Film-Tech

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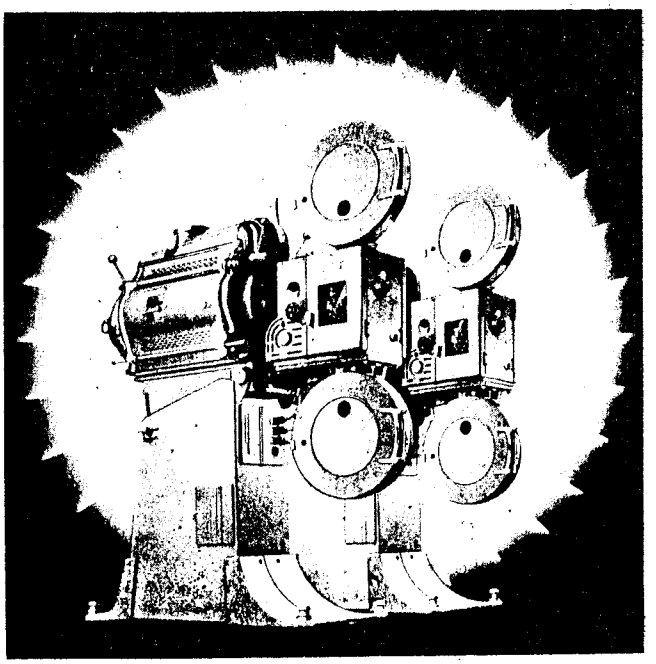
OPERATING AND SERVICE MANUAL

DeVRY

"12000 SERIES"

35MM MOTION PICTURE SOUND EQUIPMENT



DeVry Corporation

1111 ARMITAGE AVE. CHICAGO 14, ILL., U.S.A.

***Branch Offices:* New York -- Hollywood**

Distributors in Principal Cities of the World

GUARANTEE

TYPE..... No.....

Be it known that in consideration for the return of the attached REGISTRATION CARD properly filled out, the EQUIPMENT of the above type and number is warranted against imperfections in material and workmanship. If used according to printed instructions, kept properly cleaned and oiled and handled with reasonable care, should any of its parts (excepting lamp and tubes) prove defective in not functioning for a period of ONE YEAR from date of ownership (as shown by REGISTRATION CARD), such parts will be replaced or repaired without charge if returned, transportation charges prepaid, to our factory.

Read reverse side of this Card Carefully

DE VRY CORPORATION
1111 Armitage Ave.
Chicago 14, Illinois

READ CAREFULLY

TO OWNER:

It is understood that our guarantee is effective only when the equipment is oiled and cared for as instructed in the accompanying Manual and when this guarantee card is returned properly filled out.

Positively no guarantee services rendered if the mechanism is disassembled or otherwise tampered with—all repairs must be performed at our factory.

Transportation charges must be prepaid on all goods returned, whether returned to make good our guarantee or for charge repairs. When ordering accessories or parts, always specify type and number of the equipment. You are entitled to receive 100% satisfaction from your machine. If, thru any cause, you do not—inform us.

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SCHEMATIC WIRING DIAGRAMS

A. POWER REQUIREMENTS

1. PROJECTOR

115 volt, 60 cycle ALTERNATING CURRENT (A.C.) is required for the correct operation of the projector.

NOTE: The projector will not operate at correct speed on any frequency other than 60 cycle. Do not attempt to operate on Direct Current (D.C.) or 25, 40 or 50 cycle Alternating Current (A.C.), unless the projector is specifically designed for such operation.

2. AMPLIFIER

105-125 volt, 50-60 cycle ALTERNATING CURRENT (A.C.) is required for correct operation of the Amplifier, unless specifically made for other frequencies.

B. POWER CONSUMPTION

1. PROJECTOR DRIVE MOTOR (Running)

The power consumption of the projector drive motor while running is approximately 177 watts.

2. PROJECTOR DRIVE MOTOR (Starting)

The momentary starting current of the motor is 17 amperes or 1900 watts. The power line should be sufficient to carry this starting current with a minimum voltage drop.

3. AMPLIFIER

The power consumption of the amplifier depends on the model of amplifier. See amplifier name plate.

4. EXCITER LAMP RECTIFIER

The power consumption of the D.C. Exciter Supply Rectifier is approximately 60 watts.

5. CHANGEOVER

The power required by the changeover devices is instantaneous and, therefore, can be neglected for all practical purposes.

6. VOLTAGE READINGS

Voltage readings shown on amplifier diagrams taken with no signal, line voltage 120, all voltage readings to ground. Meter used for taking these readings is preferably 20,000 ohms per volt.

C. TUBE COMPLEMENT OF 12106 POWER AMPLIFIER

Type	Part No.	Code	Quantity
6N7G	4314	V1	1
6L6G	4327	V2 & V3	2
5U4G	4310	V4	1

D. TUBE COMPLEMENT OF 12107 EQUALIZER

6J5	4322	V1 & V2	2
5Y4G	4321	V3	1

E. TUBE COMPLEMENT OF 12110 MONITOR SPEAKER

117N7GT	4359	V1	1

F. TUBE COMPLEMENT OF 12111 PRE-AMPLIFIER

6J7	4301	V1 & V2	2

G. TUBE COMPLEMENT OF 12580 POWER AMPLIFIER
ALTEC LANSING 287W 250 WATT UNIT

805	4351	V1 & V2	2
866A	4348	V3 & V4	2

H. LAMP AND PHOTO TUBE DESCRIPTIONS

Type	Description	Part No.	Quantity
Exciter Lamp	T-5 bulb, prefocused base, C-8 filament, one ampere, 6 volt lamp.	399	1
Amplifier Pilot Lamp	Number 44, 6 to 8 volt bayonet base.	400	3
Aperture Framing Lamp	110 volt, 2 candle power, T7 bulb, candelabra base.	413	1
Monitor Speaker Pilot Lamp	110 volt, T-4½ bulb, candelabra base.	415	1
Photo-electric Cell	CE-25, small 3 pin highly sensitized P. E. cell, 60-70 volts. RCA 927 OR 5583 OR 1P32	4453	1

I. INSTALLATION

1. PLACEMENT OF EQUIPMENT

a. General

We assume that the best possible location for operating the equipment has already been selected. The preferred location is, of course, a fireproof projection booth.

A model projection booth would be 18 feet in length, 12 feet deep and 8 feet in height. These suggested dimensions are sufficient to provide for the installation of the two DeVry projectors, rectifiers, amplifier and booth accessories.

b. Projectors

The location of the projectors should be pre-determined so that the electrical conduits may be properly located. See Figure 1 for a suggested booth conduit layout, and the supplemental diagrams in the rear of this manual.

c. Arc Lamp Rectifiers

The arc lamp rectifiers are usually placed in a specially built power equipment room or on the booth wall or back wall, depending on the arrangement of the booth.

d. Amplifier

The placement of the amplifier will depend on the arrangement of the room or booth in which the equipment is to be shown. A suggested location is shown in Figure 1. However, never install the amplifier near a radiator or in a position where the ventilation is poor. Common failures in sound systems have occurred because of this.

When amplifiers 2820 or 2823 are used, the unit should be mounted on the front wall midway between the projectors and just below the observation port. These models do not require pre-amplifiers.

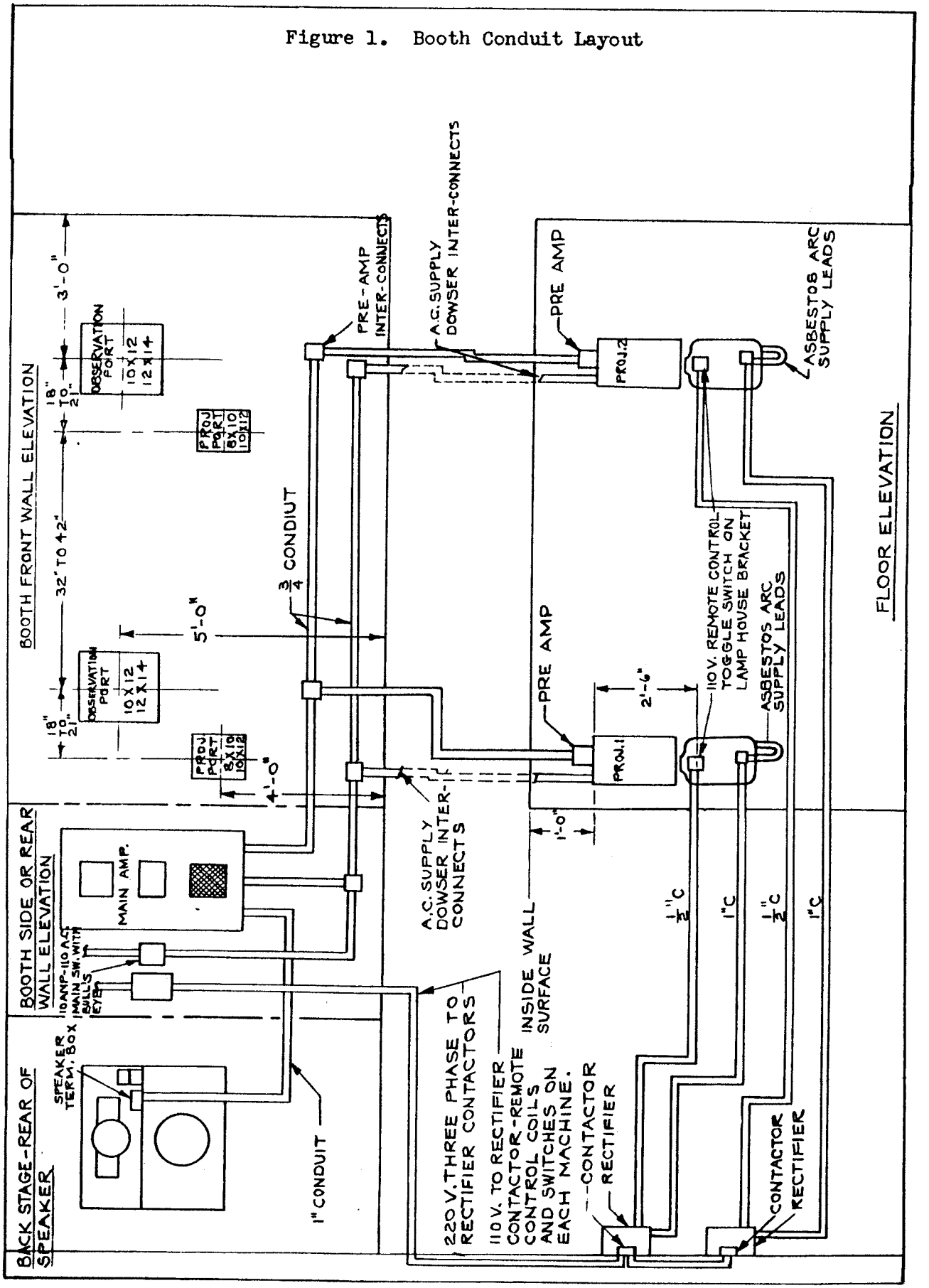
e. Pre-Amplifiers

The pre-amplifiers, one each, are to be mounted on the front of each projector when pre-amplifiers are supplied.

f. Loud Speaker System

The loud speaker should be located in a position that permits the horn to face the screen at two-thirds (2/3) of the height of the projected picture. A wooden or steel platform should be constructed around this height dimension.

Figure 1. Booth Conduit Layout



FOR INTERMEDIATE RECTIFIERS USE 220 VOLT SINGLE PHASE

2. INSTALLING THE PEDESTALS OR BASES

After determining the exact position the projectors are to occupy, place the pedestals or bases in place.

3. TILTING PEDESTAL OR BASE

This is accomplished by the hand wheel mounted inside the base. After correct tilt is made, securely tighten knurled nut against the hand wheel hub. See Figure 2.

4. MOUNTING PROJECTOR TO BASE

After the projector pedestals (bases) are secured in place, various projector elements - the head, feed and take-up magazines, pre-amplifiers, flywheel and arc lamps - are to be mounted or affixed in place.

a. Mounting Projector Head to Pedestal

The first step in this procedure is to securely attach the projector head supporting arm to the pedestal with the four 3/8-24x1½" long hexagonal head bolts and lock washers provided for this purpose. These four bolts will be found attached to pedestal's tilting platform. See Figure 4.

Then, with the tilting frame approximately level, mount the projector head to the supporting arm with the four 5/16-18x1½" long hexagonal head bolts and lock washers provided. Be sure these bolts are securely tightened. These bolts are packed in a separate envelope. See Figure 5.

b. Mounting Take-Up Magazine

The take-up chain, which is packed in a separate envelope, is then inserted through the hole in the base and placed over its sprocket. See Figure 5. Let chain hang until the take-up magazine is mounted.

The take-up magazine is attached to the head supporting arm with the two 5/16-18x1¼" hexagonal head bolts supplied. These bolts are partially threaded into the head supporting arm at the factory prior to shipping. When attaching the take-up magazine, the take-up drive chain is to be arranged as shown in Figure 5.

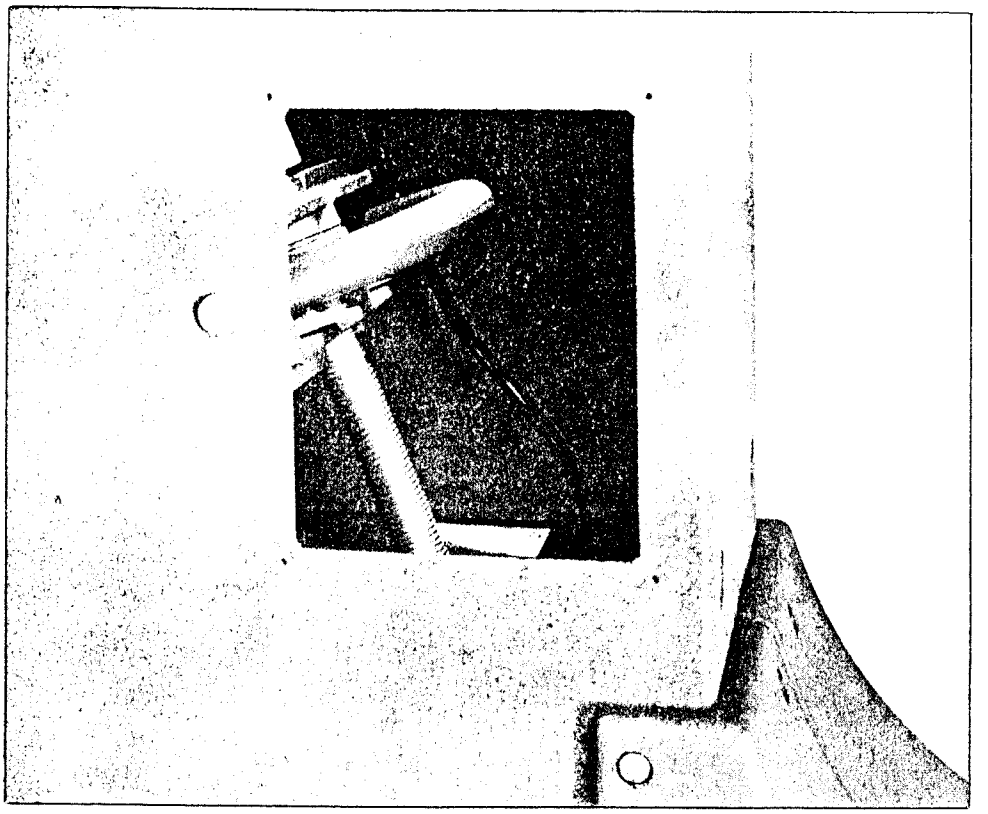
c. Mounting Reel and Take-Up Guard

The reel and take-up guard is then attached to the take-up magazine casting with the four 10/32x3/4" round head screws. These screws are partially threaded into their respective holes in the casting at the factory prior to shipping. See Figure 6 showing guard in place.

d. Mounting Feed Magazine

The feed magazine is attached to the projector head with the two 5/16-18x1¼" nuts and washers provided. These nuts and washers are

