# THE MODEL U-300 UTILISCOPE

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FIGURES

# SECTION I

## INTRODUCTION

The Model U-300 Utiliscope has been designed to replace the Model U-200 Utiliscope. In operation, both sales-wise and circuit-wise, the U-200 was found to have several inadequacies. The design of the U-300 was undertaken to overcome these inadequacies which the field operations and sales investigation into new uses of industrial television provided.

Some of the main shortcomings of the U-200 Utiliscope are as follows:

1. Improper aspect ratio
2. Too much "S" distortion
3. Insufficient definition
4. Insufficient video gain
5. Design of fast lenses impossible due to long focal length required by solid cathode Dissector
6. Improper "packaging" of units
7. Failure of low voltage rectifiers
8. Inter-reaction of field frequency control and linearity controls
9. Monitor line structure too coarse
10. Equipment too costly to manufacture
11. Equipment should be simplified in spite of improved performance specifications
12. Transformer tapped primary method of compensating for line voltage unsatisfactory
13. Objectional fold-over on right hand side of picture

The above deficiencies have all been overcome on the Model U-300 and should be construed as improvements over the Model U-200. Figures 1 and 2 show pictures taken from the Monitor cathode ray tube.

SECTION II

GENERAL

The Model U-300 Utiliscope is a wired television equipment designed to be used wherever the application requires remote viewing of an object or objects.

Appendix No. 1, attached to this report, sets forth the specifications of the Model U-300. Figure 3 shows the complete equipment which includes, for the sending end, a Camera Unit and a Power Unit, and for the receiving end a Monitor Unit.

Simplicity of design and freedom from service are considerations of major importance. Since field difficulties are directly proportionate to the number of tubes in an equipment, a minimum number of tubes have been used in order to meet the performance specifications. A total of fifteen tubes, exclusive of the cathode ray tube and Dissector, are used. These fifteen tubes are all of the common receiving type.

Referring to Figure 3, the Camera Unit is placed near the object to be viewed. This unit is connected through a single multiple conductor cable to the Power Unit. These units may be separated by as much as twenty-five feet.

This sending end is then coupled by three coaxial cables to the Monitor which may be separated by a distance of one thousand feet or less.

These three cables transmit the video, horizontal sync pulses and vertical sync pulses from the sending end to the Monitor.

Since simplicity of operation and freedom from service are of extreme importance with this type equipment, it is felt that the use of three cables, rather than one cable which would carry a composite signal, is well justified.

To understand briefly the operation of the equipment, refer to Figure 4 which is a block diagram of the complete equipment. The image is focused optically on the cathode of the Dissector, V201. Horizontal, vertical deflection power, focus power and the multiplier voltage is supplied to the Dissector from the Power Unit. The video signal from the Dissector collector is fed in to the automatic black level setter, V203a. Blanking pulses are also fed to V203a from the Power Unit. The composite signal is then amplified by V20[illegible] after which it goes through V20[illegible]b which matches the composite output to the 91 ohm line.

Referring to the Power Unit, V101 supplies vertical deflection power to the Camera Unit as well as vertical sync pulses for the Monitor and vertical blanking pulses which feed V102. V103, the beam relaxor, supplies horizontal scanning power to the Dissector and horizontal blanking pulses to V102. V102 mixes, clips and shapes the horizontal and vertical blanking pulses. The beam relaxor, V103, also supplies horizontal sync pulses to the Monitor. V106 is a cathode follower which isolates the vertical blanking pulses from the sync pulses fed to the Monitor. The beam relaxor furnishes high voltage pulses which are rectified by V104 and V105, which are in parallel. These rectifiers supply the multiplier and cathode voltage to the Dissector.

Finally refer to the Monitor. The vertical sync pulses trigger V301 which supplies vertical deflection power to the cathode ray tube. The horizontal pulses, from the Power Unit, are amplified by V304 which synchronizes the beam relaxor V305. This beam relaxor supplies horizontal deflection to the Dissector tube as well as high voltage pulses to V306 and V307. These two rectifiers supply approximately 7.5 KV to the picture tube anode. The video signal from the Camera, is amplified by V302 and V303 before being applied to the grid of the picture tube. A 1N34 is used as the DC restorer.

The U-300 has a standard four to three aspect ratio. The resolution of the system is 300 lines horizontally and vertically.

## SECTION III

## METHOD OF OPERATION

This section will cover the operation of the various circuits in detail. Figure 5 is a schematic of the Camera; Figure 6 is a schematic of the Power Unit and Figure 7 the Monitor.

1. Camera

The Camera consists of five main units as follows:

1.1 Lens

1.2 Dissector

1.3 Dissector Coil System

1.4 Video Amplifier Unit

1.5 Main Chassis

1.1 Lens

The lens focuses the object on the translucent cathode of the Dissector. This lens is a Miller Optical Co. Model UL3 with a 90 MM focal length and a speed of F1.4 or better. The lens is coated for 7000A° transmission. The mounting uses a rack gear and pinion type focus adjustment. The angle of coverage for a 2" horizontal scan is approximately 27°. The optical focus adjustment will focus on objects between 20" from the lens and through infinity.

A remote control motor can be attached to the pinion gear for remotely focusing the camera.

1.2 Dissector

The Dissector is new in that it uses a translucent cathode instead of the solid cathode as previously used. Figure 8 shows a photograph of the Dissector which is a D30L type. Figure 9 shows a typical response curve of this type Dissector. The peak sensitivity is in the near infra red portion of the spectrum.

The cathode connection is brought out to a cap, which is painted yellow, on the front of the tube. Directly behind the cathode can be seen five rings. Each ring is brought out through a terminal on the front of the tube. Immediately behind the five rings is the nickel wall coating on the anode. There is an overall voltage between cathode and anode of approximately 400 volts. These rings are connected between the cathode and anode and have a differential of 75 volts between them. The purpose of these rings is to improve the field in the vicinity of the cathode and decrease the amount of "S" distortion.

There is one more cap on the front of the tube which is painted red. This connection is not used in the equipment as it is used only during the formation of the Dissector.

An eleven-stage multiplier is mounted at the rear of the tube. The aperture, which in most cases is a 30 mil square, is located at the front of the multiplier housing. This multiplier is of the $A_g - M_g$ type. This type multiplier is used instead of the $C_s - O - A_g$ in order to provide better uniformity in multiplier performance from tube to tube. The problem of caesium shorts in the multiplier is also eliminated.

The above photo sensitivity is approximately 20 ua per lumen. There is approximately $6 \times 10^{-10}$ amperes entering the square 30 mil aperture at any instant when the illumination is seven foot candles on the cathode. This current is multiplied by approximately 500,000 by the electron multiplier which has approximately 200 volts across each stage.

1.3 Dissector Coil System

Figure 10 is a photograph of the dissector coil assembly. This assembly contains the horizontal deflection coil, vertical deflection coil and focus coil. The features of this coil assembly are listed below.

1. Complete plug-in assembly
2. Minimum "S" distortion with simple construction
3. Horizontal inductance 2 mh; horizontal resistance 8.9 ohms
4. Vertical inductance 2.5 uh; vertical resistance 1 ohm
5. Focus coil turns 2,900; focus coil resistance 210 ohms
6. Electron image magnification approximately 1.5

Referring to Figure 10, the horizontal coil is the inner coil and is approximately nine inches long. The vertical coil is a toroidal type approximately one inch long wound over an iron form. This coil fits snugly on the horizontal coil and is directly behind the focus coil. These two coils are rotated 90°, electrically, with respect to each other. The focus coil is semi-layer wound and sets directly over the dissector cathode in the coil assembly housing. The coil assembly is supported by three studs on the front of the focus coil. These three studs extend through slots in the bakelite front plate of the coil housing and are secured with thumb nuts. The coil assembly can be rotated through the range of these slots to align the picture electrically with the picture on the Dissector cathode.

1.4 Video Amplifier Unit

Figure 11 shows a bottom view of the video unit and Figure 12 shows a schematic of this unit. This unit is connected by three plugs and can be removed readily without the use of a soldering iron. The function of this unit is to mix the blanking pulses with the video from the Dissector collector, providing an automatic black level setting, amplify the composite signal and match the output to a 93 ohm line.

Referring to Figure 12, V203A is the automatic black level setter. The operation of this tube is as follows. Relatively large blanking signals are fed to the cathode of V203A in series with the video from the Dissector collector. This video is developed across R231 which is the Dissector collector load.

The DC voltage developed across the Dissector collector load resistor due to random noise in the Dissector will remain a constant value. Any light which strikes the Dissector cathode will cause a corresponding increase in collector current, hence increased negative voltage of the collector. Since more light causes more electrons to flow to the collector, the collector becomes more negative with respect to ground.

The initial clipping level of the black level setter can be properly adjusted by applying just enough positive voltage to the cathode of $V_7$ to allow only a very small amount of the blanking pulses to come through V203A. This is accomplished by varying R234 to give the proper potential. R233 is an isolating resistor to minimize the capacitance across the collector load.

Any light on the Dissector cathode will then cause more negative voltage to appear at the clipper cathode, which will pass through the diode, so the pedestal will always be full but no video can ever extend beyond the black level. This tube has a loss of approximately 6 db.

Again referring to Figure 12, V202 is used as the video amplifier and has a gain of approximately 18. R224 has been made large to minimize "bounce" due to line surges. Decreasing the value of this resistor will increase the gain, however if this is done picture "bounce" due to line surges becomes objectionable. R226 and C205B are used to minimize video "bounce" due to sudden line surges.

V203B is used as a cathode follower to provide a low impedance output for the video line. R222 and R230 have been designed to give maximum linear output without exceeding the tube rating. The gain of this tube, with the line properly terminated, is approximately .3 . Figure 13 gives the overall frequency response curve of the video unit.

1.5 Main Chassis

To understand the operation of the components on the main chassis refer to Figure 5, the Camera schematic. X204 is the socket into which the coil system is plugged. P205 plugs into the video unit. The Dissector multiplier voltage divider is shown in the upper left-hand portion of the schematic. The overall voltage across the multiplier is approximately 2000 volts, or 180 volts per stage. C206 and C207 are necessary to improve the low frequency response of the multiplier due to the high impedance of the multiplier divider. Without these capacitors, a scene which has a very black square against a white background will be followed by trailers. R202 is the width control. Actually this width control is an overall size control in that it changes the cathode-anode voltage. An increase in this voltage will decrease the width of the scanned image and also the height of the image.

R208 is the video overload control. Actually this controls the gain of the multiplier. It is necessary due to variation in Dissector tubes and extreme light conditions which may be encountered. For example, when the control is at the center of its range, the gain of the multiplier will be at maximum. It will be necessary to operate the multiplier at the maximum gain when the light level is quite low and the picture is very noisy. However, if the light is high, it will be necessary to reduce the gain of the multiplier with this control. If this is not done the last stages of the multiplier will be operating in an overload condition. Since this overload problem concerns only the last two or three multiplier stages, the control is used on stage #6.

Figure 14 shows the saturation a little more clearly. Referring to the figure, the x coordinate shows the light on the photosensitive cathode while the y coordinate shows the collector current for varying amounts of light. Curve A is a plot of the cathode current as it varies with light. If there is no multiplier saturation, the collector current should follow the same characteristics as this curve. Curve C illustrates the saturation of the multiplier when using 200 volts per stage on this particular Dissector. It will be noted that saturation occurs at a variac setting of approximately 30 volts. Curve B shows the collector current curve for the case when the gain of stage #6 has been considerably reduced by dropping the voltage between multiplier stage #5 and #6. It will be noted also that this curve is relatively linear up to the maximum variac setting. Incidentally, the variac voltage shown is the voltage which was supplied to a small slide projector. The light from this projector was then projected on the cathode of the Dissector. Referring again to the curve, it can be seen that if the light on the cathode varied between 50 and 100, the actual collector current change would be only about .3 ma. However, with the gain decreased in stage #6, the collector current change would be approximately 1.2 ma, or four times the video output. If the light were to swing between the values of approximately 20 and 80 or 90, it can readily be seen that the points which correspond to maximum light on the cathode would be crushed and the picture would have a washed-out appearance.

If this multiplier is operating in the overload condition, the automatic black level setter will not operate properly. The best way to determine the setting of the video overload control is with an oscilloscope at the Camera video output. The gain of the multiplier can be increased to a point just before the video is distorted. If no oscilloscope is available, the Monitor contrast control should be set between ½ and ⅔ maximum contrast. The Camera video overload control should then be adjusted for the best picture.

R232 is the electrical focus control. It is important that this focus control be set correctly. If it is not properly set the picture detail will be down and the picture may exhibit "S" distortion.

This focus control must always be adjusted after each change of either the width control or the video overload control.

2. Power Unit

Figure 15 shows a photograph of the Power Unit with the case removed. The function of the Power Unit is to deliver heater voltage, B voltage, multiplier voltage, scanning power and blanking signals to the Camera Unit. This is done through a single multi-conductor cable. The Power Unit also supplies vertical sync pulses and horizontal sync pulses to the Monitor.

The Power Unit draws approximately 100 watts and will operate on a line voltage of between 95 volts and 135 volts. A meter is available on the front panel to determine the proper voltage control setting for any voltage between these two limits. The meter is provided with a red line and the voltage control, which is available from the front, is adjusted such that the meter pointer coincides with the red line.

Figure 6 shows a schematic of the Power Unit. An analysis of the various circuits in the Power Unit will be made under the following sections.

2.1 Power Supply

2.2 Horizontal deflection and high voltage supply

2.3 Vertical deflection circuit

2.4 Blanking mixer and sync output

2.1 Power Supply

The nominal power supply voltage is 275 volts after filtering. The ripple voltage after filtering is .7 volts RMS. A bridge rectifier circuit is used which utilizes eight 200 mil selenium rectifiers. The selenium rectifiers and bridge circuit were chosen for their ability to give trouble free operation for extremely long periods of time.

A variable series resistor is used between the rectifiers output and the filter to permit proper voltage adjustment under wide limits of input line voltage.

A heavy duty power transformer is used. This transformer is conservatively rated at 200 mils although approximately 160 mils is the total current drained. This transformer also supplies heater voltage for the tubes on the Power Unit and Camera. A 4 amp fuse is used in series with the primary of the transformer. A 110 volt neon pilot bulb is also used. The neon bulb was chosen for its long life.

2.2 Horizontal Deflection and High Voltage Supply

A single 6L6 in a beam relaxor circuit is used to provide horizontal scanning power for the Camera as well as to supply high voltage pulses to the multiplier voltage supply rectifiers. The beam relaxor is a self oscillating circuit chosen for its durability and high efficiency. This is a free running oscillator which operates at a frequency of approximately 21.5 KC. The beam relaxor has a high degree of frequency stability over long periods of time. This frequency is controlled by the adjustable cathode resistor R120. The correct setting of this resistor is approximately 75 ohms. This resistor should never be reduced below 25 ohms as this will cause improper operation of the blanking mixer since this cathode pulse is used to feed the horizontal blanking to the blanking mixer. This control is not critical and will vary slightly from transformer to transformer. It should never be necessary to adjust this resistor unless the transformer has been replaced.

Figure 16 shows a close-up of the horizontal deflection transformer. This transformer consists of a grid winding of approximately 100 turns. The plate winding which consists of 500 turns is wound directly over the grid winding. The high voltage winding consists of 300 turns connected in auto transformer fashion. Considerable development time was spent on this transformer in that it must serve three functions and these functions are interdependent. The transformer must provide the proper scanning power to the Camera, the proper high voltage for the Dissector multiplier, and its return time must be slightly faster than the blanking return time. These criterions must be met with satisfactory scanning linearity. The return time of this transformer is 5.7 micro seconds or .12 H. This transformer has been tested at three times its normal operating voltage with no evidence of corona or breakdown. R108 is used as a damping resistor to remove the overshoot which would otherwise occur through the scanning coils causing severe non-linearity.

The positive impulse derived from the horizontal deflection transformer is rectified by the two 1B3s in parallel. This provides a negative voltage of approximately 2500 volts. Since the current drain very nearly approaches the current rating of the 1B3, two are used in parallel. This is done as an added precaution against failure in the field.

