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RCA VICTOR

TELEVISION SERVICE CLINIC

THE 700 SERIES

Color Television Receivers

TECHNICAL FEATURES – SET-UP – SERVICING

PREPARED BY COMMERCIAL SERVICE
RCA SERVICE COMPANY, INC., CAMDEN 8, N. J.

A Service of Radio Corporation of America

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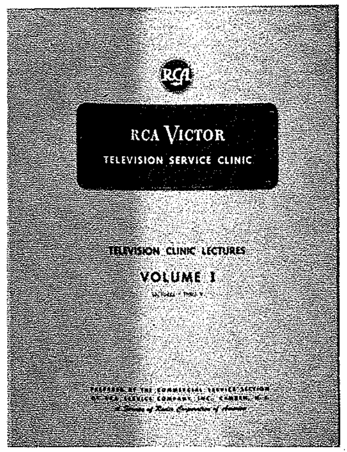
THE RCA VICTOR TELEVISION SERVICE CLINIC

The RCA Victor Television Service Clinic is a means by which all service technicians can keep abreast of the ever increasing field of television servicing.

The success of our Clinic Program is attributed to the meeting of a demand for comprehensive coverage of television service and installation practices. This demand has been met through the presentation of a series of Service Clinic Lectures, beginning with basic television principles, progressing through UHF, and continuing with the latest developments in color television.

The first nine lecture booklets have been compiled in Volume I—Television Service Clinic Lectures. The volume includes the following titles:



No. 1: *Basic Circuit Description of an RCA Victor Television Receiver.*

No. 2: *Servicing the RCA Victor Television Receiver—The R-F Unit, Picture I-F and Sound Channel.*

No. 3: *Servicing the RCA Victor Television Receiver—The Video and Sync Circuits.*

No. 4: *Servicing the RCA Victor Television Receiver—Deflection Circuits and Power Supplies.*

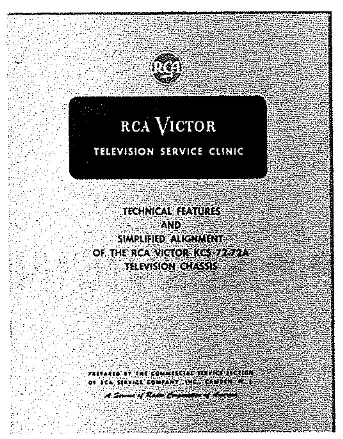
No. 5: *Servicing the RCA Victor Television Receiver—Troubles Other Than Component Failures.*

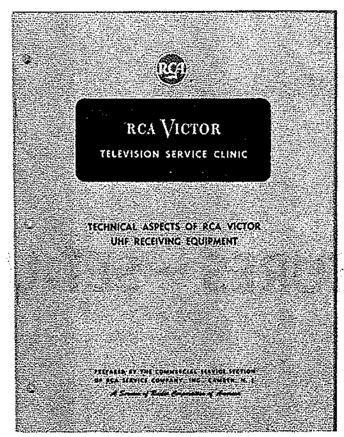
No. 6: *Practical Antenna and Transmission Line Considerations and RCA Victor Television Receiver Installation Techniques.*

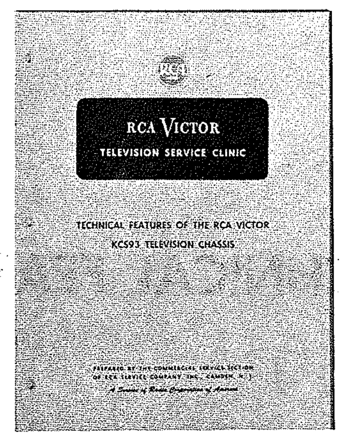
No. 7: *Technical Features of the New RCA Victor "Million Proof" Television Chassis.*

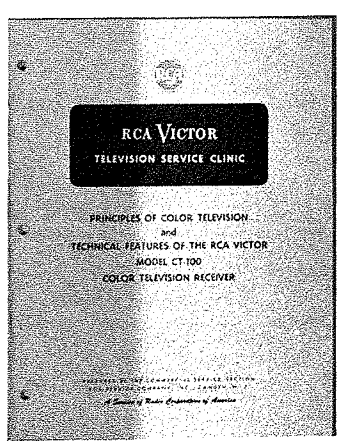
No. 8: *Technical Features of the RCA Victor KCS66-68 Intercarrier-Sound Television Chassis.*

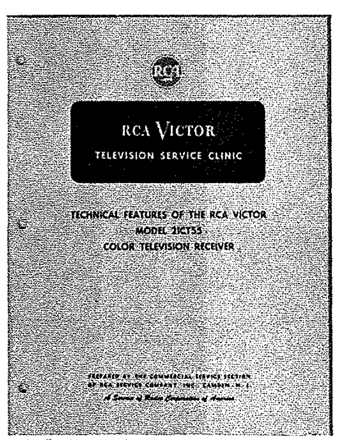
No. 9: *Introduction to UHF Television.*

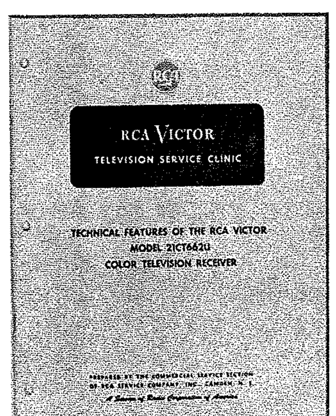


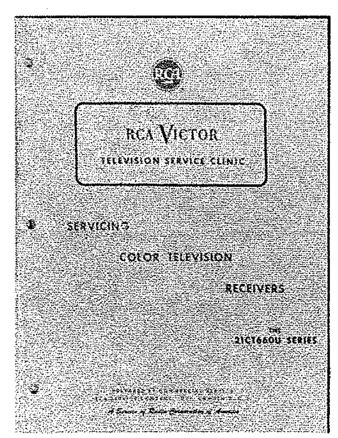












The Volume and the booklets shown above are available, at nominal cost, from the RCA Service Company, Inc., Commercial Service, Camden 8, N. J.

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FOREWORD

The purpose of this booklet is to provide the television service technician with practical information which will enable him to rapidly acquire an understanding of circuit operation, set-up and servicing techniques applicable to the RCA Victor 700 series color television receivers.

The booklet is divided into three sections.

The Technical Features section presents a circuit-by-circuit description of the two types of chassis in the 700 series receivers, with the assumption that the technician is familiar to some degree with basic color theory and the terms used in color television receivers.

One of the most important contributions the service technician can make, to provide enjoyable color reception for his customers, is to insure that the receiver is set-up properly and is operating properly at the time of initial installation, and remains so at the conclusion of any service call that may be required.

A section of this booklet is devoted entirely to a set-up procedure which is quick, accurate and easy to follow.

The concluding section, "Servicing the Receiver," contains information which will prove valuable because it is presented in a manner which stresses step-by-step practical methods to enable the service technician to quickly analyze, localize and easily correct any malfunction that may occur.

This booklet, and previous Television Service Clinic booklets have been made available by the RCA Victor Television Division and RCA Victor distributors solely to assist the technician in understanding color television receivers and, in gaining this understanding, becoming proficient in all aspects of servicing color television receivers.

THE TEXT OF THIS BOOKLET IS DESIGNED FOR PRESENTATION IN LECTURE FORM AT CLINIC MEETINGS SPONSORED BY THE RCA VICTOR TELEVISION DIVISION AND THEIR RCA VICTOR DISTRIBUTORS. THE SERVICE ORGANIZATIONS, AND OTHERS WHO ATTEND THESE LECTURES, HOWEVER, ARE NOT DESIGNATED AS AUTHORIZED TO RENDER TELEVISION SERVICE TO RCA VICTOR TELEVISION RECEIVERS BY MERE ATTENDANCE AT THE CLINIC MEETINGS.

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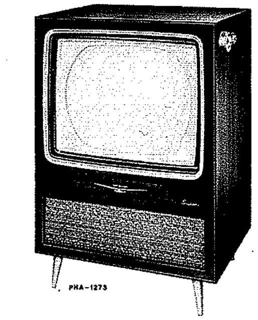

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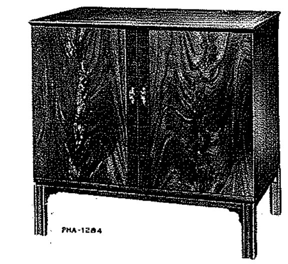

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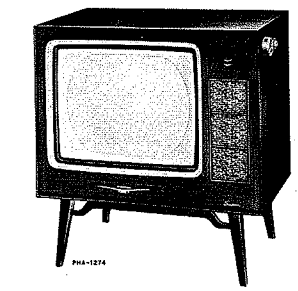

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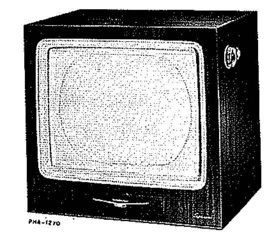

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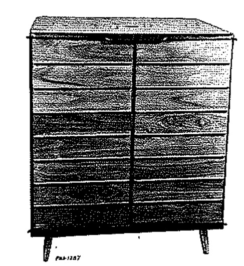

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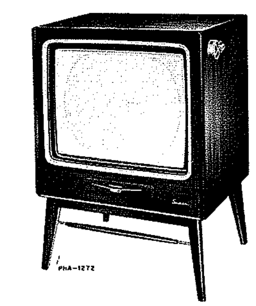

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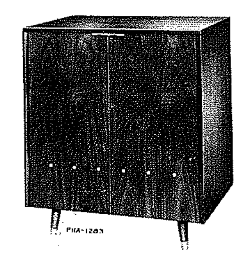

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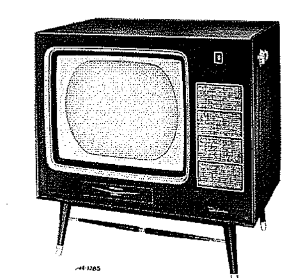

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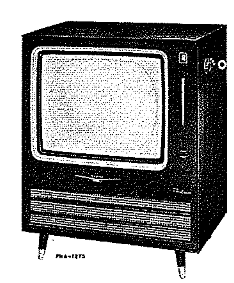
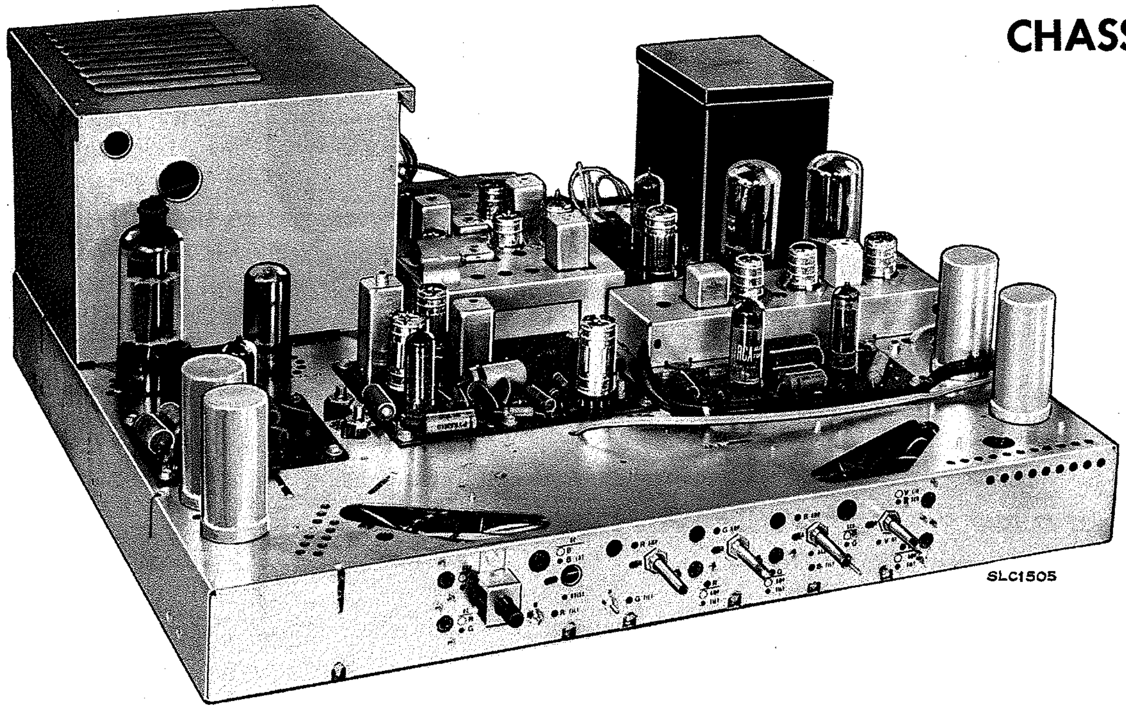


21CD7895 "Deluxe"

21CD7996 "Deluxe"

CTC5

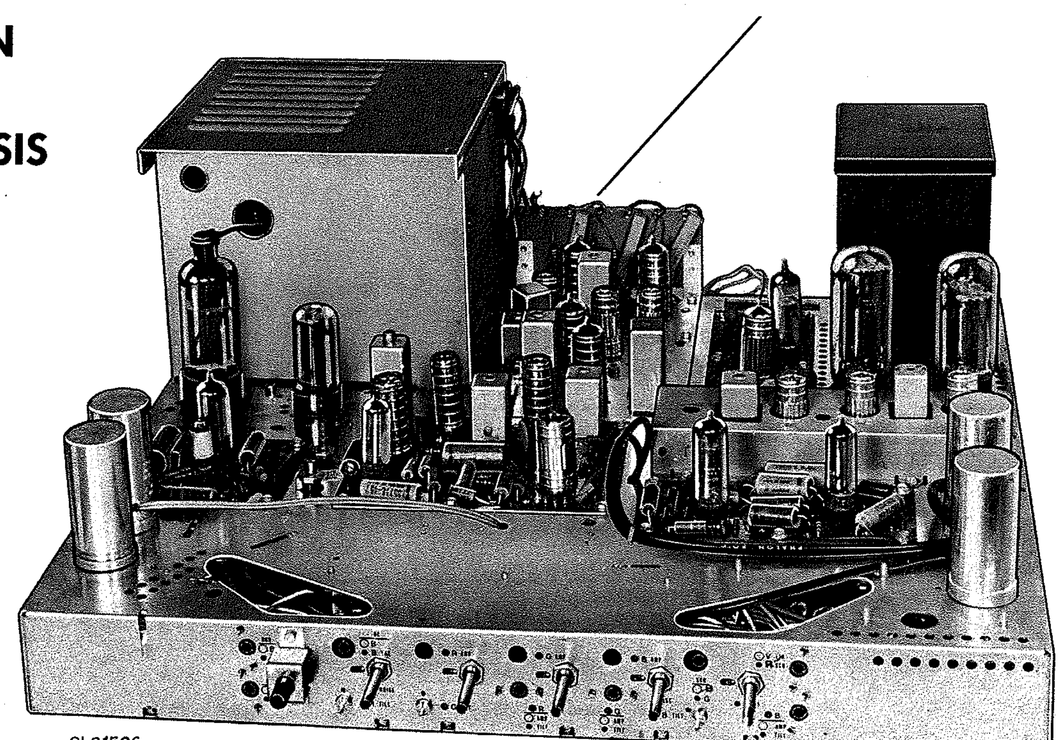
CHASSIS



(NOTE TERMINAL BOARD)

CTC5N

CHASSIS



TECHNICAL FEATURES OF THE RCA VICTOR 700 SERIES COLOR TELEVISION RECEIVERS

INTRODUCTION

The RCA Victor 700 Series color television receivers have been developed as a result of RCA Victor experience in providing the public with the first mass-produced color receivers, the first large-screen color receivers, and later, a selection of models, using the 21AXP22 tricolor kinescope. The RCA Victor 700 Series color television receivers consist of a complete line of instruments, made available to satisfy the demand for an even larger selection of high-quality, large screen color television instruments. These instruments include three separate groups, designated the "Special," "Super," and "Deluxe" models.

Two distinct types of chassis are used in the overall series. The "Special" and "Super" models employ chassis designated CTC5, CTC5A, CTC5B, CTC5C, CTC5D and CTC5E. For simplicity, throughout this booklet, these chassis are referred to as the CTC5 chassis.

The CTC5 chassis used in the "Special" and "Super" models utilizes, in the VHF-only versions, 26 tubes and 2 crystal-diode rectifiers.

The "Deluxe" models use the chassis types designated CTC5N, CTC5P, CTC5R, CTC5T, CTC5U, CTC5W, CTC5AA and CTC5BB. For simplicity, throughout this booklet, these chassis are referred to as the CTC5N.

The CTC5 chassis incorporates many new features and improvements over previous color television instruments. These include; simplified color circuits, separate second detectors for picture and sound channels, a noise-immune color-killer circuit and crystal-controlled Automatic Frequency Phase Control in the color synchronization circuits. Six printed-circuit boards contain approximately 80% of the circuitry.

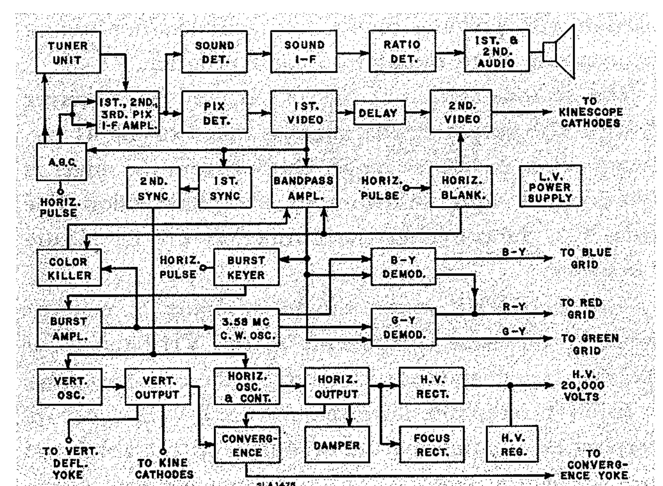


Fig. 1—Block Diagram, CTC5 Chassis.

The CTC5N chassis are similar, mechanically, to the CTC5 chassis but incorporate additional circuit refinements and features including; wide-band color demodulation, automatic chroma control, noise cancellation circuits, an additional stage of sound I-F amplification, audio tone control and the RCA Victor Panoramic Speaker System.

The CTC5N chassis includes, in the VHF-only versions, 29 tubes and 3 crystal-diode rectifiers.

Both the CTC5 and CTC5N chassis are equipped, optionally, with a combination UHF-VHF tuner unit which has in addition to the two tubes in the VHF tuner, a separate UHF oscillator and a crystal-diode mixer in the UHF tuner section.

Many features, in all models, have been included specifically as considerations for the service technician. For instance, ease of adjustment has been greatly stressed and service controls and adjustments are accessible from the front of the instruments. Removal of only the control-box cover permits access to the kinescope convergence and grey-scale adjustments.

Color equalizing magnet adjustments are easily accessible at the front of the instruments when the decorative bezel about the periphery of the kinescope safety-glass is removed. The bezel is held in place by spring-loaded snap catches which, when released, from the front of the instrument, permit removal of the bezel.

The printed-circuit boards are mounted flush with the chassis and, when the shields are removed, both sides of the boards are easily accessible for circuit tracing and replacement of components.

Block-diagrams for each chassis, showing the signal paths in the circuitry, are shown in figures 1 and 2.

These diagrams may be used for reference as an aid in understanding the circuit descriptions which follow.

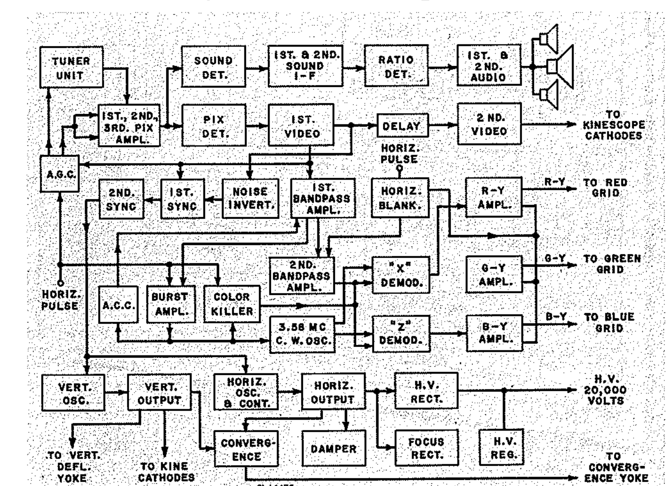


Fig. 2—Block Diagram, CTC5N Chassis.

TUNER UNIT

Two types of tuners are used with the 700 series receivers. For VHF reception only, a twelve-channel switch-type unit, uses two tubes, a 6BQ7A and a 6X8.

For UHF-VHF reception the receivers are equipped with a unit consisting of a VHF section similar to the tuner mentioned above, and a UHF section having continuously variable tuning.

The UHF-VHF unit has three tubes, a 6BQ7A, a 6X8 and a 6AF4A. A type 1N82 crystal-diode is used as the UHF mixer.

Both tuners are preceded by an identical antenna matching unit which provides impedance transformation, through an antenna matching transformer, from 300 ohms balanced, at the antenna input terminals, to the unbalanced grid input circuit. In addition, the antenna matching unit contains traps to attenuate signals falling in the I-F range, and an adjustable FM trap.

The VHF tuner uses the 6BQ7A dual triode in a driven grounded-grid R-F amplifier circuit as shown in the schematic diagram, figure 3. R-F input to this stage is applied to the grid of the tube through a tapped inductance for channels 2 to 6, and directly to the grid for channels 7 to 13.

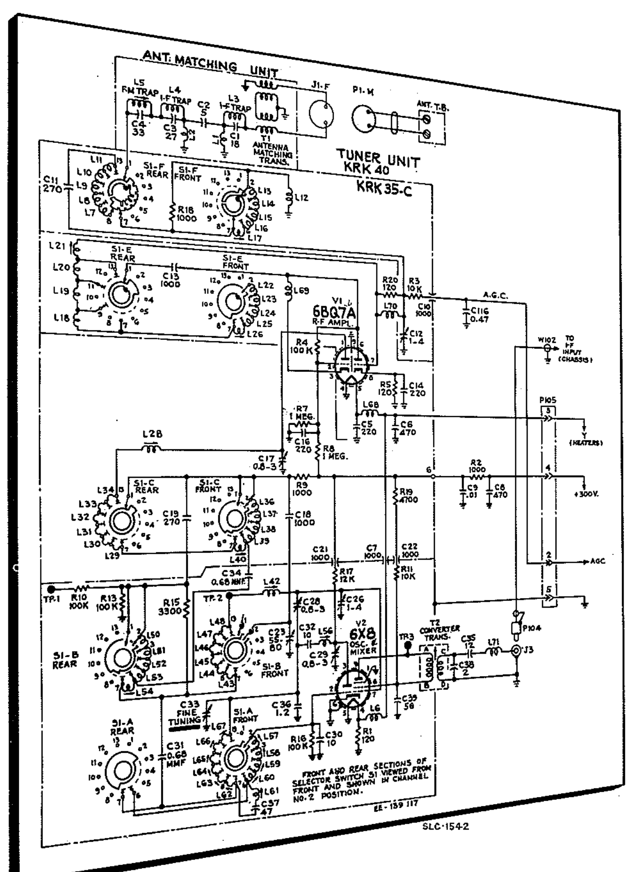


Fig. 3—Schematic Diagram VHF Tuner Unit.

To maintain stability, which is important for good reception of color programs, the grid-to-plate capacity of the first triode section of the 6BQ7A is neutralized by tuning L-26 for channels 2 to 6, and L-21 for channels 7 to 13. This results in minimizing the shift that occurs in input tuning from variations in grid bias voltage.

The 6X8 triode-pentode is used as the mixer-oscillator. The triode section of the 6X8 is used in a compensated Colpitts circuit. Incremental inductance switching is employed for channel tuning in this circuit. Oscillator frequency adjustments for channels 2 to 12 are accessible through openings in the front shield cover of the tuner. The oscillator adjustment for channel 13 is adjacent to the 6X8 on the forward corner of the tuner unit as shown in figure 4.

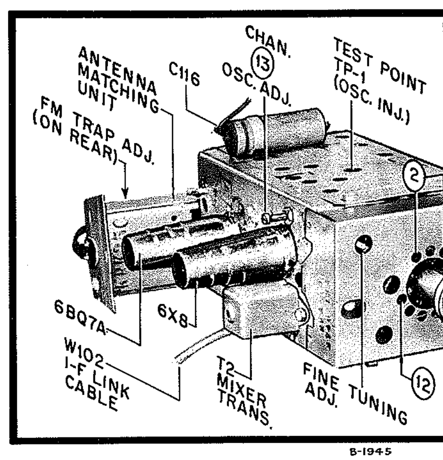


Fig. 4—VHF Tuner Adjustment Locations.

The VHF fine-tuning range in this tuner is approximately plus and minus 2 mc. which is restricted, in comparison with previous tuners, but facilitates fine tuning adjustments when tuning in a color program.

The pentode section of the 6X8 is used in the mixer circuit. The output of the mixer is tuned to the 41 mc. intermediate frequency range. Output from the mixer is link-coupled with a low-impedance transmission line from T-2, the converter transformer, to the 1st picture I-F stage.

The UHF-VHF tuner, shown in figure 5, employs basically the same components as the VHF tuner for VHF reception, and the tubes perform the same functions.

In UHF reception, however, the UHF-VHF tuner incorporates an additional set of wafers (S-1D, front and rear) shown in figure 6. These are switched into operation when the channel selector switch is placed in the

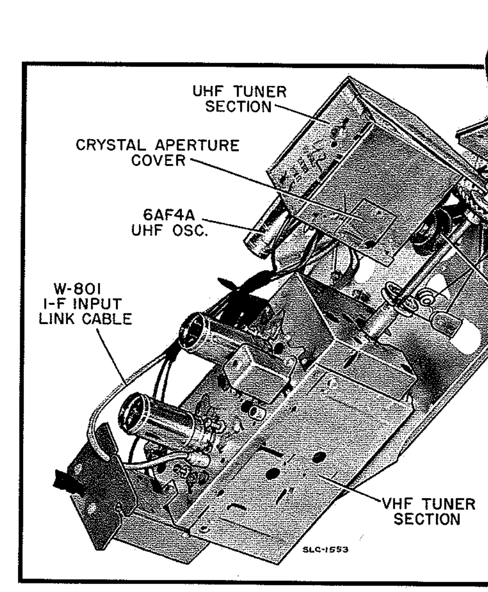


Fig. 5—UHF-VHF Tuner Unit.

UHF position. This function changes the 6BQ7A and the pentode section of the 6X8 to I-F amplifiers at 41 mc. The triode section of the 6X8, normally the VHF oscillator, is inactivated during UHF operation.

The UHF section of the tuner is a separate unit using a 6AF4A triode oscillator operating at fundamental frequency throughout the entire UHF tuning range. Output from the oscillator is fed to the 1N82 crystal-diode mixer.

The UHF R-F signal is tuned in the preselection circuits, C-801, L-801, C-802, L-802 and is also fed to the 1N82 crystal.

The mixer output is tuned to the 41 mc. I-F range by C-808 and L-810. Output from the mixer is link-coupled to T-3 which couples the signal to the 6BQ7A and the pentode section of the 6X8. These stages become 41 mc. I-F amplifiers during UHF operation. A block diagram of the changes that occur when switching from VHF to UHF operation is shown in figure 7.

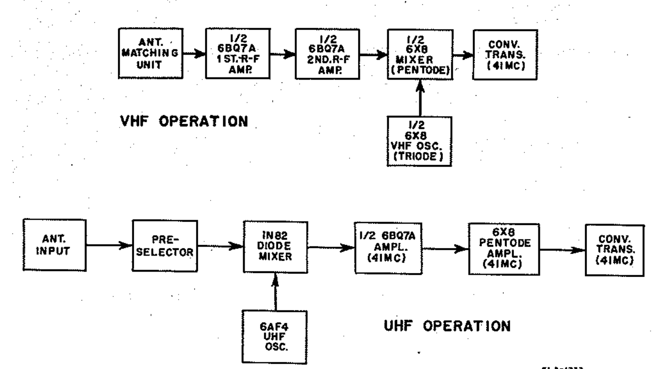


Fig. 7—Block Diagram—UHF-VHF Operation of UHF-VHF Tuner.

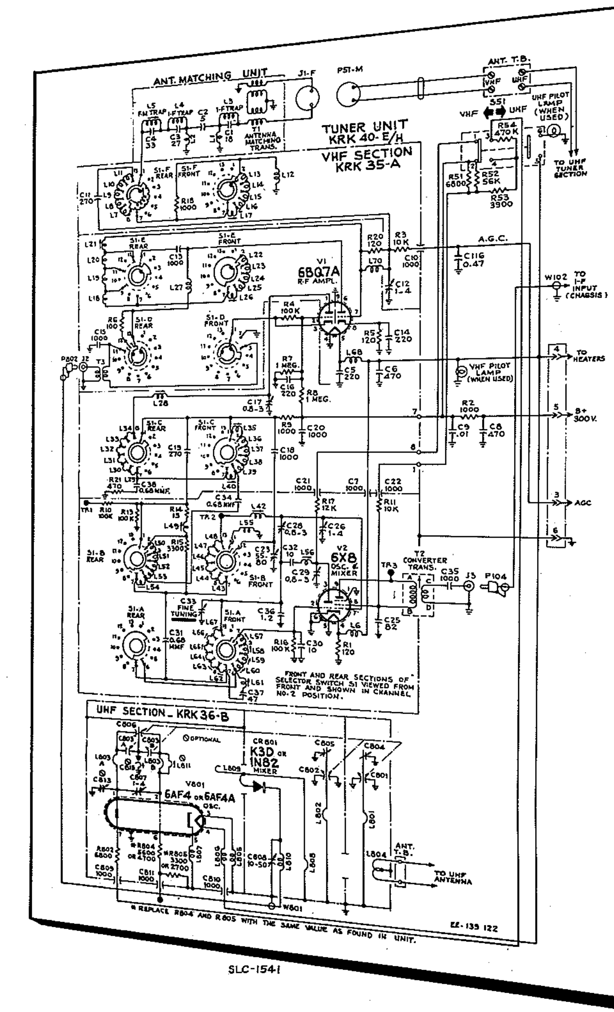


Fig. 6—Schematic Diagram UHF-VHF Tuner Unit.

Various mechanical arrangements are used depending upon the model of receiver. A list of the type numbers for the tuner units and the applicable series is shown below.

TUNER TYPE DESIGNATIONS

VHF Only		*UHF-VHF Combination*
KRK40	21CS—"Special" Models	KRK40A
KRK40B	21CT—"Super" Models	KRK40C
KRK40D KRK40F KRK41 KRK42	21CD—"DeLuxe" Models	KRK40E KRK40H KRK41A KRK42A

PICTURE I-F

The picture I-F stages in all models are identical and consist of three stages of amplification. The tubes and associated components for these stages are mounted on a printed circuit board designated PW-300.

The PW-300 printed circuit board includes the 1st, 2nd and 3rd picture I-F stages and the picture and sound detectors. A schematic diagram is shown in figure 8.

The 2nd Picture I-F Amplifier uses another 6DE6 and has its bifilar transformer, T-302, tuned to 42.5 mc.

The 3rd picture I-F stage, using a 6CB6, incorporates a 41.25 mc. trap (accompanying sound) in conjunction with a bifilar-wound transformer (T-303) tuned to 43.8 mc. A sound rejection control, R-312, is adjusted to obtain maximum rejection of sound going to the picture

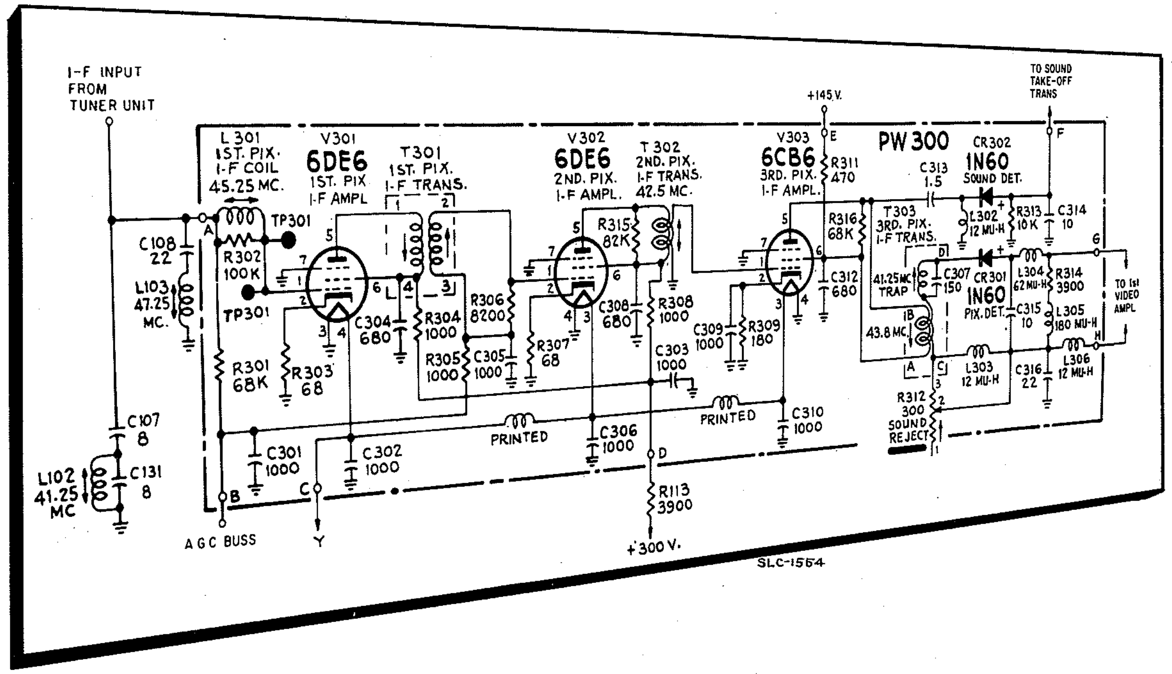


Fig. 8—Schematic Diagram—1st, 2nd, 3rd Picture I-F Stages and Picture and Sound Detectors.

The 1st picture I-F amplifier uses a type 6DE6 tube with its grid circuit tuned to 45.75 mc. A trap (L-102, C-131) tuned to 41.25 mc. provides a means of attenuating the accompanying sound carrier. An adjacent sound trap (L-103, C-108), tuned to 47.25 mc., provides rejection for the adjacent channel sound carrier. These traps are in the grid input circuit of the 1st picture I-F amplifier and are temperature compensated to minimize drift.

The 1st picture I-F transformer, T-301, is double-tuned, which results in a bandwidth of approximately 3.5 mc. for this stage.

detector, CR301, a 1N60 crystal-diode. A separate sound detector, CR302, using another 1N60 crystal diode, couples the sound signal to a sound take-off transformer.

A unique feature of the 700 series receivers is the use of separate second detectors for separation of the picture and sound information at the output of the 3rd picture I-F amplifier. A particular advantage of the use of separate second detectors is that attenuation of the accompanying sound information can be applied directly at the picture detector without impairing sound gain, since the sound information is supplied to the sound I-F amplifier through a separate detector.

The printed circuit board PW-300 is shown in figure 9.

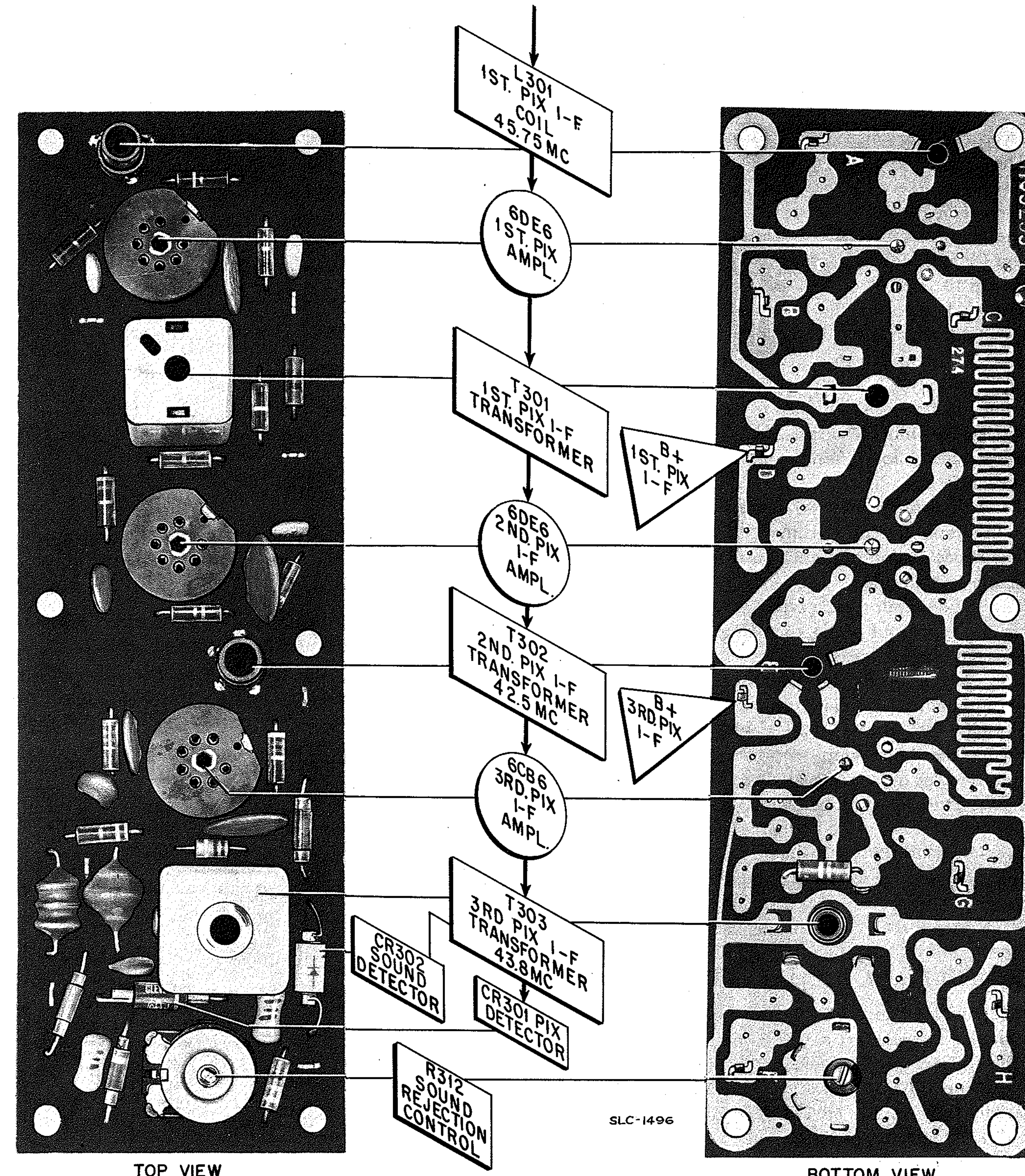


Fig. 9—Picture I-F and Picture and Sound Detector Circuits—Printed Circuit Board PW-300.

SOUND I-F AND AUDIO—CTC5 CHASSIS

The sound I-F and audio stages in the CTC5 chassis consist of a sound I-F amplifier, a ratio detector, an intermediate stage of audio amplification and an audio output stage.

These stages and associated components are mounted on a printed circuit board designated PW-200. The PW-200 printed circuit board also carries the AGC and 1st sync amplifier tube and components for these circuits.

The intercarrier-type sound system, using the 4.5 mc. difference beat between the sound and picture carriers as the sound intermediate frequency, is used in all models in the 700 series receivers. A schematic diagram for the sound I-F and audio stage for the CTC5 chassis is shown in figure 10.

The grid circuit of the sound I-F amplifier contains the sound take-off transformer, T-201, tuned to 4.5 mc. and an RC network which provides optimum immunity from impulse-type noise.

Sound information is applied to the grid circuit of the sound I-F amplifier from the 1N60 crystal-diode sound detector which is located on the picture I-F printed circuit board.

The ratio detector uses two of the diodes of a type 6T8 tube in a ratio detector circuit.

The triode section of the 6T8 is used as the first stage of audio amplification.

The audio output tube, a type 6AQ5, provides a maximum of 3 watts of audio to a single 6″ x 9″, or 8″ permanent magnet speaker.

The cathode of the 6AQ5 is operated at 150 volts above ground. The voltage drop across the cathode is thoroughly filtered by C-102B, C-103B, and C-104B and is used as the B-plus supply source for the 1st Sync Amplifier, the sync output stage, the sound I-F amplifier and the 3rd picture I-F amplifier stage.

Because of this method of providing B-plus for the above stages, if the 6AQ5 audio output tube becomes inoperative and causes a "no sound" condition, a "no picture" condition may also result due to the lack of a voltage drop at the cathode of the 6AQ5.

SOUND I-F AND AUDIO—CTC5N CHASSIS

The sound I-F and audio stages in the CTC5N chassis are similar to those in the CTC5 chassis.

The CTC5N chassis, however, includes an additional stage of sound I-F amplification using a type 6AU6 tube, an audio tone control (R-170A) in the plate circuit of the 6T8 1st audio tube, and the RCA Victor Panoramic Speaker system using three speakers.

A schematic diagram of the sound I-F and Audio circuits in the CTC5N chassis is shown in figure 11.

In addition to supplying B-plus voltage for the 1st Sync Amplifier, Sync output, 3rd Picture I-F amplifier and 1st Sound I-F amplifier, the cathode circuit of the 6AQ5 also supplies B-plus voltage for the 2nd Sound I-F amplifier and the screen voltage for the two chrominance demodulator tubes.

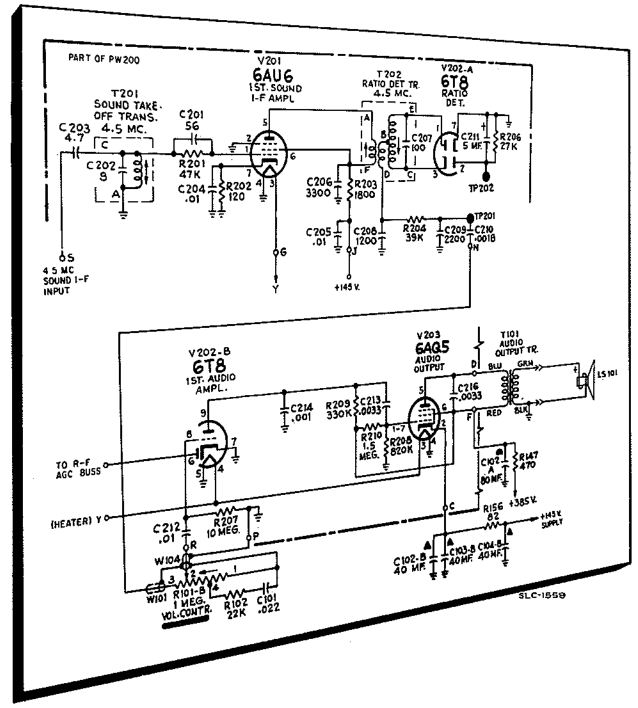


Fig. 10—Schematic Diagram—Sound I-F and Audio Circuits—CTC5 Chassis.

Figure 12 shows the sound I-F and audio printed-circuit board PW-200 used in the CTC5 chassis.

Figure 13 shows the sound I-F and Audio printed circuit board PW-200 used in the CTC5N chassis.

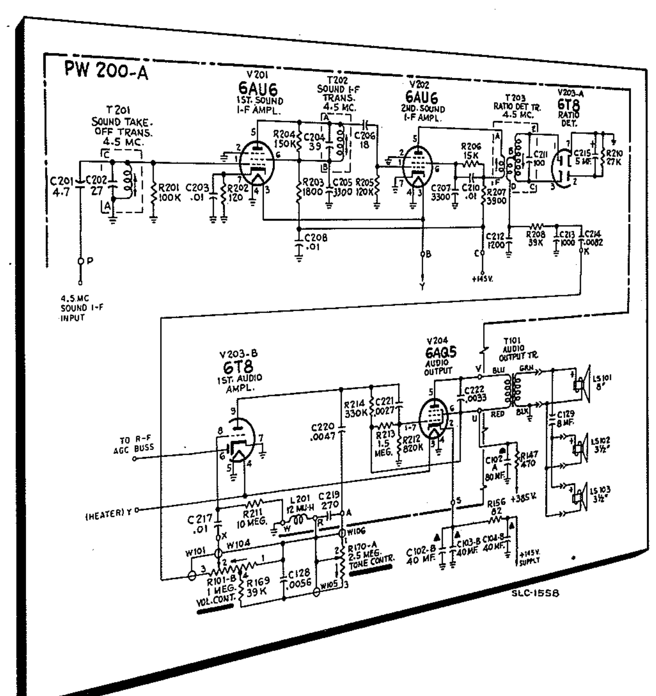


Fig. 11—Schematic Diagram—Sound I-F and Audio Circuits—CTC5N Chassis.

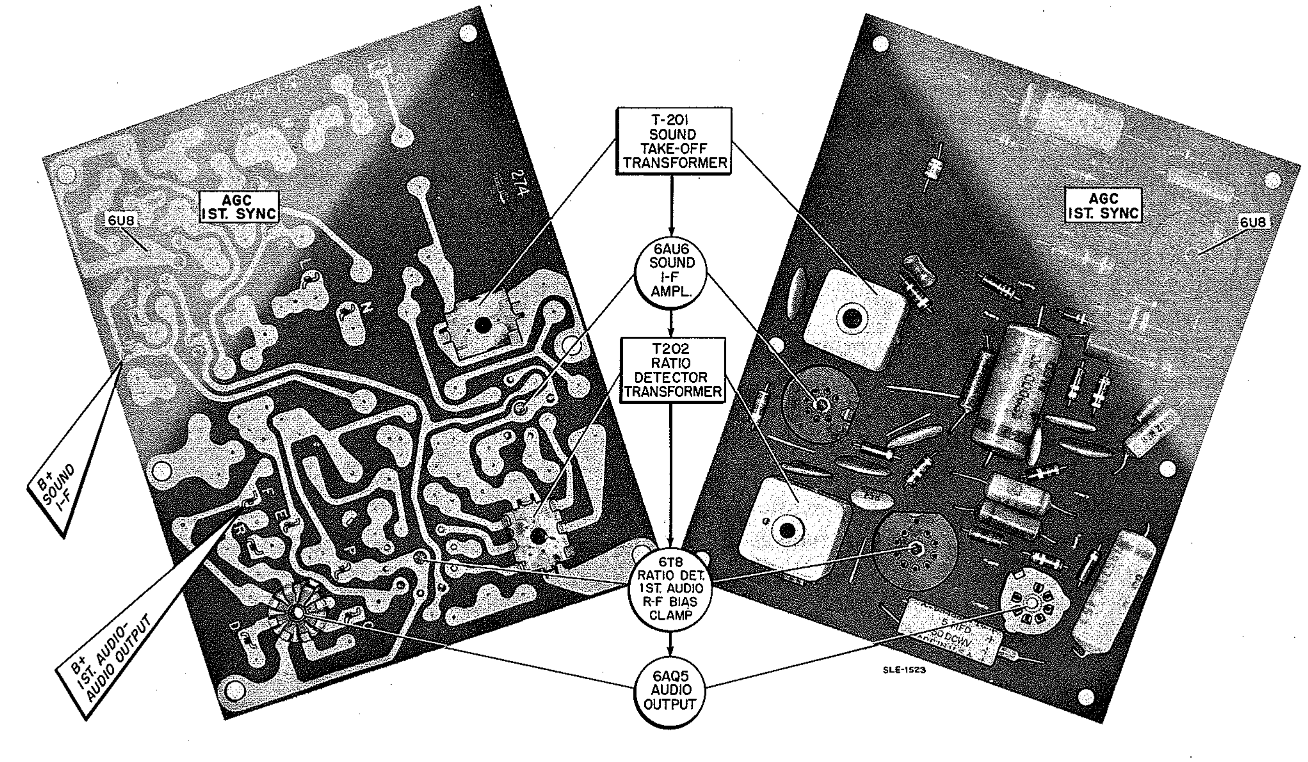


Fig. 12—Sound I-F and Audio Circuits—Printed Circuit Board PW-200—CTC5 Chassis.