Figure 2. Hand Wheel in Base for Tilting



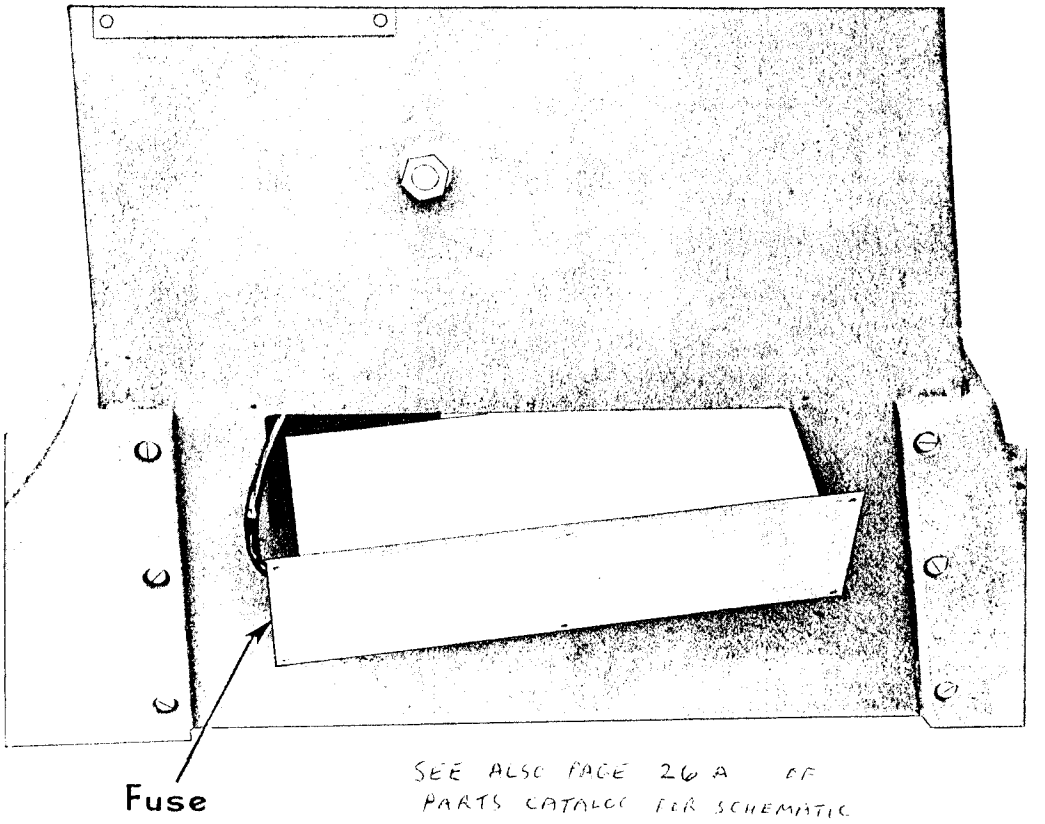
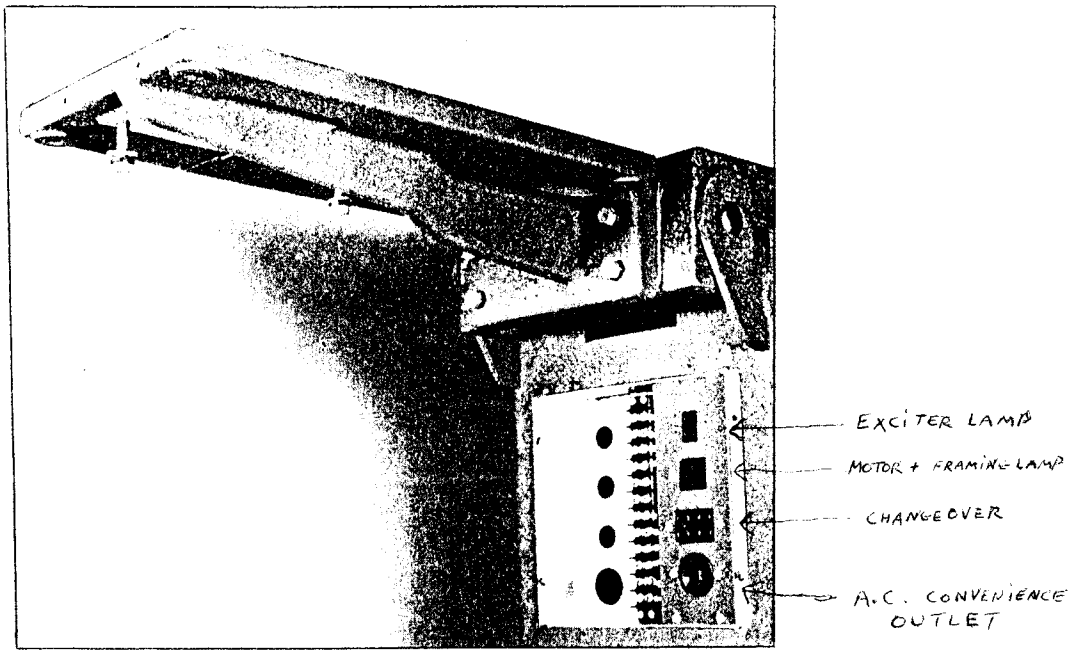


Figure 3. Exciter Lamp Rectifier in Base

Figure 4. Projector Head Support Arm Mounted to Base



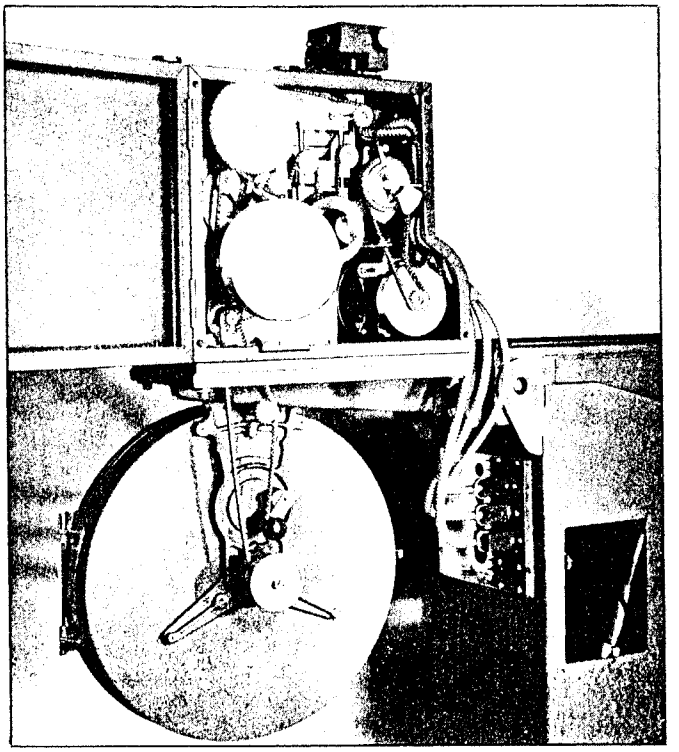


Figure 5. Projector Head Mounted
Take-up Magazine Mounted to Projector Head

threaded onto the permanent bolts at the factory before shipping. Be sure to securely tighten both nuts. See Figure 6 showing feed magazine in place.

e. Attaching Flywheel to Sound Drum Shaft

The hermetically sealed rotary sound stabilizer (flywheel) and a 1/8" diameter rod are packed and shipped in a separate carton. Figure 5 shows flywheel after mounting. IMPORTANT: All flywheels are carefully inspected before packing to be sure they are in perfect balance, a trueness that materially helps the DeVry soundhead to reproduce superb sound. Always handle the flywheel with extreme care.

To mount flywheel to the sound drum shaft, place either end of the 1/8" diameter rod into the unthreaded hole of the collar on the shaft. Thread the flywheel onto the sound drum shaft, meanwhile keeping the collar steadily in place with the rod. Turn flywheel until firmly tight. CAUTION: Do not overtighten as this might spring the shaft, which will cause the flywheel to wobble and produce "wows" in the sound during operation of projector.

5. MOUNTING THE PRE-AMPLIFIERS

The two pre-amplifiers are mounted on the front of each projector as shown in Figure 8. They are designed to float on flexible shock mountings to minimize microphonic noise.

The pre-amplifiers are shipped attached to the pre-amplifier mounting bracket. Remove this bracket by unscrewing the two lock nuts from the bottom. Open the pre-amplifier door and remove the 8/32" round head screw. The three 8/32" round head screws for holding the bracket to the projector will be found in their respective holes in the case. Remove these three screws. Figure 7 shows Pre-amplifier bracket mounted.

Attach the pre-amplifier bracket to the projector with these three 8/32" round head screws. Place the pre-amplifier on the bracket and thread the 8/32" round head screw from the inside of the pre-amplifier into the hole provided. Insert the two lock nuts and washers into their slots in the bottom of the pre-amplifier and securely tighten.

In making the electrical connections, it is necessary that the shield of the photo cell cable be connected to input terminal No. 2 and the core to input terminal No. 1.

If pre-amplifiers are not used, cables, plugs and jacks are provided. Using these items, plug the cables in between the projection heads and the amplifier.

6. MOUNTING ARC LAMPS

The arc lamp is placed on each pedestal in line with the adjustable slots and the lamp is secured in position with the arc lamp mounting bolts that come with the equipment. For further instructions regarding the arc lamp, refer to the manual on Operating and Servicing the Arc Lamp, a copy of

which is inserted inside each arc lamphouse. If available, an optical aligning rod should be used. If necessary, spacers should be used under the lamphouse to obtain optical correctness, in case the lamphouse is not of standard height for proper optical centering.

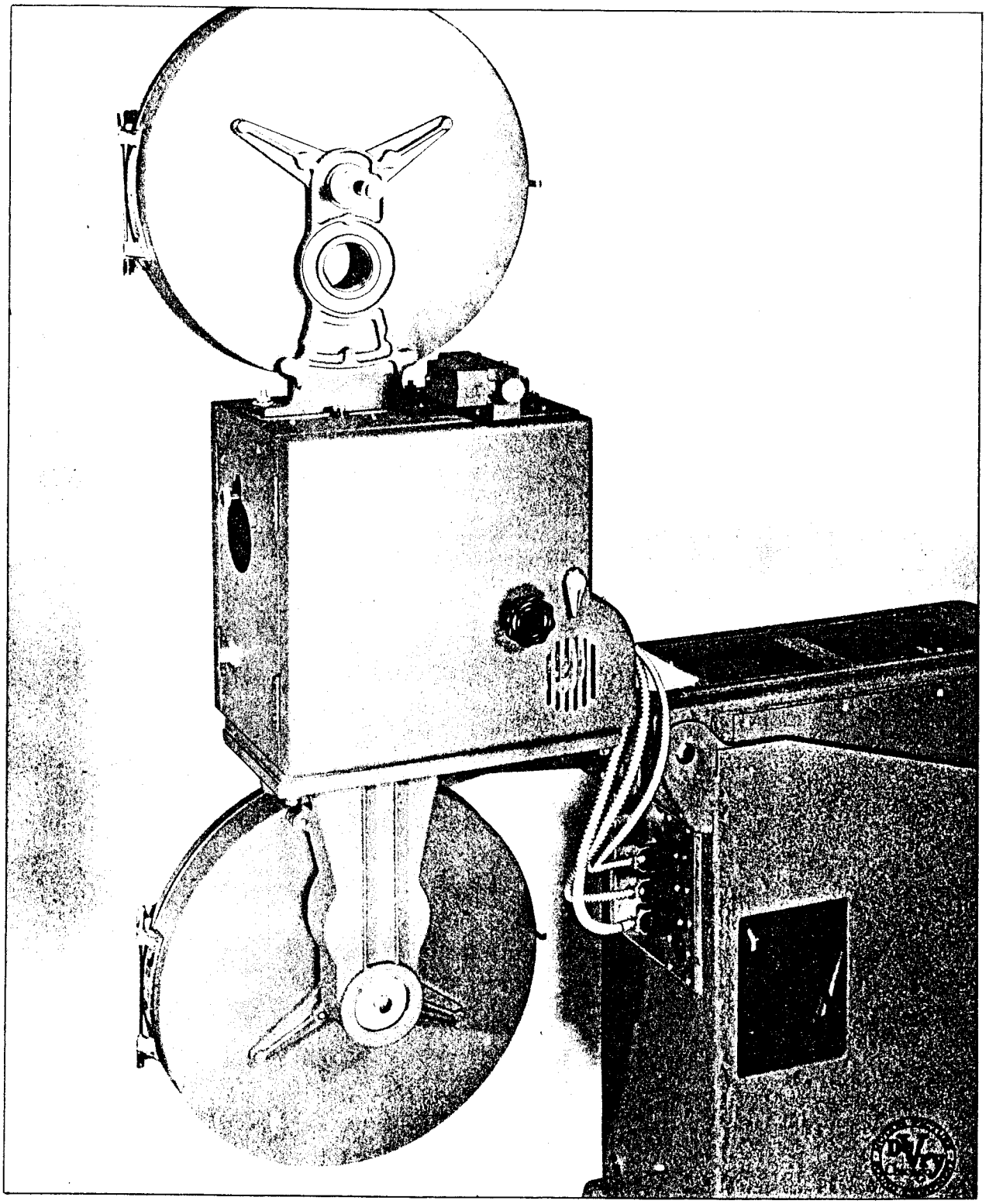
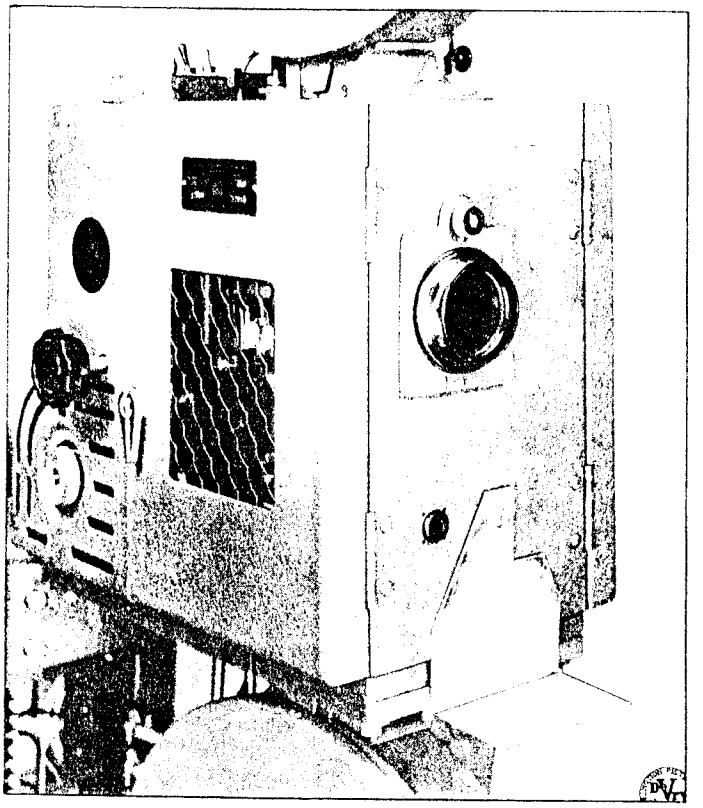


Figure 6. Projector Head, Feed Magazine, Take-up Magazine and Take-Up Guard Mounted in Operating Position.

Figure 7. Pre-amplifier Bracket Mounted to Projector Head



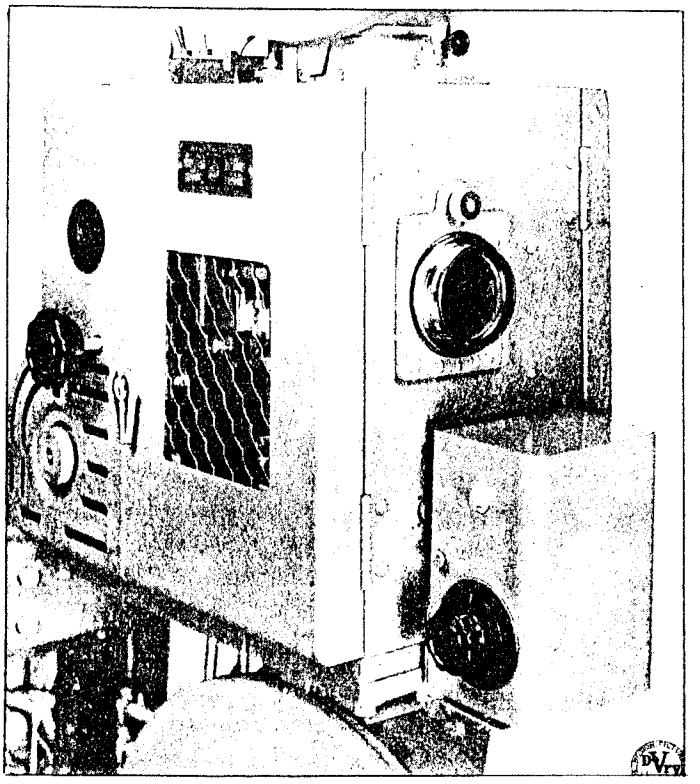


Figure 8. Pre-amplifier Mounted to Projector Head

J. OPERATING PROJECTOR and SOUND SYSTEM

1. PRELIMINARY TESTS

After the equipment is set up, recheck the electrical connections to be sure they were made according to markings on name plates of projectors, amplifiers and rectifiers and according to the Booth Conduit Layout and Schematic Wiring Diagrams.

a. Testing Automatic Dowsers

After checking all electrical connections, check the automatic dowsers with each changeover switch. When the changeover switch is depressed momentarily on each projector, the dowser should open and the exciter lamp should light on the projector corresponding to the switch depressed. Likewise, the exciter lamp should go out and the dowser close on the opposite projector.

b. Testing Sound System

Turn the amplifier "OFF-ON" switch to the "ON" position. Likewise, turn the field supply unit "ON" where system uses a field supply.

