Amplifier during horizontal sync pulses by means of a keyed negative sync pulse taken off the horizontal output circuit and fed into the screen grid of the amplifier tube.

The signal at the output of the Band Pass Amplifier is then fed into both I and Q demodulators. The output of the Q demodulator is fed into a filter which limits the bandpass of the output signal to .5 *mc*. Notice that a 3.58 *mc* component of the signal is also present in the plate circuit of the Q demodulator due to the restoration of the subcarrier by the 3.58 *mc* signal from the local oscillator. This is a necessary step in the demodulation process in order to extract the original Q signal from the suppressed subcarrier sidebands. The output Q circuit filter, while permitting Q signals up to .5 *mc* to pass, attenuates the 3.58 *mc* subcarrier so that the output waveform corresponds to *Fig. 4*(J).

A similar process takes place in the output circuit of the I demodulator resulting in a waveform corresponding to *Fig. 4* (I) at the output of the I circuit filter which has a frequency cutoff at 1.5 *mc*. However, in addition, a certain amount of artificial delay is introduced in the I channel in order to compensate for the natural delay given the signal by the narrow band Q filter.

Following the 1st Matrix where the I and Q signals are combined in the correct proportions,* R-Y, B-Y, and G-Y signals may be obtained. Their corresponding waveforms are (G), (F), and (H) in *Fig. 4*.

When combined with the Y signal in the second Matrix, these color-difference signals result in the original color video signals G, R and B present in the

**See RTSD Nov. 1954, P. 15.*

output of the camera tube of the transmitter. These color video signals, (B), (G), and (D) in *Fig. 4*, then excite the individual color guns to reproduce the color display shown in *Fig. 4 (A)*.

As a final note in this section it might be recalled that a portion of the output signal from the 3.58 *mc* resonant circuit connected in the video amplifier is fed into a "Burst Gate." The latter is an amplifier keyed by a horizontal flyback pulse so that it conducts only during the time the color burst is present. As a result, only color burst information appears at the output of the Burst Gate (see *Fig. 6*—Note 4).

NEW CHASSES

[*from page 33*]

sound frequency and adjacent channel rejection. Full video amplification with minimum 4.5 M.C. and adjacent channel interference.

Tubes: 2—6BA6 I.F. Amplifier
1—6AU6 I.F. Amplifier
1—6AM8 I.F. Amplifier, Detector

Unit C—Push-pull Sound Amplifier

2 stages of 4.5 M.C. amplification with balanced ratio detector give maximum noise-free sound reception. Push-pull output is used for undistorted, wide range sound amplification.

Tubes: 2—6AU6 4.5 M.C. Amplifier
1—6AL5 Balanced Ratio Detector
1—12AX7 1st Audio & Phase Inverter
2—6AQ5 Push-Pull Output

Unit D—Video, A.G.C. and Sync Circuits

2 stages of pentode video amplification. Keyed Automatic Gain Control amplifier. Sync separator with automatic noise gate for widest range video response and maximum noise immunity in fringe areas.

Tubes: 1—6AU6 1st Video Amplifier
1—6AQ5 2nd Video Amplifier
1—6AU8 Keyed A.G.C. and Sync Amplifier
1—6BE6 Sync Separator and Noise Gate
1—6AL5 Horizontal Phase Detector

Unit E—Vertical Sweep Amplifier

A 2 stage vertical sweep for power output using improved multivibrator oscillator circuit with pentode output stage. Time delayed for steady vertical picture and best interlace.

Tubes: 1—12AU7 Oscillator

1—6V6GT Power Output

Unit F—Horizontal Amplifier and Hi-voltage Supply

A 4 tube shielded unit comprised of an oscillator, damper, horizontal output and high voltage rectifier tubes supplying horizontal sweep and high voltage. Self-biased horizontal output tube protects components against overload in case of drive failure.

Tubes: 1—12AU7 Oscillator
1—6CU6 Output
1—6AX4 Damper
1—1B3 Hi-Voltage Rectifier

Unit G—Main Power Supply

A fully encased over-sized power transformer in conjunction with rectifier, filter choke and filter capacitors supply filament and plate voltages to all tubes.

Tubes: 1—5U4GA or GB Rectifier

Unit H—AM Radio Tuner

A selective, sensitive 3-gang radio using iron core antenna, RF and IF coils. Range 535 to 1,700 K.C. Built-in low impedance loop antenna.

