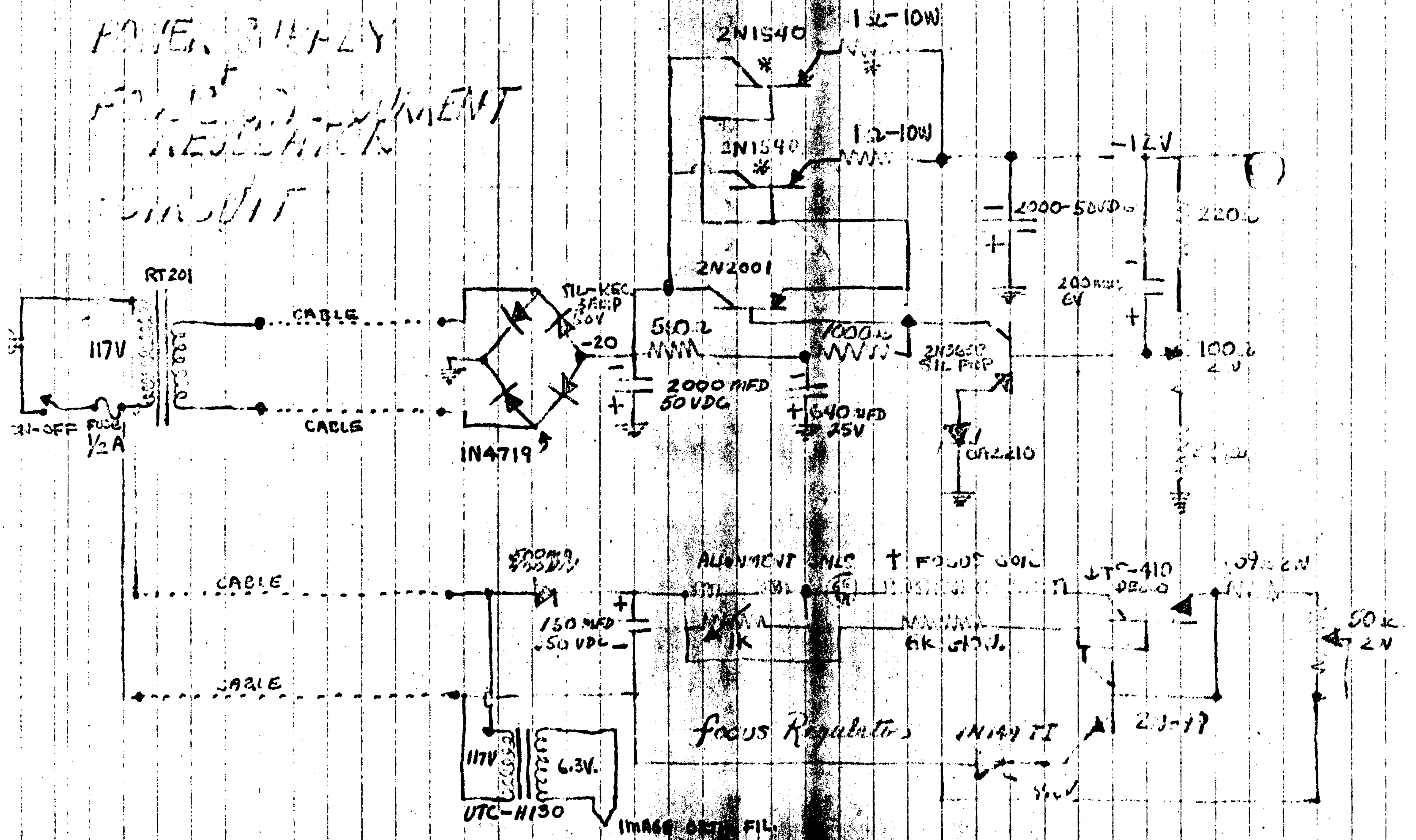
IMAGE ORTHICON
T.V. CAMERA

BY ERIC SIEGE

POWER SUPPLY for FOCUS-ALIGNMENT REGULATOR CIRCUIT



* NOT ON PRINTED CKT BOARD

† - 65-75 ohm FOCUS COIL CIRCUIT

DTS-410 [illegible] HFE [illegible]

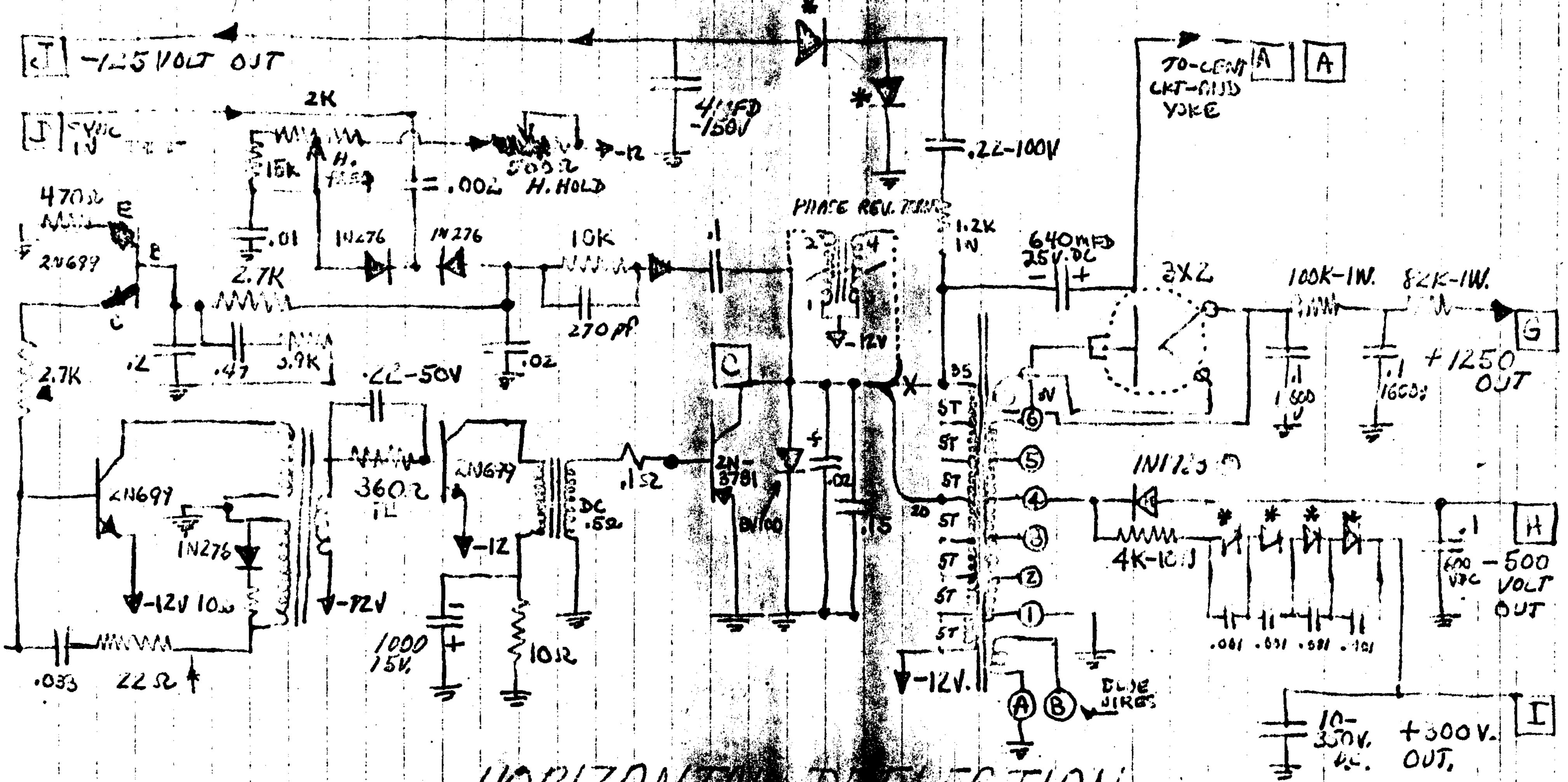
Designed by Eric Xiegel
1968

▲ DETERMINES FREQ

Ŧ DETERMINES EFFENCY - TO HIGH LENGHTENS FLYBACK TIME - TOO LOW NO FUNCTION

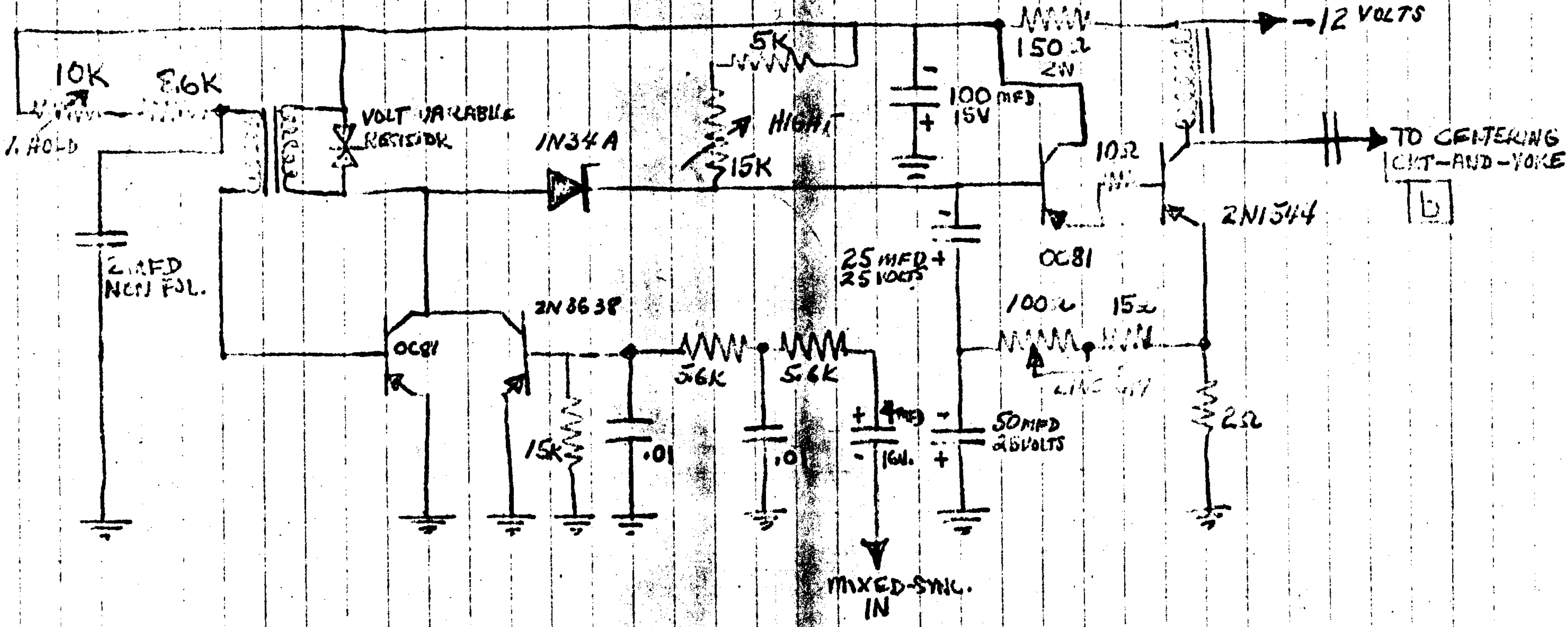
TL DETERMINES EFFECY AND PULSE WIDTH

* DETERMINES FLYBACK TIME ON-CLAMPING WIDTH (LOWER SHORTER - HIGHER LONGER)