> CAUTION: Where D.C. field type speakers are used, NEVER feed a signal to the loud speaker system, without FIRST turning the field supply ON.

With the exciter lamp burning and the amplifier volume control about 75% on, take a strip of paper and pass it rapidly back and forth between the sound lens and sound drum. If a rumble is heard in the loud speaker and also in the monitor speaker, the sound system is ready for operation. Turn OFF the volume control.

c. Readying the Arc Lamp

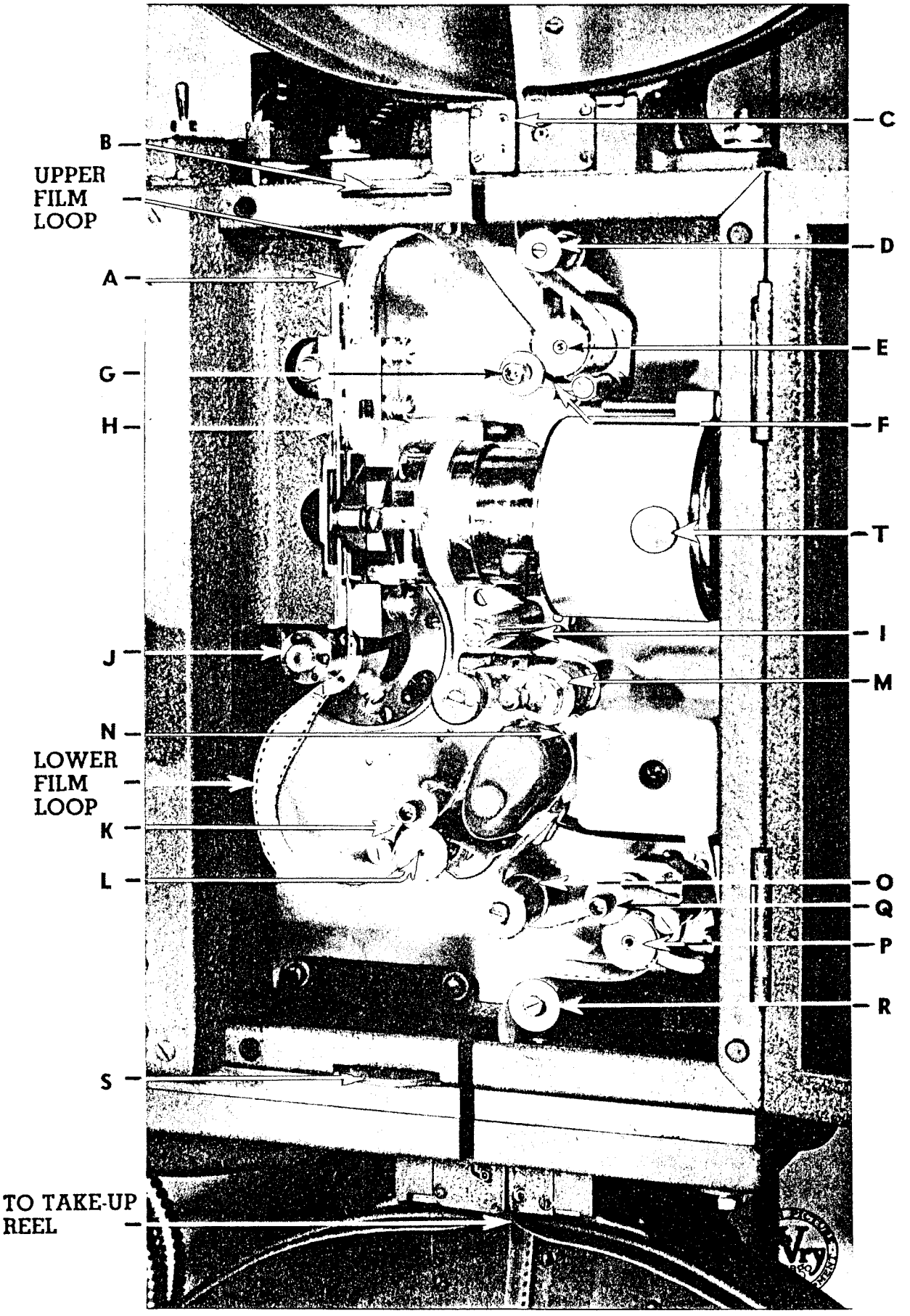
Complete information on installing the carbons into the arc lamps,as well as all preliminary operating steps, are given in Arc Lamp Instruction Manual found inside each lamphouse.

2. THREADING THE PROJECTOR (Refer to Figure 9)

a. Place reel of film on feed shaft in upper magazine. Lock reel in place. IMPORTANT: Reel must be placed into the upper magazine so that the emulsion (dull) side of film is toward the light source. The image should be upside down with the sound track or scanned area on the right side (toward operator) when film is in the projector. Feed reel turns in COUNTER-CLOCKWISE DIRECTION.

b. Turn the framing light switch on the top of the projector to the "ON" position. This lights the lamp to illuminate the framing aperture "A" just above the guide rollers. Turn projector mechanism by use of the motor knob until the intermittent has passed the point of movement. Place film in projector with one frame directly over the framing aperture. The gate may be closed and the picture is in frame.

Figure 9. Threading Illustration



NOTE: The film should be threaded with the 8 ft. mark at the framing aperture or picture aperture. This allows the correct footage for changing over from one projector to the other in accordance with the standard film cue markings for this purpose.

c. The Safety Controls "B" and "S" automatically open the film traps in the case for threading, when the projector door is opened. When the door is closed, the guards automatically close in correct position.

d. Draw out 6 to 8 feet of film leader and pass film between upper fire rollers "C" and around rear or left side of the guide roller "D", over and between the feed sprocket "E" and idler "F". Open idler "F" by pulling outward on Idler Knob "G" and lower idler away from sprocket. After checking to see that all film perforations are fully engaged in the sprocket teeth, close idler "F" by merely pushing it against the sprocket where it locks.

e. Open the Film Gate "H" by moving Trigger "I" upward. Leave a "LOOP OF FILM" of approximately the size shown in threading photograph between the feed sprocket "E" and the film gate. After forming the "Loop", lay the film on the aperture, being certain that the film lies perfectly flat over the aperture and that it is between the guide rollers at top of the gate and engages the Intermittent Sprocket "J" at the bottom of the gate. While holding film in this position, lock gate by lowering Trigger "I".

f. Open idler "K" by pulling the knob at end of idler and raising idler away from sprocket "L". Form a LOOP OF FILM of about the size shown on the threading photograph and pass the film over the sprocket, being sure to engage sprocket teeth. Close idler. A correct loop of film is obtained when pressed with finger toward the case at left until tight. The film will be approximately 1/2" away from the case after the intermittent has just finished advancing the film.

g. Raise Impedance Roller "M" and place film over the Sound Drum "N". Release Impedance Roller. Open Idler "Q" as you did the other idlers, and pass the film under Roller "O" up and over the sprocket "P". IMPORTANT: As you engage the film perforations with the sprocket teeth, pull the film up tight and then BACK UP ONE SPROCKET HOLE, so that there will be SLACK between Sprocket "L" and the Impedance Roller "M". Close idler. NEVER OPERATE THE PROJECTOR WITHOUT AT LEAST ONE SPROCKET HOLE OF SLACK between sprocket "L" and the impedance roller "M", or the emulsion side of the film will rub on the underside of the impedance roller and cause film damage.

h. To complete the threading, pass film over Roller "R" down through the Fire Roller, into the take-up magazine, securely fastening film to the hub of the take-up reel.

3. CHECKING FILM THREADING

Always check film path after threading projector, by slowly turning projector mechanism by hand. To do this, turn motor knob clockwise, as indicated by arrow on knob. If knob turns freely and film travels through mechanism without strain, and "Loops" are retained, projector is threaded properly.

4. INSERTING LENS - FOCUSING

Before the lens can be inserted into the lens housing, it is necessary to unscrew the knurled thumb screw "T" located in the extreme lower right hand end of the lens housing, Figure 9. Tighten knurled screw after inserting the lens to keep it in place. To focus, loosen the Lever Screw located at the top right hand corner of the lens housing, and manipulate the focusing knob on front of projector until picture is in focus, then tighten Lever Screw.

5. SHOWING THE PICTURE

A few minutes before you are ready to start the show, turn the amplifier "OFF-ON" switch to the "ON" position to enable the amplifier tubes to reach normal operating temperature. Turn the volume control on the preamplifier to a setting of 20, which should be normal for most film.

On the projector threaded with film, turn on the rectifier and strike the arc. Start the projector motor. After motor has come up to speed, open the hand dowser on the lamphouse. Allow a few seconds for the leader to pass through the gate, then press the changeover switch, this will project the picture on the screen in synchronization with the sound.

Adjust the amplifier volume to a normal level for sound reproduction in the auditorium.

Frequency correction controls are located on the front of the main amplifier and allow 35 different reproduction characteristics to be selected. These will be found most convenient in adjusting the reproduction characteristics of the system to match the acoustical capabilities of the auditorium. Read section on Frequency Response Curves, following.

Adjust the volume control on the monitor speaker.

6. READYING SECOND PROJECTOR

While the first reel of film is being shown by the first projector, thread the second reel in the second projector just as was done for the first machine. When the film in the operating projector is about 100 to 200 feet from the end, strike the arc on the second projector.

7. OPERATING THE SECOND PROJECTOR

When the first changeover cue appears on the film being shown, start the motor and follow the same procedure used on first projector for changing to the second projector.

In order to make perfect changeovers from one projector to the other, several days of practice is the best teacher.

8. OPERATING TESTS

Before starting each show it is recommended that the sound system be checked to be sure it is in operating condition. Follow the procedure

given under (b) Testing Sound System, this section. Likewise check arc lamp for proper adjustment, carbons, etc.

9. FREQUENCY RESPONSE CURVES

A method has been evolved for better identification of the various response curves obtainable from the correction networks. This method consists of combining the individual "HI" and "LO" control settings to form the individual numbers of a two number series.

Example

High control setting Number 4 and low control setting Number 3, as indicated in Graph Number 2, form the correct setting for duplicating the recommended Academy Curve. By combining these two setting numbers, the combination Number 43 is obtained and this curve is therefore identified as Number 43. See Graph Number 4.

Graphs 1 and 3 are included in this book to illustrate the best frequency response settings for the typical curves described.

a. High Frequency Control

The high frequency control is the left hand control and allows five different high frequency sensitivities ranging from minus 15 db at 10,000 cycles to plus 15 db at 10,000 cycles.

b. Low Frequency Control

The low frequency control is the right hand control and has seven positions, varying from a low frequency loss of minus 20 db at 50 cycles to a low frequency gain of plus 10 db at 100 cycles or plus 10 db at 40 cycles.

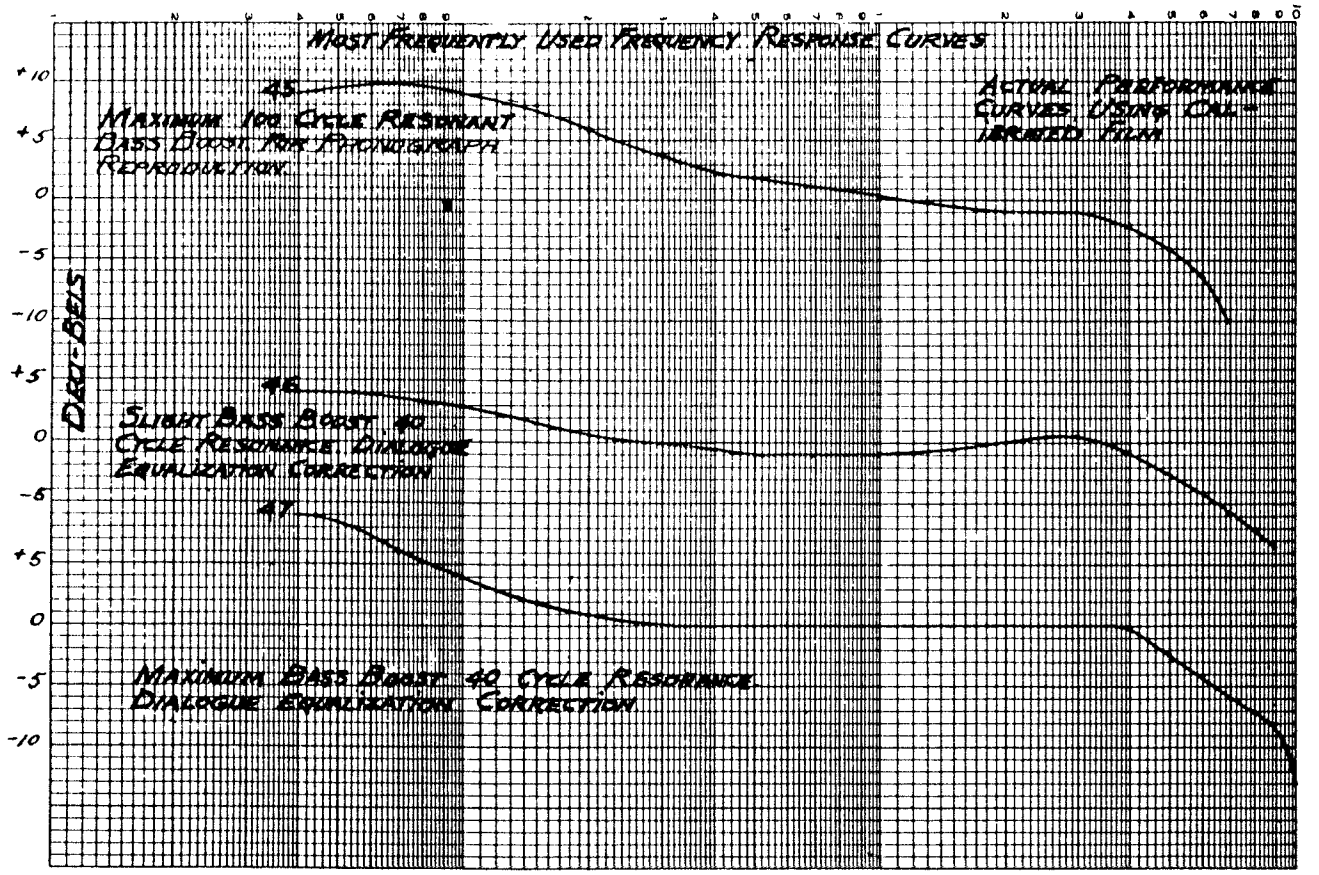
c. Frequency Response Control Settings Most Frequently Used

Curve 43, Graph No. 4, is the curve required to reproduce film with the maximum fidelity, as given by the Academy of Motion Picture Arts and Sciences, when using the speaker system supplied with this equipment. Curve 53 is usable in certain types of film recording where pre-emphasis of high frequencies is not used, and is quite useful in reproducing films apparently lacking in crispness.

