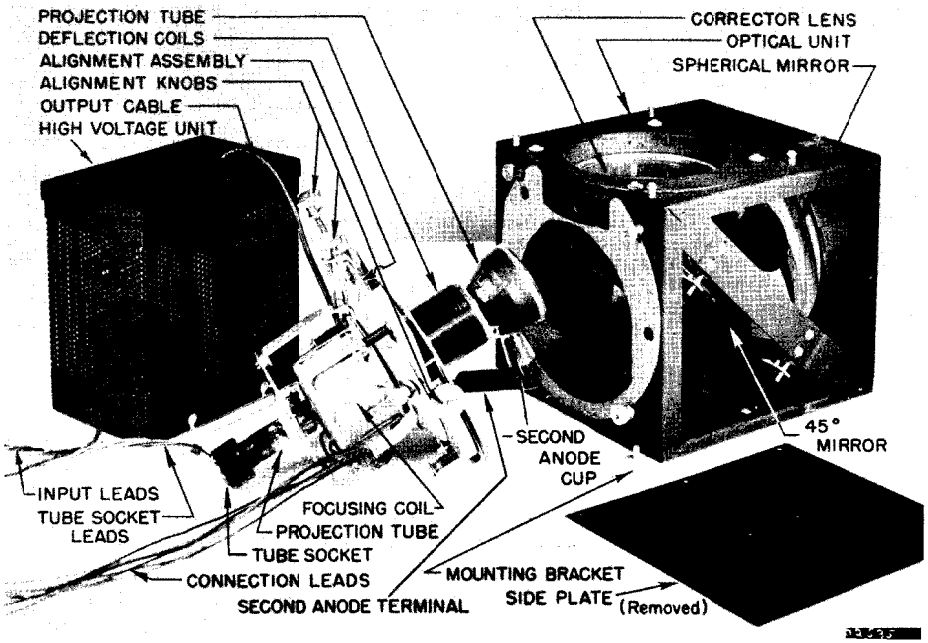
1. 3NP4 Projection Tube
2. 3NP4 Tube Socket with Cable
3. Tailpiece
4. Optical Box
5. High Voltage Power Supply



PARTS DESCRIPTION

3NP4 CATHODE-RAY PROJECTION TUBE AND TUBE SOCKET (160A-5)

This tube is a specially designed triode having a special five-prong base. The face of the tube has a diameter of 2.5 inches. The raster produced is 1.4 x 1.86 inches. The tube is 10.5 inches long. A glass cup surrounds the anode contact, which is placed near the face of the tube. A molded thermo-plastic cable terminal, which carries the 25 kv anode potential, is attached to the anode by a spring arrangement.

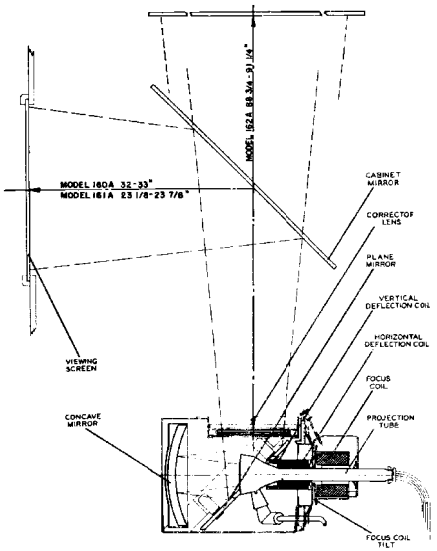
Dimensional tolerances of the glass are held quite closely. Because it is an element in the Schmidt optical system, the face plate of the tube is optically correct. The inside dimensions of the neck have been held to such accuracy that the electron gun is centered by it. Various glasses, developed for specific tasks, are used in the assembly. The face plate is composed of soft glass and therefore is not discolored as rapidly as ordinary glass is by the low intensity, soft, X-radiation produced by the 25 kv electron bombardment. A spark trap is provided between plate and cathode to protect the elements against destructive arc-over. The glass cup around the anode cable terminal provides added insurance for corona-free operation.

The aluminized phosphor screen increases the light output and prevents ion spots so that no ion-trap is needed. This inside coating - the anode - also covers the cone and the greater part of the neck. An outside coating, of "Aquadag", is grounded and used as a static shield. The capacitance between inside and outside coatings serves as the final filter capacitor for the 25-kv high-voltage.

The total deflection angle is 42 deg. Grid driving voltage required is about 90 volts peak-to-peak in order to insure adequate modulation of high cut-off tubes. The filament operates at 6.3 volts, 0.60 amp. Average beam current is approximately 90 microamps, but highlight peaks reach 500 microamps. Notwithstanding this, the spot size remains substantially constant, approximately 0.003 in. The peak brightness on the tube face reaches 3000 foot-lamberts

DESCRIPTION

A 1.4" x 1.86" picture is produced on the face of the 3NP4 cathode-ray tube. The light output of this tube reaches approximately 3,000 foot lamberts.



This light is gathered by a concave mirror, reflected to a plane 45° mirror and projected through an aspherical corrector lens. This optical system which is an adaptation of the "Schmidt" optical principle is essentially a very efficient picture magnifier having a linear magnification of nine times.

The length of the projected beam, from the face of the corrector lens to the screen, is shown on this drawing. This beam is usually "folded" one or more times in order to conform to cabinet design. Mirrors used for the purpose of "folding" the beam, which are of necessity placed between the projection unit and the screen, are of the highest quality. Only front surfaced mirrors are used.

A variety of picture sizes can be produced ranging from cabinet-contained screens, from 130 to 234 square inches, e.g.:

Model 161A
130 square inches with rounded corners 13-1/3" x 10"
Model 160A
192 square inches with square corners 16" x 12"
Model 160A
234 square inches with rounded corners 18" x 13-1/2"

and

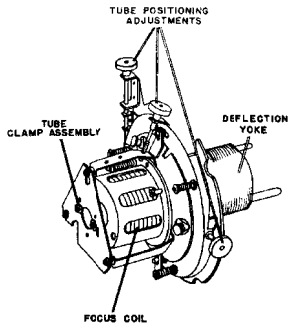
Model 162A for movie-type projection on large screens from 32" x 24" (768 square inches) to 48" x 36" (1728 square inches)

The same Protelgram unit is used in all of the above models with the exception of the corrector lens in the optical box which determines the distance from the corrector lens to the screen. (See description of optical box, page 6).

The chassis used with Protelgram is a conventional television chassis with the following probable modifications:

1. A 350 V. - 50 ma D.C. source for the 25 kv high-voltage unit.
2. Wider focus current range to allow for the greater degree of adjustment desired for a projection tube.
3. Provisions for a somewhat higher video output voltage.
4. A protection circuit to prevent screen burns on the projection tube face in the event of sweep failure in the TV chassis.