* SIL-RECT 800 PIV-1 AMP

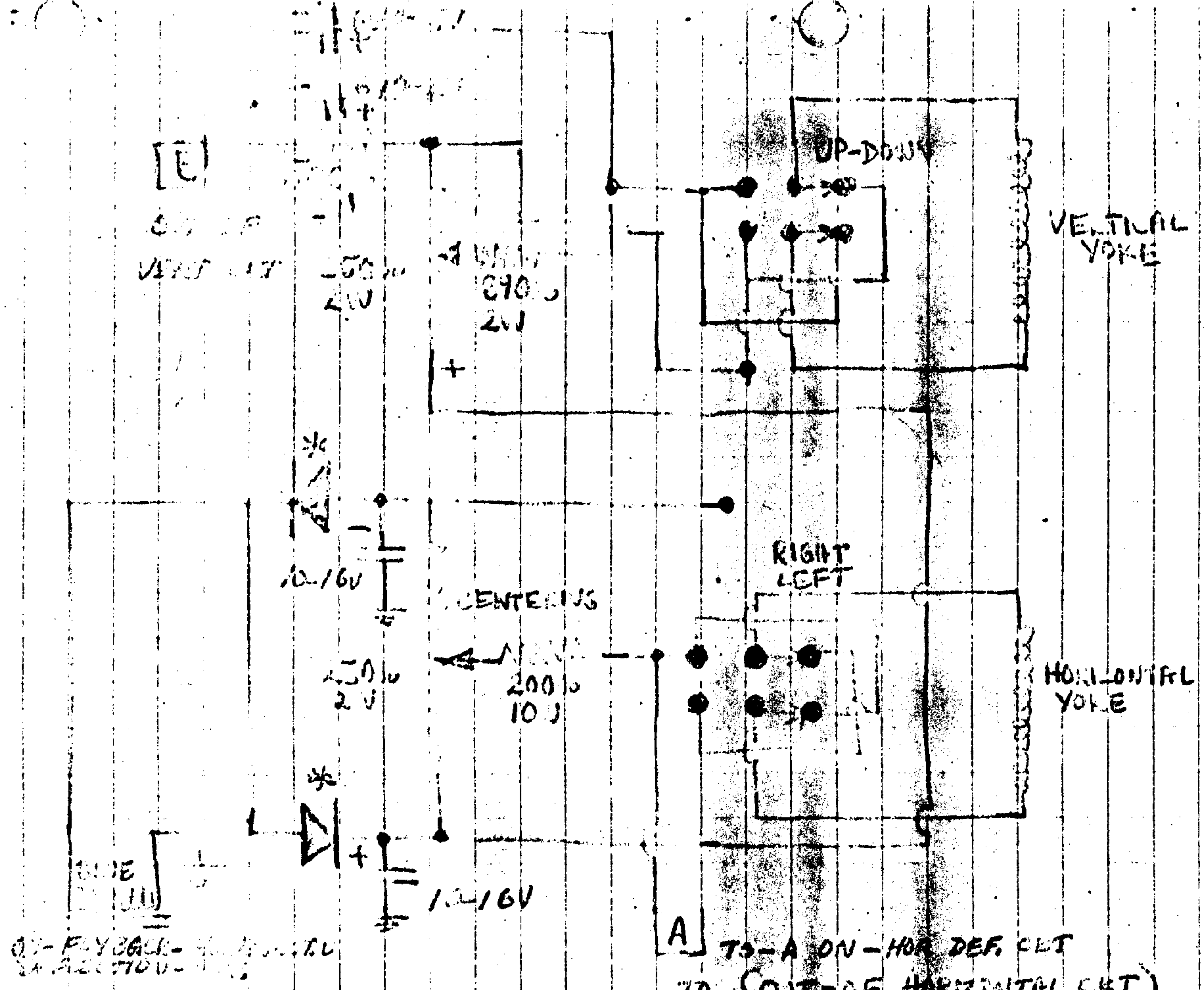
HORIZONTAL DEFLECTION + VOLTAGE GEN. CIRCUIT



VERTICAL DEFLECTION CIRCUIT

Designed by

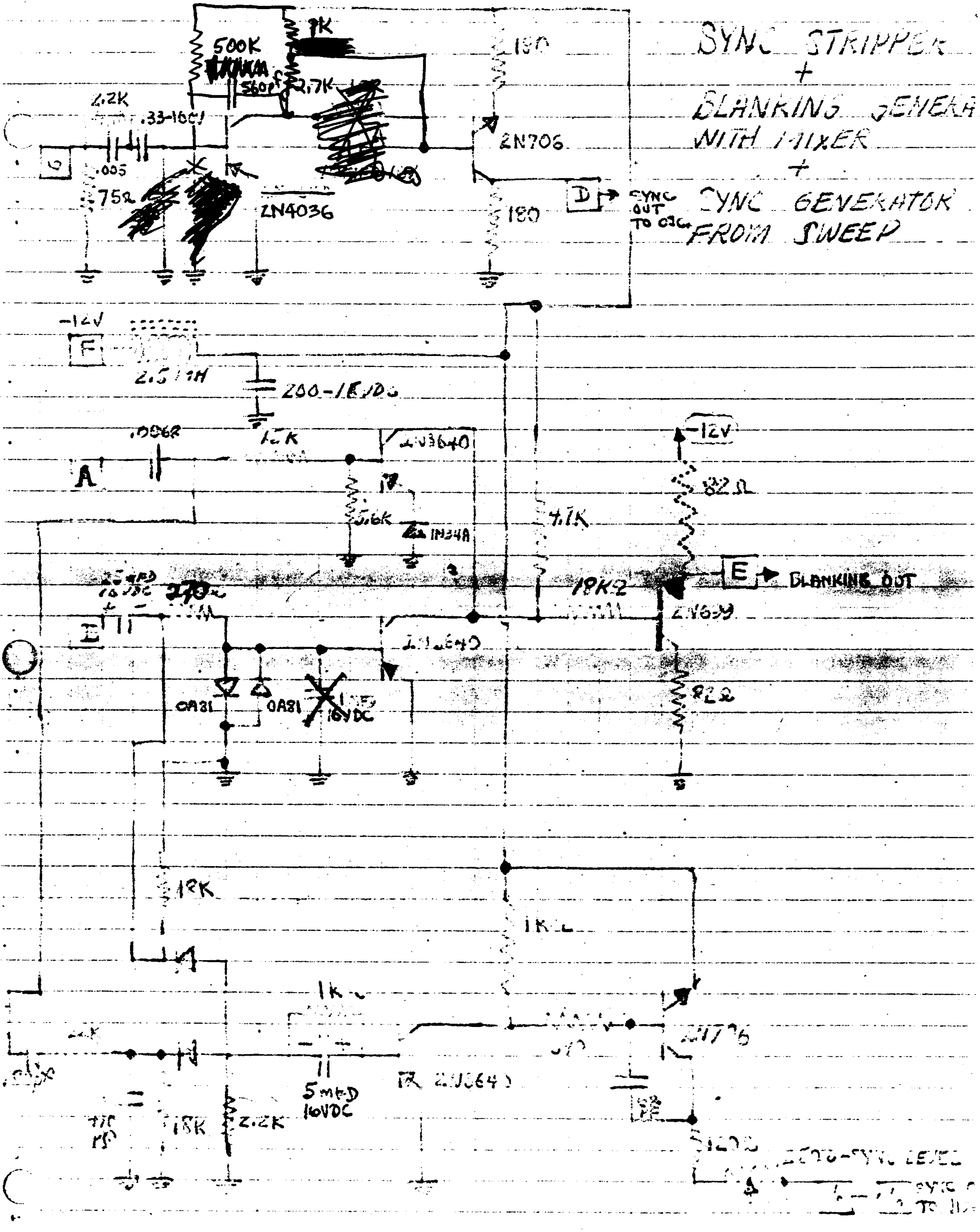
1968



K SIL, OCT 11 p.

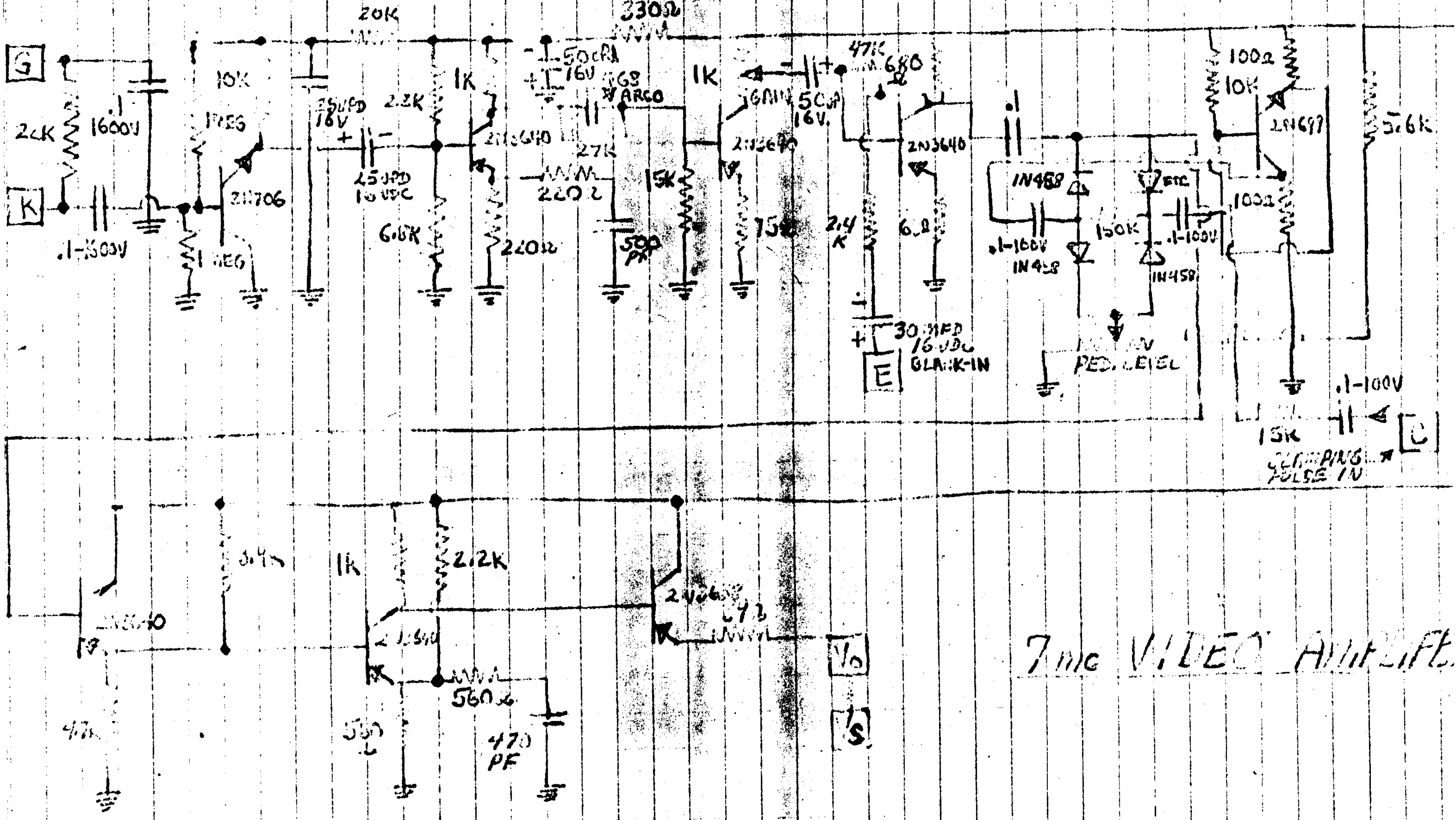
VERTICAL + HORIZONTAL
CENTERING CKT.

SYNC STRIPPER
+
BLANKING GENERA
WITH MIXER
+
SYNC GENERATOR FROM SWEEP



Designed by

1968



7 mc VIDEO AMPLIF

I. WIRES OF YOKE.

A. — DECELLERATION — BLUE YELLOW
B. — ELECTRONIC FOCUS — GREEN
C. — GRID 6 — WHITE-BLACK-RED
D — GRID 3 — ORANGE
E - PHOTO CATHODE — SOLID WHITE
F — TARGET — GRAY SHELDED AT CONN.
G — BEAM — YELLOW
H — ALIG. — PURPLE — NEG.
I — ALIG. — BROWN — POS.

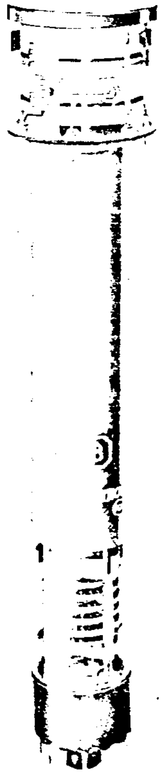
7198

IMAGE ORTHICON

Magnetic Focus
Magnetic Deflection

For Use Under Adverse Environmental Conditions
High Sensitivity

3" - Diameter Bulb
15.20" Length



RCA-7198 is a camera tube of the image-orthicon type designed primarily to provide reliable performance in television cameras for industrial or military service under adverse environmental conditions. It is capable of withstanding operating conditions involving severe shock and vibration, altitude up to 60,000 feet, wide-temperature range, and high humidity.

The 7198 has high sensitivity combined with spectral response approaching that of the eye, and very good resolution capability. The response of the 7198 covers the range from about 3200 angstroms to 6950 angstroms as shown in Fig. 1.

The target in the 7198 is designed to have low capacitance. Because of this feature, the 7198 has negligible microphonics due to movement of target and mesh with respect to each other and is capable of reproducing motion in low-light-intensity scenes with a minimum of smearing. When used with proper, low-noise amplifiers, the 7198 can produce signal information with illumination on the photocathode as low as 0.00001 footcandle. Under such low-illumination levels, the resolution is about 75 TV lines.

PRINCIPLES OF OPERATION

The 7198 has three sections—an image section, a scanning section, and a multiplier section—as shown in Fig. 2.

Image Section

The image section contains a semitransparent photocathode on the inside of the faceplate, a grid (grid No. 6) to provide an electrostatic accelerating field, and a target which consists of a thin glass disc with a fine mesh screen adjacent to it on the photocathode side. Focusing is accomplished by means of a magnetic field produced by an external coil, and by the proper selection of the photocathode voltage and grid-No. 6 voltage.

Light from the scene being televised is picked up by an optical system and focused on the photocathode which emits electrons from each illuminated area in proportion to the intensity of the light striking the area. The streams of electrons are focused on the target by the magnetic and accelerating fields.

On striking the target, the electrons cause secondary electrons to be emitted from the glass. The secondaries thus emitted are collected by the adjacent mesh screen which is held at a definite potential of two volts positive with respect to target-cutoff voltage. Therefore, the potential of the glass disc is limited for all values of light and stable operation is achieved. Emission of the secondaries leaves on the photocathode side of the glass a pattern of positive charges which corresponds with the pattern of light from the scene being televised. Because of the thinness of the glass, the charges set up a similar potential pattern on the opposite or scanned side of the glass.