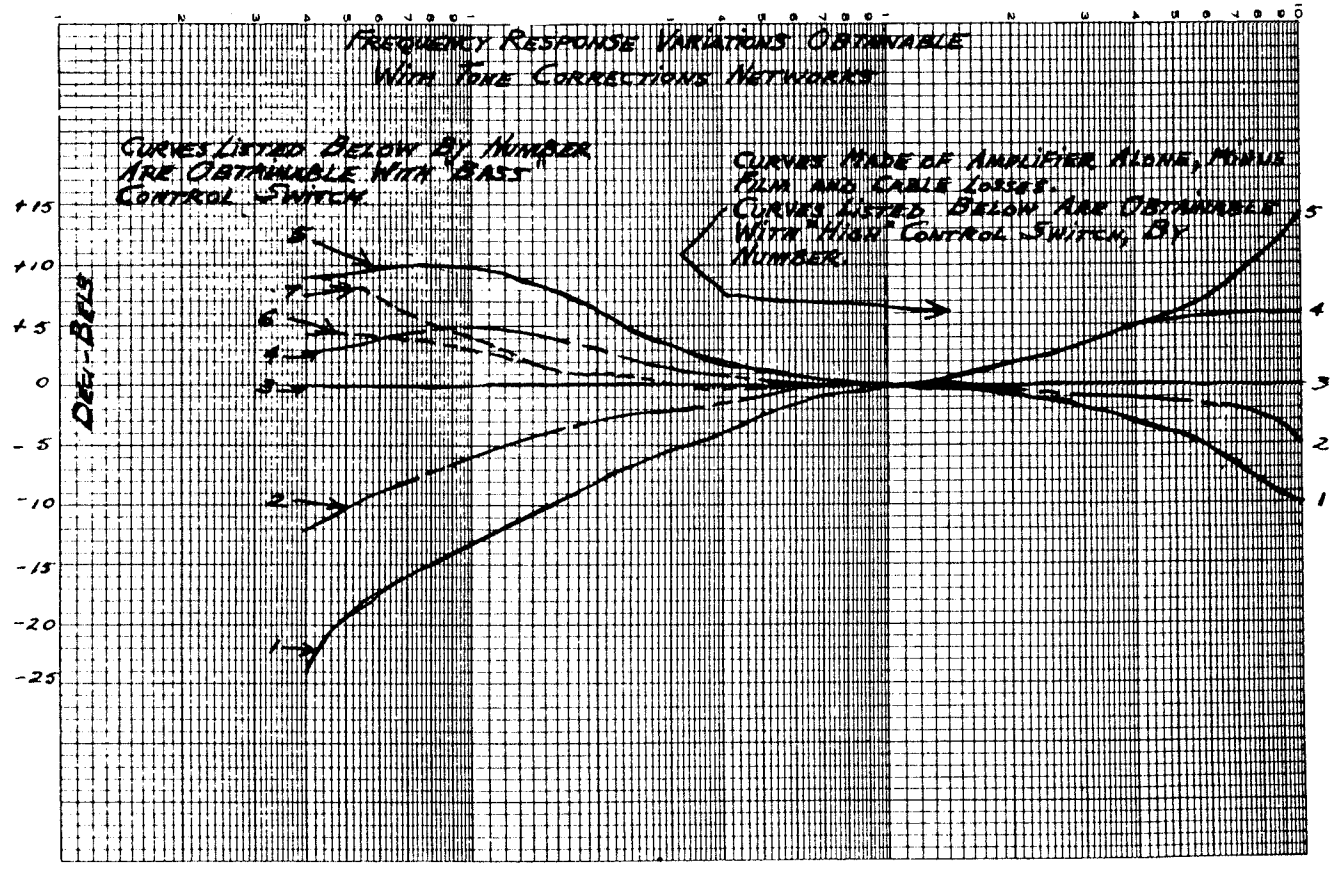
d. Supplemental Curve Selection for Auditorium Correction in Reproducing Records or As a Public Address System. (Refer to Graph No. 2).

High position No. 3 is the high frequency flat position of the amplifier, eliminating the cable and film equalizer. In this position, the amplifier is suitable for microphone operation and has an extended frequency range when used for this purpose of 17,000 cycles. High positions, Numbers 1, 2 or 3 are high frequency attentuation positions when used for film reproduction and are very useful in the reproduction of noisy film, or film recorded with too many high frequencies.

Figure 10. Frequency Response Curves



FREQUENCY GRAPH NO. 1



FREQUENCY GRAPH NO. 2

e. Frequency Control Settings for Phonographic Reproduction (Refer to Graph No. 2)

High positions Numbers 1 and 2 are also useful where phonograph reproduction is involved and a scratch filter required to eliminate the needle scratch.

f. Low Frequency Control Positions (Refer to Graph No. 2)

Low control positions Numbers 1 and 2 attentuate the low frequencies at different cut-off points, attenuation increasing linearly to infinity. Low control position Number 1, cut-off incept 800 cycles. Low control position Number 3 is the flat low frequency response position and equalizes the amplifier down to 30 cycles. Low control positions 4 and 5 emphasize frequencies at a peak fundamental boost location of 100 cycles in varying degrees. Low control positions 6 and 7 accentuate frequencies at a peak fundamental period of 40 cycles in varying degrees.

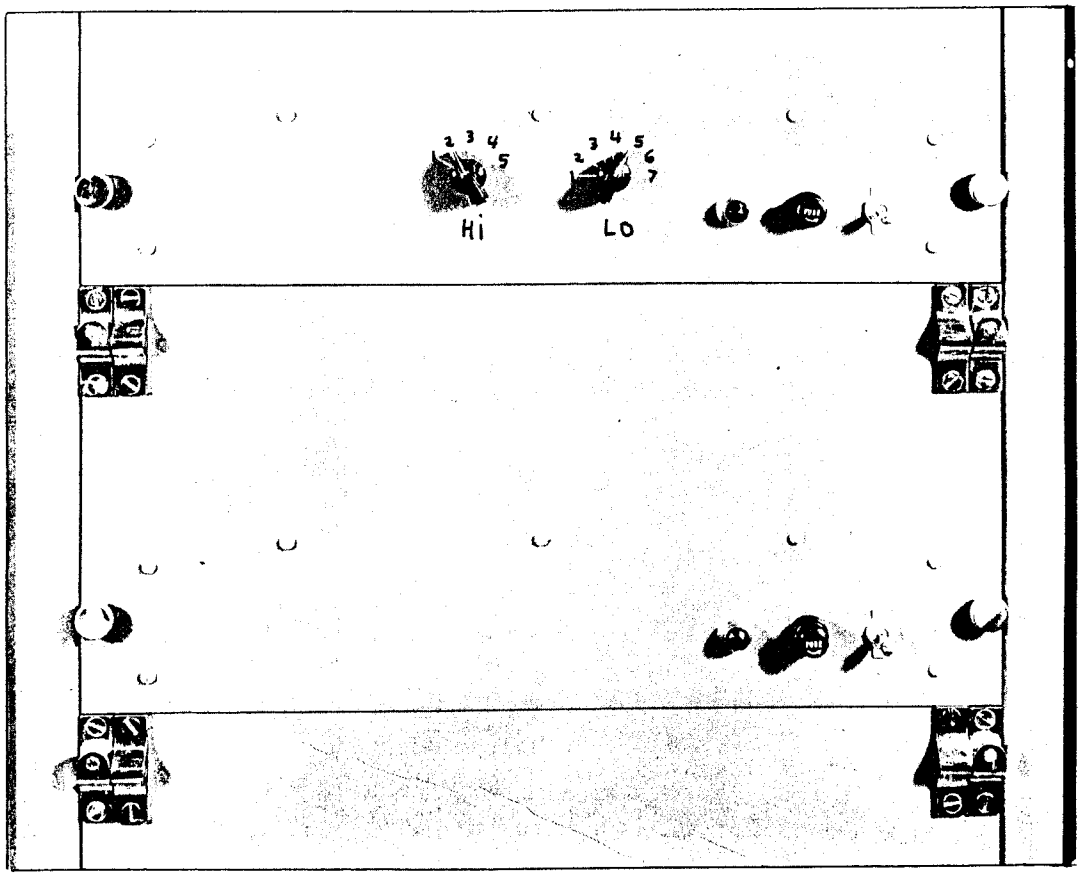
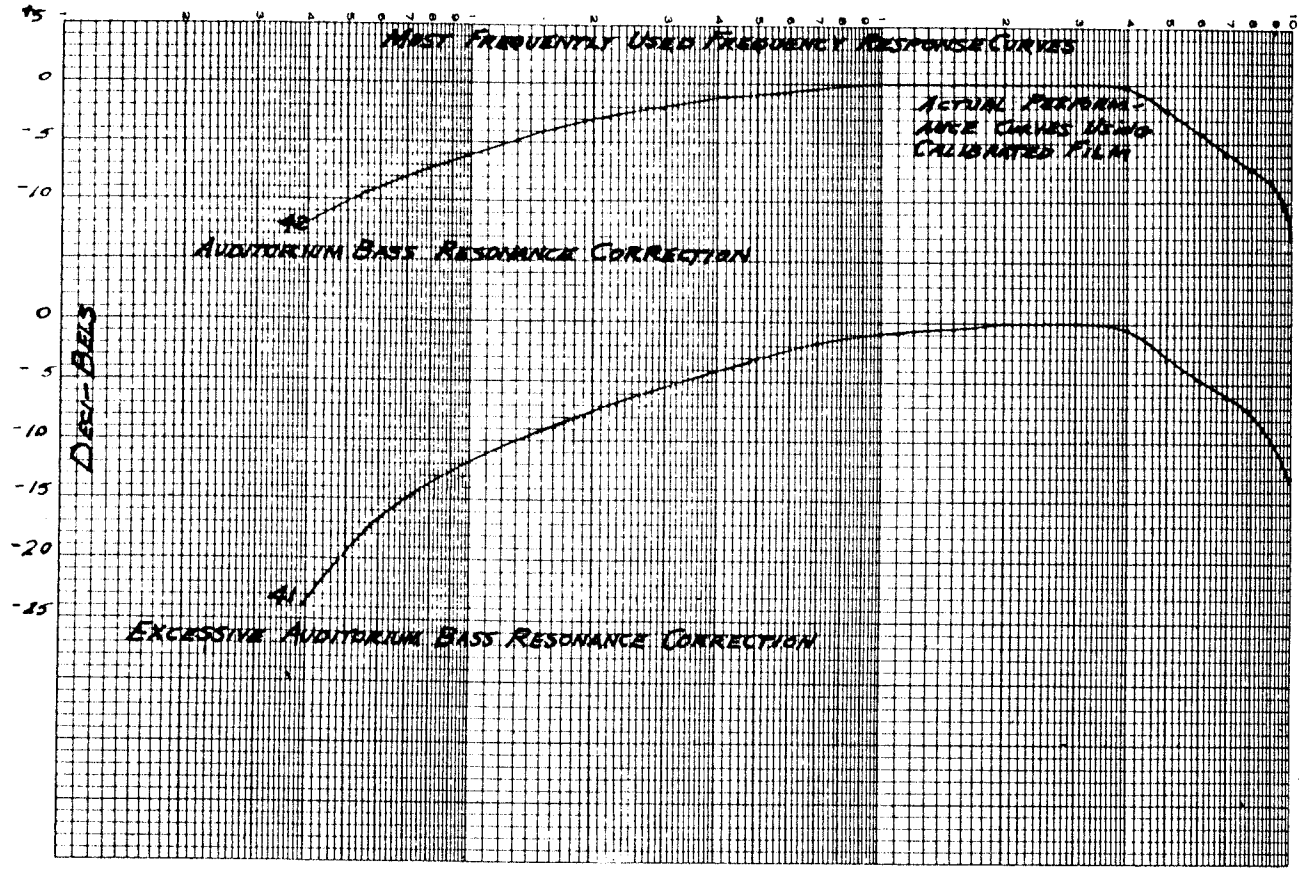


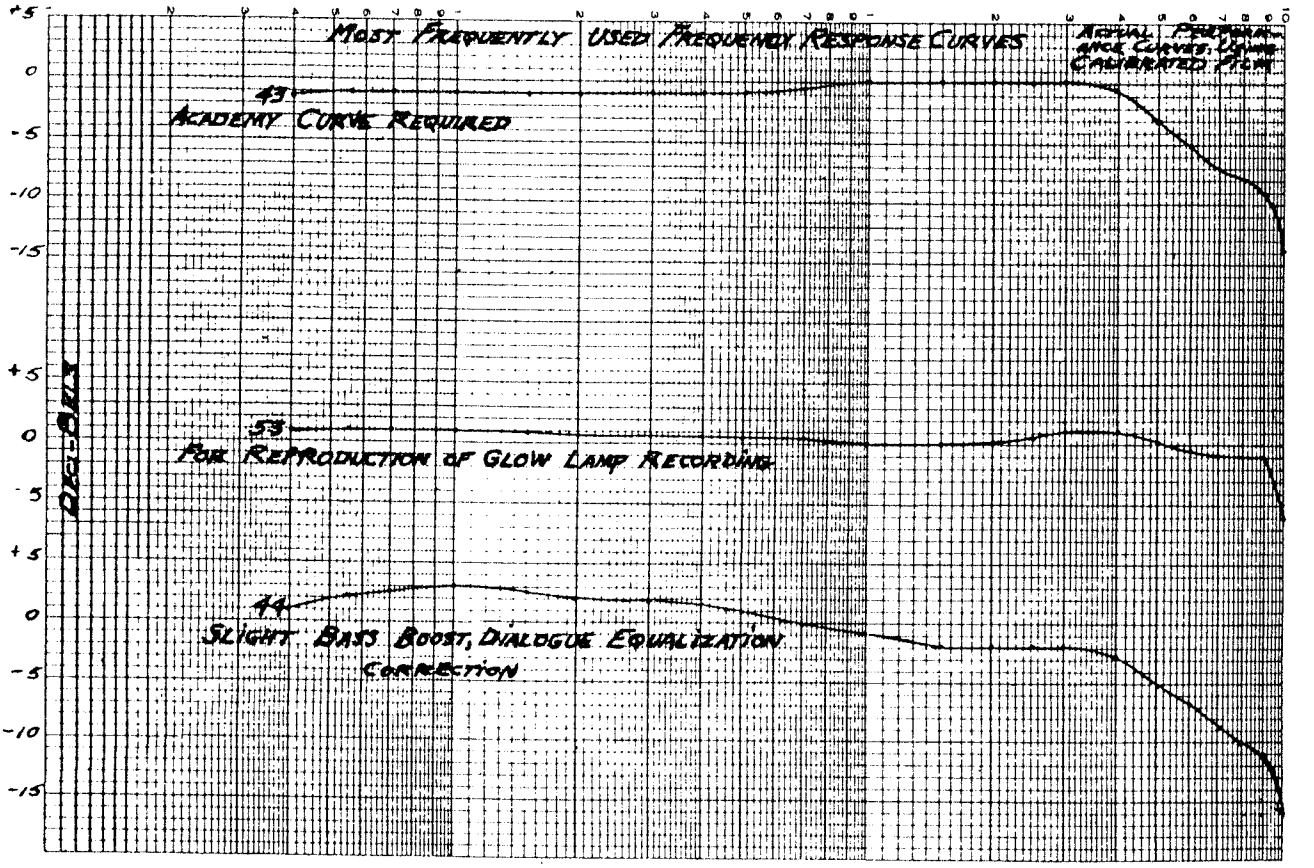
Figure 11. Amplifier Panel Showing "HI-LO" Frequency Controls

MFD. By ALTEC-LANSING

Figure 12. Frequency Response Curves



FREQUENCY GRAPH NO. 3



FREQUENCY GRAPH NO. 4

K. CLEANING

1. GENERAL

One of the most important contributing factors to superb operation and long trouble-free performance is thorough cleanliness of the equipment. Keeping the equipment clean at all times will pay dividends. The operator should take a clean, soft, lintless cloth and go over the entire machine every day before operating, wiping off all dirt, dust and excess oil from the entire mechanism and cabinet.

2. PROJECTION LENS

Oil, fingerprints, dust, dirt, etc., on a lens surface seriously impairs the definition of the projected screen image. The best cleaning preparation consists of a mixture of half clear water and half grain alcohol, used with a soft cloth. The cloth should be damp, not dripping. Be careful not to scratch the surface of the lenses. Lens tissue or Kleenex is ideal, too.

3. FILM GATE ROLLERS

Clean every day. Saturate a clean cloth with carbon tetrachloride or grain alcohol and hold against rollers while rotating rollers by hand.

4. FILM SPROCKETS

Clean every day. Open film idlers and clean sprocket by gently rubbing a dry tooth-brush over the entire surface of the sprocket until clean. Remove any oil deposited with clean cloth dampened with carbon tetrachloride.

5. FILM GUIDE RAILS (Aperture)

Clean every day. Use cloth dampened with carbon tetrachloride and lightly rub each rail in vertical direction until clean.

6. FILM PRESSURE SHOES (Film Gate)

Clean every day. Remove film gate assembly and rub all film pressure shoes with a clean cloth saturated with carbon tetrachloride until clean.

7. SCANNING SOUND LENS

The sound lens should be kept clean and free from oil. The exposed glass surfaces should be cleaned with a soft camel hair brush or with a soft dry cloth wrapped around a match stick or tooth-pick. Care must be ex-

ercised so as not to scratch the glass. Do not remove the slit lens from its mount as it is accurately set at the factory and should not be tampered with.

8. SOUND DRUM

Remove the accumulation of emulsion, dirt and dust that gathers around the sound drum particularly the edge, by rubbing a clean dry cloth over the entire surface of the drum. Remove any oil deposits with clean cloth dampened with carbon tetrachloride.

9. IMPEDANCE ROLLER

This is the roller that sets over the sound drum. To remove accumulated emulsion, etc., clean with clean cloth dampened with carbon tetrachloride.

10. APERTURE MASK

Remove the mask gate from the projector. Attach a clean cloth dampened with carbon tetrachloride to a match stick and rub the cloth over the plate until clean.

11. PROJECTOR CASE

After each oiling we recommend that the inside of the projector cases be cleaned with a dry cloth so as to remove any overflow oil.