2.3 Vertical Deflection Circuit

The vertical deflection circuit which consists of the dual triode V101, must supply vertical deflection power to the Camera, vertical blanking pulses to the blanking mixer and vertical sync pulses to the Monitor. One-half of the 6SN7, V101, is used as a blocking oscillator. The frequency determining time constant is C104 and R104. The lower end of the blocking oscillator transformer is returned to the 6.3 volt heater winding on the power transformer. The capacitor C105 on the plate of the vertical oscillator as well as the shielding of leads to the height potentiometer are necessary to remove horizontal pickup which occurs during the retrace of the beam relaxor. This pickup will cause "jitter" or a "bounce" in the scanning amplitude. A resistor, R105, is inserted in the cathode circuit of the vertical oscillator. A positive pulse is developed across this resistor which is used for blanking and Monitor synchronization. C106 reduces the horizontal pickup on this lead. The second section of V101 is used as a conventional vertical amplifier. R118 is the vertical linearity control while R119 is the height control. T102 is the vertical output transformer used to present the proper plate load impedance on the vertical amplifier from the vertical scanning coils.

2.4 Blanking Mixer and Sync Output

Referring once again to Figure 6, V102 is the blanking mixer. One section of this tube is used to mix the horizontal and vertical blanking pulses while the other section is used as a cathode follower. A positive vertical pulse is fed to the cathode of the blanking mixer. A negative horizontal pulse from the beam relaxor cathode is injected on the grid of the blanking mixer. A very low plate voltage is used, hence the blanking pulses cause very early plate saturation of the tube. This causes the base line of the blanking pulses to be absolutely flat which is extremely important, otherwise at low light levels a shading component will appear. The values of R109 and R112 were picked very carefully to provide proper phasing of the horizontal blanking pulse with respect to the initial sync pulse delivered to the Monitor.

V106 is a cathode follower to isolate the cathode of the vertical oscillator from the Monitor vertical oscillator. If this is not done a large pulse is fed back to the Power Unit from the Monitor vertical oscillator. This pulse, if applied across the cathode resistor of the Power Unit vertical oscillator is slightly out of phase with the cathode pulse and will make it impossible to derive a clean vertical blanking pulse from this point.

3. Monitor

The Monitor is quite conventional and will not be treated in too much detail. The Monitor will be broken down under the following headings:

3.1 General

3.2 Horizontal Deflection and High Voltage System

3.3 Vertical Deflection System

3.4 Sync System

3.5 Power Supply

3.6 Video Amplifier

3.1 General

Figure 17 shows a top view of the Monitor with the case removed. The Monitor is so constructed that the cathode ray tube and all other tubes may be shipped in place. A small clamp is used to keep the 6L6 tube in its socket. Figure 18 shows a bottom view of the Monitor. All controls are available from the front. Brilliance, contrast and focus controls are available screwdriver adjustments. Other controls are available behind a hinged door. A meter is used to properly set the width control for any given line voltage between 105 and 135 volts. This meter can be seen when the door on the front panel is open. This meter has a green shaded area on its face. The width control should be set to just completely fill the mask. If the equipment is functioning properly, with the correct amount of horizontal scan, the meter pointer should be within the green area.

A plug termination for the video input cable is provided at the rear of the Monitor. This terminating resistor is 120 ohms for all normal installations. However, where more than one Monitor is used, this plug termination should be changed to properly terminate the video line.

3.2 Horizontal Deflection and High Voltage System

A 6L6, V305 is used in a beam relaxor circuit to provide horizontal deflection and high voltage for the picture tube. Circuit-wise this is quite similar to the beam relaxor on the Power Unit. However, synchronization is controlled by injecting the horizontal sync pulse from the Power Unit on the screen of the 6L6 and controlling the frequency by means of a variable cathode resistor. Care should be taken in the initial adjustment of the horizontal frequency control. The beam relaxor will remain in sync over a rather large range of the frequency control. As this control approaches one end of its "lock-in" range the picture width will decrease. The proper setting of this control is near the other end of its "lock-in" range. The controls on the Monitor are not too critical, however after an equipment is set up in proper fashion, the line voltage should be varied over approximately a 20 volt range with a variac to make sure the Monitor will remain in synchronization. If it does not, a slight re-adjustment of the horizontal sync control should be made to make sure the Monitor will remain in sync over at least this range.

Basically the beam relaxor transformer T303 is similar to the Power Unit beam relaxor transformer with the addition of two heater windings for the 1B3 rectifiers. The transformer is designed to match a 2 MH deflection yoke. The transformer is also designed to provide 7500 volts for the picture tube and the return time must be faster than the Camera blanking time. This return time is 5.7 micro seconds or .12 H.

Two 1B3 tubes are used in a voltage doubler circuit to provide the picture tube high voltage. The voltage doubler circuit was chosen as providing a more efficient overall circuit where power drain and return time are of great importance.

3.3 Vertical Deflection System

The vertical deflection system is very similar to the Camera vertical deflection system. C303 and R305 are the frequency determining elements. These fixed elements have been chosen as tests have shown the oscillator will stay in sync over large variations of line voltage and other parameters.

3.4 Sync System

The vertical sync from the Power Unit is injected directly into the vertical oscillator.

The horizontal sync is amplified and injected by both sections of V304. The grid, cathode and plate time constants were carefully chosen for the horizontal sync amplifier to properly phase the triggering of the beam relaxor with respect to the blanking pulse.

### 3.5 Power Supply

The power supply is also very similar to the supply used on the Power Unit except the DC output through the filter is 350 volts. The ripple voltage appearing at this point is .6 volts RMS.

### 3.6 Video Amplifier

A two-stage video amplifier is used. V302 is a type 5693. This tube is the same as the 6SJ7 except that it is of the ruggedized long life type. This tube is relatively free from microphonics. A 6AC7 is used as the second video amplifier. R314, R316 and C306 are used to reduce "bounce" due to line surge. Figure 19 shows the overall response curve of the Monitor video system.

A 1N34 is used as a partial DC restorer. The function of the 1N34 is to maintain the average brilliance level constant on the kinescope during rapid changes of scene which are encountered when the Utiliscope is used to view rapidly moving objects. It is also helpful in reducing "bounce" due to sudden line voltage surges.

## SECTION IV

## MISCELLANEOUS

### 1. Wave Shapes

Appendix 2 attached to this report presents the wave shapes which should be obtained at various points of the circuit. These wave shapes correspond to the points on the schematic diagram as marked. For example, (P2) shows a wave shape of a point on the Power Unit. Referring to the Power Unit schematic, the point (P2) can readily be seen. These wave shapes were taken with a Dumont Type 241 Oscilloscope. The wave shapes shown were taken with the equipment in normal operating condition while viewing an average scene.

2. Voltage Measurements

DC voltage measurements are shown on the three schematic diagrams. These voltage measurements were taken with a Simpson Model 260, 20,000 ohm per volt meter. Voltages were taken under normal operating conditions.

3. Caution

Considerable design effort has been expended on this equipment. It has been pointed out that many factors are interdependent. Should any trouble occur in the equipment, this trouble should be remedied by finding the source of the trouble and returning the equipment to its proper operating conditions. A trouble which develops should never be corrected by a re-design of any portion of the equipment as this can lead to other difficulties which may be more difficult to find. For example, an incorrect remedy of Monitor vertical syncronization might allow the vertical sync to work properly but blanking difficulties, either in blanking pulse amplitude or width might occur.

As an additional word of warning, no work should be done on the Camera Unit with the power turned on as there are many points which have potentials of greater than 2 KV on this unit.

General:

1. Number of Units (3)

   1.1 - Camera Pickup
   1.2 - Camera Power (Sending end)
   1.3 - Monitor -(Receiving end)

2. Maximum Separation Between Units

   2.1 - Camera Pickup Unit to Camera Power Unit: 100 Feet
   2.2 - Single 17 Conductor Interconnecting cable
   2.3 - Sending and to Receiving end: 1000 Feet
   2.4 - Three RG62U connecting cables

3. Operation - Continuous or Intermittent

4. Maximum Ambient Temperature

   4.1 - Camera Pickup and Camera Power Unit: 65°C.
   4.2 - Monitor: 50°C.

5. Lens

   5.1 - Miller Optical Company F1.4 (coated) - 90 MM Focal length
   5.2 - Focus Adjustment 20 inches through infinity

6. Illumination Required

   6.1 - Minimum object illumination required, about 300 foot candles of sunlight, or 2870° Kelvin tungsten-lamp light.

7. Power Requirements

   7.1 - Nominal 115 volt AC (60 cycle only)
   7.2 - Camera Power, 100 Watts
   7.3 - Monitor Power, 125 Watts

8. All Controls Available From the Front (except clipping level control and camera width-control)

9. Available Controls

   9.1 - Camera Pickup Unit - None
   9.2 - Camera Power Unit - None
   9.3 - Monitor Unit - Three
      a. Focus
      b. Brilliance
      c. Contrast
   9.4 - Monitor Remote Control of Camera - Four
      a. Lens Focus
      b. Lens Shift
      c. Magnetic Focus
      d. Video Overload

10. Pre-set Controls

    10.1 - Camera Pickup Unit - Two
        a. Scan size (width)
        b. Clipping Level
    10.2 - Camera Power Unit - Four
        a. Height
        b. Vertical Linearity
        c. Line V ltage
        d. Horizontal Linearity
    10.3 - Monitor - Six
        a. Width
        b. Height
        c. Vertical Linearity
        d. Horizontal Centering
        e. Vertical Centering
        f. Horizontal Sync

11. Tube Complement - Total Seventeen

    11.1 - Camera Pickup Unit - Three
        a. Dissector - One
        b. Receiving Tubes - Two
    11.2 - Camera Power Unit - Six
        a. Receiving Tubes - Four
        b. Rectifiers - Two
    11.3 - Monitor- Eight
        a. Cathode Ray Tube - One
        b. Receiving Tubes - Five
        c. Rectifiers - Two

12. Accessable Plug Termination on Monitor for Video Line

13. Each Power Transformer is Fused

Electrical Specifications:

1. Direct Horizontal & Vertical Synchronization of Monitor

2. Scanning Frequencies

    2.1 - Horizontal - 21,500 cycles (free running)
    2.2 - Vertical - 60 cycles synchronous with power line frequency
    2.3 - Non-interlaced

3. Aspect-Ratio - 4/3

    3.1 Monitor Picture Width - 8-1/4"
    3.2 Scanned Image on Dissector - 2 inches Wide Nominal; 1-7/8" minimum

4. Resolution (center of picture)

    4.1 - Horizontal - 300 lines
    4.2 - Vertical - 300 lines

5. Video Bandwidth - 4MC

6. Video Gain

    a. Camera - 2 volts
    b. Monitor - 80 volts
    From Dissector to Cathode-ray 160 volts

7. Maximum Overall Scanning Distortion

    7.1 - Horizontal - 15%
    7.2 - Vertical - 10%
    7.3 - "S" Distortion - 10%

8. Design Center Line Voltage - 115 volts

    8.1 - Operating Line Voltage Center 105 volts to 130 volts

9. Picture Tube Anode Voltage: 7500 volts Nominal

10. Dissector Multiplier Voltage: 1900 volts Nominal

Mechanical

1. Size

    1.1 - Camera Pickup Unit - 9 3/4" Wide x 8½" High x 17½" Deep
    1.2 - Camera Power Unit - 9 3/4" Wide x 8½" High x 17½" Deep
    1.3 - Monitor - 13" Wide x 16 5/8" High x 20 3/8" Deep

2. Weight

    2.1 - Camera Pickup Unit - 47 pounds
    2.2 - Camera Power Unit - 37 pounds
    2.3 - Monitor - Approximately 60 pounds