TAILPIECE 160AT-60 (CONTAINING A 11,000 OHM FOCUS COIL)
160AT-61 (CONTAINING A 290 OHM FOCUS COIL)



The tailpiece includes the focus coil, the deflection yoke and its associated wire-wound shield, the tube clamp assembly and the tube positioning adjustments.

Protelgram, being a "short focus", system, requires precise positioning of the tube in the optical box. These controls are adjusted only when the tube is installed; they are easy to operate - while their effect can be clearly observed on the viewing screen.

A 1000 ampere-turn coil is used for focusing. Two types of focus coil are used -
Shunt (Tailpiece 160AT-60) - 11,000 ohms
and Series (Tailpiece 160AT-61) - 290 ohms
While the deflection coils are built to standard electrical specifications, their shape is necessarily different from conventional forms. A molded phenolic form is used for the deflection coils, so shaped that the tube seats firmly in it. The deflection coils are so designed that linear current will produce linear deflection over the full picture area; their design also corrects spot astigmatism near the edge of the tube face at wide angles of deflection.

There are 7 leads attached to the tailpiece which are used to connect the focus coil, ground and deflection coils to the chassis.

SPECIFICATIONS

Wiring Color Code:

Horizontal Deflection Coil:	*Orange with white tracer
	*Orange with black tracer
Vertical Deflection Coil:	*Blue with white tracer
	*Blue with black tracer

*Polarity determined by the direction of sweep desired

Tailpiece 160A-60T Shunt Focus Coil, 11,000 ohms — Red / Black with white tracer

Tailpiece 160A-61T Series Focus Coil, 290 ohms — Red / Yellow

Ground: Black: Must be securely fastened to provide a low resistance connection to all other grounded chasses in system. It is imperative that the optical box be electrically connected to the ground side of the H. V. supply.

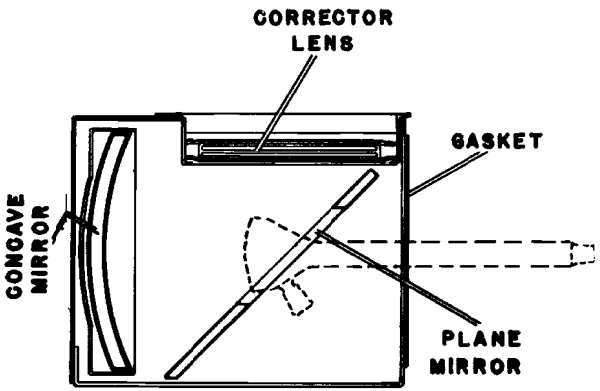
Focus Coil:

Two types available: 1) P9.205.11 M	Shunt D.C. resistance	290 ohms ± 10%
	Current nominal	125 milliamps
2) P9.205.12 M	Series D.C. resistance	11,000 ohms ± 10%
	Current nominal	21 milliamps

Deflection Yoke:

Horizontal: Inductance	8.3 millihenrys ± 10% @ 1000 c/s
D.C. Resistance	approx. 15 ohms
Inductance approx.	45 millihenrys @ 1000 c/s
D.C. Resistance	68 ohms ± 10%

OPTICAL BOX (160A-0) (161A-0) (162A-0)



The optical box is 8-1/2 x 8-1/2 x 9 in. and weighs 18-1/2 lbs. It contains the Schmidt optical elements - a concave mirror 6.7" in diameter having a curvature of 7-7/8" (200 mm), a plane mirror and an aspherical corrector lens 4.5 inches in diameter. The plane mirror, which is mounted at a 45° angle to the concave mirror and a corrector lens fold the light beam, hence the description "folded Schmidt" system. There are no obstructions in the light path (with the obvious exception of the tube face itself) that intercept useful light. Clearance for the tube face is obtained by an elliptical hole in the 45° plane mirror. The light emitted from the tube face is gathered by the spherical mirror, reflected to the plane mirror and from there projected upwards through the aspherical corrector lens

The throw distance from the corrector lens to the viewing screen varies in accordance with the particular corrector lens used. These distances are as follows:

Model	Picture Size	Throw Distance
160A	16" x 12" square corners 18" x 13 1/2" rounded corners	32" - 33"
161A	13 1/3" x 10" rounded corners	23 1/8" - 23 7/8"
162A	32" x 24" to 48" x 36"	88 3/4" - 91 1/4"

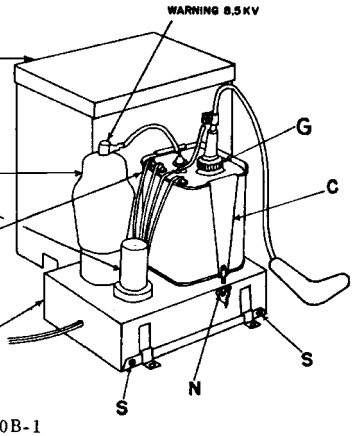
The same Protelgram unit is used for the three Models, with the exception of the corrector lens in the optical box.

This light throw forms an elongated projected beam with a circular base of 4.5 in. diameter at the corrector lens and a rectangular base at the viewing screen. It can be "folded" in this path with another (large) 45° plane mirror, near the top of the cabinet, for horizontal projection. The spherical mirror, the 45° plane mirror and the aspherical corrector lens inside the optical box, are adjusted in the factory and remain in adjustment under normal use. No adjustments of the elements or of the corrector lens should be attempted.

The optical unit is dust-proof. Only the upper face of the corrector lens is exposed. This corrector lens is made from a special gelatin-in-water solution molded to a flat glass plate. This solution is shrunk, by controlled density and evaporation, to the correct shape. The lens is treated against fungus growth and atmospheric influences and then is chemically hardened. The corrector plate is covered with another glass plate so that it can be dusted with an ordinary cloth without being scratched. The linear magnification of the picture is 9.0. A numerical aperture of 0.62 is obtained with the "folded Schmidt" system.

HIGH VOLTAGE POWER SUPPLY (160B OR 160 B-1)

This unit supplies the 25-kv required for the second-anode of the 3NP4 tube. It is small in size (8-1/2 in. high, 4-1/2 in. wide and 7 in. long); light in weight (5 lbs.); has great stability for optimum picture quality and causes no radiation interference with its associated television receiver or with near-by television or radio-receivers.



It consists of the following parts:

a) Cover

b) 2 tubes - 6BG6G
6SR7

c) Sealed Can with 4 leads and H.V. lead and anode connector for 3NP4 tube

d) Chassis and circuit components (see drawing on page 10)

Two types of this unit are used; 160B or 160B-1

The performance characteristics are identical. However, in the model 160B-1, the negative side of the plate power input has been insulated from the chassis.

The sealed can contains 3 rectifier diodes, type EY51, a specially designed transformer using a new low-loss magnetic core material (Ferroxcube) and high-voltage capacitors. Replacement of this can, if necessary, is a simple service operation.