12. AMPLIFIER

All switches, controls, socket prongs, etc. should be kept scrupulously clean, if not, the dirt or dust combines with the moisture in the air and creates poor contacts, leakage in wiring or between terminals, resulting in the reproduction of disturbing noises in the loud speaker. Clean amplifier with a brush and/or a dry cloth to remove all dirt.

13. PRE-AMPLIFIERS

The pre-amplifiers likewise should be kept scrupulously clean. Clean inside periodically with a brush and/or dry cloth to remove all dirt. Keep cover shut at all times.

14. ARC LAMPS

If maximum light efficiency of the arc lamp is to be maintained, it is essential that the reflector be kept clean. The arc lamphouse likewise must be kept clean of metallic drippings. For complete information on cleaning the reflector and lamphouse, refer to Arc Lamp Operating Manual.

L. LUBRICATION CHART

Parts to Lubricate	When to Oil	Where to Oil	Type Lubrication	Comment
Intermittent Movement Specifications of Intermittent Oil Flash point not less than 360°. Four Point not more than 0° F. Viscosity - Sayboldt Universal at 100° F. Range from 145 to 155 seconds.	Watch oil level each 8 hour interval of operation.	Oil Cup "A" on rear of Projector Mechanism.	Use ONLY DeVry Intermittent Oil. If not available, see specifications at left.	Change oil every 100 hours of operation. Do NOT flush out the oil well with kerosene or other liquids. Oil drain shown at B.
End Bearing on Intermittent Sprocket	Every 8 hours of operation.	Press oil can against star wheel outer bearing "C" and let oil flow in.	Same as specified for intermittent movement.	Oil sparingly to avoid overflow.
Feed and Sound Sprocket Shafts	Every 8 hours of operation.	Oil Cup at top of Projector Case.	Light Machine Oil 10-SAE or similar.	Fill oil cup.
Drive Motor	Every week.	Oil Cup at each end of motor.	Light Machine Oil 10-SAE or similar.	Oil sparingly.
Chain Idler Roller	Every 8 hours of operation.	Drop of oil between screw and roller "E". Oil other side of roller.	Light Machine Oil 10-SAE or similar.	Oil sparingly. Remove excess.

Refer to Figures 13 and 14

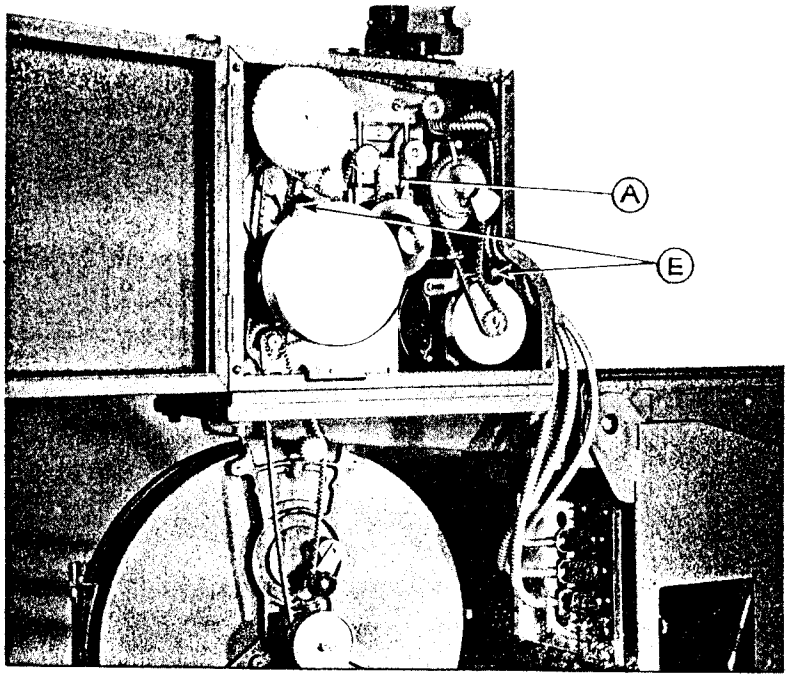


Figure 13. Lubrication Illustration (Rear of Projector)

L. LUBRICATION CHART

Parts to Lubricate	When to Oil	Where to Oil	Type Lubrication	Comment
Film Rollers	Every 8 hours of operation.	With very small oil can, place drop of oil between lock nut and roller "F".	Light Machine Oil 10-SAE or similar.	Oil very sparingly. Remove excess oil.
Feed Magazine Shaft	Every 100 hours of operation.	Oil cup at top of shaft housing, magazine rear.	Light Machine Oil 10-SAE or similar.	Use sparingly.
All Drive Chains	Every 50 hours of operation.	Grease each chain while projector runs.	No. 0 Cup Grease.	Use sparingly.
Fire Trap Rollers	Every 25 hours of operation.	Drop of oil on each roller bearing supporting fire trap rollers. Also on rear roller shaft.	Light Machine Oil 10-SAE or similar.	Oil very sparingly. Remove excess oil.
Fire Guards	Every 100 hours of operation.	Place small amount of grease between case and bottom of guard.	No. 0 Cup Grease.	Remove excess.
Impedance Roller	Every 8 hours of operation.	Each end of roller "F"	Light Machine Oil 10-SAE or similar.	Remove excess.

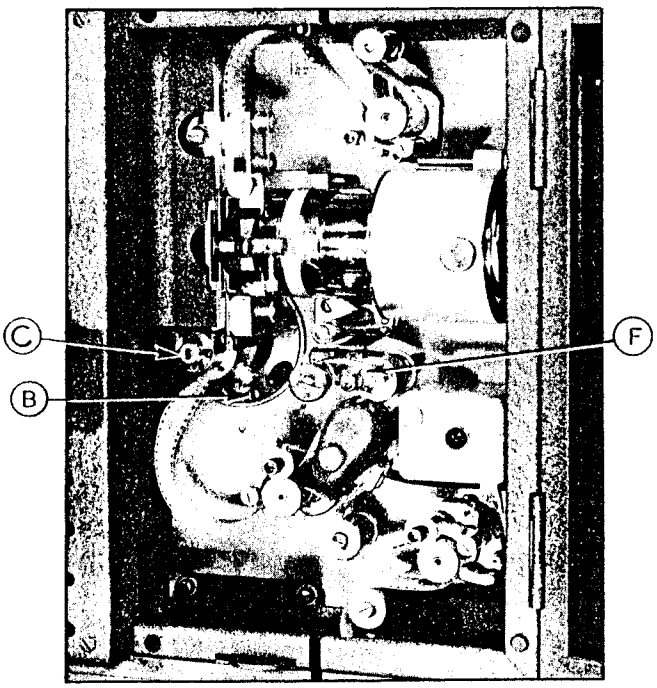


Figure 14. Lubrication Illustration (Front of Projector)

M. GENERAL TROUBLE SHOOTING

Trouble	Cause	Remedy
Picture "Flutter" (Traveling Ghost)	Shutter out of timing with intermittent movement.	Retime shutter.
Fuzzy borderline on screen image.	Accumulation of film emulsion on aperture mask.	Clean aperture mask.
"Jumpy" Picture	1. Improper tension on main aperture tension shoe. 2. Wear in intermittent. 3. Improper threading of film. 4. Intermittent loose in framer assembly. 5. Weak springs on upper or lower shoes.	1. Adjust tension of shoe 2. Set eccentric adjustment on intermittent movement. If adjustment is exhausted, replace star and cam. 3. Check threading. 4. Tighten as needed. 5. Replace springs.
"Color" on screen or uneven distribution of light.	1. Accumulation of dirt, dust, etc. on Optical System, lens, arc lamp reflector. 2. Arc lamp or reflector out of adjustment.	1. Clean projection lens and arc lamp reflector. 2. Adjust lamp and reflector.
Noise and/or tightening of film at fire rollers.	Lack of lubrication and accumulation of foreign substances on fire and micarta rollers.	Place drop of oil on roller shafts. Remove excess oil.
Damage to film perforations.	1. Improper tension on film shoe. 2. Wear on sprocket teeth. 3. Excessive tension on take-up spindle.	1. Adjust tension on shoe 2. Reverse or replace sprockets. 3. Ease tension of take-up plungers.
If film over-runs feed reel.	Improper tension on feed shaft.	Adjust tension of feed shaft.

Continued on next page

M. GENERAL TROUBLE SHOOTING

Trouble	Cause	Remedy
Audible distortion sound output	1. Impedance roller not functioning properly. 2. Accumulation of foreign substances on sound drum.	1. Adjust impedance roller as per instruction in manual. 2. Clean sound drum.
Decrease in sound volume.	1. Dirt, etc. on sound lens. 2. Sagging of exciter lamp filaments, discoloration of lamp. 3. Slit lens improperly set. 4. Bad tube, resistor, condenser in amplifier.	1. Clean sound lens. 2. Insert new exciter lamp. 3. Adjust lens. 4. Repair amplifier.
Exciter lamp fails to light.	1. Faulty lamp. 2. Faulty lamp socket. 3. Faulty switch. 4. Faulty transformer.	1. Replace lamp. 2. Repair lamp socket. 3. Replace switch. 4. Insert new transformer
Scratches in film.	1. Accumulation of emulsion and dirt in film path and fire roller housing. 2. Worn out parts.	1. Clean film path and fire roller housing. 2. Replace worn parts.

We have outlined here Service Troubles and Remedies that will afford quick relief against most of the common causes of projector and sound system troubles. However, every case of trouble can be a new and different experience to which well established remedies may or may not apply. The projectionist is urged to exercise patience and common sense.

N. TROUBLE SHOOTING AMPLIFIER

1. TESTING AMPLIFIER TUBES

A periodic check-up of the tubes in the amplifier with a normal tube tester should be made at intervals of every 30 to 60 days, depending upon the usage given the amplifier. Deteriorated or noisy tubes should be replaced.

Not all tube testers will indicate a "gassy" tube condition which, if present, might cause excessive current drain and result in sound distortion. Therefore, cathode or bias voltage readings should be made periodically on all tubes. In each "12000 Series" amplifier panel a closed circuit jack is provided for each tube. A milliameter inserted in this jack will read the cathode current for that particular tube. The proper current is indicated on the panel close to the associated jack.

NOTE: For proper voltage readings for all tubes, see voltage chart on Amplifier Schematic Wiring Diagram.

2. PROLONGING LIFE OF TUBES

Tube life can be prolonged by always operating the amplifier at its rated line voltage. Over-volting or under-volting tube heaters causes overheating with a resultant deterioration in the life of the tubes. NOTE: Line tap set for 115 volts, A.C., 60 cycles. Amplifier - Primary taps are provided to adjust voltage from 105-125 volts.

3. LOSS OF SOUND

If sound should be lost in the system, make these preliminary tests:

a. Check to see if Volume Control is ON.

b. Determine if power is being supplied to the system and if fuses are good.

c. Check exciter lamp.

If, after making all of these preliminary tests, no sound is as yet reproduced from the loud speakers, further probing within the amplifier itself is necessary.

4. CHECKING AMPLIFIER FOR TROUBLE

a. Move the 6N7 drive tube up and down in socket, making and breaking contact. If a "plop" is heard in the speaker system, amplifier and speaker are okay from there out. If no sound is heard in speaker, check connections on speaker system, rectifier tubes, output tubes, plate voltage, etc.

b. If sound is okay from drive stage, move back, stage by stage, until a point is found where no sound is heard when tube is moved in or out of the socket or by touching top grid of tube. This is an ideal, speedy method to use to find bad tubes.

c. Do not attempt to locate more serious trouble until it has definitely been determined that all tubes are functioning properly and that none are shorted.

d. If tubes are okay and no sound is as yet reproduced, then check for cathode or bias voltage on each stage. If no cathode voltage is obtained, probe for the following trouble.

1. Substitute new rectifier or other interstage tube where cathode voltage reads zero.

2. Determine whether plate voltage is open or shorted.

3. Determine whether By-Pass condenser is shorted.

4. See if screen supply is open or shorted.

5. See if screen by-pass condenser is shorted.

6. Determine condition of cathode resistor.

e. If no plate voltage is obtained at any point after rectifier tube is sound to be okay, the trouble may be caused by:

1. Shorted condenser in amplifier.

2. Short in wiring.

3. Open or shorted power transformer winding.

4. Short in pre-amplifier parts or wiring.

f. No photo-electric cell voltage may be caused by:

1. Short in photo-electric cell wiring.

2. Shorted condenser.

3. Open resistor.

4. Shorted cell or cell socket.

5. POOR QUALITY OF SOUND

This type of trouble may be caused by any or all of the following.

a. Dirt, dust, grease or oil accumulation on sound lens. Remedy is to keep lens clean.

b. Improper alignment of sound track over sound drum.

c. Motor-boating or buzz noise. Remedy is to adjust impedance roller by loosening the locking screw and adjusting the knurled knob clockwise or counter-clockwise until noise is eliminated.

d. Improper SLACK between sprocket and impedance roller. Remedy is to rethread the projector so that there is slack of at least ONE SPROCKET HOLE between sprocket and impedance roller. See Threading Instructions.

e. Exciter voltage too low or exciter lamp filament is sagging. Replace lamp.

f. Defective photo-electric cell.

g. Weak or partially shorted tube.

O. PROJECTOR SERVICING

1. Replacing the Intermittent

a. Remove the flywheel by placing the 1/8" rod supplied with the equipment into the unthreaded hole of the collar on the shaft of the stabilizer. Unscrew the flywheel while holding the shaft steadily in place. Refer to Figure 15.

b. Examine the chain drive system, noting particularly each chain roller and sprocket, and just how the chain rides on each. Remove the large chain sprocket from the shaft of the upper film feed sprocket by taking out the three screws holding this chain sprocket to its shaft. Pull this chain sprocket toward you, thus removing it and freeing the chain so that it may be dropped clear of the intermittent movement. Refer to Figure 16.

c. Move to the operating side of the projector. Open the film gate and loosen the two screws which hold the "dogs" onto the intermittent housing assembly. The screws need not be completely removed, but merely loosened enough to allow the "dogs" to be pushed free of the housing toward the center on the intermittent movement. Refer to Figure 17.

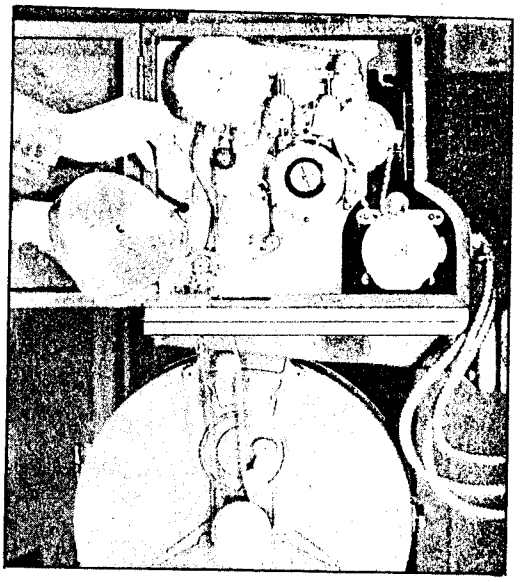


Figure 15.
Removing Intermittent (1st Step)

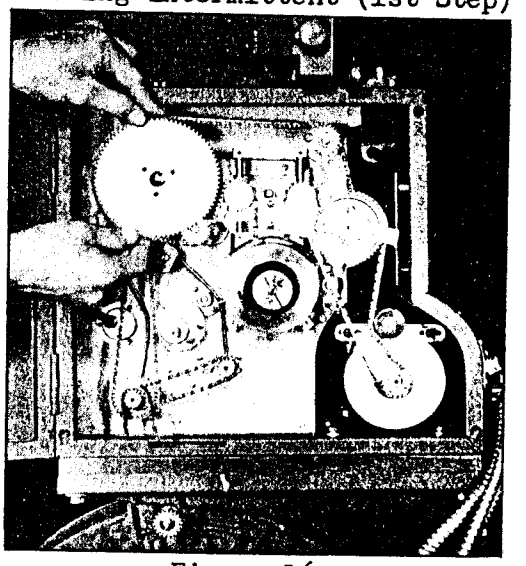


Figure 16.
Removing Intermittent (2nd Step)

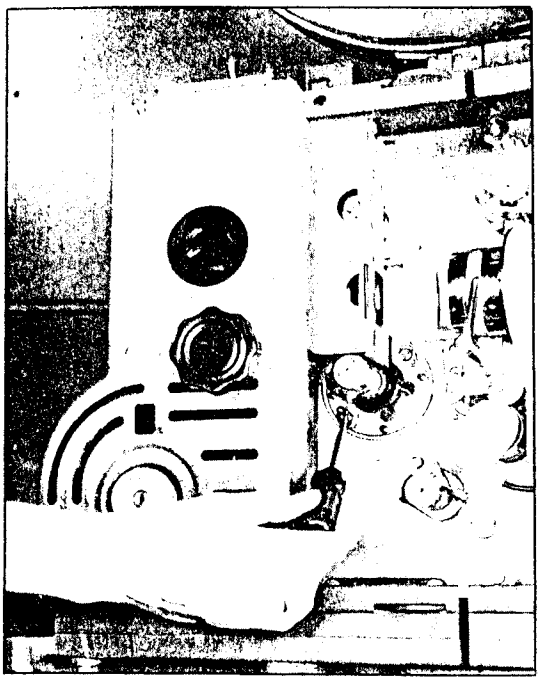


Figure 17.
Removing Intermittent (3rd Step)