3. Mounting Provisions - Shock Mounts

4. Line Power Input Plugs - Locking Type

5. Appearance - Rugged and Reliable but Cost a Major Consideration

Pickup Tube - Translucent Dissector Type D30LL

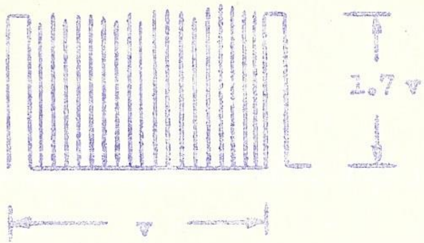
Miscellaneous

1. Picture Tube - Type 10FP4 (aluminized)

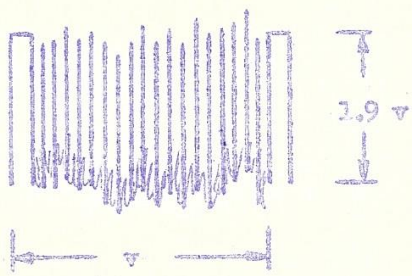
APPENDIX 2

WAVE SHAPES - Page 1

G1

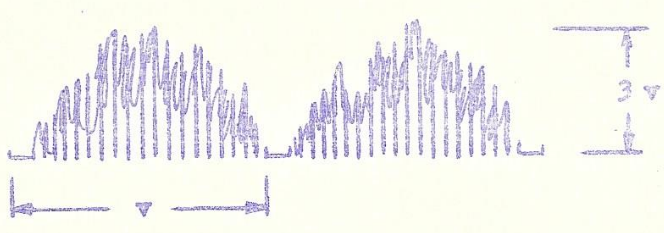



G2

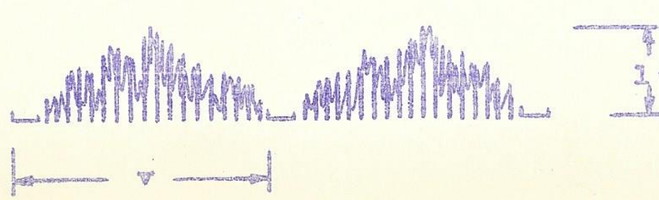



G3

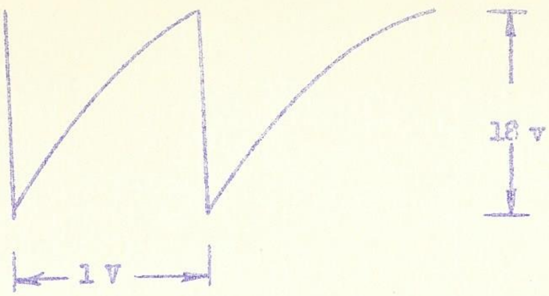

G4



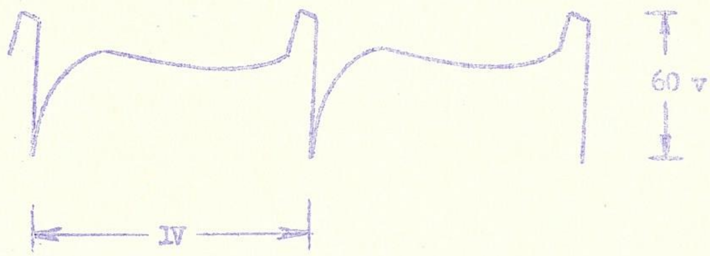

G5



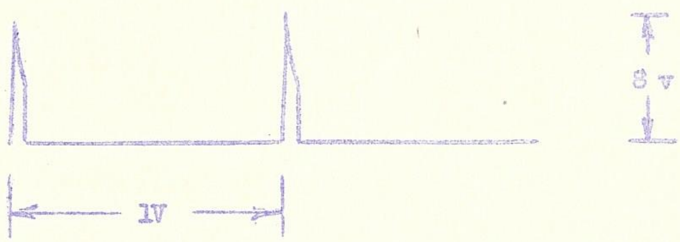
P1



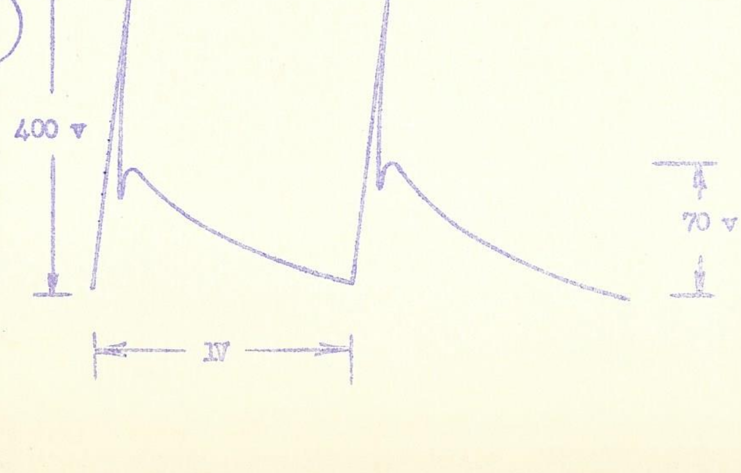

P2



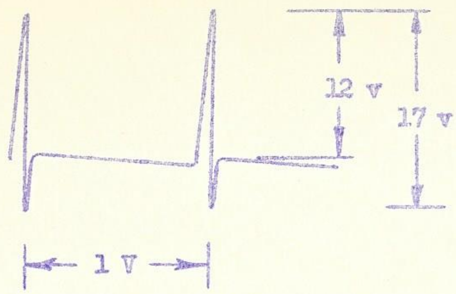

P3



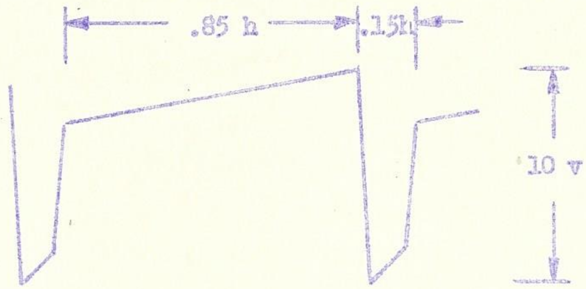

P4



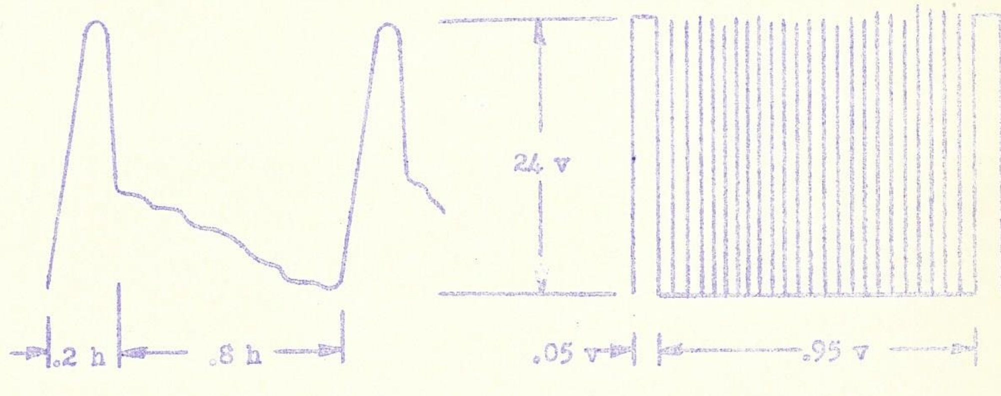
P5



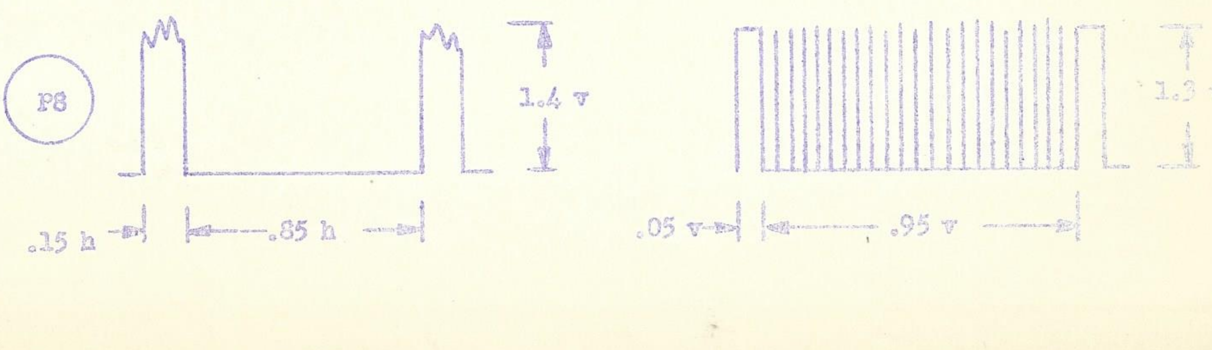

P6



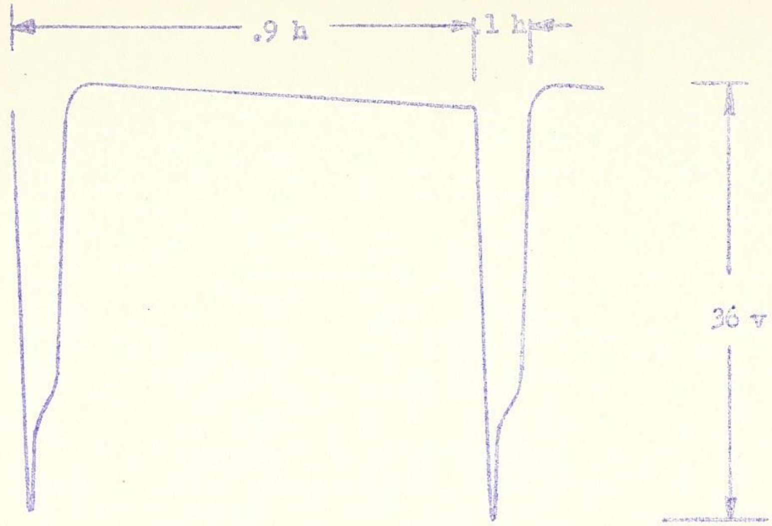

P7



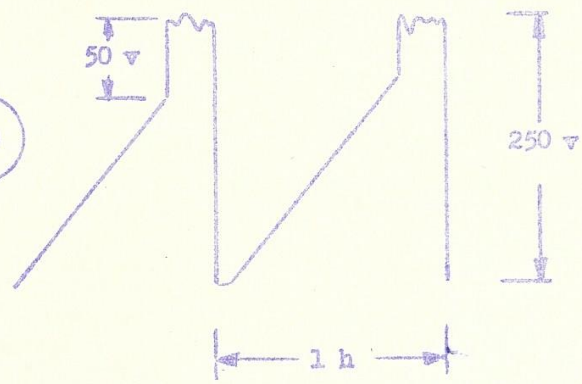

P8



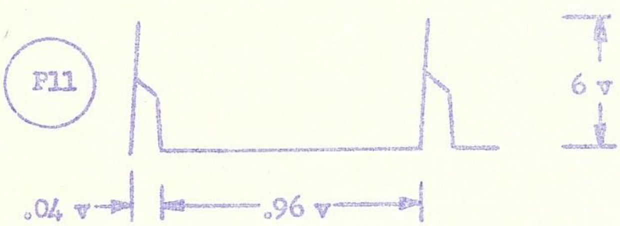
P9



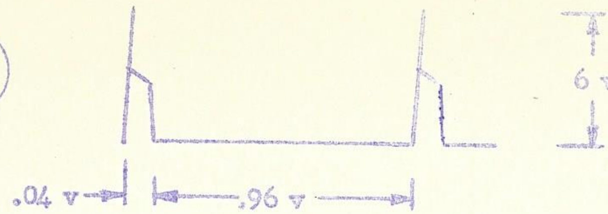

P10



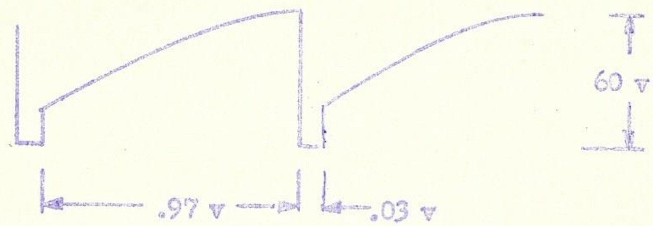

P11



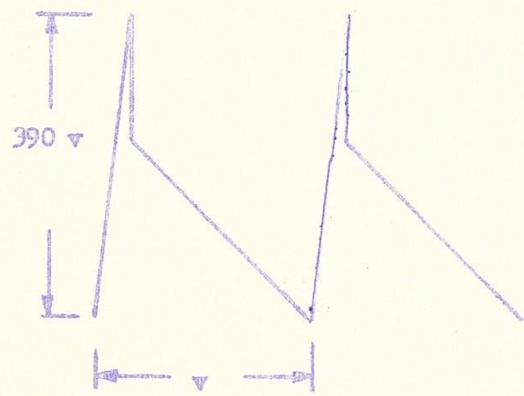
M1



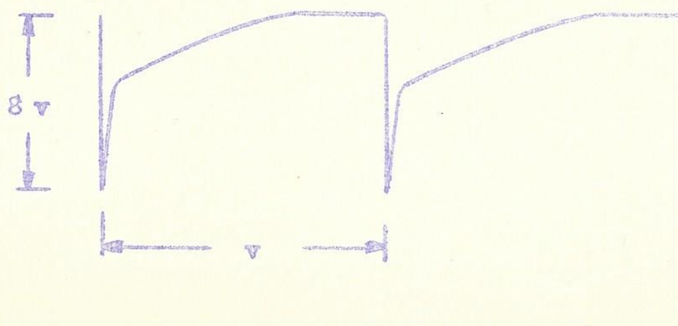

M2



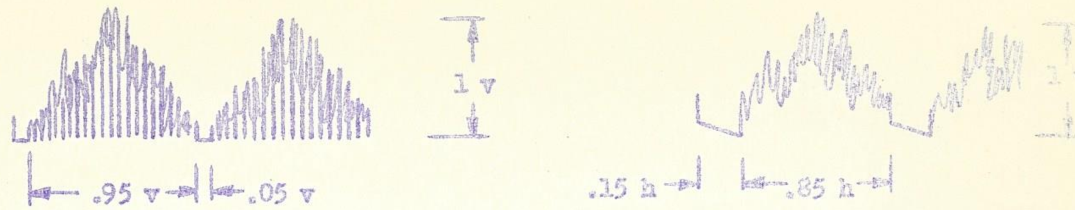

M3



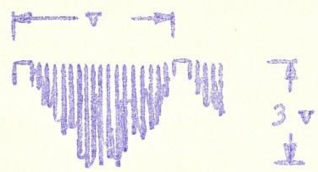

M4



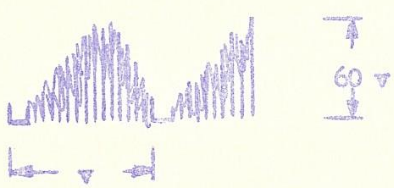
M5



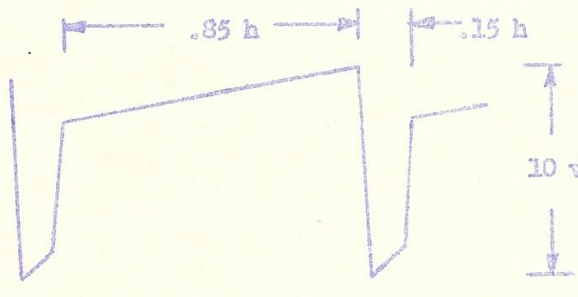

M6



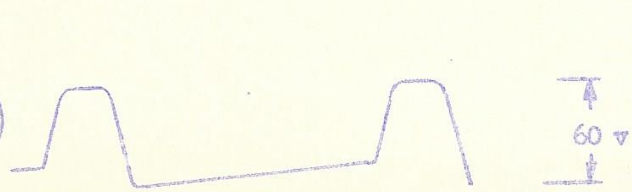

M7



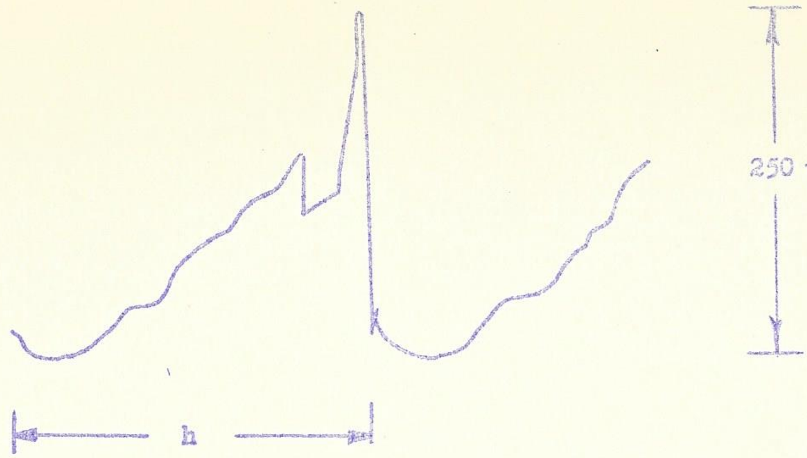

M8



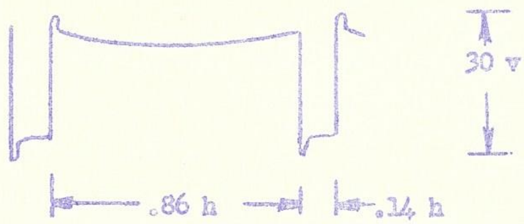

M9



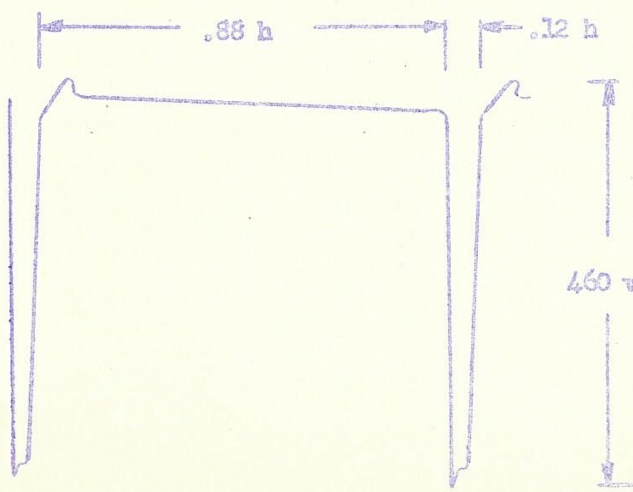
M10




M11




M12



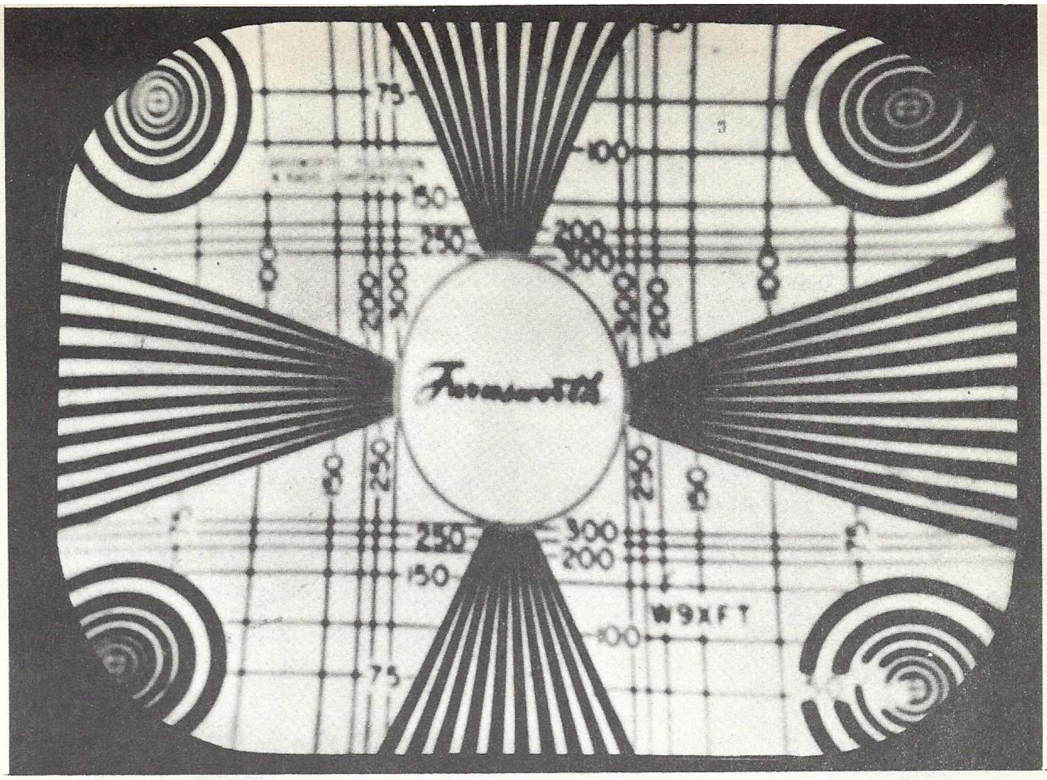



FIGURE 1

FIGURE 2