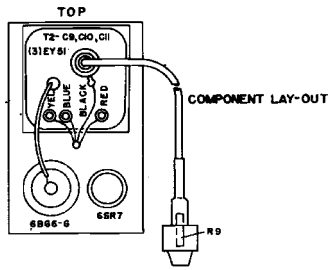
DESCRIPTION OF THE CIRCUIT

The triode section of the 6SR7 tube operates as a conventional blocking oscillator, whose frequency is 1000 ± 70 cycles. The saw-tooth voltage which it generates, is applied between the control grid and cathode of the 6BG6G driver tube, which is biased beyond cut-off. The driver tube plate-current flows through a portion of the primary of the high-voltage transformer, in pulses corresponding to the saw-tooth peaks of the input signal. The top end of the primary is connected to the voltage tripler circuit. The peak voltage across the high-voltage winding is approximately 8.5 kv. Three indirectly heated rectifier tubes, which have been developed for pulse operation, are used in the voltage tripler circuit. The heater power is derived from individual windings on the high-voltage transformer. Because the transformer is self-resonant to approximately 25 kc/s, each 1000 cycle pulse will start a damped train of high voltage transient oscillations whose frequency is 25 kc/s and whose initial peak amplitude is approximately 8.5 kv. The amount of power supplied to the heaters of the rectifier tubes is a function of the frequency. Therefore, in order to maintain the proper operating temperature on the rectifier heaters, the blocking oscillator frequency must be held to 1000 ± 70 cycles. A trimmer condenser C-1 which is accessible through a hole in the side of the chassis serves to adjust this frequency. This adjustment has no effect on H.V. amplitude, and should not be touched except when a frequency determining element requires replacing and then only with the proper equipment

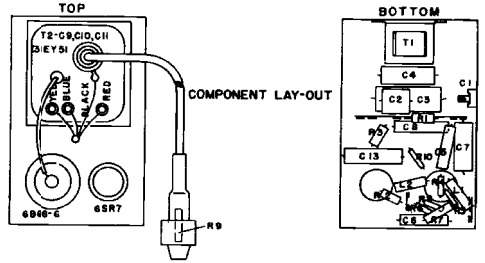
Automatic control of the driver tube bias, by means of a control voltage derived from the voltage peaks across the resonant circuit provides a most effective method of obtaining high power efficiency and good regulation. The control voltage is obtained from a separate winding on the high-voltage tripler transformer and is rectified by the diode sections of the 6SR7 tube. The rectified control voltage is filtered by the network consisting of C6, C8, and R8, and then applied to the driver grid circuit across resistor R6, The use of this method of automatic voltage control of the driver tube provides a regulation characteristic which is substantially flat within the desired operating range.

The output voltage falls off very rapidly beyond this range. This is a very desirable feature from the viewpoint of protection against external short circuits. It also reduces the accidental shock hazard. Despite this, *USE EXTREME CARE WHEN WORKING ON THE HIGH VOLTAGE CIRCUITS.*

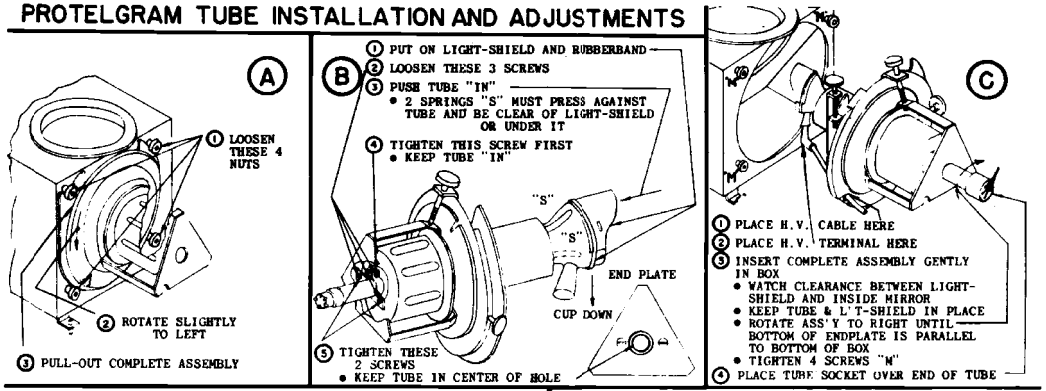
HIGH VOLTAGE POWER SUPPLY
MODEL 160-B



HIGH VOLTAGE POWER SUPPLY
MODEL 160 B-1

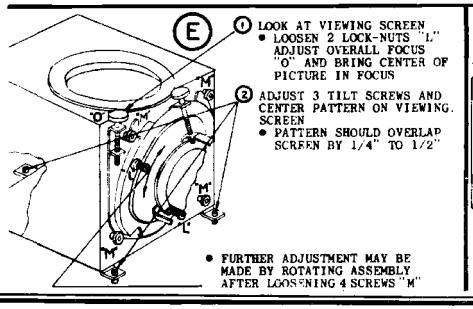


PROTELGRAM TUBE INSTALLATION AND ADJUSTMENTS

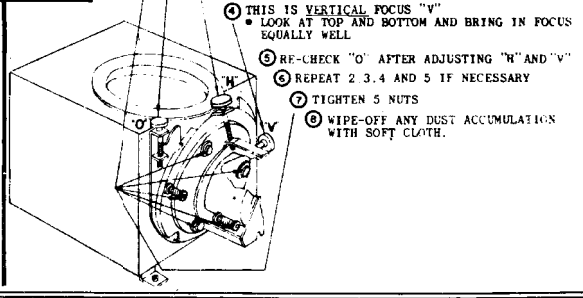


D ELECTRICAL ADJUSTMENTS.

1. PROPERLY TUNE RECEIVER TO TRANSMITTED TEST PATTERN. LOOK DOWN INTO BOX AT PATTERN REFLECTED FROM 45° MIRROR.
2. ADJUST ELECTRICAL CONTROLS OF RECEIVER TO OBTAIN NORMAL AND PROPERLY FOCUSED PATTERN ON TUBE FACE AS DESCRIBED IN SERVICE NOTES.
3. ADJUST SIZE OF PATTERN AND CENTER SO THAT EACH CORNER JUST TOUCHES EDGE OF TUBE FACE.



F LOOK AT VIEWING SCREEN WHILE MAKING THESE ADJUSTMENTS.



C1	110-560	MMF	MICA TRIMMER	R1	390 K	±5%	1 W.
C2	2700	MMF	±5% 500V. MICA	R2	220 K	±10%	1 W.
C3	.1	MMF	600 V.	R3	18 K	±10%	1 W.
C4	8	MMF	250 V.	R4	330	±20%	.5W.
C5	.01	MF	600 V.	R5	330 K	±10%	.5W.
C6	.015	MF	400 V.	R6	220 K	±5%	.5W.
C7	20	MF	50 V.	R7	390	±10%	2W.
C8	.03	MF	400 V.	R8	47 K	±5%	.5W.
C9	5000	MMF	10 K.V.	R9	1.5	MEG.	
C10	2500	MMF	20 K.V.	R10	330	±20%	.5W
C11	2500	MMF	20 K.V.	L1	RF CHOKE		
C12	100	MMF	±20% 500V. MICA	L2	RF CHOKE		
C13	.1	MFD	400 V.				

