THE MOTOROLA SERVICE NEWS

Sept. - Oct., 1954

MOTOROLA, COLOR TV

IN THIS, AND SUCCEEDING ISSUES OF THE "MOTOROLA SERVICE NEWS" WE WILL FEATURE DISCUSSIONS ON THE MOTOROLA COLOR-TV RECEIVER, THE FIRST "BIG LOOK" 205 SQUARE INCH INSTRUMENT IN THE INDUSTRY.

COLOR-TELEVISION, MASTER DISTRIBUTION SYSTEM

"Master TV Antenna Systems and Distribution Amplifiers", have in some cases caused reception problems in Color-TV.

The problem is one of insufficient band pass with consequent restriction or complete removal of the color signal information. In cases where distribution amplifiers are involved in a master system, it is suggested that the following simple, but conclusive, check be made:

1) Use a color TV receiver that you have prechecked on an antenna you know to be good in receiving color-TV programs, or station color test signals. The performance of this receiver on a master system will then demonstrate the effectiveness of the system in question on color signals.

2) The use of test equipment in checking the response characteristics of master systems will be covered in detail in future issues of the "Motorola Service News".

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BANK USES MODERN MERCHANDISING TO PROMOTE CREDIT

A new wrinkle in bank promotion of consumer' credit facilities is demonstrated here by the enterprising Citizens and Southern National Bank of Atlanta, Georgia, in conjunction with the local Motorola distributor, Kenrow-Georgia Inc. The two firms have combined forces to bring product sales appeal where the money is -- the installment loan branch of the bank.

Here a bank customer can admire Motorola's newest product, a 19-inch screen color television model, on display in the lobby of the bank. Along with the sales message describing the set is another on the polite placard hanging above it. The placard reads, "Equipment shown here can be financed through our installment loan department."

Essential Equipment for Color TV Service

1) A vacuum tube voltohmeter and high voltage probe.

2) A standard signal generator.

3) A scope having a wide "pass band" (5 MC) and high vertical amplification.

4) A video sweep generator that covers 0-5 MC in linear fashion.

5) A dot generator, small dot size preferred.

6) A color bar generator.

7) A good quality mirror with adjustable floor stand.

8) Miscellaneous hand tools, tubes, parts, etc.

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Motorola, Color TV (TS-902)

In this issue and those to follow we will discuss the service information relative to the Motorola Color-TV Chassis #TS-902. This chassis consists of two units, one in a horizontal position designated as #TS-902A-03, and another one located in a vertical position designated as #BP-902A-01. These two comprise the 19 inch Motorola Color-TV receiver which uses the 19VP22 tri-color picture tube, having a usable picture area of 205 square inches.

CHASSIS DESCRIPTION

The receiver circuits are built around 29 circuit tubes, a 19VP22 19-inch tri-color picture tube (aluminized-glass envelope, electrostatic focusing, 62 degree deflection angle) plus three germanium diodes and three selenium rectifiers. The horizontal chassis contains all signal circuits except those devoted strictly to color, the scanning circuits, filament and "B" supply. The vertical chassis contains the color section.

(Continued on page 3)

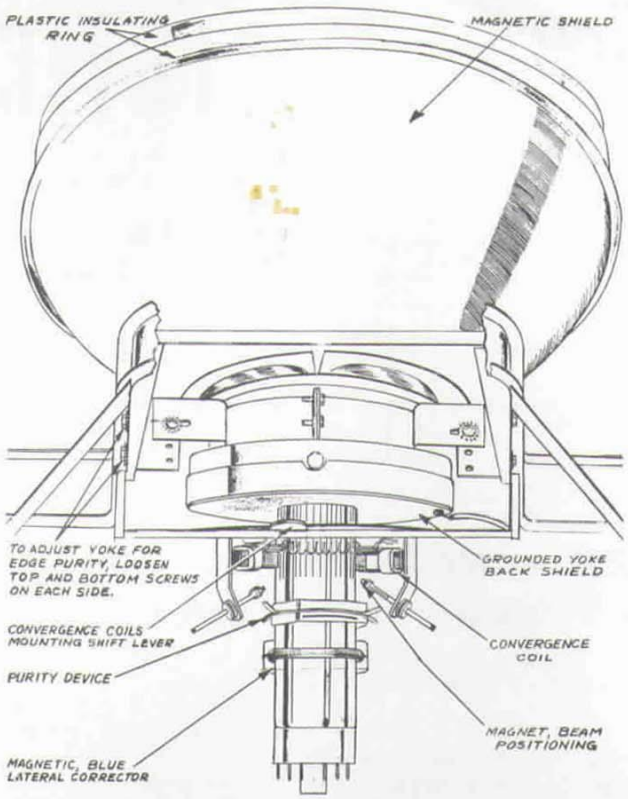
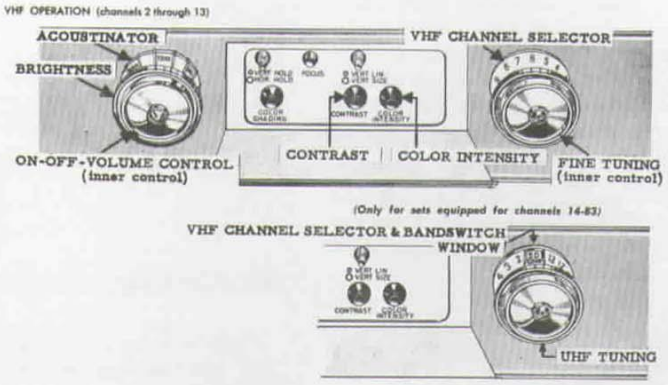
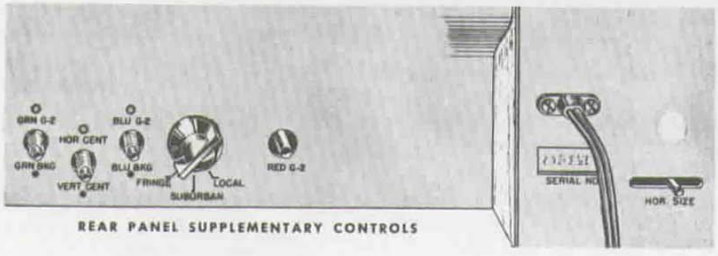


FIGURE 1. TOP VIEW OF TRICOLOR PICTURE TUBE



FRONT PANEL CONTROLS



REAR PANEL SUPPLEMENTARY CONTROLS

FIGURE 2. CONTROLS

ELECTRICAL SPECIFICATIONS

POWER RATING - Source: 117 volts, 60 cycle AC
360 to 375 watts

NUMBER OF TUBES - 29 tubes plus 3 selenium rectifiers, 3 germanium diodes and a tri-color picture tube.

INTERMEDIATE FREQUENCIES - Video: 45.75 Mc
Sound: 41.25 Mc and 4.5 Mc

FREQUENCY RANGE - Channels 2 through 13 (VHF tuner - WTT-67) Channels 14 through 83 (UHF tunner - TT-37)

ANTENNA INPUT IMPEDANCE - VHF & UHF: Balanced 300 ohm

FUSES - Filament: 1 inch #26 copper wire, located beneath chassis near filament transformer
Power: Special 7.5 ohm plug-in resistor, located near filament transformer on top rear of horizontal chassis

POWER SUPPLY VOLTAGES (117 volts AC line voltage) -

B triple plus	390 volts
B double plus	240 volts
B plus	125 volts

AUDIO OUTPUT - 1.5 watts undistorted.

INSTALLATION & OPERATION
LOCATING THE RECEIVER

It is advisable to determine the approximately permanent position of the receiver before any attempt is made to erect an antenna or to install lead-in wires. Once the location of the receiver is determined, it is desirable to retain this location, due to the effect of stray external magnetic fields on the purity adjustments of the color fields, etc. Balancing adjustments have been incorporated into the receiver to compensate for such natural conditions; however, these controls may require re-adjustment for each change in receiver location. Such receiver movements should be avoided.