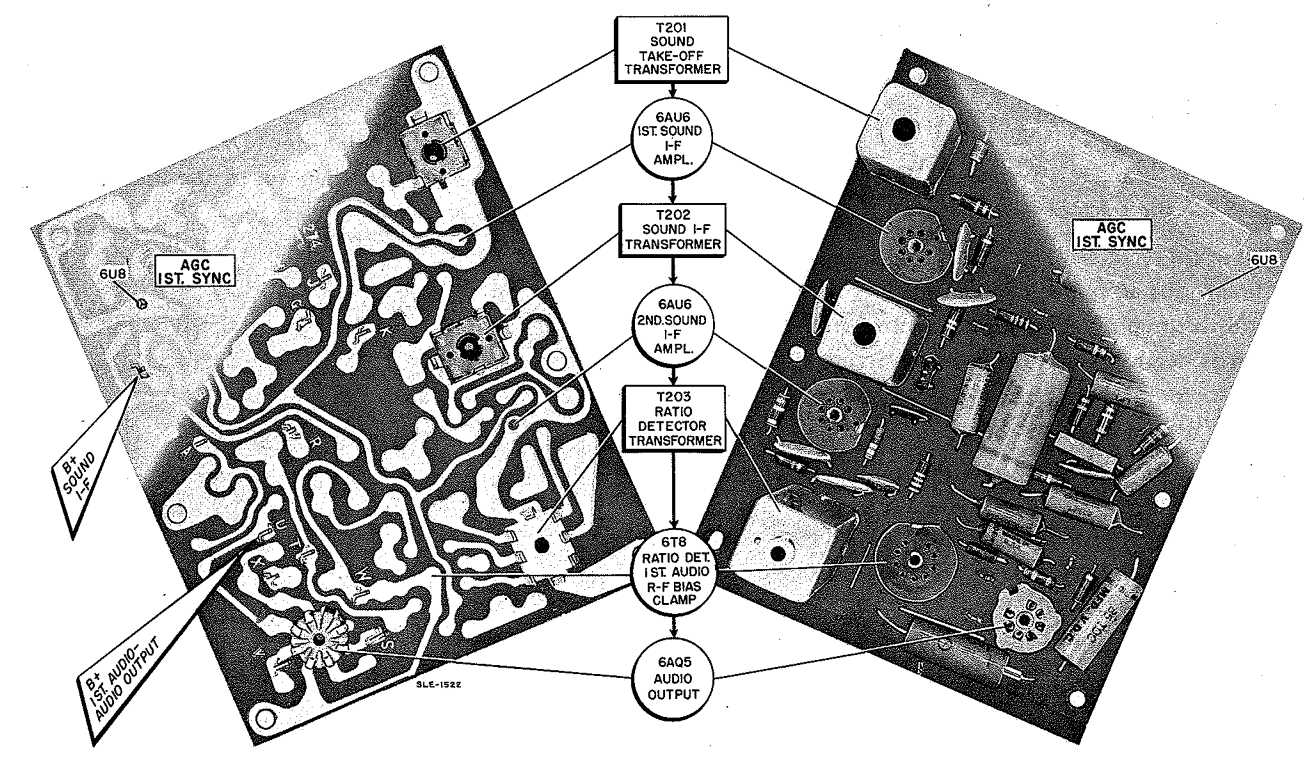


Fig. 13—Sound I-F and Audio Circuits—Printed Circuit Board PW-200—CTC5N Chassis.

LUMINANCE CHANNEL

The luminance channel amplifies the composite television signal to a level suitable for application of the brightness (luminance) portion of the signal to the kinescope cathodes; and the color signal information to the color circuits of the receiver.

In both the CTC5 and CTC5N chassis the luminance channel consists of the first video amplifier stage, the pentode section of a type 6AW8, and the second video amplifier, a type 12BY7A.

The two video stages are mounted on a printed circuit board designated PW-400.

The printed circuit board for the CTC5N differs slightly from the board used in the CTC5 chassis since in the CTC5 chassis the triode section of the 6AW8 is used as the horizontal blanking amplifier, while the CTC5N chassis uses the triode section of this tube as the noise inverter stage.

A schematic diagram of the 1st and 2nd video amplifiers is shown in figure 14.

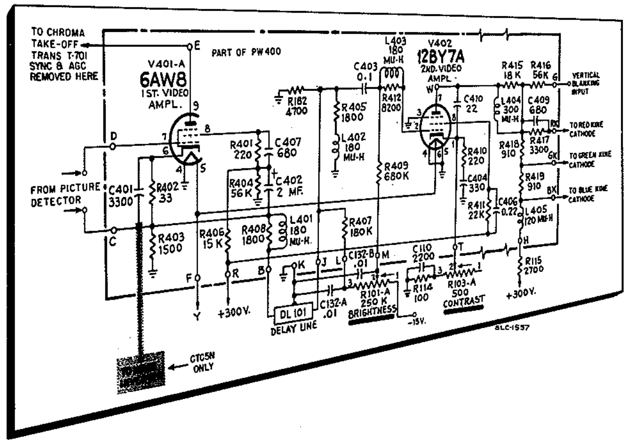


Fig. 14—Schematic Diagram—1st and 2nd Video Amplifiers.

The first video amplifier may be considered the signal distribution center of the receiver since brightness information is derived from its cathode circuit and sync, AGC and chrominance information are derived in the plate circuit of this stage.

A simplified schematic diagram of the 1st video amplifier stage is shown in figure 15.

Input signal to the video amplifier stages is applied between the grid and cathode of the 1st video amplifier stage.

The plate circuit of this stage includes the chrominance take-off transformer, T-701, which is located physically with the chrominance circuits in the chassis. Sync and AGC voltages are obtained from the primary of this transformer. The secondary provides chrominance information to the grid of the bandpass amplifier. In the

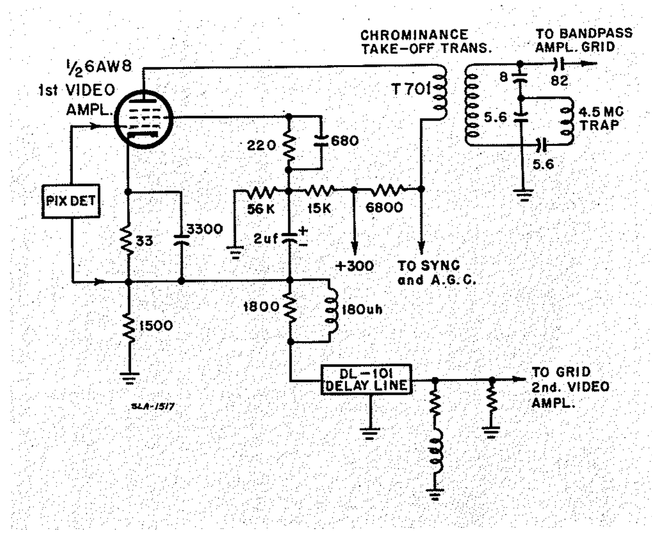


Fig. 15—Simplified Schematic Diagram—1st Video Amplifier.

CTC5 chassis, the secondary of this transformer also contains a 4.5 mc. trap. The 4.5 mc. trap rejects from the chrominance signal any 4.5 mc. sound I-F information which may be present at this point. The 4.5 mc. signal, if present at the grid of the bandpass amplifier or the input to the demodulators, would cross-modulate with the 3.58 mc. sub-carrier signal and result in a 920 kc. beat interference pattern in the picture.

The 4.5 mc. trap in the CTC5N chassis is in the primary circuit of T-701 and performs the same function as in the CTC5 chassis (rejection of 4.5 mc. information).

The cathode circuit of the 1st video stage provides luminance information to the grid of the 2nd video amplifier through the delay line, DL-101.

A simplified schematic diagram of the 2nd video amplifier stage is shown in figure 16.

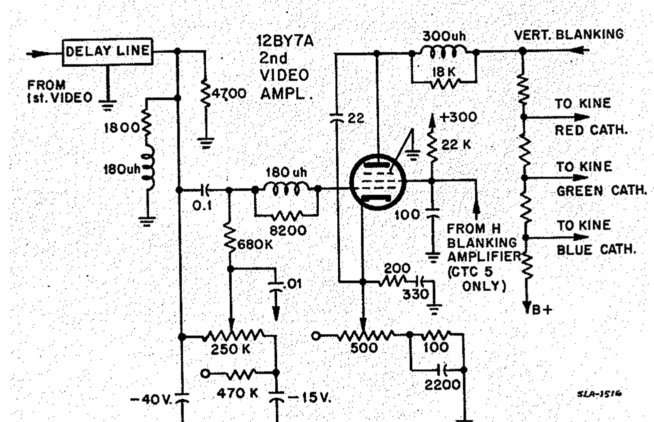


Fig. 16—Simplified Schematic Diagram—2nd Video Amplifier.

Luminance signal input to the cathodes of the kinescope is supplied from the voltage dividing network in the plate circuit of the 2nd video amplifier. The voltage dividing network provides luminance drive in the correct ratio to properly drive each cathode of the kinescope.

Peaking circuits are incorporated in the cathode, grid and plate circuits of this stage.

The presence of color sub-carrier information in the luminance signal is reduced and video peaking is improved by the use of plate-to-cathode capacitive feedback.

Picture brightness is controlled by varying the DC grid voltage of the 2nd video amplifier, with a potentiometer (R-101A) in the grid voltage supply line. Grid bias for this stage is developed from the horizontal output tube grid circuit.

Picture contrast is varied by controlling the amount of cathode degeneration, by a potentiometer, R-103A.

Vertical blanking is accomplished by adding a vertical retrace pulse, from the vertical output stage, directly to the plate circuit of the second video amplifier. The positive pulse adding to the signal at that point blanks out the kinescope during vertical time.

Figure 17 shows the luminance channel printed circuit board PW-400.

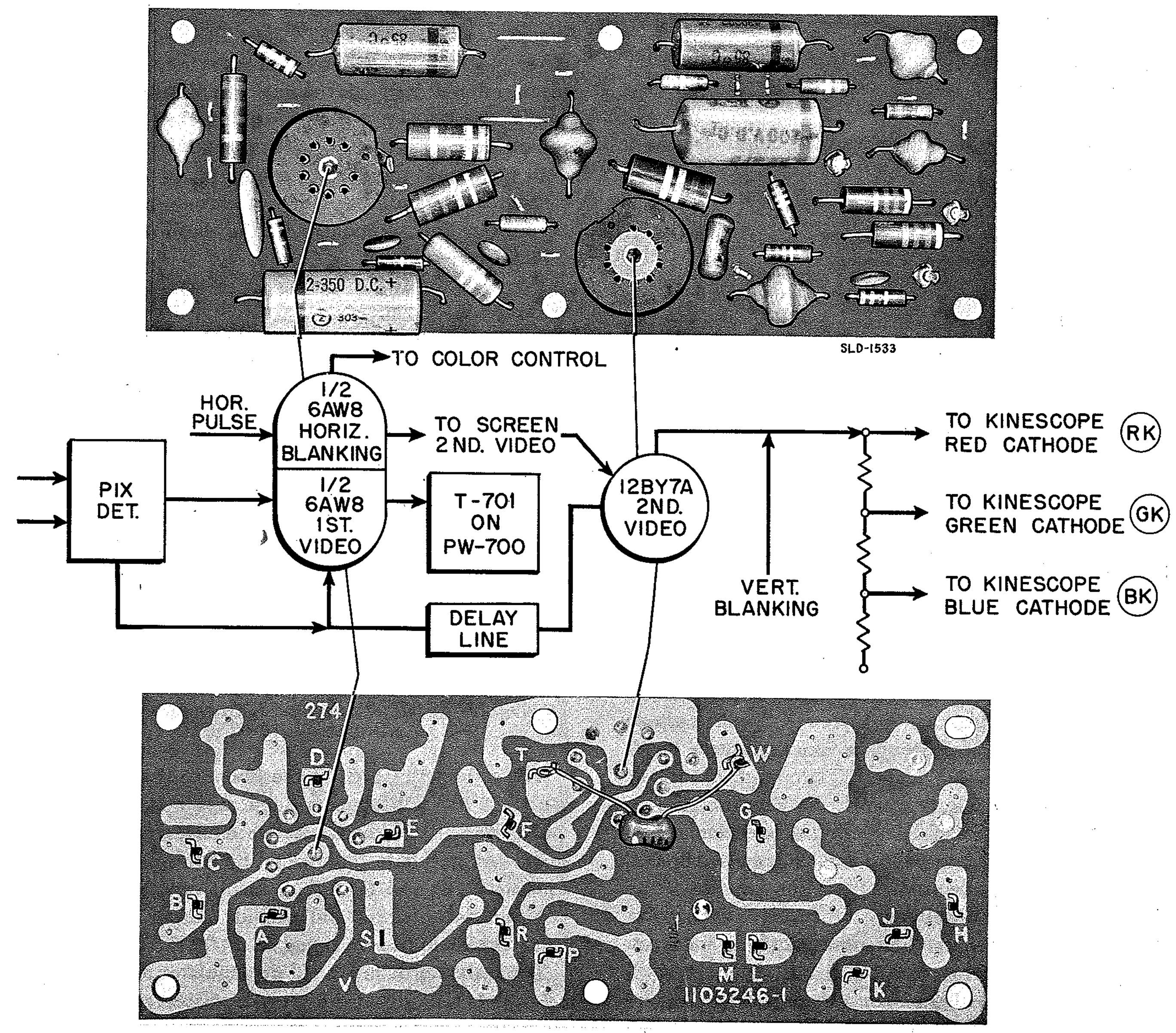


Fig. 17—Luminance Channel Circuits—1st and 2nd Video Amplifiers—Printed Circuit Board PW-400.

CHROMINANCE CHANNEL—CTC5

The chrominance channel recovers the information contained in the color sub-carrier and its accompanying sidebands.

The circuitry for the chrominance channel differs greatly between the CTC5 and CTC5N chassis, so for clarity, the chrominance channel circuits for each chassis will be discussed as separate subjects.

The chrominance channel components and the color synchronization circuits and components are mounted on a printed circuit board designated PW-700 in the CTC5 chassis.

The chrominance channel in the CTC5 chassis consists of a bandpass amplifier, the pentode section of a type 6AW8, and two demodulators operating on the B—Y and G—Y axes using type 12AT7 tubes in push-pull circuits.

Bandpass Amplifier

The bandpass amplifier stage provides the function of amplification and band-limiting of the chrominance signal.

A schematic diagram of the bandpass amplifier circuit is shown in figure 18.

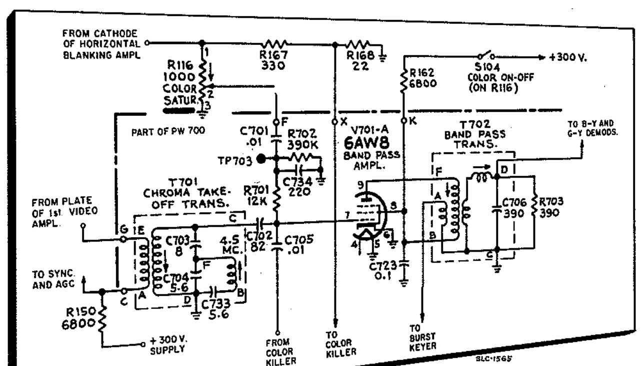


Fig. 18—Schematic Diagram—Bandpass Amplifier Circuit—CTC5 Chassis.

Burst, the color synchronization signal, is extracted in the plate circuit of this stage and is coupled to the cathode of the burst keyer tube through a winding on the bandpass transformer, T-702.

Color saturation is controlled by varying the gain of the bandpass amplifier stage by using a potentiometer to vary the grid bias voltage. Grid bias voltage is supplied, in part, from the horizontal pulse at the cathode of the horizontal blanking amplifier.

In operation, a positive horizontal blanking pulse appears across the color control, R-116. This pulse is coupled to the grid of the bandpass amplifier. The amplitude of the pulse determines the bias voltage applied to the grid.

During burst keying, the stage is driven to the point where grid current is drawn. With the cathode of the tube at ground potential the grid operates at zero bias and burst is amplified at maximum gain. During picture time, the grid operates at a bias dependent upon the amplitude of the pulse received through the color saturation control, and the chrominance signal amplification in this stage is proportional to this bias.

The CTC5 chassis features a color "on-off" switch on the same shaft as the color saturation control. With the switch in the "off" position, B-plus to the stage is removed. This prevents operation of the stage and is particularly advantageous under very weak black-and-white signal reception since it prevents noise, which might be translated as burst, from causing a shift in background color.

Demodulators and Matrix

Demodulation of the color signal is accomplished in the two twin-triode, 12AT7 demodulator tubes. These tubes operate in a balanced push-pull circuit and provide color difference signals having equal bandwidth. The bandwidth for each of the color difference signals is approximately 0.7 mc.

In operation, the four control grids of the tubes are connected in parallel and receive chrominance information from the secondary of the bandpass amplifier transformer.

Figure 19 shows a simplified schematic diagram of the demodulator circuits.

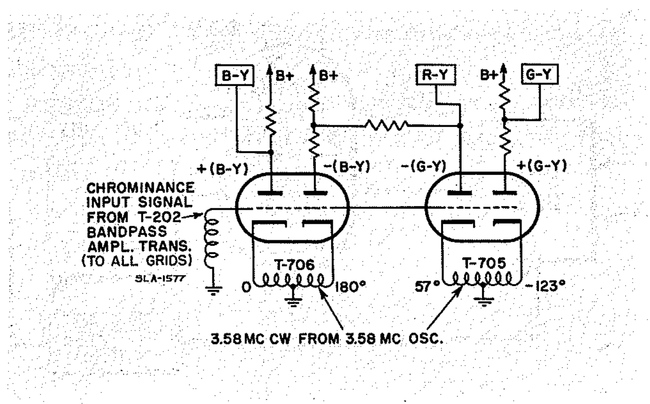


Fig. 19—Simplified Schematic Diagram—Chrominance Demodulators—CTC5

The cathodes of each of the four triodes are supplied with 3.58 mc. CW signal voltage developed by the 3.58 mc. CW oscillator. Each cathode receives signal voltage in the proper phase (controlled by adjustment of transformers T-705 and T-706), to enable cancellation of the 3.58 mc. information and provide output of only the correct color difference signal in the plate circuits.

The cathodes of the B—Y demodulator are driven by a 3.58 mc. CW signal differing in phase by 123 degrees from the signal fed to the cathodes of the G—Y demodulator.

In the demodulators, the process of synchronous phase detection produces a varying plate voltage having its amplitude proportional to the amplitude of the chrominance signal, phased in relation to the fixed phase CW signal, and producing both positive and negative values of B—Y and G—Y. Matrixing the negative values of B—Y and G—Y signals in the plate circuits of the demodulators produces the required R—Y color difference signal. Peaking coils, acting as resonant filters are used in the plate circuits to reduce radiation and to reduce the amount of 3.58 mc. information in the picture. R-F chokes, in series with B-plus to the demodulator plates, reduce radiation of the 3.58 mc. sub-carrier harmonics.

The R—Y, G—Y and B—Y color difference signals are direct coupled to the respective control grids of the kinescope. This, together with direct coupling of the luminance signals to their respective cathodes, preserves the DC components of the signal necessary for correct picture reproduction.

A schematic diagram of the demodulator and matrix circuits is shown in figure 20.

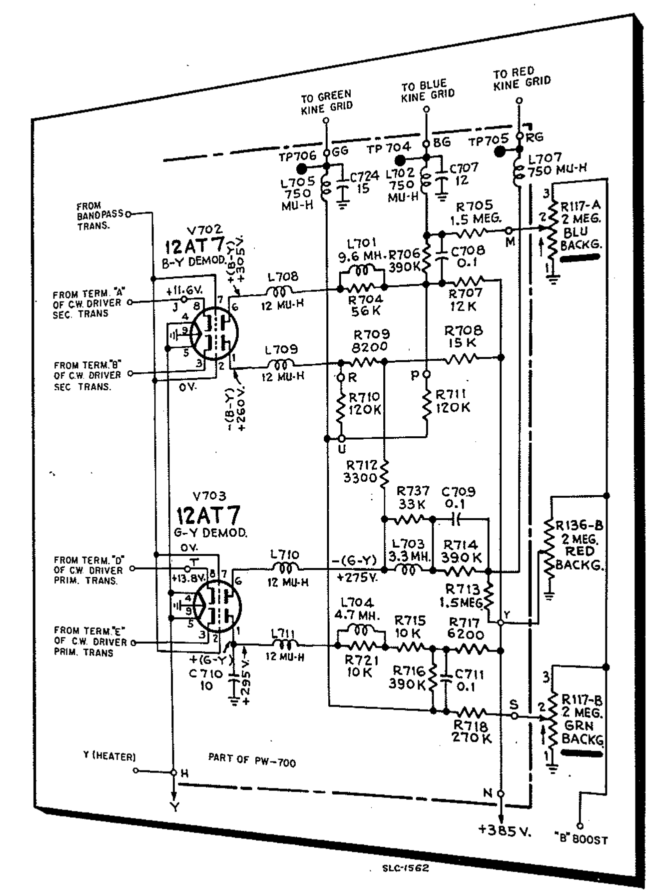


Fig. 20—Schematic Diagram—Demodulator and Matrix Circuits—CTC5.

Color Synchronization—CTC5

The color synchronization section of the CTC5 chassis includes a burst keyer stage, the triode section of a type 6AN8, a burst amplifier, using the pentode section of the same tube, a 3.58 mc. sub-carrier oscillator using a type 6CB6 and a color killer stage using the triode section of the 6AW8 bandpass amplifier.

The Automatic Frequency Phase Control (AFPC) system processes the color synchronizing signal for use as the phase reference necessary to drive the demodulator tubes to enable reproduction of the proper colors at the proper time on the screen of the kinescope.

Phase reference information is transmitted as part of the composite color television signal in the form of a "burst" of approximately 8 cycles of the color sub-carrier frequency. This information appears in the composite signal immediately following each horizontal sync pulse.

A schematic diagram of the color synchronization circuits in the CTC5 chassis is shown in figure 21.

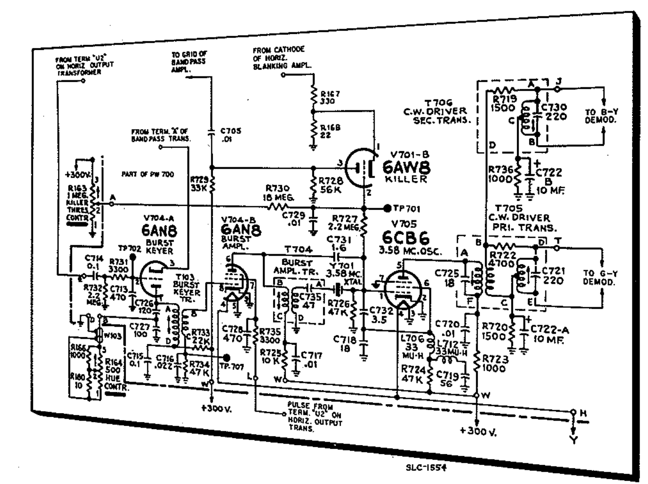


Fig. 21—Schematic Diagram—Color Synchronization Circuits—CTC5.

As mentioned previously, burst, the color synchronizing signal, is fed to the burst keyer tube from a winding on the bandpass transformer, T-702.

A horizontal pulse, supplied from a winding on the horizontal output transformer, is applied to the grid of the burst keyer tube. This pulse is delayed, by the resistance-capacitance network in the grid circuit of the keyer tube, to arrive at the grid at the instant burst is present in the signal. Thus, the keyer tube conducts only at burst-time. The burst signal is coupled to the grid of the burst amplifier stage through a transformer, T-703. The "hue" control, R-164, is combined with a capacitor in the primary of T-703. Adjustment of the control effectively varies the load on the primary winding and thus changes the phase of the burst signal at the grid of the burst amplifier.

The 3.58 mc. sub-carrier oscillator is a grounded-cathode electron-coupled type having its frequency controlled by the quartz crystal, Y-701.

The amplified burst information is fed to the grid of the sub-carrier oscillator through a filter network and the crystal, Y-701. The oscillator is kept at the crystal frequency by the injection-lock principle.

Output from the oscillator is fed through transformers T-705 and T-706 respectively, to the cathodes of the G—Y and B—Y demodulator tubes.

Color Killer

The color killer circuit incorporates the triode section of the 6AW8 Bandpass Amplifier.

When burst is present in the received signal, an increased DC grid bias is present at the grid of the 3.58 mc. sub-carrier oscillator. This grid bias is also used as the color killer grid bias source and is sufficient to hold the killer tube at cut-off.

A positive pulse, obtained from the color saturation control (source: cathode of horizontal blanking amplifier) is applied to the cathode of the killer, and, when the killer conducts, the pulse is amplified and coupled to the grid of the bandpass amplifier. This causes the bandpass amplifier to cut-off during picture time while maintaining zero bias during pulse time.

When burst occurs during pulse time the color killer is biased off and the bandpass amplifier operates normally.

The killer threshold control, R-163, is adjustable to vary the level at which the color killer tube conducts.

Figure 22 shows the chrominance channel printed circuit board PW-700.

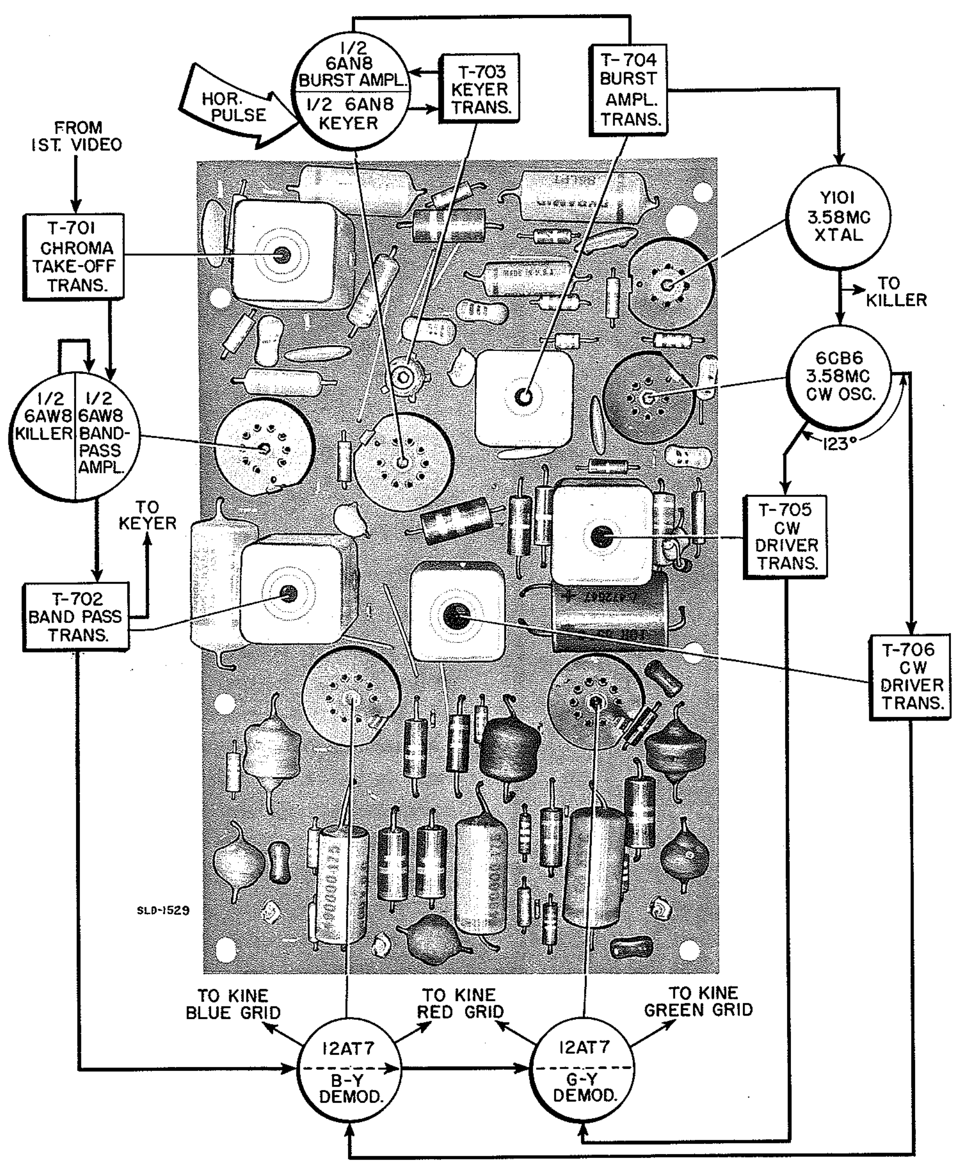


Fig. 22—Chrominance and Color Synchronization Circuits—Printed Circuit Board PW-700—CTC5 Chassis.

CHROMINANCE CHANNEL—CTC5N

The chrominance channel in the CTC5N chassis consists of two bandpass amplifiers, two demodulators, and an amplifier for each of the three color difference signals developed in the demodulators and matrix sections of the receivers.

The components and tubes for the chrominance channel, and the color synchronization stages, are mounted on a metal plate designated MP-700.

Bandpass Amplifiers

The first bandpass amplifier stage uses the pentode section of a type 6AW8 tube.

Signal from the chroma take-off transformer, T-701, (which includes a 4.5 mc. trap in the primary) is fed to the grid of the 1st bandpass amplifier as shown in the schematic diagram, figure 23.

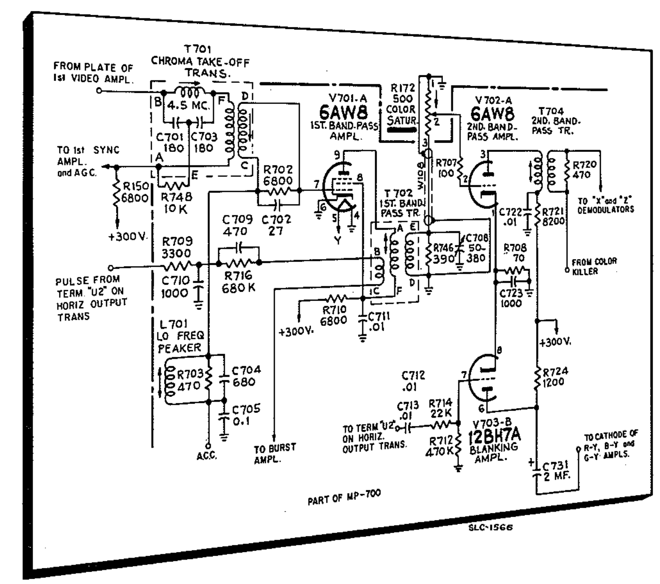


Fig. 23—Schematic Diagram—1st and 2nd Bandpass Amplifiers —Blanking Amplifier—CTC5N.

Control grid bias from the automatic chroma control circuit regulates the gain of this stage in accordance with the amplitude of burst in the received signal. If burst amplitude becomes large, the gain of the stage is lowered and less amplification of the chrominance signal takes place. Should burst amplitude drop, the gain of the stage increases, greater chrominance signal amplification results and the picture level remains constant. Burst is removed for processing from the transformer T-702, in the output of the 1st bandpass amplifier.

The output of the 1st bandpass amplifier supplies drive to the 2nd bandpass amplifier stage, the triode section of a 6AW8, through a potentiometer R-172, the color saturation control.

Burst information which may be present in the signal is removed in the 2nd bandpass amplifier stage. To accomplish this, a positive horizontal pulse, obtained from the horizontal blanking amplifier, is applied to the cathode and cuts off the stage during horizontal blanking time.

Output from the 2nd bandpass amplifier is applied to the grids of the two demodulators in parallel through transformer T-704.

Demodulators and Matrix Amplifiers

The color demodulation system used in the CTC5N chassis employs two 6BY6 synchronous detectors operating at a phase displacement of 57.5 degrees.

Chrominance information, from the 2nd bandpass amplifier, as mentioned above, is fed to the paralleled #1 grids of the 6BY6 demodulators as shown in the simplified schematic diagram, figure 24. The 3.58 mc. CW subcarrier reference signal is fed to the #3 input grids of the demodulators through the CW driver transformer, T-705.

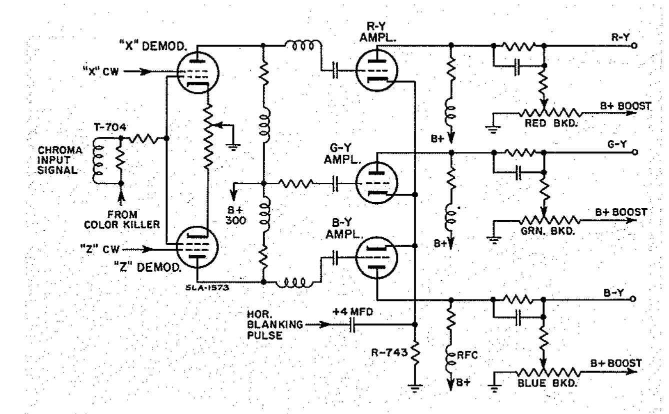


Fig. 24—Simplified Schematic Diagram—Demodulators and Matrix Amplifiers—CTC5N.

When properly adjusted, this transformer couples the 3.58 mc. CW signal to the grid of each tube with the phase of the voltage applied to one tube displaced 57.5 degrees from the phase of the voltage supplied to the other tube.

The demodulation axes are arbitrarily designated "X" and "Z". These axes have been chosen because they best satisfy the color reproduction requirements for the receivers using the CTC5N chassis.

By the process of synchronous detection, the demodulator plate voltages vary in amplitude continuously proportional to the amplitude and phase of the chrominance signal.

The "X" and "Z" demodulators each provide output with a bandwidth of 1.3 mc. of "X" or "Z" information. By applying the "X" signal to the R—Y matrix amplifier grid and the "Z" signal to the B—Y matrix amplifier grid a voltage which represents G—Y is developed across resistor R-743.

The grid of the G—Y matrix amplifier is at AC ground potential and the G—Y amplifier produces the desired G—Y signal at its plate.

The other two matrix amplifiers have the "X" signal minus G—Y and the "Z" signal minus G—Y respectively at their plates where the "X" and "Z" signals are chosen to produce R—Y and B—Y respectively.

The R—Y, G—Y and B—Y color difference signals are amplified individually, by the three matrix amplifiers, to the level necessary to drive the individual red, green, and blue grids of the kinescope and reproduce pictures in color. The matrix amplifiers are directly coupled to the kinescope grids and therefore must maintain a fixed reference level. This is accomplished by DC restoration taking place in the grid circuits of the matrix amplifiers. A schematic diagram of the demodulator and matrix amplifier circuits is shown in figure 25.

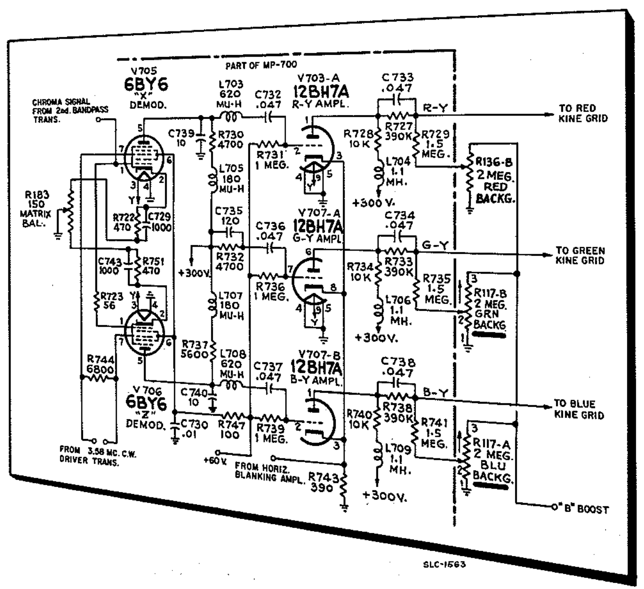


Fig. 25—Schematic Diagram—Demodulator and Matrix Amplifier Circuits—CTC5N.

Color Synchronization—CTC5N

The color cynchronization stages (Automatic Frequency Phase Control) in the CTC5N chassis include a burst amplifier and an injection-locked crystal oscillator circuit similar to that used in the CTC5 chassis.

Burst is separated from the color signal by means of a delayed horizontal pulse which is passed through a winding on the 1st bandpass amplifier transformer T-702, shown in the schematic diagram, figure 23. The delayed pulse, which coincides with the time of occurrence of the burst pulse, is applied to the control grid of the burst amplifier, the pentode section of a 6AW8. Another horizontal pulse is applied to the screen grid of the burst amplifier, thus permitting the burst amplifier to conduct only at the time burst is present. Figure 26 shows the schematic diagram of the color synchronization circuits.

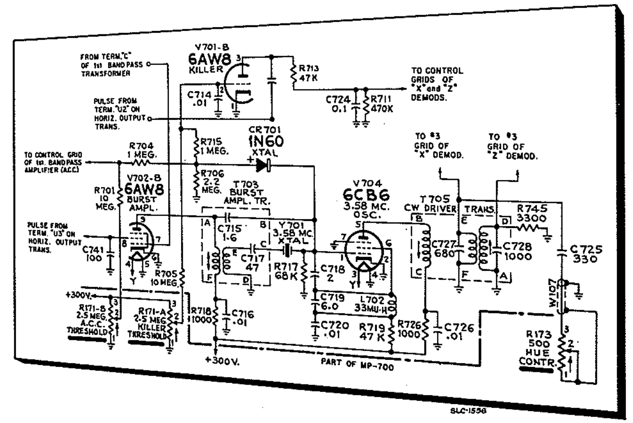


Fig. 26—Schematic Diagram—Color Synchronization Circuits—CTC5N.

The burst signal is amplified and applied to the grid of the 6CB6 3.58 mc. oscillator through T-703, the burst amplifier transformer, and the 3.58 mc. crystal Y-701.

The output of the 3.58 mc. oscillator is applied through transformer T-705, the CW driver transformer, to the #3 grids of the "X" and "Z" demodulators.

When the primary and secondary of the CW driver transformer are tuned for maximum CW output, with the "hue" control at the center of its range, the correct phases of "X" and "Z" CW will be applied to the #3 grids of the demodulator tubes with "X" and "Z" voltages differing in the phase by 57.5 degrees.

"Hue" is varied by a potentiometer, R-173, in series with a capacitor, C-725, which effectively varies the load capacity in the secondary of the CW driver transformer. Varying the load on the secondary of the transformer effectively changes the resonance and causes the phase of the CW signal to be shifted.

Color Killer and Automatic Chroma Control

An increased DC bias is present at the grid of the 3.58 mc. oscillator when burst occurs in the received signal. 3.58 mc. CW is also present at the grid of this stage.

A 1N60 crystal-diode rectifies the negative going portion of the 3.58 mc. CW at this point and produces a doubling action which provides, across the diode load-resistor, a negative bias which varies directly with the burst level.

This bias is used as a control voltage for automatic chroma control and the color killer.

The plate of the color killer (the triode section of the 6AW8 1st bandpass amplifier) is supplied with a horizontal pulse from the horizontal output transformer but the tube is prevented from conducting by the bias at its grid.

Remembering that this grid bias is a result of burst being present in the signal, burst causes the 3.58 mc.

oscillator to operate at 3.58 mc. and develop the increased bias. When no burst is present, as in a black-and-white transmission, the oscillator has no output at 3.58 mc., insufficient bias is developed to hold the killer at cut-off and the color killer conducts. When the killer conducts, it develops a voltage which is applied through T-704, the 2nd bandpass transformer, to the grids of the "X" and "Z" demodulators. This cuts off the demodulators and prevents any color information from appearing in the picture during reception of a black-and-white transmission. The killer threshold control R-171A, adjusts the level at which the killer tube begins to conduct.

The bias developed at the 1N60 diode is also applied to the grid of the first bandpass amplifier at a level sufficient to permit normal gain of the stage when burst at normal level is being received.

As soon as the level of burst drops, the automatic chroma control bias drops and the bandpass amplifier operates at higher gain, thus automatically adjusting the chrominance signal to its normal level. The killer and automatic chroma control circuits are not affected by electrical noise interference because the control voltages are derived from the grid circuit of the 3.58 mc. subcarrier oscillator. Figure 27 shows the chrominance and color sync mounting plate, MP-700.

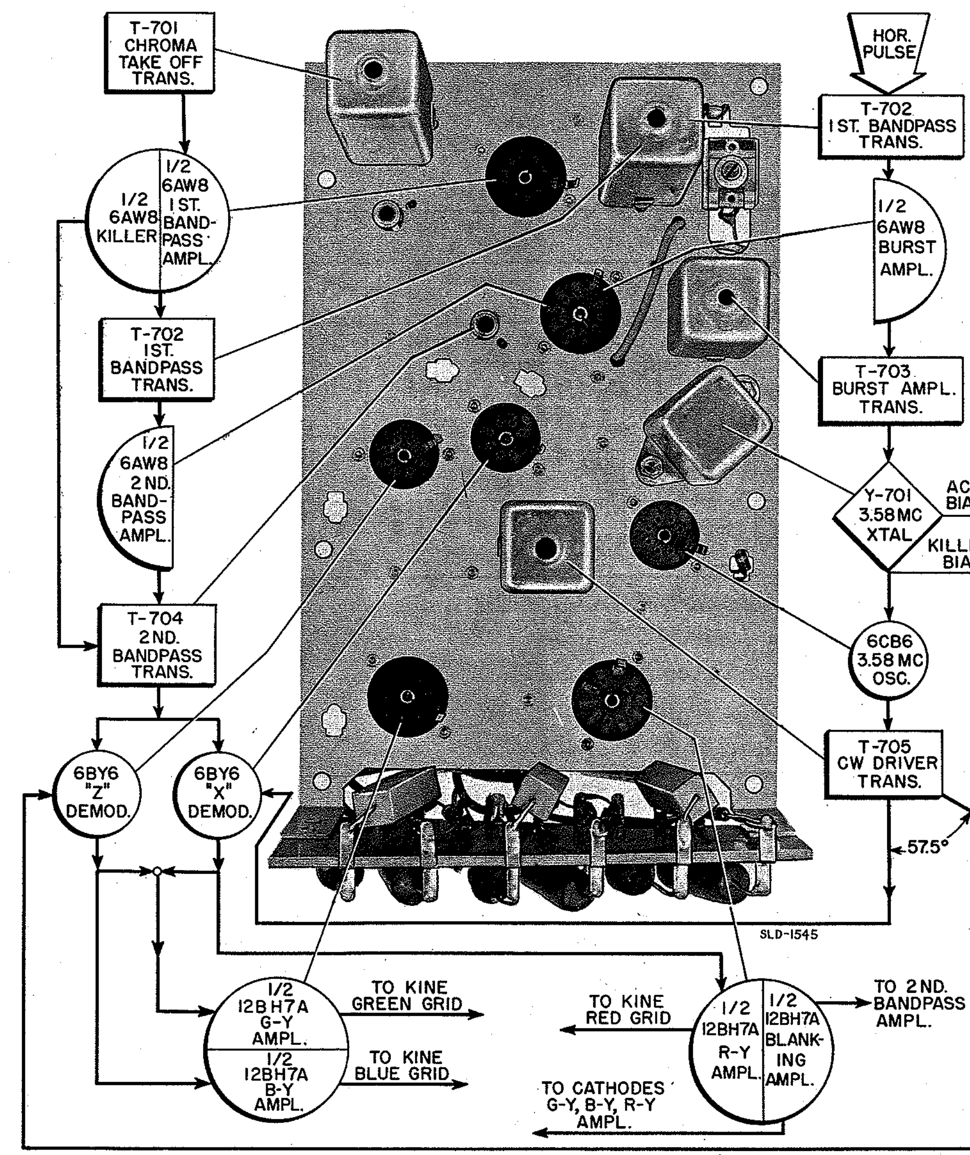


Fig. 27—Chrominance and Color Synchronization Circuits—Mounting Plate MP-700—CTC5N Chassis.

DEFLECTION SYNCHRONIZATION—AGC

The sync stages in both the CTC5 and CTC5N chassis consist of a 1st sync amplifier and a sync output stage. Since AGC is closely related to sync it is also discussed here in conjunction with the sync circuits.

The sync amplifiers and AGC circuits in both the CTC5 and CTC5N use the same circuits and are mounted in the same relative positions on the printed circuit boards in each chassis.

The 1st sync amplifier uses the triode section of a type 6U8 tube and, together with the AGC amplifier stage, which uses the pentode section of the same tube, is mounted on the sound I-F and audio printed circuit board PW-200. The location of this tube on the board can be seen by referring to figures 12 and 13, page 13.

The CTC5N chassis includes, in addition to the sync stages, a noise inverter stage which may be considered to be in the sync circuit. The noise inverter circuit is mounted on the printed circuit board, PW-400.

The sync output stage uses one of the triode sections of the 6CG7 vertical oscillator tube and is mounted on the vertical sync printed circuit board, PW-500.

Composite video signal is fed to the grid of the 1st sync amplifier as shown in the schematic diagrams, figures 28 and 29.

An RC network in the grid circuit of the 1st sync stage has a long time constant and charges to the amplitude of the horizontal blanking pedestals. Sync is separated from the video information by having the 1st sync stage operate normally at cut-off and, when the composite sync pulses appear on the grid, the tube conducts.

The sync output stage has, in its output circuit, a differentiating network which separates the horizontal pulses from the composite sync and an integrating network to separate the vertical sync pulses.

Horizontal sync is fed to the synchroguide horizontal oscillator and control circuit and vertical sync is fed to the vertical oscillator.

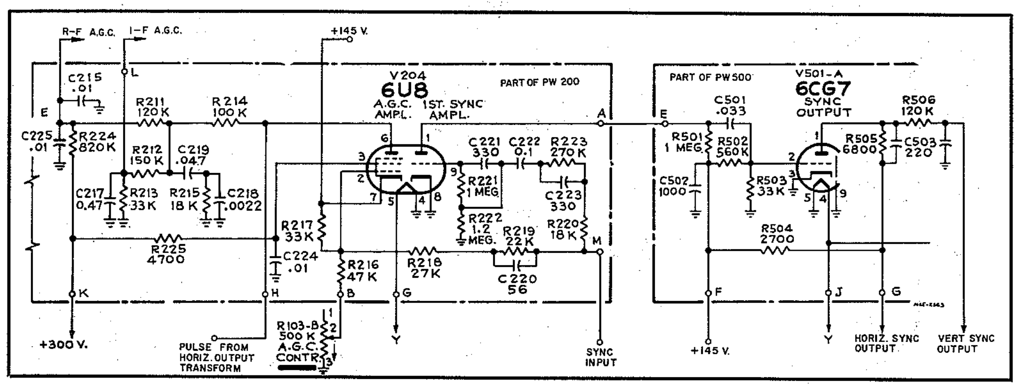


Fig. 28—Schematic Diagram—AGC and Sync Amplifier Circuits—CTC5.

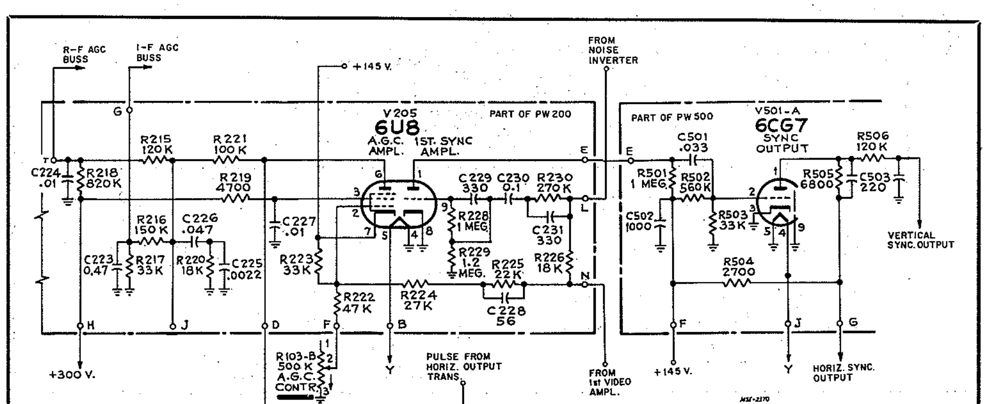


Fig. 29—Schematic Diagram—AGC and Sync Amplifier Circuits—CTC5N.

AGC

The AGC amplifier, using the pentode section of a type 6U8, receives composite video at its grid through a frequency selective network. The fixed bias operating condition for the tube is adjusted by the AGC potentiometer, R-103B, shown in figures 28 and 29.

The plate of the tube is supplied with voltage derived from a pulse from the horizontal output transformer.

During the time a horizontal pulse is present at the plate, the positive tips of sync at the grid cause the tube to conduct and produce a rectified negative DC voltage at the plate. This voltage is filtered and used for a bias source for the R-F and I-F amplifier stages.

Since the output of the AGC amplifier is proportional to the amplitude of sync tips at the grid input, the R-F and I-F bias, and thus the gain of these stages, is varied in proportion to the sync level received. If the received sync level drops, the AGC amplifier conducts less, and less bias is applied to the R-F and I-F stages and increases the gain. If the level of received sync increases, the AGC stage provides greater bias and the gain of the R-F and I-F stages decreases.

Noise Inverter (CTC5N Only)

The CTC5N chassis includes a noise inverter stage in the circuit location of the horizontal blanking amplifier used in the CTC5 (printed-circuit board PW-400).

The noise inverter circuit improves stability of sync under impulse noise conditions.

A simplified diagram of the operation of this circuit is shown in figure 30.

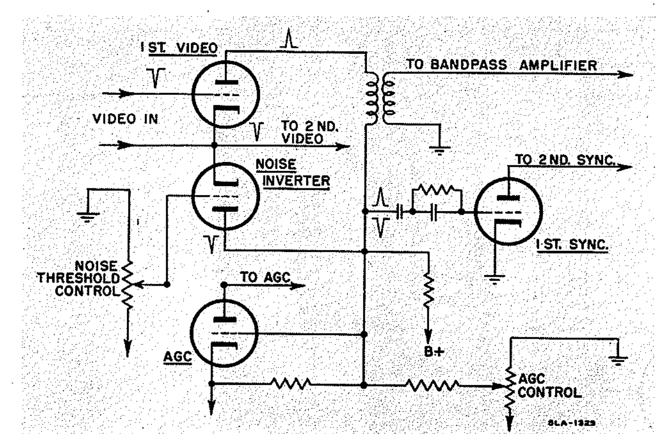


Fig. 30—Simplified Schematic Diagram—Noise Inverter Circuits—CTC5N.

Composite video signal from the second detector is fed to the grid and cathode of the 1st video amplifier and to the cathode of the noise inverter stage. During noise-free signal conditions, the noise inverter stage is cut-off and does not operate.

Noise appearing in the video signal will appear at the plate of the 1st video stage and, in opposite polarity, at the cathode of the noise inverter. The noise inverter is held at cut-off by adjusting its grid bias, with the noise threshold control R-170B (see figure 31), so that conduction occurs only when a noise pulse higher than tips of sync is present in the signal.

When the tube conducts, due to a noise pulse, the amplified noise appears at the plate output which is also the grid input to the 1st sync amplifier.