The spacing between the target glass disc and the mesh in the 7198 is about fifty times greater than in a conventional image orthicon for TV broadcast service. This greater spacing reduces the capacitance between the glass disc and the adjacent mesh, with the result that the small photocurrent-produced image-charges produce higher voltages than would be obtained in a tube without the increased spacing. These higher voltages more effectively modulate the scanning beam at low light levels with consequent increase in ratio of reproduced signal to noise. Furthermore, the lower value of signal-storage capacitance reduces the tendency of moving objects to cause smearing which would otherwise normally occur at extremely low light levels. Movement of the target and mesh with respect to each other is a small percentage of the wide target-mesh spacing in the 7198 and, therefore, the possibility of target-assembly microphonics is reduced.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Scanning Section

The opposite side of the glass is scanned by a low-velocity electron beam produced by the electron gun in the scanning section. This gun contains a thermionic cathode, a control grid (grid No.1), and an accelerating grid (grid No.2). The beam is focused at the target by the magnetic field of an external focusing coil and the electrostatic field of grid No.4.

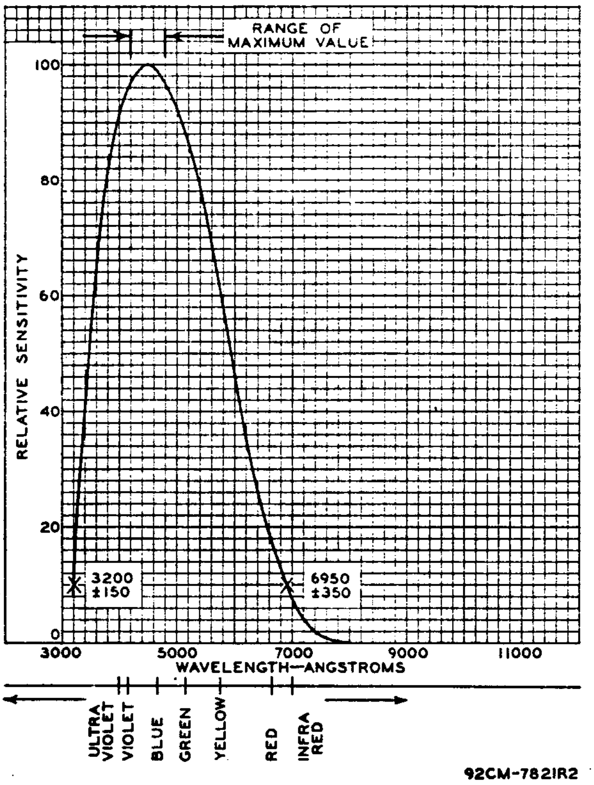


Fig. 1 – Spectral Sensitivity Characteristic of Type 7198 which has S-10 Response. Curve is shown for Equal Values of Radiant Flux at All Wavelengths.

Deflection of the beam is accomplished by transverse magnetic fields produced by external deflecting coils.

Alignment of the beam from the gun is accomplished by a transverse magnetic field produced by external coils located at the gun end of the focusing coil.

By proper adjustment of potentials including that of grid No.5, the beam is caused to approach the target perpendicularly and with essentially zero velocity. The electrons stop their forward motion at the surface of the glass and are turned back and focused into a five-stage signal multiplier, except when they approach the positively charged portions of the pattern on the glass. When this condition occurs, they are deposited from the scanning beam in quantities sufficient to neutralize the potential pattern on the glass. Such deposition leaves the glass with a negative charge on the scanned side and a positive charge on the photocathode side. These charges neutralize each other by conductivity through the glass in less than 1/60 of a second.

The electrons turned back at the target form the return beam which has been amplitude modulated by absorption of electrons at the target in accord with the charge pattern whose more positive areas correspond to the highlights of the televised scene.

Multiplier Section

The return beam is directed to the first dynode of a five-stage electrostatically focused multiplier. This utilizes the phenomenon of secondary emission to amplify the modulated beam more than 500 times. The electrons in the beam impinging on the first-dynode surface produce many other electrons, the number depending on the energy of the impinging electrons. These secondary electrons are then directed to the second dynode and knock out more new electrons. Grid No.3 facilitates a more complete collection by dynode No.2 of the secondaries from dynode No.1. The multiplying process is repeated in each successive stage, with an ever-increasing stream of electrons until those emitted from dynode No.5 are collected by the anode and constitute the current utilized in the output circuit.

The effect of photocathode illumination on signal-to-noise ratio for a typical 7198 is shown in Fig.5. The signal is defined as the peak-to-peak amplitude of the video current (large-area white to large-area black). The noise is defined as follows:

$$\text{RMS Noise Current} = 1/6\sqrt{N_T^2 - N_S^2}$$

Where N_T = peak-to-peak noise current as measured on a black scene

N_S = peak-to-peak system current as measured with the beam of the camera tube cut off

Fig.5 shows that signal-to-noise ratio of the output signal of the 7198 is approximately proportional to the square root of the highlight illumination of the scene. If the beam current is adjusted to just discharge the highest highlights of the scene being reproduced, the amount of signal current produced is nearly in direct proportion to the light intensity, while the noise varies as the square root of the scanning-beam current. The noise, therefore, is not a fixed quantity, but varies with the amount of scanning-beam current utilized or required. Because of this characteristic, the operator can choose parameters such that the 7198 will operate over a rather wide range of signal current or scene illumination without a direct proportional change in signal-to-noise ratio of the video

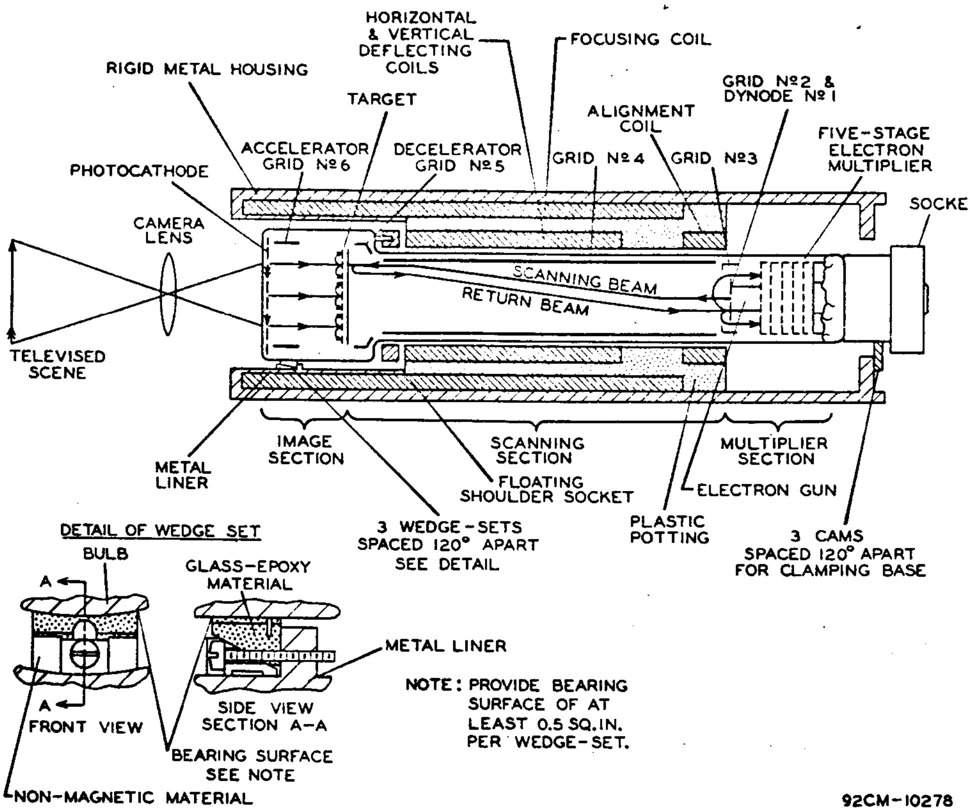


Fig. 2 - Schematic Arrangement of Type 7198 and Associated Components.

signal. For this reason, the 7198 is particularly suitable for picking up extremely low light levels, but strict attention must be given to the set-up parameters affecting the amount of beam current utilized.

It can be seen that when the beam moves from a less-positive portion on the target to a more-positive portion, the signal-output voltage across the load resistor (R_{25} in Fig.3) changes in the positive direction. Hence, for highlights in the scene, the grid of the first video amplifier stage swings in the positive direction.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	ampere
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	μμf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 or 3 x 4 aspect ratio):		
Useful size of	1.8" max.	Diagonal

NOTE: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of. . . .Proper orientation is obtained when the vertical or horizontal scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Shoulder Base	Keyed Jumbo Annular 7-Pin
End Base	Small-Shell Diheptal 14-Pin Base (JEDEC Group 5, No.B14-45)
Operating Position	See *Operating Considerations*
Weight (Approx.)	1 lb. 6 oz.
Minimum Deflecting-Coil Inside Diameter	2.38"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment Coil Length	0.94"
Photocathode Distance Inside End of Focusing Coil	0.50"

Maximum Ratings, *Absolute-Maximum Values:*♦

PHOTOCATHODE:		
Voltage	-650 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Any part of bulb	71 max.	°C
Of bulb at large end of tube (image section)	20 min.	°C
Storage Temperature Range	-65 to +71	°C
TEMPERATURE DIFFERENCE:		
Between image section and any part of bulb hotter than image section	7.5 max.	°C
GRID-No.6 VOLTAGE	-650 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts

GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	400 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
DYNODE-No.2-TO-DYNODE-No.1 VOLTAGE.	350 max.	volts
DYNODE-No.3-TO-DYNODE-No.2 VOLTAGE.	350 max.	volts
DYNODE-No.4-TO-DYNODE-No.3 VOLTAGE.	680 max.	volts
DYNODE-No.5-TO-DYNODE-No.4 VOLTAGE.	350 max.	volts
ANODE-TO-DYNODE-No.5 VOLTAGE.	100 max.	volts
ANODE-SUPPLY VOLTAGE*	1850 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts

Typical Operating Values:

Photocathode Voltage (Image Focus).	-400 to -600	volts
Grid-No.6 Voltage (Accelerator) (Approx. 75% of photo-cathode voltage)	-300 to -450	volts
Target-Cutoff Voltage○.	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus).	130 to 180	volts
Grid-No.3 Voltage▲.	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff.	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Target Temperature Range (See text).	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage.	5	volts
Field Strength at Center of Focusing Coil†.	75	gausses
Field Strength of Alignment Coil (Approx.).	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and altitude up to 60,000 feet (unless otherwise noted).

Cathode Radiant Sensitivity at 4500 angstroms	0.028 μa/μw
Anode Current (DC)—For Highlight Illumination on Photocathode at 0.01 footcandle	30 μa
Signal-Output Current (Peak-to-Peak).	See Fig.4
Ratio of Peak-to-Peak Video-Signal Current to RMS Noise Current for Bandwidth of 9 Mc	See Fig.5
Center Square-Wave Amplitude Response**	See Figs.6 & 7

Vibration Tests. These tests are performed on a sample lot of tubes from each production run with highlight illumination on photocathode of 0.003 footcandle. Tubes and their associated components# are vibrated on apparatus providing dynamic conditions similar to those described in MIL-E-5272A□, par. 4.7.1.

Resonance. Tubes and associated components# are vibrated (per the method of MIL-E-5272A□, par. 4.7.1.1) at 25° C and at vibration accelerations not exceeding 10g in each of three mutually perpendicular axes for 3 hours or one million cycles, whichever is less. After vibration, the center resolution of the tubes will be at least 525 lines as determined with an RETMA Resolution Chart, or equivalent, with not more than 0.003 footcandle highlight illumination on the photocathode.

Cycling. Tubes and associated components# are vibrated (per the method of MIL-E-5272A□, par. 4.7.1.2 pertaining to specimen without vibration isolators) in each of three mutually perpendicular axes at 25° C and at vibration accelerations not exceeding 5g. One survey cycle is made for each axis. The cycle has a duration of one hour during which time the frequency is varied from 5 to 500 and back to 5 cycles per second. During this test the tubes will maintain center resolution of at least 350 lines as determined with an RETMA Resolution Chart, or equivalent, with not more than 0.003 footcandle highlight illumination on the photocathode. After vibration the center resolution, determined under the same conditions as above, will be at least 525 lines.

Shock Tests. These tests are performed on a sample lot of tubes from each production run with no voltages applied to the tubes. Tubes alone are subjected in these tests (per the method of MIL-E-5272A□, par. 4.15.2.1) to 12 impact shocks of 30g, each shock impulse having a time duration of 11 ± 1 milliseconds. The intensity is within ± 10 per cent as measured with a filter having a bandwidth of 0.2 to 250 cycles per second. The maximum g is reached in approximately 5-1/2 milliseconds. The shock is applied in the following directions: a) vertically, perpendicular to longitudinal axis, 3 shocks in each direction; b) horizontally, perpendicular to longitudinal axis, 3 shocks in each direction. After shock tests, the tubes are operable and will have resolution of at least 525 lines as determined with an RETMA Resolution Chart, or equivalent, with not more than 0.003 footcandle highlight illumination on the photocathode.