The selection of the permanent location of the receiver should be based upon the best picture visibility from the greatest number of room positions; so that all persons can view the picture comfortably. Locating the receiver near windows and corners should be avoided. The location should be chosen so that the cabinet will be subjected to a minimum amount of heat and moisture; otherwise the cabinet finish may suffer damage. Allow sufficient space behind the cabinet for proper ventilation of the chassis.

ROOM LIGHTING

It is desirable to have some light in the room when viewing any type of television picture. A completely darkened room tends to create eye-strain. Light from a shaded lamp which does not fall directly on the face of the screen is usually satisfactory.

A condition of room lighting must be taken into consideration with color receivers, however, which was not important previously. That is the overall color tint of the lighting used. The room lighting color tint can accentuate or reduce certain color reproductions acutely. While the receiver may be adjusted to compensate for such lighting conditions, it is desirable to use a colorless bulb and lampshade during color program viewing.

It is also important that any receiver set-up adjustments made by the technician are performed while using the room lighting that will be available during program viewing. If different color lighting is used during set-up, it is quite possible to adjust for white screen conditions only to find that under the viewing lights, the screen may have a predominant blue, green, or red tinge.

ANTENNA REQUIREMENTS

Indoor antennas of the portable type are often satisfactory for color reception, provided the receiver is located in a strong signal area. However, an outdoor antenna will invariably give a better overall picture on all channels and is recommended whenever possible.

A color signal, as received from the transmitter, contains a number of additional signals which must reach the receiver for good color reproduction. Due to these extra requirements, many present antenna types and their lead-in wires are unsatisfactory. Color reception requires a broadband type of antenna, a narrow-band single channel antenna can completely remove the color signals. The same is true of incorrect lead-in wires and mismatched lines. Keep in mind that it is entirely possible for an existing antenna installation to furnish satisfactory reception on a black/white receiver, but fail completely on color broadcasts. In the case of antennas for UHF reception, the above information applies with the extra care required for more critical UHF antenna set-up.

When deciding on an antenna type, remember that it is entirely possible for stations to change channels in the VHF group, and that single-channel, high-band or low-band antennas may have to be replaced to receive the new channels.

INITIAL INSTALLATION INSTRUCTIONS

After the receiver has been placed in its permanent position as determined by the viewing requirements and lead-in facilities, it is necessary to remove the cabinet back cover and shift the lever connected to the dynamic convergence coils to such position that the coils are moved flush against the neck of the picture tube (the convergence coils are moved away from the picture tube neck during shipment only). This lever is at the extreme top of the rear CRT mounting bracket and may be seen in the top view drawing of the tri-color picture tube (Fig.1).

As stated previously, external magnetic fields of varying degrees and directions are encountered

for each new receiver location and it is necessary to balance the receiver circuitry for the initial installation location, as well as to correct any misadjustment caused in shipment. The first receiver checks to be made, therefore, are those for correct purity, convergence and focus. Since it is almost always necessary to adjust the purity and convergence systems in an initial installation, a complete set-up procedure follows.

NOTE: To facilitate adjustments to the picture tube components and other parts, the cabinet is provided with a removable hinged top section. This top section may be moved only after the cabinet back has been removed.

Depending on the cabinet style, two different top panel locking mechanisms will be encountered. In one type, a small wooden slider, at the center underside of the top panel, will move to the rear; thus unlocking the top panel at the front end of the cabinet. The other type is fastened to the wooden side channels by thumbscrews.

HIGH VOLTAGE WARNING

Operation of this receiver with the chassis accessible involves shock hazard; therefore, no work should be done on this receiver by anyone not familiar with these hazards.

Due to the circuit used, there is always a potential difference between the chassis and ground. AN ISOLATION TRANSFORMER SHOULD BE USED WHEN SERVICING THIS RECEIVER.

Do not operate the receiver with the high voltage compartment shield removed. Make sure the ground springs between the chassis and the picture tube shield and between the yoke assembly and the picture tube shield are making contact.

PICTURE TUBE HANDLING PRECAUTIONS

Extreme care must be used in handling the picture tube as rough handling may cause it to implode due to atmospheric pressure. DO NOT NICK OR SCRATCH GLASS, OR SUBJECT IT TO ANY UNDUE PRESSURE IN INSTALLATION OR REMOVAL. Do not remove the receiver chassis, install, remove, or handle the picture tube in any manner unless shatter proof goggles and heavy gloves are worn. DISCHARGE 2nd ANODE LEAD BEFORE HANDLING.

THE TRI-COLOR PICTURE TUBE SET-UP (TS-902)

One of the first problems in setting up the picture tube is to make the apparent deflection centers of the three beams the same as that dictated by the particular picture tube design. The term "deflection centers" refers to the point inside or near the deflection yoke at which the three beams begin bending for horizontal and vertical sweeping. The forward and rear positioning of the deflection yoke on the neck of the tube locates the correct deflection centers of the beams. When the deflection center of any of the beams is incorrect, the beam will scan phosphor dots of incorrect colors.

The purity magnet mounted on the neck of the tube provides an adjustment whereby the three beams can be made to pass through their centers of deflection when the central area of the screen is being scanned.

PURITY ADJUSTMENT

1. Inject a signal from a dot pattern generator or other appropriate source into the receiver.

2. Adjust the three beam positioning magnets and the blue lateral corrector magnet for convergence of the three beams at the center of the screen. (Fig. 1).

3. Remove all signal to the receiver or switch the channel selector to a vacant channel.

4. Cut off the blue and green guns by grounding their grids into the ground holes of the receptacle. (See vertical chassis, front view.) (Fig. 14).

5. Adjust the BRIGHTNESS control for high raster brightness.

6. Loosen four screws (two screws on each side of bracket) to allow backward-forward movement of yoke. If set has not been previously adjusted for purity, position yoke back as far as the mounting will allow. If set has been adjusted previously for purity, confine yoke adjustment to a minimum. Keep yoke concentric with neck of picture tube.

7. Locate the purity device, consisting of two magnetic rings mounted on the tube neck. The device is between the blue corrector magnet and the dynamic convergence coils. Position the tabs of one ring opposite the tabs of the other ring so that a minimum strength magnetic field is produced. If the correct tabs are opposite each other, rotating both rings of the device together should have no affect on the raster. If the position of the tabs is incorrect, rotate the rings to place the opposite tabs adjacent to each other.

8. Check the purity at the center of the screen. If it is not satisfactory:

   a. Separate the tabs by a small amount to produce a weak magnetic field.

   b. Rotate the purity device to obtain better red purity in the central area of the screen.

   c. Continue the process of adjusting the field strength and direction of the magnetic field until the purity in the central area of the screen has been made as large as possible.

   NOTE: Use as weak a magnetic field as possible. Avoid shadow due to beam cut-off by the tube neck.

9. Move the yoke forward and backward along the neck of the tube to obtain best edge purity.

10. Re-adjust the purity device for best overall purity.

NOTE: If satisfactory edge purity cannot be obtained, it may indicate either a defective yoke or picture tube.

11. Check the purity of the green and blue fields, one at a time, by keeping the grid of the desired gun inserted into the grid receptacle and grounding the grid plugs of the other two guns. Avoid any shadows due to neck cut-off of the beams.

12. It may be necessary to compromise the setting of the purity device which resulted in best red purity in an effort to obtain best overall purity of all colors. In any compromise setting, however, the red field should always be favored strongly. Re-insert all grid plugs after purity adjustments have been completed.

DYNAMIC CONVERGENCE SYSTEM

Because the phosphor screen is not a true spherical surface, the distance the three beams travel from the center of deflection is greater at the outer areas of the phosphor screen than at the center. At the outer areas, therefore, the beams will cross-over, or converge, before they reach the shadow mask, thus causing over-convergence in these areas. The dynamic convergence coils apply electromagnetic correction to each of the three beams at a horizontal and vertical sweep rate to correct this condition. This correction causes the point of convergence to change according to the sweep rate and beam position so that it always follows the curvature of the shadow mask.