Since at the same time the pulse is negative at the grid of the 1st sync amplifier, the same noise pulse is present in opposite polarity (arriving from the plate circuit of the 1st video amplifier through the primary of the chroma take-off transformer where sync and AGC are removed from the composite video signal), cancellation of the noise pulse takes place and noise does not appear in the sync output.

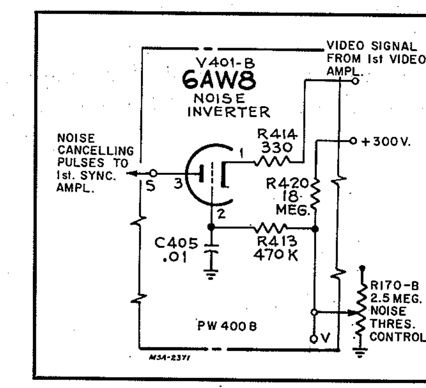


Fig. 31—Schematic Diagram—Noise Inverter Circuit.

VERTICAL DEFLECTION

The vertical deflection stages in both the CTC5 and the CTC5N chassis are identical and consist of a vertical oscillator, one of the triode sections of a type 6CG7 tube, and an output stage which uses a 6AQ5. A schematic diagram of the vertical deflection stages is shown in figure 32.

The vertical circuits are mounted with the sync output stage on printed circuit board PW-500.

The vertical oscillator plate voltage is supplied from the "B" boost voltage source so that picture height will track with changes in brightness.

The controls in the vertical circuit; height, linearity and vertical hold, are accessible from the front of the front of the receiver.

The vertical output transformer has a bifilar secondary winding and three additional secondary windings which supply vertical convergence voltages to the convergence circuits.

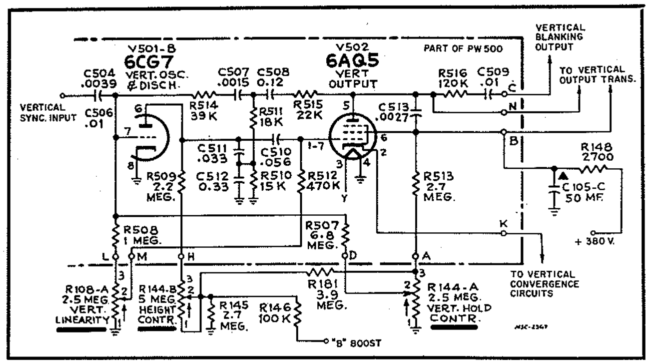


Fig. 32—Schematic Diagram—Vertical Oscillator and Output Circuits.

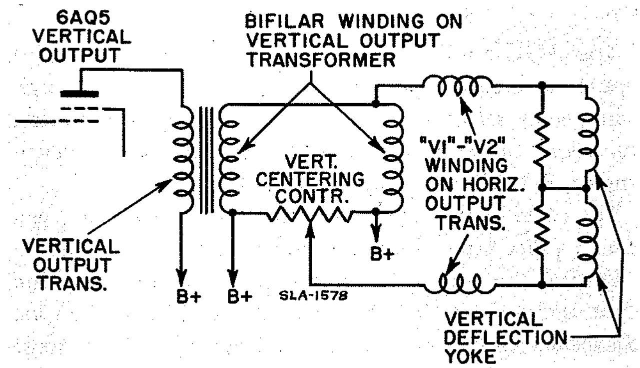


Fig. 33—Simplified Schematic Diagram—Vertical Output Circuit (Partial).

A vertical isolation winding is added to the horizontal output transformer. Vertical deflection currents are fed to the vertical deflection coils in the yoke through this winding and the vertical yoke operates at a horizontal pulse potential.

Vertical centering is accomplished by adjusting the 40-ohm vertical centering control. This control, shown in the simplified schematic diagram figure 33, is part of a bridge network. When the movable arm of the potentiometer is at its electrical center, the bridge is balanced and the raster is properly centered.

Figure 34 shows the vertical sync printed circuit board, PW-500.

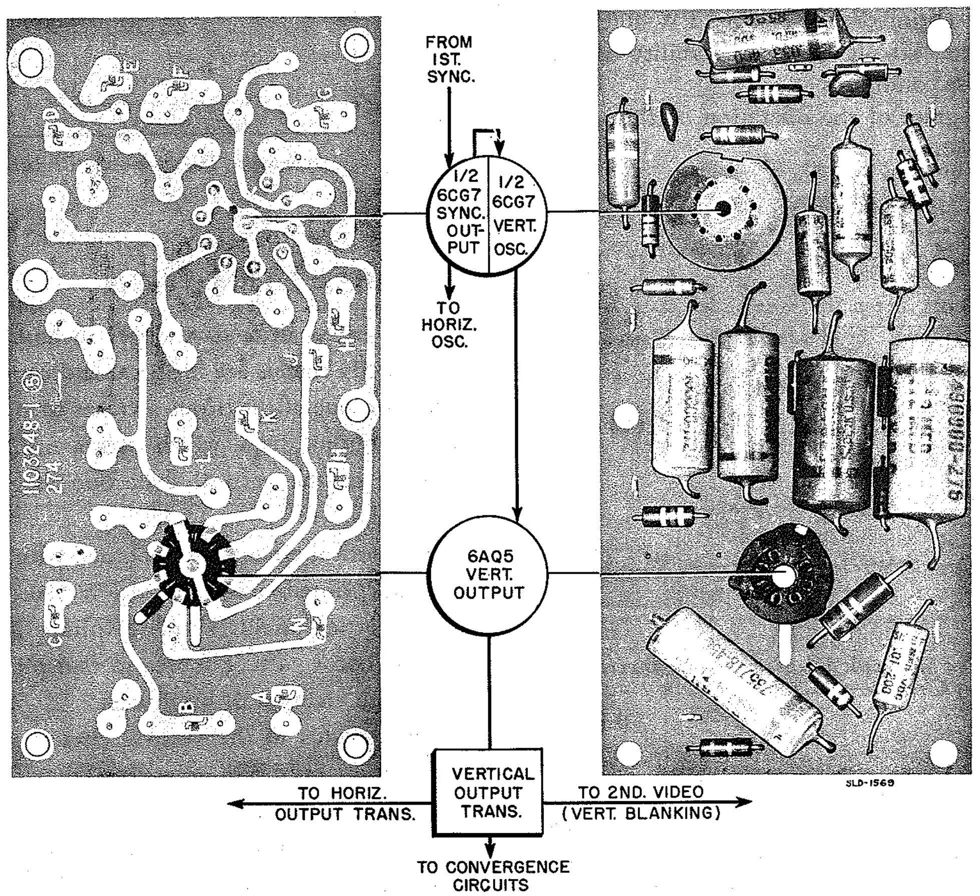


Fig. 34—Sync Output, Vertical Oscillator and Output Circuits—Printed Circuit Board PW-500.

HORIZONTAL DEFLECTION AND HIGH VOLTAGE

The horizontal deflection and high-voltage sections of the CTC5 and CTC5N chassis are nearly identical. These circuits include the horizontal oscillator and control stage, horizontal sweep output, a damper, the high voltage rectifier, a focus voltage rectifier, and a high-voltage regulator.

In addition to the function of supplying high voltage and focus voltage for the kinescope, the horizontal deflection circuits also provide control voltages for other stages in the receiver. These stages include the 2nd Video amplifier (brightness control), AGC, Horizontal Blanking, Burst Keyer, DC (static) convergence, Horizontal dynamic convergence, B-plus boost, and horizontal and vertical deflection.

Horizontal Oscillator and Control

The horizontal oscillator and control stage uses a type 6CG7 tube in the well-known "synchroguide" circuit and is mounted on an individual printed circuit board PW-600. Schematic diagrams of this circuit are shown in figures 35 and 36. The horizontal frequency control is used as the Horizontal Hold control and is located in the customer control box at the front of the receiver.

A stabilizing pulse from the horizontal output transformer AGC line is coupled to the horizontal sync input to this circuit in the CTC5N chassis as shown in figure 36.

Figure 37 shows the printed circuit board PW-600.

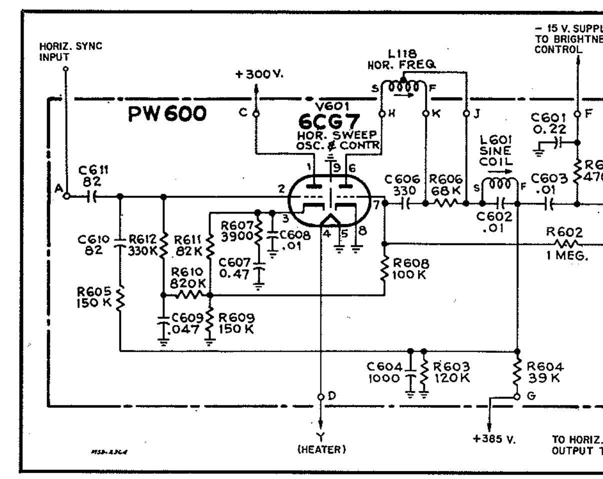


Fig. 35—Schematic Diagram—Horizontal Oscillator and Control Circuit—CTC5.

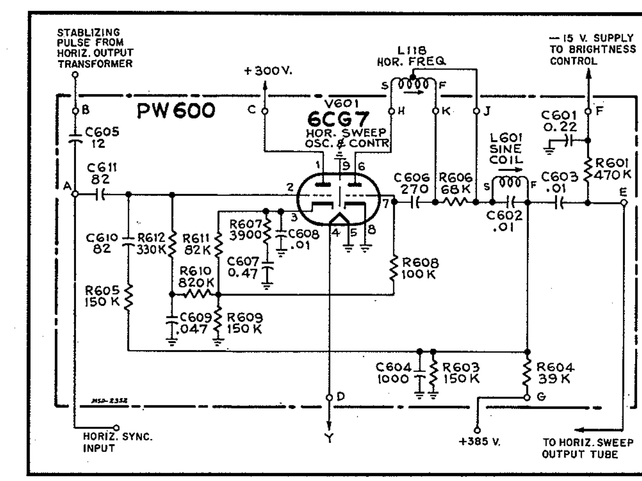


Fig. 36—Schematic Diagram—Horizontal Oscillator and Control Circuit—CTC5N.

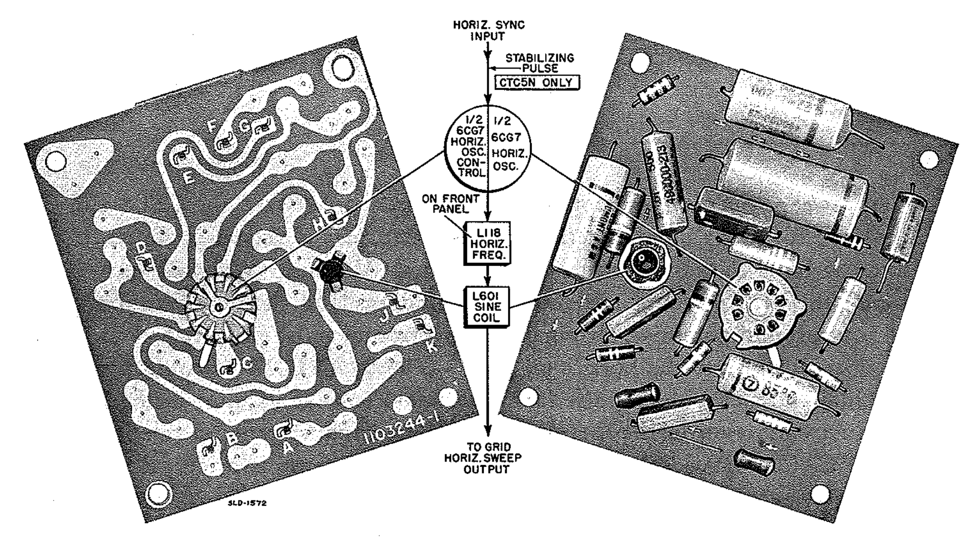


Fig. 37—Horizontal Oscillator and Control Circuit—Printed Circuit Board PW-600.

Horizontal Output—High Voltage

The high voltage section of the chassis is mounted on the chassis proper and does not use the printed circuit type construction.

A type 6CB5A horizontal sweep output tube is driven by the horizontal oscillator. The grid circuit of the 6CB5A is used as the supply source for the brightness control which is in the grid circuit of the 2nd Video Amplifier.

As shown in the schematic diagram, figure 38, the cathode circuit of the horizontal output tube is used as the supply source for the DC (static) convergence controls. The horizontal sweep output transformer, T-103, provides a pulse source for many other functions in the receiver aside from the high voltage function.

One winding, designated the "U" winding has four terminals. Terminal "G" is at ground potential, terminal "U1" provides a positive 35 volt pulse to the horizontal convergence circuits. Terminal "U2" provides a pulse for horizontal blanking and burst extraction in the CTC5N chassis; burst keying in the CTC5 chassis.

Terminal "U3" provides a pulse for horizontal blanking in the CTC5 chassis; burst keying in the CTC5N chassis. A schematic diagram showing the connection differences between the CTC5 and CTC5N high voltage transformer is shown in figure 39. The windings designated V1 and V2 are vertical deflection isolation windings and permit operation of the vertical yoke at horizontal pulse potential.

The 21AXP22A tricolor kinescope is operated with 20,000 volts at its ultor in the 700 series receivers.

The high voltage, developed by the 6CB5A and the high voltage transformer, is rectified by a type 3A3 and regulated to maintain 20,000 volts under varying brightness conditions by the shunt regulator circuit using a type 6BK4 tube.

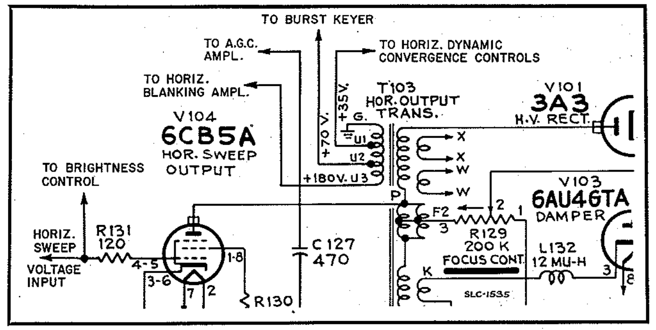


Fig. 39—Schematic Diagram—"U" Winding on High Voltage Transformer—CTC5 Chassis.

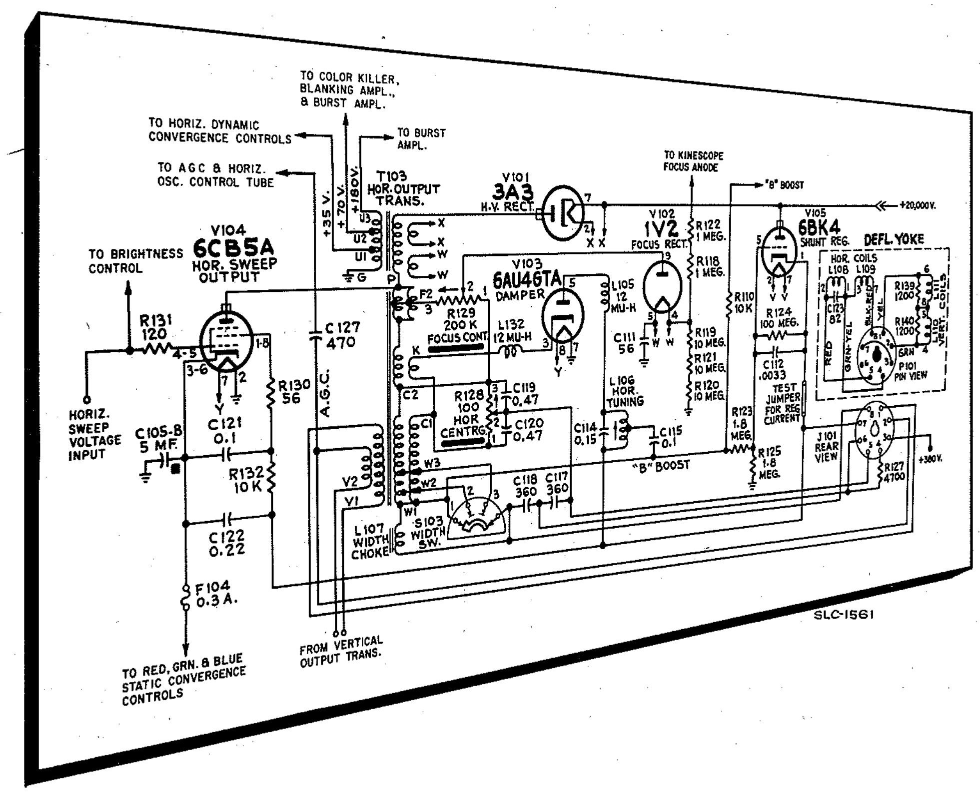


Fig. 38—Schematic Diagram—Horizontal Output and High Voltage Circuits—CTC5N.

The regulator operates as a constant voltage device. In operation, the cathode of the 6BK4 is supplied with 385 volts DC referenced to ground potential. The grid drive is supplied from B-plus boost which is dropped by resistors R-123 and R-125 to place the grid at the proper operating potential with respect to the cathode.

Variation of picture content from a dark to a light picture causes a change in the kinescope beam-current demand and a change in B-plus boost. Since the B-plus boost is the grid supply voltage for the 6BK4, any variation in B-plus boost would result in a change in conduction of the tube. The plate current of the 6BK4 therefore varies, and since the plate is in shunt with the high voltage, the effect is to have a constant load on the high voltage output and thus maintain 20,000 volts at the kinescope ultor regardless of picture content.

A test point for measuring the regulator current has been included in the cathode circuit of the regulator tube. With 20,000 volts measured at the ultor of the kinescope, the current, measured in series with the cathode (jumper temporarily removed), should be 800 microamperes (0.8 milliampere).

Focus voltage for the kinescope focus anode is rectified by the 1V2 focus rectifier. Focus is controlled by varying the amplitude of the pulse applied to the plate of this tube, by R-129, the focus control.

A type 6AU4GTA damper tube completes the tube complement of the horizontal sweep output section of the chassis. The horizontal tuning coil L-106, permits adjustment for optimum linearity of yoke deflection current. Adjusting the slug of this coil until minimum plate current is obtained in the 6CB5A horizontal output tube results in optimum linearity and maximum efficiency of the horizontal output circuits.

Figure 40 is a simplified diagram showing the circuits whose functions are dependent upon proper operation of the horizontal sweep output circuits.

HORIZONTAL BLANKING

Horizontal retrace blanking is incorporated in both the CTC5 and CTC5N chassis.

Horizontal retrace blanking is necessary because burst is demodulated during horizontal retrace time due to its position immediately following the horizontal sync pulse. If the burst signal were permitted to appear at the kinescope grids, a yellow stripe would appear on the screen of the kinescope during the horizontal blanking interval.

In the CTC5 chassis the horizontal blanking circuit is located on the video printed circuit board, PW-400.

Horizontal blanking is accomplished by coupling a pulse from the horizontal output transformer to the grid of the horizontal blanking amplifier, the triode section of a type 6AW8.

The amplified blanking pulse is applied to the screen grid of the 2nd video amplifier. Since the pulse is of negative polarity at the plate of the blanking amplifier and at the screen of the 2nd video amplifier, the 2nd video amplifier is cut-off during horizontal blanking time, its plate voltage rises and causes the resultant positive pulse to appear at the kinescope cathodes, thus blanking the kinescope during horizontal retrace time.

A schematic diagram of the horizontal blanking amplifier used in the CTC5 chassis is shown in figure 41.

In the CTC5N chassis, horizontal retrace blanking is accomplished by applying the amplified horizontal pulse to the cathode of the 2nd bandpass amplifier, thus causing the demodulators to become inoperative during horizontal retrace time. In addition, the pulse is coupled to the cathodes of the three matrix amplifiers which cuts-off these tubes and blanks the kinescope. The horizontal blanking circuit for the CTC5N chassis is shown in figure 23, page 19.

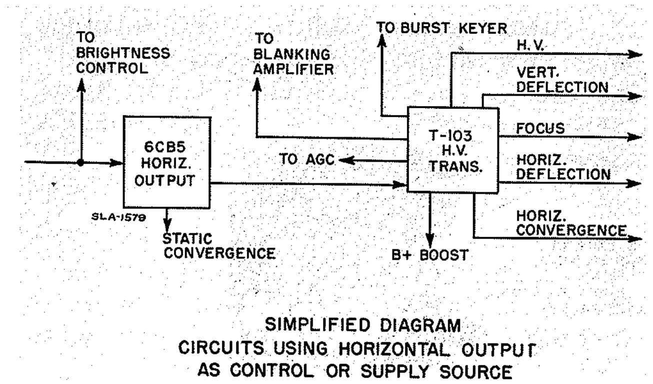


Fig. 40—Simplified Diagram—Circuits Controlled by Horizontal Sweep.

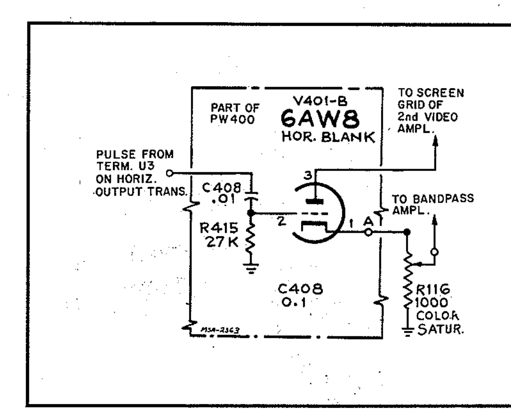


Fig. 41—Schematic Diagram—Horizontal Blanking Amplifier—CTC5.

TRICOLOR KINESCOPE AND ACCESSORIES

The 700 series color television receivers use the type 21AXP22A tricolor kinescope to reproduce both black-and-white and color pictures having an area of approximately 255 square inches.

The electron-gun structure of the 21AXP22A is shown in figure 42.

The 21AXP22A differs slightly from a 21AXP22, used in previous color receivers, by the inclusion of an internal resistive coating on the neck section of the tube. This resistance, approximately 50,000 ohms, prevents damage to the internal gun structure and associated external components in the event of a momentary high voltage arc. A potential of 20,000 volts is used at the ultor of the kinescope in the 700 series receivers.

One of the new features in the 700 series receivers is the use of the coated polyethylene plastic covering the metal shell portion of the kinescope.

This structure, known as the "boot," and shown in figure 43, serves five purposes. It is a partial mechanical mount for the kinescope; a mechanical mount for the deflection yoke; a horizontal frequency radiation shield; the high voltage capacitor; and a high voltage protective shield.

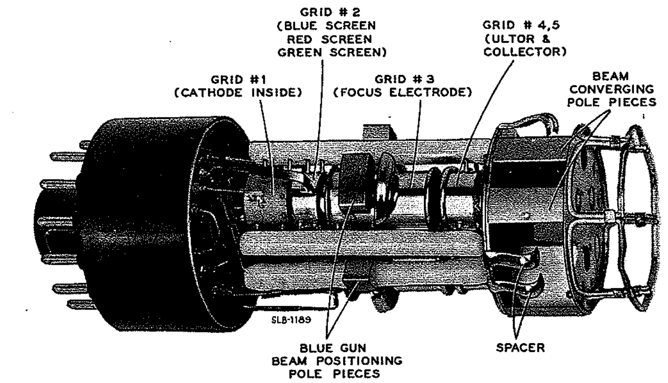


Fig. 42—21AXP22A Tricolor Kinescope Electron—Gun Assembly.

The boot covers the metal portion of the kinescope. The exterior surface of the boot is coated with a conductive covering which is grounded.

In serving as the high voltage capacitor, the external coating of the boot serves as one plate of the capacitor and the metal surface of the kinescope is the other plate. A capacitance of approximately 2200 mmfd. is formed in this manner.

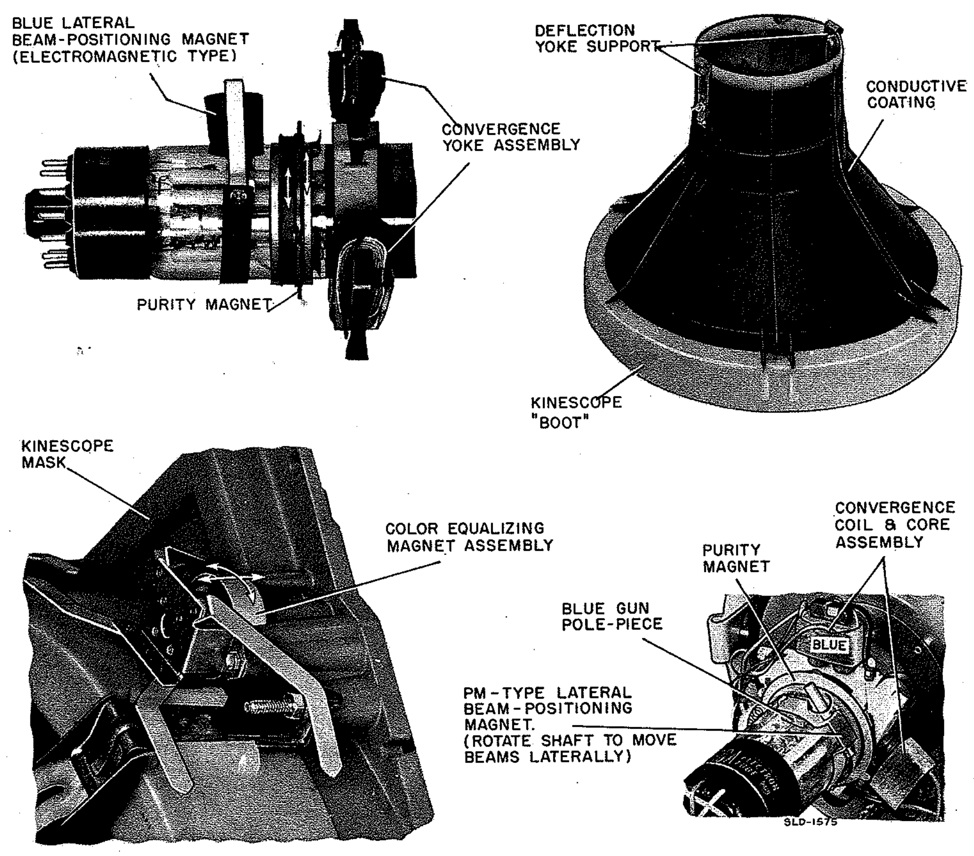


Fig. 43—Kinescope Accessories.

Purity Magnet

A "purity" magnet assembly, consisting of two ring-type magnets, is installed over the electron gun assembly in the base end of the tube. Purity, in color television, is achieved when the beams from each of the three electron guns pass through the shadow mask and excite only the centers of their respective phosphor dots on the kinescope screen.

Rotating one, or both of the magnets in the assembly aids in obtaining the condition of purity. The position of the purity magnet is shown in figure 43.

The visible indication of purity is, with only the respective kinescope screen controls at maximum, individually, a red, green, or blue screen with no color contamination appearing. Thus, red purity would be achieved when only the red phosphor dots on the face of the kinescope are excited by the beam from the red gun. Green, and blue purity would be achieved when only green and only blue phosphor dots are excited by only their respective beams. Positioning of the deflection yoke and adjustment of the color equalizing magnets also aid in obtaining purity.

Blue Lateral Magnet

Another magnetically operated function in the kinescope is the lateral (sideways) movement of the beam from the electron gun which excites only the blue phosphor dots. Lateral control of this beam is provided to facilitate convergence adjustments.

Two types of lateral control are provided. One type, shown in position over the blue gun pole-piece in figure 43 is electromagnetically operated. The DC source for the electromagnet is the cathode circuit of the 6CB5A horizontal output tube.

Lateral movement of the blue beam in receivers equipped with this type magnet is effected by a control on the front apron of the chassis. This control is accessible from the front of the receiver when the customer control box cover is removed.

The other type of lateral beam control is a permanent magnet which is installed between the blue gun pole-piece and the red gun as shown in figure 43.

This type lateral control magnet is rotated in its holder and its magnetic field affects all three beams.

When the magnet is rotated, the blue beam will move laterally in one direction and the red and green beams will move laterally together in the other direction. This is a distinct aid in performing the convergence adjustments.

Color Equalizer Magnets

The three beams in the 21AXP22A tricolor kinescope may be affected by magnetic fields external to the receiver. If not compensated for, these fields can result in color impurity in the picture.

Six circular permanent magnets are mounted about the periphery of the kinescope face.

Each of the magnets can be rotated to move toward, or away from, the face of the kinescope rim so that a localized magnetic field of variable intensity (depending upon the position of the magnet with respect to the kinescope) is available.

The localized magnetic field neutralizes stray magnetic fields near the edges of the kinescope which may deflect the electron beams from their deflection paths and cause color impurity at the edges of the picture. One of the six color equalizer magnets is shown in figure 43.

Convergence

The three electron beams must converge at every aperture in the shadow mask. If this is not accomplished, the beams will excite improper phosphors and result in color fringing, or misregistration, (called misconvergence).

In the 700 series receivers the beams are caused to converge at the center of the screen by the mechanical alignment of the electron guns in the kinescope and electromagnetically controlled positioning of the beams with respect to the axis of the kinescope.

This is called center convergence, or static convergence, or sometimes, DC convergence.

Static convergence is maintained by controlling the intensity of magnetic field produced by an electromagnet placed above the respective convergence pole-pieces in the kinescope gun structure. DC voltage for the static convergence electromagnets is obtained from the same source as the DC blue lateral magnet, the voltage drop across the cathode circuit of the 6CB5A horizontal output tube.

Currents derived from the horizontal and vertical sweep output stages of the receiver are applied to electromagnets which are positioned above the openings of the beam converging pole-pieces in the kinescope. Thus the beams are affected by these magnetic fields in synchronization with the scanning.

A simplified schematic diagram of the convergence circuits is shown in figure 44.

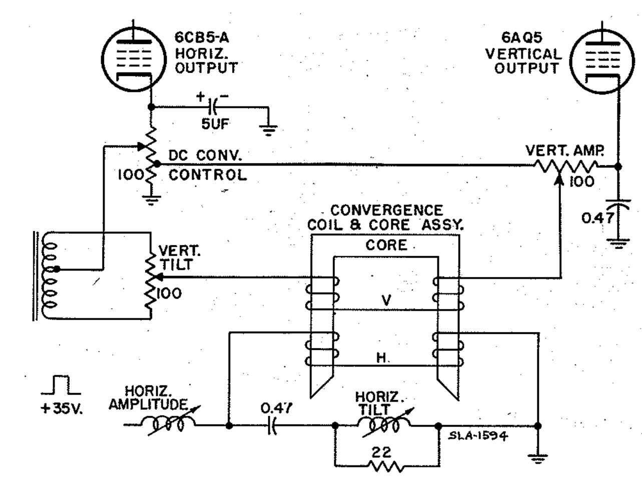


Fig. 44—Simplified Schematic Diagram Convergence Circuits.

When the current through the electromagnets is regulated so that the beams are caused to go through the proper holes in the aperture-mask in synchronization with scanning, dynamic convergence is achieved. These currents are regulated by the dynamic convergence controls.

The assembly, consisting of the static and dynamic convergence coils and cores, is placed on the neck of the kinescope as shown in figure 43 and is called the convergence yoke.

Figures 45 and 46 show, respectively, the convergence circuits used in the models using the DC-type blue-lateral magnet and the PM-type lateral beam-positioning magnet.

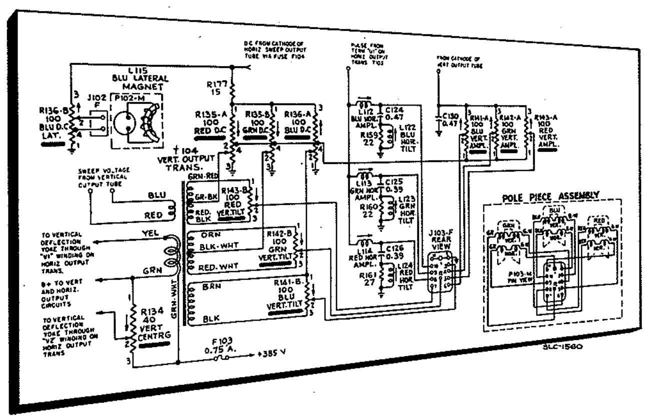


Fig. 45 Schematic Diagram—Convergence Circuits—EM-Type Blue Lateral Magnet.

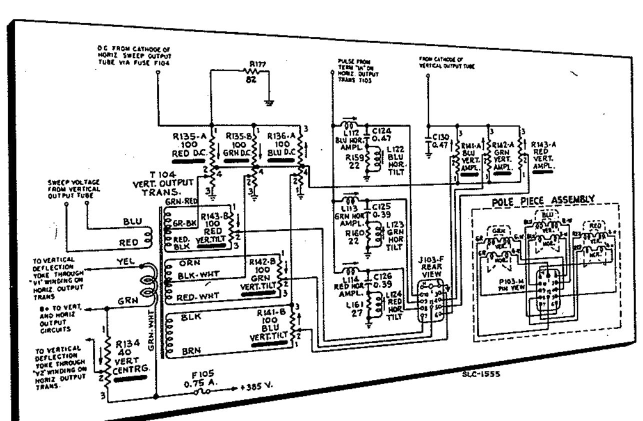


Fig. 46—Schematic Diagram—Convergence Circuits—PM-Type Lateral Beam-Positioning Magnet.

Kinescope Controls

The 21AXP22A tricolor kinescope has three different sets of phosphors deposited on the viewing screen. Each of the sets of phosphors, because of the difference in phosphor efficiencies, requires a different value of excitation to produce the same amount of light output.

When showing a black-and-white picture, unequal drive must be supplied to each of the kinescope cathodes so that for a white portion of the picture the red, green and blue phosphors will be excited to produce white and, for a grey portion of the picture, the light output from the red, the green and the blue phosphors must drop equally in intensity to produce grey. This difference in drive to the cathodes is accomplished by a voltage divider network in the plate circuit of the 2nd Video Amplifier.

In order to set-up the kinescope for the proper values of red, green, and blue light output to produce a white raster on the kinescope, the output of each gun is controlled by the voltage applied to the screen grid of each gun. These individual controls are the red, green and blue screen controls R-108B, R-109B and R-109A shown in figures 47 and 48.

When adjusting the receiver to produce a white raster having the correct color temperature these are the controls used.

The red, green and blue background controls R-136B, R-117B and R-117A, serve to adjust the overall color balance to produce a black-and-white picture without an overall color-caste in either the highlight or lowlight areas of the picture.

The screen and the background controls are mounted on the front apron of the chassis and are accessible at the front of the receiver after removal of the customer control box cover.

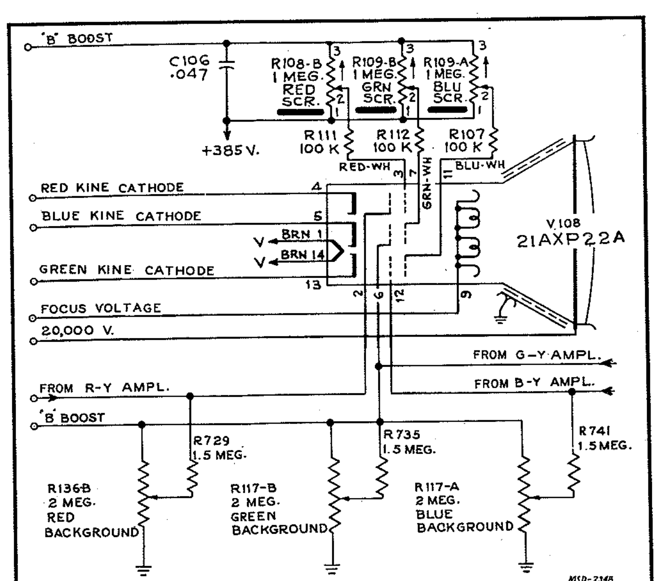


Fig. 47—Schematic Diagram—Kinescope Circuit and Controls—CTC5N.

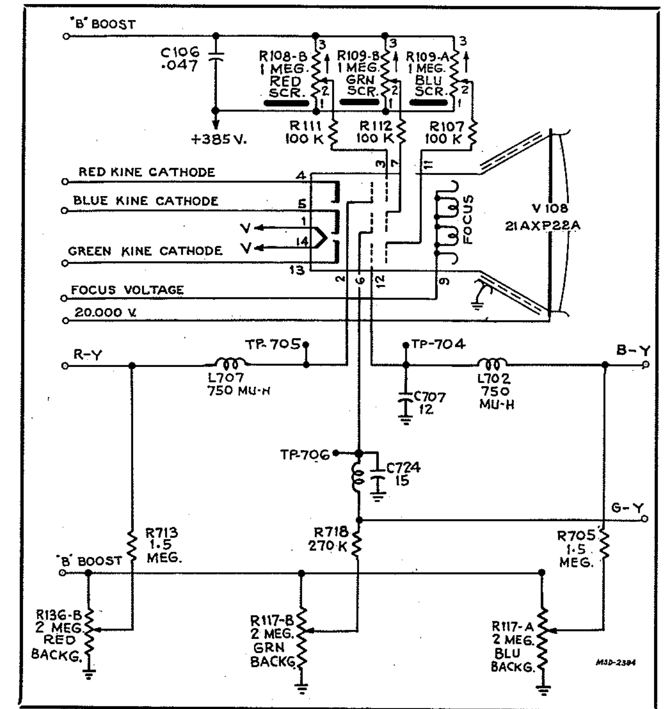


Fig. 48—Schematic Diagram—Kinescope Circuit and Controls—CTC5.

LOW VOLTAGE POWER SUPPLY

The low voltage power supply provides the 385-volt and 300-volt B-plus sources in the receiver and the heater current for all tubes except the high-voltage and focus rectifiers.

The full-wave rectifier circuit uses two type 5U4GB tubes in parallel. This insures full-wave rectification in the event of failure of one of the tubes.

Power supply components are protected by a 2.0 ampere fuse of the wired-in type connected between the rectifier output and the input filter capacitor.

Two separate heater windings are used. One winding supplies heater voltage for all tubes except the kinescope and shunt regulator. This winding is fused with a length of #22 magnet wire covered with flexible glass sleeving. The other winding supplies the kinescope and the 6BK4 shunt regulator. This winding is operated at 300 volts DC above ground.

A schematic diagram of the low voltage power supplies for the CTC5 and CTC5N chassis are shown in figure 49.

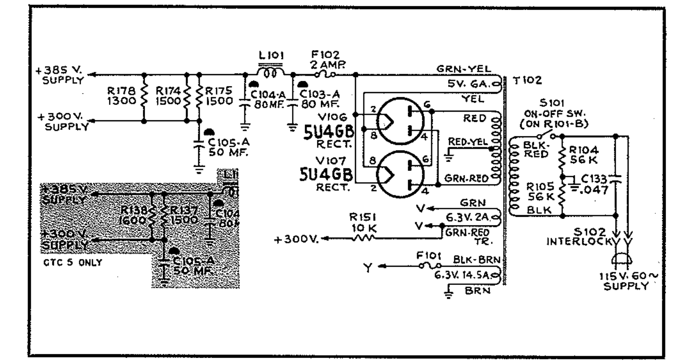


Fig. 49—Schematic Diagram—Low-Voltage Power Supply.

The .047 mfd. capacitor connected across the terminals of the 117 volt AC input interlock attenuates horizontal deflection frequencies which may radiate from the power cord.

Two 56,000-ohm resistors, connected between ground and each side of the AC line at the interlock terminals, provide a leakage path to ground for any electrostatic charges that may be present on the chassis.

SUMMARY

The "Technical Features" section of this booklet has been written to provide the service technician with a working knowledge of the circuits, and their relationship to each other, in the RCA Victor 700 Series color television receivers.

It is the constant aim of the RCA Victor Television Service Clinic to present facts which will be of *practical* value to the service technician. Thus, mathematical concepts, vector analyses and complex derivations of circuitry have purposely been omitted from this booklet.

It is assumed that technicians attending the Television Service Clinic meetings have a basic knowledge of color television theory and of the terms used when discussing color television receivers.

Basic theory of operation of circuits peculiar to color television receivers and detailed information concerning the tricolor kinescope and its accessories is included in previous Television Service Clinic booklets and other publications.

The following chapters of this booklet contain detailed, practical information to enable the service technician to quickly and efficiently set-up and service the 700 series color television receivers.

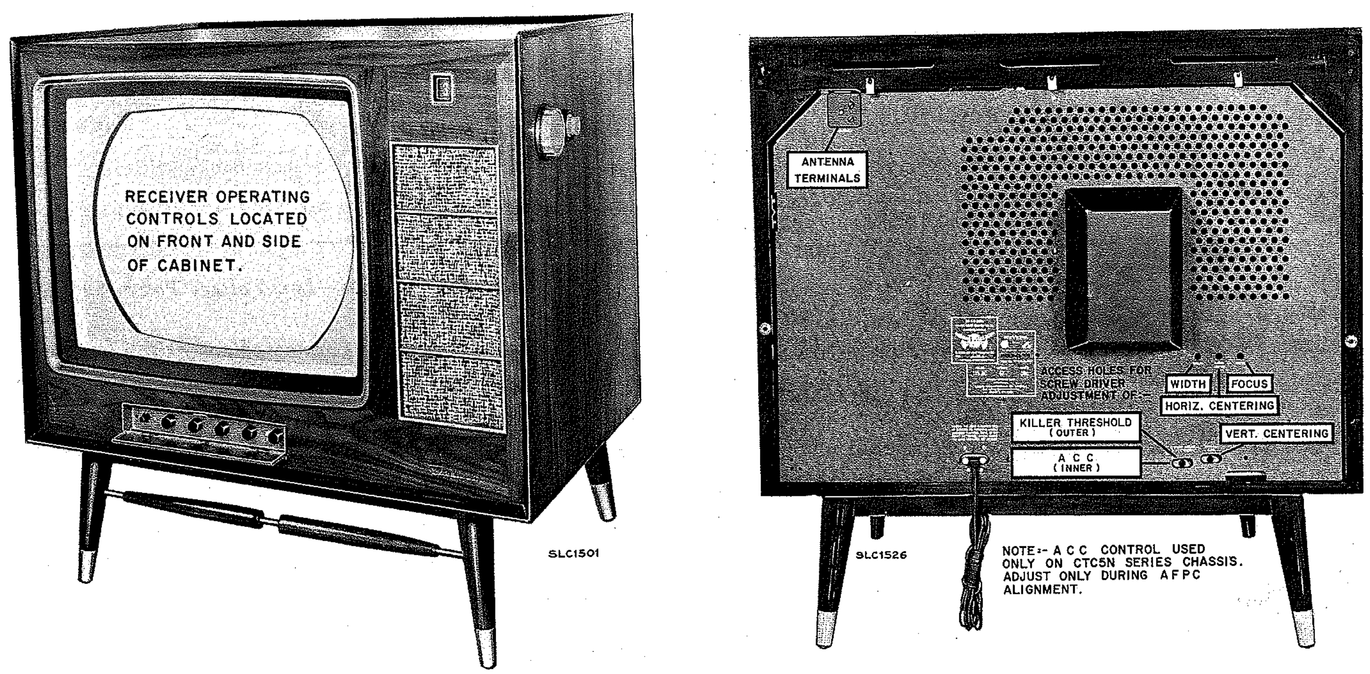


Fig. 50—Front and Rear Views of "Deluxe" Model 700 Series Color Television Receiver—CTC5N Chassis.

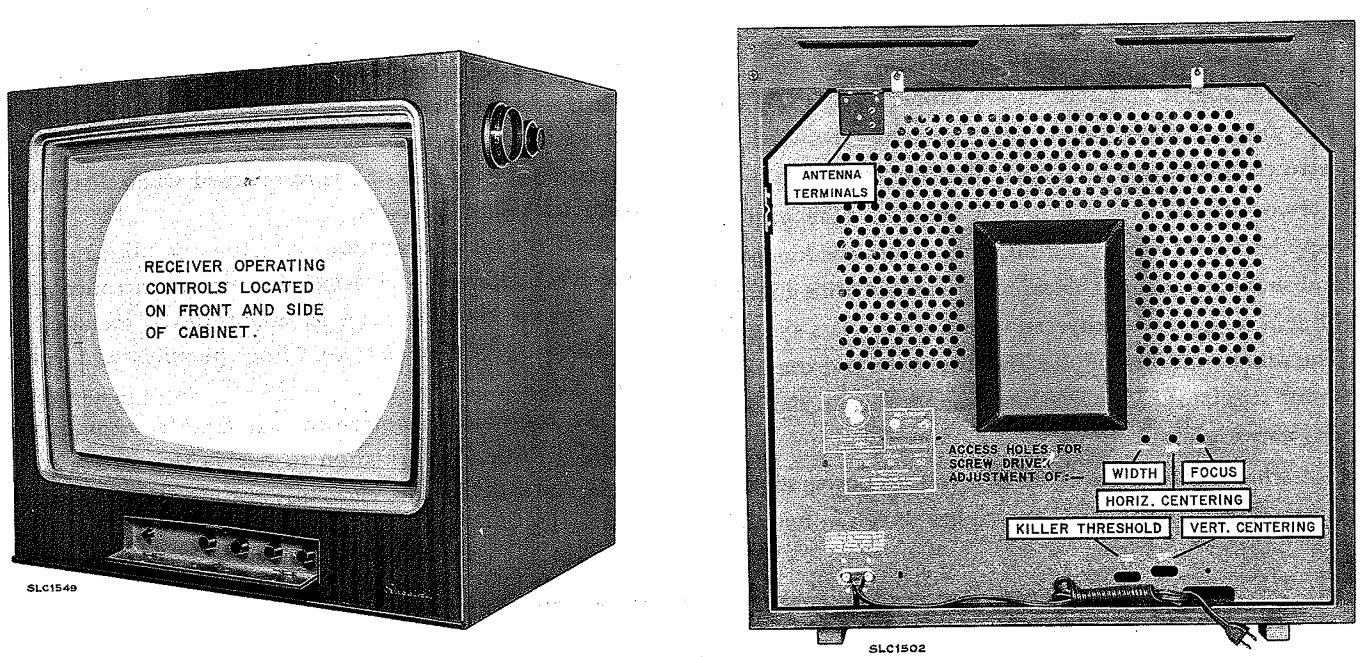


Fig. 51—Front and Rear Views of "Special" Model—700 Series Color Television Receiver—CTC5 Chassis.

RECEIVER SET-UP PROCEDURE

RECEIVER SET-UP CONSIDERATIONS

The receiver must first be set-up for proper black-and-white reception. Conventional adjustments of height, vertical linearity, width, focus, centering and operation of the horizontal hold control are required. If the receiver is overloading it will be necessary to adjust the AGC control and, on the CTC5N series receivers, the noise threshold control.

Since the color receivers incorporate a three-beam tricolor kinescope the operation of the kinescope must be checked for proper convergence, purity and color temperature. These adjustments must be correct before good black-and-white pictures, free of color fringing, can be produced on the screen of the kinescope. The application of techniques involved in making kinescope circuit adjustments mark the major difference between the set-up procedure for black-and-white television and color television receivers.

EQUIPMENT REQUIRED

The following equipment is desirable in performing certain set-up adjustments on the color receivers.

- Vacuum-Tube Voltmeter (RCA "VoltOhmyst" WV-98A or equivalent)
- Dot-Bar Generator (RCA WR-36A or equivalent)
- Degaussing Coil
- Portable Mirror
- Color-Bar Generator (RCA WR-61A or equivalent)
- Kinescope Control-Grid Switch

For additional information regarding the use of this equipment, see pages 43 to 46.

CHASSIS SET-UP ADJUSTMENTS

Connect the antenna transmission line to the receiver antenna terminals and check the operation of the receiver. It should be possible to lock-in a picture by manipulating the customer operating controls.

If the picture appears to be overloading or does not hold sync, the AGC, Noise Threshold (on Deluxe models) and Horizontal Oscillator adjustments should be checked.

AGC and Noise Threshold Adjustments

Receivers using the CTC5 chassis do not incorporate a Noise Threshold control. When an AGC adjustment is required on these receivers, proceed as follows:

1. Remove the knob from the Contrast control to gain access to the AGC control. See figure 53 for control location.
2. Select the channel with the strongest signal and turn the AGC control clockwise until a picture of greatest contrast without overload is received and the picture can be synchronized.
3. Replace the knob on the Contrast control.

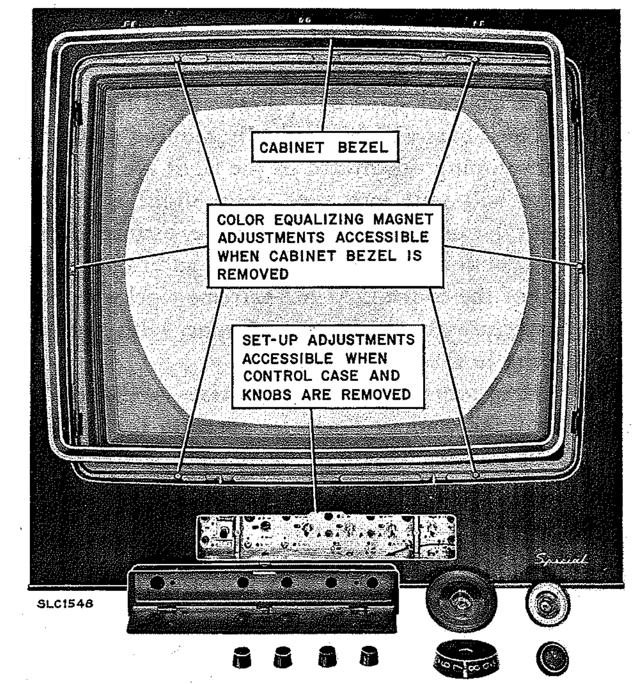


Fig. 52—Set-Up Control Accessibility.