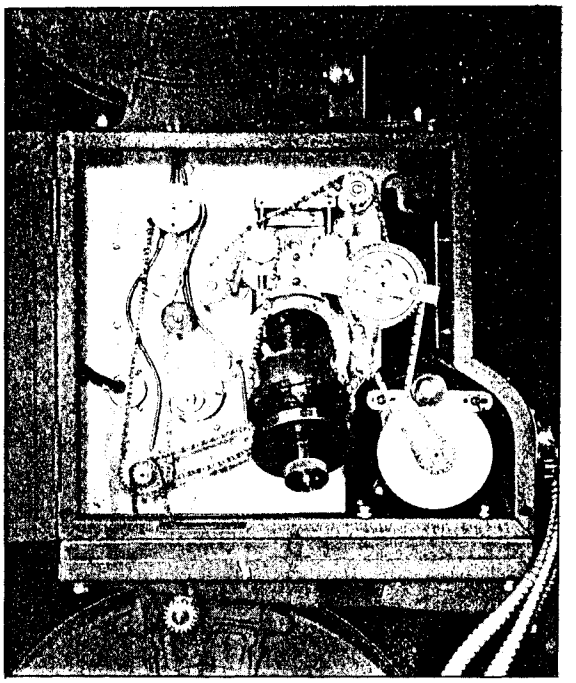


Figure 18.
Removing Intermittent (4th Step)

d. Move to the rear of the machine. The intermittent movement can be slipped out directly toward you. Be sure that the unit clears all chains during this removal process. Refer to Figure 18.

e. To replace this unit or install a new unit, slip the unit back into the machine in the reverse manner from which it was withdrawn. There is an aligning pin on the intermittent housing and only one proper hole on the intermittent movement to fit this pin. Do not confuse the aligning hole on the movement with the three tapped screw holes which are spaced at three corners of a square on the movement case. Dependent on the position of the framer mechanism, the alignment hole and its pin normally appear near the top of the intermittent movement. When the pin and hole are correctly in line, push the intermittent unit into the housing until it is firmly seated.

   Move to the operating side of the projector and slip the retaining "dogs" over the edge of the housing (away from the center of the unit) and lock them by tightening the screws holding these two "dogs". Move to the rear of the machine and replace the chain, taking care that all sprockets and rollers are properly threaded. Then thread the large chain sprocket with the chain and slip it onto its shaft, and replace the screws which hold it to the upper feed sprocket shaft. Be sure the intermittent is properly filled with oil, then check the operation of the new intermittent unit. Replace the flywheel stabilizer.

f. In practically all cases the shutter will now require retiming for proper projector operation. This information is given on the next page.

2. Timing the Shutter (Refer to Figure 19)

To time the film shutter, have the left-hand thread screw (#12853) slightly loosened so that the film shutter may be turned while the mechanism is held steady by means of the motor knob. Turn the mechanism until the intermittent unit is just half-way through its movement period. Hold the motor knob steady with the hand and turn the film shutter until it cuts off all light from the light source, (at this position the center of one blade will face the light source directly and the other blade will face the film gate), and still holding the motor knob, turn the screw (#12853) to the left until the shutter is tight on its shaft. Check the timing again by turning the motor knob a few times and then stopping the mechanism again at the point just half-way through the movement period of the intermittent movement. The shutter should be in the maximum cut-off position. If it has changed, loosen the screwn (#12853) and readjust. Follow this procedure until the shutter is in time.

3. Adjusting the Fire Shutter (Refer to Figure 19)

To adjust the fire shutter booster weight (#12860), loosen the nut (#12863) from the fire shutter bushing (#12861) by using two 5/8" wrenches. When the fire shutter is in its lowered position, the front side of the booster weight (#12860) must be perpendicular to the ground level, irrespective of what angle the machines are tilted. A plumb line of a small piece of string and a weight, held by hand just above the shutter unit, will quickly determine the accuracy of this setting, and accuracy is of the utmost importance for proper operation. When the booster (#12860) has been adjusted to this position, lock the nut (#12863) onto the bushing (#12861) with the two wrenches. Check operation of new fire shutter by turning machine off and on. It should rise when the machine has attained a speed equal to 45 ft. per minute, and should drop when the unit slows down to about the same speed.

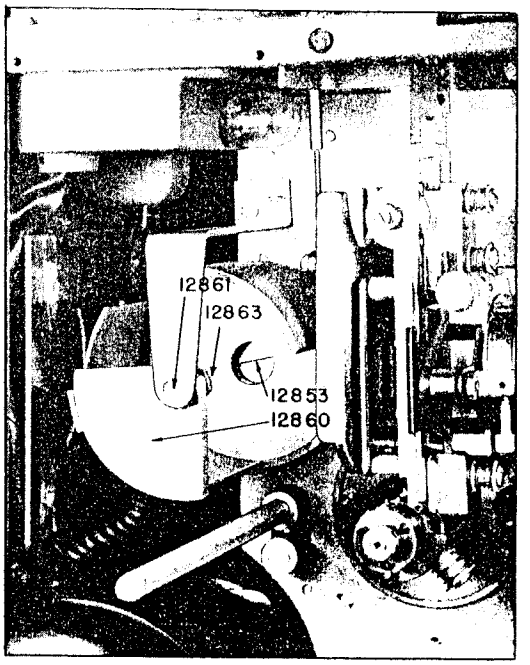


Figure 19.
Timing the Shutter and
Adjusting the Fire Shutter

4. Impedance Roller Adjustments

The "12000 Series" Projector is equipped with an impedance roller which rests on top of the film just as it passes over the sound drum. Its purpose is twofold. First, it maintains the lateral adjustment of the film as it passes over the drum. Second, dependent on its tension, it "irons" the film onto the drum, thus providing the proper amount of friction between the film and the drum. Although this unit is factory adjusted, it is possible that the impedance roller may need readjustment at some later date. No adjustments should be made until the absolute necessity has been determined by a qualified service man.

a. Tension

The tension or "weight" of the impedance roller on the sound drum is determined by the amount of spring force applied to it. This spiral spring is mounted on the shaft of the bracket, between the bracket and its mounting casting. Two persons are normally required for readjustment of this tension. It is first necessary to remove the sound drum stabilizer or flywheel from the rear of the projector by inserting a 1/8" rod into the unthreaded hole on the sound drum stabilizer shaft. Hold the shaft with this rod and unscrew the stabilizer unit and remove. CAUTION: KEEP THE STABILIZER UNIT AND ITS SHAFT IMMACULATELY CLEAN AT ALL TIMES.

On the front or operating side on the machine, a screw-driver should be placed into the slot provided in the end of the impedance roller assembly shaft. Hold this screw-driver firmly in the same position while loosening the nut holding this shaft. This nut is on the rear of the mechanism plate and requires a wrench. With this nut slightly loosened, the tension of the impedance roller may be adjusted by turning the shaft itself with the screw-driver from the front. To develop more tension, turn the shaft clockwise. To relieve the tension, turn the shaft counter-clockwise. Since this unit was pre-adjusted at the factory, very little setting should ever be necessary. When the tension has been set properly, lock the unit by tightening the nut which was loosened on the rear of the mechanism plate.

b. Horizontal Adjustments

When the longitudinal flat of the impedance roller is not properly adjusted with relation to the sound drum, the film will tend to weave in its path over the drum, or will tend to jump out of the track completely. Either of these conditions will be noticed first on thin wide stock such as newsreel print.

On the operator's side of the "U" arm casting which supports the impedance roller, and close to the impedance roller shaft, will be found two hexagon head screws, one on the top of the arm and one on the bottom. Since these screws work against opposite sides of the same pin, one must be loosened before the other is tightened. When the top screw is loosened and the bottom tightened, the impedance roller is lowered on the operator's side of the roller with respect to the center of the roller. When the bottom screw is loosened and the top tightened, the roller is lowered

on the mechanism plate side of the roller. In each case, the lowering of one side raises the other side in a like amount. It can be seen, therefore, that this adjustment is quite critical. Film should be used as a final test to observe the proper setting.

c. Lateral Adjustment

A buzz or low frequency note continually heard through the sound system indicates that the lateral adjustment of the impedance roller is not properly aligned, that is, the roller is too far in or out from the mechanism plate. The sound unit under these conditions is reproducing either the sprocket holes of the film or the frame lines. When readjustment is necessary, use a buzz track loop. This film has a blank or "dead" track in the middle, a 300 cycle track on one side and a 3000 cycle track on the other side. If the impedance roller is not properly set, one or the other frequencies will be heard.

Loosen the round head machine screw which protrudes from the body of the thumb nut on the operator's side of the impedance roller assembly shaft. With a buzz track loop playing continually through the soundhead, adjust the thumb nut until neither frequency is heard through the system with the fader setting higher than normal. (With some buzz track a minimum setting is the best that can be obtained). Tighten the machine screw in the thumb nut to lock this nut for a permanent setting. Run the buzz track again as a final check.

1.33 : 1 ASPECT RATIO

SCREEN DIMENSIONS FOR 35MM SOUND FILM

For Corrections Due to Angle of Projection and Other Tolerances See Notes Below.

Lens Size Throw	3.00 in.	3.25 in.	3.50 in.	3.75 in.	4.00 in.	4.25 in.	4.50 in.	4.75 in.	5.00 in.	5.25 in.	5.50 in.	5.75 in.	6.00 in.	6.25 in.	6.50 in.	6.75 in.	7.00 in.	7.25 in.	7.50 in.	7.75 in.	8.00 in.
15 ft.	47.8	44.0	40.8	37.9	35.5	33.3	31.3	29.6	28.0	26.6	25.3	24.1	23.0	22.1	21.2	20.3	19.5	18.8	18.1	17.5	16.9
20 ft.	64.3	59.2	54.9	51.1	47.8	44.9	42.3	40.0	37.9	36.0	34.3	32.8	31.3	30.0	28.8	27.7	26.6	25.6	24.7	23.9	23.1
25 ft.	80.8	74.5	69.0	64.3	60.2	56.6	53.3	50.4	47.8	45.5	43.3	41.4	39.6	37.9	36.4	35.1	33.7	32.5	31.3	30.3	29.3
30 ft.	97.3	89.7	83.2	77.5	72.6	68.2	64.3	60.9	57.7	54.9	52.3	50.1	47.8	45.9	44.0	42.3	40.8	39.3	37.9	36.6	35.5
35 ft.	113.8	105.0	97.3	90.7	85.0	79.9	75.3	71.3	67.6	64.3	61.3	58.6	56.1	53.8	51.6	49.7	47.8	46.1	44.5	43.0	41.6
40 ft.	130.3	120.2	111.5	103.9	97.3	91.5	86.3	81.7	77.5	73.8	70.3	67.2	64.3	61.7	59.3	57.0	54.9	53.0	51.1	49.4	47.8
45 ft.	146.8	135.4	125.6	117.1	109.7	103.2	97.3	92.1	87.4	83.2	79.3	75.9	72.6	69.6	66.9	64.3	62.0	59.8	57.7	55.8	54.0
50 ft.	163.3	150.7	139.8	130.3	122.1	114.8	108.3	102.6	97.3	92.6	88.3	84.4	80.8	77.5	74.5	71.7	69.0	66.6	64.3	62.2	60.2
55 ft.	179.8	165.9	153.9	143.5	134.5	126.5	119.3	113.0	107.2	102.1	97.3	93.0	89.1	85.5	82.1	79.0	76.1	73.4	70.9	68.6	66.4
60 ft.	196.3	181.1	168.0	156.7	146.8	138.1	130.3	123.4	117.1	111.5	106.3	101.6	97.3	93.4	89.7	86.3	83.2	80.3	77.5	75.0	72.6
65 ft.	212.8	196.3	182.2	169.9	159.2	149.8	141.3	133.8	127.0	121.0	115.3	110.3	105.6	101.3	97.3	93.7	90.3	87.1	84.1	81.4	78.8
70 ft.	229.3	211.6	196.3	183.1	171.6	161.4	152.3	144.2	136.9	130.0	124.3	118.9	113.8	109.2	105.0	101.0	97.3	93.9	90.7	87.8	85.0
75 ft.	245.8	226.8	210.5	196.3	184.0	173.0	163.3	154.7	146.8	139.8	133.3	127.5	122.1	117.1	112.6	108.3	104.4	100.7	97.3	94.1	91.1
80 ft.	262.4	242.0	224.6	209.5	196.3	184.7	174.3	165.1	156.7	149.2	142.3	136.1	130.3	125.1	120.2	115.7	111.5	107.6	103.9	100.5	97.3
85 ft.	278.8	257.3	238.8	222.7	208.7	196.3	185.3	175.5	166.6	158.6	151.3	144.7	138.6	133.0	127.8	123.0	118.6	114.4	110.5	106.9	103.5
90 ft.	295.3	272.5	252.9	235.9	221.1	208.1	196.3	185.9	176.5	168.1	160.3	153.3	146.9	140.9	135.4	130.3	125.6	121.2	117.1	113.3	109.7
95 ft.	311.9	287.7	267.1	249.1	233.5	219.6	207.3	196.3	186.4	177.5	169.3	161.9	155.1	148.8	143.0	137.7	132.7	128.1	123.7	119.7	115.9
100 ft.	328.4	303.0	281.2	262.3	245.8	231.3	218.3	206.8	196.3	186.9	178.3	170.5	163.3	156.7	150.6	145.0	139.8	134.9	130.3	126.1	122.1
105 ft	344.8	318.2	295.3	275.6	258.2	242.9	229.3	217.2	206.2	196.3	187.3	179.1	171.6	164.7	158.3	152.3	146.8	141.7	136.9	132.5	128.3
110 ft.	361.4	333.4	309.5	288.7	270.6	254.6	240.3	227.6	216.1	205.8	196.3	187.7	179.8	172.6	165.9	159.7	153.9	148.6	143.5	138.9	134.5
115 ft	377.8	348.7	323.6	302.0	283.0	266.2	251.3	238.0	226.0	215.2	205.3	196.3	188.1	180.5	173.5	167.0	161.1	155.4	150.1	145.2	140.7
120 ft.	394.3	363.9	337.8	315.1	295.3	277.9	262.3	248.5	235.9	224.6	214.3	205.0	196.3	188.4	181.1	174.3	168.1	162.2	156.7	151.6	146.8
125 ft	410.9	379.1	351.9	328.3	307.7	289.5	273.3	258.9	245.8	234.1	223.3	213.6	204.6	196.3	188.7	181.7	175.1	169.0	163.3	158.0	153.0
130 ft.	427.3	394.3	366.1	341.5	320.1	301.2	284.3	269.3	255.7	243.5	232.3	222.1	212.8	204.3	196.3	189.0	182.2	175.9	169.9	164.4	159.2
135 ft.	443.8	409.6	380.2	354.7	332.5	312.8	295.3	279.7	265.6	252.9	241.3	230.8	221.1	212.2	204.0	196.3	189.3	182.7	176.5	170.8	165.4
140 ft.	460.3	424.8	394.4	367.9	344.8	324.5	306.3	290.1	275.5	262.3	250.3	239.4	229.3	220.1	211.6	203.7	196.3	189.5	183.1	177.2	171.6
145 ft.	476.9	440.0	408.5	381.2	357.2	336.1	317.3	300.6	285.4	271.8	259.3	248.0	237.6	228.0	219.2	211.0	203.4	196.3	189.7	183.6	177.8
150 ft.	493.4	455.3	422.6	394.4	369.6	347.8	328.3	311.0	295.3	281.2	268.3	256.6	245.8	235.9	226.8	218.3	210.5	203.2	196.3	190.0	184.0
155 ft.	509.8	470.5	436.8	407.5	382.0	359.4	339.4	321.4	305.2	290.6	277.3	265.2	254.1	243.9	234.4	225.7	217.6	210.0	202.9	196.3	190.2
160 ft.	526.3	485.7	450.9	420.7	394.3	371.1	350.3	331.8	315.1	300.1	286.3	273.8	262.3	251.8	242.0	233.0	224.6	216.8	209.5	202.7	196.3
165 ft.	542.8	501.0	465.1	434.0	406.7	382.7	361.3	342.2	325.0	309.5	295.3	282.4	270.6	259.7	249.7	240.3	231.7	223.7	216.1	209.1	202.5
170 ft.	559.4	516.2	479.2	447.1	419.1	394.3	372.3	352.7	334.9	318.9	304.3	291.0	278.8	267.6	257.3	247.7	238.8	230.5	222.7	215.5	208.7
180 ft.	592.3	546.7	507.5	473.6	443.8	417.6	394.3	373.5	354.8	337.8	322.3	308.3	295.3	283.5	272.5	262.3	252.9	244.1	235.9	228.3	221.1
190 ft.	625.3	577.1	535.8	499.9	468.6	440.9	416.3	394.4	374.5	356.6	340.4	325.5	311.8	299.3	287.7	277.0	267.1	257.8	249.1	241.1	233.5
200 ft.	658.3	607.6	564.1	526.3	493.3	464.2	438.3	415.2	394.3	375.5	358.3	342.7	328.3	315.1	303.0	291.7	281.2	271.4	262.3	253.8	245.9
210 ft.	693	639.7	594.0	554.4	519.8	489.2	462	437.7	415.8												
220 ft.	726	670.2	622.3	580.8	544.5	512.5	484	458.5	435.6												
230 ft.	759	700.4	650.6	607.2	569.3	535.8	506.3	479.4	455.4												
240 ft.	791.9	731	678.9	633.6	594	559.1	528	500.2	475.2												
250 ft.	825	761.5	707	659.9	618.8	582.4	550	521	495												
260 ft.	858	792	735.4	686.4	643.5	605.7	572	541.9	514.8												

ALTEC SERVICE CORP.
LOUIS BORNWASSER
3709 HUGHES ROAD
LOUISVILLE, KY. 40207

TABLES GIVE PICTURE WIDTH—FOR PICTURE HEIGHT MULTIPLY BY 40/55 or 0.727273

TABLES COMPUTED IN INCHES—TO DETERMINE NUMBER OF FEET DIVIDE BY 12.