PROCEDURE

1. Turn all dynamic amplitude controls to minimum (fully counterclockwise). (Fig. 14).

2. Turn vertical tilt controls to minimum (mid-position). (Fig. 14).

3. Position shift lever so that convergence coil pole pieces are seated on the neck of the picture tube. (Fig. 1).

4. Use the signal from a dot pattern generator or other suitable source. Adjust the brightness of each beam so that each color dot can be easily observed. (Use the background and G-2 controls.) CAUTION: Maintain picture tube brightness and modulation level of signal source within limits of good focus.

5. Adjust the three beam positioning magnets and the blue lateral magnet for best convergence at center of screen.

6. Using the red field, adjust yoke and purity device for optimum purity. (Refer to purity adjustment instructions.) NOTE: If purity has been adjusted previously, yoke adjustment is unnecessary.

7. Repeat step 5 for best convergence at center of screen.

VERTICAL DYNAMIC ADJUSTMENT

1. Choose a vertical column of dots near the center of the screen. Notice that the dots, while converged at the screen center, become progressively over-converged away from the screen center toward the top and bottom of the screen.

2. Observe the position of the blue dot in each dot trio along this vertical column of dots. Adjust the red and green vertical tilt controls so that the red and green dots are converged and spaced symmetrically from the blue dot in each group (trio). This symmetrical over-convergence should be made to increase uniformly from screen center to top and screen center to bottom.

3. Adjust the blue vertical tilt control so that blue dots in each trio along a center vertical line have the same relative position with respect to the red and green dots.

4. Adjust the beam positioning magnets for center convergence, if necessary.

5. Adjust the green vertical amplitude control to position the green dots so that they are equally spaced from the blue dots from top to bottom of the screen.

6. Adjust the green beam positioning magnet to reconverge the green dot with the blue dot at the center of the screen.

7. Repeat step 5 for the red dots.

8. Adjust the red beam positioning magnet to converge the red dot with the blue and green dots at the center of the screen.

9. Adjust the blue vertical amplitude control using the same procedure as used for the red and green amplitude controls.

10. Adjust the blue beam magnet for convergence of the vertical row of dots.

HORIZONTAL DYNAMIC ADJUSTMENT

1. a. Peak each of the horizontal dynamic phase coils one at a time for maximum as follows:

   b. Turn the blue horizontal dynamic amplitude control to maximum (fully clockwise). Set the red and green horizontal dynamic amplitude controls to minimum (fully counterclockwise). (Fig. 14).

   c. Tune the blue horizontal phase coil so that, over the center portion of the screen, the blue dot is displaced a maximum amount from the other two dots. This displacement, which makes the blue dots appear to follow a parabolic path across the screen, should be such that the blue dots are moved toward a horizontal reference line at edges of the screen.

   d. Turn the blue horizontal dynamic amplitude control to minimum (fully counterclockwise).

2. Repeat the foregoing procedure for the green gun only.

3. Repeat the foregoing procedure (steps 1a to 1d) for the red gun only.

4. Select a horizontal row of dots at the center of the screen.

5. Adjust the blue dynamic amplitude and phase together to obtain the same amount of misconvergence of the blue dot at the screen center and the edges of the screen. This will establish a horizontal

line across the screen which can be used as reference for positioning the red and green dots.

6. Adjust the blue beam positioning magnet (not the blue lateral corrector magnet) for convergence of the dots at the center of the screen.

7. Adjust the green horizontal dynamic amplitude and phase controls so as to obtain uniform and symmetrical displacement of the green dots away from the blue dots in all horizontal dot trios.

8. Adjust the green beam positioning magnet for center convergence.

9. Adjust the red horizontal dynamic amplitude and phase controls so as to obtain uniform and symmetrical displacement of the red dots away from the blue dots in all horizontal dot trios.

10. Adjust the red beam positioning magnet for center convergence.

11. Check purity and, if necessary, adjust the three beam positioning magnets and blue lateral magnet for center convergence.

12. Make any required touch-up adjustments necessary to give best possible overal convergence of all the dots. The beam positioning magnets and the dynamic controls are used as indicated by a study of the dot pattern. NOTE: It will not be necessary to reset purity when the touch-up adjustments are made since the adjustments should be small enough so as not to upset the purity.

BALANCING THE BACKGROUND AND G-2 CONTROLS

Compensation for differences in the three phosphor efficiencies, the cut-off voltages and the emission characteristics of the three guns is provided as follows: Three G-2 controls adjust the screen voltages for each gun; two BACKGROUND (grid 1) controls adjust the static bias on the blue and green guns. Static bias on the red gun is fixed by circuitry.

Procedure for balancing BACKGROUND and G-2 controls

1. Turn channel selector to a channel transmitting a black and white picture - preferably a test pattern. (Fig. 2).

2. Set BRIGHTNESS and CONTRAST controls for normal picture. Disregard color fringing effects due to misadjustment of the convergence controls.

3. Turn GREEN G-2, BLUE G-2 and RED G-2 controls to maximum clockwise position.

4. Adjust GREEN BACKGROUND, BLUE BACKGROUND and, if necessary, RED G-2 for highlight white on the brightest picture portions.

5. Turn BRIGHTNESS control counterclockwise so that screen becomes less bright (grey). If a color begins to tint the screen as brightness is reduced: Adjust the G-2 control corresponding to this color until the bright portions of the screen are white or grey.

6. Adjust the BRIGHTNESS control for normal brightness on the screen. Re-set the BACKGROUND controls so that brightest portions of picture appear white.

7. Repeat steps 2, 4, 5 and 6 until no color tinting occurs over the usable range of the BRIGHTNESS control. (Maximum brightness setting is not considered part of the usable range.)

OPERATING CONTROLS

Front Panel Operating Controls

The large twin front panel knobs control the basic receiver functions for monochrome reception. Only two additional controls are required on the front panel for color reception. These controls are the COLOR INTENSITY and COLOR SHADING controls, located under the front panel cover. (In some models the color intensity control is labeled "chroma" and the color shading control is labeled "fine phase".) (Fig. 2).

Front Panel Controls Used For Color Reception

COLOR INTENSITY CONTROL

The COLOR INTENSITY control governs the gain of the color system and thus the intensity of the reproduced colors. Turning the COLOR INTENSITY control counterclockwise will remove all color from the picture.

When receiving a black/white picture transmission, always keep the COLOR INTENSITY control turned to the counterclockwise stop. Viewing a black/white transmission with the COLOR INTENSITY control turned up may result in color fringes outlining picture subjects. This gives the appearance of colored "snow" in the picture.

COLOR SHADING CONTROL

The purpose of the COLOR SHADING control is to allow the picture colors to be tinted as desired. The most faithful color reproduction is usually obtained by adjusting the COLOR SHADING control for natural flesh tones. Any object having a familiar color (such as sky or water) may be used for this adjustment.

Front Panel Controls Used For Monochrome (black/white) Reception

1. ON-OFF-VOLUME CONTROL

Turn the receiver on by rotating the ON-OFF-VOLUME control to the right until a click is heard. Allow the receiver to warm up for a few minutes. (NOTE: The warm-up period required for a color television receiver to produce a good picture, either in color or in monochrome, is longer than that required for a black/white receiver.) After the receiver is turned on, allow several minutes for the circuitry to stabilize. Then, advance the ON-OFF-VOLUME control temporarily to mid-position and adjust later as required.

2. COLOR INTENSITY CONTROL (Under front panel cover)

Turn off by rotating counterclockwise until stop is reached.

3. CONTRAST CONTROL (Under front panel cover)

Turn CONTRAST control to about the middle of its range.

4. BRIGHTNESS CONTROL

Turn clockwise until picture screen is lighted. Readjust later in conjunction with CONTRAST as required.