Receivers using the CTC5N chassis incorporate a Noise Threshold control. When an AGC adjustment is required on these receivers, proceed as follows:

1. Remove the knob from the Contrast and Tone controls.

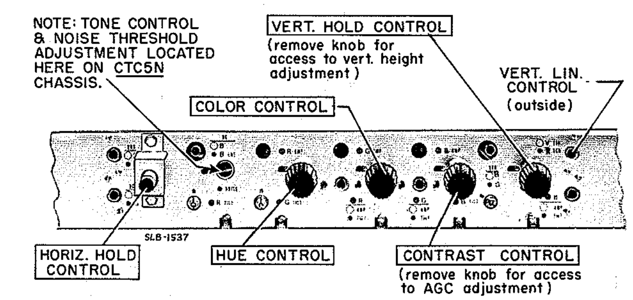


Fig. 53—Location of Front Panel Set-Up Controls.

2. Set the Noise Threshold control fully counter-clockwise.
3. Select the channel with the strongest signal to be received and adjust the AGC control clockwise until a picture having greatest contrast without overload is obtained.
4. Switch the receiver to the weakest channel to be received.
5. Turn the Noise Threshold control clockwise until the best signal-to-noise ratio is obtained.
6. Select the strongest signal once again and make certain that the adjustment of the Noise Threshold control did not cause overload. The Noise Threshold control should be set for best signal-to-noise ratio without causing overload on strong signals.
7. Replace the Contrast and Tone control knobs.

Check of Horizontal Hold Control

Turn the Horizontal Hold control to the extreme counter-clockwise position. The picture should be out of sync with multiple bars slanting to the right.

Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when 1 to 3 bars sloping downward to the right are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. The picture should remain in sync for a minimum of three additional clockwise turns of the control. At the extreme clockwise position, the picture should be out of sync, with multiple bars slanting to the left.

Rotate the control counter-clockwise to the pull-in point. Continue counter-clockwise rotation for two full turns from pull-in. This will be the proper setting of the control.

Width and Horizontal Centering Adjustments

Adjust the Width Switch and Horizontal Centering Control which are located on the rear of the high voltage compartment, shown in figures 54 and 55, so that the raster overscans the masking area by approximately three-quarters of an inch on each side.

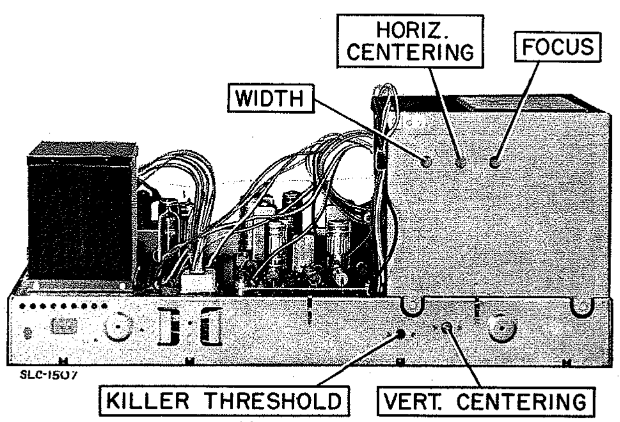


Fig. 54—Rear of Chassis Controls—CTC5.

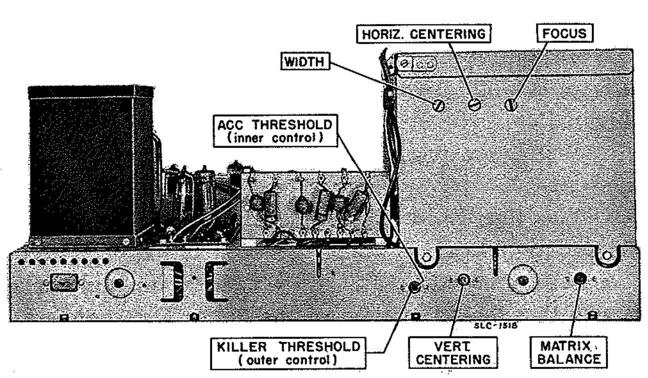


Fig. 55—Rear of Chassis Controls—CTC5N.

Horizontal Tuning Adjustment

Normally it is not necessary to adjust the Horizontal Tuning coil during initial set-up of these receivers since the adjustment is pre-set at the factory. However, horizontal tuning may be checked as follows:

1. Connect a "VoltOhmyst" between the exposed part of fuse F-104 and ground.
2. Adjust the Horizontal Tuning Coil, L-106, for minimum voltage reading on "VoltOhmyst." This should be approximately 7.5 volts. Figure 56 shows the location of the H.V. Fuse (F-104) and the Horizontal Tuning Coil.
3. Disconnect "VoltOhmyst."

Height, Vertical Linearity, and Vertical Centering Adjustments

1. Adjust the Height and Vertical Linearity Controls (these controls are under the cabinet front cover, see figure 53) until the picture is symmetrical from top to bottom.
2. Adjust the Vertical Centering Control to center the picture and then make final adjustments with the Height and Vertical Linearity controls so that the raster overscans the mask by one-half inch at both the top and bottom. Figures 54 and 55 show the location of the Vertical Centering Control.

Focus Adjustment

Adjust the Focus Control to obtain maximum overall definition of fine picture detail. This control is located on the rear of the high voltage compartment. Refer to figures 54 and 55.

High Voltage Check

H.V. adjustment is not required in the CTC5 and CTC5N chassis. However if desired, the high-voltage may be checked as follows:

1. Connect a "VoltOhmyst," using a H.V. probe, to the cup at the base of the H.V. rectifier tube. See figure 56.
2. Check the reading on the "VoltOhmyst." A reading of between 18,000 and 22,000 volts should be obtained, with a nominal reading of 20,000 volts being desirable.

CAUTION

OPERATION OF THIS RECEIVER OUTSIDE OF THE CABINET OR WITH THE COVERS REMOVED INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THIS RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE NOT FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING UNDER THESE CONDITIONS.

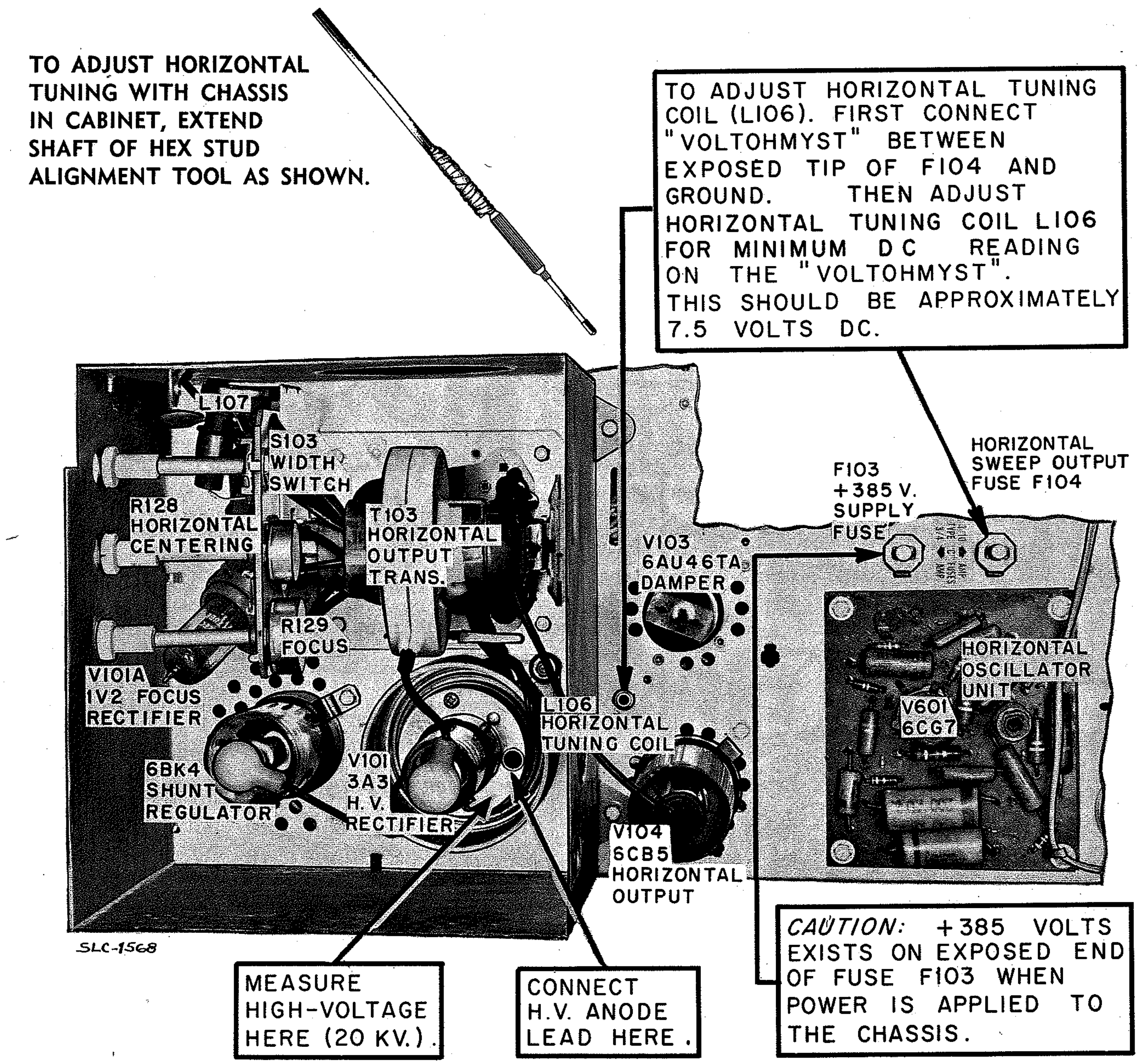


Fig. 56—Adjustments and Components in Horizontal Sweep Output and High Voltage Sections.

The screw securing the top of the H.V. compartment has a very long thread which requires approximately one-half minute to completely loosen. The length of the screw serves to delay the opening of the cover on the high-voltage compartment to allow sufficient time for any charge existing on the high-voltage components to be dissipated.

When the receiver is turned on with the high voltage cover opened, extreme caution should be exercised when working in these circuits since a potential of 20,000 volts is present at the rectifier cup. When the receiver is turned off, a full half-minute should be allowed before attempting further work in this section of the receiver.

TUNER SET-UP ADJUSTMENTS

R-F Oscillator Adjustments

Check all available stations to see that the Fine Tuning control tunes to the center of its range on all channels. If adjustments are required it will be necessary to detach the tuner from the cabinet. To do this, remove all knobs from the controls on the tuner sub-chassis. Remove the nuts securing the tuner bracket to the cabinet. Figure 57 shows an example of one of the methods used to secure the tuner sub-chassis to the cabinet.

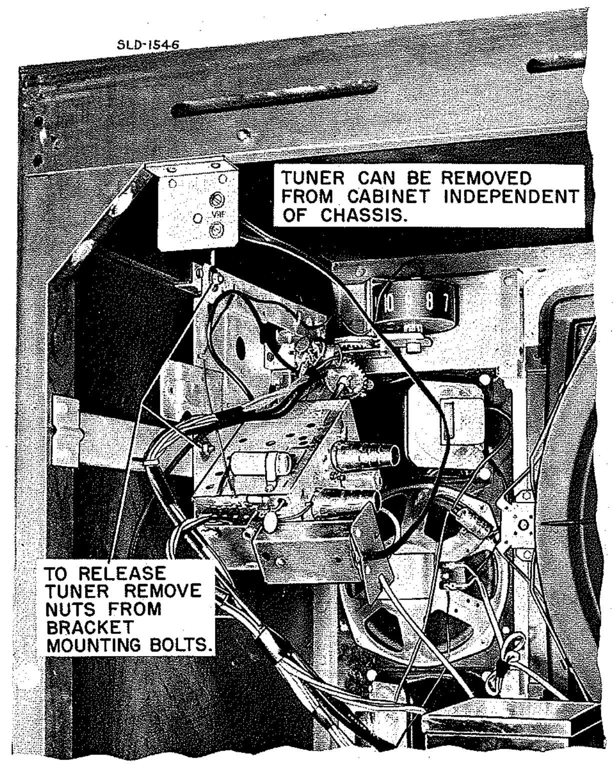


Fig. 57—Tuner Unit Mounted on Inside of Cabinet. Additional Mounting Nut, Not Shown, Is Under Fine Tuning Knob.

To facilitate oscillator adjustments, the tuner may be secured in the bracket adapter on the rear apron of the chassis as shown in figure 58.

The location of R-F oscillator tuning adjustments are shown in figure 59. When minor adjustments of the VHF oscillator are required proceed as follows:

1. Turn the station selector to the highest channel to be received and set the fine tuning control at the center of its range.

2. Adjust the overall oscillator tuning adjustment C29, located on the top of the tuner chassis, for best picture reception.

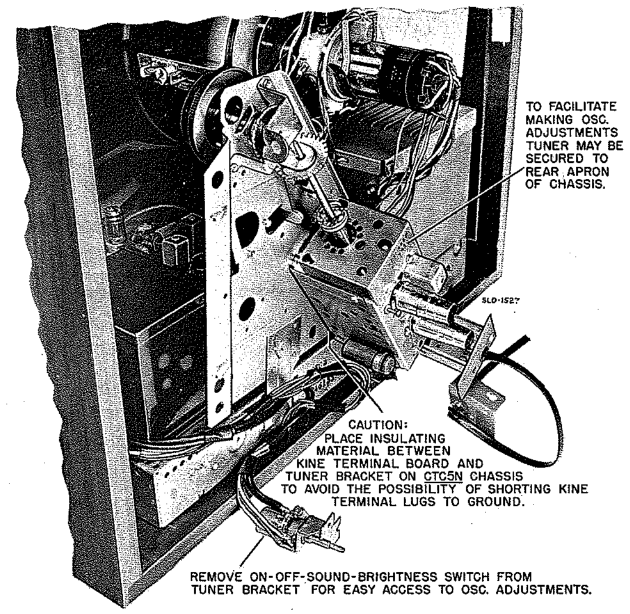


Fig. 58—Tuner Sub-Chassis Secured to Receiver Chassis for Oscillator Adjustment.

3. Turn the channel selector to each channel to be received and adjust the respective oscillator trimmer for best picture reception. Make these adjustments, proceeding in sequential order from the highest to the lowest channels. Retain the fine tuning control at the center of its range during the entire adjustment procedure.

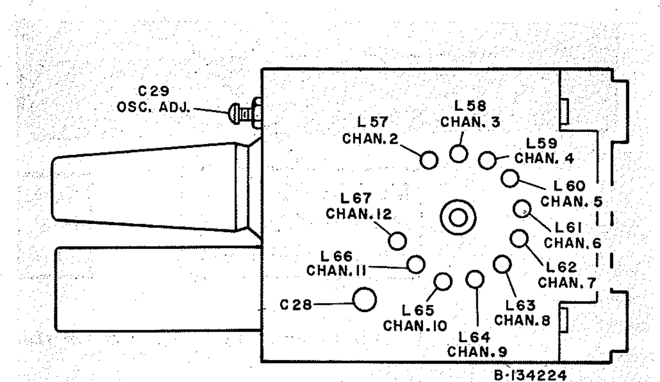


Fig. 59—R-F Oscillator Adjustment Locations.

FM Trap Adjustment

If interference is encountered from a strong FM station signal, adjust the FM trap to minimize the interference in the picture. Refer to figure 4, page 8, for the location of this adjustment.

The FM trap can tune into channel 6 or even channel 5 in some receivers, therefore if either of these channels are to be received, check to make certain that the trap does not affect the sensitivity on these channels.

KINESCOPE SET-UP ADJUSTMENTS

Check the operation of the receiver on black-and-white reception. Check all areas of the screen. No color shading should be apparent. Color fringing should not be objectionable and should be confined to the outer edges of the kinescope. The screen should remain a neutral gray throughout the range of the brightness control.

NOTE

It is essential that the position of the magnet assemblies on the kinescope neck be inspected to insure that they are properly positioned before any kinescope adjustments are performed. Figure 60 shows the proper placement of these assemblies.

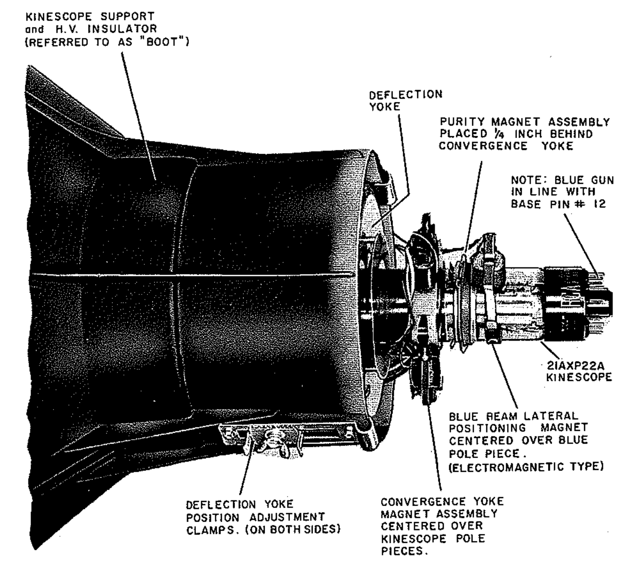


Fig. 60—Position of Kinescope Accessories on Neck of Tube.

Some chassis employ a PM-type lateral beam-positioning magnet, shown in figure 61, in place of the electromagnetic-type blue lateral beam-positioning magnet.

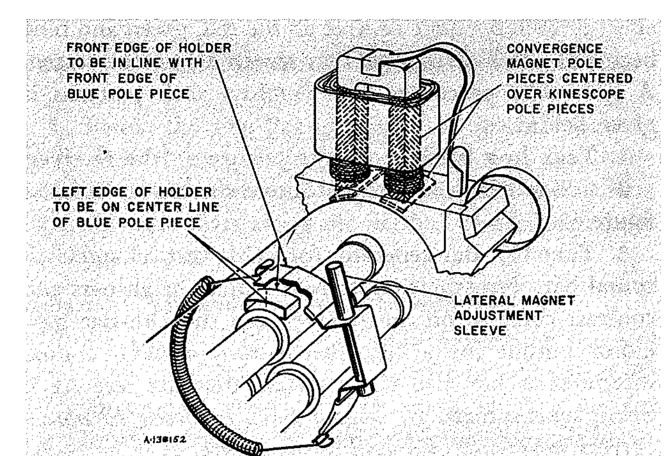


Fig. 61—PM-Type Lateral Beam-Positioning Magnet.

The position of the blue beam lateral control on the chassis is occupied by a red background control and lateral adjustment of the beam is made by mechanical means.

Color Purity Adjustments (Color Shading)

Any color shading apparent within the area of the kinescope screen, while viewing a black-and-white picture, requires color purity adjustments.

If only slight shading exists about the edges of the screen, check the adjustment of the color field equalizing magnets. See figure 52 for the location of these adjustments. If color shading still persists, color purity adjustments should be made as follows:

1. Retract the six color equalizing magnets completely into their housings. This is accomplished by turning the screw-type adjustments fully counter-clockwise.

2. Demagnetize the receiver chassis and kinescope with a degaussing coil. Care should be taken to avoid the area about the neck of the kinescope. This procedure is important since magnetic influences anywhere about the chassis or kinescope will noticeably impair the purity and convergence of the receiver. With the chassis and kinescope properly degaussed, a minimum of magnetic field neutralization is necessary to obtain white uniformity.

3. Converge the center of the picture using only the DC convergence controls. Use a dot pattern from a dot generator to facilitate the adjustment. Figure 62 shows how to connect the dot generator.

Figure 63 shows the location of the DC convergence controls.

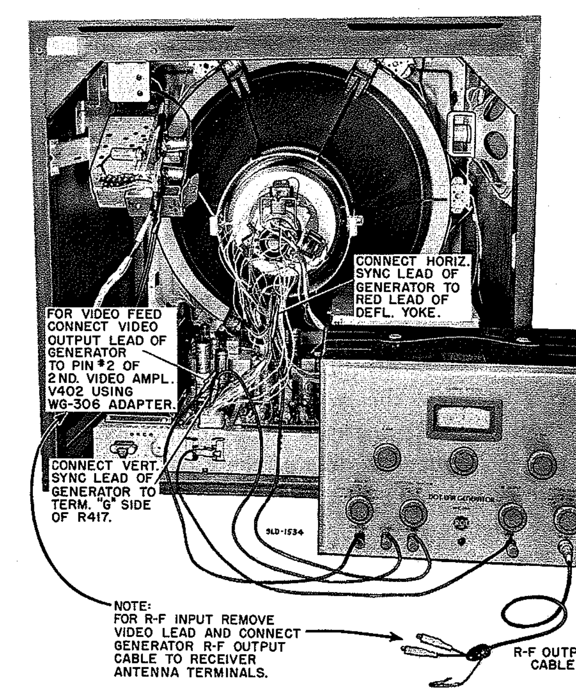


Fig. 62—Dot-Bar Generator Connections.

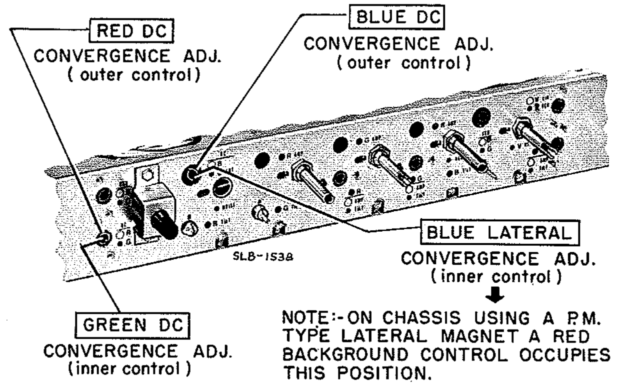


Fig. 63—Location of DC (Static) Convergence Controls.

4. Remove the dot generator signal and set the CONTRAST and BRIGHTNESS controls for normal raster illumination and the COLOR control to its counter-clockwise position.

5. Turn the RED SCREEN control to maximum and the BLUE SCREEN and GREEN SCREEN controls to minimum. Figure 64 shows the location of the screen controls.

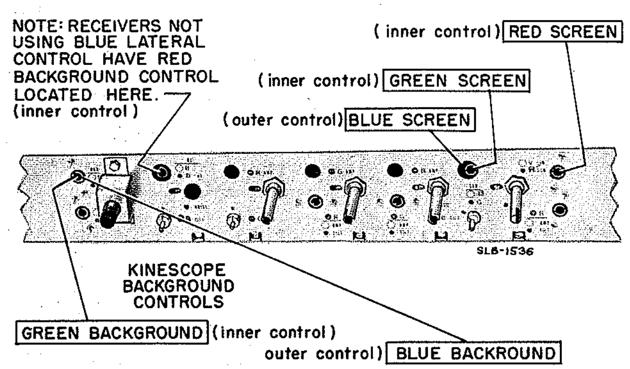


Fig. 64—Location of Screen and Background Controls.

6. Loosen the deflection yoke and pull it toward the rear of the cabinet.

7. Adjust the purity magnet for a pure red field in only the center area of the kinescope. Do not spread the red tabs on the purity magnet any further apart than necessary to attain the required results.

8. Push the yoke forward to attain a pure red field over the entire viewing area of the kinescope.

9. Adjust the RED, BLUE and GREEN SCREEN controls for a white screen.

10. Recheck center convergence with the aid of a dot generator signal. If adjustment of the DC convergence controls is required, recheck purity. Best purity will be obtained when the receiver has good center convergence.

11. If necessary, adjust the color equalizing magnets for best white uniformity in the areas of the individual magnets.

Convergence Adjustments (Color Fringing)

Static Convergence

Observe a black-and-white picture on the screen of the kinescope. If objectionable color fringing exists, convergence adjustments are required. When color fringing is uniform throughout the area of the kinescope screen, *static* (DC) convergence adjustments may be all that are required. However, first check the position of the convergence yoke and the blue beam lateral positioning magnet. These assemblies, shown in figure 60, will cause color fringing if they have been shifted from their proper positions.

Static convergence refers to the converging of the red, green and blue kinescope beams in the *center of the screen.* The procedure for static convergence is as follows:

1. Connect a dot generator to the receiver antenna terminals or if preferred, to the 2nd Video Amplifier tube with the aid of the RCA WG-306A Adapter. Figure 62 shows how to make these connections.

2. Adjust the receiver BRIGHTNESS and CONTRAST and the Dot-Bar generator output for a clear dot pattern on the face of the kinescope.

3. Adjust the red, green and blue DC convergence controls and blue lateral control until one group of red, green and blue dots in the center of the picture converges to a white dot. See figure 63 for control locations. The red and green dots should be converged first, then the blue.

Check the convergence of the dot trios throughout the screen area. If objectionable color fringing exists at the top, bottom, or sides, dynamic convergence adjustments are required.

Dynamic Convergence

Dynamic convergence refers to the adjustment of controls that affect the application of sweep correction voltages on the red, blue and green beams of the kinescope. These adjustments are required to make the three beams scan the height and width of the kinescope screen together, without causing color fringing. It is easiest to perform these adjustments when a procedure is used employing dot-bar patterns that most readily show the effect of each dynamic control on the red, green and blue beams of the kinescope as they sweep across the screen. A systematic procedure that employs such patterns is given below.

1. Tune in a black-and-white picture on the receiver.

2. Connect Dot-Bar generator to the receiver. Refer to figure 62.

3. Tune Dot-Bar generator for stable vertical and horizontal bars (crosshatch pattern). Adjust brightness and contrast controls on the receiver and the Dot-Bar generator output for a clear bar-pattern without station interference, but also make certain that the receiver is being synchronized by station sync. *In order to obtain correct horizontal dynamic convergence, it is necessary to perform dynamic convergence adjustments while the receiver is being scanned at the station rate.*

Vertical Dynamic Convergence Adjustments

4. Set Dot-Bar generator for vertical bars. If necessary, separate the red and green bars slightly from the blue with the DC convergence controls. Using the blue bar at the center of the screen as a reference, adjust the red and green vertical amplitude and tilt controls (see figure 65), for parallel red, green and blue bars, as shown in figure 66. (The shape of the vertical blue bar cannot be altered by vertical dynamic convergence controls.)

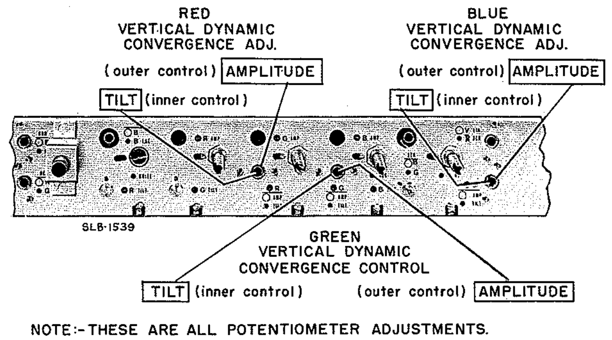


Fig. 65—Location of Vertical Dynamic Convergence Controls.

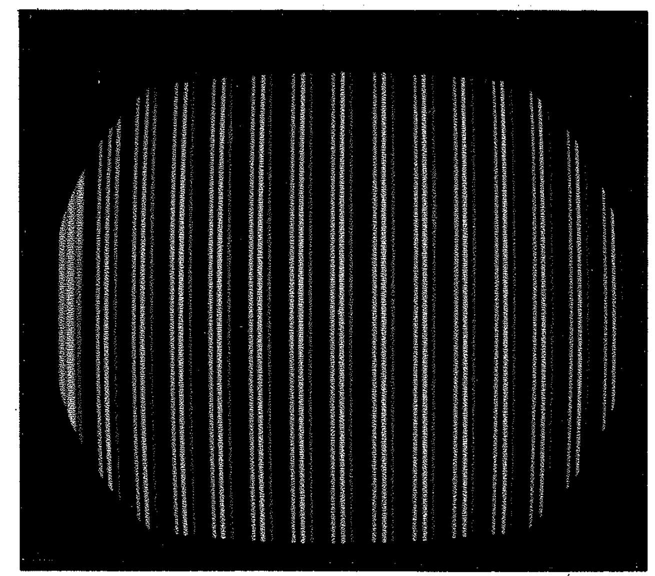


Fig. 66—Vertical Dynamic Convergence—All Vertical Bars Parallel.

5. Switch the Dot-Bar generator to obtain a pattern of horizontal bars. Adjust the blue vertical amplitude and tilt controls for equal displacement of the blue bars from the other bars along the vertical center line of the screen.

Horizontal Dynamic Convergence Adjustments

6. Set the red, green and blue horizontal tilt and amplitude controls fully counter-clockwise and adjust the DC convergence controls if necessary, so that the red bars are *above* the blue bars and the green bars are *below* the blue bars. See figure 67 for Horizontal Dynamic Convergence control locations.

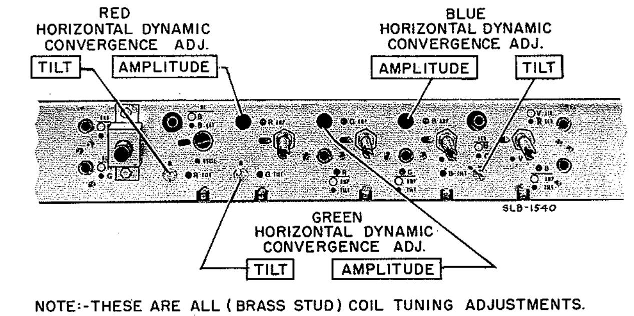


Fig. 67—Location of Horizontal Dynamic Convergence Controls.

7. Cut-off the red and green beams, (see note below) and turn the blue horizontal amplitude control clockwise until the blue bar bows in the center of the screen. Then alternately adjust the blue horizontal amplitude and tilt controls to attain a straight horizontal blue bar across the center of the screen. See figure 68.

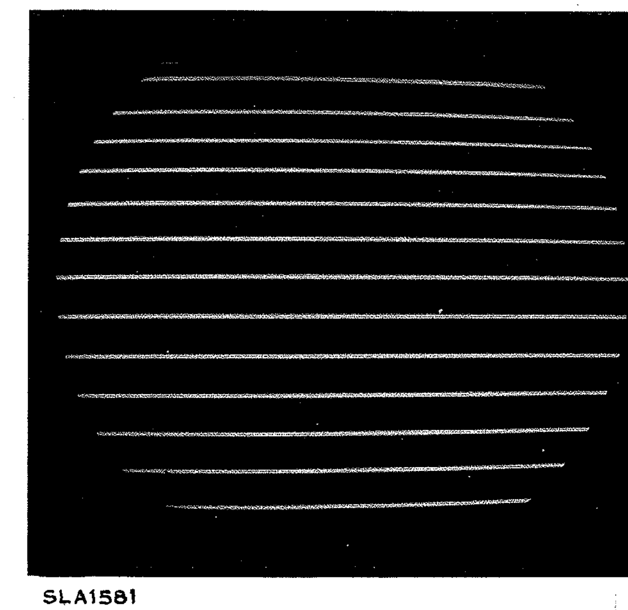


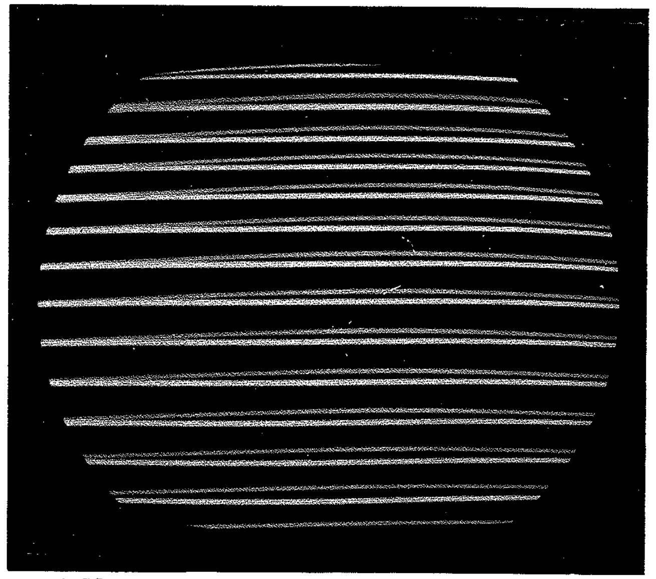
Fig. 68—Horizontal Dynamic Convergence—Blue Bar Horizontal.

NOTE

To facilitate dynamic convergence adjustments it is of advantage to be able to cut off the red, green and blue kinescope beams individually during the course of the convergence procedure. This may be done most readily with a control switch, (see page 45) which provides a means of connecting a 100K resistor from each of the kinescope control grids to ground, at will.

The kinescope screen controls may be used to cut off the beams if desired, however this makes it necessary to perform color temperature adjustments when converg-ence adjustments are completed.

8. Turn on the red beam so that red and blue horizontal bars appear on the screen. Turn the red horizontal amplitude control clockwise until the red bar bows upward on the right half of the kinescope screen as shown in figure 69. Then turn the red horizontal tilt control clockwise until the red bar straightens out and parallels the blue bar as shown in figure 70.



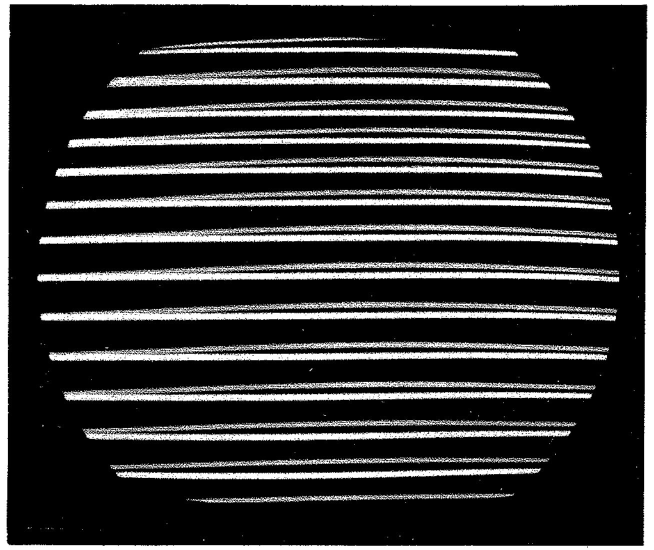
SLA1583

Fig. 69—Horizontal Dynamic Convergence—Red Bar Bows Up at Right.

SLA1584

Fig. 70—Horizontal Dynamic Convergence—Red Bar Parallels Blue Bar.

9. Cut off the red beam and turn on the green beam. Turn the green horizontal amplitude control clockwise until the green bar bows upward at the right half of the kinescope screen as shown in figure 71. Then turn the green horizontal tilt control clockwise until the green bar straightens out and parallels the blue bar.



SLA1583

Fig. 71—Horizontal Dynamic Convergence—Green Bar Bows Up at Right.

10. Turn on the red beam so that all three beams are represented as red, green and blue bars across the kinescope. Touch-up the red, green and blue horizontal amplitude and tilt controls, as required, to make the red, green and blue bars parallel across the center of the kinescope screen.

11. Retaining the horizontal bar setting on the Dot-Bar generator, adjust the blue vertical amplitude and tilt until the blue horizontal bars are all equally displaced from each respective set of red and green horizontal bars.

Final Convergence Adjustments

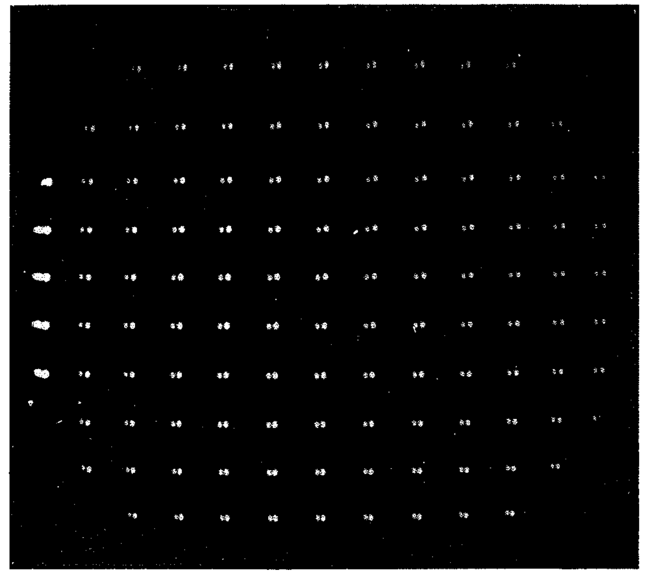
12. Switch the Dot-Bar generator for a stable dot pattern. Cut off the blue beam and adjust the DC convergence controls to converge the red and green dots in the center of the kinescope screen.

13. Adjust green and red horizontal amplitude and phasing slightly, for the same displacement on the same side of the horizontal row of dots across the center of the screen, using the dot at the extreme left of the screen, the center dot, and the dot at the extreme right of the screen for reference. Then adjust the green horizontal amplitude and tilt controls to attain the most equal displacement of the red and green dots. See figure 72.

14. Converge the green and red dots at the center of the screen and make final touch-up adjustments on the red and green horizontal amplitude and tilt and the DC controls to attain the best over-all convergence of red and green dots.

15. Turn on the blue beam and touch-up the blue horizontal amplitude and tilt for most uniform displacement of the blue dots from the yellow dots.

16. Make a final check on the vertical convergence by inspecting the vertical row of dots at the center of the kinescope screen and touch-up the green and red vertical amplitude and tilt controls for best results.



SLA1582

Fig. 72—Horizontal Dynamic Convergence—Equal Displacement of Red and Green Dots.

17. Make a final adjustment of the DC convergence controls to converge the red, green and blue dots most uniformly throughout the area of the kinescope screen as shown in figure 73.

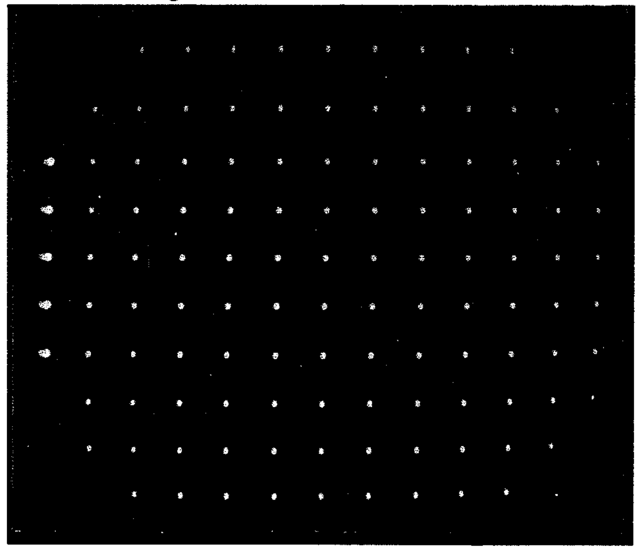


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Fig. 73—Final Convergence Adjustment.

Kinescope Color Temperature Adjustment

In order to obtain satisfactory performance from the kinescope, in both black-and-white and color operation, it is essential that there be no color temperature shift as the intensity of light output from the kinescope is varied through its useful range. The high-lights and low-lights in a black-and-white picture should retain a neutral shade of grey.

The kinescope color temperature refers to the caste of white or grey produced in the raster and *not* to the brightness level. The proper color temperature of a 21AXP22A tricolor kinescope raster is referred to as "8200° Kelvin." This appears grey, or white. A bluish-white or greenish-white raster indicates that the color temperature is too high, a pinkish-white raster is an indication of too low a color temperature.

A condition where the receiver is adjusted to too high a color temperature will result in a loss of red in the picture detail and will result in the inability to obtain good flesh tone reproduction when observing a color picture.

Too low a color temperature will result in loss of blue, green, or cyan colors in the picture with objects assuming a generally reddish-brown caste.

The procedure for proper kinescope color temperature adjustments is as follows:

1. Pre-set the screen controls fully-counterclockwise and the green and blue background controls approximately 30% from their fully-clockwise position. Refer to figure 64 for control locations.

2. Switch the station selector to an unused channel or, for a clean raster, temporarily remove the I-F link from the tuner.

3. Measure the bias on the red gun of the kinescope between the control grid and cathode, using a voltmeter having 20,000 ohm-per-volt sensitivity or better. Adjust the brightness and contrast controls for —70 volts bias with no signal input.

4. Maintain —70 volt bias on the red gun of the kinescope and adjust the red, green and blue screen controls for a low-level grey raster (color temperature 8200° Kelvin.)

NOTE

After setting the screen controls for a low-level grey raster remove the meter and DO NOT change the setting of red screen control during the balance of this procedure.

5. Switch the receiver to a local channel (replace tuner I-F link if removed) and adjust the contrast and brightness controls for a normal picture. One color will normally predominate in the high brightness areas of the picture. Depending on the color which is predominant in the high brightness areas of the picture, proceed as follows:

1. *Green Predominant In Highlights*—Turn the green background control slightly counter-clockwise making the picture magenta and, observing the low-light areas, adjust the green screen control clockwise to achieve grey in low-light areas.

2. *Blue Predominant In Highlights*—Turn the blue background control slightly counter-clockwise making the picture yellow and, observing the low-light areas, adjust the blue screen control clockwise to achieve grey in low-light areas.

3. *Blue-Green (Cyan) Predominant In Highlights*—Turn both the blue and green background controls slightly counter-clockwise making the picture red, and adjust the blue and green screen controls clockwise to achieve grey in low-light areas.

Any of the above conditions is an indication that the color temperature is too high. Steps 1, 2 and 3 are designed to lower the temperature to the correct value (8200°K).

4. *Magenta Predominant In Highlights*—Turn the green background control slightly clockwise making the picture green and, observing the low-light areas, adjust the green screen control counter-clockwise to achieve grey in low-light areas.

5. *Yellow Predominant In Highlights*—Turn the blue background control slightly clockwise making the picture blue and, observing the low-light areas, adjust the blue screen control counter-clockwise to achieve grey in low-light areas.

6. *Red Predominant In Highlights*—Turn both the blue and green background controls slightly clockwise making the picture cyan and, observing the low-light areas, adjust both the blue and green screen controls counter-clockwise to achieve grey in low-light areas.

Any of the conditions described in steps 4, 5, and 6 is an indication of low color temperature. These steps are designed to raise the temperature to the correct value (8200°K.)

7. Vary the brightness control through its range and observe all areas of the picture. No color should be predominant in either high or low brightness areas at any setting of the brightness control.

Repeat the above adjustments until proper tracking in low-light and high-light areas is obtained at all settings of the brightness control, at the correct color temperature.

It is helpful when making these adjustments to occasionally move away from the receiver and observe the surrounding light and objects in the room to prevent the incident light falling on the screen from affecting a true interpretation of a proper black and white condition. A light standard to determine proper Kelvin temperature of 8200°, if available, is very helpful when making the above tracking adjustments.

Red Background Control

In some chassis a PM-type lateral beam-positioning magnet is employed in place of the electromagnetic blue lateral magnet. In these chassis a *red background control* is installed on the chassis in the place where the blue lateral control was located. Refer to figure 64. When a red background control is employed, the following adjustment must be made before proceeding with the kinescope color temperature adjustments described above.

1. Set the contrast control to its extreme clockwise position and the brightness control to its extreme counter-clockwise position.

2. Adjust the red background control for 90 volts difference between the red kine control grid and cathode.

After making this adjustment proceed with the color temperature adjustment described above.

RECEIVER SET-UP CHECK LIST

1. Check the status of the 117V. AC power available to the receiver. Ascertain that the power requirements of the receiver are not hampered by an inadequate supply line or possible heavy drain of power from appliances which may cause excessive line voltage drop.

2. Check the operation of the receiver on black-and-white signal reception as outlined below.

(a) Check the AGC and Noise Threshold adjustment on all channels. The receiver must not overload on strongest channel and should have best signal to noise on weak channel. See page 33 for details on these adjustments.

(b) Check for normal operation of horizontal frequency control. The picture should hold sync for three full turns of the control. Refer to page 34 for details of this adjustment.

(c) Check the centering of the picture. Adjustment can be made with the centering controls on rear apron of chassis. Refer to figures 54 and 55.

(d) Check width and horizontal linearity. Width switch should be set for ¾-inch overscan at each side of the screen. If linearity is incorrect check the horizontal tuning adjustment for correct setting. Refer to page 34 for details of horizontal tuning adjustment.

(e) Check height and vertical linearity. Reset controls as required for ½-inch overscan at top and bottom. Refer to figure 53.

(f) Check focus for best definition and detail. Focus control is at the rear of the high-voltage compartment. Refer to figures 54 and 55.

(g) Check R-F oscillator adjustment. All stations should tune-in without excessive fine tuning adjustment as the channel selector is rotated through its range. Make oscillator adjustments if necessary, starting at the high-frequency channel, proceeding to the lowest. Remove tuner to make these adjustments. Refer to figure 58.

(h) Check black-and-white reception for color *shading* in large areas of the screen. Demagnetize the receiver if necessary and make color purity adjustments. Refer to page 37 for details of these adjustments.

(i) Check black-and-white reception for color *fringing*. Re-adjust DC convergence controls and if necessary, make dynamic convergence control adjustments as prescribed on page 39.

(j) Check kinescope color temperature adjustment. Raster must remain a neutral gray, or white, as the brightness control is varied through its useful range. If adjustment is required refer to page 41.

3. Check for reception of color signal. Use a color program or a transmitted color stripe signal if available in area where receiver is installed. This will also check antenna for color reception. A color bar generator may be employed but this will not insure reception of color signal through the antenna system.

SERVICING THE 700 SERIES COLOR TELEVISION RECEIVERS

SERVICING CONSIDERATIONS

The operating condition of a color television receiver can be easily checked and any malfunctioning circuits quickly analyzed if service is performed in a logical and orderly manner. This requires a reasonable understanding of the receiver circuitry and the use of appropriate test equipment.

Servicing techniques and test equipment used on black-and-white receivers apply equally to color receivers. However, in addition to the techniques and equipment proven effective in servicing black-and-white receivers, the application of new techniques and equipment peculiar to color receivers must be employed.

TEST EQUIPMENT

Test equipment designed to facilitate servicing color television receivers is readily available and should be used to best advantage whenever possible. Good servicing techniques can be developed through intelligent use of appropriate color test equipment and reasonable knowledge of the circuitry for the particular receiver to be serviced.

The following test equipment, or its equivalent, is recommended for use in servicing color television receivers.

Dot-Bar Generator

A Dot-Bar Generator is required when scanning correction adjustments are made on the red, green and blue beams of a tricolor kinescope. These adjustments, referred to as *static* and *dynamic* convergence adjustments, govern sweep correction voltages which keep the three beams properly converged as they scan the screen of the kinescope.

The RCA WR-36A Dot-Bar Generator, and the RCA WR-46A generator shown in figures 74 and 75 are designed especially for use in making convergence adjustments. These instruments provide a selection of patterns consisting of small dots, vertical lines, horizontal lines or cross-hatch. Since the patterns are linear they may also be used for precise adjustment of linearity in either color or black-and-white receivers.

Normally, the R-F output of the WR-36A Dot-Bar generator is connected to the receiver antenna terminals. The generator also has provision for Video output which may be fed into the 2nd video amplifier stages of the receivers. However when using video input to the 700 series receivers an adapter, WG-306A, should be used.

Video feed has the advantage of minimizing background interference and allows convergence adjustments to be made on any channel, including UHF.

Sync input terminals are provided, allowing horizontal and vertical sync from the receivers to be fed into the generator when required.

Fig. 74—RCA WR-36A Dot-Bar Generator.

Fig. 75—RCA WR-46A Video Dot/Crosshatch Generator.

NOTE

When performing convergence adjustments, make certain that the receiver is properly synchronized with the station signal.

Color Bar Generator

A color bar generator will facilitate checking and adjusting all color functions in color television receivers, including:

- Color AFPC.
- Demodulator phasing.
- Matrixing.
- Registration of luminance and chrominance signals.
- Overall R-F, I-F and video acceptance of color signals.
- Check of color sync action for normal and weak color-sync (burst) signals.
- Non-Linear amplitude characteristics in the receiver that might affect color reproduction.
- Sound rejection, and beat interference between the color subcarrier and the sound carrier.

The RCA WR-61A Color-Bar Generator, shown in figure 76, generates 10 different color bars simultaneously, including bars corresponding to "R—Y," "B—Y," "G—Y" and "I" and "Q" Signals.

The generator is easy to use since its output may be fed directly into the receiver antenna terminals. No other connections are required.

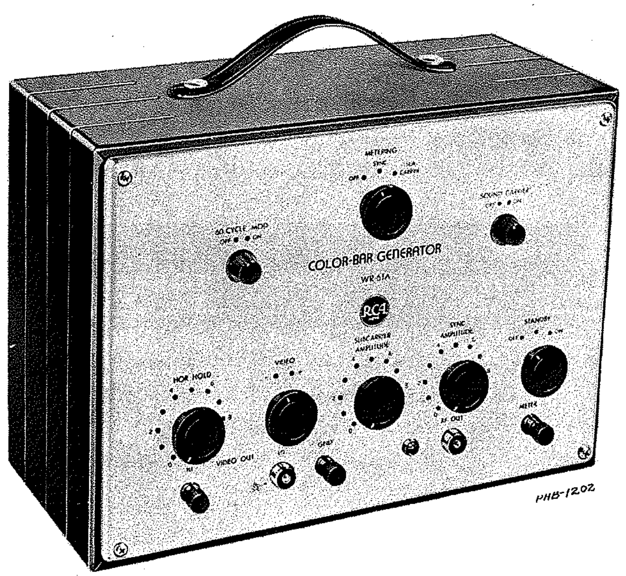


Fig. 76—RCA WR-61A Color-Bar Generator.