BLOCKING OSCILLATOR
FREQUENCY 1000C/S±70C/S

VOLTAGES MEASURED WITH V.T.V.M. WITH RESPECT TO B- AND AT NORMAL PICTURE CURRENT (90 μA AMPS.)

3NP4 CATHODE-RAY TUBE

SPECIFICATIONS

GENERAL CHARACTERISTICS

Electrical

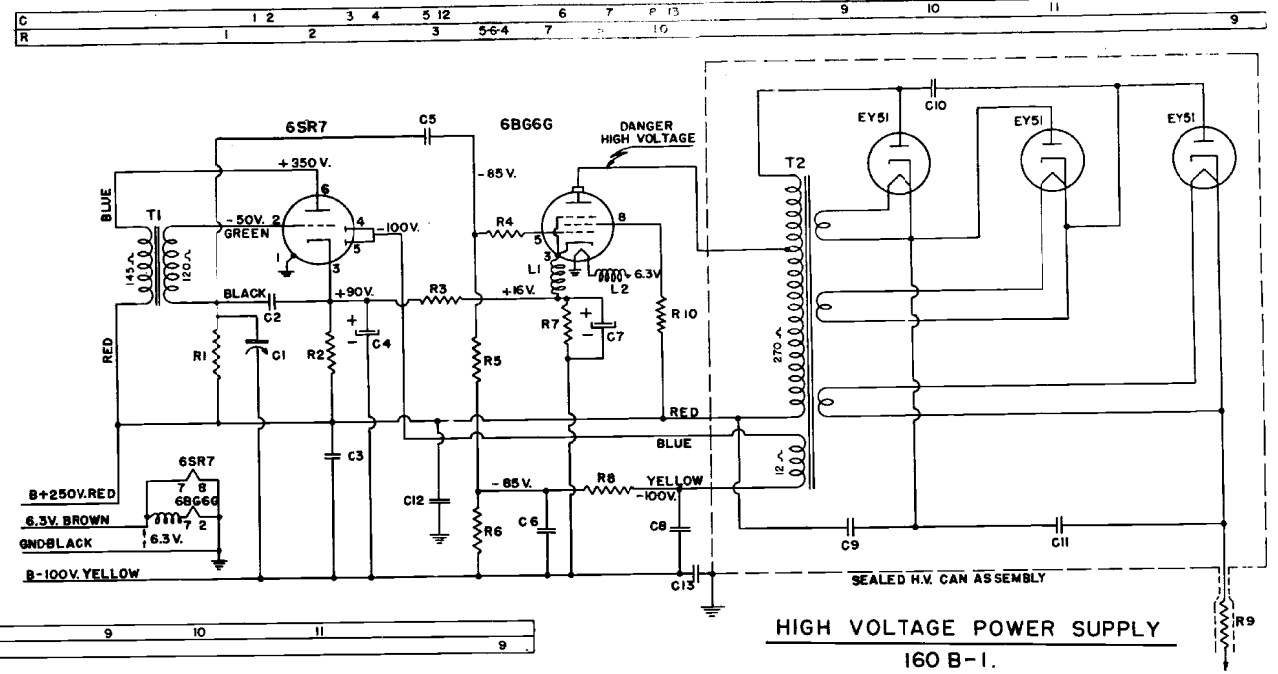
Heater Voltage:	6.3 volts
Heater Current:	0.6 amps ± 10%
Focusing Method:	Electromagnetic
Deflecting Method:	Electromagnetic
Maximum Deflection Angle:	42°
Phosphor:	No.4 aluminized
Fluorescence:	White 6000° - 8000° Kelvin
Persistence:	Medium

Interelectrode Capacitances

Cathode to all others:	8 mmf
Grid to all others:	14 mmf
Ext. coating to Anode:	min. 275 mmf, max. 375 mmf

Maximum Ratings

Anode Voltage:	25,000 volts DC
Grid Voltage Negative Bias:	125 volts DC
Grid Voltage Positive Peak:	2 volts DC
Max. Heater to Cathode Voltage: (with heater positive or negative)	175 volts DC



HIGH VOLTAGE POWER SUPPLY
160 B-1.

Typical Operating Conditions

Anode Voltage:		24,000 volts DC ± 1 kv
Anode Current Normal:		90 microamps Momentary highlights
Anode Current Peaks:		150 microamps 500 microamps
Grid Voltage for visual extinction of undeflected focused spot:		minus 60 volts DC ± 40%
Focusing Current:	shunt	290 ohm coil 125 milliamps - nominal
	series	11,000 ohm coil 21 milliamps - nominal

Grid Circuit resistance not to exceed 1.5 megohms

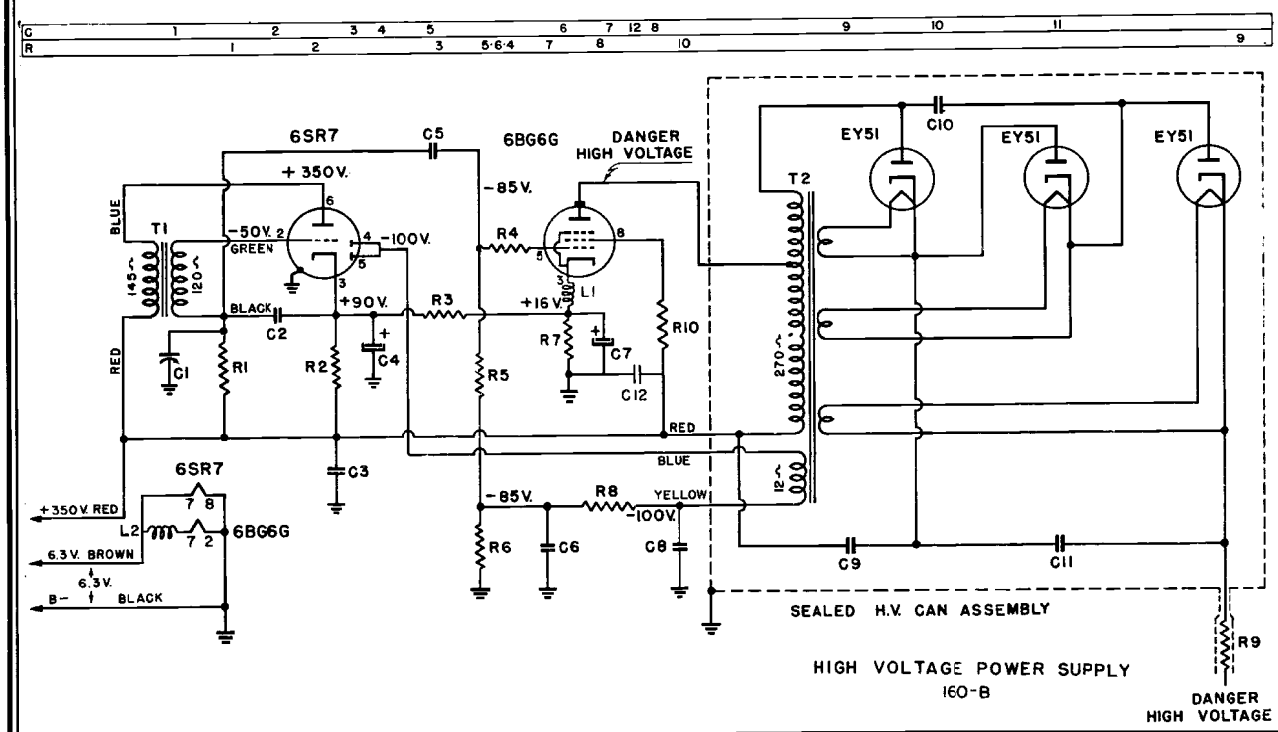
Base Connections Pin No.		Socket Wire Color
1	Grid	Red
2	Heater	Yellow
3	Ground	Blue
4	Heater	Black
5	Cathode	Green
	Anode	Bulb Contact