5. VHF CHANNEL SELECTOR

Turn the VHF CHANNEL SELECTOR until the desired channel number appears on top. (VHF channels are numbered 2 through 13).

6. FINE TUNING

Adjust the FINE TUNING control for best picture detail. Readjust CONTRAST and BRIGHTNESS control for most pleasing picture.

7. ACOUSTINATOR

Adjust the ACOUSTINATOR tone control for the most pleasing tone.

Tuning UHF Stations

(Only for sets equipped to receive channels 14 to 83.)

Turn VHF CHANNEL SELECTOR control so that window located between numbers 2 and 13 is at top. This switches receiver to UHF and exposes the UHF dial scale.

With the VHF CHANNEL SELECTOR control set to the UHF position, UHF stations can be tuned with the FINE TUNING control. Tune first to desired channel, then tune for best picture detail. Readjust CONTRAST and BRIGHTNESS controls for most pleasing picture.

Receiving Color Programs

1. Adjust receiver for a satisfactory monochrome picture as outlined under "Front Panel Controls Used For Monochrome (Black/White) Reception".

2. COLOR INTENSITY CONTROL
(Under front panel cover)

Advance COLOR INTENSITY control to right (clockwise) until color begins to appear in picture. Adjust COLOR INTENSITY control until desired strength of color is obtained.

3. COLOR SHADING CONTROL
(Under front panel cover)

Adjust the COLOR SHADING control for most natural or pleasing flesh tones, or for natural appearance of some object having familiar coloring.

4. FINE TUNING

Readjust for best picture detail and most satisfactory color reproduction. If fine tuning control is not adjusted correctly, the color may be removed from the picture.

Supplementary Controls Located Under Front Panel Cover

The small controls located under the front panel cover are provided for customer use, as required, (These controls are practically independent of critical color and monochrome circuitry.) The more-frequently used supplementary controls are provided with knobs, while those used infrequently have knurled shaft ends. This provides instantaneous recognition of the primary and secondary supplementary controls. (Fig. 2).

It is advisable to adjust these "under-cover" controls while viewing a black/white transmission, preferably a test pattern. This will reduce the possibility of error when analyzing picture defects. During the adjustment of these controls, color effects can be eliminated by turning the COLOR INTENSITY control fully counterclockwise.

HORIZONTAL HOLD

This control locks the picture horizontally. If the picture has a tendency to move across the screen horizontally or appears as a series of sloping lines or bars, this control should be adjusted. This adjustment is very broad and should be set to the center of the range in which the picture remains locked-in, or stationary.

VERTICAL HOLD

When the picture exhibits intermittent or constant vertical movement; when the picture appears to be rolling up or down, the VERTICAL HOLD control should be adjusted. The correct adjustment is in the center of the lock-in range.

VERTICAL SIZE AND VERTICAL LINEARITY

When the size of the picture, from top to bottom, is too large or too small, adjust the VERTICAL SIZE control. Stretching or squeezing of the picture at the top or bottom can be eliminated by adjusting the VERTICAL LINEARITY control. It may be necessary to adjust the VERTICAL SIZE and VERTICAL LINEARITY controls simultaneously until a picture which is balanced in shape from top to bottom (linear) fills the screen. If the picture should roll during these adjustments, reset the VERTICAL HOLD control.

FOCUS

Adjust the FOCUS control for the clearest picture.

Supplementary Controls Located At Rear of Receiver

The supplementary controls located at the rear of the receiver fall into two classifications: those that can be adjusted easily without affecting the color

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Tim Alexander . . National Service Director
Russ Hansen . . . Editor

balancing and picture tube set-up controls and those that require careful adjustment in conjunction with one another. The more critical controls are described in the section "Balancing the Background and G-2 Controls". These controls should be adjusted by a trained technician. (These controls should be adjusted when viewing a black/white test pattern.)

HORIZONTAL CENTERING CONTROL

This control shifts the entire raster and the picture, from left to right, on the screen. Adjust this control to get a picture that is well-centered from left to right.

VERTICAL CENTERING CONTROL

This control shifts the entire raster and the picture, from top to bottom, on the screen. Adjust this control to get a picture that is well-centered from top to bottom.

HORIZONTAL DRIVE CONTROL
(On models which have a drive control)

This control affects the brightness and width of the picture. Adjust this control until white vertical bars appear on the screen; then back off control to the position where bars just disappear. (NOTE: Adjust HORIZONTAL DRIVE control before making horizontal size adjustment.)

HORIZONTAL SIZE CONTROL

This control varies the width of the picture. Move the horizontal size control to the left until dark edges can be seen on each side of the picture. Then move control to the right until picture is slightly larger than the picture mask.

AREA SELECTOR SWITCH

The quality and stability of the picture is controlled by the area selector switch. Set this switch to the position in which the picture is the clearest and most stable.

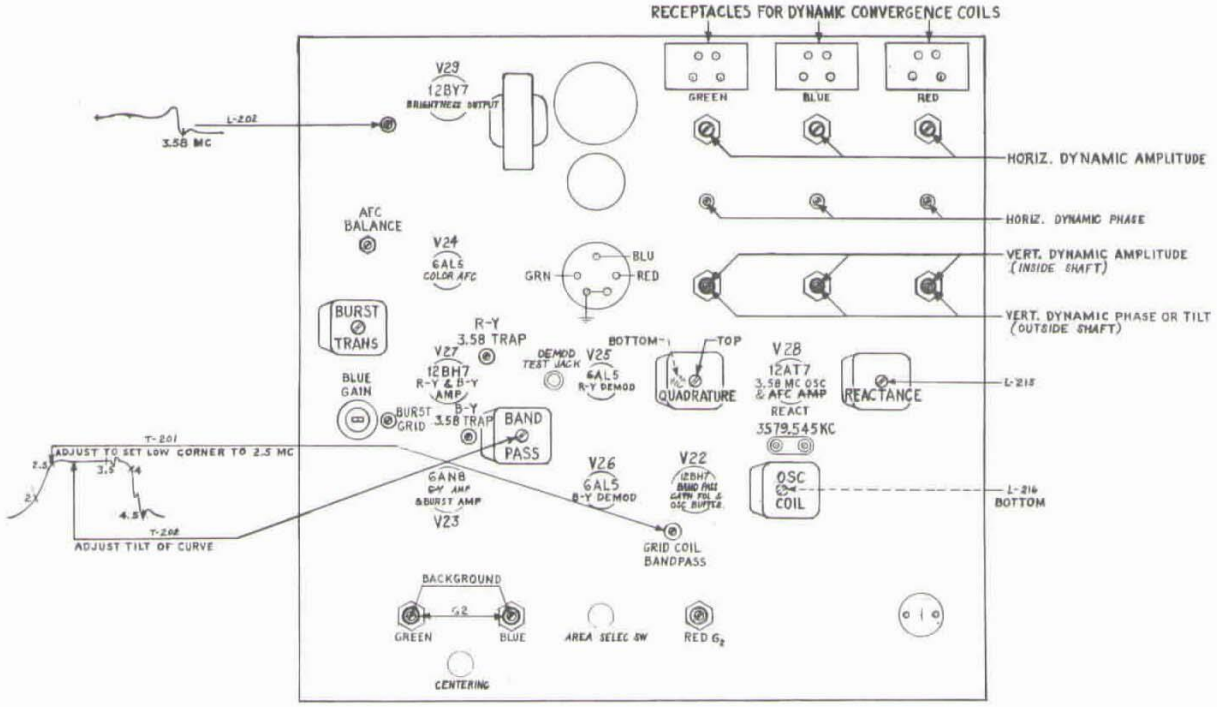

FIGURE 14.

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MOTOROLA, COLOR TV

IN THIS ISSUE WE ARE FEATURING "SERVICE NOTES" ON THE MOTOROLA, COLOR TV RECEIVER. THIS IS A CONTINUATION OF THE COLOR TV DISCUSSION STARTED IN OUR SEPTEMBER-OCTOBER 1954 ISSUE OF THE MOTOROLA SERVICE NEWS

SERVICE NOTES
Motorola, Color TV (TS-902)

CHANGING OF TUBES

(Refer to TS-902 horizontal chassis top view and BP-902 vertical chassis top view for tube locations.) (See Figs. 11 & 14).