Voltmeter and High Voltage Probe

An accurate voltmeter having a sensitivity of at least 20,000 ohms per volt should be used for making voltage measurements when servicing the receiver. A vacuum-tube voltmeter such as the RCA Senior "VoltOhmyst" WV98A, shown in figure 77 is preferable. To measure high voltage accurately it is necessary to employ a suitable high-voltage probe in conjunction with the meter. The high-voltage probe, WG-289, shown in figure 78, may be used with the RCA Senior "VoltOhmyst" WV-98A.

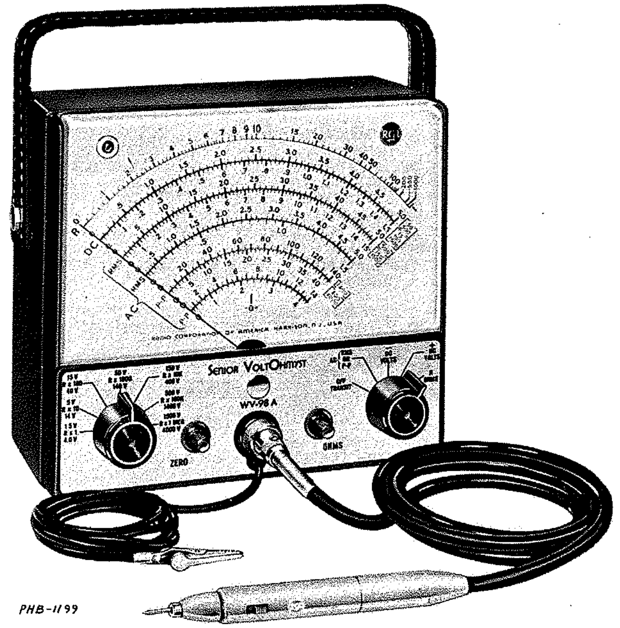


Fig. 77—RCA WV-98A Senior "VoltOhmyst."

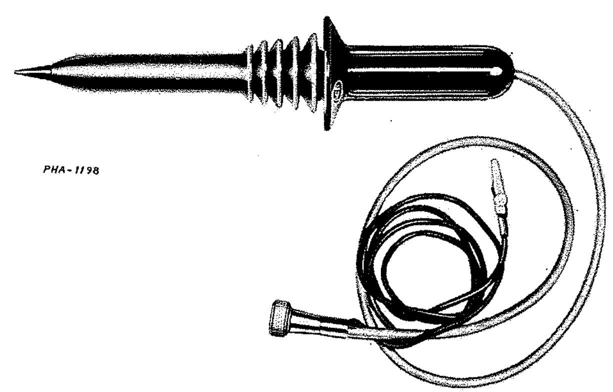


Fig. 78—RCA WG-289 High Voltage Probe.

For 20,000 ohm-per-volt meters having phono-tip connectors and a 5,000 volt range, use the RCA High Voltage Probe WG-290, and WG-210 multiplier resistor. This combination extends the range of the meter to permit measurement of high voltage up to 50,000 volts.

Degaussing Coil

A degaussing coil is required should it become necessary to demagnetize the television chassis or kinescope. Undesired magnetic influences anywhere about the chassis or kinescope will noticeably impair purity and convergence.

A degaussing coil, shown in figure 79, may be constructed of 425 turns (approximately 1335 ft.) of number 20 enamel-covered copper wire, 12 inches in diameter. All turns should be bound together with several layers of insulating tape. The ends of the wire should be connected to an eight foot AC line cord.

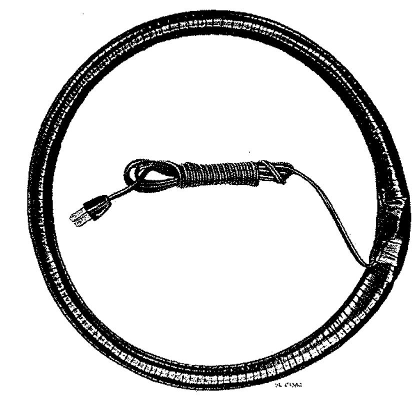


Fig. 79—Degaussing Coil.

The degaussing coil demagnetizes most effectively when the force of its electro-magnetic field is applied and removed uniformly to the material being demagnetized. Therefore, to demagnetize a receiver, plug in the AC cord of the degaussing coil, taking care that the coil is at least six feet away from the receiver. Move the coil slowly over the front and sides of the cabinet for a minute or two and then slowly withdraw it to a distance of at least 6 feet from the receiver before disconnecting the AC plug.

CAUTION

When using the degaussing coil, make certain to withdraw the color equalizing magnets into their housings and avoid passing the degaussing coil over the neck of the kinescope since it can demagnetize the magnets of the kinescope accessories.

Also be careful not to have any meters within five feet of the coil when it is energized since it can cause permanent damage to the magnetic elements within the meter.

Oscilloscope

An oscilloscope is required when aligning the R-F, I-F, and chrominance sections of the color receiver. It may also be used to advantage in analyzing and localizing malfunctioning circuits within the receiver by observing the characteristics of associated signal waveforms. For applications such as measurement of 3.58 mc. signals, a wide-band oscilloscope having a flat response to 4.5 mc. should be employed.

The RCA WO-91A oscilloscope, or the RCA WO-78A oscilloscope shown in figure 80 are excellent for these applications.

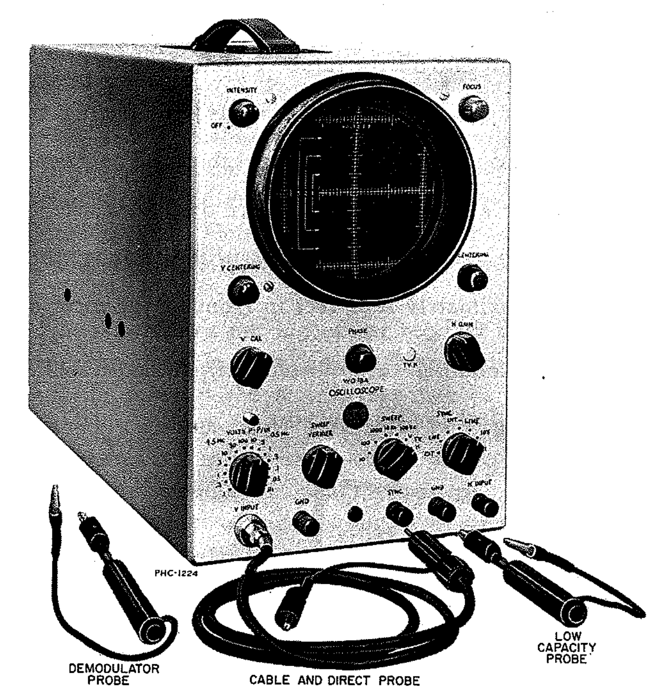


Fig. 80—RCA WO-78A Oscilloscope.

Kinescope Control Grid Switch

A switch box for connecting a 100K resistor from each of the tricolor kinescope control grids individually to ground, at will, is useful when making convergence and matrix adjustments in the field. Such a box is easy to construct. An illustration of a switch box and a schematic diagram is shown in figure 81.

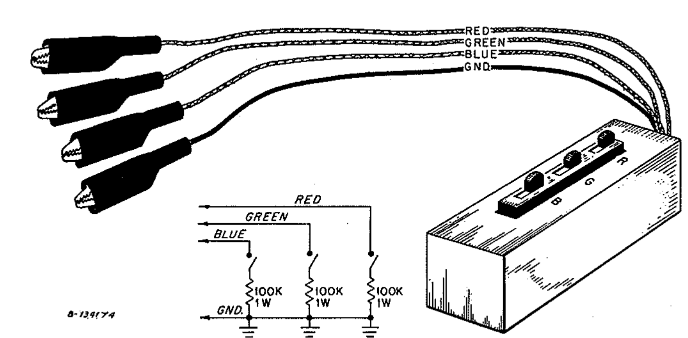


Fig. 81—Kinescope Grid-Shorting Switch-Box.

Mirror

A large portable mirror can be extremely useful when performing certain set-up adjustments or servicing the receiver chassis while it is in the cabinet. The mirror should be of sufficient size to reflect the entire area of the kinescope screen toward the rear of the receiver when placed approximately four feet in front of the receiver.

A mirror mounted on a portable tripod, as shown in figure 82 is ideal for this purpose.

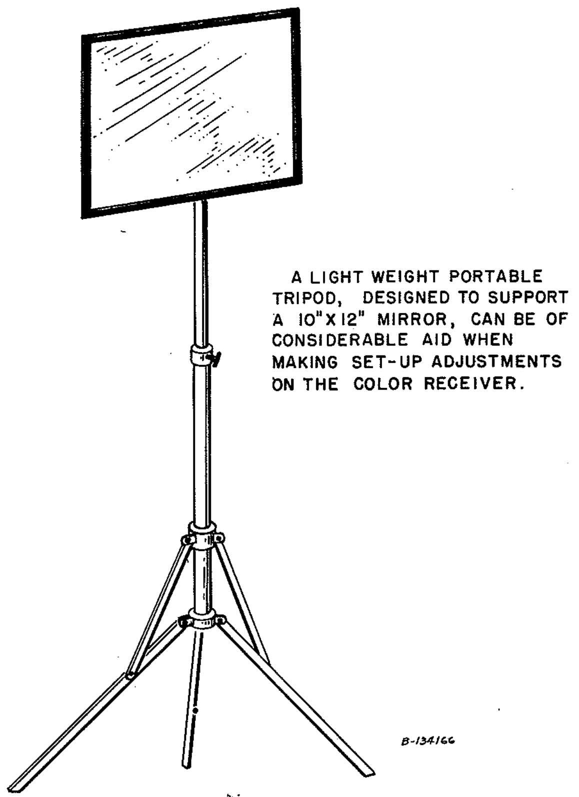


Fig. 82—Portable Mirror.

Extension Cables

The 700 series receivers may be operated with the chassis removed from the cabinet by employing a set of extension cables for the deflection yoke, convergence assembly, blue lateral positioning assembly, high-voltage and ground connections. Such cables facilitate servicing components located on the underside of the chassis. The cables required may be constructed as shown in figures 83 to 88.

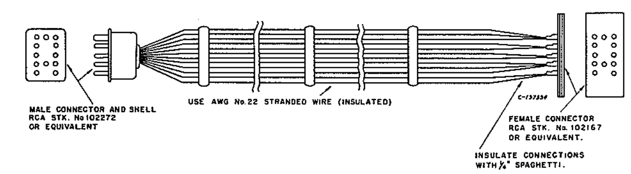


Fig. 83—Convergence Cable.

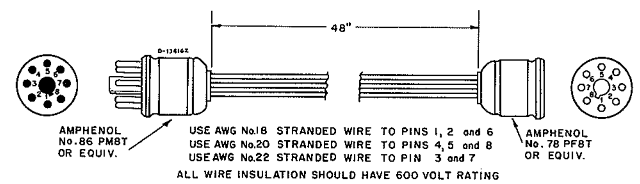


Fig. 84—Deflection Yoke Cable.

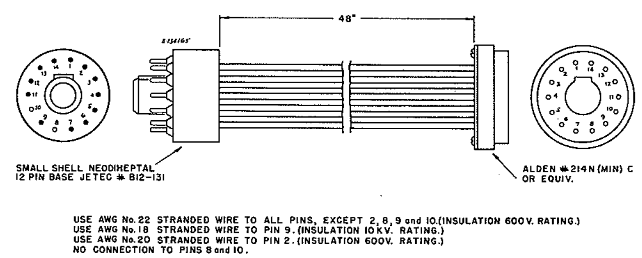


Fig. 85—Kinescope Cable.

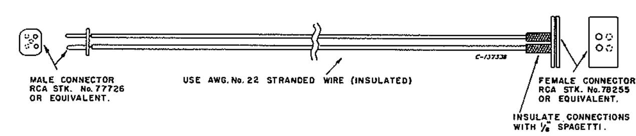


Fig. 86—Blue-Lateral Magnet Cable.

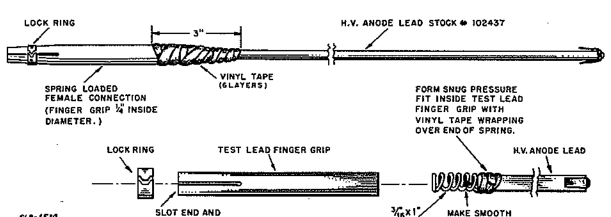


Fig. 87—HV Cable.

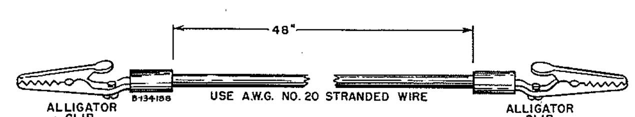


Fig. 88—Grounding Cable.

PRELIMINARY SERVICE INVESTIGATION

Before proceeding to service a color television receiver, make a preliminary investigation of all facts pertaining to the operating condition of the receiver. Very often such an investigation will prove of considerable value in determining the most suitable course of analysis to be used in localizing a malfunctioning circuit.

It is also advisable to make a quick check of the operating controls, noting which are, or are not, reacting properly. *Do not change the adjustment of the set-up controls until a diagnosis of the receiver performance has been made. Changing these adjustments may hide symptoms that are of value in diagnosing malfunction of circuits in the receiver.*

CAUTION

OPERATION OF THESE RECEIVERS OUTSIDE THE CABINET OR WITH THE COVERS REMOVED INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVERS SHOULD NOT BE ATTEMPTED BY ANYONE NOT FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING UNDER THESE CONDITIONS.

CHECKING BLACK-AND-WHITE OPERATION

When servicing a color receiver it is of value to keep in mind that the receiver is basically a reproducer of black-and-white pictures, and that certain additional circuits are devoted entirely to color. Therefore, the first logical step toward analyzing improper operation of a color receiver is to observe the reception of a black-and-white transmission.

Color operation of the receiver should be evaluated only after good black-and-white operation has been confirmed.

The block diagrams shown in figures 89 and 90 show, in the shaded portions, the commonly designated "color circuits" of both the CTC5 and the CTC5N chassis. The unshaded blocks may be considered the "black-and-white" circuits. Defects or improper operation in the black-and-white circuits can be localized without a color signal.

Since the major portion of the receiver circuitry concerns functions familiar in black-and-white television receivers, most of the service that may be required can be quickly and efficiently performed by applying service techniques used to service black-and-white receivers.

Effects observed in black-and-white reception will expose malfunction of circuits that are common to both color and black-and-white operation of a color receiver. For example:

1. General operating defects such as, no picture; no brightness; no sync; distorted picture; no sound, etc., reveal faults common to both black-and-white and color reception.
2. When video and chrominance circuits are DC coupled to the kinescope they can cause a condition of no brightness and should be considered if such a condition exists.
3. Color *fringing* on a black-and-white picture indicates primarily, improper operation of the *convergence* circuits.
4. Color *shading* in sections of the background of an otherwise normal black-and-white picture indicates *impurity* in the primary color fields.
5. A *color caste* over the entire background of the picture indicates improper *color balance* which can be caused by faults in the kinescope circuitry, faults in the matrix circuits or faults in the color demodulator circuits.

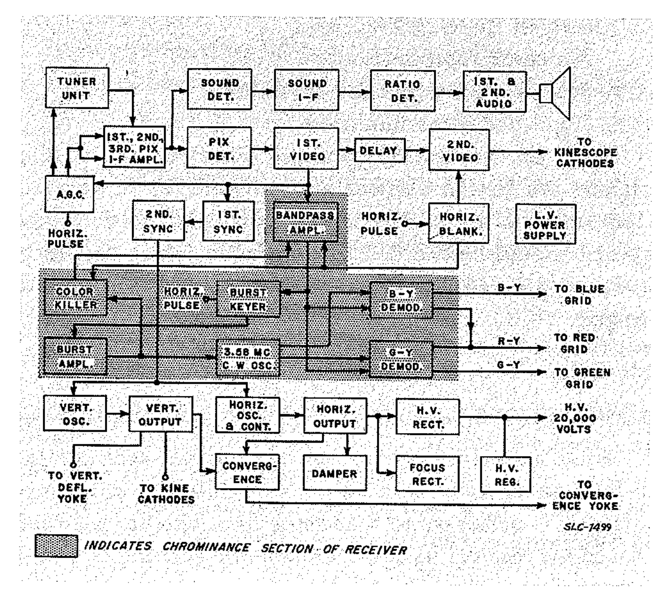


Fig. 89—Color Circuits—CTC5.

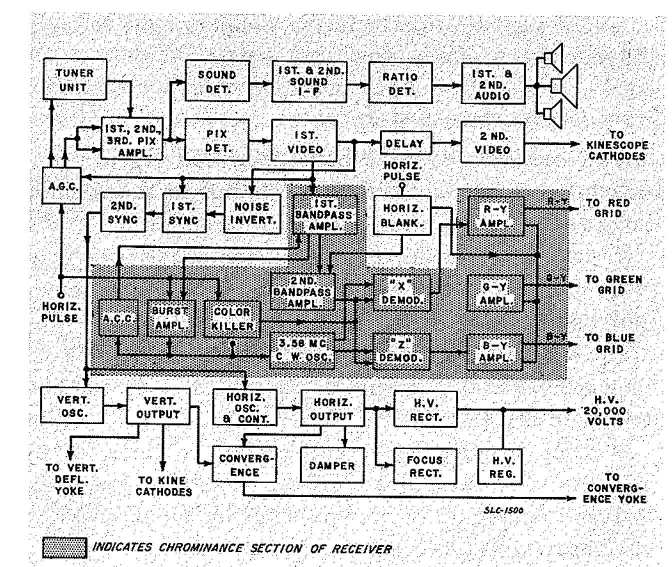


Fig. 90—Color Circuits—CTC5N.

If normal black-and-white pictures can be produced it is a good indication that the following circuits are in proper working order:

Low-voltage power supply.
High-voltage power supply.
Horizontal and vertical sync.
Sound I-F and audio circuits.
2nd Video Amplifier.
AGC circuits.
Convergence circuits.
Color Killer.
Horizontal Blanking Amplifier.
Horizontal and vertical deflection.
Kinescope and controls.

The Antenna Tuner unit, Picture I-F circuits and 1st Video Amplifier might also be added to this list but there are occasions when they could affect color reception without noticeable effect on black-and-white reception. This condition could occur when the R-F, I-F and 1st video circuits are mis-aligned to the extent that the chrominance information is greatly attenuated. Improper antenna characteristics or orientation which may not affect black-and-white reception may cause poor reception of color signals.

Color Shading

Color shading in a black-and-white picture is caused by impurity of the primary color fields resulting from improper operation of the deflection yoke, kinescope, or kinescope accessories. Color impurity resulting from defects in these components or circuits can be located by following the procedure for obtaining color purity, as described in the set-up procedure for the receiver. See page 37. Do not forget that good purity is dependent upon good convergence and proper demagnetization of unwanted magnetic fields about the tricolor kinescope. External magnetic fields, which cannot be compensated for in the receiver, may be in the vicinity of the receiver and may affect color purity.

Beam Convergence and Focus

It is necessary to have both good convergence and focus of the red, blue and green beams in the tricolor kinescope for good black-and-white reception.

If static convergence is normal, the beams will converge at the center of the screen when the DC convergence controls are properly adjusted.

The dynamic convergence controls will affect the convergence of the three beams at the sides and the top and bottom of the picture.

If color fringing exists and cannot be corrected by following the convergence set-up procedure (see page 38,) the operation of the convergence circuits of the receiver must be checked.

Remember, it is imperative that the kinescope focus, convergence, and purity be adjusted carefully if a good black-and-white or color picture is to be obtained. These adjustments have inter-related effects which must be taken into consideration when making these adjustments.

Color Temperature Adjustments

To insure that no color tint appears in the highlights or lowlights in a black-and-white picture, and that proper colors are represented in highlights and lowlights of a color picture, the receiver color temperature tracking must be properly adjusted.

Color temperature adjustments should be checked on black-and-white reception. When improper tracking is detected, the color temperature adjustments on page 41 should be performed. If color temperature tracking cannot be obtained by adjustment, kinescope control and matrix voltages should be checked.

The color demodulator stages should also be checked when proper kinescope color temperature cannot be obtained.

Keep in mind at all times that before a color receiver can be expected to produce a good color picture, it must first be able to produce a good black-and-white picture.

CHECKING COLOR OPERATION

The performance of the color signal circuits in a color receiver can be evaluated when, and only when, the receiver is functioning properly on black-and-white reception.

A color receiver may respond beautifully to all signals required to reproduce a good black-and-white picture but fail to respond as it should, to color signal information. When this condition exists, the receiver produces black-and-white pictures even when tuned to a station transmitting a color program. Color signal deficiencies may be placed in three classifications:

1. No color reproduction
2. No color lock (Synchronization)
3. Improper color rendition

These can be quickly localized since the responsible circuits are few in number and not difficult to analyze. The tubes and controls in the particular section concerned should be checked first. When a faulty condition persists, proceed to analyze associated components and wiring.

No Color

Chrominance Channel Check—Tubes and Adjustments

When a receiver fails to reproduce color, even though it is properly tuned to a station transmitting a color program, it is necessary to determine first whether the fault lies in the receiver itself or is due to the antenna. A rough test that indicates whether the receiver is passing color information may be made as follows:

Set the COLOR control to its maximum position (fully clockwise) and the color killer threshold control to its maximum counter-clockwise position. Rotate the station selector and observe the screen of the kinescope. If the receiver is capable of passing color signals through its chrominance channels, color snow and beat disturbance will be seen on the screen of the kinescope and an antenna check is in order. In most cases, a portable-type antenna will prove of value in rough checking color signal reception when a faulty antenna or transmission line is suspected. If the above test indicates that the antenna or transmission line is at fault, both antenna and transmission line should be checked.

Antenna Considerations

Partial or complete loss of the chroma portion of the color television signal can sometimes result from an unsuitable antenna installation. Some of the causes for this condition are:

Multi-path signal reception due to reflection from an object or the ground plane.

Multi-path reception due to transmission line or power line signal pickup.

Antenna or transmission line impedance mis-match. Critical transmission line length when associated with impedance mis-match.

Reaction of one receiver on another when both are connected to a common transmission line from the antenna.

Selective absorption at certain frequencies in some commercial antennas. Frequency-dependent reception patterns of highly directional antennas.

The following remedies may eliminate most of the causes of loss of chroma signal due to the antenna installation.

Use of an antenna rotator so that optimum orientation can be obtained. Or, in the case where a fixed antenna is required, optimum orientation for reception from stations transmitting color programs.

Broad-band antennas should be used where possible, in preference to high-gain types, since high-gain antennas are likely to have limited bandwidth. Elevator or balun impedance transformers should be used at the receiver antenna input where coaxial cable transmission lines are used. Where more than one television receiver is installed in the same location, unless attached to a well-designed central distribution system, separate antenna installations will be of benefit for the reception obtained by the color receiver.

If separate antennas are not practical, or permissible, low-capacitance switches may be used in the lead-in to switch from one receiver to the other.

A resistive isolation pad at the input to each receiver may also help to eliminate the condition of loss of chroma due to the antenna or lead-in.

Mis-match due to lead-in receiver-input impedance differences may be reduced by the installation of a non-inductive resistance load (300 to 1000 ohms) across the tuner input terminals.

In instances when extremely high signal levels are present, attenuation pads should be installed at the tuner "Antenna input" terminals.

Figure 91 shows schematic diagrams and values of the carbon resistors needed to construct pads that will produce respectively, ten-to-one, three-to-one and two-to-one reduction in signal strength.

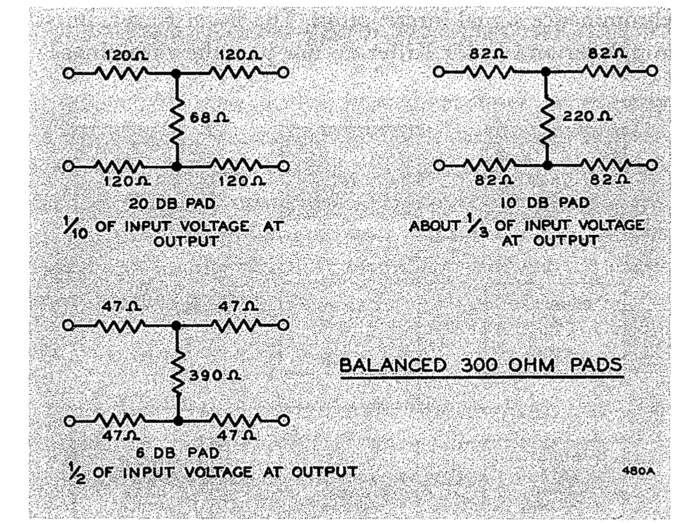


Fig. 91—Antenna Attenuation Pads.

A similar overload condition may exist in receivers connected to a multiple-outlet system or a community cable system where the received signal is amplified before it is distributed to the receivers. In this case, reducing the signal at the antenna input of the receiver will correct the overload condition. However, if the amplifiers of the community system are being overloaded by the signals they are receiving, then padding the antenna input to a receiver will not correct the overload condition. The signal handling capabilities of the amplifier should be increased or the signal applied to the amplifier should be decreased.

Receiver Considerations

If color is not indicated when the Color control is set to its maximum position (clockwise), the Color Killer Threshold control at maximum counter-clockwise position, and the Fine Tuning Control rotated, the color circuits in the receiver should be checked.

Certain checks can be made if a color stripe or color program is being transmitted by the television station to which the set is tuned, but a color bar generator is the most applicable piece of test equipment for color signal circuit analysis and should be used whenever possible.

Localizing Faults Resulting in No Color Reproduction

The chrominance sections of the CTC5 chassis and the CTC5N chassis differ considerably from each other and therefore must be reviewed separately.

No Color (CTC5)

Circuits that can cause the loss of color reproduction in the CTC5 chassis are shown in block diagram form in figure 92. Defects in the Bandpass Amplifier (V701A), Burst Keyer (V704A), Burst Amplifier (V704B), Color Killer (V701B) or 3.58 mc. CW oscillator (V705), involve the circuits most likely to be responsible for chrominance signal interruption. The Burst Keyer, Burst Amplifier and Color Killer do not pass the chrominance

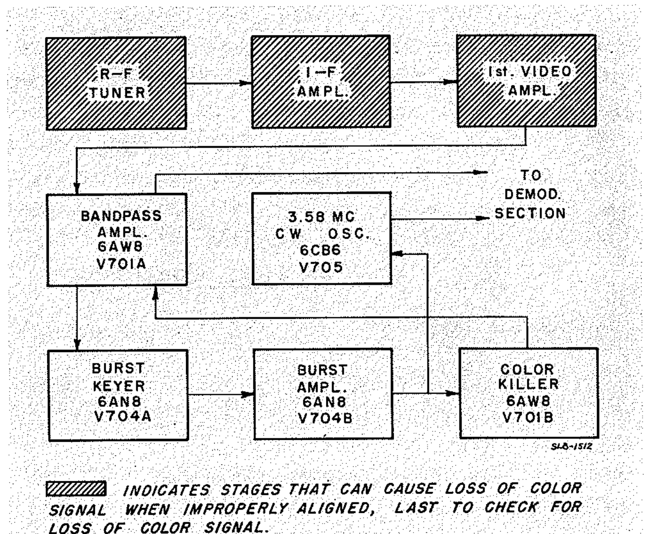


Fig. 92—Block Diagram—Circuits to Check for Loss of Color—CTC5.

signal themselves but act to control the passage of the chrominance signal through the Bandpass Amplifier. The 3.58 mc. burst signal must pass through the Burst Keyer and Burst Amplifier if the Color Killer is to be biased-off and allow passage of chrominance signals through the Bandpass Amplifier.

The 3.58 mc. CW oscillator must be functioning properly before the color difference signals (R—Y, G—Y and B—Y) can be demodulated. Color difference signals must be applied to the grids of the kinescope before a color picture can be produced.

No Color (CTC5N)

Circuits that can cause the loss of color reproduction in the CTC5N chassis are shown in block diagram form in figure 93. Defects in the 1st Bandpass Amplifier (V701A), 2nd Bandpass Amplifier (V702A), Burst Amplifier (V702B), Color Killer (V701B) and 3.58 mc. CW Oscillator (V704), involve the circuits most likely to be responsible for chrominance signal interruption. The Burst Amplifier and Color Killer do not pass the chrominance signals themselves but govern the passage of these signals through the Bandpass Amplifiers. The 3.58 mc. CW Oscillator must be functioning before the color difference signals (R—Y, G—Y & B—Y), required to produce a color picture on the kinescope, can be produced.

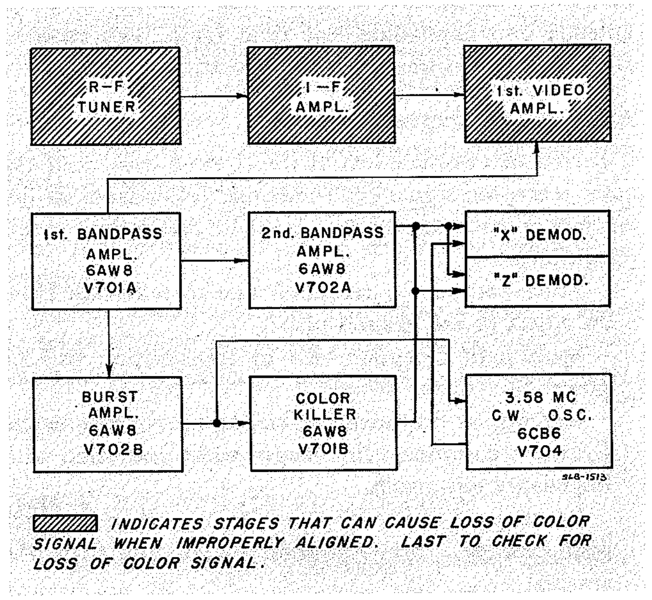


Fig. 93—Circuits to Check for Loss of Color—CTC5N.

Localizing Faults Causing No Color Lock

It may be visualized that a color television receiver forms a color picture by superimposing the color difference signals (R—Y, G—Y and B—Y) over a black-and-white picture. To maintain color synchronization, the circuits which process the burst signal must be operating properly.

A condition referred to as "no color lock" exists when color is present in the picture but is seen only as bars moving at random, horizontally and vertically, across the screen.

Malfunctioning components in the AFPC (Automatic Frequency Phase Control) circuits can cause this condition. There are slight differences between the AFPC circuit used in CTC5 and the AFPC circuit in the CTC5N chassis. The AFPC circuits therefore will be considered separately for each chassis.

Automatic Frequency Phase Control (CTC5)

When a condition of no color lock exists in the CTC5 chassis, the Burst Keyer (V704A), the Burst Amplifier (V704B), and their associated circuits should be checked. Figure 94 shows a block diagram of circuits that can cause lack of color lock when functioning improperly.

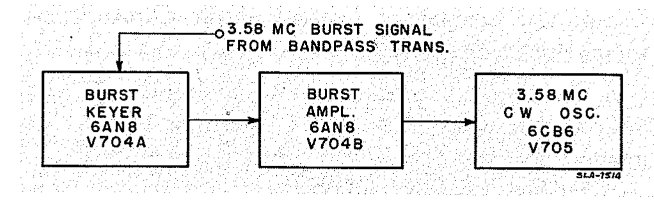


Fig. 94—Block Diagram—Circuits to Check for Loss of Color Lock—CTC5.

Automatic Frequency Phase Control (CTC5N)

When a condition of no color lock exists in the CTC5N chassis, the Burst Amplifier V702B and its associated circuitry should be checked. A block diagram of circuits that can effect color lock are shown in figure 95.

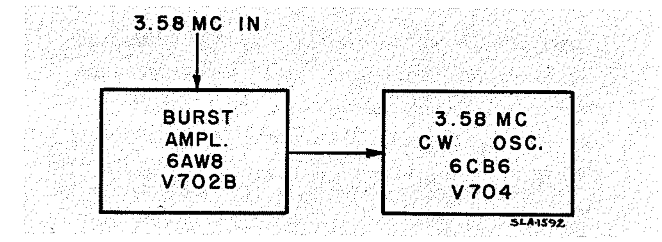


Fig. 95—Block Diagram—Circuits to Check for Loss of Color Lock—CTC5N.

Localizing Faults Causing Improper Color Rendition

Color involves hue, saturation and brightness. A condition causing an uncalled-for change in any one of these characteristics in a color receiver will cause improper color rendition. As stressed previously, black-and-white reproduction of the picture should be normal before attempting to service the chrominance channels in the receiver. Good black-and-white reception indicates that the brightness component of the color signal is normal. Hue and saturation are the other characteristics to be considered.

The circuits that affect hues, in the sense of phase relationships, are shown in block diagram form in figure 96 for the CTC5 chassis and figure 97 for the CTC5N chassis.

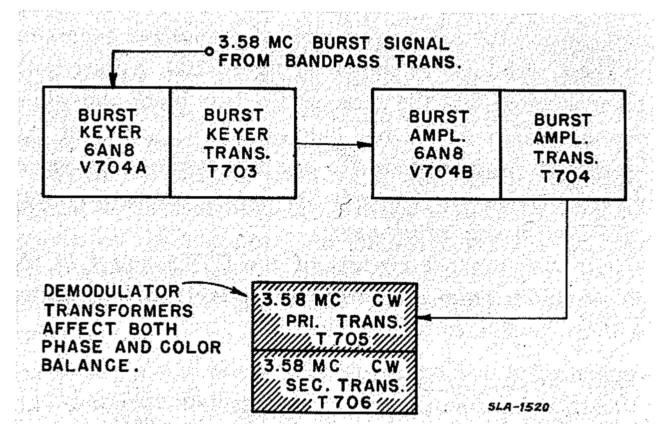


Fig. 96—Block Diagram—Circuits That Affect Hue—CTC5.

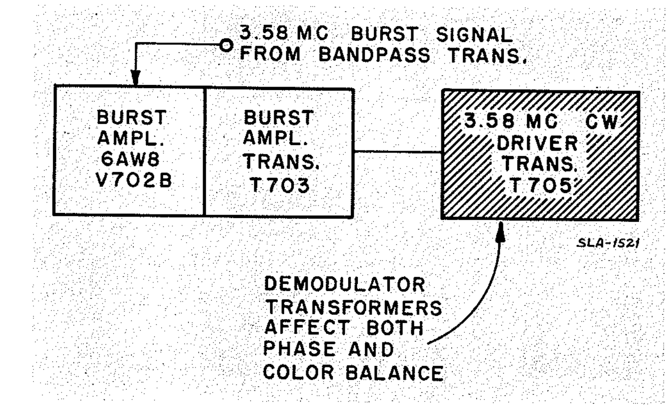


Fig. 97—Block Diagram—Circuits That Affect Hue—CTC5N.

When all hues are present but show improperly throughout the picture, the phase relationship between burst and the 3.58 mc. reference signal is incorrect. This condition usually results from improper operation in the AFPC or Demodulator circuits, and the cause can be readily located by checking the AFPC and matrix alignment of the receiver.

NOTE

Before trying to localize the source of this condition, check the HUE control and determine the amount of correction required. In many cases, only slight adjustment of the Burst Amplifier Transformer may be all that is required.

Improper colors due to color saturation deficiencies, when luminance is normal, may be observed as weak color, color too strong, or no control of color. Malfunctioning circuits controlling the amplitude of the color signal may cause such conditions. Assuming the receiver is aligned properly and that black-and-white reproduction is normal, the circuits handling the chrominance and color difference signals should be checked.

Since the chrominance sections of the CTC5 and the CTC5N chassis differ from each other in many respects, they will be reviewed separately.

Chrominance Channel (CTC5)

In the CTC5 chassis the Bandpass Amplifier (V701A) and its associated circuit should be the first to be checked when a condition of insufficient control of color or weak color exists. The Burst Keyer (V704A), the Burst Amplifier (V704B), the 3.58 mc. CW Oscillator and the Color Killer should also be checked since they too have some effect on color saturation. In addition, the G—Y and B—Y Demodulators, V702 and V703, can affect color saturation. However, defects in these circuits will cause improper color balance and normally show up in black-and-white reception. Chrominance circuits that affect color saturation in the CTC5 chassis are shown in block diagram form in figure 98.

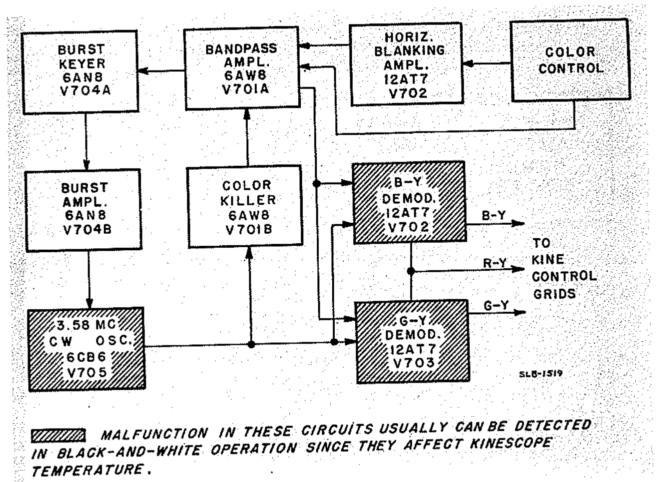


Fig. 98—Block Diagram—Circuits That Affect Color Saturation —CTC5.

Chrominance Channel (CTC5N)

In the CTC5N chassis, insufficient control of color, or weak color, calls for a check of the 1st Bandpass Amplifier (V701A), the 2nd Bandpass Amplifier (V702A) and their associated circuits. The Burst Amplifier (V702B), the Color Killer (V701B) and the 3.58 mc. CW Oscillator (V704) can also affect color saturation to a certain degree and should be checked after the 1st and 2nd Bandpass Amplifiers. In addition the "X" and "Z" demodulators, V705 and V706, and the R—Y, G—Y and B—Y Amplifiers V703A, V707A and V707B should also be checked since they can cause color saturation deficiences. However, malfunction in these circuits affects color balance and is normally detected in black-and-white reception.

Chrominance circuits that affect color saturation in the CTC5N chassis are shown in block diagram form in figure 99.

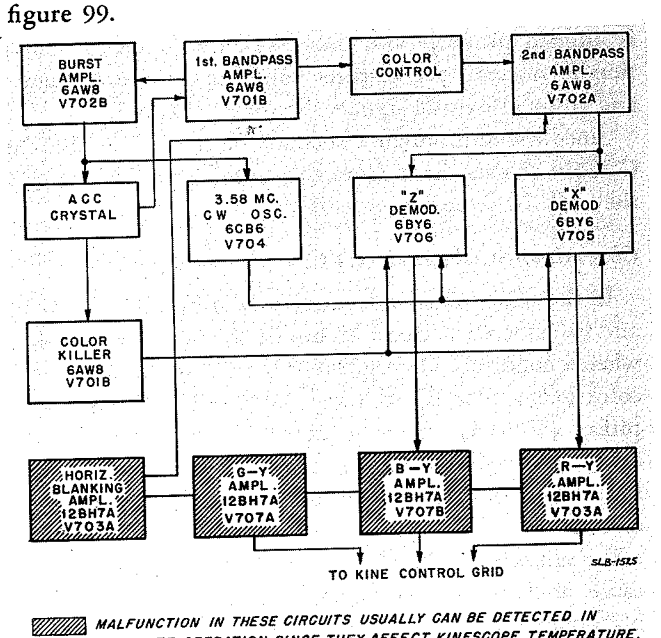


Fig. 99—Block Diagram—Circuits That Affect Color Saturation —CTC5N.

Circuit and Component Analysis of the Chrominance Channels

If the faulty condition persists after all tubes and associated controls in the affected sections of the chrominance channels have been checked, the receiver must be analyzed for defective components. To accomplish this, the chassis and tuner should be removed from the cabinet. If the top of the receiver cabinet is adequately protected with a heavy pad, or other suitable protective covering, it provides a convenient place to set the chassis. In this position the chassis may be easily connected to the kinescope and its components by means of extension cables.

CAUTION

Make sure that the chassis and the kinescope support shield are connected by a jumper. Failure to make this connection may result in a shock hazard from the shield and its metal fittings.

To localize malfunctions in the chrominance circuitry which cause loss of color, loss of color sync, or improper hue, it is recommended that a step-by-step analysis of AFPC and matrix alignment be employed.

The procedure following serves to detect the presence and status of all signals involved in the various sections of the chrominance circuitry. It provides a quick and systematic method of tracking down any malfunctioning circuit in the chrominance channels of the receiver. Circuits functioning improperly will fail to respond to alignment.

A color bar generator is suggested as a color signal source when making these checks because it provides a stable signal of known characteristics and constant output.

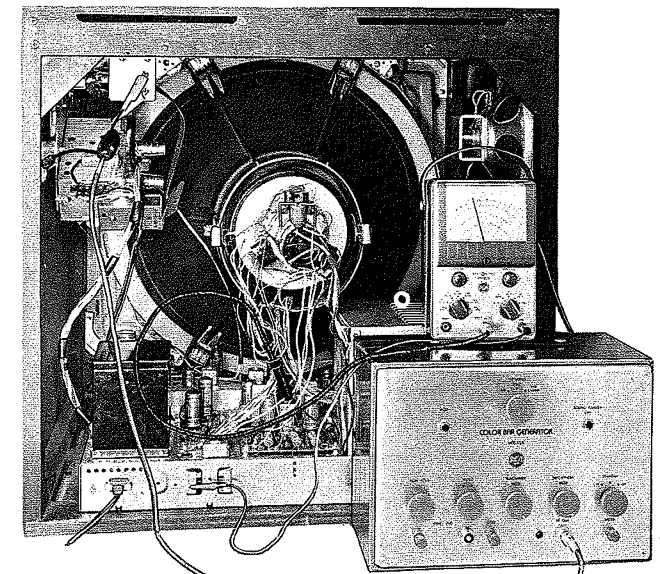
AFPC and Matrix Alignment Used for Chrominance Circuit Analysis

To check the chrominance circuitry, remove the transmission line from the receiver antenna input terminals and connect the R-F output cable of a color bar generator to these terminals as shown in figure 100. Adjust both the generator and the receiver for best black-and-white representation of the bar pattern on the screen of the kinescope. *Make certain that the fine tuning adjustment of the receiver is properly set before attempting any AFPC or matrix adjustments.*

The chrominance circuits of the CTC5 and CTC5N chassis differ from each other appreciably and therefore will be considered independently.

AFPC Alignment—CTC5

To check chrominance circuitry in the CTC5 chassis, proceed with the AFPC and matrix alignment adjustments as described below.



AFPC ALIGNMENT CAN BE MADE ON CTC5 CHASSIS WITHOUT REMOVING THE CHASSIS FROM THE CABINET SINCE ADJUSTMENTS AND TEST POINTS ARE ACCESSIBLE FROM THE TOP OF THE CHROMINANCE CIRCUIT BOARD.

Fig. 100—Color Bar Generator Connections.

1. Set the Color, Hue and Contrast controls of the receiver to the centers of their ranges.
2. Check the 3.58 mc. CW oscillator. If it is functioning, a "VoltOhmyst" will reveal a voltage of negative polarity on the grid of the color killer, at TP701. This voltage should be approximately —6 volts when burst is not applied to the oscillator grid, and range from —10 to —25 volts (to bias off the color killer) when burst is applied.
3. Connect the "VoltOhmyst" to terminal "C" of the burst keyer transformer, TP707, and tune T703 for maximum DC reading on the meter. A peaking response to this adjustment indicates that the bandpass amplifier and burst keyer stages are functioning.
4. Connect the "VoltOhmyst" to the grid of the color killer, at the test point TP701, and tune the 3.58 mc. CW oscillator by adjusting T704, the burst amplifier transformer, for maximum voltage reading of negative polarity. Response to this adjustment indicates that the burst amplifier is functioning.

When the circuits involved in the AFPC alignment appear to be functioning normally and color does not appear on the kinescope, the circuitry involved in transferring the chrominance signal from the bandpass amplifier to the B—Y and G—Y demodulators should be checked.

The B—Y and G—Y demodulators affect color balance and therefore malfunction in these circuits can normally be detected in the black-and-white signal reproduction of the receiver.

Matrix Alignment CTC5

When color bars are present on the screen of the kinescope, and the Hue control is in the center of its range, the hues should be in the order shown in figure 101. If the colors are not as they should be, and the AFPC

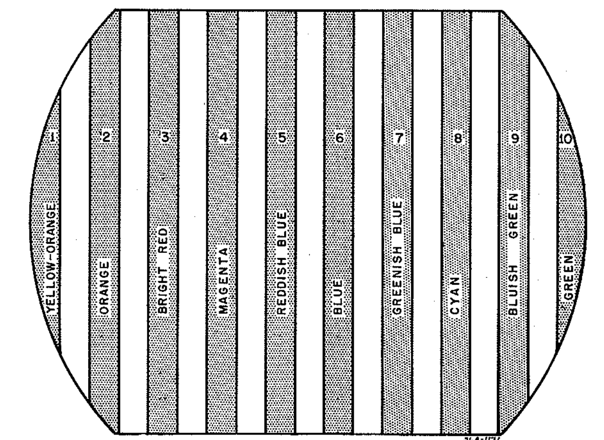


Fig. 101—Color Bar Pattern.

adjustments have been checked as described in the previous paragraphs, the matrix alignment should be checked. This can be done easily by checking the bar pattern of each individual primary color separately as described below.

1. Connect the "VoltOhmyst" to terminal "C" of T705, the CW driver primary transformer, and adjust both the bottom and top cores of T705 for maximum DC voltage indication on the meter.

Response to this adjustment indicates that the 3.58 mc. CW oscillator is functioning and the CW driver primary transformer is reacting normally.

2. Connect the "VoltOhmyst" to terminal "C" of T706, the CW driver secondary transformer and adjust the core for maximum DC voltage indication of the meter.

Response to this adjustment indicates the 3.58 mc. CW signal is present at the color demodulators.

3. Short the green and red control grids of the kinescope to ground through 100K resistors.
4. Adjust the bottom core of T705 until the third and ninth bars are the same brightness level as the background (Hue control in the center of its range).
5. Remove the 100K resistor from the grid of the green gun and connect it between the grid of the blue gun and ground.
6. Adjust the top core of T705 until the first and seventh bars are the same brightness as the background.
7. Remove the 100K resistor from the grid of the red gun and connect it between the grid of the green gun and ground.
8. Touch-up the top core of T705 until the 6th bar is the same brightness as the background.

Pages 54 and 55 illustrate test points and steps to accomplish AFPC and matrix adjustment in the CTC5 chassis.

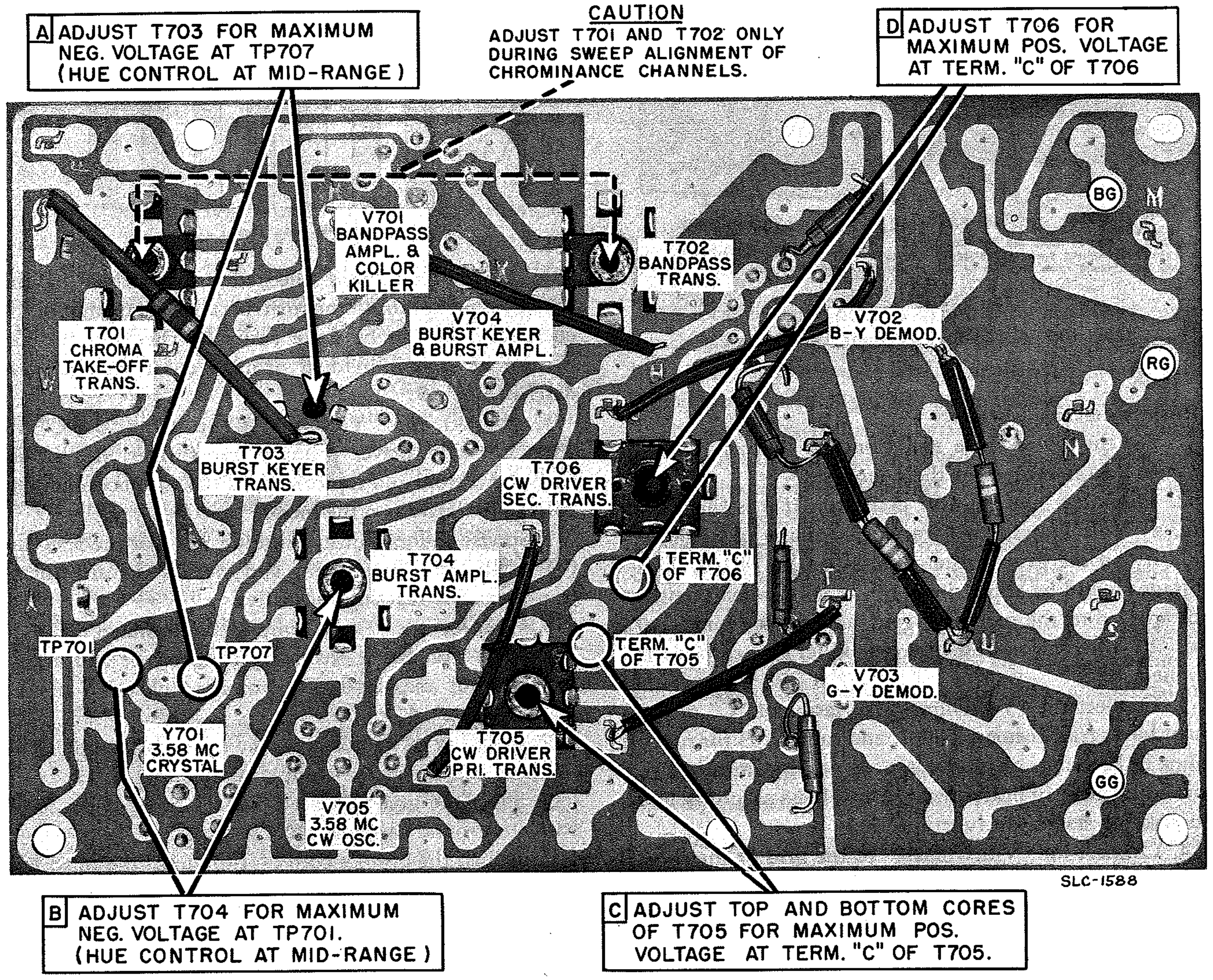


Fig. 102—Test Points and Adjustments—AFPC Alignment CTC5—Bottom View Printed Circuit Board PW-700.