Tubes: 1—6BA6 R.F. Amplifier
1—6BE6 Mixer
1—6AM8 I.F. Amplifier and Detector

CONDENSER CHECKER

[*from page 16*]

fed into the resistive circuit of *Fig. 6*, the average current would be zero and the meter needle would not deflect. Of course the pulse repetition frequency would have to be high enough to prevent the needle from following the positive and negative excursions of each cycle.

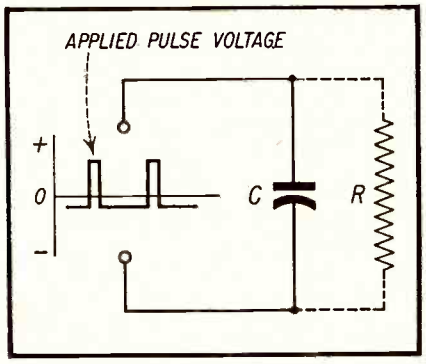

Fig. 7—If the condenser is good the action is same as in resistor.

Figure 7 shows similar circuit with a condenser taking the place of the resistor. If the condenser is good, the action is similar to that described for a resistor. If ordinary leakage resistance is present, however, the current flow will be greater in one direction that the other because of the third characteristic of leakage resistance previously mentioned. The needle will now swing off the zero mark since the average current is no longer zero. Thus, a leaky condenser causes the needle to deflect to one side or the other when the pulse voltage is applied. If the condenser is good, the needle remains stationary.

It was pointed out previously that leakage resistance is usually unstable. As a result of this instability a further check may be made on the condition of the condenser. After the pulse voltage test described above is completed, the function switch is turned back to the "Adjust Meter" position. We are now back to the position where only *dc* from the internal 7½ volt battery is being applied to the circuit. Unstable leakage resistance will cause the meter needle to come to rest at a position off the "Good" line, to which it had been adjusted in the first step described above.

The condenser may also be checked for breakdown in the following manner. With the test leads clipped across the condenser, and the function switch in the "Adjust Meter" position, the "Meter Adjust" control is rotated to center the

needle on "Good" as before. The function switch is then turned to the "Test" position and the "Pulse Voltage" control is then advanced to deliver a voltage 50% higher than the rated working voltage of the capacitor. If the needle remains stationary, the condenser is good. A kicking needle or an off scale deflection indicates that the condenser dielectric is breaking down. This is often accompanied by a crackling sound from within the condenser.

Occasionally, we run across an unstable resistor, that is, a resistor whose value changes during operation. Such a resistor may be responsible for noisy or intermittent operation. The model 383 may be used to detect such a resistor by employing the following two tests.

1. Static Test—(Steady *dc* applied to resistor.) With the test leads clipped across the resistor, and function switch set to "Adjust Meter" turn the "Meter Adjust" control to bring the needle to the good line. Tap the resistor gently with a pencil watching the meter at the same time. If the needle moves off the "Good" line, even momentarily, an unstable resistor is indicated.

2. Dynamic Test—(Pulse Voltage Applied.) After completing the static test, turn the function switch to the "Test" position and advance the "Pulse Voltage" control to 300 volts. Repeat the tapping process, watching the meter. Any movement of the meter away from the "Good" line again indicates an unstable resistor.

Precautions

1. Be sure to remove any detector or converter crystals, or transistors from any circuit across which the test leads are placed. The higher values of pulse

voltage will burn out such components.

2. After each use of the instrument get into the habit of turning the "Pulse Voltage" control completely counter clockwise. If the test clips are touched while a high voltage pulse is being delivered, an annoying shock will be received.

3. Electrolytic capacitors in any branch circuit across the test points will result in fake "Bad" readings. If the electrolytic is isolated by a resistance of 1000 ohms or more it may simply be shorted out during the test. Otherwise, one end of the electrolytic should be disconnected.

In conclusion it might be pointed out that this condenser checker is truly an important advance in the art of checking condensers without removing them from the circuit. In light of its already proven effectiveness in the field it does merit consideration as a standard piece of equipment in the shop.

WORKBENCH

[*from page* 25]

Because we still did not determine the cause of the defective resistors, the 6Y6 was checked on the tube checker. The 6Y6 however, proved to be functioning properly. Next, *C207* off of pin #3, was voltage leakage checked, but was also found to be satisfactory. *C214*, .01 *mf* off of pin #5 was now voltage leakage checked. This condenser however, checked a direct short. *C214*, was now replaced with a new .01 *μf* and the receiver operated properly in all respects.