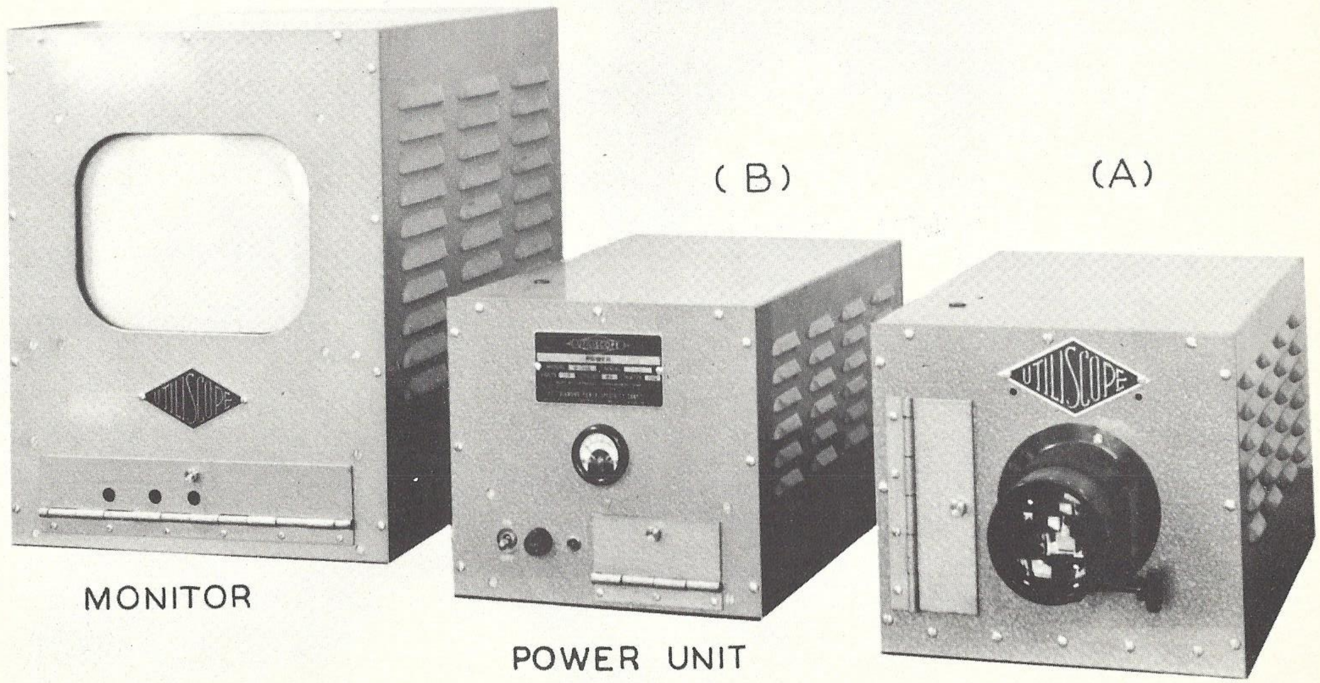



FIGURE 3

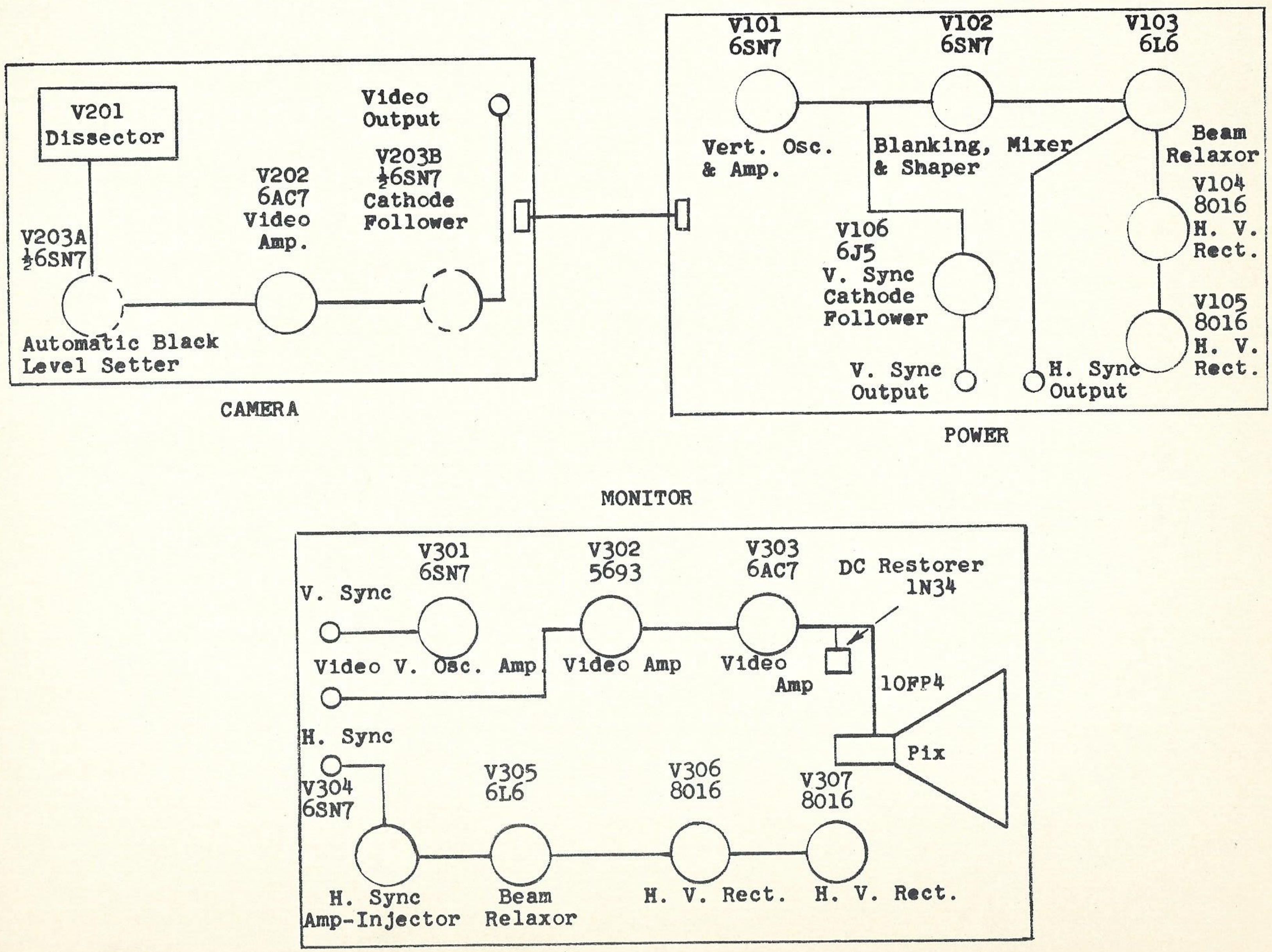

V201
Dissector
V203A
½6SN7
Automatic Black
Level Setter
V202
6AC7
Video
Amp.
V203B
½6SN7
Cathode
Follower
Video
Output
CAMERA
V101
6SN7
Vert. Osc.
& Amp.
V102
6SN7
Blanking, Mixer
& Shaper
V103
6L6
Beam
Relaxor
V104
8016
H. V.
Rect.
V105
8016
H. V.
Rect.
V106
6J5
V. Sync
Cathode
Follower
V. Sync
Output
H. Sync
Output
POWER
MONITOR
V. Sync
Video
H. Sync
V301
6SN7
V. Osc. Amp.
V302
5693
Video Amp
V303
6AC7
Video
Amp
DC Restorer
1N34
10FP4
Pix
V304
6SN7
H. Sync
Amp-Injector
V305
6L6
Beam
Relaxor
V306
8016
H. V. Rect.
V307
8016
H. V. Rect.

Figure 4

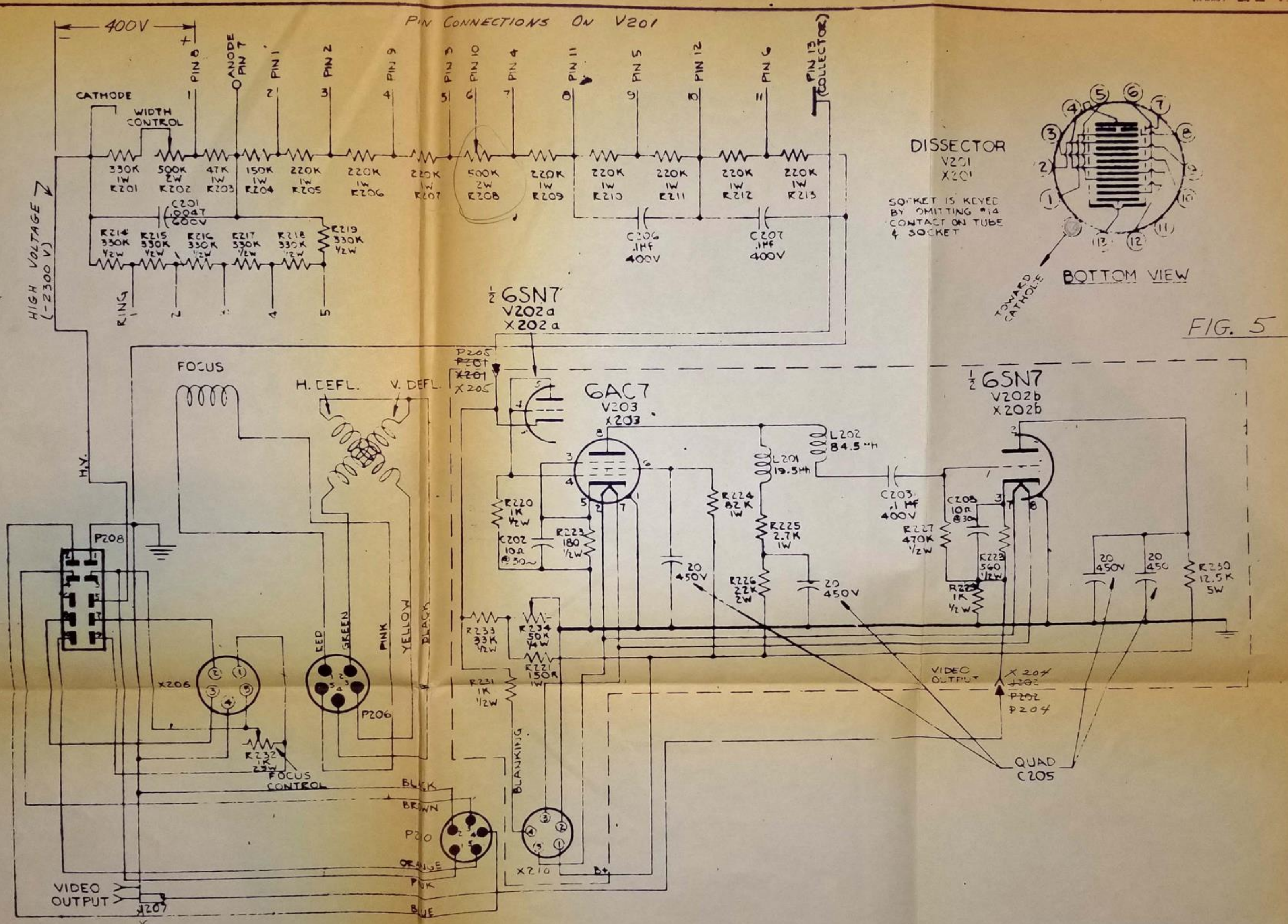



FIG. 5

DO NOT SCALE — USE DIMENSIONS ONLY

DIAMOND POWER SPECIALTY CORP.
DETROIT, MICHIGAN

SCHEMATIC FOR MODEL 300 "UTILISCOPE" CAMERA

| TRACED AND COMPILED FROM | REFERENCE DRAWINGS | DATE B/PT. ISSUED | DRAWN BY | DATE | DRAW. NO. |
| --- | --- | --- | --- | --- | --- |
| | | | BUCHAN | 11-18-49 | UD-16-S |

| REVISIONS | BY | CHK | DATE | REVISIONS | BY | CHK | DATE | REVISIONS | BY | CHK |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

DRAW. No. UD-16-S

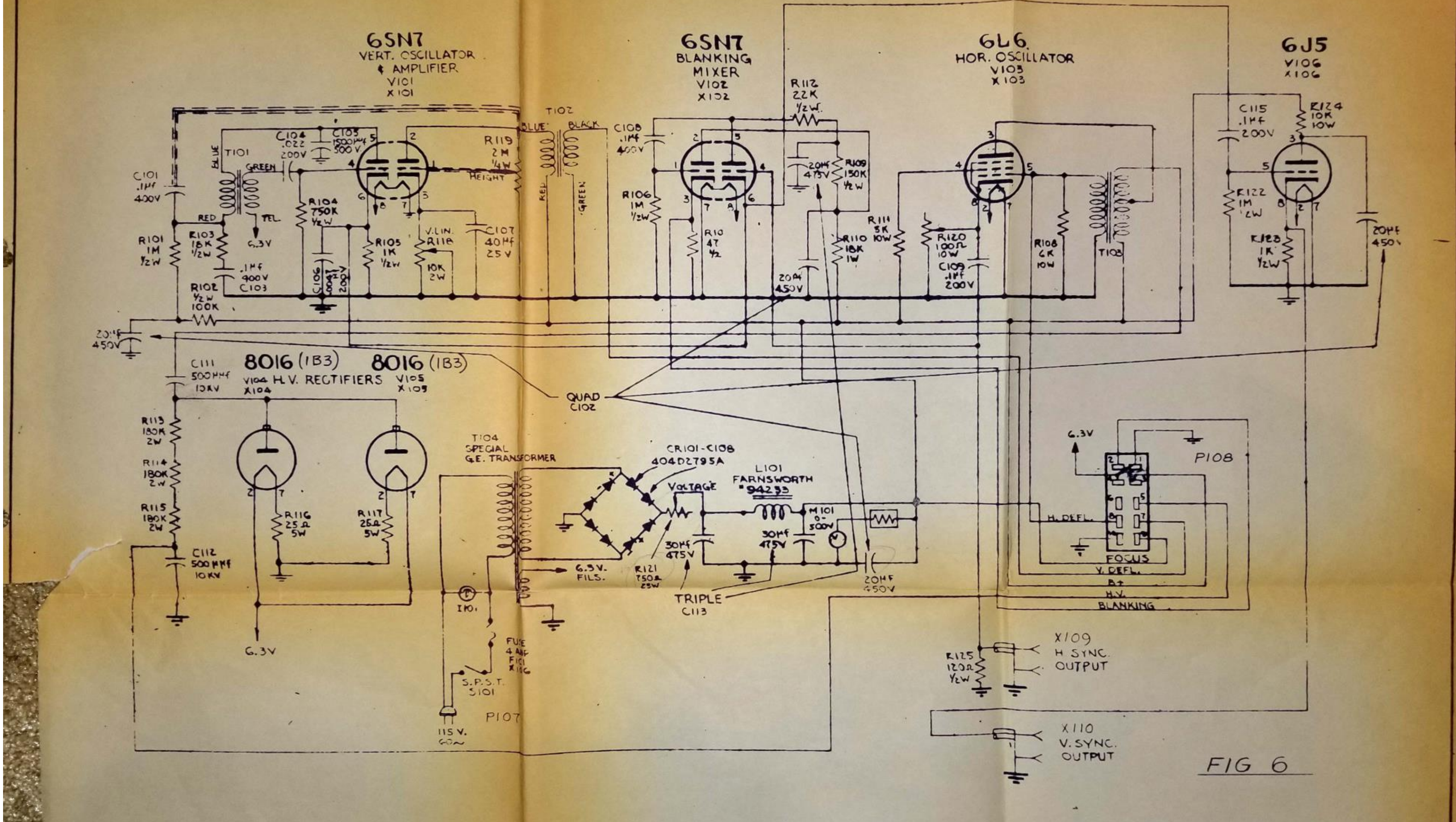



FIG 6

DO NOT SCALE — USE DIMENSIONS ONLY

TRACED AND COMPILED FROM

REFERENCE DRAWINGS

DATE B/PT. ISSUED

**DIAMOND POWER SPECIALTY CORP.**
DETROIT, MICHIGAN

SCHEMATIC FOR MODEL 300
"UTILISCOPE" POWER UNIT

| DRAWN BY | DATE | DRAW. NO. |
|---|---|---|
| BUCHAN | 11-19-49 | UD-15-S |
| CHECKED BY | SCALE | |
| APPROVED BY | | |

| REVISIONS | BY | CHK | DATE | REVISIONS | BY | CHK | DATE | REVISIONS | BY | CHK |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