Temperature-Humidity Tests. These tests are performed on a sample lot of tubes from each production run and with no voltages applied to the tubes. The tubes are subjected (per MIL-E-005272B(USAF)⊕, par. 4.4.1, Procedure I) to relative humidities up to and including 95% at temperatures up to and including +71° C. Following this test the tubes are operative, and there will be no picture streaking or other evidence of arcing when operated under the following conditions: grid-No.1 voltage adjusted for cutoff; photocathode voltage = -650 volts; grid-No.6 voltage = -650 volts; dynode-No.2 voltage = 700 volts; dynode-No.3 voltage varied from 780 to 1050 volts; dynode-No.4 voltage = 1400 volts; dynode-No.5 voltage = 1750 volts; and anode voltage = 1850 volts. In addition, the leakage resistance determined separately between each of six specific diheptal-base pins (pins 5,6,7,8,9, and 10) and the 13 other diheptal-base pins tied together and grounded will be greater than 500 megohms when a voltage of 350 volts is applied between that specific pin and the others.

♠ The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Absolute-Maximum Rating System* for rating electron devices.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in device characteristics.

* Ratio of dynode voltages is shown under *Typical Operating Values.*

○ Normal setting of target voltage is +2 volts from target cutoff. The target-supply voltage should be adjustable from -3 to +5 volts.

▲ Adjust to produce maximum signal.

† Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

** Measured with amplifier having flat frequency response.

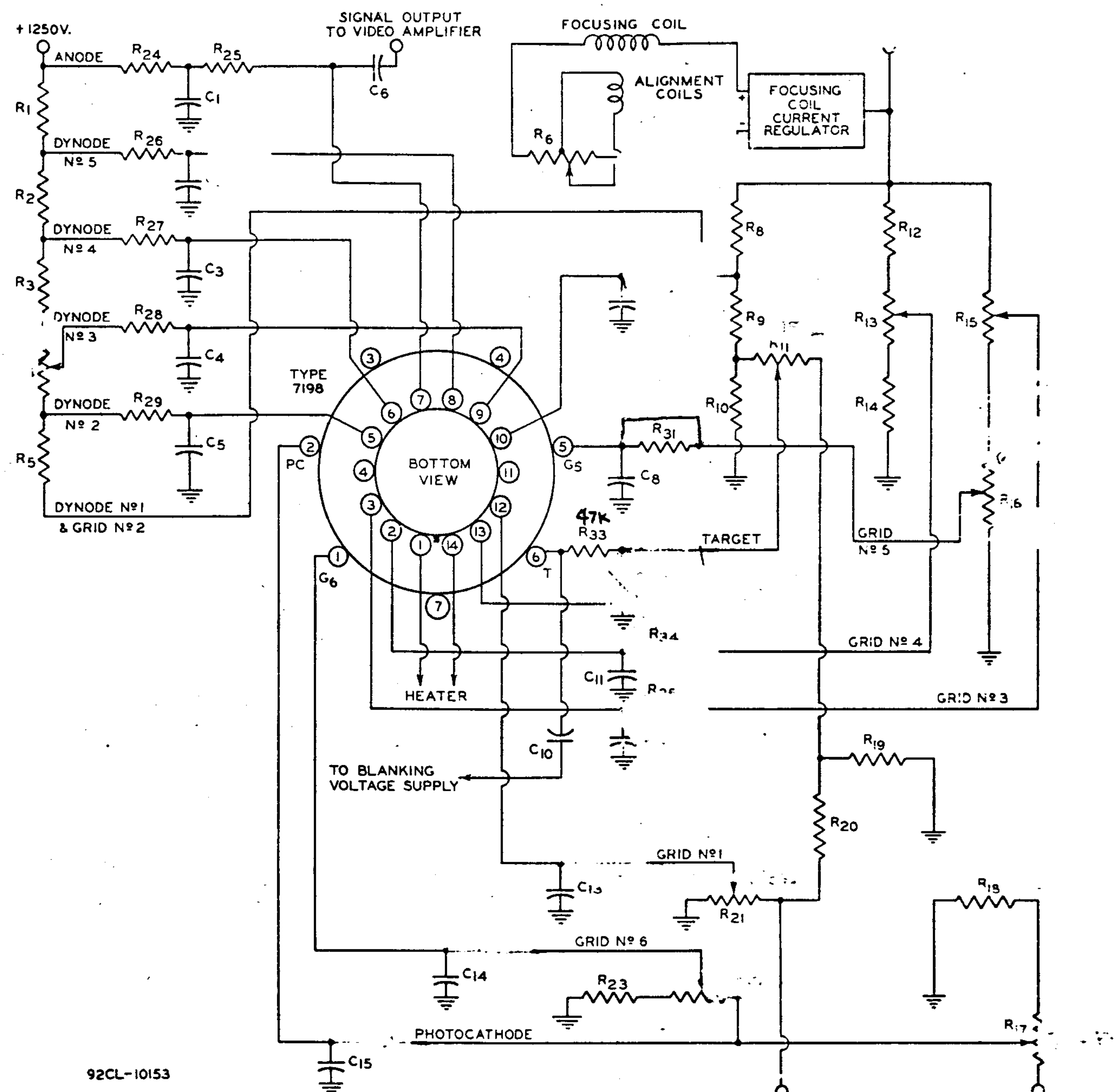
\# Tube sockets and components assembly which consists of the deflecting coils, focusing coil, and alignment coil.

□ 1 January 1956

⊕ 5 June 1957

CAMERA-DESIGN CONSIDERATIONS

Support for the 7198 should be designed so that vibration and shock will not cause the tube to be displaced with respect to the focusing,



C_1 C_2: 0.05 μf, 1600 v working voltage
C_3: 0.01 μf mica, 1600 v working voltage
C_4: 0.001 μf mica, 1000 v working voltage
C_5: 0.001 μf mica, 600 v working voltage
C_6: 0.03 μf, 1600 v working voltage
See text under *voltage divider.*
C_7 C_8 C_9 C_{11} C_{12} C_{13} C_{14} C_{15}: 0.001 μf
~~mica~~, 400 v working voltage
C_{10}: 1 μf, 400 v working voltage
R_1: 47000 ohms, 1/2 watt
R_2 R_3: 220000 ohms, 1/2 watt
R_4: 220000-ohm potentiometer, 1 watt
R_5: 270000 ohms, 1/2 watt

R_6 R_7: 200-ohm potentiometer, center-tapped, 2 watts
R_8: 5100 ohms, 1/2 watt
R_9: 51000 ohms, 2 watts
R_{10}: 510 ohms, 1/2 watt
R_{11}: 150000-ohm potentiometer, 1/2 watt
R_{12}: 125000 ohms, 1/2 watt
R_{13}: 75000-ohm potentiometer, 1 watt
R_{14}: 125000 ohms, 1/2 watt
R_{15}: 250000-ohm potentiometer, 1 watt
R_{16}: 150000-ohm potentiometer, 1 watt
R_{17}: 250000-ohm potentiometer, 1 watt
R_{18}: 510000 ohms, 1 watt

R_{19}: 11000 ohms, 1/2 watt
R_{20}: 310000 ohms, 1/2 watt
R_{21}: 500000-ohm potentiometer, 1 watt
R_{22}: 250000 ohms, 1 watt
R_{23}: 560000 ohms, 1/2 watt
R_{24}: 47000 ohms, 1/2 watt
R_{25}: 20000 ohms, 1/2 watt
R_{26} R_{27}: 100000 ohms, 1/2 watt
R_{28} R_{29} R_{31} R_{32} R_{34} R_{35} R_{36} R_{37} R_{38}: 200000 ohms, 1/2 watt
R_{30}: 50000 ohms, 1/2 watt
R_{33}: 100000 ohms, 1/2 watt

Fig. 3 - Voltage-Divider Circuit for Type 7198 with Recommended Arrangement for Connecting the Focusing Coil and Alignment Coils.

deflecting, and alignment fields. Suitable support is provided for the tube and its sockets by the arrangement shown in Fig.2.

Proper orientation of the annular socket with respect to the horizontal-deflecting field is essential, and is obtained when the plane which is perpendicular to the plane of the annular socket and which passes through the center of the annular socket and the center line between pins 3 and 4 of the annular base is at right angles or parallel to the horizontal scanning field. This orientation minimizes beat-pattern effects by placing the sides of the mesh holes at an angle of 45° with respect to the horizontal scanning lines.

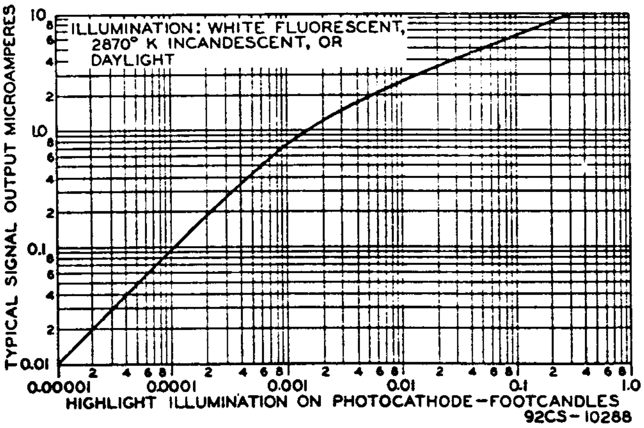


Fig.4 -Basic Light Transfer Characteristic of Type 7198.

The *deflecting yoke and focusing coil used with the 7198* must incorporate means to prevent the magnetic field produced by the deflecting yoke from extending into the image section of the tube. Unless proper shielding is provided, crosstalk from the deflecting yoke into the image section will cause the electron image to "jitter". This jitter produces a loss of picture sharpness. It is common practice to enclose the focusing coil in a cylindrical magnetic shield. Additional shielding can be provided by fitting the inside portion of the focusing coil which is directly over the image section of the 7198 with a copper cylinder having a length of approximately 2-1/4" and a wall thickness of 1/32".

For the *high dc voltages* required by the 7198, two pulse supplies may be used. The plate voltage and current for these pulse supplies should be provided by a well-regulated "B" supply. One of the pulse supplies should be capable of furnishing 1250 volts with an output current of 1 milliampere for the multiplier section; the other pulse supply should be capable of furnishing -550 volts with an output current of 1 milliampere for the image section. In addition to supplying the plate voltage and current for the pulse supplies, the "B" supply should also provide an output current of 90 milliamperes for the focusing and alignment coils and for the voltage divider which is used to supply the voltages for the electrodes in the scanning section of the 7198. Provision should be made for regulating the focusing-coil current.

A *voltage-divider* to provide the required operating voltages for the various electrodes of the 7198 is shown in Fig.3. It is to be noted that the blocking capacitor C_6 should be of sufficiently high quality so that its leakage current will not introduce disturbing effects into the picture.

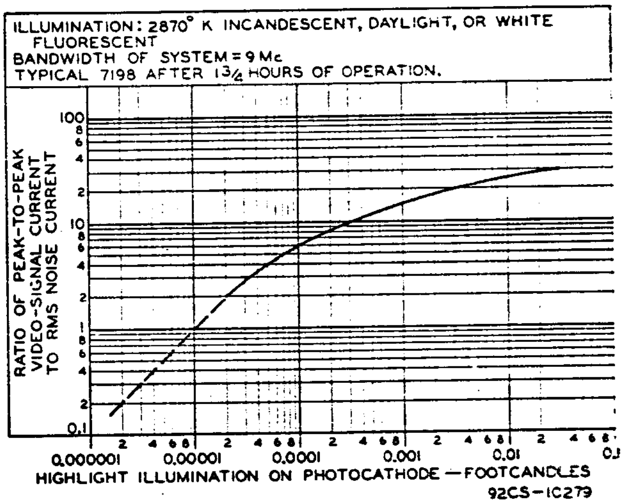


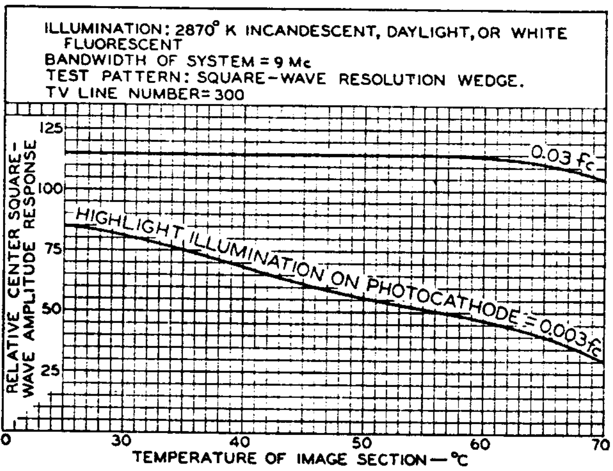
Fig.5 - Effect of Photocathode Illumination on Signal-to-Noise Ratio of Typical 7198.

The dc output of individual 7198's may have a range of 8 to 1. This range, therefore, must be considered in designing a voltage divider for the multiplier stages of the 7198. If the bleeder-resistor values are too high, the distribution of voltages applied to the dynodes will be upset by a 7198 with a dc output at the upper end of the range. As a result, there will be an abrupt drop in the ac output of the tube as the beam current is increased. When this drop occurs before the beam is at its optimum value, the ratio of signal to noise will be lessened, and compression of the signal information will result.