AFPC ADJ.-CTC5

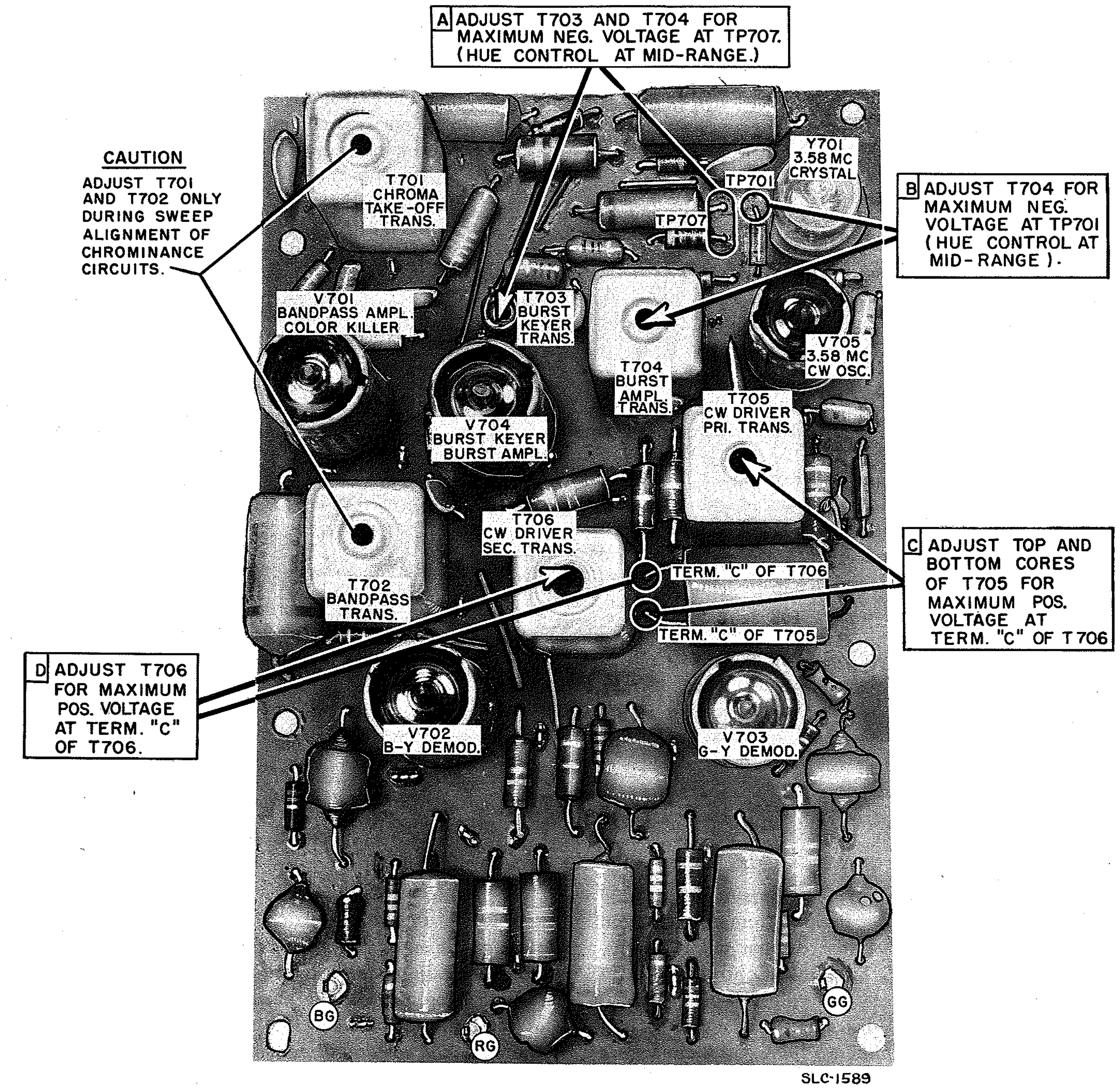


Fig. 103—Test Points and Adjustments—AFPC Alignment—CTC5 Chassis—Chassis Need Not Be Removed From Cabinet to Make These Adjustments.

AFPC Alignment (CTC5N)

The chrominance circuitry used in the CTC5N chassis may be checked by following the AFPC and matrix alignment procedure described below. The location of the test points and adjustments involved in the procedure are shown in figure 105, on page 57.

1. Turn the COLOR, HUE and CONTRAST controls to mid-range (color killer threshold fully counter-clockwise).

2. Check the 3.58 mc. CW oscillator. This can be done by checking the voltage present at the oscillator grid with a "VoltOhmyst".

A voltage of from —1 to —3 volts should be present at the grid of the oscillator, pin #1 of V704, if the oscillator is functioning and burst is not present. When burst is present, a voltage of at least —6 to —8 volts should be present at this point.

3. Check the action of the ACC diode, CR701.

This can be done by measuring the voltage on both sides of the diode. The voltage on the color killer grid circuit side of the crystal should be approximately double the voltage on the oscillator side of the crystal.

4. Connect the "VoltOhmyst" to the color killer side of the ACC diode, CR701, and adjust the burst amplifier transformer T703, for maximum negative voltage reading on the meter.

Adjustment of this transformer provides maximum burst injection to the 3.58 mc. oscillator and causes the oscillator to function at the correct frequency and phase.

Response to this adjustment indicates that the burst amplifier, 1st bandpass amplifier and 3.58 mc. CW oscillator are functioning.

NOTE: *In some chassis, the coil L710, in the screen-grid circuit of the oscillator, is adjustable. When it is adjustable it should be adjusted to provide a negative voltage of —6 volts on the color killer side of CR701 with burst removed. To remove burst temporarily, short terminals "B" and "C" on T702, the 1st bandpass transformer.*

5. Connect the "VoltOhmyst" to the junction of R703 and CR701 and connect a jumper from this junction to terminal "D" of T701, the chroma take-off transformer. Adjust the ACC Threshold Control, shown in figure 55, for a reading of —0.5 volts DC on the meter. Remove the jumper and disconnect the "VoltOhmyst".

The 2nd bandpass amplifier, V702A and the blanking amplifier, V703B, are not involved in AFPC alignment. These stages should be checked when all the circuits involved in AFPC alignment appear to be functioning normally and color does not appear on the kinescope.

The "X" and "Z" color demodulators can prevent color from appearing on the kinescope but only when *both* demodulators are inoperative.

Malfunction in the "X" color demodulator will result in the loss of red in the color picture.

Malfunction in the "Z" color demodulator will result in the loss of blue, green and cyan hues in the picture.

The R—Y, G—Y and B—Y amplifiers affect the kinescope color temperature and therefore malfunction in these circuits can normally be detected in the black-and-white operation of the receiver.

Matrix Alignment (CTC5N)

When color bars are present on the screen of the kinescope, and the HUE control is in the center of its range, the hues should appear in the order shown in figure 101. If the color sequence, or hues, are not correct, and the AFPC alignment has been checked as described in the previous paragraphs, the matrix alignment should be checked. This can be done easily in the field by checking the bar pattern of each of the individual primary colors separately on the screen of the kinescope.

To perform the matrix alignment adjustments on the CTC5N chassis proceed as follows:

1. Set the COLOR, HUE and CONTRAST controls to the centers of their ranges.

2. Connect the "VoltOhmyst", through a detector probe, to terminal "E" of T705, the CW driver transformer. A schematic diagram of a suitable crystal detector is shown in figure 104.

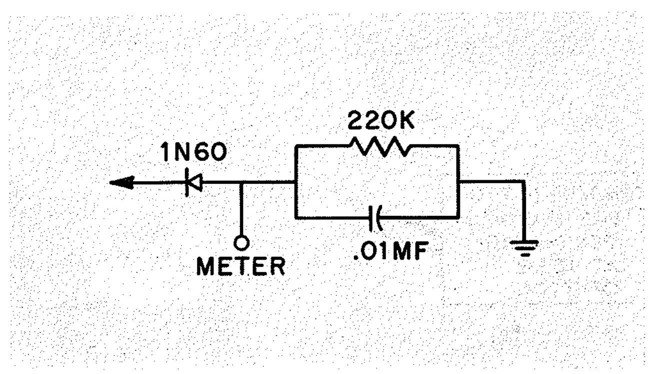


Fig. 104—Schematic Diagram—Crystal Detector Probe.

3. Rotate the Hue control from one extreme of its range to the other and observe the reading on the "VoltOhmyst". Adjust the bottom core of T705 until the same reading is registered on the meter at the extreme positions of the hue control. Leave the HUE control set in the minimum DC position after completing this adjustment. This is its electrical center. *The HUE control should remain at its electrical center for the remainder of the matrix alignment procedure.*

Response to this adjustment indicates that the 3.58 mc. CW reference signal from the oscillator is present, the primary side of the CW transformer is reacting normally and that the HUE control is functioning.

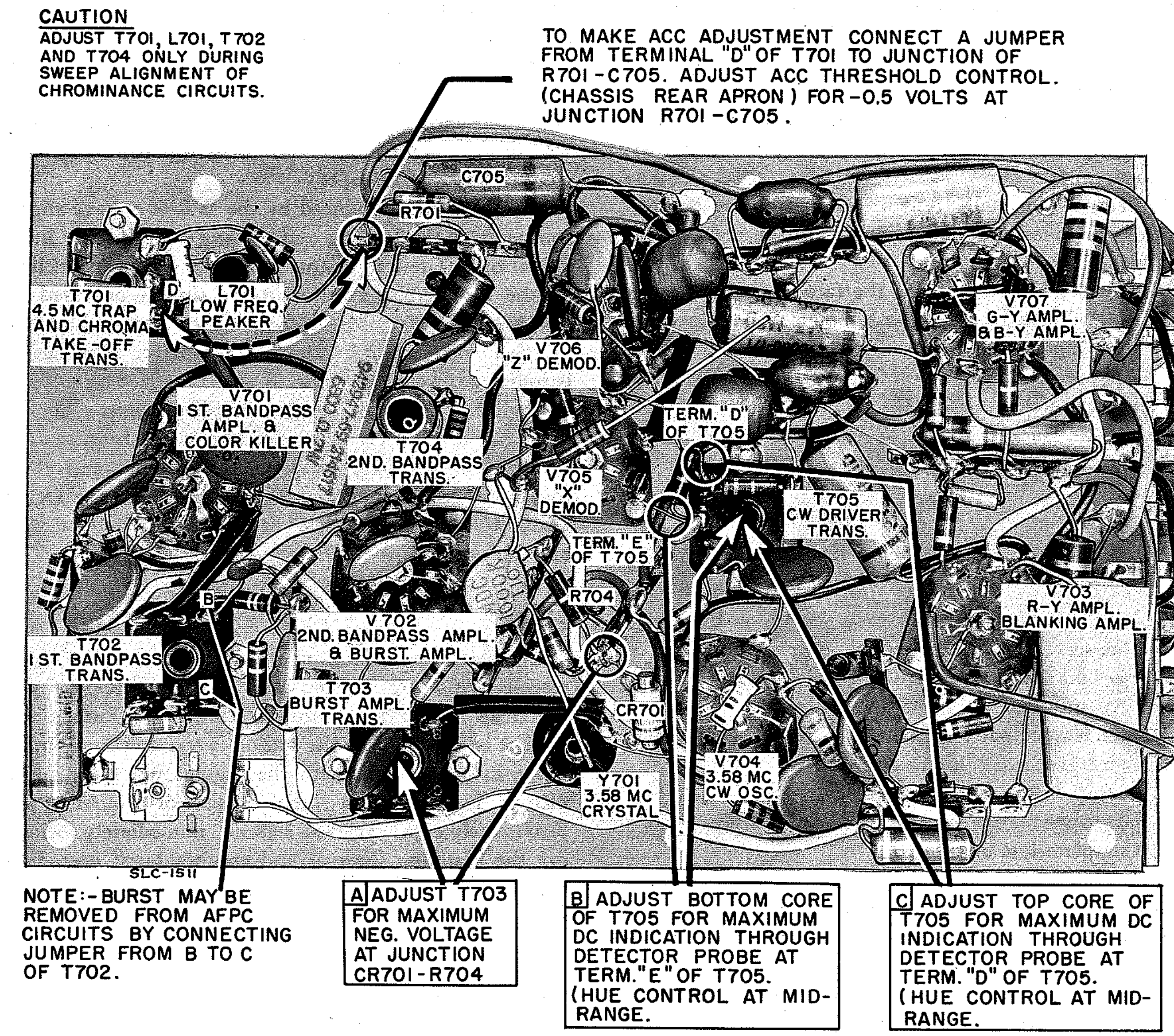


Fig. 105—Bottom View—Chrominance Circuits, MP-700—CTC5N Chassis, Showing Components and AFPC Alignment Procedure.

4. Move the detector probe of the "VoltOhmyst" to terminal "D" of T705, and adjust the *top* core of T705 for a maximum DC reading on the "VoltOhmyst".

5. Remove the "Z" demodulator, V706, from its socket and adjust the *bottom* core of T705 to make the sixth bar the same brightness level as the background.

6. Replace the "Z" demodulator tube, remove the "X" demodulator, V705, from its socket, and adjust the *top* core of T705 to make the second and eighth bars the same brightness level as the background. Replace the "X" demodulator.

7. Short the blue and green control grids of the kinescope to ground through 100K resistors. Adjust the HUE control to make the 6th bar the same brightness level as the background.

8. Remove the 100K resistor from the blue control grid of the kinescope and connect it to the red control grid.

Blue bars should appear on the face of the kinescope with the 3rd and 9th bars the same brightness level as the background.

9. Remove the 100K resistor from the green control grid and connect it to the blue control grid.

Green bars should appear on the kinescope with the 1st and 7th bars the same brightness level as the background.

SERVICING WITH THE COLOR BAR GENERATOR

Before making any checks with the Color Bar Generator the service technician should understand the effects that the Fine Tuning Control has on the reception of color. An incorrect adjustment can cause:

1. Interference pattern caused by a beat between the sound and 3.58 mc. color carriers.
2. A shift in the hue of the colors.
3. Improper fit, or registration, of the colors.
4. Complete loss of color.

From this, it is easy to understand why the Fine Tuning control and, in fact, all of the controls of the color television receiver must be properly adjusted before servicing is begun.

The normal operation of the RCA WR-61A Color Bar Generator requires the Sub-carrier Amplitude Control to be set to the maximum clockwise position. In this position the peak-to-peak amplitude of the sub-carrier is approximately equal to horizontal sync just as it is with a transmitted signal. The amplitude of the sub-carrier is roughly in proportion to the degree of rotation of the control.

This provides a means of checking the sensitivity of the color-lock action in the receiver. For example, if the Sub-carrier Amplitude Control were set at 50% of rotation, the "burst" signal would have only half its normal amplitude. If the receiver failed to hold color sync under this condition further checks should be made to determine the cause of poor color sync. The R-F and I-F alignment should be checked as should the color sync circuits of the receiver.

Another control on the WR-61A, labeled "60-Cycle Mod.," provides another service check for the receiver. When this control is in the "On" position a 60 cps signal is applied to the output signal. This will cause a horizontal area of increased brightness across the color bar pattern. If there is a change in the hues of the bars throughout the light and dark areas of the bars, it indicates clipping, or compression of the signal is taking place in the receiver. This might be due to low emission of a tube, incorrect tube bias, or change in plate load-resistor and might best be located by signal tracing with a wide-band oscilloscope.

The color bars produced by the WR-61A have slight transients at the leading and trailing edges of the individual bars. These transients produce a dark vertical line on the right edge. The luminance signals provided in this manner are useful in checking proper registration of the colors in the bar pattern. Incorrect registration is indicated by one or more of the color bars extending beyond the luminance lines. The displacement of the color bar may be either to the left or to the right depending on whether the time delay in the receiver is too short, or too long. Time delay occurs in the Delay Line, DL-101. Alignment of the R-F, I-F and Band pass amplifiers will also affect registration.

COLOR STRIPE TRANSMISSION

It is often desirable to check the operation of a color receiver with a transmitted color signal. Although a station may not be transmitting a color program at the time, it is possible that the station is transmitting a color stripe in conjunction with the regular black-and-white picture. This color test signal consists of a burst of approximately eight cycles at 3.58 mc. immediately following the blanking interval and another burst preceding the next blanking interval as shown in figure 106.

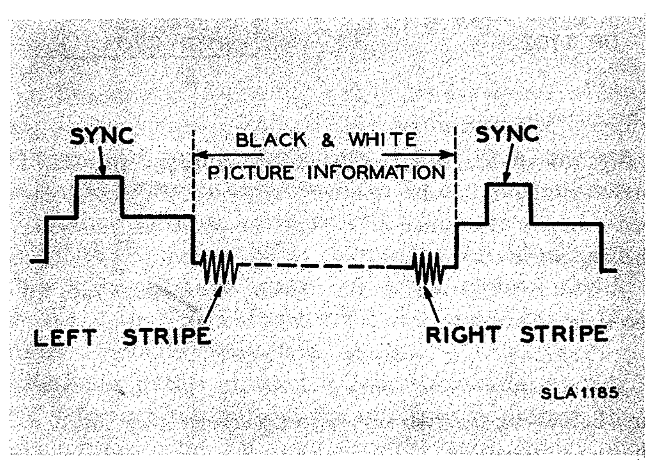


Fig. 106—Color Stripe Signal.

When the color stripes are received on a color television receiver, however, only the stripe on the right side of the picture can be made visible. Before the stripe can be made visible, the receiver must be adjusted so that the "burst" following blanking will occur during the horizontal line retrace interval. The starting point of the scanning lines must be delayed slightly to clip the left side of the picture. This may be done by delaying the horizontal sync pulse in order to delay the triggering of the horizontal oscillator. The 3.58 mc. signal will then be accepted by the Bandpass Amplifier and cause the Color Killer to become inoperative.

The color stripe signal at the right edge of the picture will then be reproduced in color. When the Hue control of the receiver is properly adjusted the stripe will appear yellowish-green.

To operate the CTC5 and CTC5N chassis in the above manner, adjust the horizontal frequency control, located on the front panel of the receiver, until the color stripe appears at the right side of the picture.

CHASSIS, KINESCOPE AND ACCESSORY SERVICING

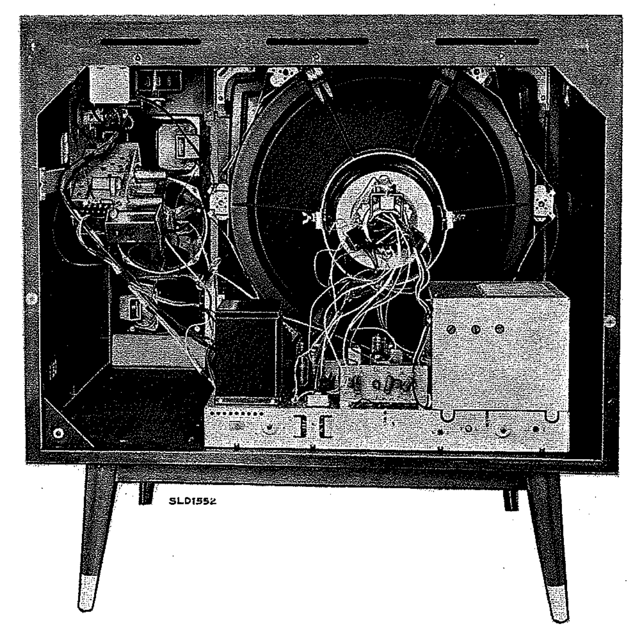


Fig. 107—Rear View—"Deluxe" Model Receiver— Rear Cover Removed.

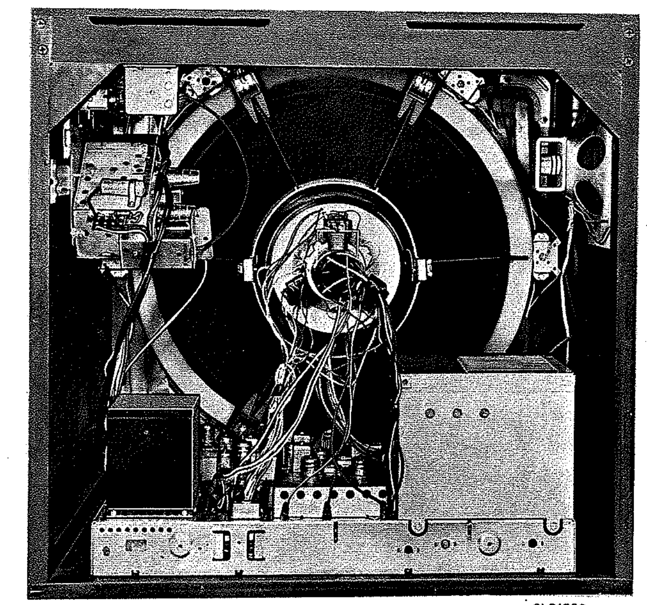


Fig. 108—Rear View—"Special" Model Receiver— Rear Cover Removed.

Chassis Removal

The chassis in these receivers are comparatively light in weight and can be removed from the cabinet independently of the tuner unit. Steps involved in removing the chassis are as follows:

1. Remove control knobs from front and side of receiver.
2. Take off rear cover from cabinet.
3. Remove volume control assembly from tuner after first loosening the two self-tapping screws securing it to the tuner assembly.
4. Disconnect the four-contact power cable and the I-F link cable from the tuner unit.
5. Disconnect the high voltage anode lead from the cup at the base of the high-voltage rectifier. To do this it is necessary to open the cover from the high voltage compartment.

NOTE: The screw securing the top of the HV compartment is designed with a very long thread to require approximately one-half minute to completely loosen. The screw is purposely designed in this fashion to allow time for any charge existing to be dissipated before the HV compartment can be opened.

CAUTION

20,000 volts is present at the rectifier cup when the receiver is turned on. Extreme caution should be exercised when operating the receiver with the high voltage compartment cover in an open position.

6. Disconnect the kinescope socket and the leads to the speaker.

7. Unplug the deflection yoke, convergence magnet assembly and the blue beam-positioning magnet cables from the chassis.

8. Remove the four chassis bolts securing the chassis to the bottom of the cabinet.

After completing the steps outlined above, the chassis may be withdrawn from the cabinet without disturbing the mounting of the tuner or the kinescope. See figure 109.

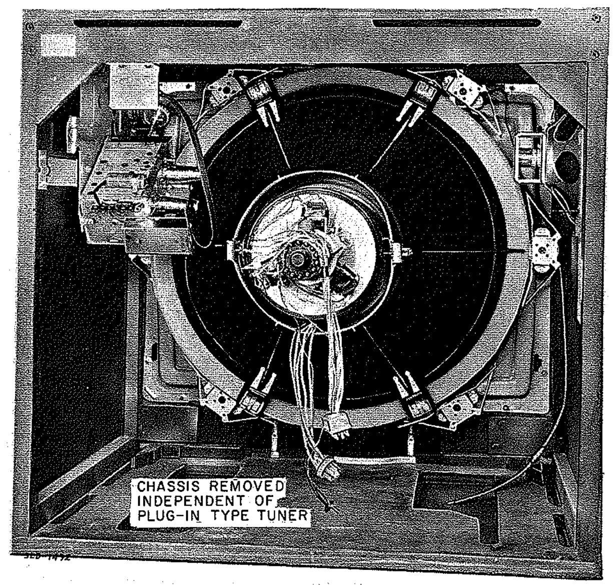


Fig. 109—Rear View of Cabinet—Chassis Removed Independently From Tuner.

Tuner Unit Removal

The tuner units on these receivers are of the plug-in type and are mounted in the cabinets mechanically independent of the receiver chassis. The tuner can be removed from the cabinet as follows:

1. Remove the control knobs.
2. Disconnect the four-contact power cable and I-F link cable from the tuner.
3. Remove the volume control assembly from the tuner bracket after first loosening the two self-tapping screws securing it in place.
4. Remove the three nuts which secure the unit to cabinet (refer to figure 57, page 36) and carefully withdraw the unit from the cabinet.

The tuner may be temporarily mounted on the special bracket on the rear apron of the receiver chassis for convenience during servicing or transporting the chassis. See figure 110.

CAUTION

When the CTC5N chassis are serviced with the tuner mounted on the rear apron, make certain the terminals on the kinescope terminal board do not short to the tuner bracket. It is advisable to insert an insulating pad between the tuner bracket and the kinescope terminal board to avoid possible short circuits when the receiver is operated with the tuner in this position.

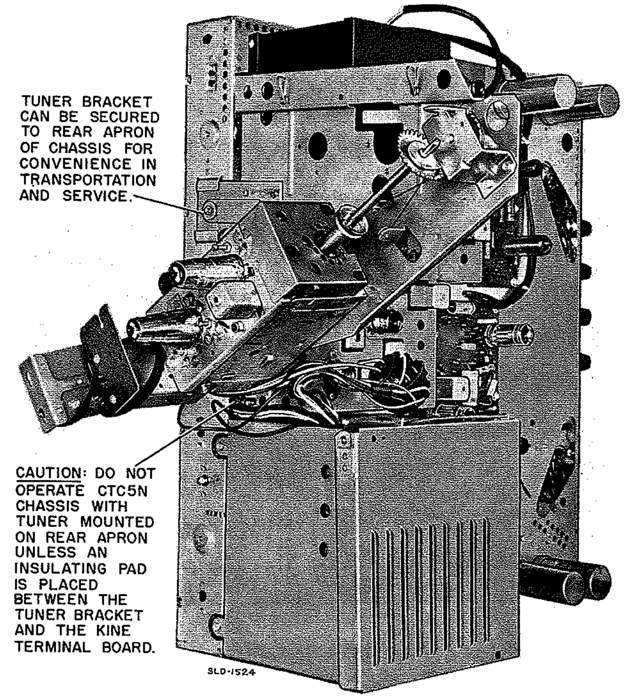


Fig. 110—Tuner Unit Mounted on Chassis for Transportation or Service.

Kinescope Installation

The kinescope in these receivers is partially enclosed in a polyethylene structure referred to as the "boot." The "boot" functions as a partial mechanical mount for the kinescope, mechanical mount for the deflection yoke and horizontal frequency radiation shield. In addition it serves as a high-voltage capacitor. One plate of the capacitor is formed by a conductive coating on the outside of the "boot," which is grounded. The other plate is the metal surface of the kinescope.

The capacitor depends upon the internal resistance built into the 21AXP22-A kinescope for a discharge path. *For this reason it is essential that a 21AXP22-A type kinescope be used with the CTC5 and CTC5N chassis.* This resistance is visible as a reddish brown paint on the inside surface of the bell and neck of the kinescope.

Removal of Kinescope

CAUTION

It is seldom necessary to handle the kinescope. However, when removal or replacement of the kinescope is necessary, reasonable precautions should be exercised. Shatterproof goggles should be worn and persons not so equipped should be kept away.

To remove the kinescope proceed as follows:

1. Remove the chassis from the cabinet, and the tuner when necessary, following the procedures outlined for Chassis Removal and Tuner Removal on pages 59 and 60.
2. Slide the blue lateral beam-positioning magnet, the purity magnet, and the convergence yoke off the neck of the kinescope. Figure 112 shows the kinescope accessories.

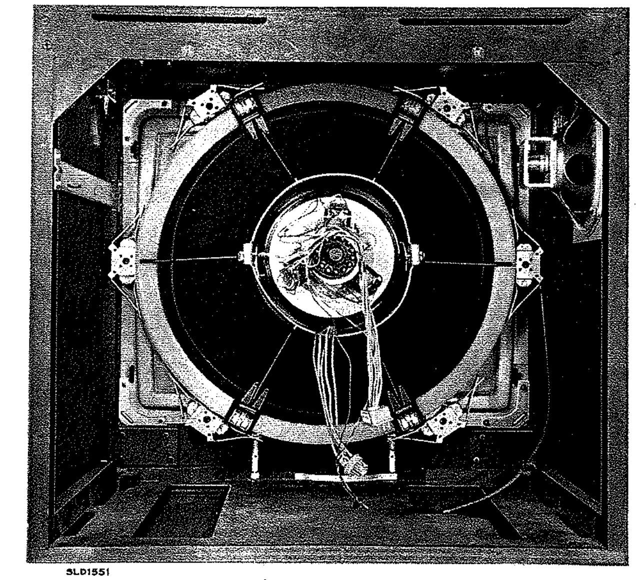


Fig. 111—Cabinet Ready for Removal of Kinescope—"Special" Model.

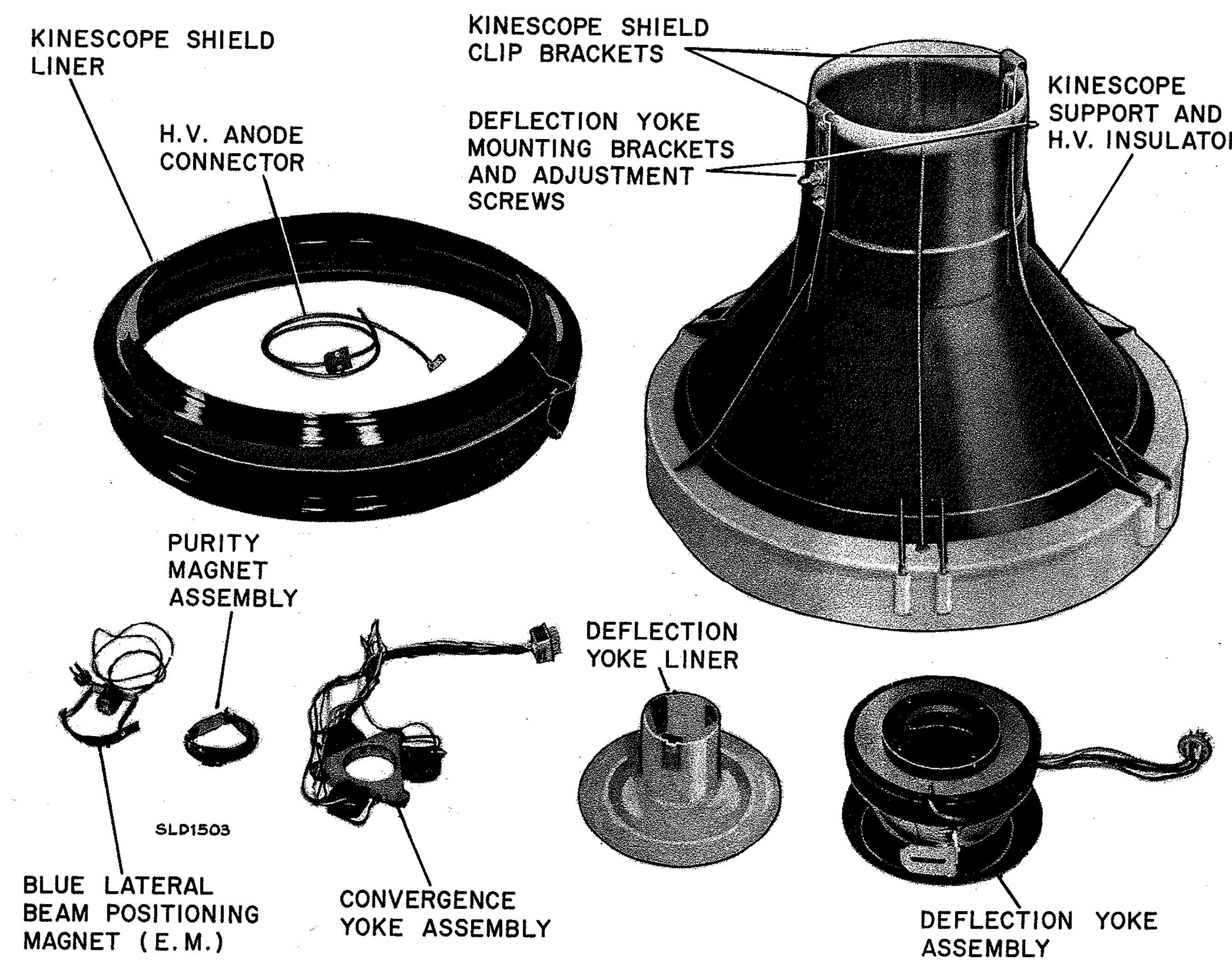


Fig. 112—Kinescope Accessories.

3. Carefully lay the cabinet face-down on a protective surface.

4. Remove the four hex nuts securing the kinescope-shield mounting brackets to the kinescope mask. See figure 113. Use a 7/16″ hollow shaft socket tool.

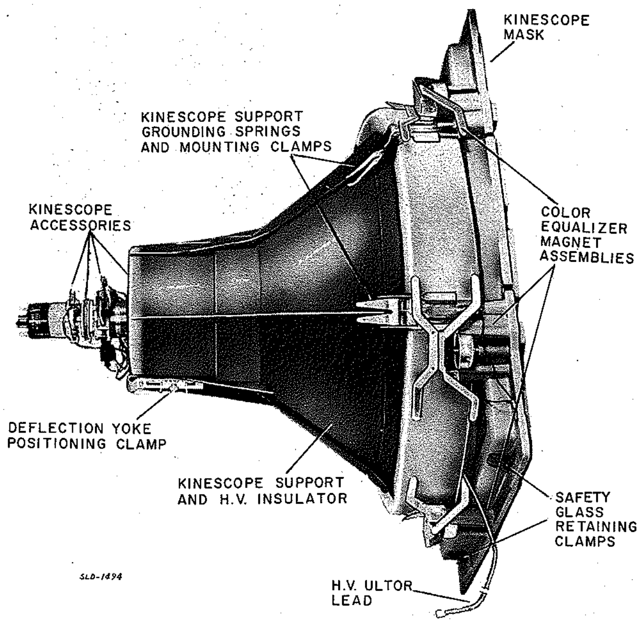


Fig. 113—Kinescope Mounting and Accessories.

5. Slide each mounting bracket upward, then out, under the equalizing magnet projections. Then, remove the kinescope shield grounding springs.

6. With the deflection yoke attached to the kinescope shield, lift the shield and yoke as an assembly, up and off the kinescope. See figure 114.

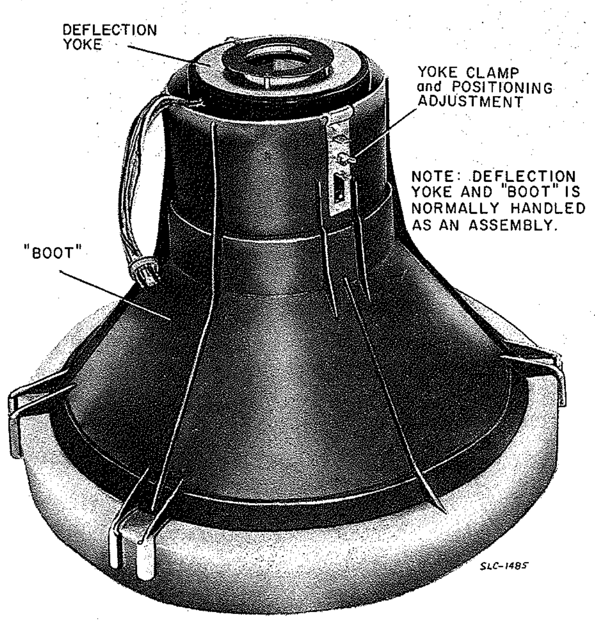


Fig. 114—Kinescope "Boot" and Yoke Assembly.

7. Grasp the flange of the kinescope, which is covered with the insulating liner, and lift the kinescope and liner from the mask. *Do not lift the kinescope by its neck.*

8. Remove the insulating liner from the flange of the kinescope and unclip the anode connector.

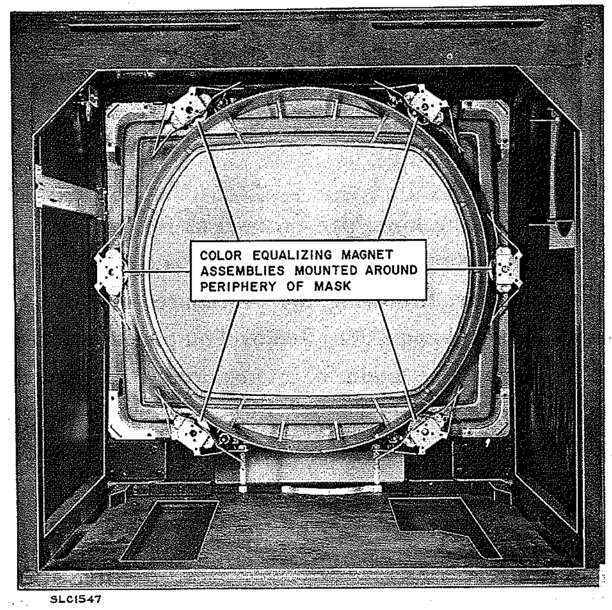


Fig. 115—Cabinet With Kinescope Removed.

Installation of Kinescope

1. Clip the anode lead to the flange of the kinescope directly in line with the blue gun of the kinescope (base pin #12) and place the insulating liner around the flange so that the anode lead emerges approximately in line with kinescope base pin #14. See figure 116.

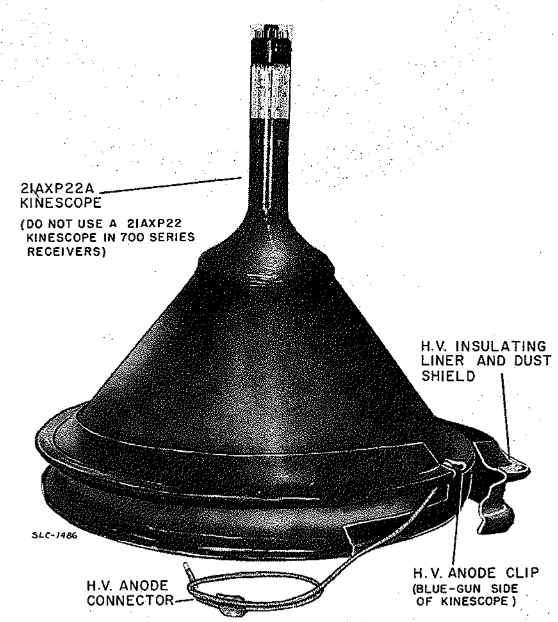


Fig. 116—Installation of HV Anode Lead and HV Insulating Liner.

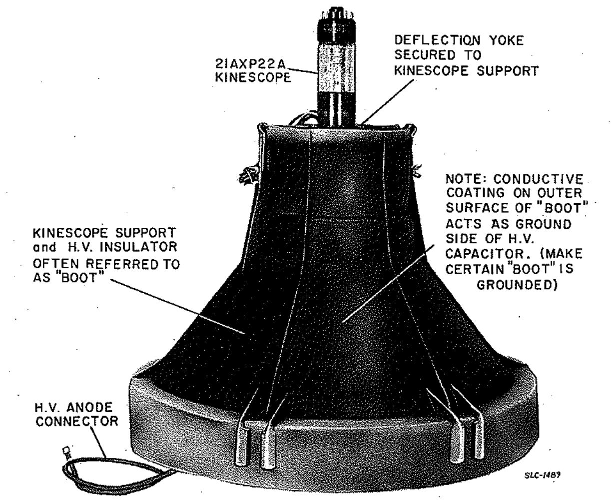


Fig. 117—Kinescope, Yoke and "Boot" Assembly.

2. Lift the kinescope by the inner flange and place it on the kinescope mask. Make certain that the kinescope base pin #12 faces the top of the cabinet so that the blue gun will be placed in its proper position.

3. Place the kinescope shield and yoke assembly over the kinescope. Install the kinescope shield grounding springs and mounting brackets and secure the entire assembly in place with the four 7/16″ hex nuts.

CAUTION

Make certain that each kinescope shield grounding spring is properly grounded through the kinescope shield mounting brackets and ground wire. See figure 118.

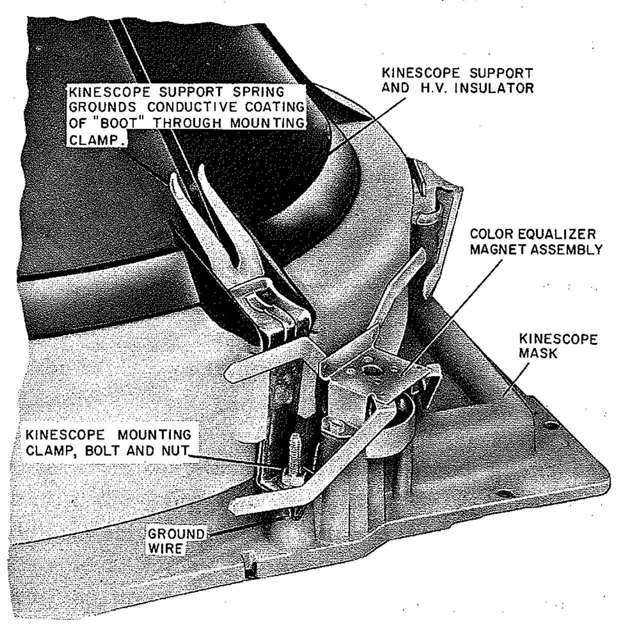


Fig. 118—Close-up View—Kinescope Mounting Clamp.

4. Set the receiver upright and place the convergence yoke, purity magnet and blue lateral beam-positioning magnet in their proper positions. See figure 113.

The convergence coil assembly should be mounted with the leads toward the kinescope bell, and its magnet pole pieces over the pole pieces at the front end of the kinescope guns. Refer to figure 60, page 37. The opening between the two magnets should be over the opening between the pole pieces and the blue coil must be positioned over the blue gun. The proper coil may be determined by the color of the wires attached.

The purity magnet should be placed over the kinescope with the supporting tabs toward the bell of the kinescope and about 1/4 inch behind the converging coil and magnet assembly.

The blue lateral beam-positioning magnet should be placed over the blue gun pole-piece. Refer to figures 60 and 61, page 37.

5. Replace the chassis in the cabinet, and also the tuner if removed. To do this reverse the procedure outlined on pages 59 and 60.

Kinescope Safety Glass Removal

The safety glass may be easily removed to allow for cleaning of the glass and kinescope face plate when required.

To do this proceed as follows:

1. Remove the knobs from the operating controls on the front of the cabinet. Take out the two screws holding the control case in place and pull the case from the cabinet. See figure 119.

2. Insert a small screwdriver into one of the round hooks along the top edge of the control case opening. Pull the hook downward and at the same time pull the front mask bezel outward above the hook. Repeat the same procedure for the second hook, loosening the bezel along the bottom.

3. Pull the bezel outward and downward out of the recesses at the top of the screen. Four clips holding the safety glass will now be visible at the sides of the glass.

4. Remove the rear cover of the receiver, reach in and release each clip by squeezing the clip together and push out through the front opening. Be careful that the glass does not fall out when the last clip is removed.

To install the safety glass, simply put the glass in place, re-insert the four clips and press them into position from the front of the cabinet. Replace the bezel, control panel case and control knobs by applying a reversal of the removal procedure.

NOTE: *Do not operate the receiver with the safety glass removed.*

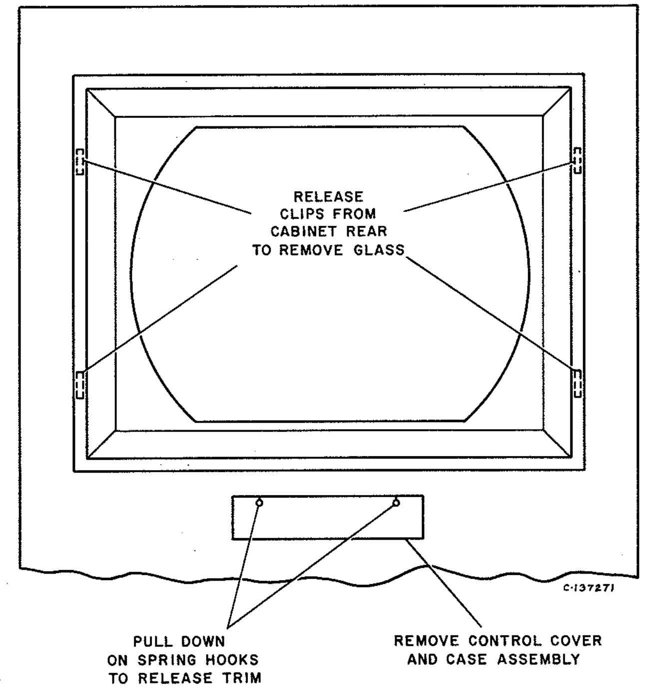


Fig. 119—Removal of Safety Glass.

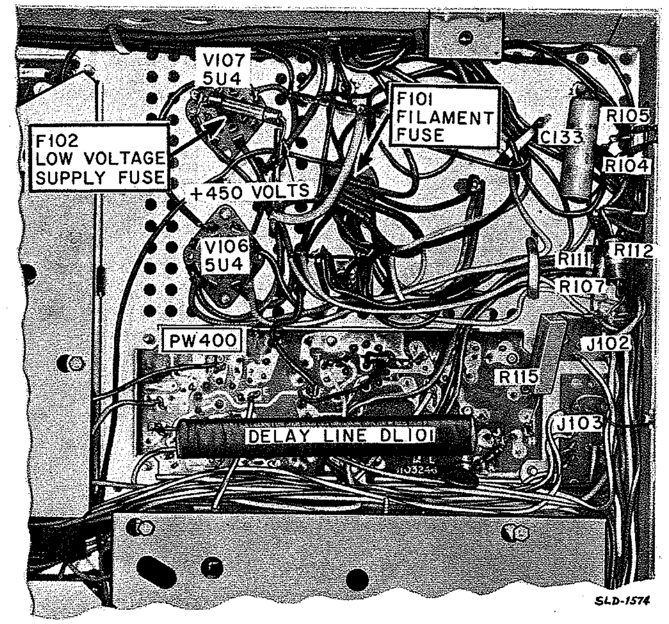


Fig. 120—Fuse Locations.

FUSE DATA

There are four fuses used in the CTC5 and CTC5N chassis. Two fuses, F103 and F104 shown in figure 56, page 35, are accessible at the top of the chassis. These two fuses are secured in holders by means of a bayonet lock which permits easy and quick insertion and removal. The holders will accept only fuses of proper size, eliminating the possibility of over-fusing their respective circuits.

The other two fuses, F101 and F102, shown in figure 120, are located beneath the chassis and are accessible only when the chassis is removed from the cabinet.

The effect that results from each fuse being open is listed below:

Symbol	*Result If Open*
F101	No brightness, No sound, most tube filaments out
F102	No brightness, No sound, filaments OK, no B-plus
F103	No brightness, Sound Normal
F104	No brightness, Sound Normal

PRINTED CIRCUITS

The following pages show the individual printed circuit boards with components, connection points and voltage measuring points clearly labeled for ease in circuit tracing.

MP-700, the chrominance section of the CTC5N chassis is a metal mounting plate. The underside of the high voltage section is shown with all components identified for convenience in servicing these circuits.

SERVICING THE PRINTED CIRCUIT BOARDS

Replacement of Components on Printed Circuit Boards

The individual components mounted on printed circuit boards may be easily replaced when the proper technique is used. *Only extensive damage to the printed connecting strips, or breakage of the board, should necessitate replacement of the complete board.*

Tools Required to Service Printed Circuit Boards

There are no special tools required when servicing printed circuit boards. The complement of tools normally employed by the television service technician are all that are necessary. However, the soldering iron used when working on the printed circuit board should not exceed 100 watts, since excessive heat can readily damage the board.

Checking Intermittent Circuitry

The technique employed in the construction of printed circuits minimizes the possibility of intermittent circuit conditions. If an intermittent condition does exist it may be localized by a slight flexing of the board and probing of the component leads. Caution should be exercised in excessive flexing of the boards, since although the board is sturdy in construction it may crack or break if proper care is not taken when servicing.

When an intermittent point or area is localized it usually can be corrected by simply heating the leads of the components, at that point or area, with a soldering iron. This will fuse the intermittent point, forming a secure connection.

If the printed circuit board has been removed from the receiver chassis for reasons other than component replacement, the parts may be removed simply by applying heat to the point on the connecting strip where the leads come through the board, bending the leads upright with a soldering aid, and lifting the part from the board. In the process of removing the solder, caution must be taken to prevent excessive heating. Use a small wire brush if necessary to quickly brush away the excessive solder from the connection. Do not leave the soldering iron on the connection when brushing away the solder. Melt the solder, remove the iron and quickly brush away the solder. It may require more than one heating and brushing process to completely remove the solder. The new part can then be mounted and secured in the original manner in place of the part that has been removed.

Replacement of Components

To replace capacitors or resistors on printed circuit boards without removing the boards from the chassis proceed as follows: (see figure 121.)

1. Cut the component in half with a pair of diagonal cutting pliers. (Fig. 121(a).)
2. Remove the body of the component from the connecting wires leaving as much wire as possible for connecting purposes. (Fig. 121(b).)
3. Prepare connecting points for the replacement component by cutting the wire, leaving one-fourth inch to five-sixteenth inch, and form a connecting loop as shown in figure 121(c).