Due to the extremely high light intensity produced on the phosphor on the tube face, protective circuits are incorporated in the television chassis. This is done to prevent line burns on the phosphor, in case of sweep-circuit failure.

Bombardment of the face plate of the tube by a 25 kv electron beam produces soft X-rays which are well shielded by the protecting optical box. Therefore, it is recommended that the tube be operated only inside the optical box.

Should it become necessary to operate the 3NP4 tube outside the optical box, the following recommendations should be followed:

Protect the observer by placing a lead glass shield in front of the tube. The equivalent lead thickness of the shield must not be less than 0.5 mm. The shield location and dimensions should be such as to interrupt the X-ray radiation between the tube and the observer. This precaution is desirable for protection of the observer in the zone within 40 inches of the tube.



HIGH VOLTAGE POWER SUPPLY
160-B

BLOCKING OSCILLATOR
FREQUENCY-1000 C/S ± 70C/S

VOLTAGES MEASURED WITH V.T.V.M. WITH RESPECT TO CHASSIS AND AT NORMAL PICTURE CURRENT (90 μA AMPS.)

C1	110-560	MMF	MICA TRIMMER	R1	390 K	±5%	1 W.
C2	2700	MMF	±5% 500V. MICA	R2	220 K	±10%	1 W.
C3	.1	MF	600 V.	R3	18 K	±10%	1 W.
C4	8	MF	250 V.	R4	330	±20%	.5W.
C5	.01	MF	600 V.	R5	330 K	±10%	.5W.
C6	.015	MF	400 V.	R6	220 K	±5%	.5W.
C7	20	MF	50 V.	R7	390	±10%	2W.
C8	.03	MF	400 V.	R8	47 K	±5%	.5W.
C9	5000	MMF	10 KV.	R9	1.5	MEG.	
C10	2500	MMF	20 KV.	R10	330	±20%	.5W
C11	2500	MMF	20 KV.	L1	R.F CHOKE		
C12	100	MMF	500V MICA	L2	R.F. CHOKE		

HOW TO INSTALL OR REPLACE THE 3NP4 PROJECTION TUBE

TUBE POSITIONING ADJUSTMENTS

The face of the 3NP4 tube is the first lens in the projection system.

It must be positioned accurately to obtain satisfactory resolution.

Three thumbscrew adjustments "O", "H" and "V" are used for this purpose.

"O" moves the tube towards and away from the concave mirror.

"H" tilts the tube horizontally.

"V" tilts the tube vertically.

The chart shows the recommended procedure of installing the tube and adjusting the position of the tube in the optical box. After a little practice, this procedure can be done within 5 minutes. Following is a more detailed explanation.

(A)

1. Loosen the 4 nuts "M" which hold the tailpiece to the optical box.
2. Rotate the tailpiece to the left and
3. Pull-out the tailpiece.

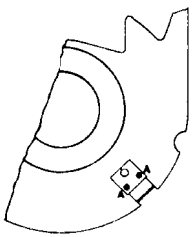
Note: This operation should be done with care to prevent the tube from hitting the 45° plane mirror.

Also be sure to clear the anode cable.

(B)

1. Loosen the screw on the tube clamp and the 2 screws which center the tube neck in the hole in the triangular endplate.
2. A light-shield and neoprene-band are packed with the tube. Place light-shield over top of tube locating it over the 2 projecting lugs on the tube and hold it in place with the neoprene-band as shown. The 2 springs "S" must make good contact with the aquadag (black coating) on the outside of the tube. Therefore the springs must be kept clear of the light-shield or placed under it.
3. Insert the tube through the deflection yoke, keeping the anode cup "down".
4. Push the tube as far as it will go into the deflection yoke and tighten the screw in the tube clamp. To avoid breaking the neck of the tube do not tighten the screw with undue force; however, the clamp should be tight enough to prevent the tube from moving out of the deflection yoke.
5. Then tighten the 2 screws on the face of the triangular end-plate keeping the neck of the tube in the center of the hole.

CAUTION: In this operation or in any subsequent operation, *do not* hold the tailpiece assembly by grasping the deflection yoke.

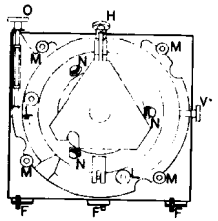


1. Place the H.V. cable connector in the anode cup on the tube. Be sure that the connector is attached securely to the metal button in the anode cup.
2. Loosen the 2 screws "A" holding the H.V. cable clamp and insert cable through hole in plastic strip. Take up the slack in the cable. Push clamp inward and tighten the 2 screws "A".
3. Carefully insert the tailpiece in the optical box. Be sure that the position of the light-shield is not disturbed and that the tube clears the opening in the 45° plane mirror. *It is essential that the position of the tube in the tailpiece is not disturbed. The tube must remain firmly seated in the deflection yoke.*
4. Rotate the tailpiece to the right until the slots in the tailpiece engage the 4 nuts "M". Keep the bottom of the triangular endplate parallel to the bottom of the optical box and hand tighten the 4 nuts "M".
5. Connect the tube socket to the tube. While doing this, hold the neck so as to avoid pushing the tube out of its position in the deflection yoke.

(D) ELECTRICAL ADJUSTMENTS

1. Plug in the line-cord and tune the receiver to a transmitted test pattern. Look down into the optical box at the pattern reflected from the 45° plane mirror.
2. Adjust the electrical controls of the receiver as described in the receiver Service Notes and place the pattern, properly focused, on the center of the tube so that each corner of the pattern just touches the edge of the tube face.