The audio output voltage dropping tube is used frequently as a voltage supply because of its regulatory effect. If, for example, there is for some reason an increase in the load current (cathode current) this will cause a greater 6Y6 cathode voltage or bias. This bias will decrease the 6Y6 plate current flow. The decrease in plate current flow will now be just enough to offset the previous increase in cathode current. This keeps the cathode voltage which is our voltage source fairly constant.

Admiral 20Z1

Distorted sound was heard from the receiver when it was turned on. After about five more minutes the video and the sound disappeared. Now the diagram was consulted. This receiver uses the 6AS5 as an audio output voltage dropping tube. It acts as a voltage source for the sound, video, and sync circuits. See *Fig.* 3.

The 6AS5 at this point, was replaced, but had no effect. The plate voltage at pin #7 measured zero volts. *R212*, 820 ohms was next resistance

checked, and found to be open. *R212* was then replaced with a new 820 ohm resistor. The receiver was then turned on and immediately *R212* started to burn. The receiver was then turned off.

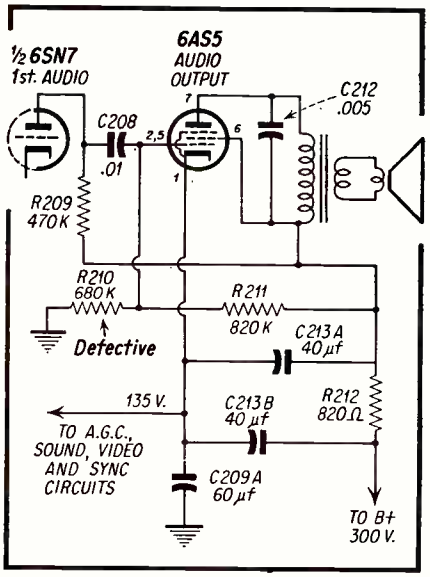

Fig. 3—Partial schematic of Westinghouse 20Z1 chassis.

The 6AS5 was again replaced as it had been replaced before a new *R212* had been installed. However. *R212* still burned when the receiver was turned on again. C208, .01 *μf* off the control grid, pin #2 was then voltage leakage checked but was found to be okay. Next, *R211* was resistance measured. It measured properly at 820 K. R210 was resistance checked and was found to measure 2.5 megohms instead of 680 K.

As a positive check the voltage was measured at the control grid of the 6AS5, pin #2. The meter read about 205 volts. Thus, according to the diagram, the control grid voltage was about 100 volts positive with respect to cathode. Obviously this caused *R212* to burn. *R210* and *R212* were now replaced with new resistors. The receiver then functioned properly.

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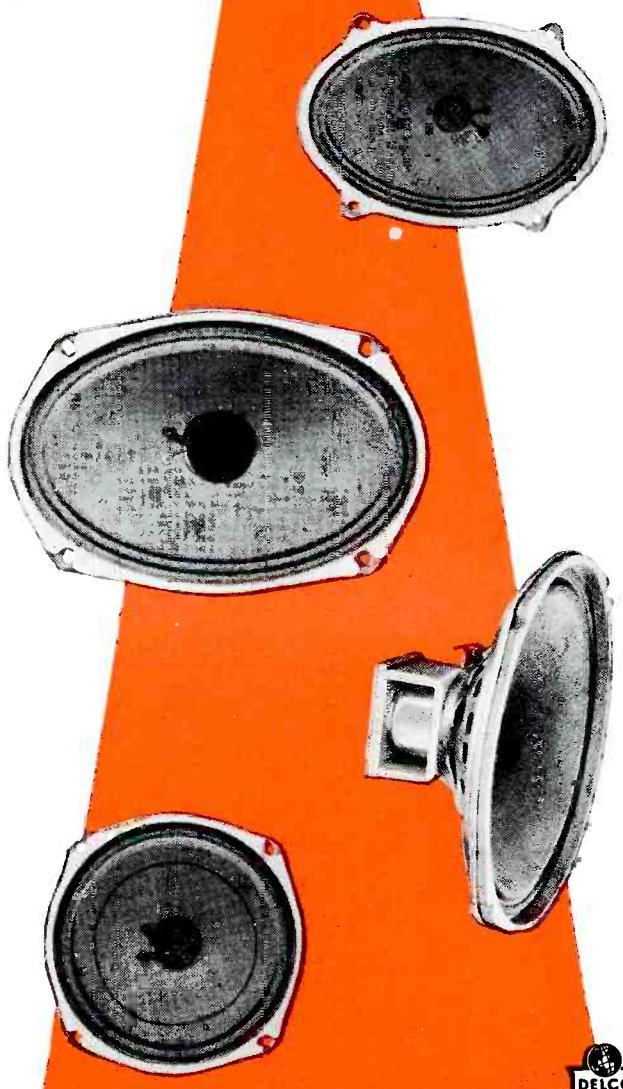
SPEAKERS