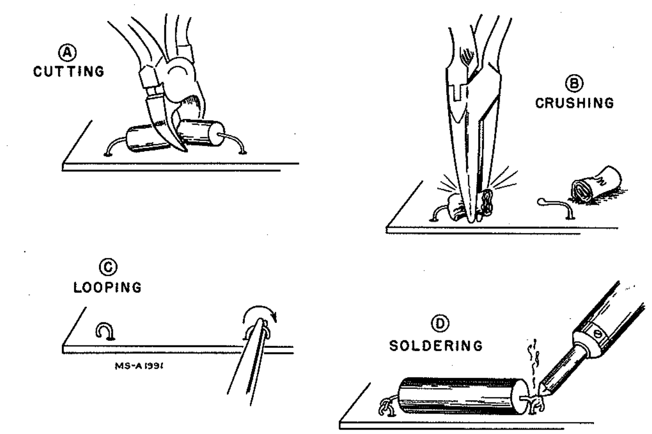


Fig. 121—Procedure Used to Replace Components on Printed Circuit Boards.

4. Thread the leads of the replacement component through the loops of wire, bend component leads to form a good connection and then solder. Cut off excess wire from component leads.

Figure 122 shows the method used to replace a tube socket on the printed circuit boards.

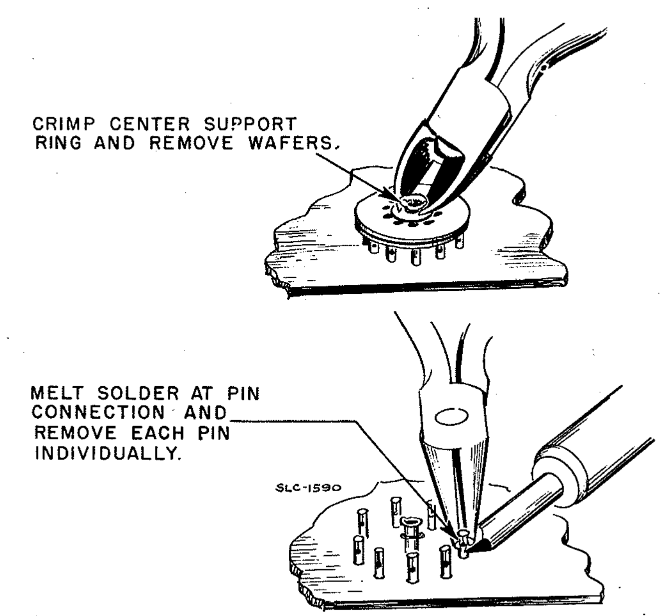


Fig. 122—Method of Replacing Tube Socket on Printed Circuit Boards.

PRINTED CIRCUIT BOARD LOCATIONS

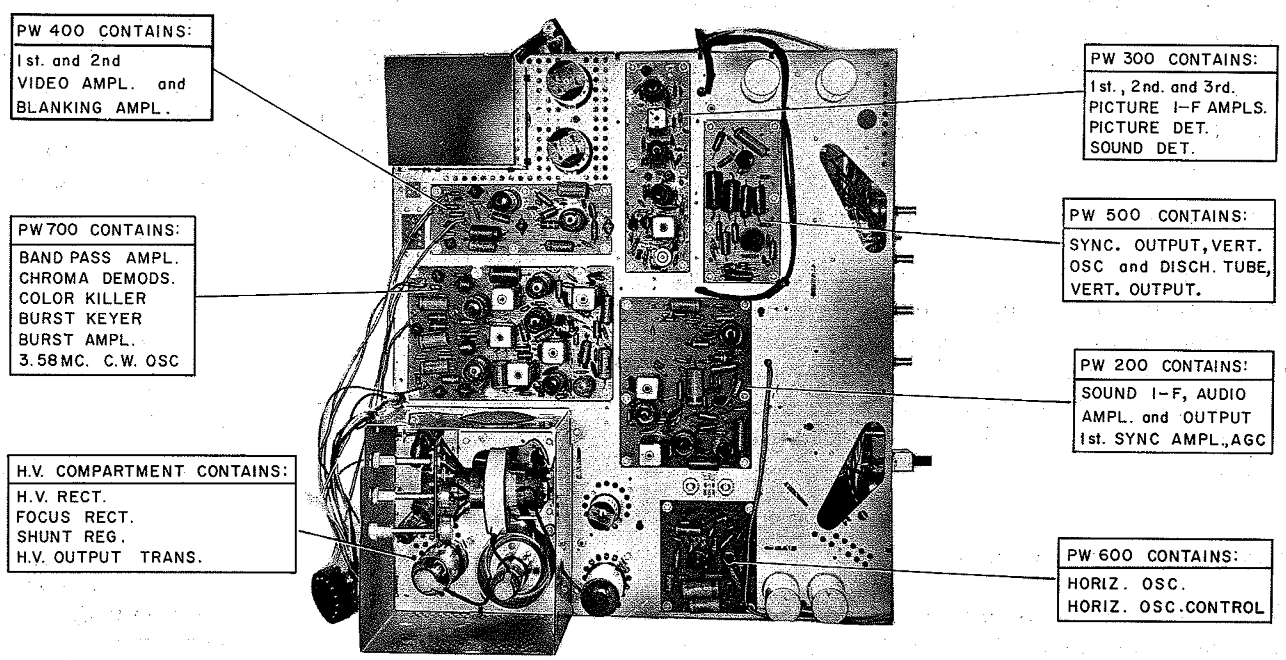


Fig. 123—Top View—CTC5 Chassis, Showing Circuit and Printed Circuit Board Locations.

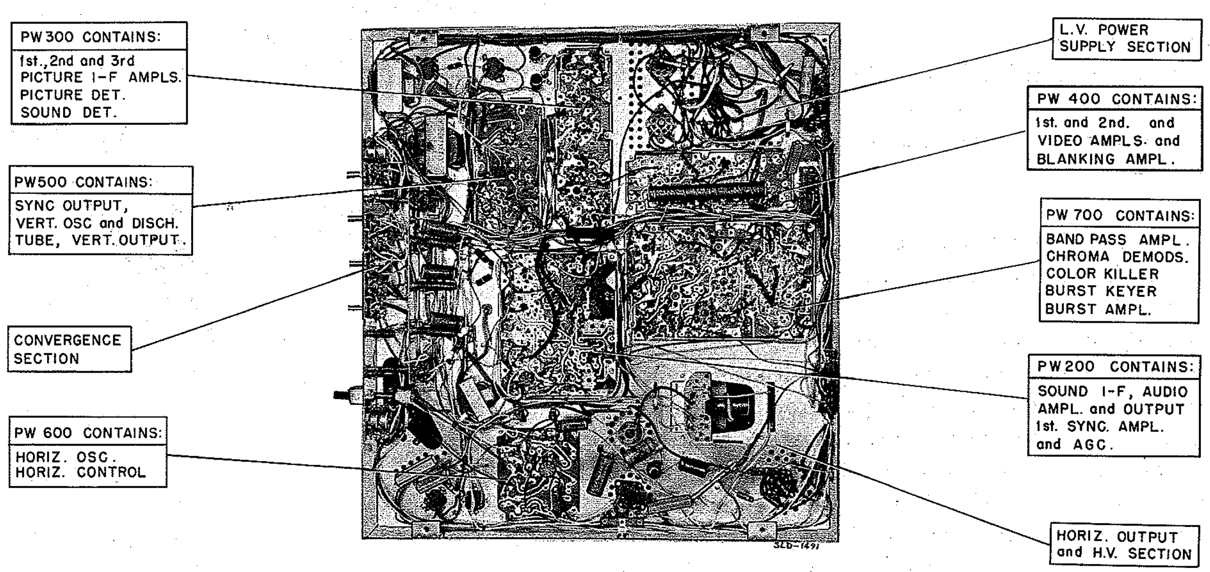


Fig. 124—Bottom View—CTC5 Chassis, Showing Circuit and Printed Circuit Board Locations.

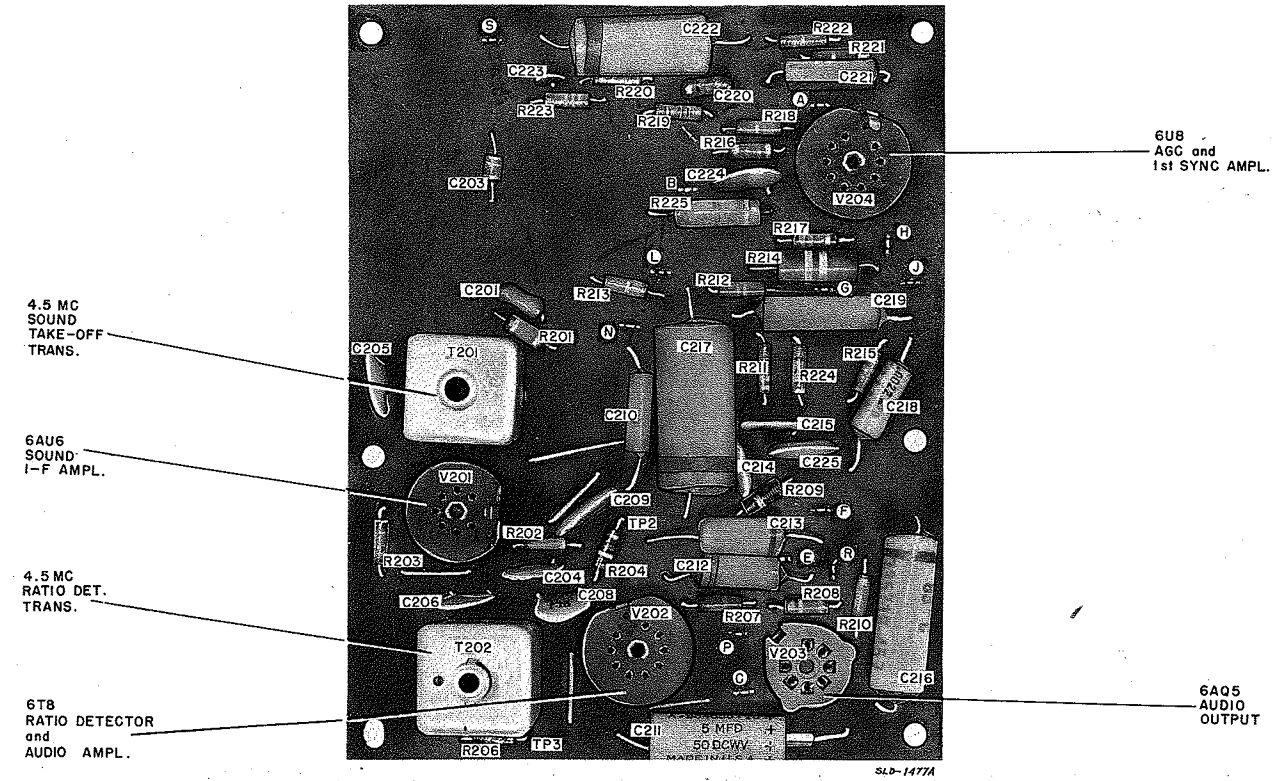


Fig. 125—Top View, Printed Circuit Board PW-200, Sound I-F Audio, AGC, 1st Sync—CTC5.

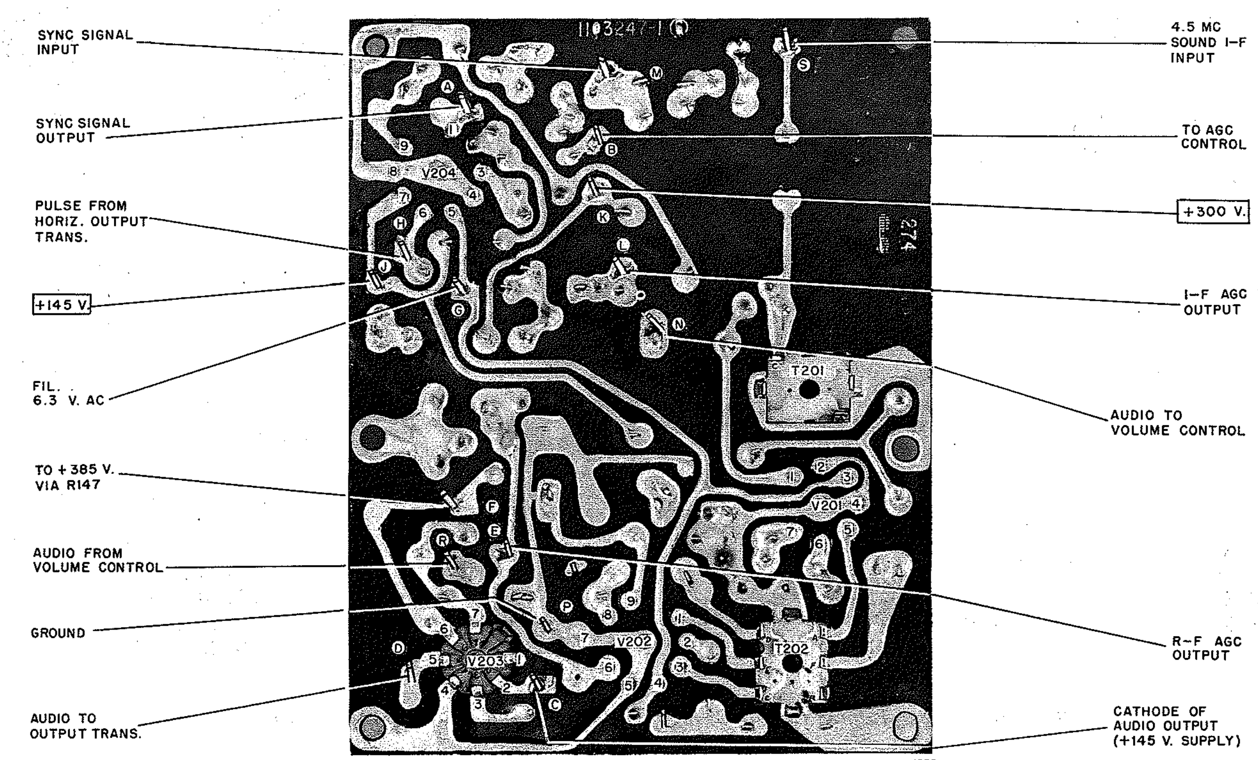


Fig. 126—Bottom View, Printed Circuit Board PW-200, Sound I-F, Audio, AGC, 1st Sync—CTC5.

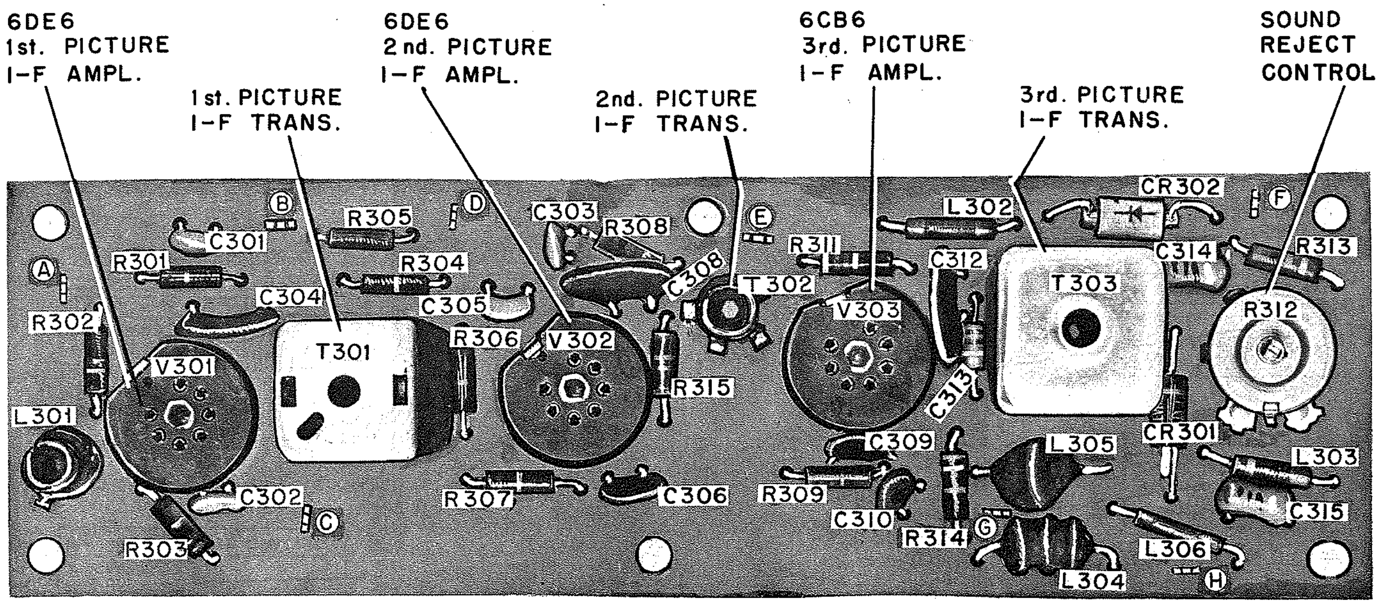


Fig 127—Top View, Printed Circuit Board PW-300, 1st, 2nd, 3rd Picture I-F—CTC5, CTC5N.

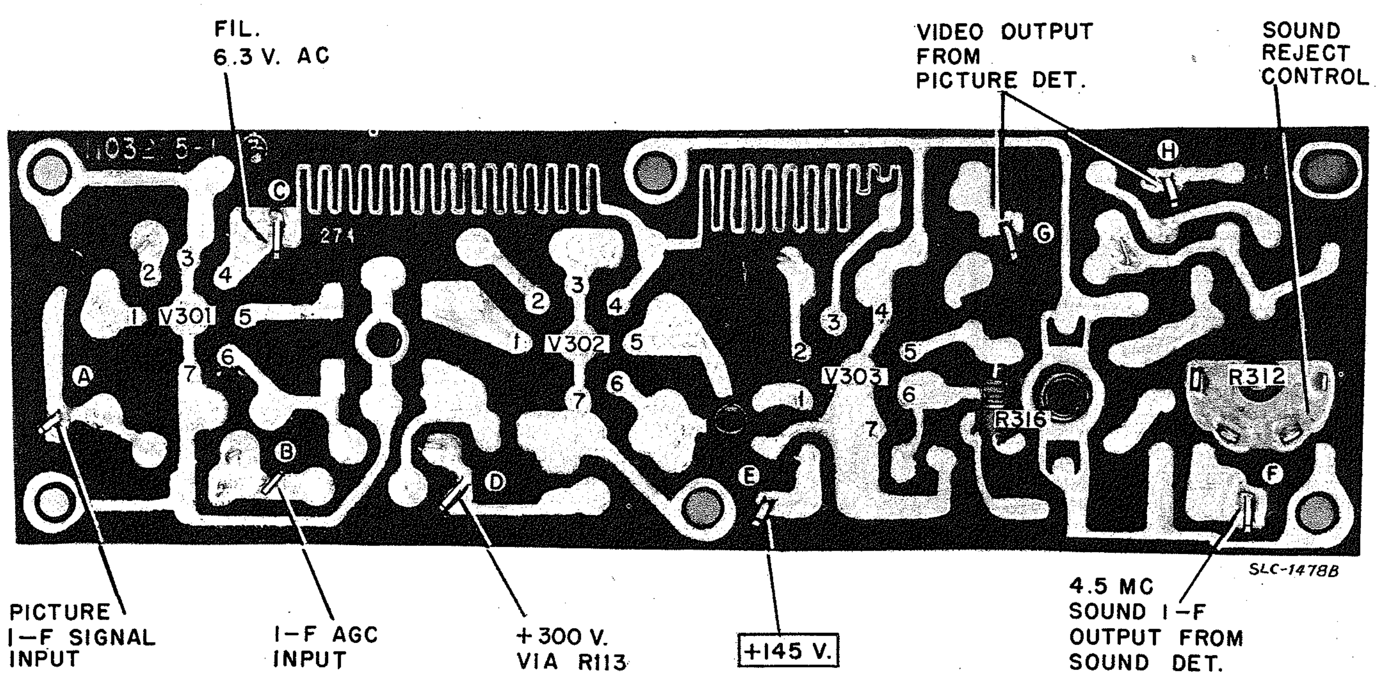


Fig. 128—Bottom View, Printed Circuit Board PW-300—1st, 2nd, 3rd Picture I-F—CTC5, CTC5N.

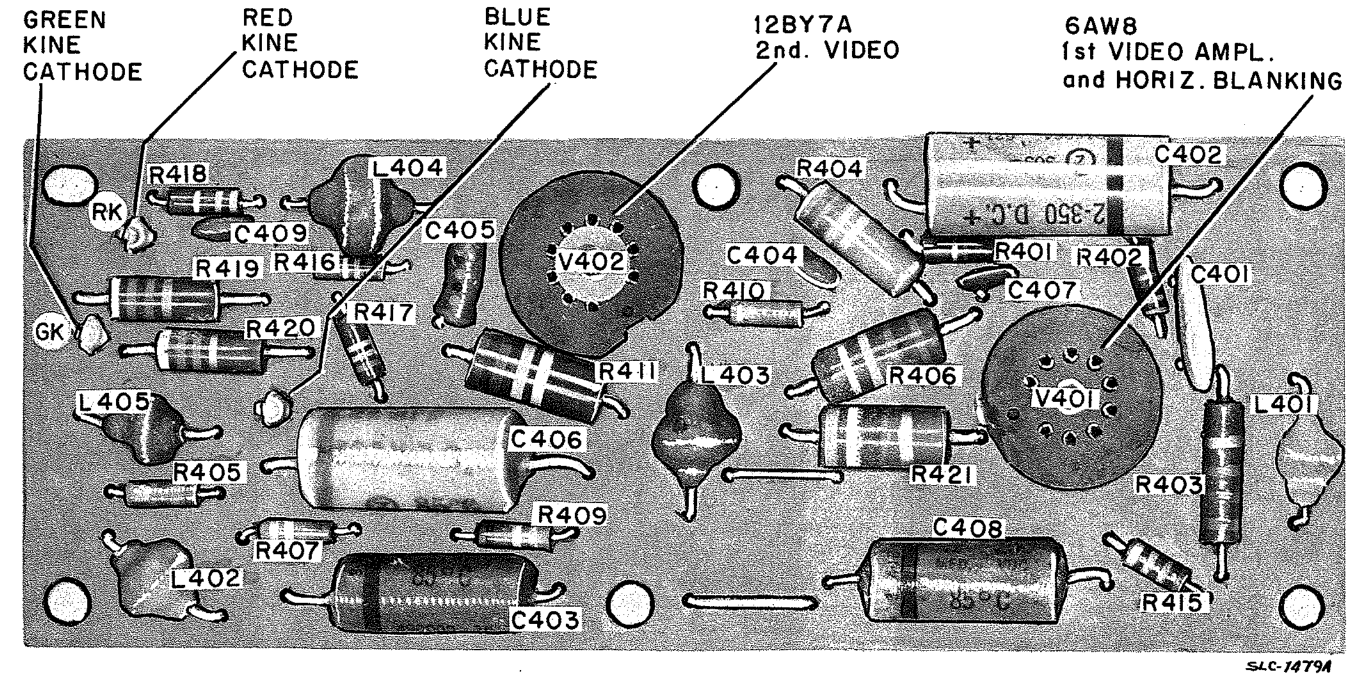


Fig. 129—Top View, Printed Circuit Board PW-400, 1st and 2nd Video, Horizontal Blanking—CTC5.

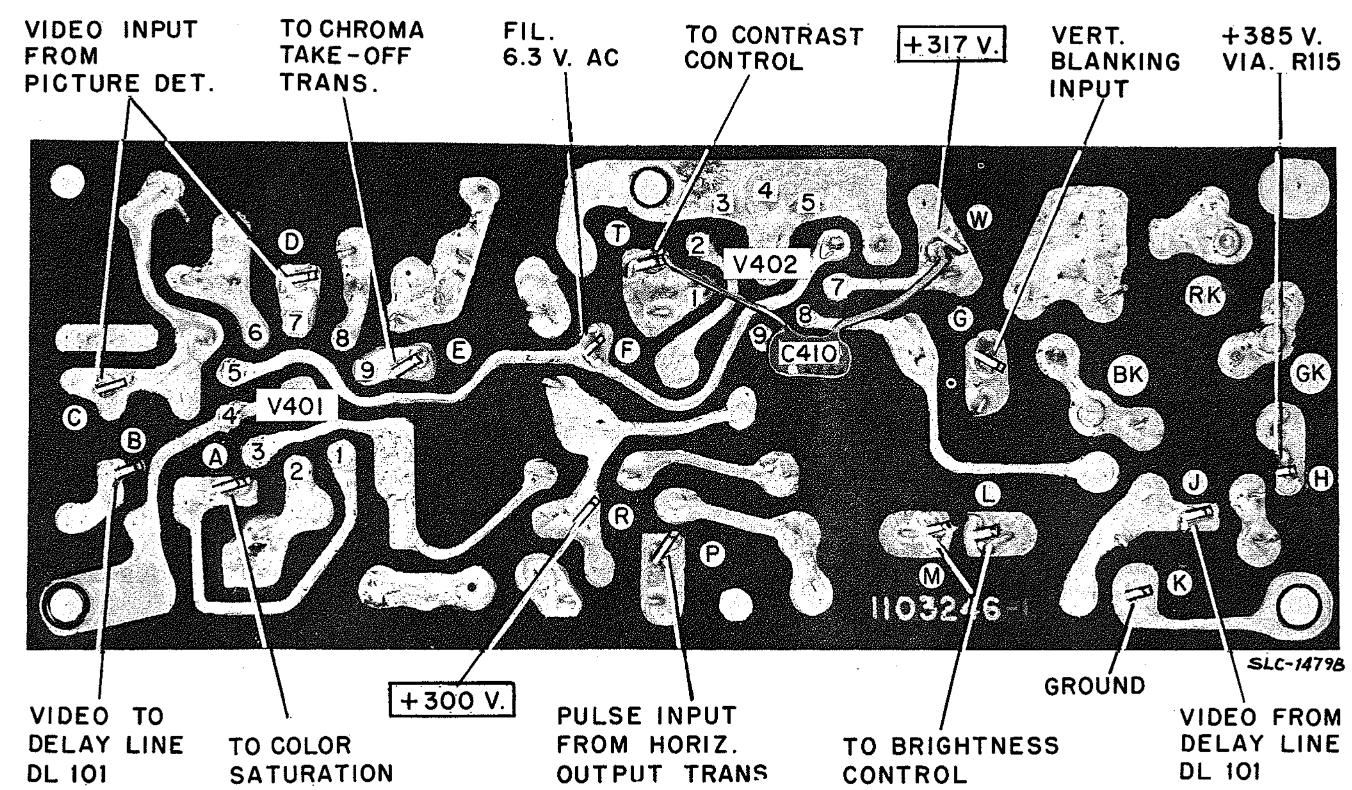


Fig. 130—Bottom View, Printed Circuit Board PW-400, 1st and 2nd Video, Horizontal Blanking—CTC5.

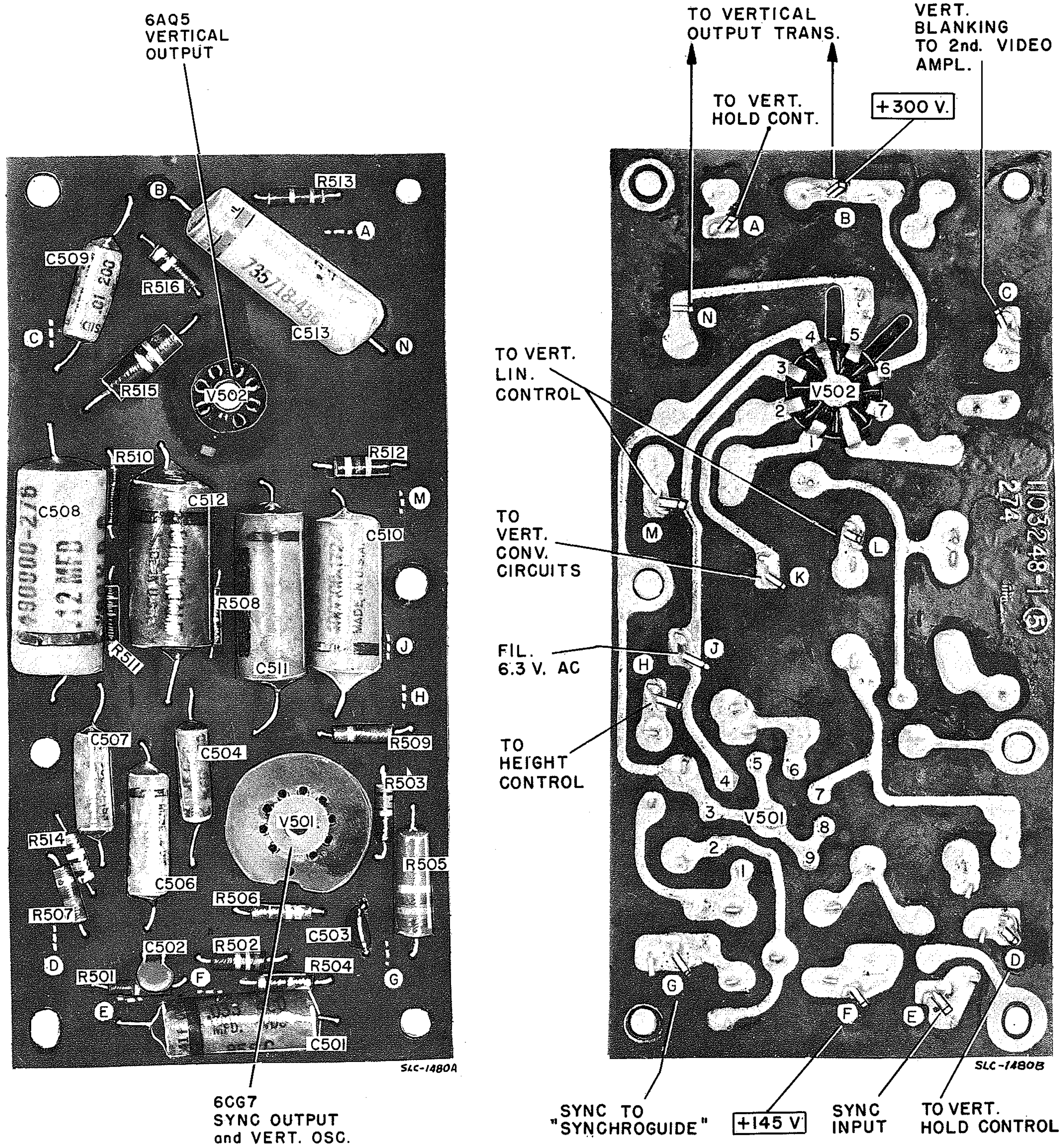


Fig. 131—Top and Bottom Views, Printed Circuit Board PW-500—CTC5—Showing Component Locations and Voltage Measuring Points—Sync Output, Vertical Oscillator, Vertical Output.

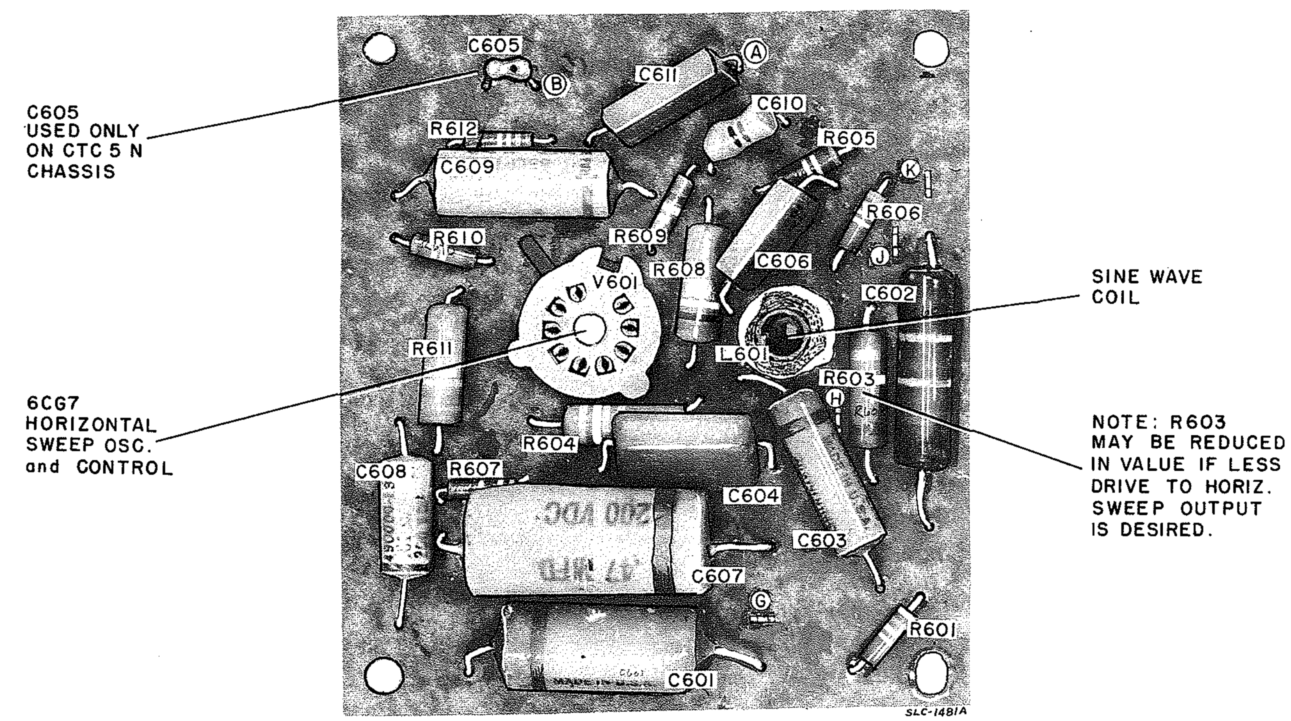


Fig. 132—Top View, PW-600, Printed Circuit Board, Horizontal Oscillator and Control Circuits, CTC5, CTC5N.

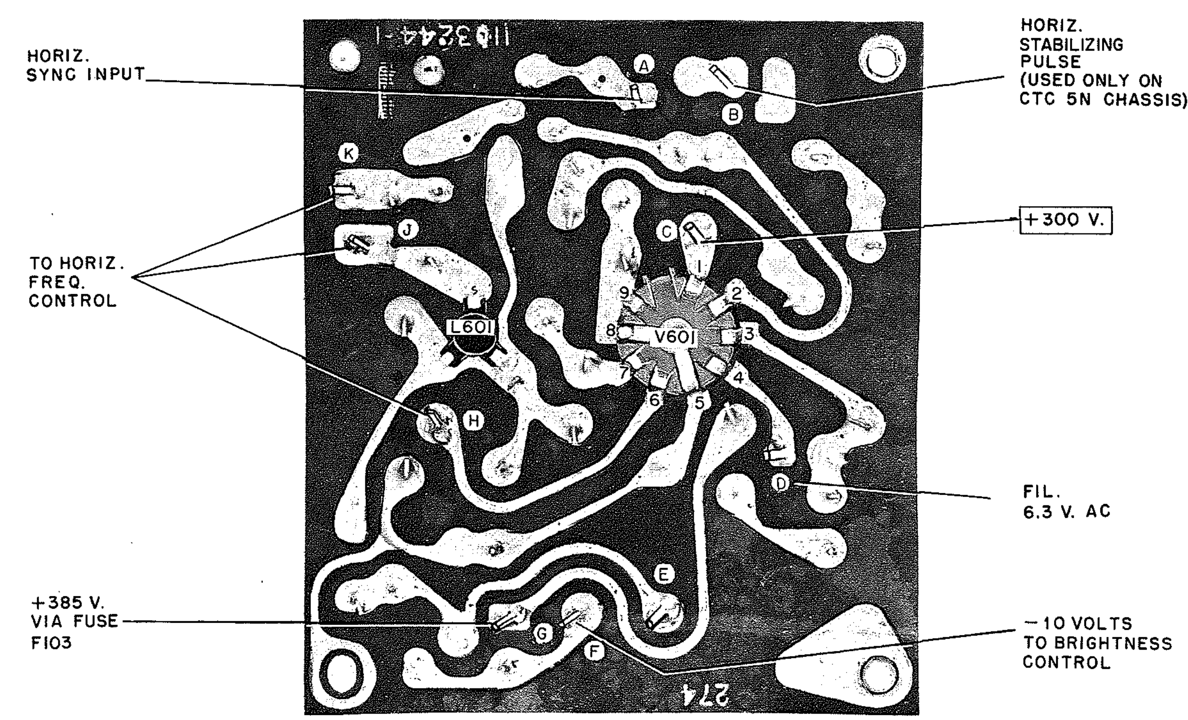


Fig. 133—Bottom View, PW-600 Printed Circuit Board, Horizontal Oscillator and Control Circuits, CTC5, CTC5N.

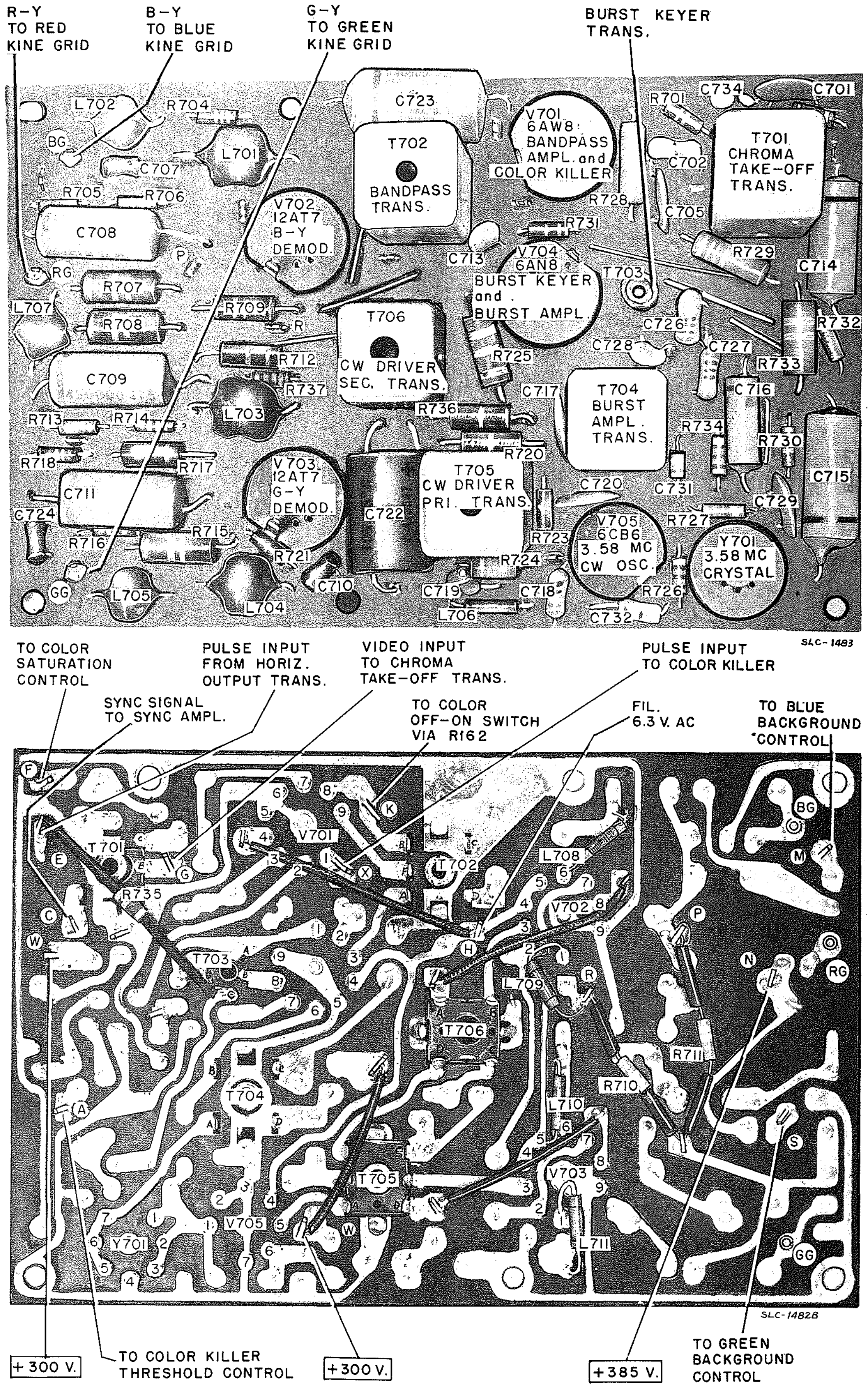


Fig. 134—Top and Bottom Views, Printed Circuit Board, PW-700, Chrominance Channel, CTC5.

PRINTED CIRCUIT BOARD LOCATIONS

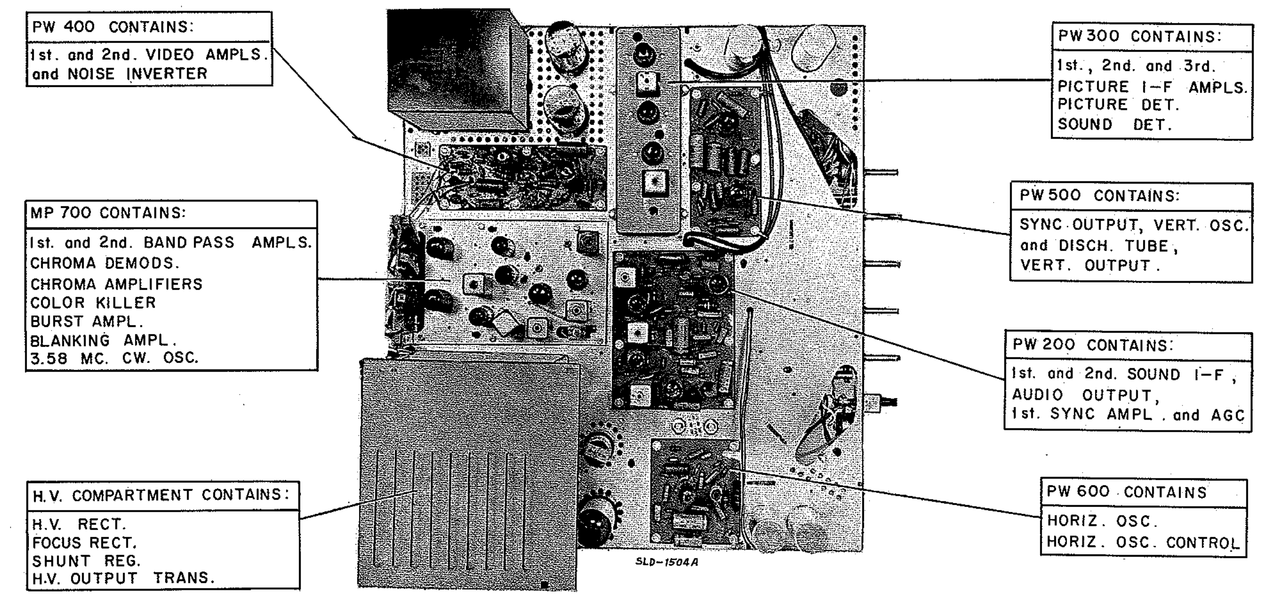


Fig. 135—Top View CTC5N Chassis Showing Circuit and Printed Circuit Board Locations.

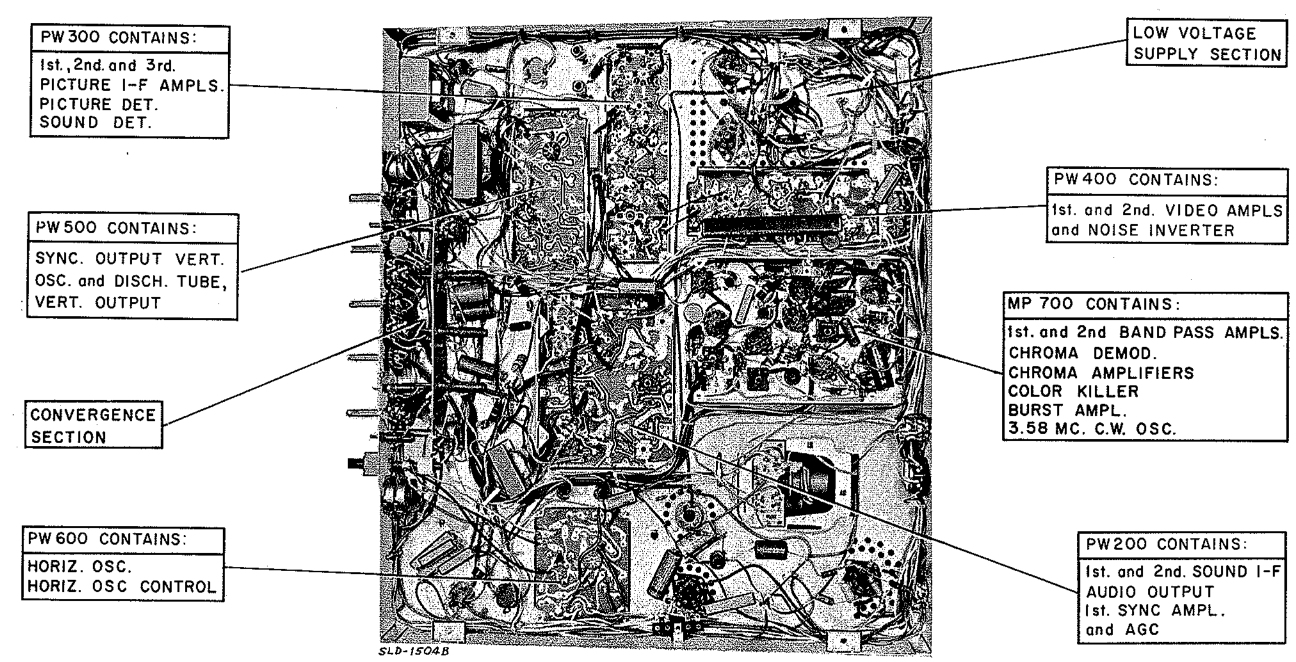


Fig. 136—Bottom View CTC5N Chassis, Showing Circuit and Printed Circuit Board Locations.

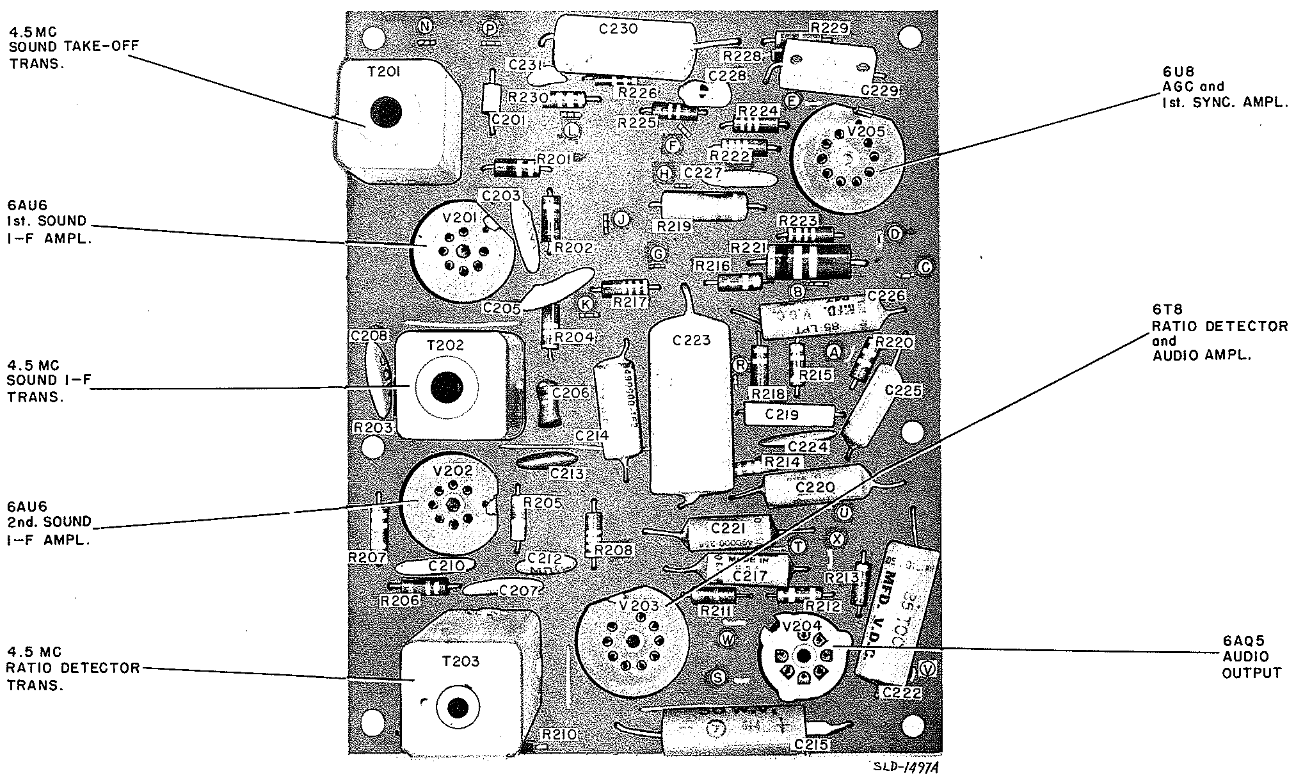


Fig. 137—Top View, Printed Circuit Board, PW-200, CTC5N—Sound I-F, Audio, AGC, 1st Sync.