(E)



1. Now look at viewing screen. Loosen two nuts "L" which lock the overall adjustment "O". Bring the center of the picture in focus on the viewing screen by adjusting the knob "O".
2. If the pattern is not level on the screen, it may be adjusted by slightly rotating the tailpiece. To do this loosen 4 nuts "M" and tighten after proper positioning of the tailpiece.
3. If the pattern is not properly centered on the viewing screen, then adjust the three tilt screws "F" after loosening the locking screws, which should be re-tightened after adjustments have been made.

WARNING

Bombardment of the face plate of the tube by a 25 kv electron beam produces soft x-rays which are well shielded by the protecting optical box when the tube is in its normal operating position. Without this shielding, free radiation will result, prolonged exposure to which could prove harmful. Therefore, it is recommended that the tube be operated only inside the optical box

(F)

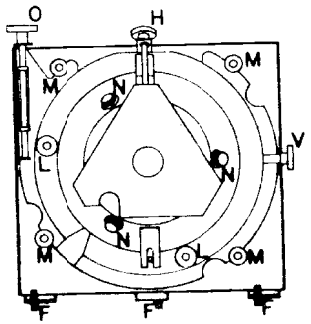
Look at the viewing screen while making the following adjustments. (Turn down contrast control on the receiver and look at the lines on a medium-bright raster).

1. Slightly loosen 2 nuts "L" and 3 screws "N".
2. Adjust the overall focus "O" and focus the center of the raster only.
3. Adjust the horizontal focus "H" so that both sides of the raster focus equally well.
4. Adjust the vertical focus "V" so that the top and bottom of the raster focus equally well.
5. Re-check overall adjustment "O".
6. Repeat steps 2,3,4 and 5 if necessary.
7. Hand-tighten 2 nuts "L" and 3 screws "N".
8. Wipe-off any dust accumulation on the corrector lens with a soft rag.

Note: If a dust-shroud is used around the optical box, be sure that the shroud is fitted securely around the optical box and does not interfere with the light rays from the corrector lens.

SERVICING THE TAILPIECE (160AT-60) (160AT-61)

REPLACEMENT OF FOCUS COIL ASSEMBLY



1. Disconnect tube socket "A".
2. Disconnect anode connector "B" from tube cup.
3. Loosen 3 screws "C".
4. Gently remove 3NP4 tube.
5. Remove triangular plate "D" by unscrewing 3 screws "E".
6. Loosen cable clamp "F".
7. Loosen 2 mechanical centering adjustment screws "G".
8. Remove 2 snap washers "H" and spring "I".
9. Remove focus coil and replace with new one.

10. Adjust 2 screws "G" as follows:

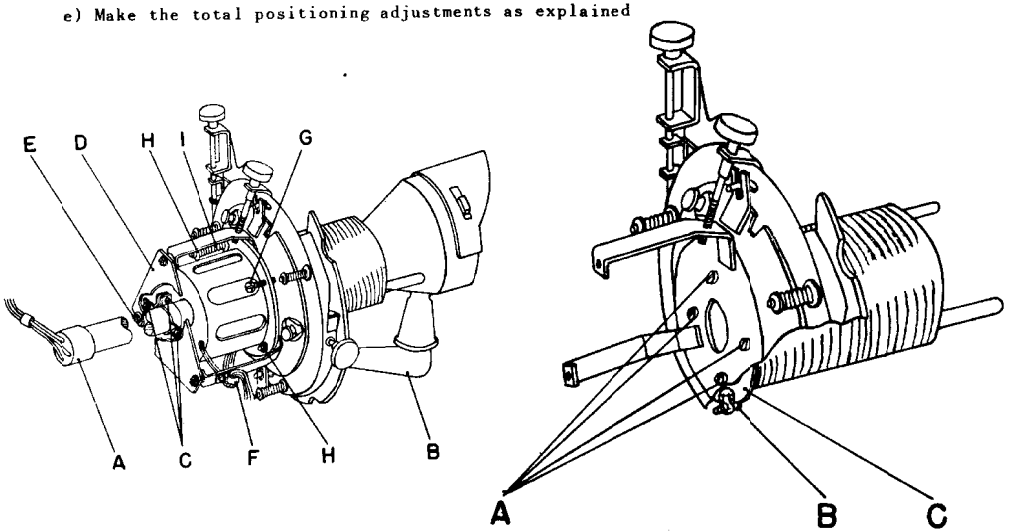
a) Completely assemble Protelgram unit in the receiver. (See Tube Installation)

b) Switch the receiver "ON" and tune to a transmitted pattern.

c) Set both the horizontal and vertical centering controls on the receiver in the middle position of the total travel.

d) Adjust the 2 screws "G" until the 4 corners of the transmitted pattern just touch the edge of the tube face.

e) Make the total positioning adjustments as explained



SERVICING THE TAILPIECE

REPLACEMENT OF DEFLECTION YOKE

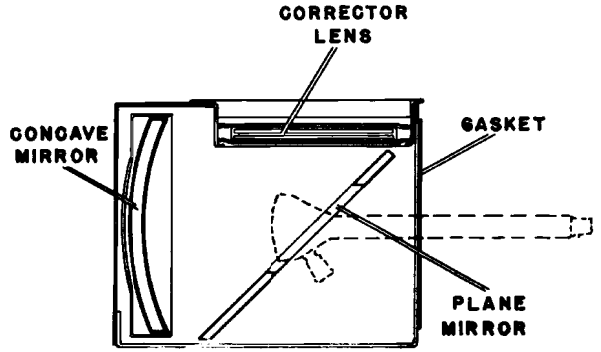
1. Remove 3NP4 tube and focus coil as described
2. *Carefully note the mounting position of the yoke to be removed.*
3. Unscrew 4 screws "A".
4. From opposite side of mounting plate remove the ground lug screw "B".
5. Remove the plastic insulating disc "C".
6. Remove the deflection yoke and replace with a new one. The yoke must be positioned exactly as it was found
7. Install the tube and make the tube positioning adjustments

SERVICING THE OPTICAL BOX (160A-0) (161A-0)(162A-0)

The optical box contains the concave mirror, the 45° plane mirror and the aspherical corrector lens. These are optically aligned at the factory and no adjustments should be attempted under any circumstances. Optical parts must be replaced at the factory.

This is a dust-proof unit and the side plates should not be removed except in those cases when the mirrors require cleaning. As a rule, this is not required. However, the unit may be used in places where dust or grease accumulation may be unusually severe. If, in such cases, the mirrors require cleaning, first remove dust with a camel's hair brush and then polish with lens tissue, such as is used for polishing eye-glasses. Where discoloration or dirt is excessive, apply a spray such as "Windex".