Resolution capability of the 7198 as affected by image-section temperature is shown in Fig.8 and as affected by highlight illumination in Fig.9.

It is necessary to use a video amplifier having sufficient bandwidth to utilize the resolution capability of the 7198. Even with a wide-band amplifier, the resolution may be limited in the image section by "cross-talk" caused by the scanning fields. Unless prevented by proper shielding from extending into the image section, these fields will cause the electron image on the target to move at scanning frequency. As a result, the picture will lack definition.

Video gain can be controlled over a wide range by reducing the voltage on one of the multiplier dynodes. It is recommended that dynode-No.3 voltage be made adjustable to perform this gain-control function. However, in no case should the voltage of dynode No.3 be lower than that of dynode No.2 or higher than the normal dynode-No.3 voltage. With this system of video-gain control, there is no necessity for providing a gain control in the first stages of the associated video amplifier. Such a gain control would normally be required to prevent overload when a 7198 having a high signal output or high multiplier gain is used. When dynode gain control is used, the video amplifier should be designed to handle without distortion and without introducing appreciable noise into the signal a peak-to-peak signal-output current of 5 microamperes. The dynode-No.3 voltage can then be adjusted to produce a signal output of approximately 5 microamperes. When dynode gain control is not used, the video amplifier must be designed to handle without distortion peak-to-peak video signals as high as 10 microamperes.

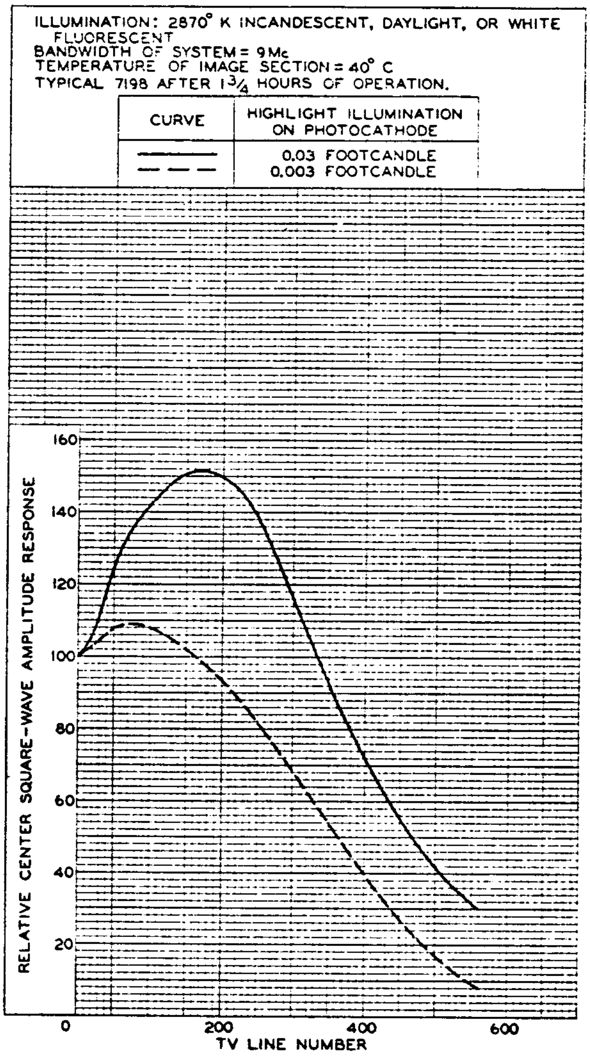


92CS-10280

Fig. 6 - Effect of Temperature of Image Section on Amplitude Response of Typical 7198.

A *blanking signal* should be supplied to the target to prevent the electron beam from striking the target during the return portions of the horizontal and vertical deflecting cycles. Unless this is done, the camera-tube return lines will appear in the received picture.

The blanking signal is a series of negative voltage pulses. The voltage between pulses must be constant to prevent fluctuation of the target voltage. During the blanking period, the full beam current without video-signal modulation is returned to the multiplier and its multiplied output flows through the load resistance. Excessive amounts of blanking voltage applied to the target will impair resolution, because during retrace the target is out of focus to the continuously flowing photocathode current. A desirable amount of target blanking is 6 volts peak to peak.



92CM-10281

Fig. 7 - Amplitude Response of Typical 7198.

Normally, *shading correction* is not required with optimum adjustment of voltage on grid No.3 in order to obtain a uniformly shaded picture. However, sawtooth and parabolic waveforms of adjustable amplitude and polarity at both the vertical- and horizontal-scanning frequency may be provided for insertion in the video amplifier to aid in obtaining a flat background. The shading-correction signal should be introduced in the amplifier after clamping is performed, because clamping circuits will remove the vertical-frequency shading component if added previous to the clamp-circuit location.

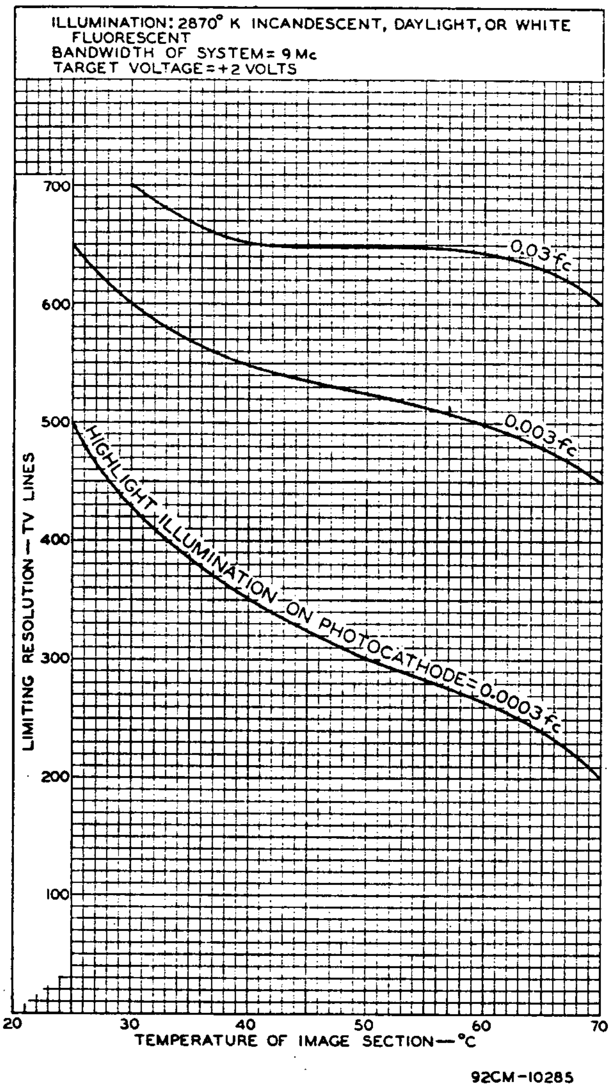


Fig. 8 - Effect of Temperature of Image Section on Limiting Resolution of Typical 7198.

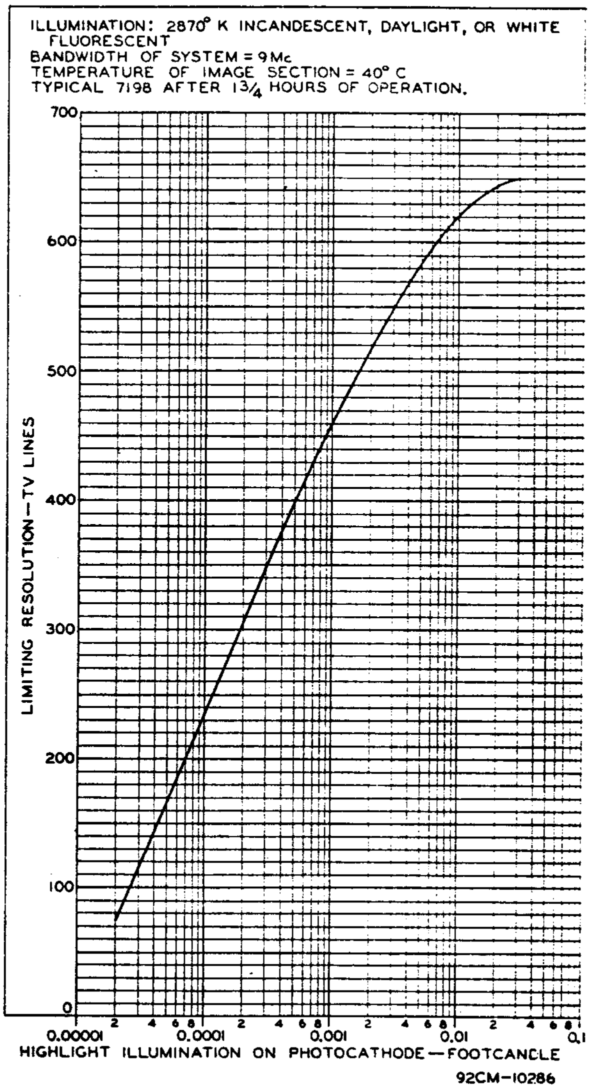


Fig. 9 - Effect of Photocathode Illumination on Limiting Resolution of Typical 7198.

Failure of scanning even for a few seconds may permanently damage the surface of the target. The damaged area shows up as a spot or line in the picture during subsequent operation.

To avoid damaging the 7198 during scanning failure, provision should be made to prevent automatically the scanning beam from reaching the target. The scanning beam can be prevented from reaching the target by (1) cutting off the scanning beam, or (2) making the target sufficiently negative. The scanning beam can be cut off by a relay which applies -115 to -125 volts bias to grid No.1. The target can be made sufficiently negative by a relay which applies a bias of at least -10 volts to it. Either relay is actuated by a signal from a tube which in turn is controlled by a portion of the scanning pulse voltage developed across either the horizontal or the vertical deflecting coils, or both. It is important to insure that the horizontal scanning pulse and the vertical scanning pulse should each independently actuate the relay in case either one fails.

The *operating temperature* of any part of the glass bulb should never exceed 71° C, and no part of the bulb at the large end of the tube (image section) should ever fall below 20° C during operation. For best results, it is recommended that the temperature of the entire bulb be held between 35° and 45° C. Operation at too low a temperature will be characterized by the appearance of a rapidly disappearing "sticking picture" of opposite polarity from the original when the picture is moved. Operation at too high a temperature will cause loss of resolution and possibly permanent damage to the tube. The loss of resolution is caused by the decreasing resistivity of the target glass disc with increasing temperature. As a result, lateral leakage of the image charge occurs. Resolution is regained by waiting for the temperature to drop below 71° C. *No part of the bulb should run more than 7.5° C hotter than the image section to prevent cesium migration to the target.* Such migration will result in loss of resolution and in probable permanent damage to the tube. Like other photosensitive devices employing cesium, the 7198 may show fluctuations in performance from time to time. Strict observance of the above recommendations with respect to operating temperature will not completely eliminate these variations but will greatly improve the stability of the characteristics during the life of the tube.

When the equipment design or operating conditions are such that the maximum temperature rating or maximum temperature difference as given under *Maximum Ratings* will be exceeded, provision should be made to direct a blast of cooling air from the diheptal-base end of the tube along the entire length of the bulb surface, i.e., through the space between the bulb surface and the surrounding deflecting-coil assembly and its extension. Any attempt to effect cooling of the tube by circulating even a large amount of air around the focusing coil will do little good, but a small amount of air directly in contact with the bulb surface will effectively drop the bulb temperature. For this purpose, a small blower is satisfactory, but the blower and its mountings should be designed to prevent excessive vibration of the 7198 and the associated amplifier equipment. (see *Vibration* under *Performance Data* on page 4).

To keep the operating temperature of the large end of the tube from falling below 20° C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflecting coils, and associated amplifier tubes so that the temperature can be controlled by the amount of cooling air directed along the bulb surface. If, in special cases, an image-section heater is required, it should fit between the focusing coil and the bulb near the shoulder of the tube, and be non-inductively wound.

A *mask* having a diagonal or diameter of 1.8 inches should always be used on the photocathode to reduce the amount of light reaching unused parts of the photocathode.

The *optical system* used with the 7198 should be of high quality and should incorporate control of the amount of light entering the television camera lens. This control may consist of an iris or an iris and suitable neutral-density filters. The entire optical system should have all inside surfaces finished in mat black to prevent internal reflections from reaching the photocathode. Under almost all conditions, the use of a lens shade is beneficial.

OPERATING CONSIDERATIONS

The 7198 has two complementary guides for inserting the tube correctly in the annular socket, i.e., the large pin (No.7) on the annular base, and the white radial line on the face of the bulb.

Installation of the 7198 in the camera is accomplished by inserting the diheptal-base end of the tube through the coil assembly and then turning the tube until the annular-base pins, keyed by pin 7, can be inserted in the annular socket. Proper insertion aligns the white radial line on the face with center of the key-pin hole in the annular socket. The diheptal socket is then put on the 14-pin base.

The *operating position* of the 7198 should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

Operating temperature considerations for the 7198 are covered under *Camera-Design Considerations* on pages 8 & 9.

Full-size scanning of the target should always be used during operation. Full-size scanning can be assured by first adjusting the deflection circuits to overscan the target sufficiently to cause the edge of the target ring to be visible in the corners of the picture, and then reducing the scanning until the edge of the target ring just disappears. In this way, the maximum signal-to-noise ratio, and maximum resolution can be obtained. Note that overscanning the target produces a smaller-than-normal picture on the monitor.