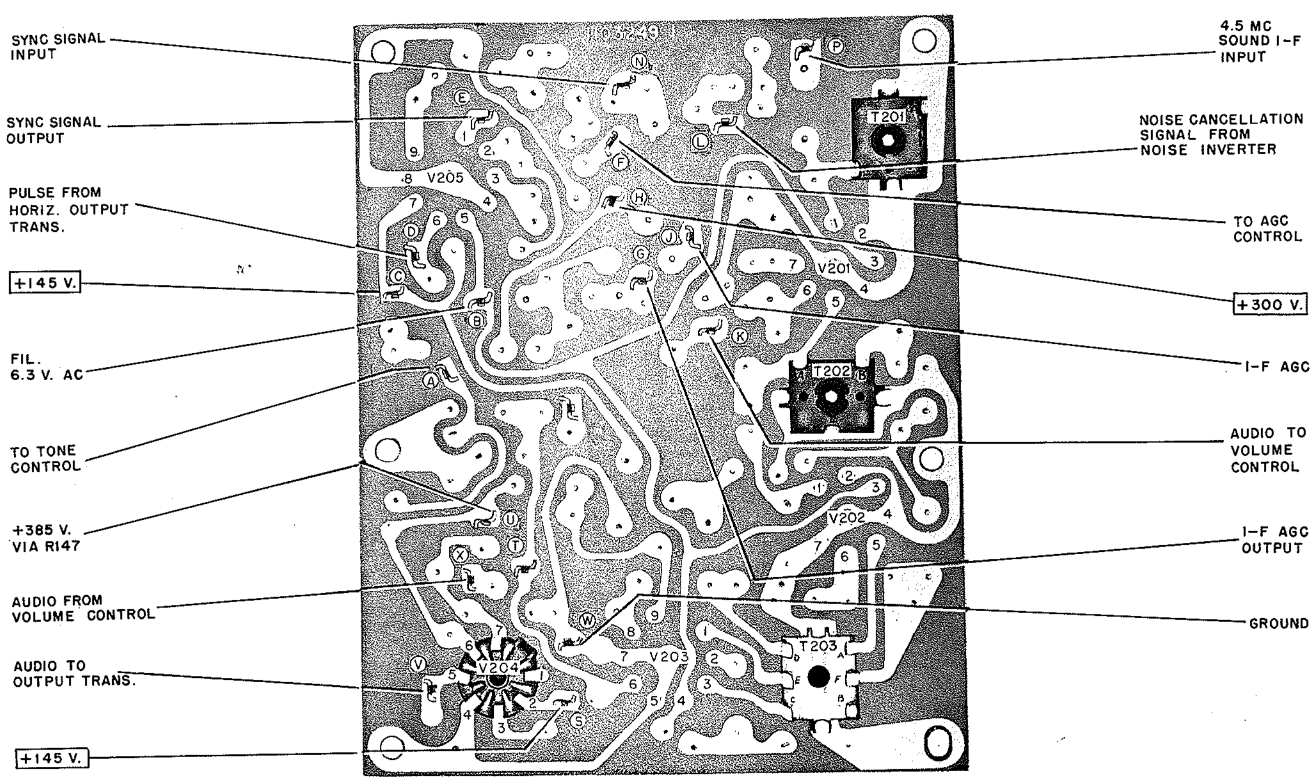


Fig. 138—Bottom View, Printed Circuit Board, PW-200, CTC5N—Sound I-F, Audio, AGC, 1st Sync.

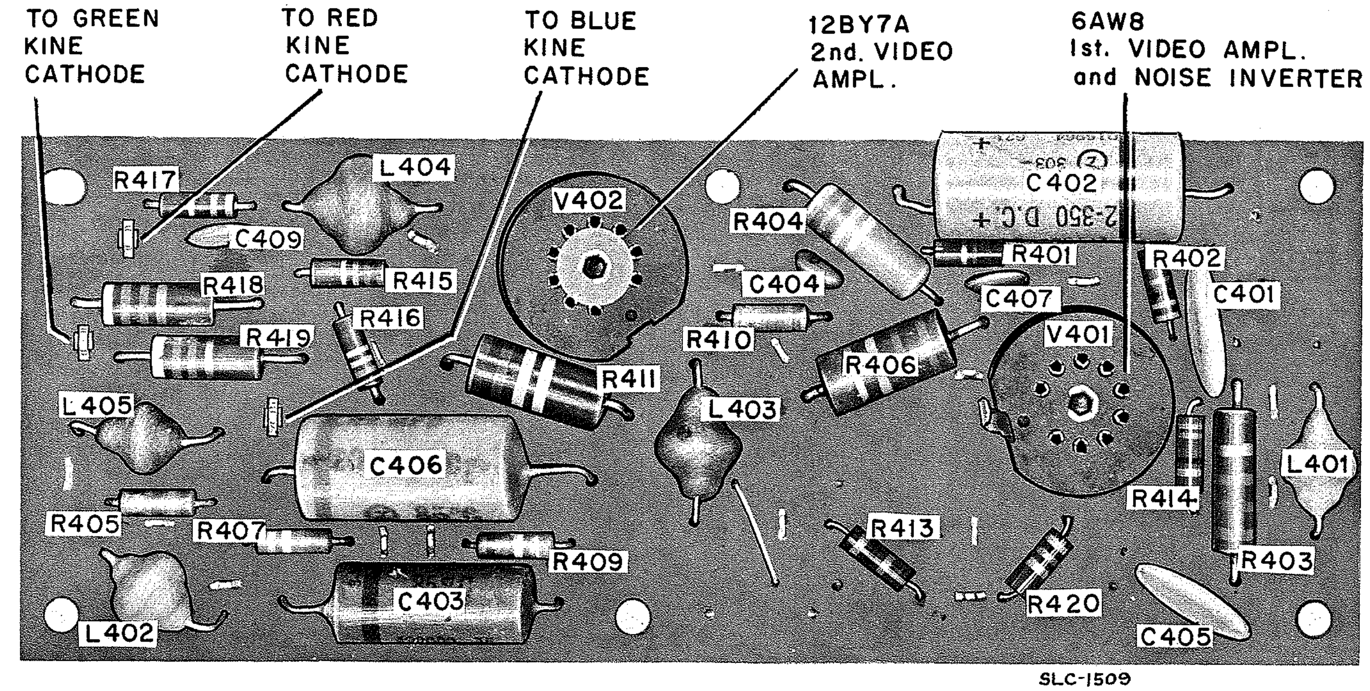


Fig. 139—Top View, Printed Circuit Board, PW-400, 1st and 2nd Video, Noise Inverter—CTC5N.

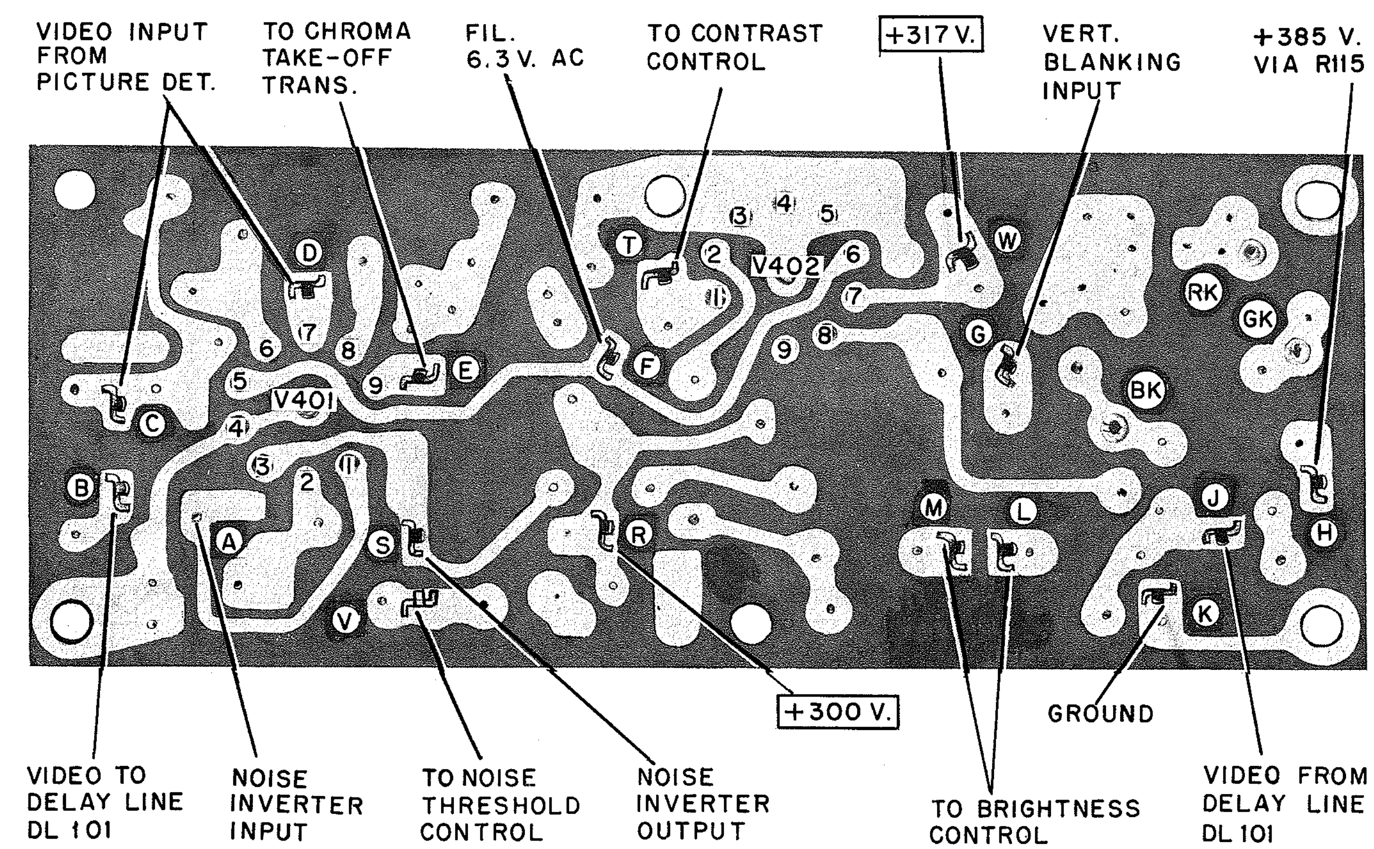


Fig. 140—Bottom View, Printed Circuit Board, PW-400, 1st and 2nd Video, Noise Inverter—CTC5N.

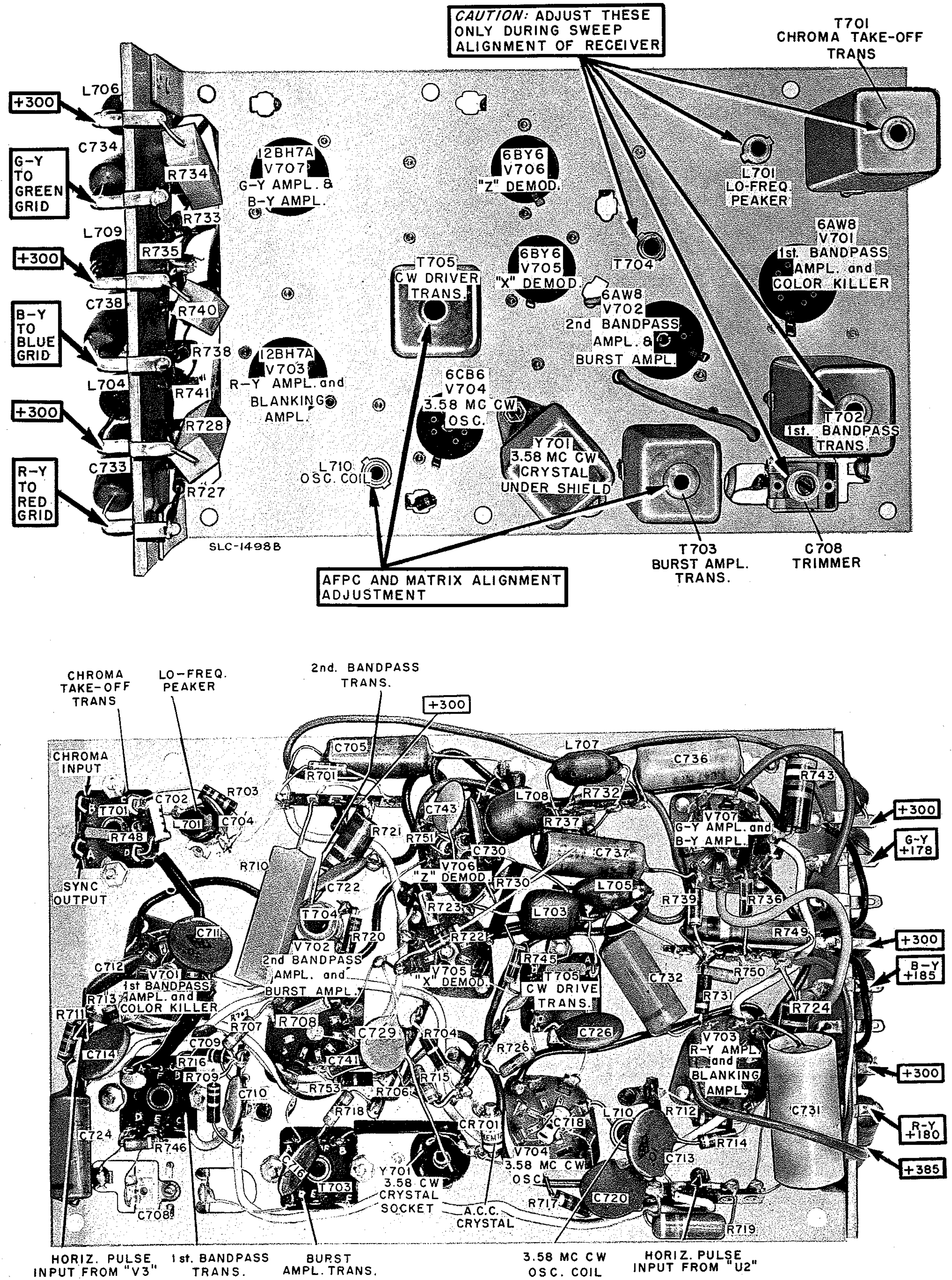


Fig. 141—Top and Bottom Views, MP-700, Mounting Plate, Chrominance Channel—CTC5N.

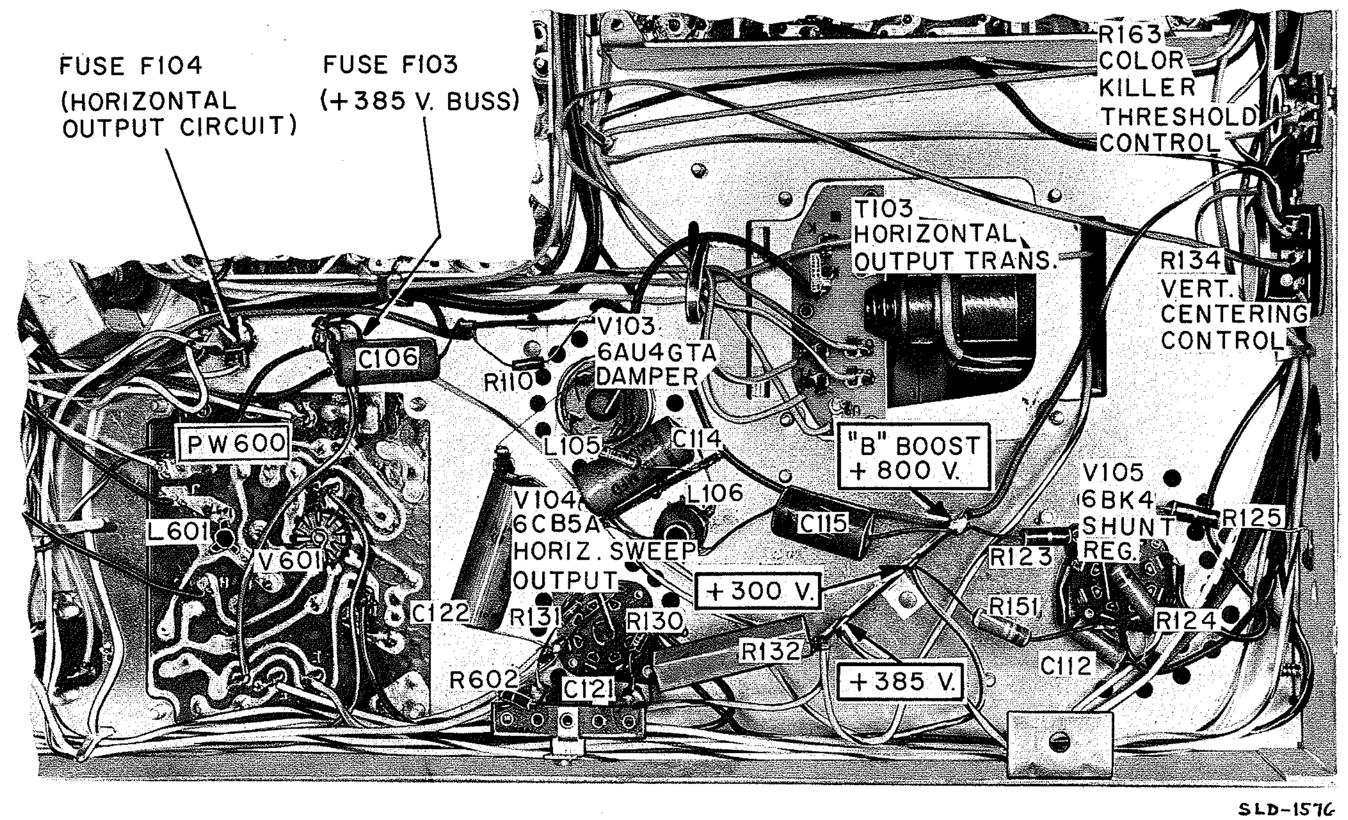


Fig. 142—Bottom View—Horizontal Deflection and High Voltage Circuits—CTC5, CTC5N.

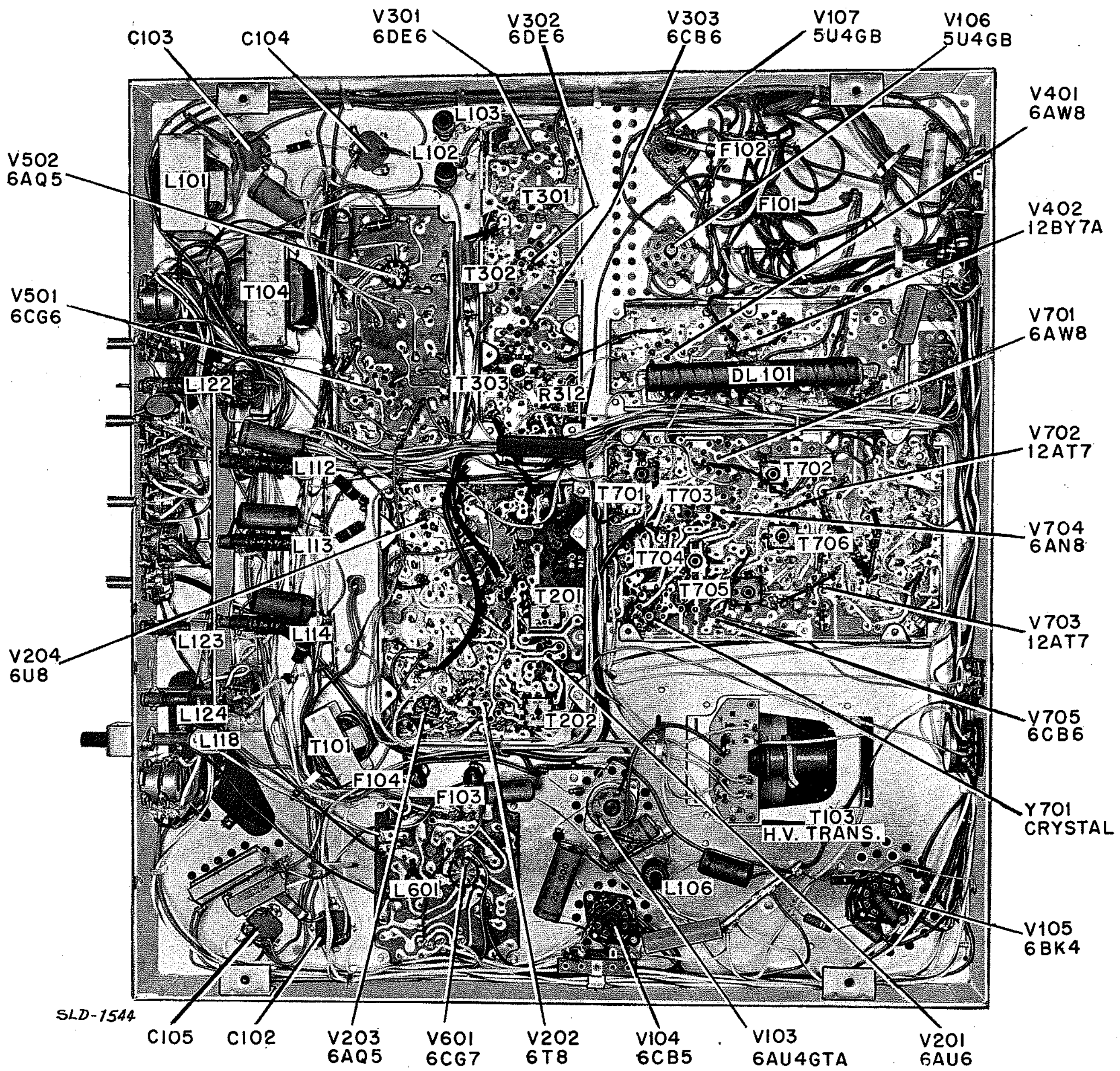


Fig. 143—Bottom View—CTC5 Chassis.

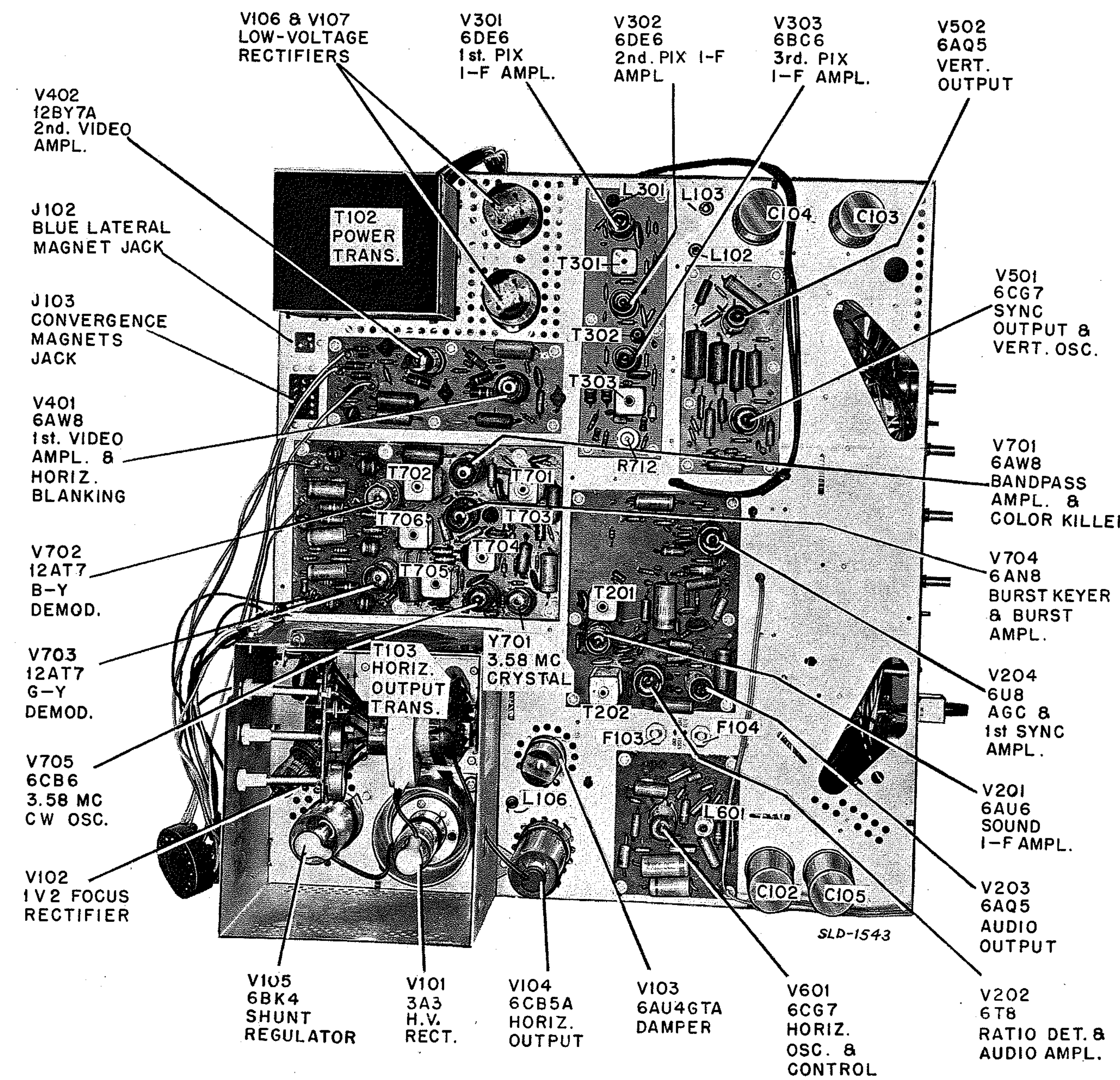


Fig. 144—Top View—CTC5 Chassis.

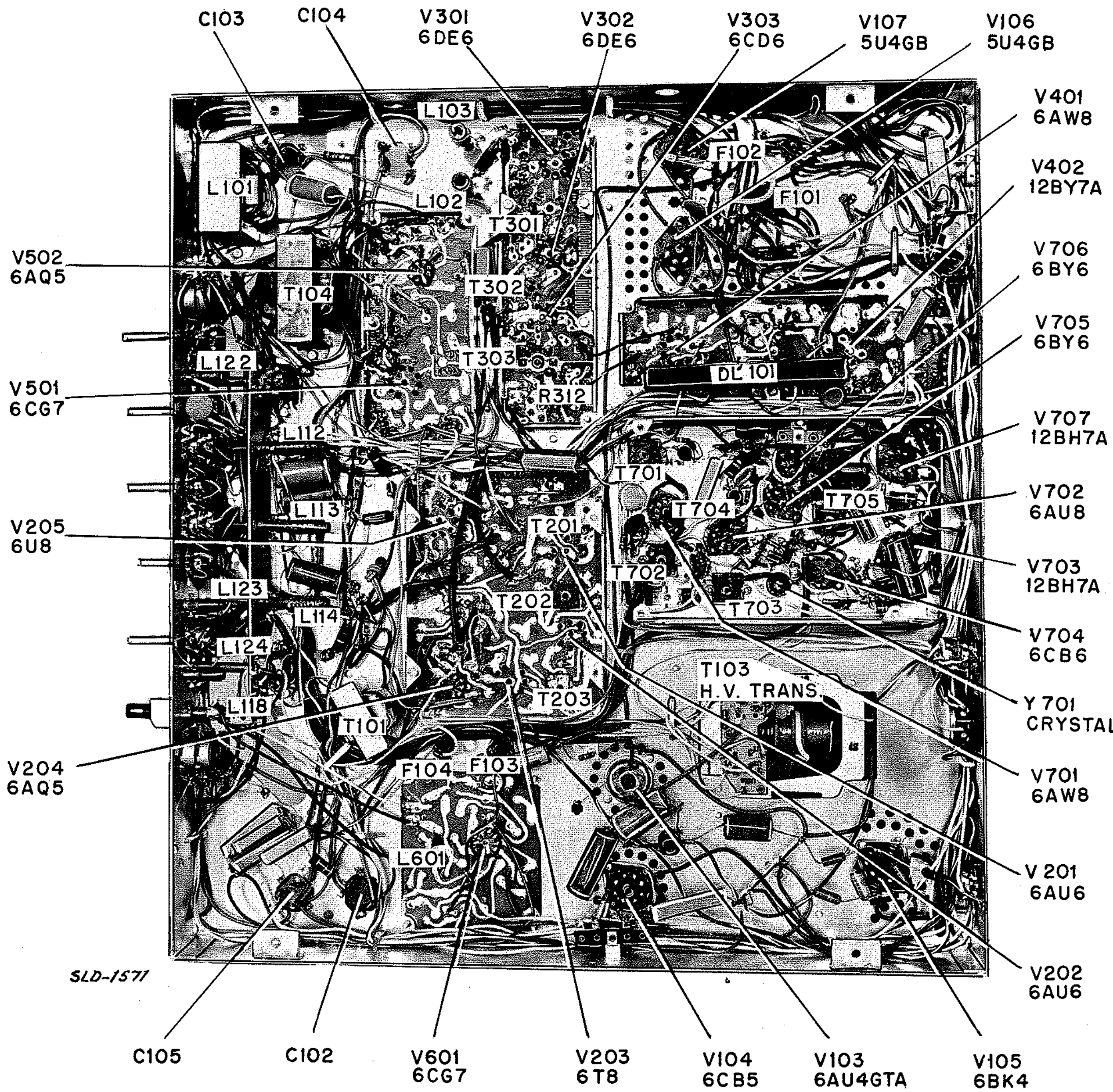


Fig. 145—Bottom View—CTC5N Chassis.

CHASSIS
CTC5N

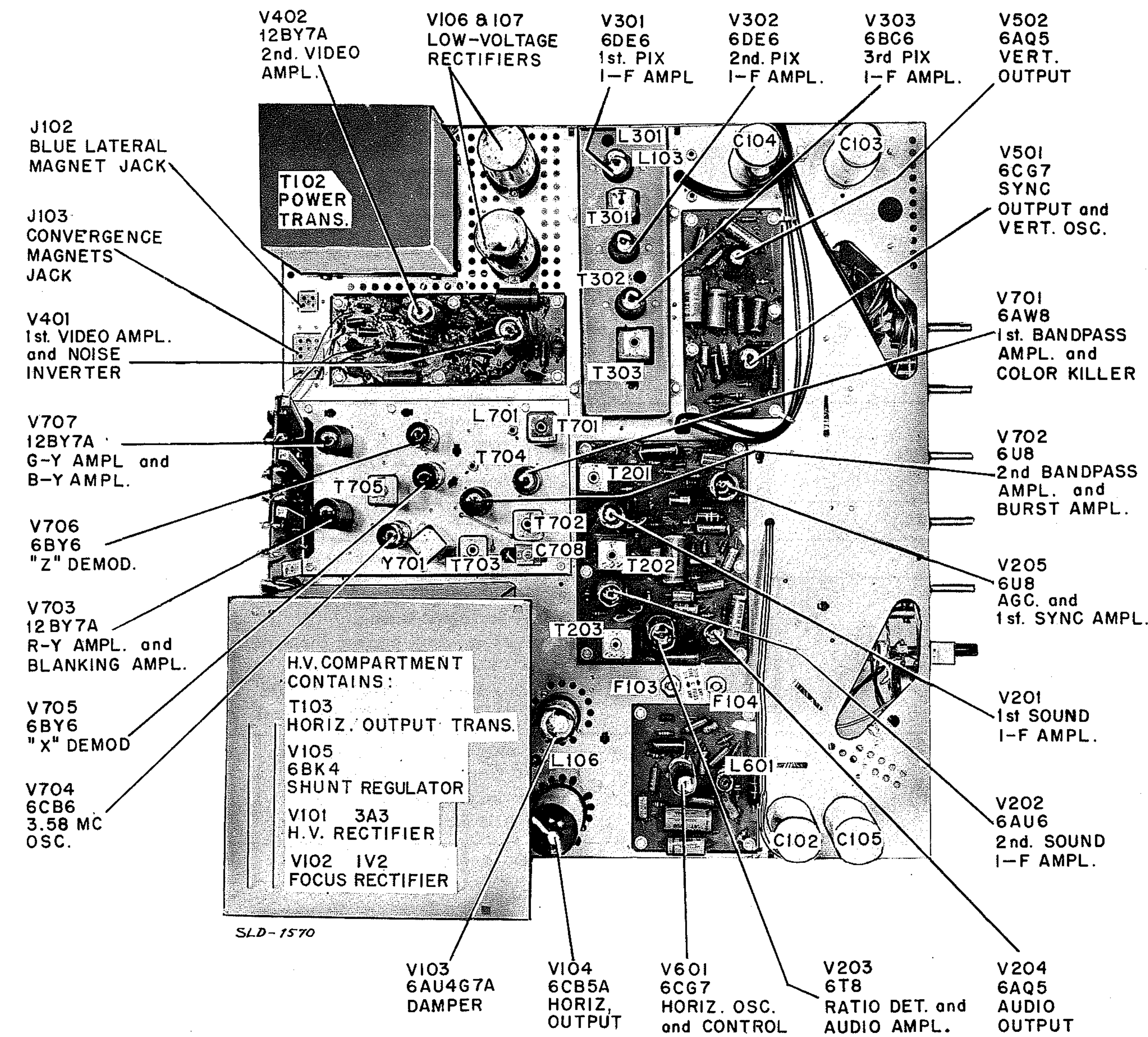
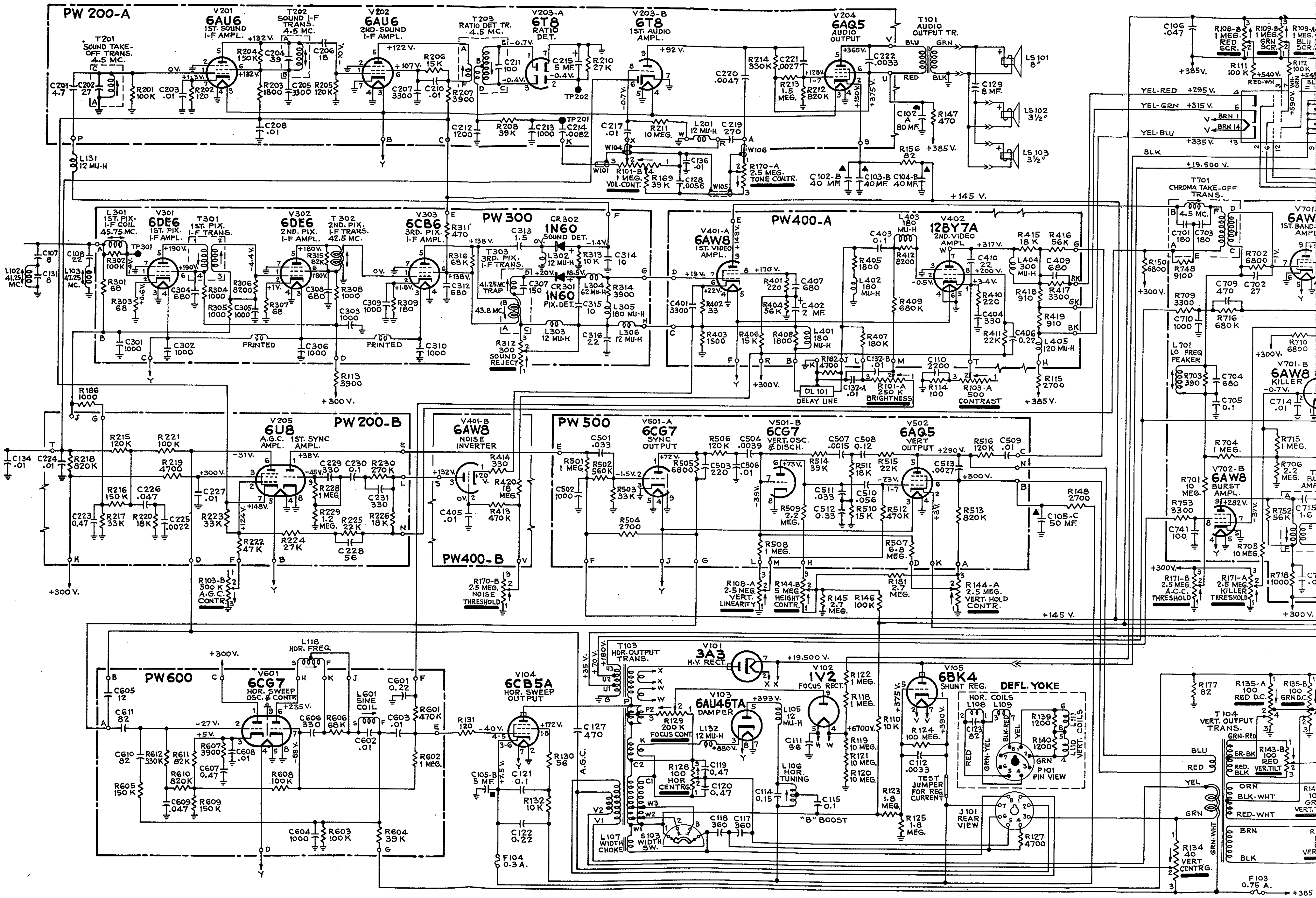


Fig. 146—Top View—CTC5N Chassis.

Service Required	*Probable Cause*
No picture, no sound.	6AW8, 1st video amplifier. 6DE6, 1st picture I-F. Fuse, F-102.
No picture, no brill.	Loose connection, kinescope socket. Fuse, F-104. 6AQ5, audio output tube. 6CG7, Horizontal oscillator.
Weak picture.	6BQ7A, R-F amplifier.
Low brill.	R-115 open.
Intermittent brill.	12BY7A, 2nd video amplifier.
Brill cannot be turned down.	12BY7A, 2nd video amplifier.
Brill reduces slowly after brill control turned down.	12BY7A, 2nd video amplifier.
No sync.	6U8, sync amplifier. 6CG7, sync output.
No vertical deflection.	C-513 shorted.
Horizontal pulling in picture.	C-222 shorted.
Ringing, left side of picture.	Width switch in-between switch positions.
Horizontal drive line in picture.	6CB5A, horizontal output tube. Adjust horizontal tuning. If drive line is still present, check value of R-603, (printed circuit board PW-600). Reducing value of resistor will aid in removing drive line. DO NOT REDUCE BELOW 82K ohms.
No color.	C-705 open. 6AW8, bandpass amplifier. 6AN8, burst amplifier. 6CB6, 3.58 mc. sub-carrier osc.
Intermittent color.	3.58 mc. crystal.
Color overload.	R-415 open.
Intermittent green screen.	Green background control.
Blue screen.	12AT7, B-Y demodulator.
Red screen.	12AT7, G-Y demodulator.
Blue lateral beam movement cannot be adjusted properly (receivers with EM type magnet only.)	Excess cathode current, 6CB5A horizontal output tube.
Hum in audio with volume control at minimum.	L-201 open.

Notes

TUNER UNIT
SCHEMATIC
DIAGRAMS
ON
PAGES
8 AND 9



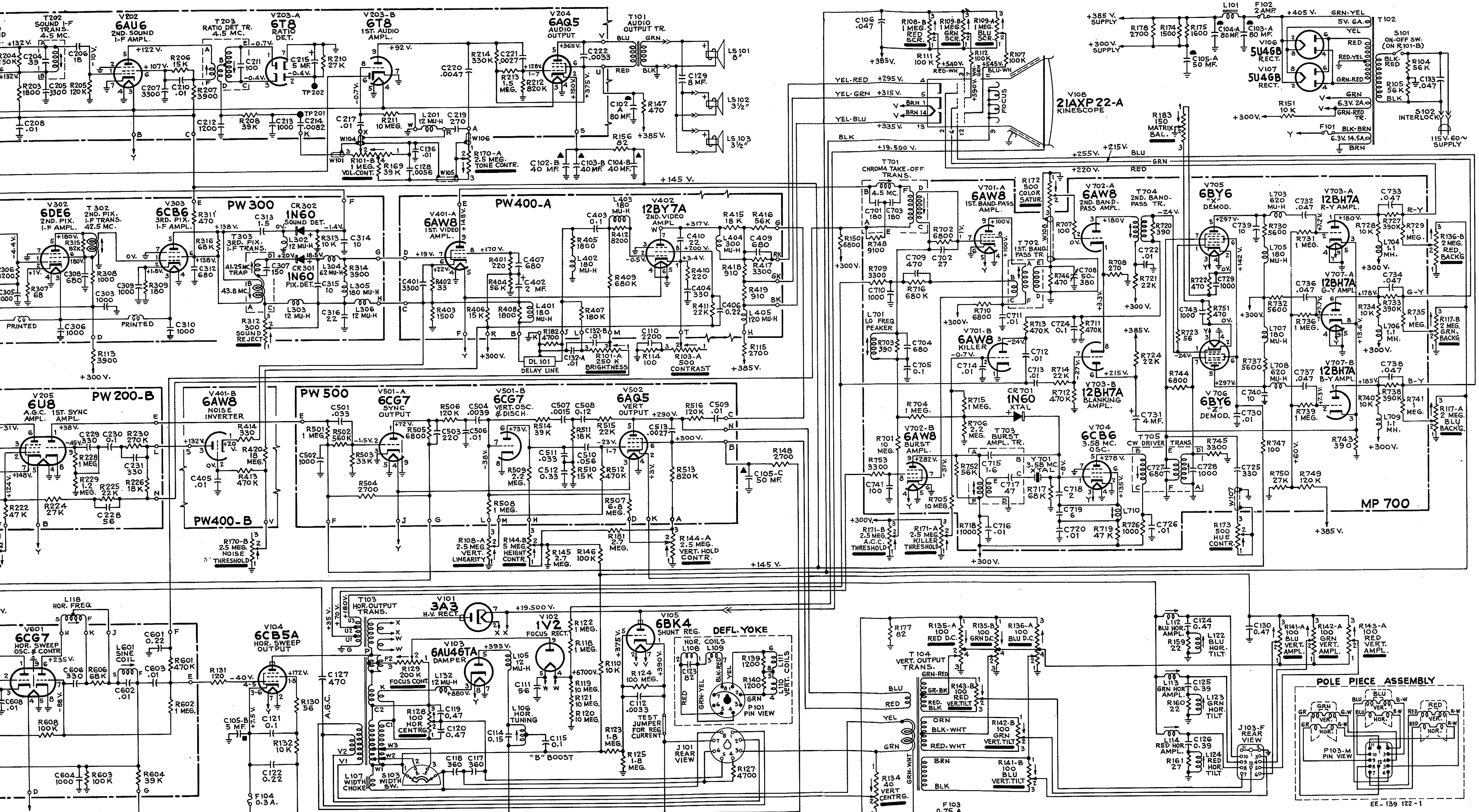
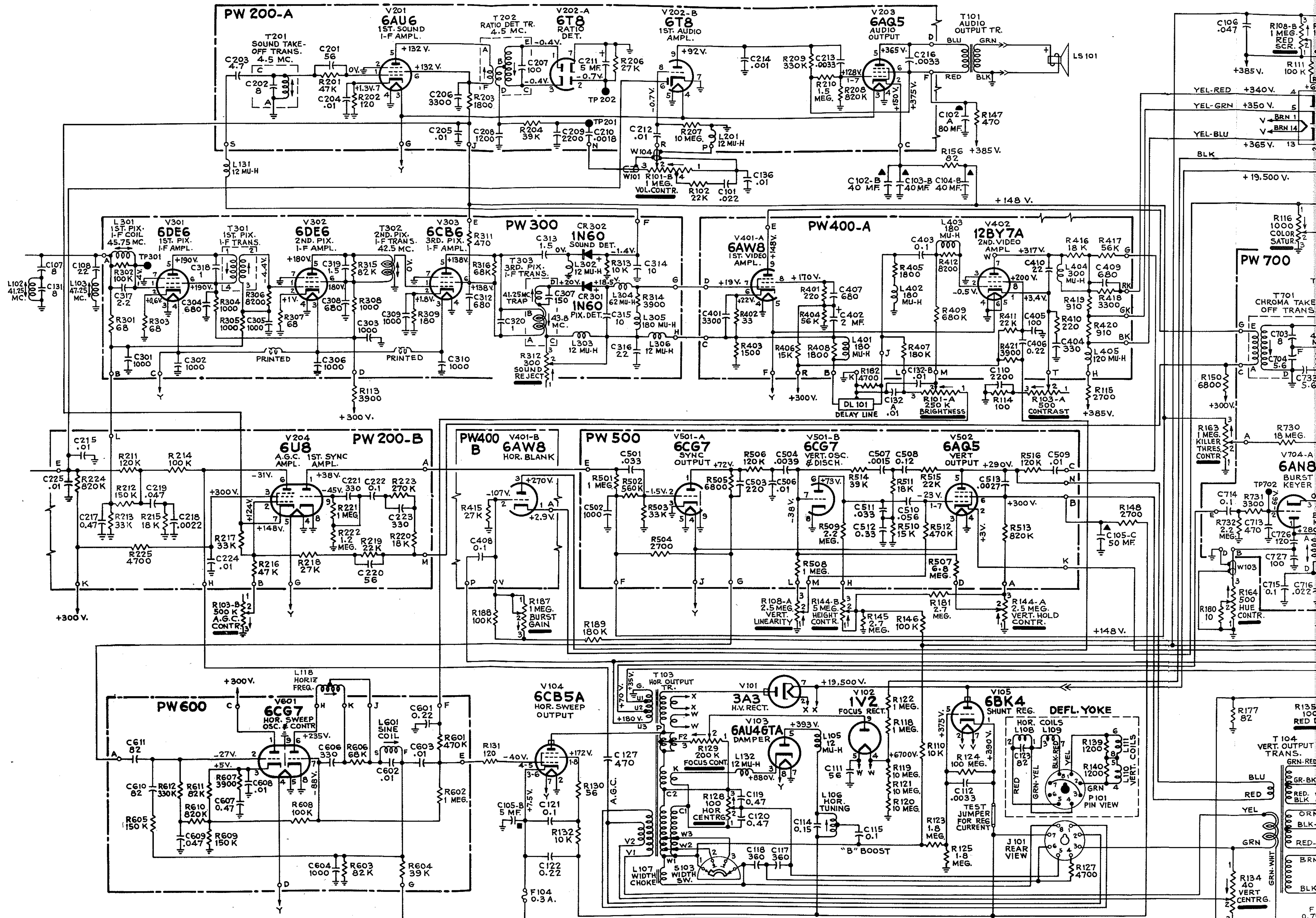


Fig. 147—Schematic Diagram—CTC5N Chassis.

TUNER UNIT SCHEMATIC DIAGRAMS ON PAGES 8 AND 9



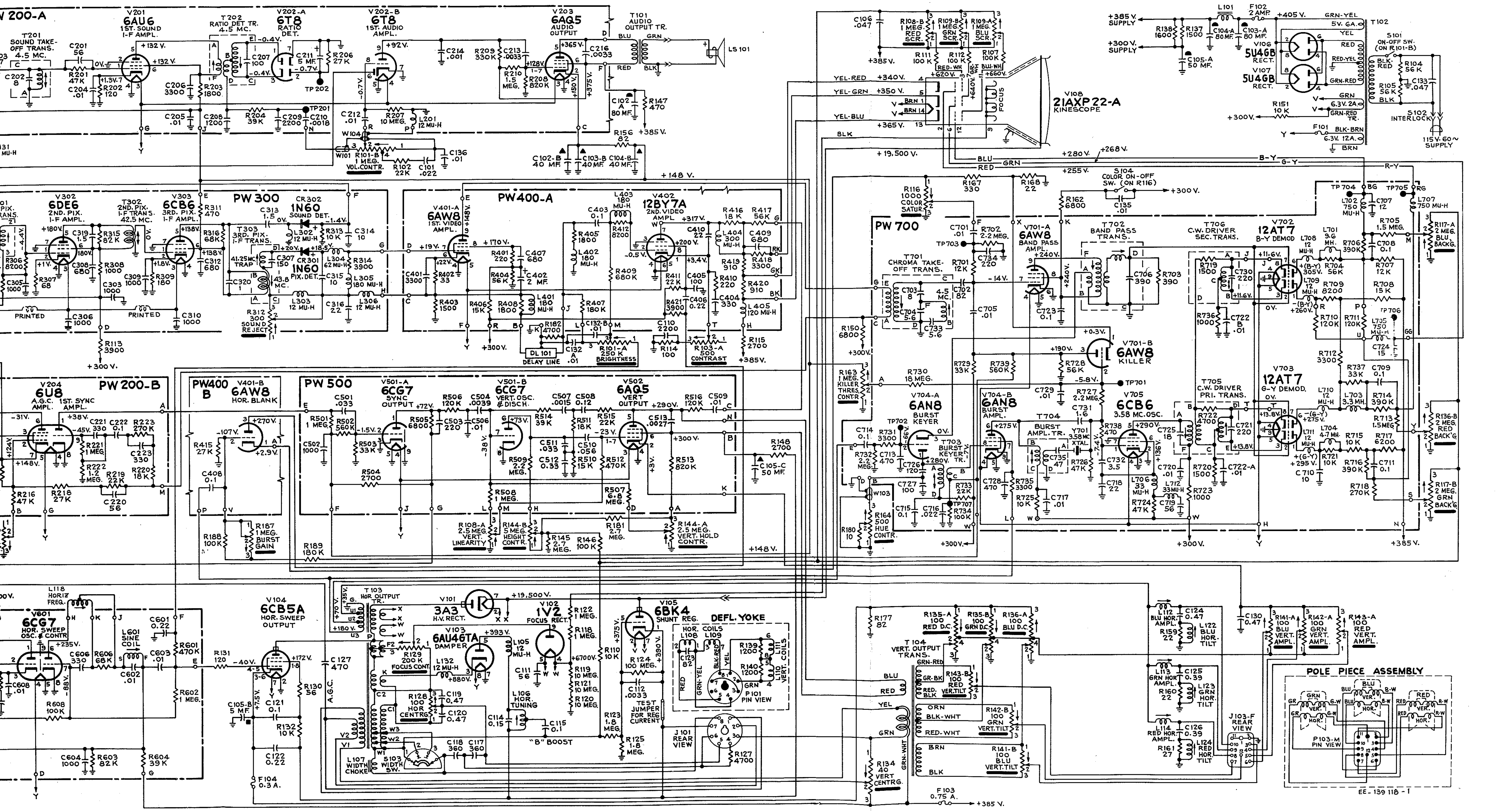


Fig. 148—Schematic Diagram—CTC5 Chassis.