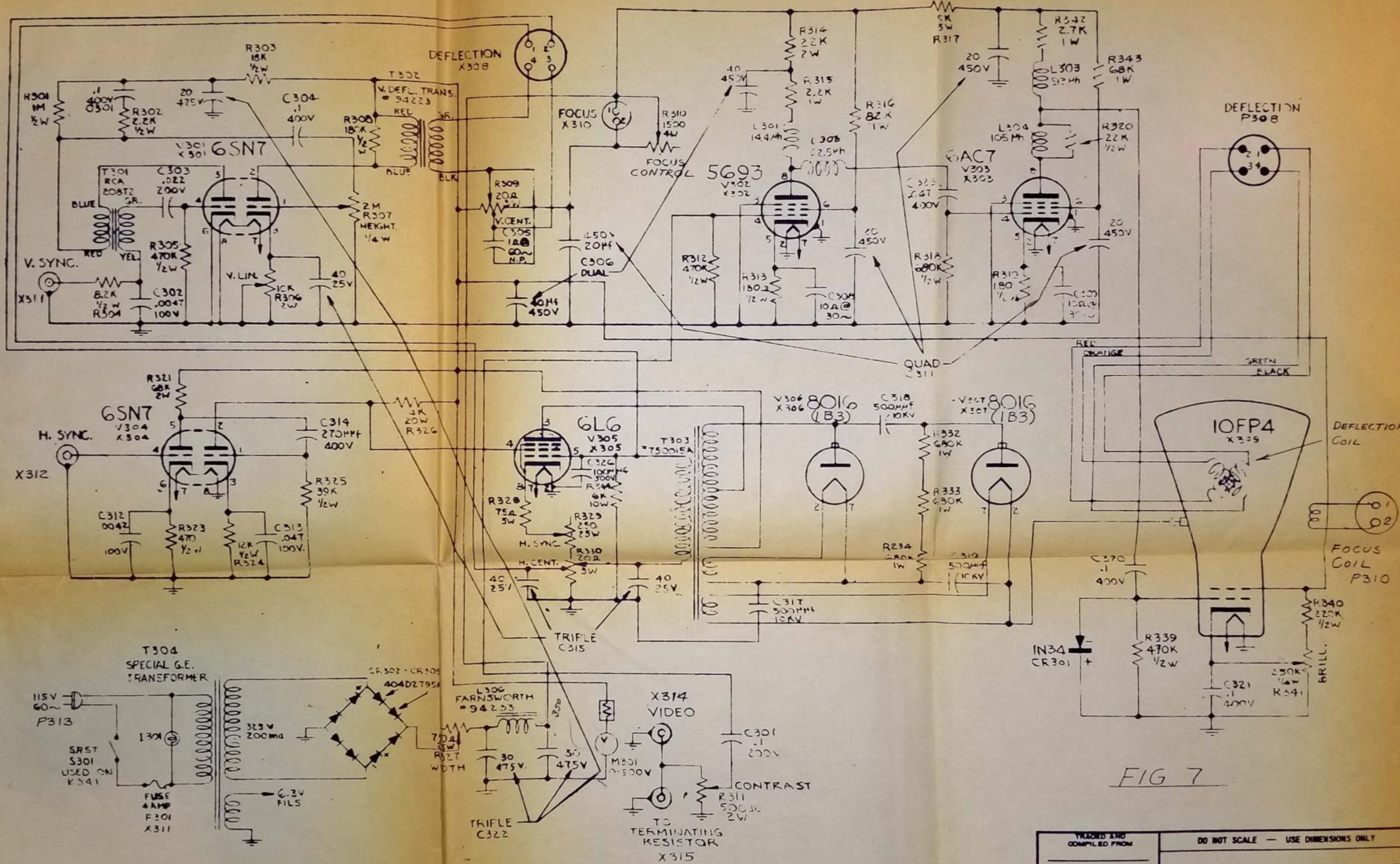



FIG 7

| TRACED AND COMPILED FROM | DO NOT SCALE — USE DIMENSIONS ONLY |
|---|---|
| REFERENCE DRAWINGS | DIAMOND POWER SPECIALTY CORP. DETROIT, MICHIGAN |
| | SCHEMATIC FOR MODEL 300 "UTILISCOPE" MONITOR |
| DATE B/PT. ISSUED | DRAWN BY BUCHAN · DATE 11-18-49 · CHECKED BY · SCALE · APPROVED BY · DRAW. NO. UD-17-S |

| REVISIONS | BY | CHK | DATE | REVISIONS | BY | CHK | DATE | REVISIONS | BY | CHK |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

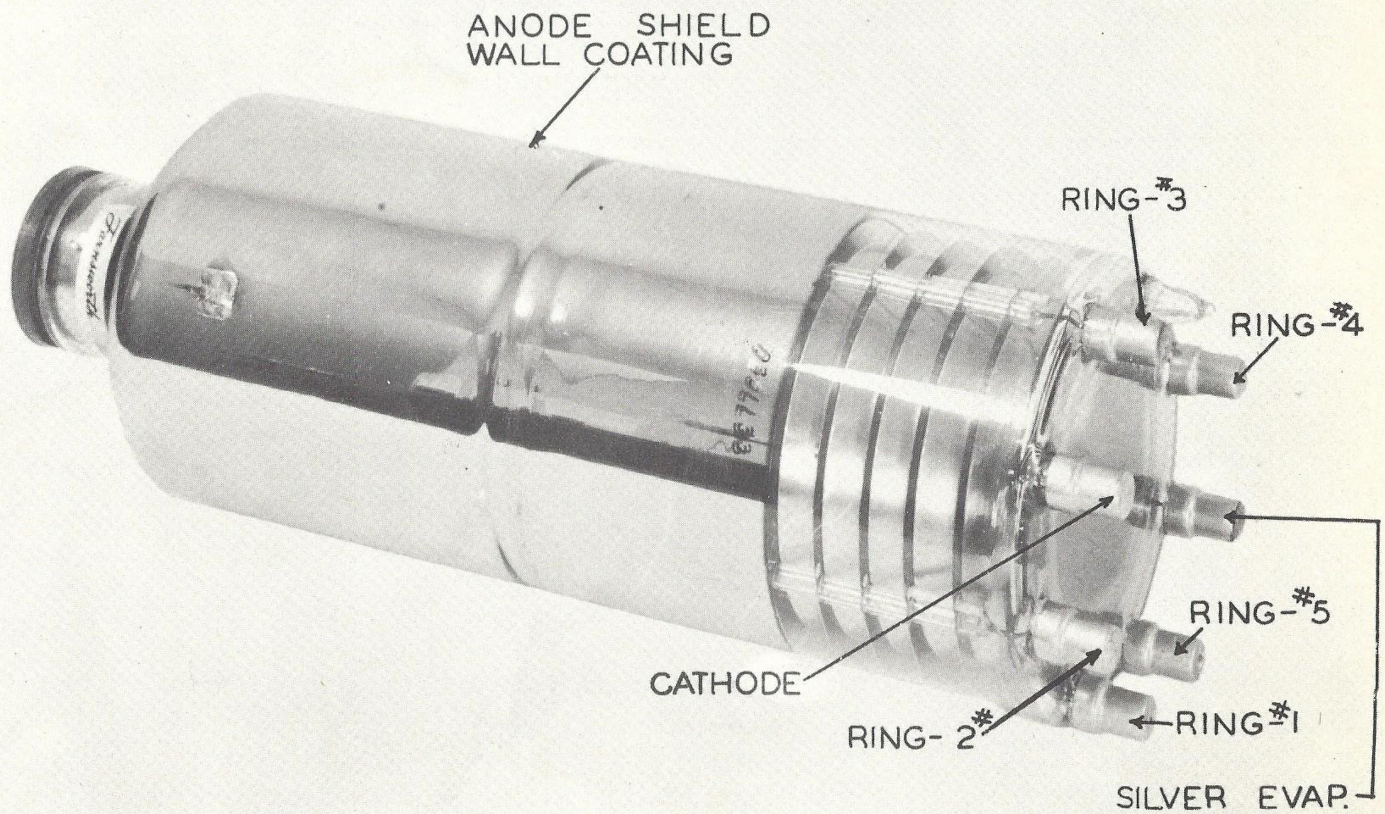
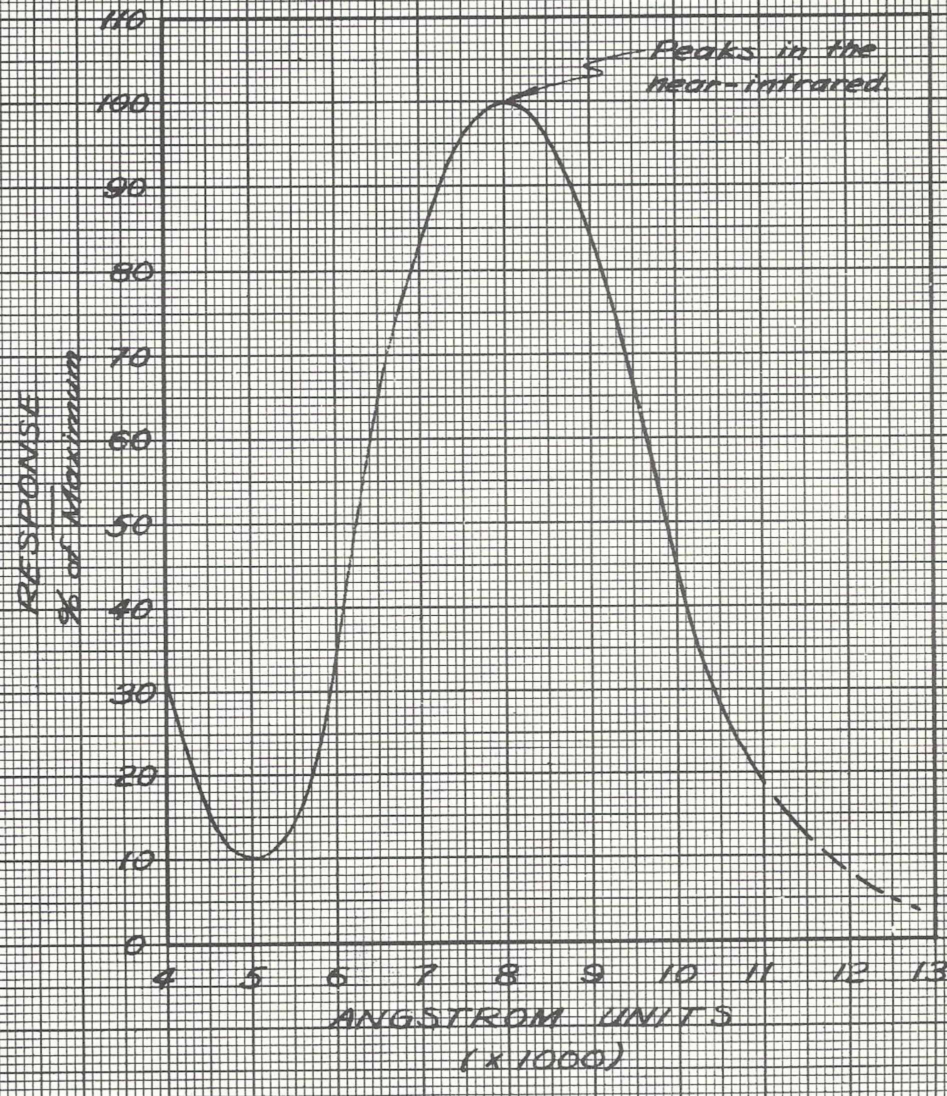
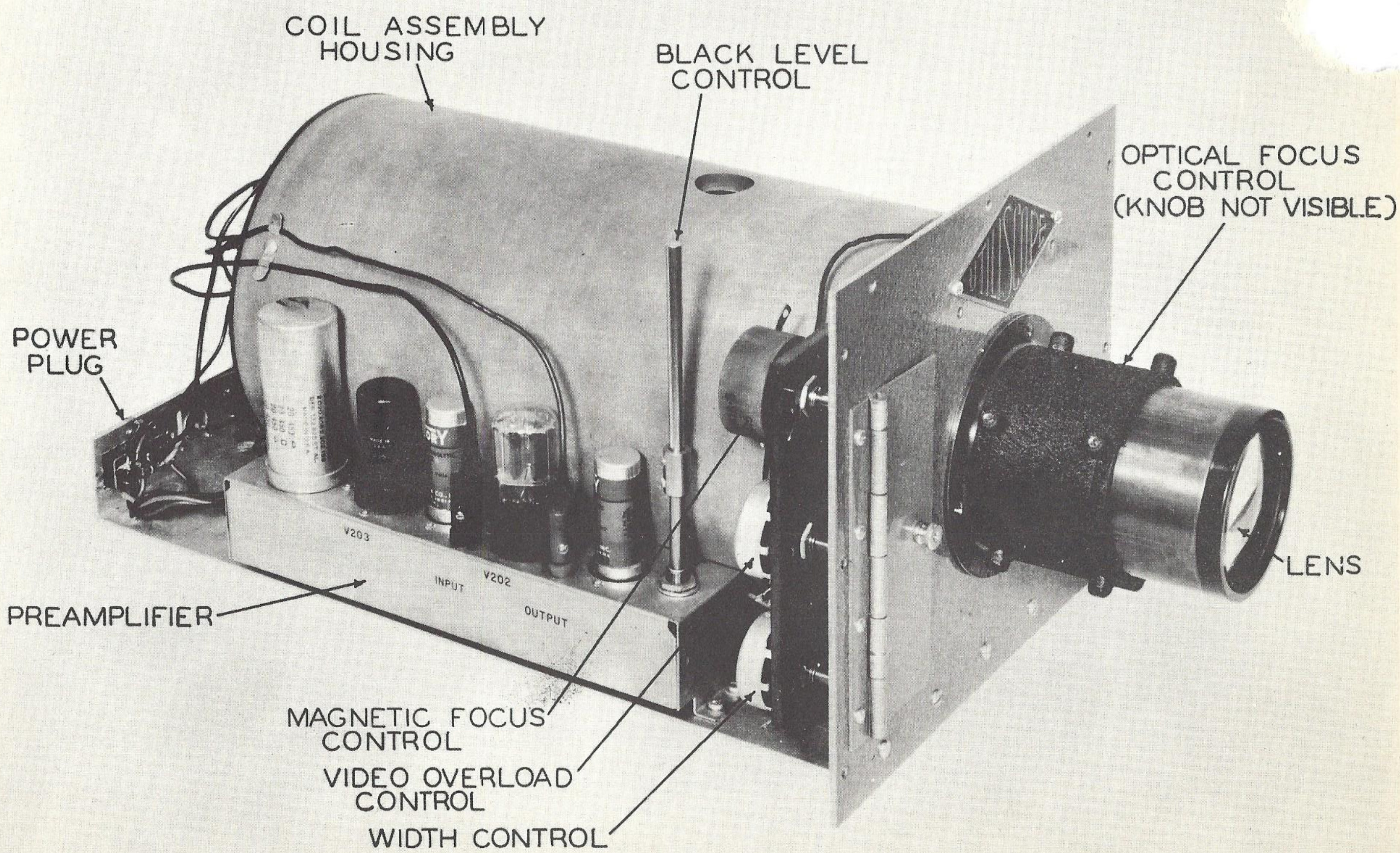