The receiver should be turned off when changing tubes. Indiscriminate changing or interchanging of tubes should be avoided for the following reasons:

1. A change of IF or RF tube, or crystal detector, can cause loss of sensitivity or poor picture quality. Check alignment and sensitivity after making such changes.

2. A change of limiter or ratio detector tubes can cause distorted audio, buzz, or loss of audio sensitivity. Check alignment and sensitivity after changing these tubes.

3. Changing the horizontal oscillator tube can result in poor noise rejection or cause the horizontal hold control to be out of range. This may necessitate readjustment of the horizontal oscillator coil.

FUSE REPLACEMENT

B plus and initial surge fuse (special 7.5 ohm resistor R-73)

This fuse is a plug-in type located on the top rear of the horizontal chassis, behind the vertical chassis. It is possible to replace this fuse by removing the back cover. Replacement is facilitated, however, by removing the four bolts from the baseboard and shifting the receiver assembly toward the rear of the cabinet.

Filament fuse (1 inch of #26 copper wire)

This fuse is located beneath the chassis in the area below the filament transformer. The chassis must be removed from the cabinet in order to replace the filament fuse. Replace with a 1 inch length of #26 wire soldered between two lugs of the terminal strip; the connection is in series with the heavy green lead from the filament transformer.

HORIZONTAL OSCILLATOR ADJUSTMENT

The HORIZONTAL HOLD control should have a sync range of approximately 25 degrees rotation. If the control adjustment is overly critical:

1. Increase the BRIGHTNESS and reduce the HORIZONTAL SIZE until the edges of the horizontal blanking pulse (grey vertical bars) are visible on either side of the raster.

2. Shunt the HORIZONTAL OSCILLATOR coil L-43 to ground with a .25 mf 400V, capacitor, and ground the control grid of the horizontal oscillator (pin 4).

3. Adjust the HORIZONTAL HOLD control until the picture is in sync or slowly floating through sync.

4. Remove the capacitor shunting L-43 to ground and adjust the HORIZONTAL OSCILLATOR coil until the picture is again in sync or floating through sync.

5. Remove short from control grid (pin 4) of horizontal oscillator.

REMOVAL OF THE CHASSIS

The chassis and the picture tube are mounted independently to a baseboard which is bolted into the cabinet. The chassis may be removed from the cabinet independently of the picture tube by removing four bolts. When removing only the chassis: disconnect the ground lead between the high voltage cage and the picture tube: disconnect the high voltage lead; disconnect antenna lead-in and unplug speaker plug; unplug the deflection yoke plug from chassis; disconnect yoke leads extending into the high voltage case; on models using a field neutralizing coil, unplug the field neutralizing coil plug.

Both the picture tube and the chassis can be removed by removing the four bolts which hold the baseboard to the cabinet. This operation must include the removal of the antenna from the side of the cabinet, disconnecting the antenna lead-in, unplugging the speaker plug and removing the wire braid from the bezel.

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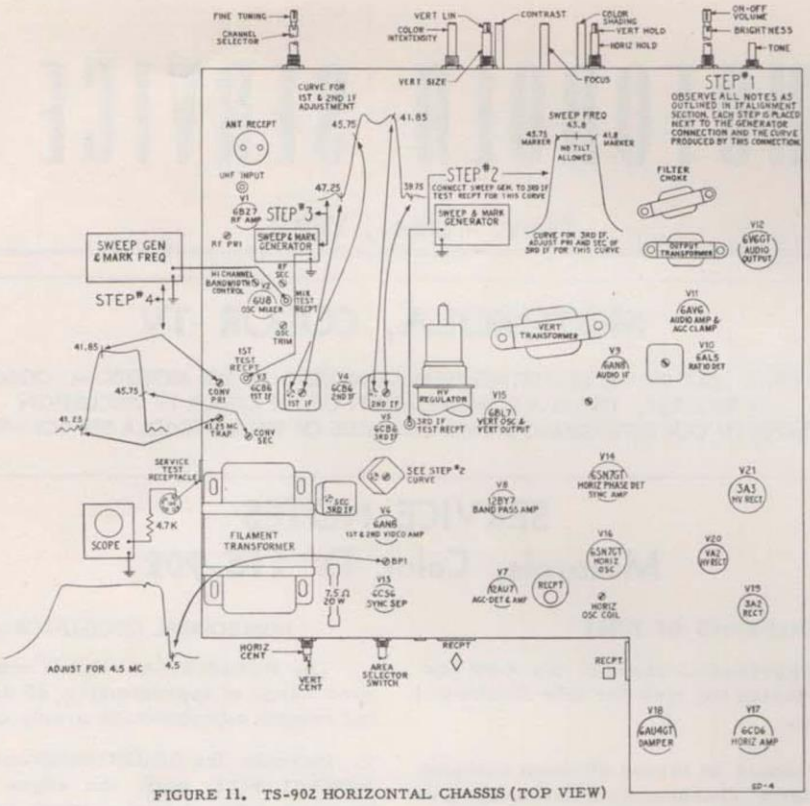


FIGURE 11. TS-902 HORIZONTAL CHASSIS (TOP VIEW)

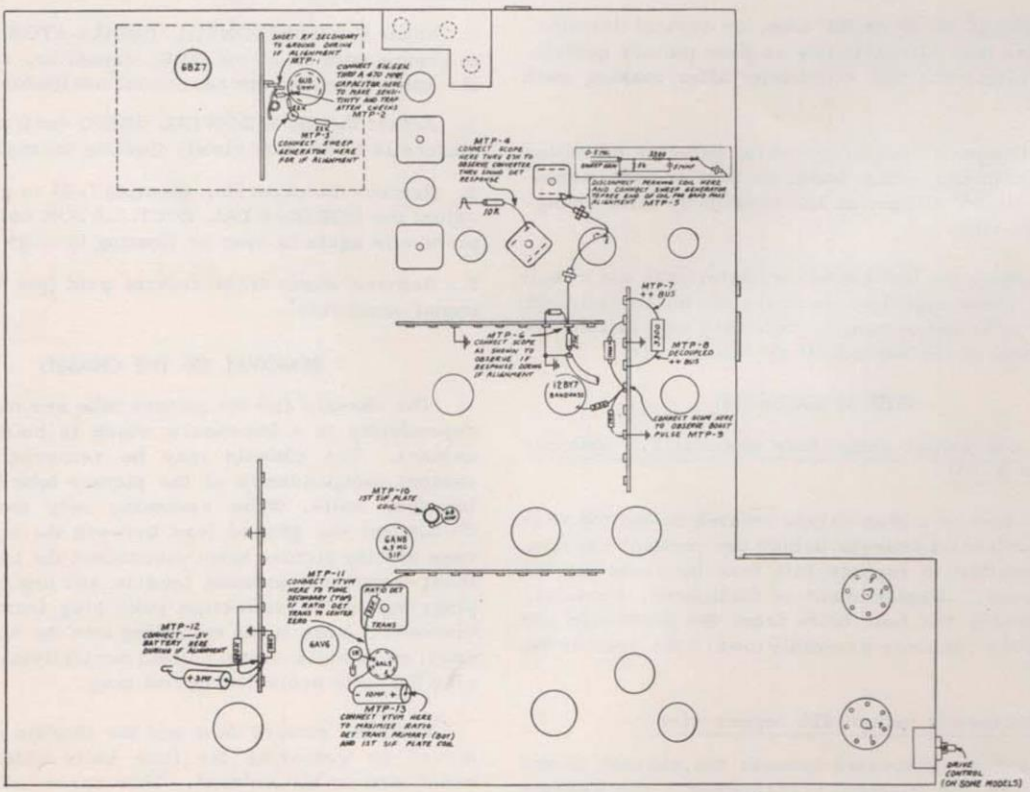


FIGURE 12. TS-902 HORIZONTAL CHASSIS (BOTTOM VIEW)

Note: Figure #1 and #14, shown in September-October issue.