for Home and Auto Radios, Phonographs and Television

Product of combined Delco Radio and General Motors engineering skills, manufactured in plants devoted exclusively to electronic parts, the Delco speaker line embraces 14 standard models for home and auto radios, phonographs, and television—plus the model 8007, a superior Hi-Fi dual-purpose speaker for replacement in AM, FM, TV and phonograph sets, and for use with custom-built high-fidelity audio systems. It's plain to see that here's the speaker line to fill your needs...products of uniformly fine design and construction, *all* of them competitively priced!

Standard Speaker Features: Designed and built to R.E.T.M.A. standards; cones uniform in response over operating frequency range; fully dustproofed with drawn brass magnet covers and felted cones; Alnico-V magnets; heavily plated metal parts.

Model 8007 Hi-Fi Speaker Features: Size 8″; 50 to 12,500 CPS frequency range; Alnico-V magnet; 10-watt power rating; 4.1 input impedance; $1\frac{3}{16}$″ voice coil.

DELCO RADIO

DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA

A GENERAL MOTORS PRODUCT — A UNITED MOTORS LINE

DISTRIBUTED BY ELECTRONICS DISTRIBUTORS EVERYWHERE

Order these quality products of a volume electronics manufacturer through your UMS Electronic Parts Distributor today.

HOW YOU CAN BUILD NEW BUSINESS AND BIGGER PROFITS WITH RCA

Silverama

SUPER-ALUMINIZED PICTURE TUBES!

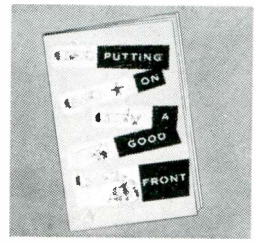
Take an active part in RCA's powerful sales promotion and advertising campaigns in your neighborhood now!

RCA's campaigns to introduce "SILVERAMA" are the most dynamic sales stimulators in picture tube history. Make your store "sales headquarters" for RCA "SILVERAMA" *in your own neighborhood.* Join successful hands with RCA and your RCA Tube Distributor. Use these *sell-powered* advertising and sales promotion materials to increase your business, prestige, and profits . . . now!

Window Display Kit, Streamers, and Hanger...dramatic, eye-catching traffic stoppers! These tell your neighbors *your store* is "Hq" for the great new "SILVERAMA" Picture Tube! See your RCA Distributor for full details on the "SILVERAMA" Window Display Contest!

SALES PROMOTION

Merchandising Booklet . . . the top secrets of "putting on a good front" window display are revealed to you. Shows you how to "stop them . . . so you can sell them!"



Direct Mail Piece . . . handy self-mailer or envelope stuffer. Ties your name and shop in with RCA "SILVERAMA" national advertising campaigns!

ADVERTISING

National Magazines . . . "Advertised in Life" . . . and in TV Guide! Important, consistent, big ads in these top magazines tell your customers about the wonders of RCA "SILVERAMA." Be ready for the demand. Contact your RCA distributor!

Local Newspapers . . . ad mats available to your distributor will feature names and addresses of service-dealers handling RCA "SILVERAMA". Be sure *your name* is on the list. Contact your RCA Tube Distributor!

Radio and TV . . . "Milton Berle" and "Martha Raye" coast-to-coast TV Shows, and network radio programs such as "Monitor", and "Fibber McGee and Molly" will bring the RCA "SILVERAMA" story right into your customers' homes . . . send them to your shop. Be ready. Contact your RCA Tube Distributor!

There's more, too! And your RCA TUBE DISTRIBUTOR has the complete story. Cash in on the new, dynamic RCA "SILVERAMA" campaign. SEE YOUR RCA TUBE DISTRIBUTOR *NOW!*

RCA®

RADIO CORPORATION of AMERICA

TUBE DIVISION HARRISON, N. J.