ANODE SHIELD
WALL COATING
RING-#3
RING-#4
CATHODE
RING-#5
RING-2#
RING-#1
SILVER EVAP.
Farnsworth

FIGURE 8




SPECTRAL RESPONSE
OF
IMAGE DISSECTOR TUBE

FIG. 9




COIL ASSEMBLY IN CAMERA

FIGURE 10-A

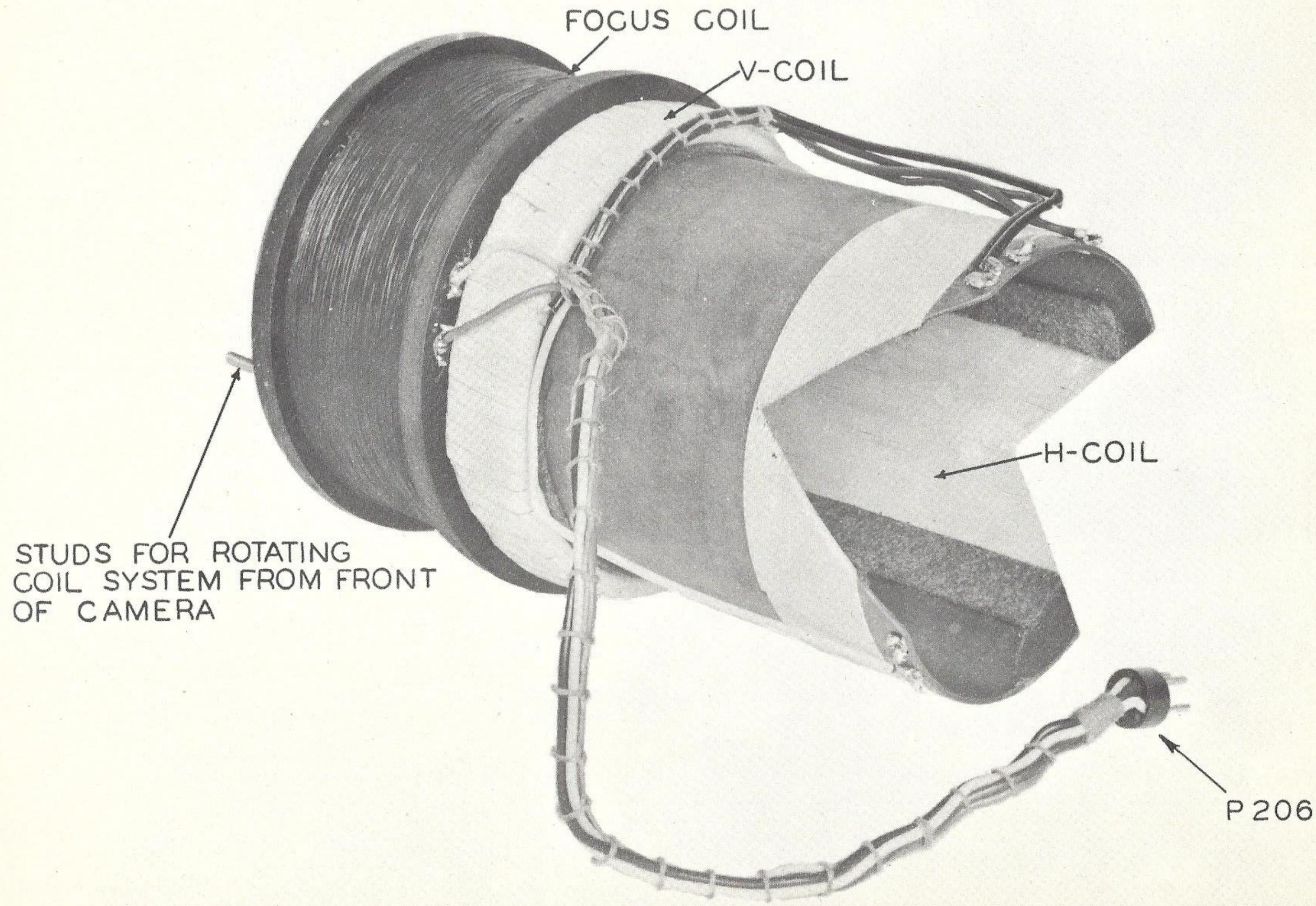
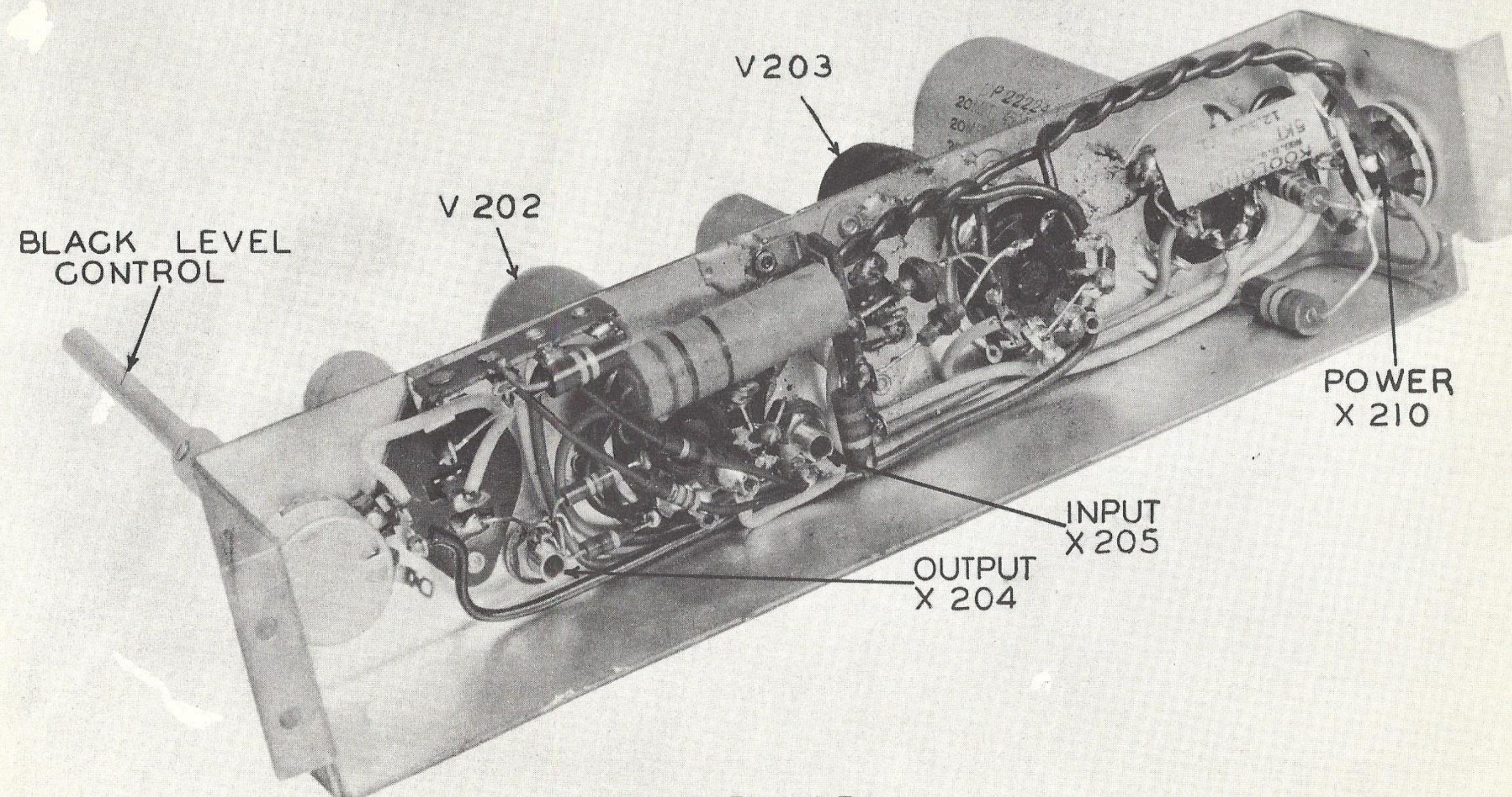
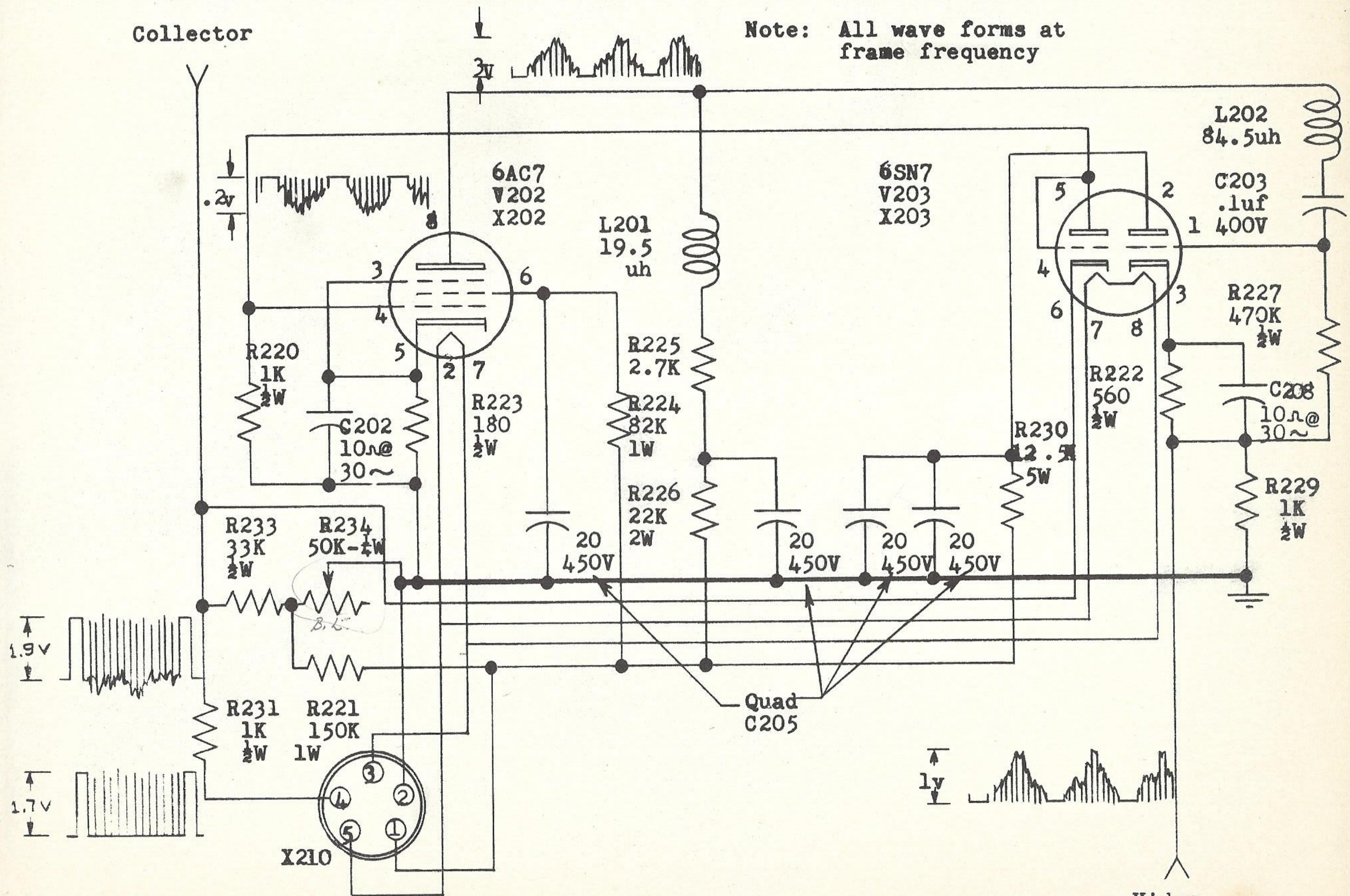

FOCUS COIL
V-COIL
H-COIL
STUDS FOR ROTATING COIL SYSTEM FROM FRONT OF CAMERA
P206

FIGURE 10-B




PREAMPLIFIER

FIGURE II



Collector
Note: All wave forms at frame frequency
3v
.2v
6AC7
V202
X202
L201
19.5
uh
6SN7
V203
X203
L202
84.5uh
C203
.1uf
400V
R220
1K
½W
C202
10Ω@
30~
R223
180
½W
R225
2.7K
R224
82K
1W
R226
22K
2W
R227
470K
½W
R222
560
½W
R230
12.5
5W
C208
10Ω@
30~
R229
1K
½W
R233
33K
½W
R234
50K-½W
20
450V
20
450V
20
450V
20
450V
1.9V
1.7V
R231
1K
½W
R221
150K
1W
Quad
C205
1v
X210
Video
Output