EFFECT OF PROJECTION ANGLE ON SCREEN PROPORTION

The sizes given are correct for horizontal projection. For a given width the height of the picture increases with the projection angle therefore the screen height should be increased accordingly. The following table from "The Cinematographers Book of Tables" gives multipliers to use to correct the screen height to the given conditions.

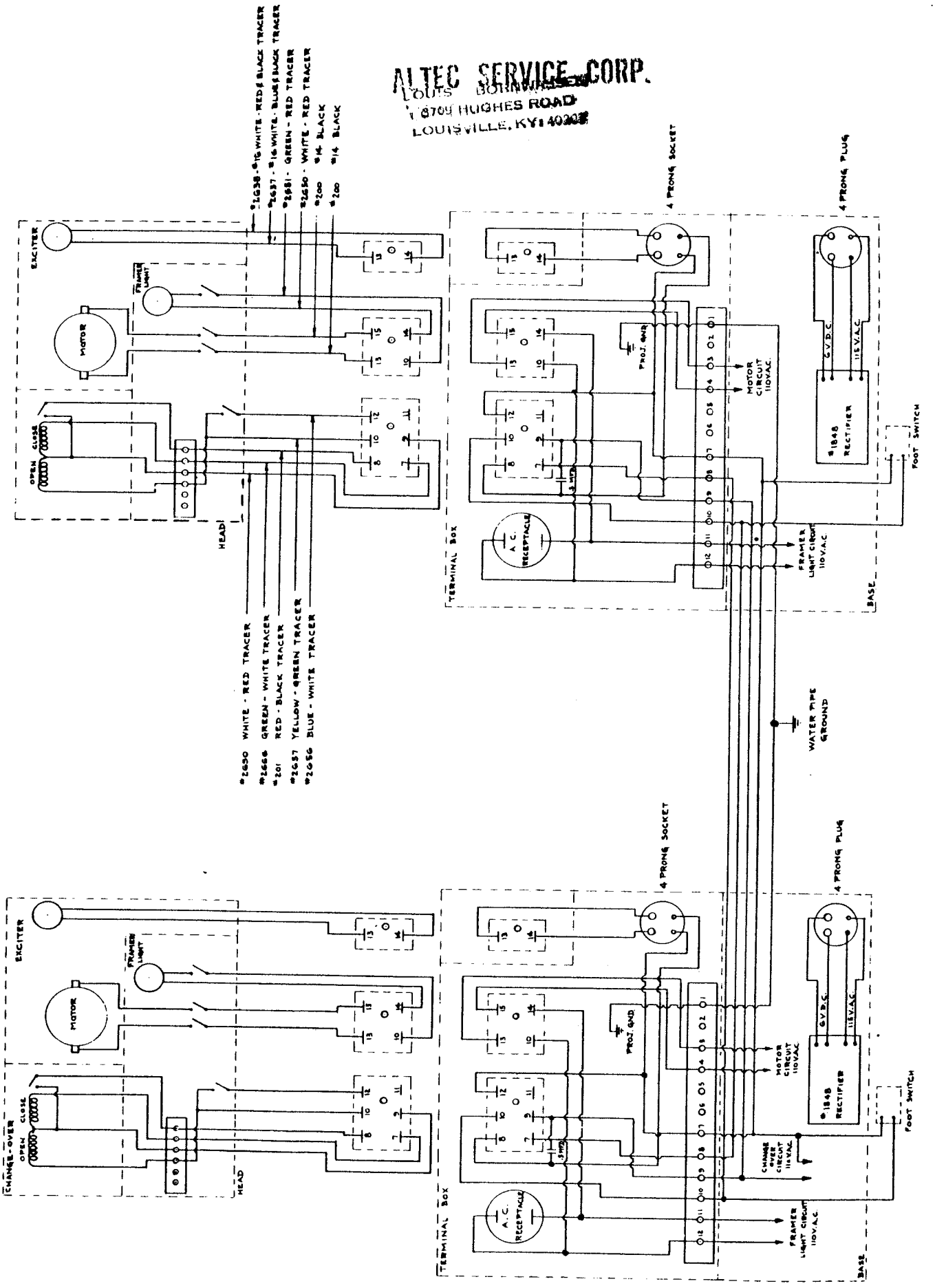
FOR EXAMPLE:—4.00 inch lens. 100 ft. throw. 20 degree projection angle; screen width from above table 245.8 inches; screen height by computation—245.8 x 0.7272=178.8 inches. Multiplier from Table at right for 4.00 inch lens at 20 degree angle is 1.093.
178.8 x 1.093=195.4 inches as correct screen height.

THE PROJECTION ANGLE TABLE at the right is based upon the screen width at the center of the screen and does not give "Keystone Effect." For a downward projection angle measure the projection distance to the top of the screen and obtain image width from the Image size Table; this will be the smallest width of the "Keystone."

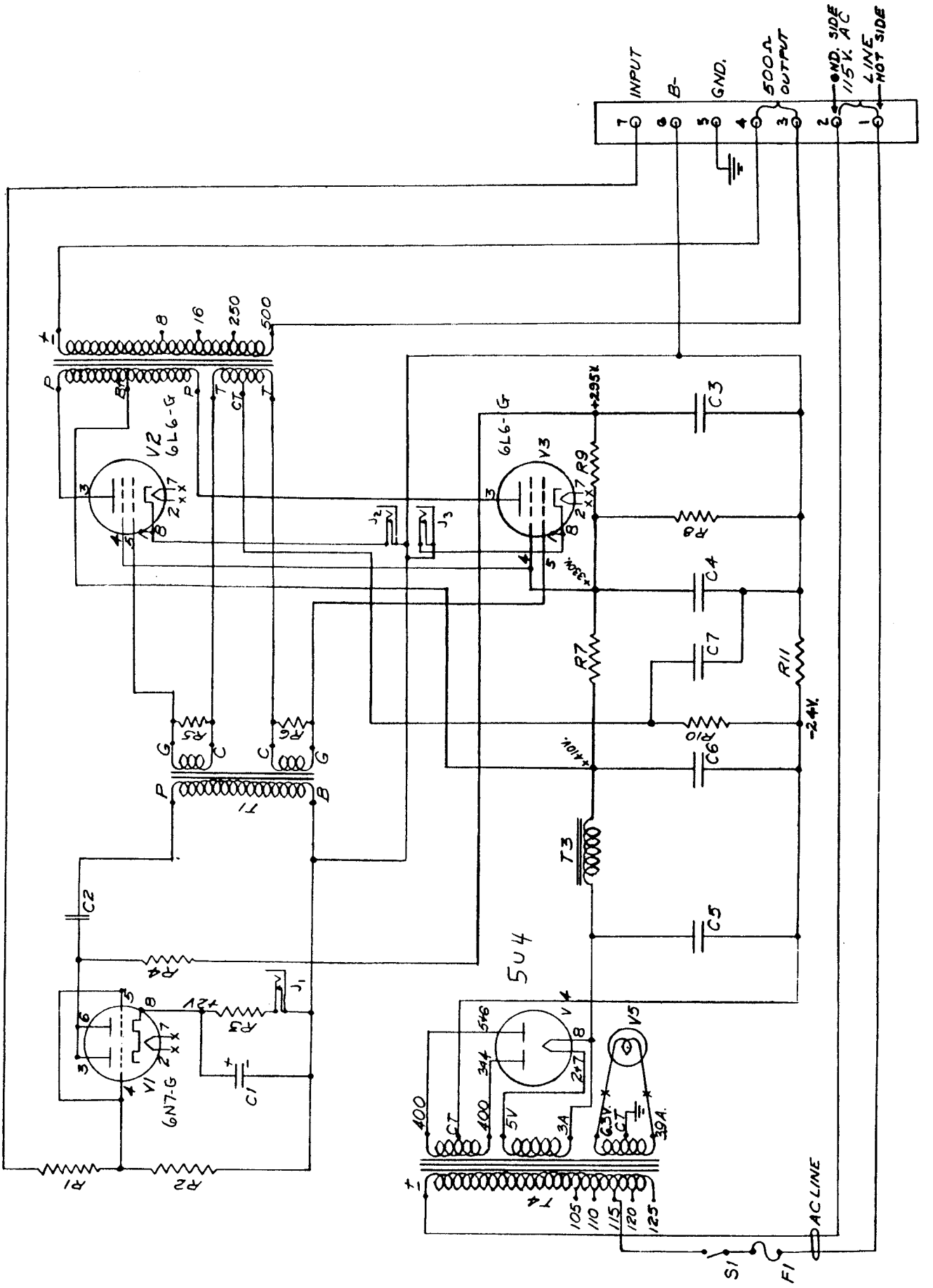
Lens	5 Deg.	10 Deg.	15 Deg.	20 Deg.	25 Deg.	30 Deg.
3"	1.0126	1.033	1.063	1.104	1.157	1.225
3½"	1.0113	1.031	1.059	1.097	1.149	1.214
4"	1.0104	1.029	1.056	1.093	1.143	1.207
4½	1.0096	1.027	1.054	1.088	1.138	1.201
5"	1.0091	1.026	1.051	1.086	1.135	1.196
6"	1.0082	1.024	1.048	1.084	1.130	1.189

Basis of computation—Distances measured from film to screen.
Based on American Standard Film ASA-Z22.4 (SMPE 35-4-1)
Horizontal projection for 0.825" ± .002 x 0.600" .002 aperture
Tolerance of Projection objectives 1% ASA Z22.8 1941 commercial 2%
(Total American Standards Association Tolerance 1.3% on image size.) Commercial Tolerance 2.3%
Notice This table is computed to correct for the distance from lens to film.

"12000 SERIES" PROJECTOR SCHEMATIC WIRING DIAGRAM



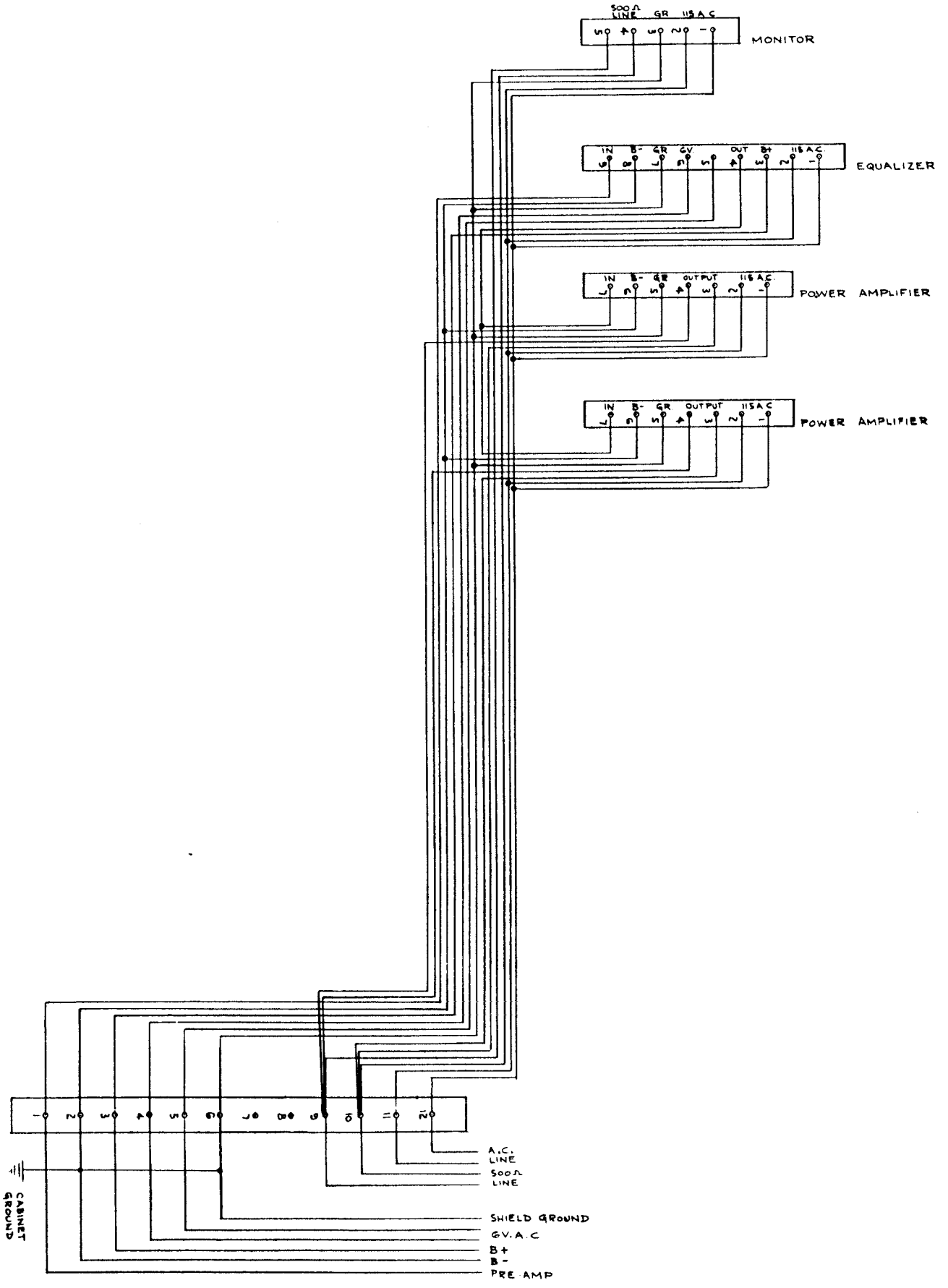
NO. 12106 POWER AMPLIFIER SCHEMATIC WIRING DIAGRAM