TONE CONTROL LINKAGE SETTING

In the event it becomes necessary to replace the tone control linkage:

1. Turn the tone control maximum counterclockwise.

2. Place the linkage over the TONE and CONTRAST-VOLUME shafts in such a manner that the arms and link are above the shafts.

3. Move the linkage assembly counterclockwise as far as possible.

NOTE: After chassis has been replaced in the cabinet, place the TONE control knob over the CONTRAST - VOLUME shaft so that the lettering on the knob is toward the top.

REMOVAL AND REPLACEMENT OF COLOR PICTURE TUBE

Replacement of the tri-color picture tube necessitates a complete purity and convergence alignment.

To remove the color picture tube:

1. Disconnect the picture tube sockets. (Refer to Fig. 1).

2. Remove the blue lateral corrector magnet.

3. Remove the PM purity device.

4. Withdraw the dynamic convergence coils from the neck of the tube by shifting the coil lever toward a vertical position.

5. Remove the fibre picture tube mounting strap.

6. Disconnect the plastic high voltage interlock.

7. Loosen connecting rods between front and rear tube supports.

8. Remove front picture tube retaining brackets. Carefully remove the picture tube out the front of the assembly. Use extreme care while pulling the neck of the picture tube through the dynamic convergence coil assembly and the yoke.

9. Remove the magnetic shield from the flare of the picture tube.

10. Remove plastic insulating sleeve from around tube; remove second anode connector.

To install color picture tube:

1. Before installing tube in chassis mounts, clip second anode connector on metal flange of picture tube. Make this connection at a position approximately in line with pin #12 of the picture tube.

2. Place plastic insulating sleeve around picture tube front. Sleeve fold-over should be positioned in line with pin #4 of the picture tube.

3. Place magnetic shield on flare of the tube.

4. Mount picture tube to chassis with pin #4 toward top. Replace the front tube - retaining brackets. Position tube so that plastic sleeve over picture tube face edge is flush against retaining brackets.

5. Replace fibre picture tube strap; tighten connecting rods between front and rear tube supports; connect high voltage interlock.

6. Replace the PM purity device.

7. Replace the blue lateral corrector magnet so that it is directly below the blue gun and then replace tube socket.

8. Move the dynamic convergence coils in close proximity to the tube neck by shifting the dynamic convergence coil lever toward the tuner side of chassis.

9. Proceed with a complete purity and convergence alignment and background tracking set-up.

TUBULAR CAPACITOR IMPROVEMENTS

Consistent with Motorola's policy of maintaining the highest quality in the performance of all its electronic equipment, another significant step has been taken that will go a long way toward maintaining this quality.

Some years ago, Motorola decided to undertake factual studies to determine what might be done to improve the quality of tubular capacitors. This work was put in motion and from it was found these facts.

Heretofore, these components were made with a paper dielectric, and mounted in paper tubular cases containing a wax or oil impregnation. The Industry, in an attempt to improve upon the quality of these components replaced paper cases by various type molded bakelite cases, in a semi-molded and plastic-seal processing and even by glass and ceramic cases.

From a performance point of view, all of these variously cased capacitors were placed in two classifications, based primarily on maximum operating temperatures of 65 and 85 degrees centigrade.

Motorola's studies found that the maximum operating temperature check was not the prime factor in establishing the merit of these units. Rather, adequate insulation resistance under humidity. (Freedom from moisture absorption) and method used in testing longevity of the units, proved most important.

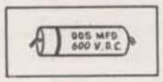
With this knowledge, Motorola undertook to establish a new class of permium performance capacitors which would meet new, higher, and more rigid requirements than previously thought possible.

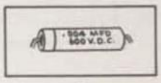
This work has been completed and from it has developed what is known at Motorola as "Class C" capacitors.

These new type capacitors are ceramic jacketed and all use highly durable end seal material. All features are specifically designed to meet the new rigid heat and humidity tests for an extended period of time with voltage applied.

(Continued on page 5)

THE A, B, C's OF DESIGN IMPROVEMENTS IN PAPER TUBULAR CAPACITORS





CHARACTERISTICS	-A- CONVENTIONAL PAPER CASE	-B- MOLDED PHENOLIC CASE	-C- CLASS "C" CERAMIC CASE
1 APPEARANCE	POOR	GOOD	GOOD
2 MARKING READABILITY	POOR	FAIR	EXCEL
3 END SEAL "POP-OUTS"	HIGH	NONE	NONE
4 IMPREGNATION DRIPPING	HIGH	SOME	SOME
5 INS. RES. CHANGE vs HUMIDITY	HIGH	SOME	NIL
6 SERVICE LIFE EXPECTANCY	POOR	GOOD	EXCEL
7 SHELF LIFE	POOR	GOOD	EXCEL
8 BULK FACTOR (SIZE VS CAP.)	GOOD	FAIR	GOOD
9 COST FACTOR (QUALITY VS PRICE)	POOR	FAIR	EXCEL

COMPARATIVE INS. RES. AFTER 15 DAYS AT 60°C, 90-95%, W. V. APPLIED

CLASS A	(.05-200V)	100 MEGS
CLASS B	"	1000 MEGS
CLASS C	"	10,000 MEGS

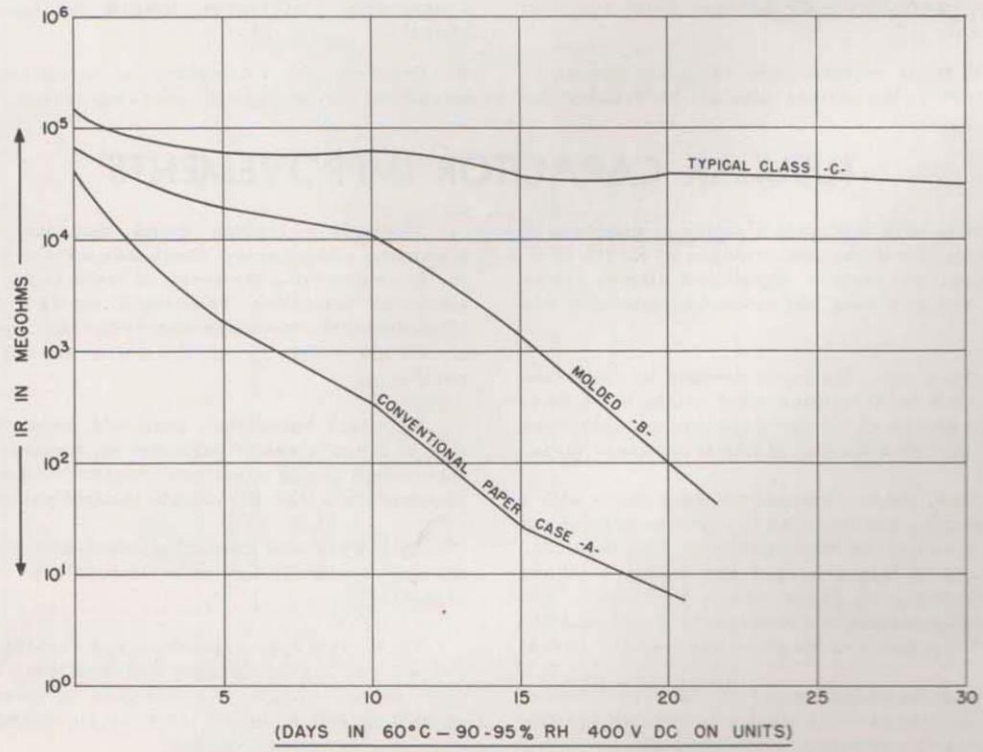
COMPARATIVE TESTLIFE (65°C, 90-95% RH — 400V DC)

CLASS A	(.05-400V)	4 DAYS
CLASS B	"	14 DAYS
CLASS C	"	30+ DAYS

COMPARATIVE LIFE EXPECTANCY IN ACTUAL SERVICE

CLASS A	ANY STD. VALUE	1 UNIT
CLASS B	" " "	3-1/2 UNITS
CLASS C	" " "	7-1/2 + UNITS

PROOF OF CLASS C SUPERIOR PERFORMANCE



The advantages of the new class over previously available types are numerous. Among them are:

1. Greater service life expectancy
2. Lower insulation resistance change versus - humidity
3. Excellent shelf life
4. Improved marking readability
5. Reduction of End-Seal Pop-outs

In addition, these improvements have not resulted in any increase of physical size versus capacity value or list price. This information is outlined in Figures 1 and 2.