Figure 12

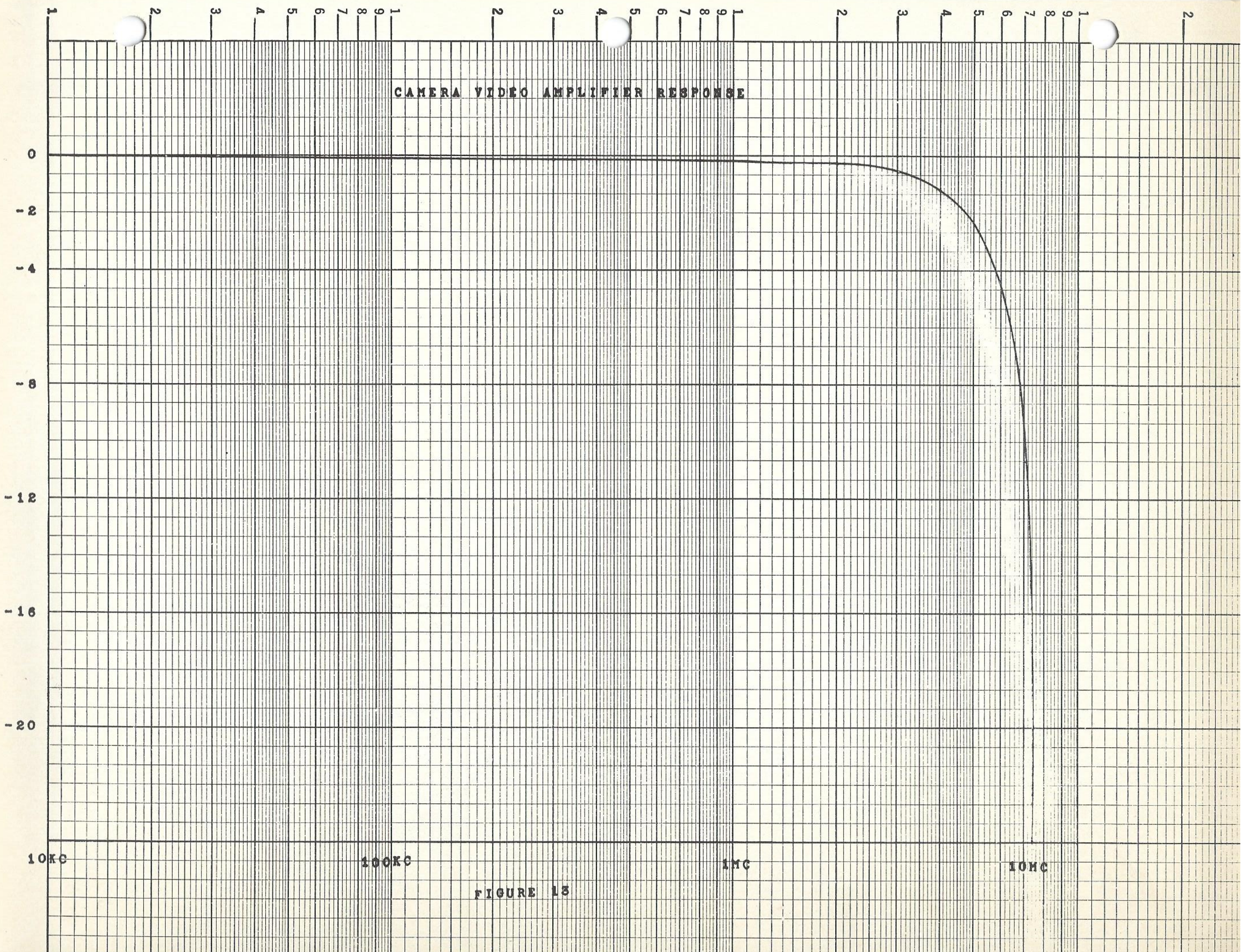
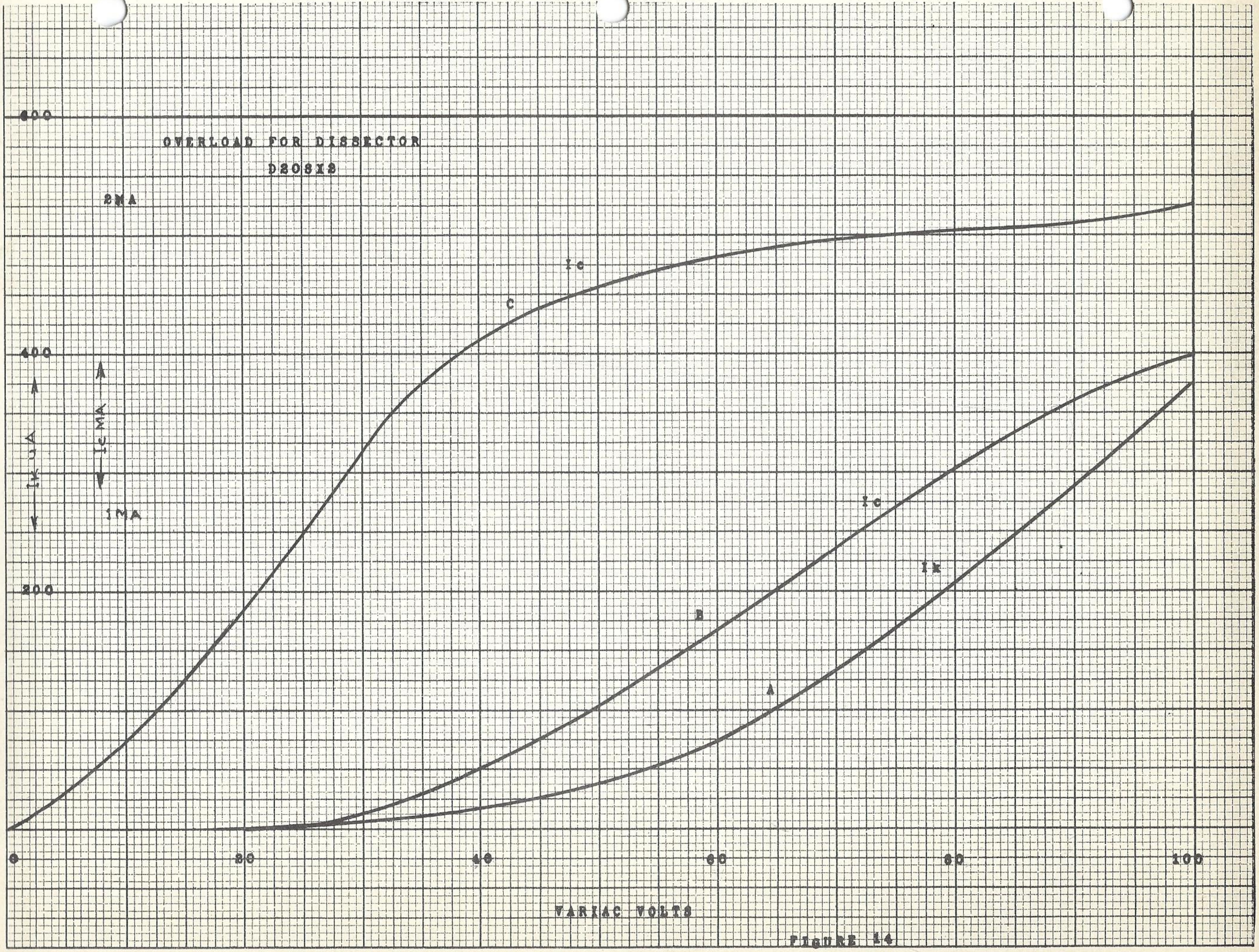
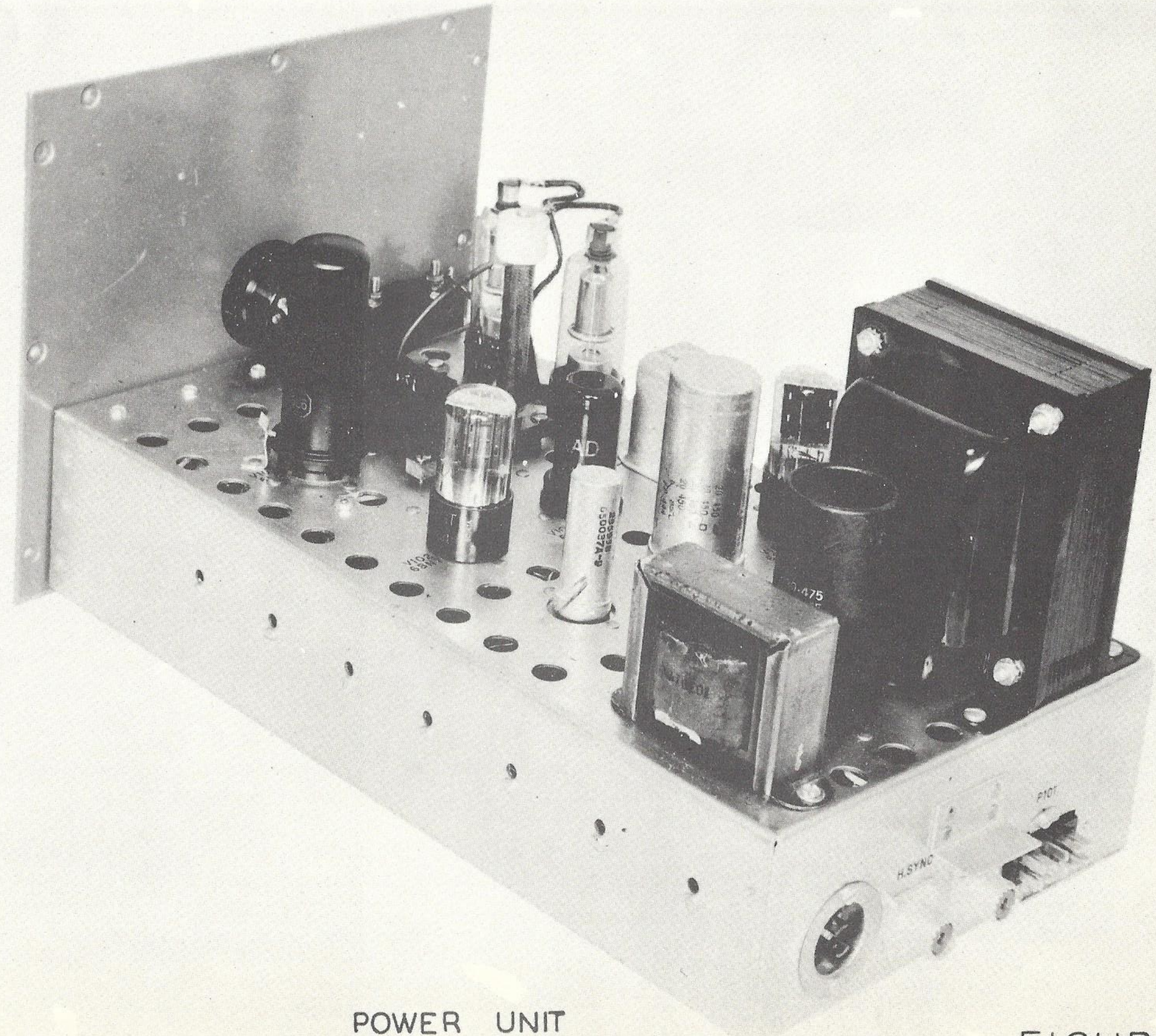

CAMERA VIDEO AMPLIFIER RESPONSE
0
-2
-4
-8
-12
-16
-20
10KC
100KC
1MC
10MC

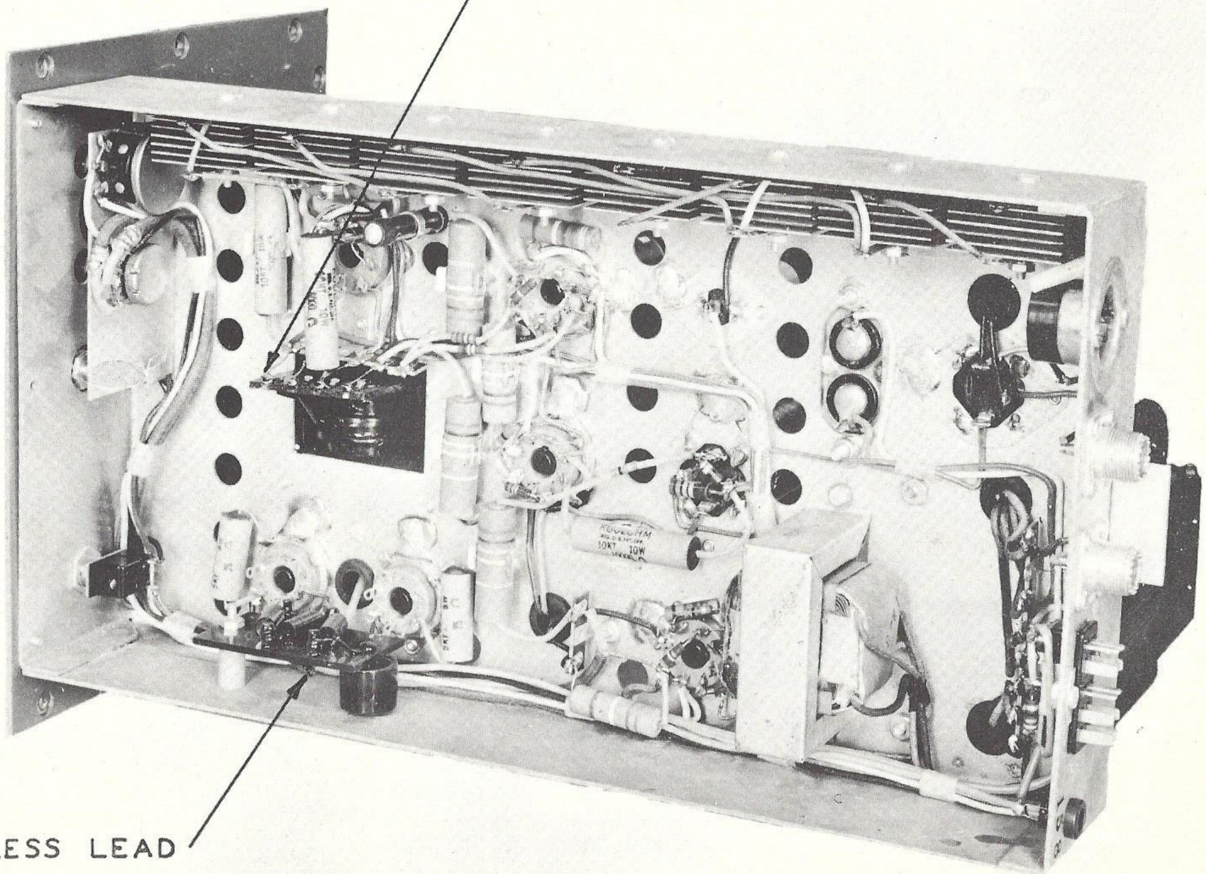
FIGURE 13


OVERLOAD FOR DISSECTOR
D208X2
600
400
200
2MA
1MA
Ik uA
Ic MA
Ic
C
B
A
Ik
0
20
40
60
80
100
VARIAC VOLTS
FIGURE 14



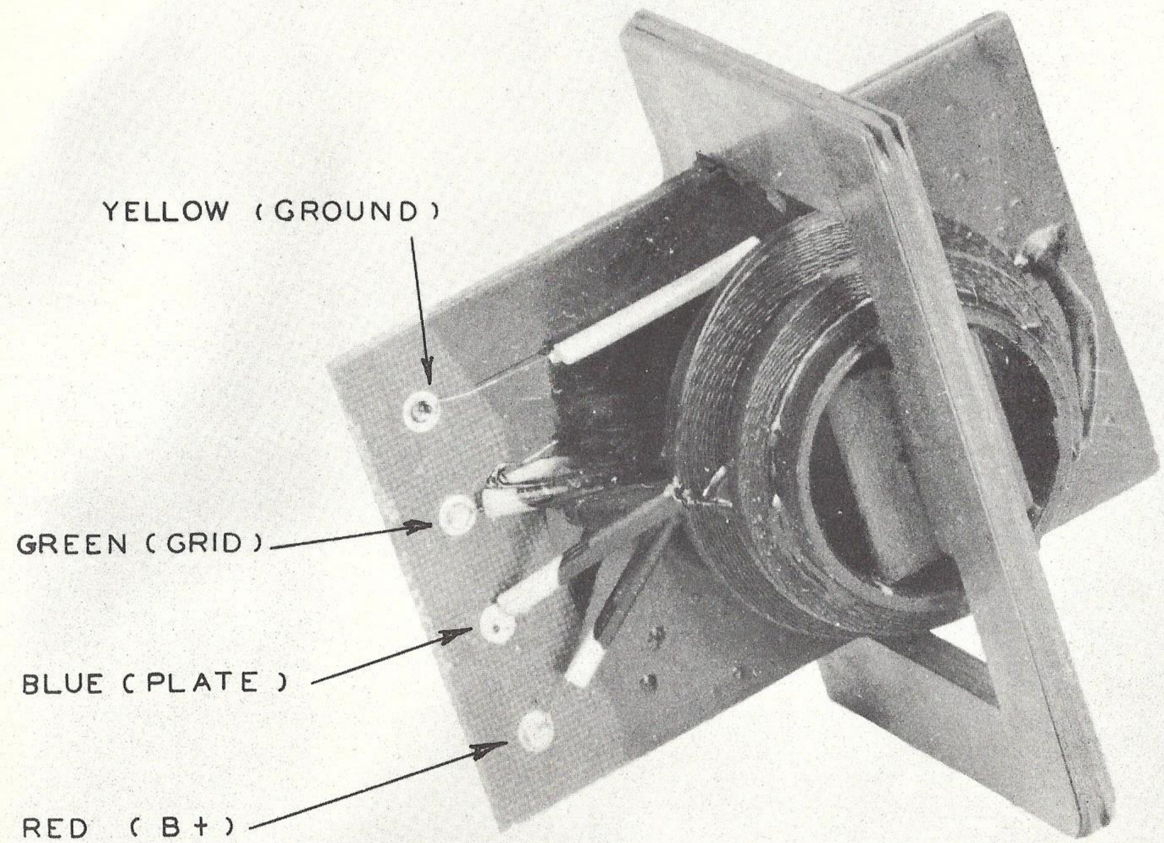

POWER UNIT
(TOP VIEW)

FIGURE 15



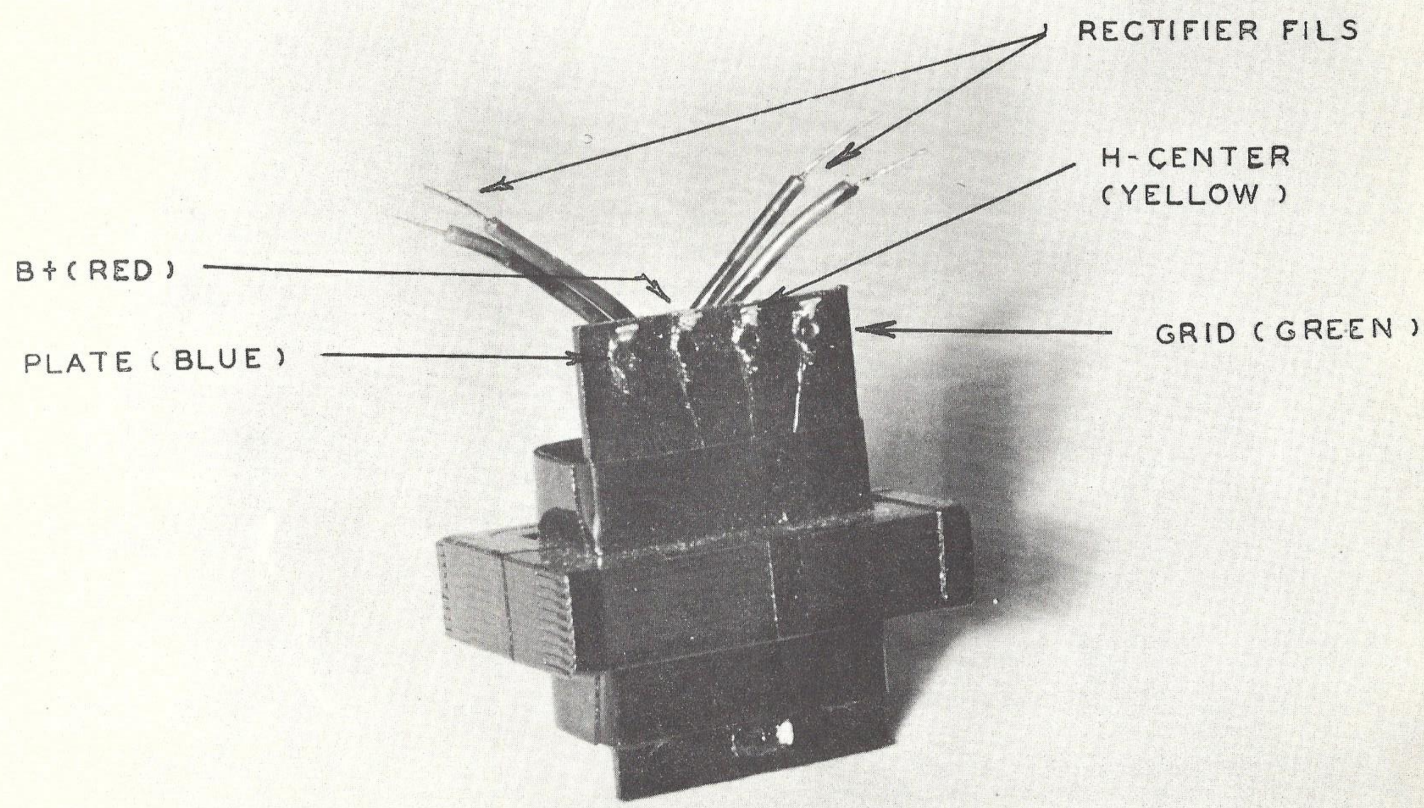

POWER UNIT
(BOTTOM VIEW)