Underscanning the target, i.e., scanning an area of the target less than its sensitive area, should never be permitted. Underscanning produces a larger-than-normal picture on the monitor. If the target is underscanned for any length of time, a permanent change in target-cutoff voltage of the underscanned area takes place with the result that the underscanned area thenceforth is visible in the picture when full-size scanning is restored.

During *standby operation*, the lens of the camera should always be closed or capped. An effective method of performing the same end result is to cut off the photocathode voltage by means of a switch. The camera will instantly be ready for operation when the photocathode voltage is again turned on.

The *light transfer characteristics* of the 7198 change for different illumination levels (see Reference 6). The basic light transfer characteristic of the 7198 is shown in Fig.4. The light values shown are applicable only for the indicated kinds of illumination incident on the photocathode. This curve is representative only for small-area highlights.

Sensitivity and Illumination. The image orthicon is a device exceeding in relative sensitivity most high-speed photographic film. When related to photographic film and compared at shutter speeds of 1/60 second which is the effective storage time of the image orthicon in a standard broadcast television system, the 7198 exposed with the highlights on the photocathode of 0.03 footcandle will have an equivalent ASA exposure index of approximately 7000. This equivalent film-speed rating can be used in conjunction with a photographic exposure meter set for a shutter speed of 1/60 second to determine the approximate light level or lens-stop setting necessary for operating the 7198 in a standard broadcast system.

The illumination on the photocathode of the 7198 is related to the scene illumination as follows:

$$I_s = \frac{4f^2\, I_{pc}\, (m+1)^2}{TR}$$

where

I_s = scene illumination in footcandles

f = f-number setting of lens

I_{pc} = photocathode illumination in footcandles

m = linear magnification from scene to target

T = total transmission of lens

R = reflectance of principal subject in scene

Except for very close shots, the linear magnification (m) from scene to target may be neglected.

For example, assume that the lens is set at f:1.5, that it has a transmission (T) of 75%, that the photocathode highlight illumination is 0.0001 footcandle, and that the highlight reflectance (R) is 50%.

Then,

$$I_s = \frac{4 \times 1.5^2 \times 0.0001}{0.75 \times 0.50} = 0.0024 \text{ footcandle}$$

Optimum resolution and best performance is obtained from the 7198 when the highlight illumination on the photocathode does not exceed 0.1 footcandle. It may not be possible to stop the lens down far enough to obtain this level of highlight illumination on the photocathode. When such a condition is encountered, the use of a Wratten neutral filter selected to give the required reduction in illumination is recommended. Such a filter with lens-adapter ring can be obtained at photographic supply stores.

The low illumination level utilized on the photocathode of the 7198 makes it necessary that no stray light from without or within the camera fall on the face of the tube. See *optical system* under *Camera-Design Considerations.*

Retention of a scene by the 7198, sometimes called a "sticking picture", may be observed if the 7198 is allowed to remain focused on a stationary bright scene, or if it is focused on a bright scene before reaching operating temperature in the range from 35° to 45° C. Often the retained image will disappear in a few seconds, but sometimes it may persist for long periods before it completely disappears. A persisting retained image can generally be removed by focusing the 7198 on a clear white screen and allowing it to operate with an illumination of about 1 footcandle on the photocathode until the retained image disappears.

To minimize retention of a scene, it is recommended that the 7198 always be allowed to warm up in the camera for 1/2 to 1 hour with the lens capped. Never allow the 7198 to remain focused on a stationary bright scene, and never use more illumination than is necessary.

Occasionally, a *white spot* which does not change in size when the beam-focus voltage is varied, may be observed in the center of the picture. Such a spot, especially if it is visible on the monitor with the camera lens capped, is probably an ion spot. If the spot begins to grow in size with continuous operation, the 7198 should be removed from service at once, and returned for re-processing. Continued operation of an image orthicon with an ion spot will eventually damage the target permanently.

SET-UP PROCEDURE

The *set-up procedure* for operating the 7198 is as follows: After the tube has been inserted in its sockets and the voltages applied as indicated under *Typical Operating Values*, allow it to warm up for 1/2 to 1 hour with the camera lens capped, and with grid-No.1 voltage adjusted to give a small amount of beam current. Make certain that the deflection circuits are functioning properly to cause the electron beam to scan the target. Adjust the deflection circuits so that the beam will "overscan" the target, i.e., so that the area of the target scanned is greater than its sensitive area. This procedure during the warming-up period is recommended to prevent burning on the target a raster smaller than that used for on-the-air operation. Note that overscanning the target results in a smaller-than-normal picture on the monitor.

With the lens still capped and the target voltage set at approximately 2 volts negative, adjust the grid-No.1 voltage until noise or a rough-textured picture of dynode No.1 appears on the monitor. Then adjust the alignment-coil current so that the small white dynode spots do not move when the beam-focus control (grid No.4) is varied, but simply go in and out of focus. During alignment of the beam, and also during operation of the tube, *always keep the beam current as low as possible to give the best picture quality* and also to prevent excessive noise.

Next, uncap the lens and open the lens iris partially. Focus the camera on a test pattern. The target voltage is then increased until a reproduction of the test pattern is just discernable on the monitor. This value of target voltage is known as the "target cutoff voltage". The target voltage should then be raised exactly 2 volts above the cutoff-voltage value, and the beam-current control adjusted to give just sufficient beam current to discharge the highlights.

Then adjust the lens to produce best optical focus, and the voltage on the photocathode as well as the voltage on grid No.4 to produce the sharpest picture.

At this point, attention should be given to the grid-No.5 and grid-No.3 voltage controls. Grid No.5 is used to control the landing of the beam on the target and consequently the uniformity of signal output. The grid-No.5 voltage control should be adjusted to produce a picture that has most uniform shading from center to edge with the lens iris opened to permit operation at the highest light level involved in the application. The value of grid-No.5 voltage should be as high as possible consistent with uniform shading. Grid No.3 facilitates a more complete collection by dynode No.2 of the secondaries from dynode No.1. The grid-No.3 voltage control should be adjusted to produce the maximum signal output.

Now with a test pattern consisting of a straight line centered on the face of the 7198, adjust the voltage on grid No.6 along with the voltage on the photocathode to produce a sharply focused straight line on the monitor. Improper adjustment of the grid-No.6 voltage control will result in the straight-line pattern being reproduced with a slight S-shape.

The above adjustments constitute a rough set-up of the 7198. Final adjustments necessary for the 7198 to produce the best possible picture are as follows: With the lens capped, realign the beam. Beam alignment is necessary after each change of the grid-No.5 voltage control and sometimes after each adjustment of the grid-No.3 voltage control.

With the camera operating at the desired illumination level, the beam current should be slowly decreased by adjusting the grid-No.1 voltage control to the point where the beam is just sufficient to discharge the highlights of the picture. Each change of scene illumination should be accompanied by appropriate changes in beam current and amplifier gain to obtain the best contrast and signal-to-noise ratio for each new scene condition.

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2. A. Rose, P.K. Weimer and H.B. Law, *"The Image Orthicon--A Sensitive Television Pickup Tube"*, Proc. of I.R.E., July, 1946.
3. Otto H. Schade, *"Electro-Optical Characteristics of Television Systems;* Introduction and
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   - Part II--*Electro-Optical Specifications for Television Systems"*, RCA Review, June, 1948;
   - Part III--*Electro-Optical Characteristics of Camera Systems"*, RCA Review, September, 1948;
   - Part IV--*Correlation and Evaluation of Electro-Characteristics of Imaging Systems"*, RCA Review December, 1948.
4. R.B. Janes, R.E. Johnson, and R.S. Moore, *"Design and Performance of Television Camera Tubes"*, RCA Review, June, 1949.
5. R.B. Janes, R.E. Johnson, and R.R. Handel, *"A New Image Orthicon"*, RCA Review, December, 1949.
6. R.B. Janes, and A.A. Rotow, *"Light Transfer Characteristics of Image Orthicons"*, RCA Review, September, 1950.
7. A.A. Rotow, *"Reduction of Spurious Signals in Image Orthicon Cameras"*, Broadcast News, February, 1955.

DOS and DON'TS
on Use of RCA-7198

Here are the "dos"--

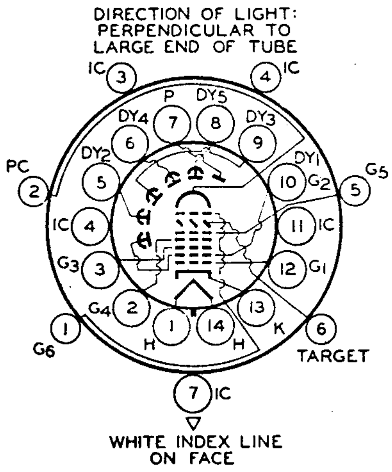
1. Allow the 7198 to warm up prior to operation.
2. Hold temperature of the 7198 within operating range.
3. Make sure alignment coil is properly aligned.
4. Adjust beam-focus control for best usable resolution.
5. Determine proper operating point with target voltage adjusted to exactly 2 volts above target cutoff.
6. Cap lens during standby operation.

Here are the "don'ts"--

1. Don't force the 7198 into its shoulder socket.
2. Don't operate the 7198 without scanning.
3. Don't underscan target.
4. Don't focus the 7198 on a stationary bright scene.
5. Don't operate a 7198 having an ion spot.

The significance of each of the above "dos" and "don'ts" in obtaining optimum performance from the 7198 is explained in the preceding pages of this bulletin.

SOCKET CONNECTIONS
Bottom View



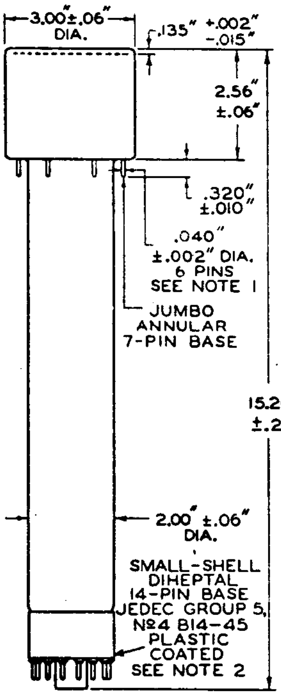
SMALL-SHELL DIHEPTAL 14-PIN BASE

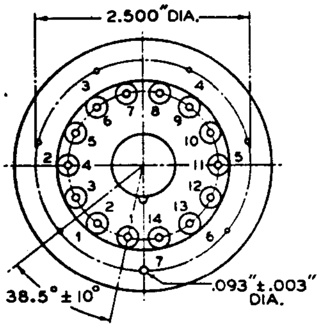
PIN 1:	HEATER
PIN 2:	GRID No.4
PIN 3:	GRID No.3
PIN 4:	INTERNAL CONNECTION--DO NOT USE
PIN 5:	DYNODE No.2
PIN 6:	DYNODE No.4
PIN 7:	ANODE
PIN 8:	DYNODE No.5
PIN 9:	DYNODE No.3
PIN 10:	DYNODE No.1, GRID No.2
PIN 11:	INTERNAL CONNECTION--DO NOT USE
PIN 12:	GRID No.1
PIN 13:	CATHODE
PIN 14:	HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1:	GRID No.6
PIN 2:	PHOTOCATHODE
PIN 3:	INTERNAL CONNECTION--DO NOT USE
PIN 4:	INTERNAL CONNECTION--DO NOT USE
PIN 5:	GRID No.5
PIN 6:	TARGET
PIN 7:	INTERNAL CONNECTION--DO NOT USE

DIMENSIONAL OUTLINE



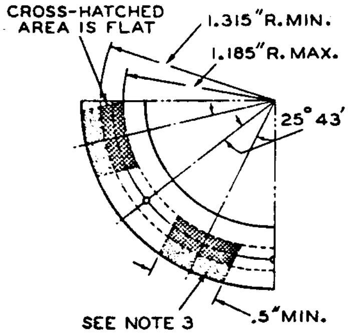


ENLARGED BOTTOM VIEW

NOTE 1: ENDS OF PINS CHAMFERED 45°; FLAT ENDS 0.020" ± 0.010".

NOTE 2: PLASTIC COATING MAY INCREASE DIAMETER OF BASE SHELL TO 2.08" MAX. AND MAY INCREASE HEIGHT OF BASE SHELL BY 0.03" MAX.