Motorola has been using these capacitors in its Home and Auto Radio and Television Receivers for a considerable period of time. From date of original use to now, close watch has been kept of any field breakdowns of these new units. The results have been very gratifying. Breakdowns have been almost non-existent.

We are happy to pass this information on to the Service Industry and strongly recommend the use of these units as replacements in all electronic equipment. Stocks of representative values and working voltages may be obtained from your Motorola Distributor.

SERVICE HINTS

Set: TS-902 (Color-TV, Chassis)

Indication: Washed out picture. Very poor low frequency response. Horizontal sync effected but still holding. Vertical sync very poor and erratic.

Trouble Found: 300uh peaking coil L-38 in video amplifier V6A (1/2-6AN8) grid circuit, was open.

Remedy: Resoldered fine wire of peaking coil, L-38.

———— * ————

Set: TS-602 Chassis.

Indication: Picture was very weak with area selector switch in local position, normal in suburban and would overload in fringe position.

Trouble Found: R-82 (10K) resistor had changed in value to a 15K causing incorrect AGC voltage. This resistor feeds cathode of pulsed AGC tube 12AU7 (V-11B). Note: If normal AGC voltages were not known, the trouble could have been suspected as being in the tuner, IF, crystal, or AGC.

Remedy: Replaced R-82 with resistor of proper value.

———— * ————

Set: TS-410A Chassis.

Indication: Picture pulling, buzz in audio, sound in picture, vertical tends to roll, and horizontal tends to slip.

Trouble Found: #C-95, 200 and 5 mfd, 150V filter, found open. (Bridging another across located the trouble).

Remedy: Change #C-95 filter capacitor.

Note: Thanks to Mr. Walter Gromek of Charlotte, Michigan for this service hint.

———— * ————

Set: WTS-518A-00, TS-402, TS-502, TS-505, TS-507, and TS-524C-00 Chassis.

Indications: Vertical distortion at high levels of contrast.

Trouble Found: Vertical non-linearity caused by the presence of video information in the grid circuit of the vertical amplifier of some of the subject sets under high contrast settings.

Recommend Corrections: To eliminate this condition, where found, it is recommended that you try changing the coupling condenser from 5000 MMF to 1500 MMF. In the WTS-518A-00 this is #C-93. In the other above mentioned chassis the identification is #C-117.

———— * ————

Mr. A. Paolucci of Binghamton, New York reports two service hints, as follows:

Sets: TS-602 Chassis.

Indication: Buzz in sound and sync is unstable.

Trouble Found: Poor ground between case and mounting bracket of #C-50.

Remedy: Install ground wire between #C-50 ground terminal and chassis ground.

———— * ————

Set: TS-502 Chassis.

Indication: Distorted sound and picture size varies with audio.

Trouble Found: Shorted #C-56C reducing bias on 1st audio amplifier causing tube to cut-off and draw excessive current.

Remedy: Replace #C-56 capacitor.

Note: Thank you Mr. Paolucci.

———— * ————

AUTO RADIO - SEARCH TUNER

SUBJECT: MoPar Models 900 & 901 Search Tuner Service Notes.

The search tuners depend wholly on the fact that they should be operated in an area which contains listenable radio signals. Areas such as steel garages, steel bridges or any other such shielded locations will prevent the tuner from operating satisfactorily. The tuner may re-cycle continuously without stopping on station. Check type of signals available by tuning across the entire frequency range

manually. A check should be made to see that the antenna trimmer is correctly adjusted, that the antenna is at least half-way extended or that the sensitivity control is not set to a low sensitivity position.

The 3-position sensitivity control is located above the search selector bar:

Left - low sensitivity for extremely strong signal areas.

Center - medium sensitivity for average signal areas.

Right - high sensitivity for weak signal areas.

If the tuner continuously stops at the low frequency end of the dial on the return cycle (including pushbutton operation) even after the service manual trouble shooting section has been consulted, check the value of resistors R-13, R-30, R-31 and R-32 against the schematic diagram. If they differ from the schematic, revise accordingly. (Remember, this is not intermittent condition. It is normal for the tuner to stop occasionally on noise, interference or radiated oscillations.)

The Model 900 installed in Dodge cars will sometimes re-cycle, without stopping on station, because the search selector bar is wedged against the instrument panel. This can be adjusted without removing the radio from the car by bending the search selector bar down.

On MoPar Models 833 (Dodge) 834 (DeSoto), 836 (Plymouth), 900 (Dodge) and 901 (DeSoto), provisions are made for a rear seat speaker. The rear seat speaker is plugged into a speaker receptacle on the rear of the radio. If no rear seat speaker is used, the circuit is completed via a shorting bar. When a radio which has a rear seat speaker is serviced, be sure that a shorting bar is inserted into the speaker receptacle; without this bar, the radio will not have audio output.

When servicing or testing any search tuner radio, be sure to use a power supply of adequate current capacity, connected through heavy leads to the radio. A poor battery or power supply will cause the radio to operate improperly.

VITAL WARRANTY NEWS

We believe the editorial, "Warranty Cards are Birth Certificates", by Marvin Joyner appearing in the October 1954 issue of "Modern Times" is the most timely and honest discussion of the warranty problem and its importance, that we have had the pleasure of reading. May we suggest that you call this editorial to the attention of your dealers sales managers.

"Warranty Cards Are Birth Certificates"
by Marvin Joyner (Reproduced by permission).

A lot of people have learned in the past few years, that just being born is not enough -- you have to prove, specifically, that you are who you claim to be, by a document called a Birth Certificate.

To those of us who have had trouble in obtaining these little gems of proof that we exist, is a full understanding and appreciation of their value.

After receiving mine a few years ago, I spent another tiresome four weeks convincing authorities that a 200 pound, twenty-five year old man, with three children, shouldn't be called "Baby Joyner".

You wouldn't like it if someone went to the State Capitol -- stole the proof that you are you, and left you to argue the rest of your days that you actually are, who you think you 'wuz' Confusing?

No more confusing than why an intelligent dealer, attempting to render an intelligent service to his community, will deliberately cheat and rob HIS CUSTOMER OF HIS BIRTHRIGHT by not properly executing the warranty card that the Manufacturer so carefully places with the product.

You could slap your customer in the 'kisser' just as he signs the Contract and actually do him a better service than not filling in his warranty card.

You could hardly expect to keep a customer or customers with the slapping practice, and to cut him loose with no identification on the product he buys, is even more ridiculous.

It always amazed me during the war to see a line of several hundred naked men taking a physical. I hate to deflate the egotism that some men may have but there wasn't enough distinctive 'characteristics' in the lot, to tell one from another. Possibly wives, sweethearts or mothers could select her boy from the group, but they all looked alike to me.

If you have watched a production line 'whacking' out hundreds of identical products and models you can see that it is impossible to determine which one is going to Joe Stalcup in Wapnucka, Oklahoma.

There is only one thing that identifies Joe's product from the thousands of others, and that is the serial number on the product matching the same serial number on the 'birth certificate' warranty card reposing in a distributors' and factories' files.