FIGURE 16



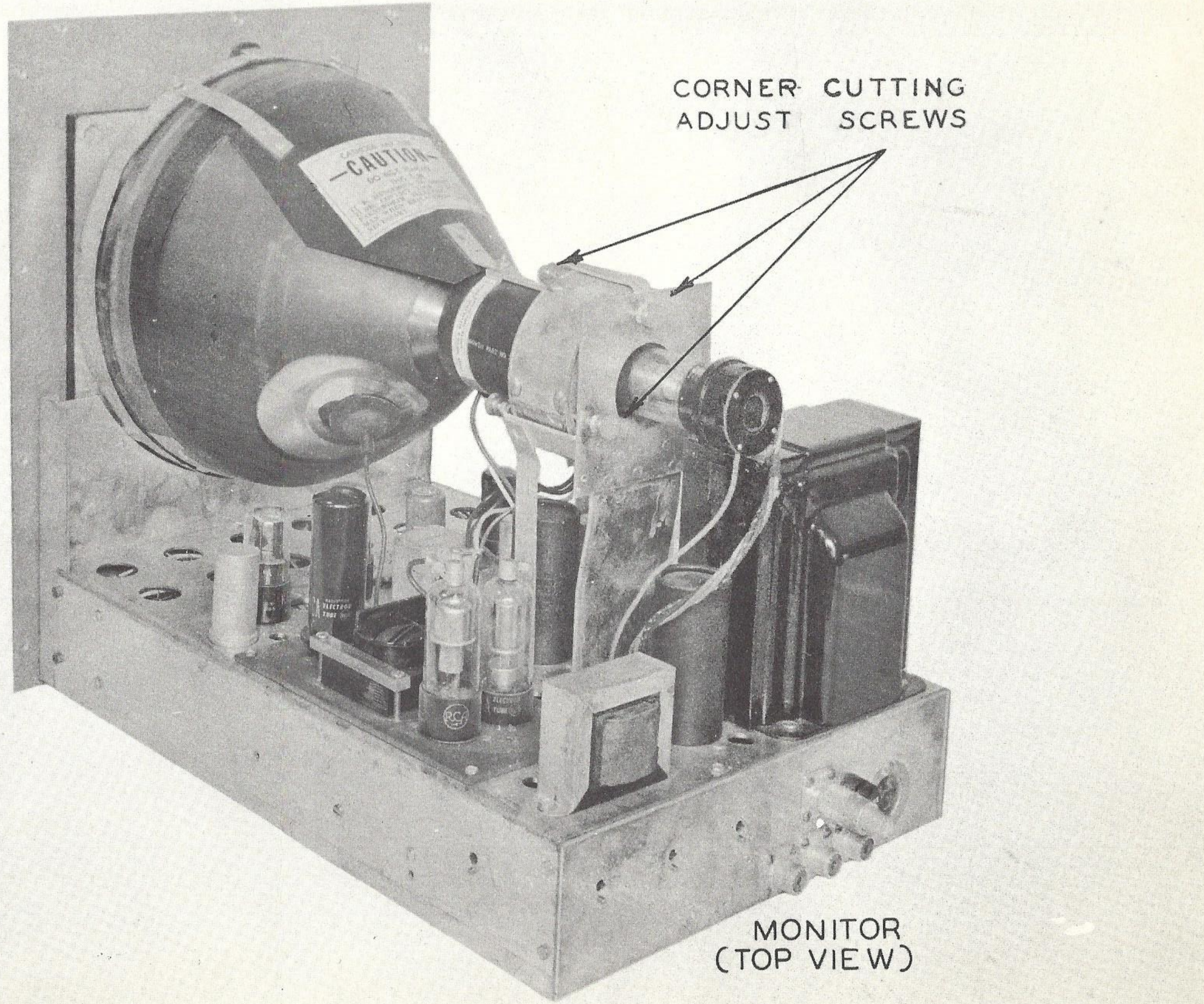

H-DEFLECTION TRANSFORMER
(POWER UNIT)

FIGURE 17-A




H-DEFLECTION TRANSFORMER
(MONITOR)

FIGURE 17-B



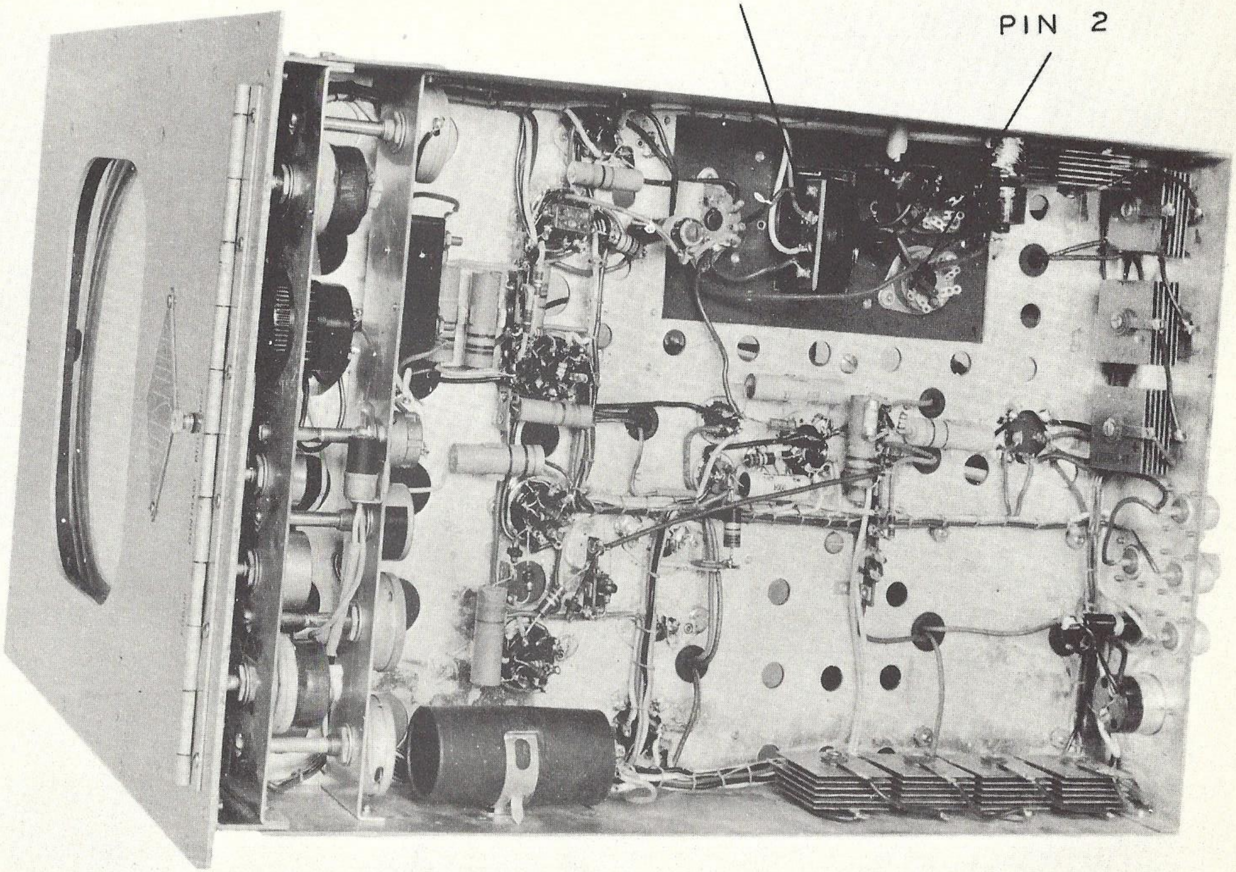

CORNER CUTTING ADJUST SCREWS

MONITOR (TOP VIEW)

FIGURE 18

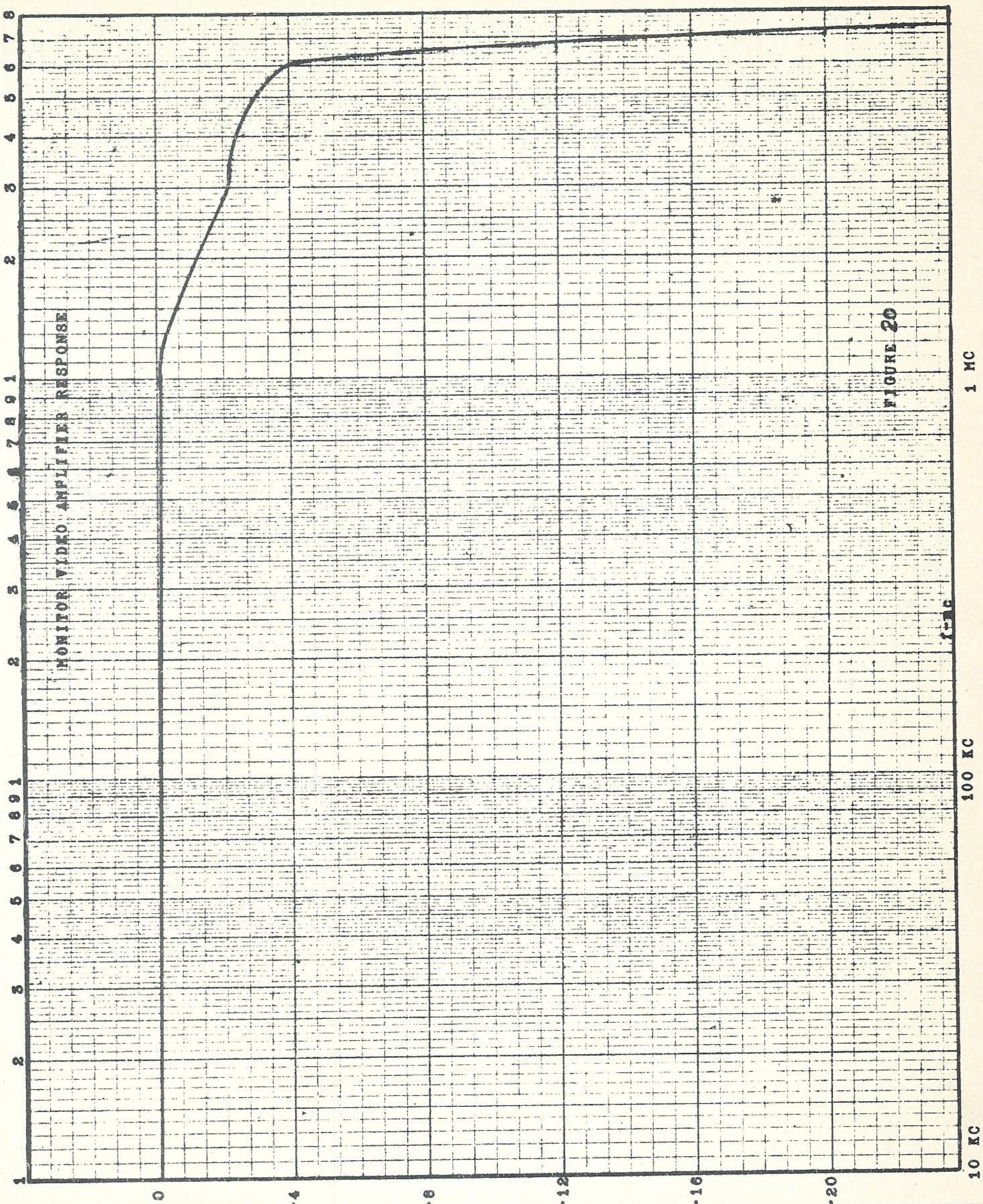
B+ (RED TERMINAL)
+350 VOLTS

H-V CHECK
+7500 V
PIN 2

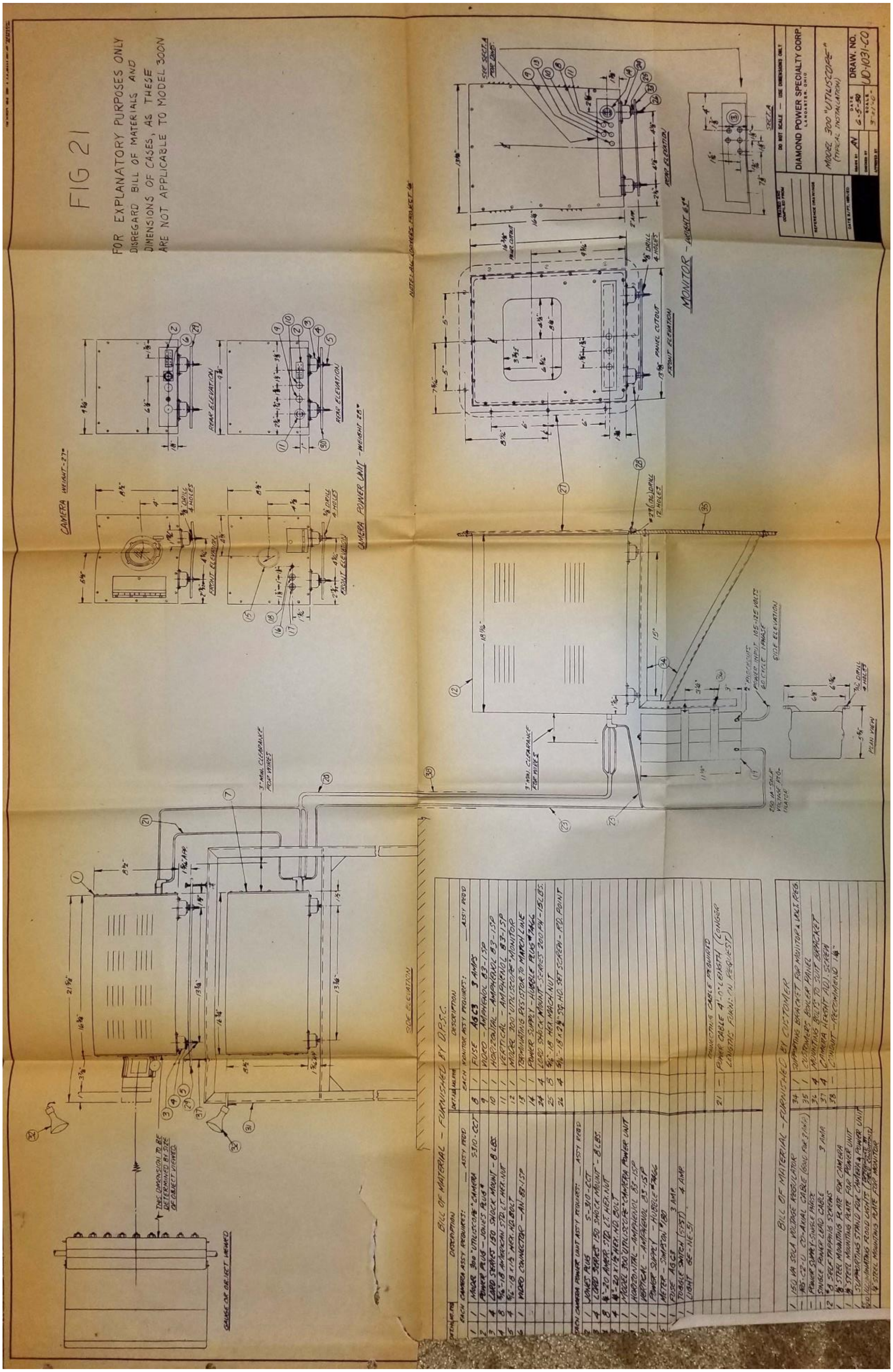


MONITOR
(BOTTOM VIEW)

FIGURE 19




| DRAWN BY | DATE | DIAMOND POWER SPECIALTY CORP. LANCASTER, OHIO | DRAW. NO. |
|---|---|---|---|
| CHECKED BY | SCALE | | |
| APPROVED BY | | | |




Courtesy of Richard Hertel