DETAIL OF BOTTOM VIEW
OF JUMBO ANNULAR BASE



NOTE 3: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

92CM-10289

WINCHESTER SOCKET

A WHITE GRAY P.C.
D GRAY — G6
H RED — +300V
L YELLOW · G3
P BLUE G5
T - [illegible] ~~[illegible]~~ OUT
V — SYNC-IN

B] HOR YOKE ORANGE
E

I] VERT YOKE VIOLET
H

R BLACK ⊖
ALIGNMENT COIL
J — END OF FOCUS COIL

C ⊕ RED
— FOCUS COIL
F → ~~[illegible]~~ -500V
K → ~~[illegible]~~ -150
~~[illegible]~~
N → 6.3V

S] — 117VOLT LINE BLACK
V

X — 15 SUPPLY — ORANGE - YELLOW

A WHITE GRAY P.C.
D GRAY — G6
H RED — +300V
L YELLOW · G3
P BLUE G 5
T — BLANK – TO VIDEO ~~SYNC~~ OUT
V — SYNC-IN

B] HOR YOKE
E] ORANGE

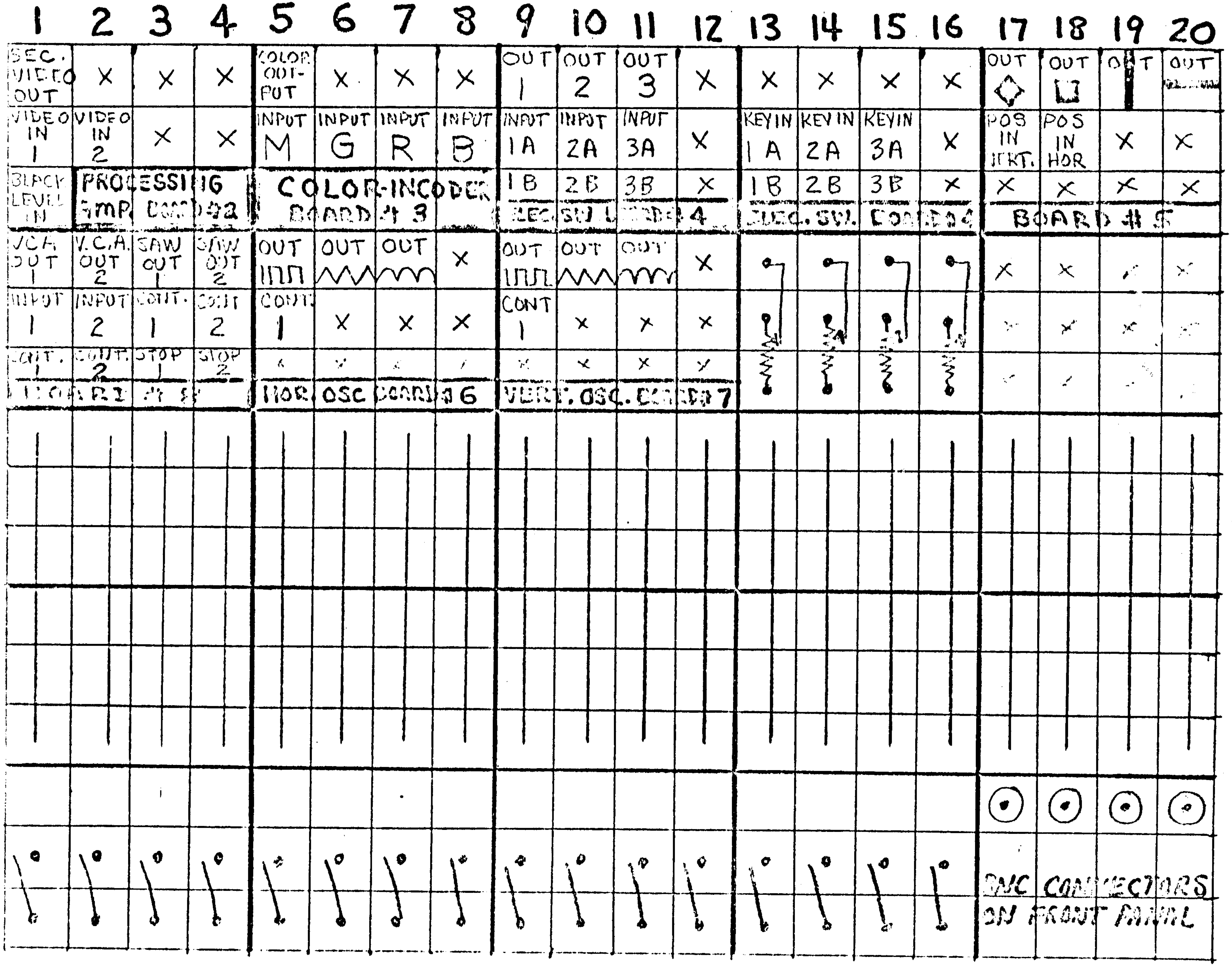
I] VERT YOKE
H] VOLT

R BLACK ⊖
] ALIGNMENT COIL
J — END OF FOCUS COIL

C ⊕ RED
— FOCUS COIL
F → ~~[illegible]~~ — 500V
K → ~~ELECT~~ — 150
~~[illegible]~~
N → 6.3V

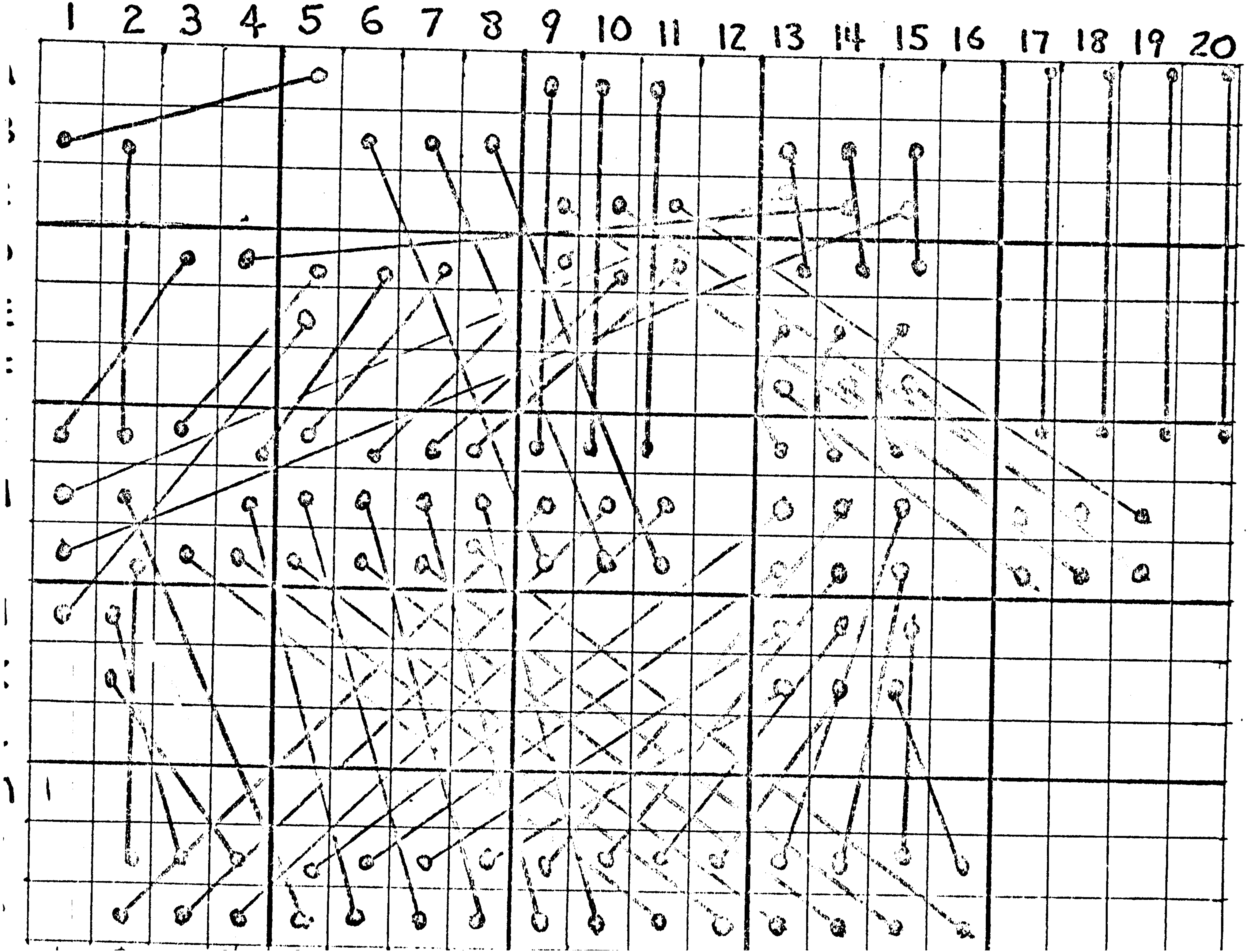
S] — 117VOLT LINE
V] BLACK
X — 15 SUPPLY —
ORANGE – YELLOW

RCA



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
SEC. VIDEO OUT	X	X	X	COLOR OUTPUT	X	X	X	OUT 1	OUT 2	OUT 3	X	X	X	X	X	OUT ◇	OUT ☐	OUT	OUT
VIDEO IN 1	VIDEO IN 2	X	X	INPUT M	INPUT G	INPUT R	INPUT B	INPUT 1A	INPUT 2A	INPUT 3A	X	KEY IN 1A	KEY IN 2A	KEY IN 3A	X	POS IN VERT.	POS IN HOR	X	X
BLACK LEVEL IN	PROCESSING AMP. BOARD #2			COLOR-INCODER BOARD #3				1B	2B	3B	X	1B	2B	3B	X	X	X	X	X
								SEC. SW. BOARD #4				SEC. SW. BOARD #4				BOARD #5			
VCA OUT 1	V.C.A. OUT 2	SAW OUT 1	SAW OUT 2	OUT ⊓⊓⊓	OUT ∧∧∧	OUT ∿∿∿	X	OUT ⊓⊓⊓	OUT ∧∧∧	OUT ∿∿∿	X					X	X	X	X
INPUT 1	INPUT 2	CONT. 1	CONT 2	CONT 1	X	X	X	CONT 1	X	X	X					X	X	X	X
CONT. 1	CONT. 2	STOP 1	STOP 2	X	X	X	X	X	X	X	X								
BOARD #8				HOR. OSC BOARD #6				VERT. OSC. BOARD #7											

BNC CONNECTORS ON FRONT PANEL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R.F. CHOKES

Sub-Miniature R.F. Chokes

An extremely versatile series of iron core R.F. chokes designed to meet the industries' demand for high reliability, ultra-miniature components. The coils are ideally suited to network and filter design, delay lines, and computer applications. Rated at 50 miliamperes maximum D.C. current they are more than satisfactory for most applications. The coils are impregnated with a moisture resistant lacquer and on special order they can be fungus-proofed per JAN-T-152 using varnish per MIL-V 1⁻³A. They can also be encapsulated in epoxy resin to conform to Grade 1, Class B of MIL-C-15305.

Miller Part No.	Measured on Model 260A Q-Meter			Resonant Frequency Minimum MHz	D.C. Resistance Maximum	Milliamp Rating Maximum	Maximum Winding Diameter	Form Length ± 1/16
	Inductance Nominal*	Q Minimum	Test Frequency					
70F107AP	.10 uh★	49	25 MHz	600	.013	3200	.156	3/16
70F157AP	.15 uh★	52	25 MHz	490	.025	1600	.141	3/16
70F227AP	.22 uh★	43	25 MHz	400	.038	1200	.141	3/16
70F337AP	.33 uh★	4[illegible]	25 MHz	330	.070	800	.125	3/16
70F477AP	.47 uh★	4[illegible]	25 MHz	280	.125	510	.125	3/16
70F687AP	.68 uh★	48	25 MHz	240	.200	400	.125	3/16
70F757AP	.75 uh★	48	25 MHz	224	.264	320	.125	3/16
70F827AP	.82 uh★	48	25 MHz	216	.290	300	.125	3/16
70F106AI	1.0 uh	41	25 MHz	118	.048	636	.165	¼
70F126AI	1.2 uh	45	7.9 MHz	118	.072	400	.160	¼
70F156AI	1.5 uh	42	7.9 MHz	102	.096	316	.160	¼
70F186AI	1.8 uh	31	7.9 MHz	89	.096	400	.160	¼
70F226AI	2.2 uh	43	7.9 MHz	87	.156	202	.160	¼
70F276AI	2.7 uh	34	7.9 MHz	74	.168	256	.160	¼
70F336AI	3.3 uh	40	7.9 MHz	66	.240	159	.150	¼
70F396AI	3.9 uh	35	7.9 MHz	61	.264	159	.150	¼
70F476AI	4.7 uh	43	7.9 MHz	53	.457	100	.150	¼
70F566AI	5.6 uh	41	7.9 MHz	49	.492	100	.150	¼
70F686AI	6.8 uh	40	7.9 MHz	49	.624	100	.150	¼
70F756AI	7.5 uh	32	7.9 MHz	44	624	100	.150	⅜
70F826AI	8.2 uh	37	7.9 MHz	41	.744	100	.150	¼
70F916AI	9.1 uh	41	7.9 MHz	21	1.44	75	.160	⅜
70F105AI	10 uh	36	7.9 MHz	19	1.56	75	160	¼
70F125AI	12 uh	52	2.5 MHz	19	1.68	75	.160	¼
70F155AI	15 uh	52	2.5 MHz	16	1.92	75	.165	¼
70F185AI	18 uh	52	2.5 MHz	15	2.28	75	.165	¼
70F225AI	22 uh	51	2.5 MHz	13	2.28	75	.165	⅜
70F255AI	25 uh	48	2.5 MHz	13	2.64	75	.170	¼
70F275AI	27 uh	49	2.5 MHz	12	2.64	75	.170	¼
70F335AI	33 uh	50	2.5 MHz	10	2.76	75	.170	¼
70F395AI	39 uh	48	2.5 MHz	9.3	3.36	75	.175	¼
70F475AI	47 uh	44	2.5 MHz	9.1	3.36	75	.175	¼
70F565AI	56 uh	45	2.5 MHz	8.6	3.84	75	.180	¼
70F685AI	68 uh	42	2.5 MHz	8.1	4.20	75	.180	¼
70F755AI	75 uh	38	2.5 MHz	7.2	4.56	75	.185	⅜
70F825AI	82 uh	41	2.5 MHz	6.7	4.80	75	.185	¼
70F915AI	91 uh	41	2.5 MHz	6.7	4.92	75	.185	¼
70F104AI	100 uh	25	2.5 MHz	3.6	7.48	75	.165	⅜
70F124AI	120 uh	40	790 kHz	3.2	8.16	75	.165	⅜
70F154AI	150 uh	47	790 kHz	3.0	8.16	75	.165	¼
70F184AI	180 uh	48	790 kHz	2.8	8.16	75	.170	⅜
70F204AI	200 uh	47	790 kHz	2.7	10.3	75	.170	⅜
70F224AI	220 uh	46	790 kHz	2.5	11.5	75	.170	¼
70F254AI	250 uh	49	790 kHz	2.5	12.1	75	.170	⅜
70F274AI	270 uh	46	790 kHz	2.5	13.2	75	.175	⅜
70F304AI	300 uh	46	790 kHz	2.2	13.2	75	.175	¼
70F334AI	330 uh	41	790 kHz	2.0	13.9	75	.175	¼
70F354AI	350 uh	46	790 kHz	2.0	14.4	75	.180	⅜
70F394AI	390 uh	45	790 kHz	2.0	15.8	75	.180	⅜
70F474AI	470 uh	35	790 kHz	1.8	16.3	75	.185	¼
70F504AI	500 uh	49	790 kHz	1.8	18.0	75	.195	⅜
70F564AI	560 uh	41	790 kHz	1.7	19.2	75	.195	⅜
70F684AI	680 uh	37	790 kHz	1.6	19.8	75	.200	¼
70F754AI	750 uh	40	790 kHz	1.6	22.9	75	.210	¼
70F824AI	820 uh	33	790 kHz	1.6	22.9	75	.210	⅜
70F914AI	910 uh	32	790 kHz	1.4	24.0	75	.220	¼