The top of the corrector lens should be cleaned with a *soft* cloth.



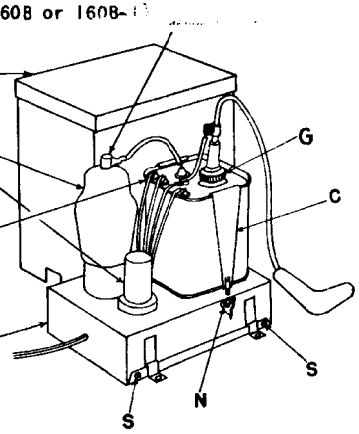
SERVICING THE HIGH VOLTAGE POWER SUPPLY (160B or 160B-1)

a) Cover

b) Tubes - 6BG6G
6SR7

c) Sealed Can with 4 leads and H.V. lead and Anode connector for 3NP4 tube

d) Chassis and circuit components



WARNING:

This unit supplies the 25 kv required for the operation of the 3NP4 cathode-ray tube. Although it is a reduced-hazard, pulse type power supply, whose power output capabilities are limited to the requirements of the 3NP4 tube, nevertheless, extreme care should be exercised while working on this unit.

REPLACEMENT OF SEALED CAN

1) Disconnect AC line from socket.

2) Remove plate cap from 6BG6G tube.

3) Unsolder 4 leads from terminals at the top of the can. *Do not* hold soldering iron to terminals any longer than necessary. *Do not* unscrew gland "G" at top of can.

4) Remove bottom of chassis by removing 4 screws "S"

5) Loosen 2 nuts "N" on underside of chassis thus releasing 2 clamps "C"
6) Replace with new can.

7) Tighten nuts on underside of chassis holding 2 clamps "C"

8) Replace bottom of chassis.

9) Solder 4 leads to terminals at top of can. Do not hold soldering iron to terminals any longer than necessary. (Note Color Coding of leads - Components layout

10) Place plate cap on 6BG6G tube. (See Precaution #1 following).

SERVICING THE H.V. POWER SUPPLY

SERVICE PRECAUTIONS

1) When replacing the 6BG6G tube, care must be taken to dress the 6BG6G plate lead away from all other connections and grounds. This lead should clear all objects by at least 1/4" to prevent corona discharge, as some radio interference may result.

2) When placing the cover on the high-voltage unit, make certain that it is not reversed. The 25-kv lead must go directly up through the cover and not cross over inside the box. Severe arcing and sparking may result if the cover is reversed.

HIGH-VOLTAGE SUPPLY SERVICE HINTS

In the interests of safety, testing of this unit should be conducted, as much as possible, with the power supply turned off. If the defective component cannot be located in this manner, an operating voltage check should prove helpful. The high voltage supply schematics, show the normal operating voltages obtained with a vacuum tube voltmeter. These check points are all accessible by removing the bottom cover of the unit, *where under normal circumstances,* no voltages in excess of those externally applied are present.

If failure occurs, first check the 6SR7 and the 6BG6G tubes by replacing them. If this does not correct the difficulty, check to see that the blocking oscillator is functioning as evidenced by a bias of approximately - 50 volts, on the grid of the 6SR7 tube.

The following conditions could indicate failure of the sealed can:

Reduced picture brightness

Excessive sweep width and height

No picture

"No picture" might also indicate action of the picture tube protection circuit.

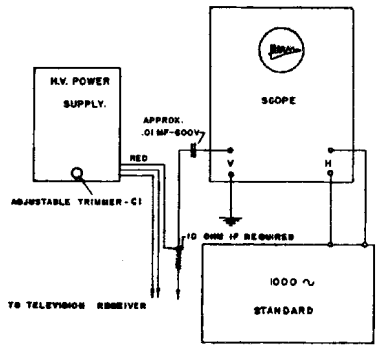
As a check for can operation, the high-voltage output may be measured using a high-voltage probe such as the RCA-WG-288 30,000 volt probe and a "Voltohmyst" (Note: Use caution in this measurement).

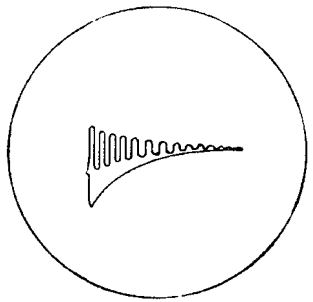
SERVICING THE H.V. POWER SUPPLY

ADJUSTMENT OF THE HIGH-VOLTAGE SUPPLY OSCILLATOR

The frequency of the blocking oscillator in the high-voltage supply must be maintained at 1000 ± 70 cycles. Adjustment should not be necessary unless a frequency determining element such as the blocking oscillator transformer has been replaced or altered. The 1000 cycle adjustment has negligible effect on either the output voltage or current regulation and should not be tampered with in an attempt to rectify failure. Its only function is to provide the proper frequency which determines just the proper amount of power to the heaters of the three high-voltage rectifier tubes inside the sealed can, to assure maximum life of these tubes.

Adjust C-1 with an oscilloscope and a dependable 1000 cycle generator. Sufficient blocking oscillator voltage can usually be obtained from the "B+" red lead to operate the vertical amplier of the oscilloscope. If sufficient voltage cannot be obtained from the red lead to produce a signal on the oscilloscope, a resistor of about 10 ohms should be soldered in series with the red lead. An increased oscillator signal can be obtained from the H.V. supply side of the resistor. *Be sure to remove this resistor after the frequency is set.* With the 1000 cycle signal from the generator applied to the horizontal sweep amplifier of the oscilloscope, adjust C-1 until a single stable Lissajou figure is obtained.





LISSAJOU FIGURE FOR 1000 CYCLE ADJUSTMENT

TAILPIECE

Item	Description	Code Number
1	Projection Tube Light-shield	P3.000.42
2	Dust ring - Neoprene	P2.000.35
3	Deflection Yoke Assembly	P9.000.22
4	Mounting and overall adj. plate assy.	P9.000.41
5	Vertical adjustment screw assembly	P9.000.57
6	Vertical adjustment plate assembly	P9.000.40
7	Washer	P4.000.92
8	Locking sleeve	P4.000.96
9	Spring	P4.000.31
10	Washer	P4.000.99
11	Thumb nut	P3,000.50
12	Snap ring	P4.000.78
13	Washer	P3.000.22
14	Spring washer	P4.000.74
15	Horizontal adjustment screw	P9.000.55
16	Coil mounting plate assembly	P9.000.56
17	Washer	P4.000.42
18	Spring washer	P4.000.40
19	Thumb screw	P3.000.20
20	Focusing Coil adjustment screw	G5.058.10
21	Spring	P4.000.32
22	Washer	P4.000.72
23	Snap ring	P4.000.78
24	Screw	G5.033.12
25	Tube clamp	P9.000.47
26	Tube clamp plate	P9.000.53
27	Washer	P4.000.73
28	Screw 5-40	G5.033.05
29	Screw 8-32	G5.053.06
30	Washer	G5.301.30
31	Tube clamp plate spacer	P4.000.89
32	Shunt focus coil and housing assembly 11,000 ohm, complete	P9.205.11M
32	Series focus coil and housing assembly 290 ohm, complete	P9.205.12M
33	Focus coil housing	P9.000.12
34	Screw 5-40	G5.033.03
35	Focus coil housing cover	P4.000.33
36	Yoke mounting screw	G5.021.05
37	Nut, hexagon, 8-32	G5.390.05
38	Spring bushing	P4.000.93
39	Spring	P4.000.31
40	Washer	P4.000.92
41	Deflection-yoke insulating spacer	P2.000.46
42	Spring	P4.000.85
43	H.V. Connector clamp	P4.000.46
44	H.V. Connector clamp insulator	P2.000.43
45	Plate Retaining Stud	P4.000.25
46	Nut	G5.390.25