Seldom a day passes in Oklahoma, that a customer isn't paying, for the second time, for service, or parts, or both.

Can you blame that consumer for being mad at the dealer, the manufacturer and in fact the world.

STOP STEALING FROM YOUR CUSTOMER! They don't like it. You are entrusted with the 'birthright' or 'liferight' of your customers' purchase. Please don't break that trust.

In other words, you'll save yourself a thousand heartaches and headaches by properly registering the merchandise you sell -- please believe me!

NEWS ITEMS

MOTOROLA HONORS 800 AT SERVICE-CLUB BANQUET

Eight hundred persons, representing a total of 12,500 years of service at Motorola Inc., were honored on October 30, 1954 at the Company's annual Service Club banquet at the Morrison Hotel, Chicago.

*

MOTOROLA DISTRIBUTOR ADVISORY PANEL

The fourth and final in the first years series of distributor advisory panels was concluded by Motorola, Inc. on November 1 and 2.

These advisory meetings between distributor principals and company executives are held away from the factory in a Chicago hotel so that the sessions can be held without distraction or interruption.

Mr. E. R. Taylor, Vice President and Assistant to the President states: "The purpose of these meetings is to exchange information and ideas".

The panel consists of eight distributor principals plus company executives. The panel membership is on a rotation basis which will eventually permit all distributors to participate.

In a recent letter to all distributors, Mr. Taylor said: "We (at the factory) continue to benefit greatly from these meetings, and urge you (distributors) to submit through any members of the panel any question which you believe will be of general interest".

*

NEW MOTOROLA PLANT FACILITIES

On December 2, 1954, Mr. P. V. Galvin, President of Motorola Inc. announced the purchase of 60,000 square feet of car radio tuner manufacturing facilities from Lee J. Drennan, Inc. in Arcade, New York.

Ever since Mr. Galvin, Motorola's founder-president originated the idea of mass-producing auto radios some 25 years ago, Motorola Inc. has held a dominant position in the industry, and currently is the world's largest independent manufacturer of car radios.

The newly acquired plant, located at 430 Main Street, Arcade, New York, will devote its entire production to supplying the company with car radio tuners.

*

ACHIEVE "BUILT-IN" TELEVISION WITH STOCK UNITS

Built-in television arrangements where the unit must be custom installed in a specially-built wall are expensive and require an inflexible furniture arrangement. Yet many of today's homemakers would like to fit television into some sort of handsome, space-saving wall unit.

This idea has been made possible and logical with the introduction of stock cabinet units that combine, mix, match, and stack into all sorts of "built-in" type arrangements. These stock units, made by several furniture manufacturers, come in all price ranges, furniture finishes, and even in unfinished versions.

Paul Pakan, interior decorator, worked with Geraldine Service, Motorola Inc. research stylist, in putting together this handsome arrangement with a brand new group of units called "Space-Span".

This series can be assembled along any wall, even in a tiny room, to incorporate storage, desk, TV, and shelf space. It is an integrated arrangement, too, and one that will add a note of high style to any room.

You can arrange a wall unit such as this for less than $150, plus the television receiver. If the television console does not line up perfectly the way this Motorola set does, you can insert furniture glides, available in hardware stores, under the cabinets to raise them.

RETMA - Educational Program

The Radio-Electronics-Television Manufacturers' Association has compiled and made available a complete, industry - approved course designed to upgrade the serviceman. In the following, we have reproduced in part Penny Martin's excellent summary of the RETMA's efforts in "Training Employees Through Technical Sessions". This article appeared in the October 1954 issue of the "Service Management" magazine.

AIMS OF THE RETMA COURSE

These are the aims of the advanced TV Technicians' Course . . .

To increase the technical skill and proficiency of practicing servicemen by instruction in advanced servicing techniques, using the most modern test equipment and working on the latest model receivers.

To train practicing servicemen in the handling of new developments such as current circuit practices, UHF, etc.

To teach servicemen the principles, practices and benefits gained from good customer relations.

To teach sound, approved business practices in the maintenance and conduct of their shop.

To inculcate the serviceman with the principles and ideals of the ethics of the industry and his profession.

WHY MORE AND BETTER TECHNICIANS ARE NEEDED

Although most men who were in their 'teens when radio began to grow can remember making their own simple crystal sets -- winding their own coils on oatmeal boxes -- they will remember that the home radio receiver, even in those early days, was a delicate and carefully adjusted scientific miracle --

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THE MOTOROLA SERVICE NEWS

Published by the Service Department of

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Chicago 51, Illinois

This publication is a free service by Motorola Inc. for their dealer servicemen. It is intended that via this medium of idea exchange, the serviceman will be better able to serve his customers.

Tim Alexander . . National Service Director
Russ Hansen . . . Editor

and servicing it was a job for a man who knew his business. It still is, because radio receivers, especially in these days of rising demand for high-fidelity reproduction are complex instruments.

But any good service technician looks on a radio receiver nowadays as child's play, compared with the complexity of television.

Today, a man working in a service shop is in an almost hopeless position in the face of this continuing development. Even if he can hope to learn slowly, by working with such new developments -- even if he can grasp the engineering progress involved with help from the busy men around him -- he cannot hope to keep up with this progress and his own work at the same time.

Meanwhile his chances of growth are small, and his chances of keeping his position in a rapidly moving field may themselves be equally small.

In short, the whole field of service is constantly upgrading its requirements -- its demands for knowledge, experience and skill among service technicians. Apart from the new skills, this demand means a corresponding increase in general educational requirements.

The industry alone cannot hope to operate enough schools to keep these technicians abreast of progress. The problem must be attacked on the community level, if there is to be any hope of improvement. It must be attacked by local dealers and servicemen -- and through local schools.

The industry as a whole stands ready to help community attacks on the problem. The industry is already doing something about it.

HOW TO DO IT IN YOUR COMMUNITY

The first step toward establishing such a radio-TV training and upgrading course for service technicians in your community is perhaps the most important step of all. The effective carrying out of this first step will assure the effective operation of the program throughout.

This first step is the setting up of an industry advisory committee, or board. This group is important because its functions are permanent, extending far beyond the initial work of establishing, equipping and staffing the school course.

The advisory board would: 1. Assist local schools in adopting the RETMA course of service technician training; 2. Assist with material procurement; 3. Keep the school acquainted, afterward, with current practices within the service field; 4. Act as program coordinator, to guide training so that it will be best fitted to the current needs of service technicians of the community.

This advisory group should be composed of local men who know the community situation, the school problems, and the service field. Represented on the group should be educators, dealers, distributors and service technicians themselves -- the best available.

This advisory group will have available all possible assistance from the RETMA Service Committee in the establishment and maintenance of the course in the local school.

First, RETMA is establishing and offering to such schools a special teacher-training course, especially designed to produce the kind of teachers needed. This is a long step toward the solution of one of the knottiest problems such schools face.

Servicemen successfully completing courses in these schools will be accredited by the industry as technically competent by industry standards. As new developments make new upgrading necessary, advanced instruction will be added, to make sure that service technicians have every opportunity to maintain their industry accreditation.

SUCCESS DEPENDS ON YOUR COMMUNITY EFFORT

The problem is as big as the nation, but for that very reason it is too big to be solved nationally. Every community's view of the service upgrading task will, necessarily, be a different view. Needs vary from city to city, from area to area. A solution that works in one community may need some revision for another.

That is why your specialized local needs must be met locally. No national organization can do the job for you. It must be tackled by local associations with the full backing of the industry. RETMA stands ready to help with advice in every way possible. In the end, your solution of the problem in many communities will mean a national solution.

The RETMA Service Committee feels that local organizations are ideally suited to sponsor this program for the benefit of the servicemen and the entire TV receiver industry in your area. If you are of the opinion that this program merits further consideration by your Association, further details can be had by writing: A. Coumont, Service Coordinator, Radio-Electronics-Television Manufacturers' Association 777 Fourteenth Street, N.W., Washington 5, D.C.