*Tolerance 0.1 to 1.0 UH ± 20%, 1.1 to 15 UH ± 10%, over 15 UH ± 5%

★Measured with leads ¼" long from Q Meter binding posts.

Continued on following page

R.F. CHOKES

Sub-Miniature R.F. Chokes

Continued from previous page

Miller Part No.	Measured on Model 260A Q-Meter			Resonant Frequency Minimum MHz	D.C. Resistance Maximum	Milliamp Rating Maximum	Minimum Winding Diameter	Form Length ± 1/32
	Inductance Nominal*	Q Minimum	Test Frequency					
70F103AI	1.00 mh	30	790 kHz	1.4	24.0	75	.225	1/4
70F123AI	1.20 mh	34	250 kHz	1.2	33.6	75	230	1/4
70F153AI	1.50 mh	40	250 kHz	1.1	37.2	75	225	1/4
70F183AI	1.80 mh	40	250 kHz	.96	42.0	75	235	1/4
70F223AI	2.20 mh	40	250 kHz	.96	45.6	75	240	1/4
70F253AI	2.50 mh	48	250 kHz	.96	45.6	75	.260	3/8
70F273AI	2.70 mh	50	250 kHz	88	45.6	75	.260	3/8
70F333AI	3.30 mh	52	250 kHz	.80	51.6	75	260	3/8
70F393AI	3.90 mh	[illegible]	250 kHz	.76	57.5	75	275	3/8
70F473AI	4.70 mh	49	250 kHz	.68	64.8	75	285	3/8
70F563AI	5.60 mh	53	250 kHz	.68	69.6	75	300	3/8
70F682AI	6.80 mh	51	250 kHz	64	78.0	75	310	3/8
70F753AI	7.50 mh	49	250 kHz	.60	85.2	75	310	3/8
70F823AI	8.20 mh	48	250 kHz	60	92.4	75	330	3/8
70F913AI	9.10 mh	52	250 kHz	.56	98.4	75	330	3/8
70F102AI	10.0 mh	41	250 kHz	.52	101	75	335	3/8
70F122AI	12 mh	46	79 kHz	36	100	75	300	1/2
70F152AI	15 mh	50	79 kHz	.32	113	75	.300	1/2
70F182AI	18 mh	49	79 kHz	.29	128	75	325	1/2
70F222AI	22 mh	50	79 kHz	.27	144	75	330	1/2
70F252AF	25 mh	59	79 kHz	.250	115	60	300	5/8
70F272AF	27 mh	61	79 kHz	.244	120	60	313	5/8
70F332AF	33 mh	61	79 kHz	.232	134	60	313	5/8
70F392AF	39 mh	59	79 kHz	.220	147	60	330	5/8
70F472AF	47 mh	57	79 kHz	.206	168	60	344	5/8
70F502AF	50 mh	57	79 kHz	.196	175	60	.360	5/8
70F562AF	56 mh	57	79 kHz	188	189	60	.360	5/8
70F682AF	68 mh	57	79 kHz	.180	215	60	375	5/8
70F752AF	75 mh	53	79 kHz	174	222	60	390	5/8
70F822AF	82 mh	50	79 kHz	168	238	60	390	5/8
70F912AF	91 mh	51	79 kHz	.166	290	60	390	5/8
70F101AF	100 mh	48	79 kHz	.157	278	60	405	5/8

*Tolerance 0.1 to 1.0 UH ± 20%, 1.1 to 15 UH ± 10%, over 15 UH ± 5%

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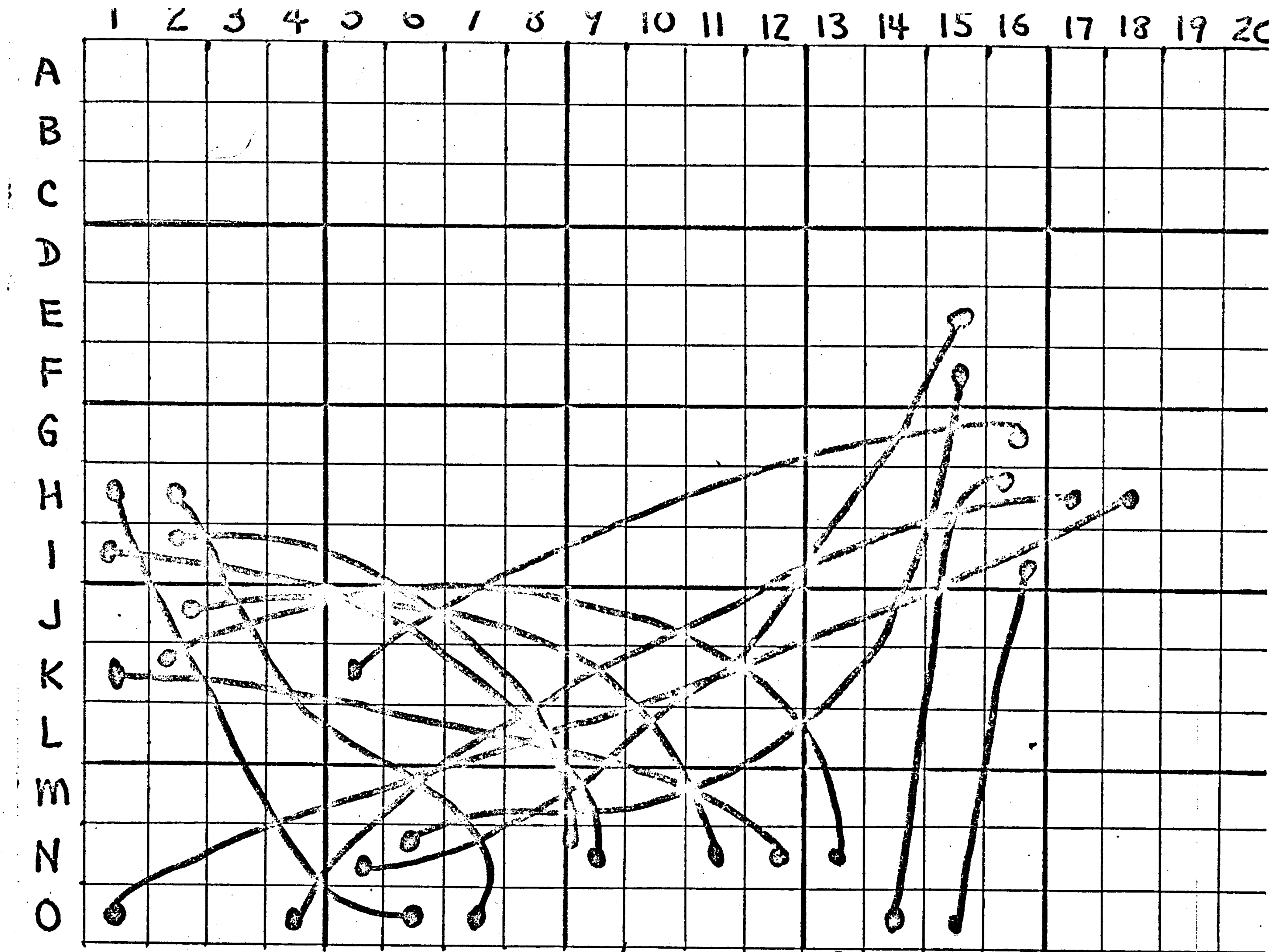
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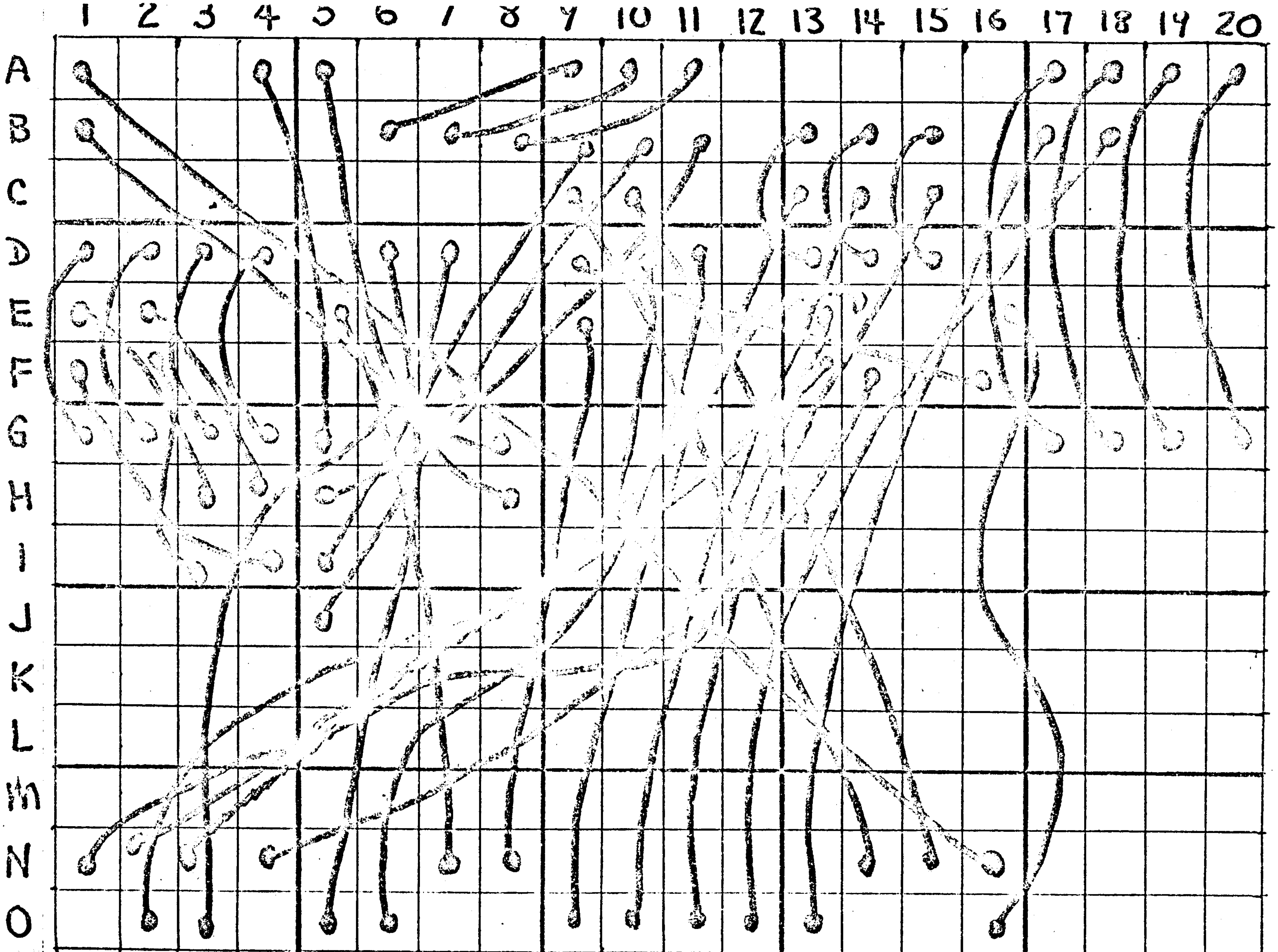

PROGRAM 2