HIGH-VOLTAGE SUPPLY

CAPACITORS

C1	110-560	mmf	Mica Trimmer	P8.000.09
C2	2700	mmf ± 5%	500 V Mica	G8.374.00
C3	.1	mf	600 V	G8.381.31
C4	8	mf	250 V/W.D.C.	G8.386.43
C5	.01	mf	600 V	G8.381.23
C6	.015	mf	400 V	G8.381.02
C7	20	mf	5J V/W.D.C.	G8.386.30
C8	.03	mf	400 V	G8.381.05
C9	5000	mmf)		
C10	2500	mmf) part of T2		
C11	2500	mmf)		
C12	100	mmf ± 20%	500 V Mica	G8.377.28

RESISTORS

R1	390 K ± 5%	1 W	G8.316.15
R2	220 K ± 10%	1 W	G8.318.05
R3	18 K ± 10%	1 W	G8.317.40
R4	330 ± 20%	1/2 W	G8.314.09
R5	330 K ± 10%	1/2 W	G8.312.62
R6	220 K ± 5%	1/2 W	G8.311.09
R7	390 ± 10%	2 W	G8.346.20
R8	47 ± 5%	1/2 W	G8.310.89
R9	H.V. Connector Resistor with Screw End		P9.000.15
R9	H.V. Connector Resistor with Spring End		P9.000.36
R10	330 ± 20%	1/2 W	G8.314.09

TRANSFORMERS

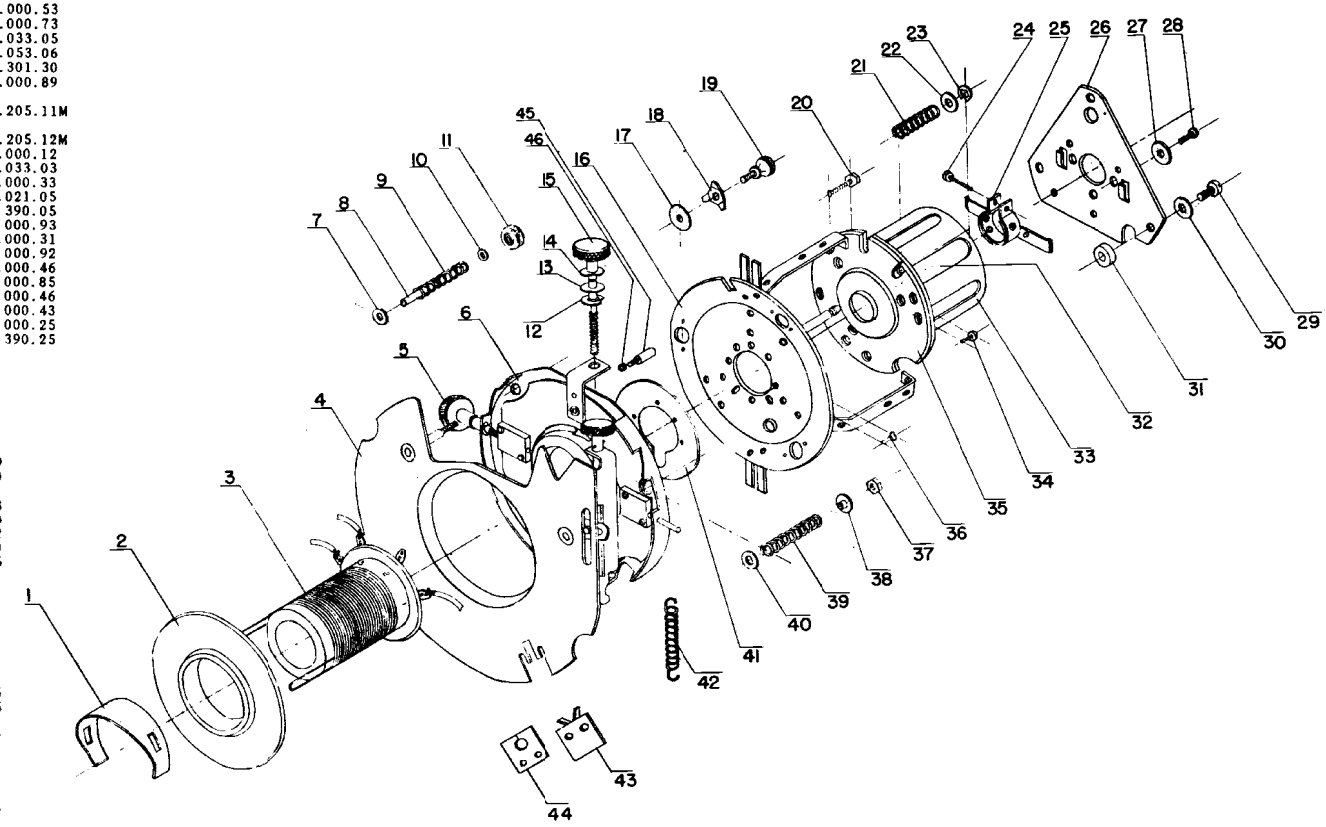
T1	Blocking Osc. Transformer	P8.000.01
T2	High Voltage Can Sealed Assembly (with Rectifiers, and C9, C10, C11)	P9.000.08
L1	R.F. Choke	P9.001.19
L2	R.F. Choke	P9.001.19

TUBES

6BG6G
6SR7

MISCELLANEOUS PARTS

Grommet for High Voltage Supply	P2.000.52
High Voltage Supply Housing Bottom Cover	P4.000.00
High Voltage Supply Housing Top Cover	P4.000.04
High Voltage Supply Metal Housing	P4.000.03
High Voltage Transformer Clamp Assembly	P9.000.02
High Voltage Transformer Neoprene Pad	P2.000.51
H.V. Supply Terminal Strip	G8.052.29
H.V. Connector Spring	P3.000.51
Optical Box Back Gasket	P2.000.40



TAILPIECE