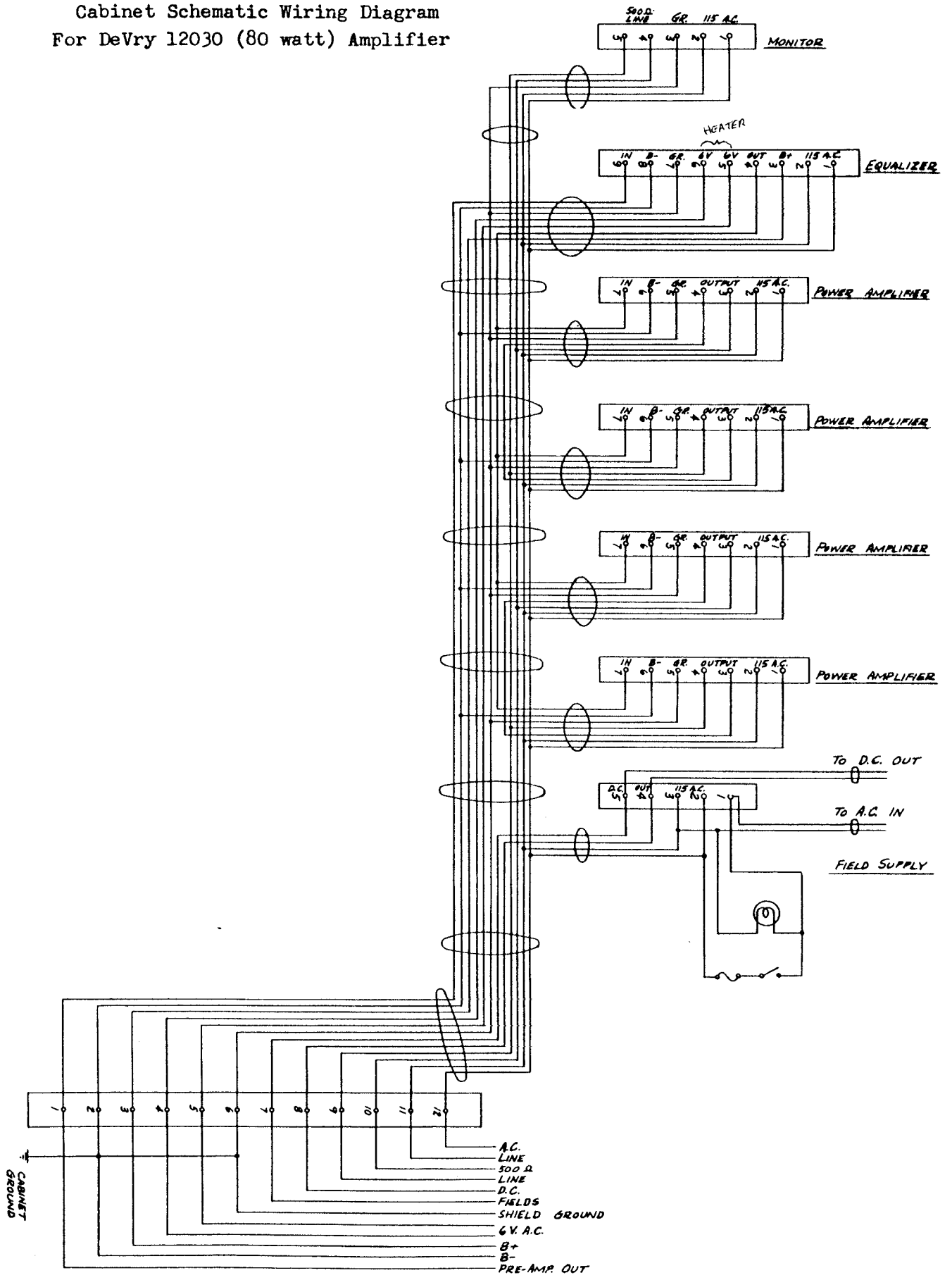
CODE AND PARTS LIST FOR DE VRY NO. 12106 POWER AMPLIFIER

Code	Part Number	Description
R1	4205	240,000 ohm 1/2 watt resistor
R2	15962	15,000 ohm 1/2 watt resistor
R3	4035	500 ohm 1/2 watt resistor
R4	4017	50,000 ohm 1 watt resistor
R5	4205	240,000 ohm 1/2 watt resistor
R6	4205	240,000 ohm 1/2 watt resistor
R7	4104	1500 ohm 25 watt resistor
R8	4080	7500 ohm 25 watt resistor
R9	4105	10,000 ohm 25 watt resistor
R10	4337	50,000 ohm 1/2 watt resistor
R11	10833	130 ohm 25 watt resistor
C1	15913	25 mfd. 50 volt elect. condenser
C2	15506	.5 mfd. 600 volt oil condenser
C3	15508	4 mfd. 600 volt oil condenser
C4	15508	4 mfd. 600 volt oil condenser
C5	10832	8 mfd. 600 volt oil condenser
C6	10832	8 mfd. 600 volt oil condenser
C7	15506	.5 mfd. 600 volt oil condenser
V1	4314	6N7G tube
V2	4327	6L6G tube
V3	4327	6L6G tube
V4	4310	5U4 tube
V5	400	6 volt pilot lamp
T1	12321	Input transformer
T2	12320	Output transformer
T3	12319	Choke
T4	12318	Power transformer
S1	4519	Single pole switch
F1	4085	3 ampere fuse
J1	4047	2 circuit jack long
J2	4047	2 circuit jack long
J3	4047	2 circuit jack long

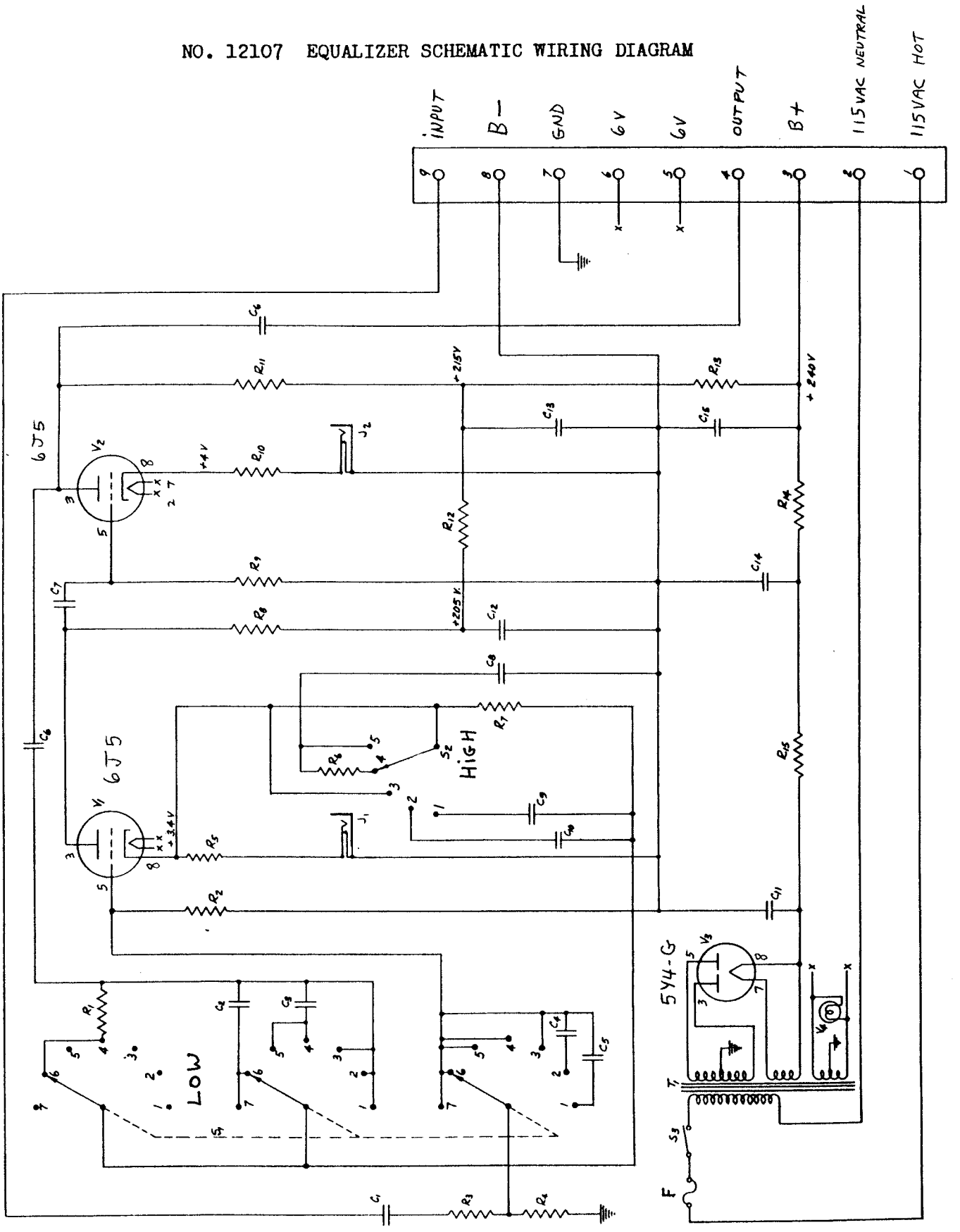
CABINET SCHEMATIC WIRING DIAGRAM FOR NO. 12016 (40 WATT) AMPLIFIER



Cabinet Schematic Wiring Diagram For DeVry 12030 (80 watt) Amplifier



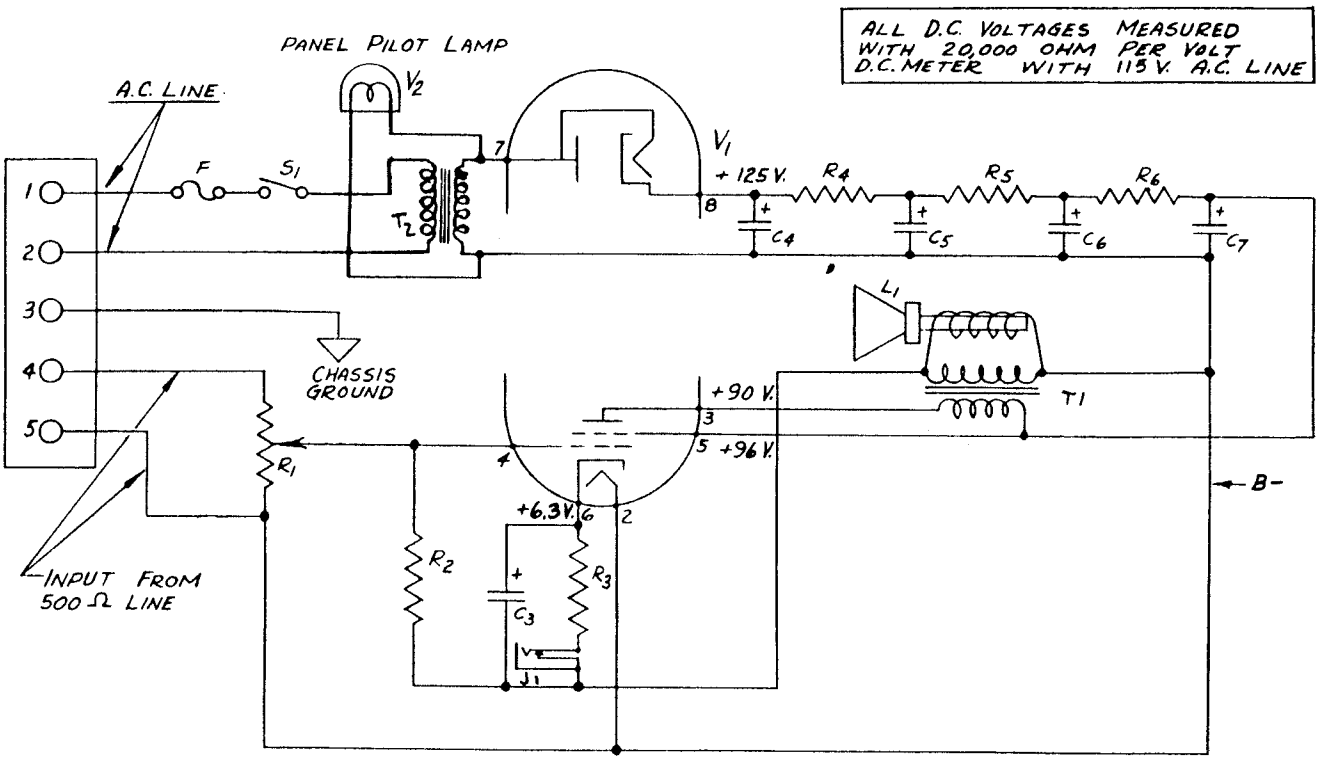
NO. 12107 EQUALIZER SCHEMATIC WIRING DIAGRAM



CODE AND PARTS LIST FOR DE VRY NO. 12107 EQUALIZER

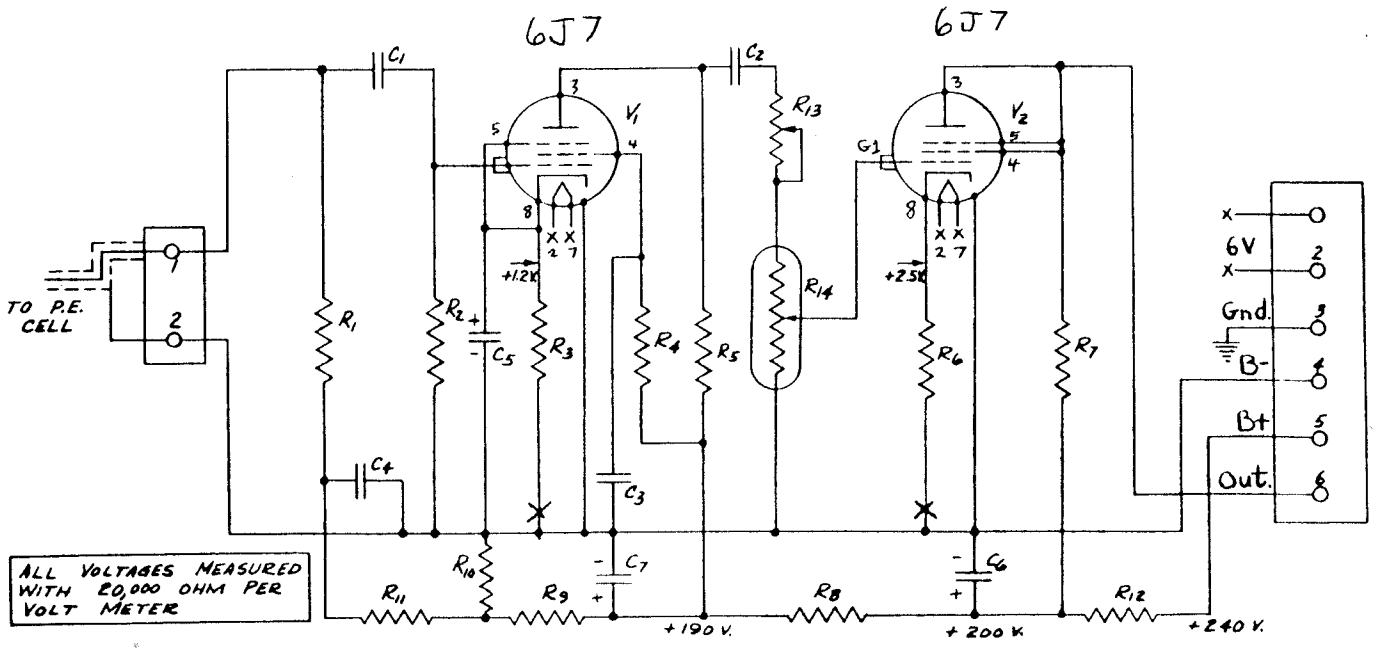
Code	Part Number	Description
R1	4037	150,000 ohm 1/2 watt resistor
R2	4205	240,000 ohm 1/2 watt resistor
R3	4205	240,000 ohm 1/2 watt resistor
R4	4198	100,000 ohm 1/2 watt resistor
R5	4038	3000 ohm 1/2 watt resistor
R6	3844	5000 ohm 1/2 watt resistor
R7	3851	75,000 ohm 1/2 watt resistor
R8	4198	100,000 ohm 1/2 watt resistor
R9	4205	240,000 ohm 1/2 watt resistor
R10	4334	2000 ohm 1/2 watt resistor
R11	4337	50,000 ohm 1/2 watt resistor
R12	4213	10,000 ohm 5 watt resistor
R13	4213	10,000 ohm 5 watt resistor
R14	4045	5000 ohm 5 watt resistor
R15	4045	5000 ohm 5 watt resistor
C1	4548	.05 mfd. 600 volt oil condenser
C2	15928	.002 mfd. 500 volt mica condenser
C3	15963	.005 mfd. 500 volt mica condenser
C4	4246	.004 mfd. 500 volt mica condenser
C5	3835	.001 mfd. 500 volt mica condenser
C6	15990	Dual .1 mfd. 600 volt oil condenser
C7	4548	.05 mfd. 600 volt oil condenser
C8	15881	.02 mfd. 600 volt oil condenser
C9	3835	.001 mfd. 500 volt mica condenser
C10	4235	.0005 mfd. 500 volt mica condenser
C11	15508	4 mfd. 600 volt oil condenser
C12	15508	4 mfd. 600 volt oil condenser
C13	15508	4 mfd. 600 volt oil condenser
C14	15508	4 mfd. 600 volt oil condenser
C15	15508	4 mfd. 600 volt oil condenser
V1	4322	6J5 tube
V2	4322	6J5 tube
V3	4321	5Y4G tube
V4	400	6 volt pilot lamp
T1	12315	Power transformer
S1	4211	3 gang 7 position switch
S2	4212	1 gang 5 position switch
S3	4519	Single pole switch
J1	4047	2 circuit jack long
J2	4047	2 circuit jack long
F	4539	Fuse 1 ampere 3AG

NO. 12110 MONITOR SPEAKER AMPLIFIER SCHEMATIC WIRING DIAGRAM



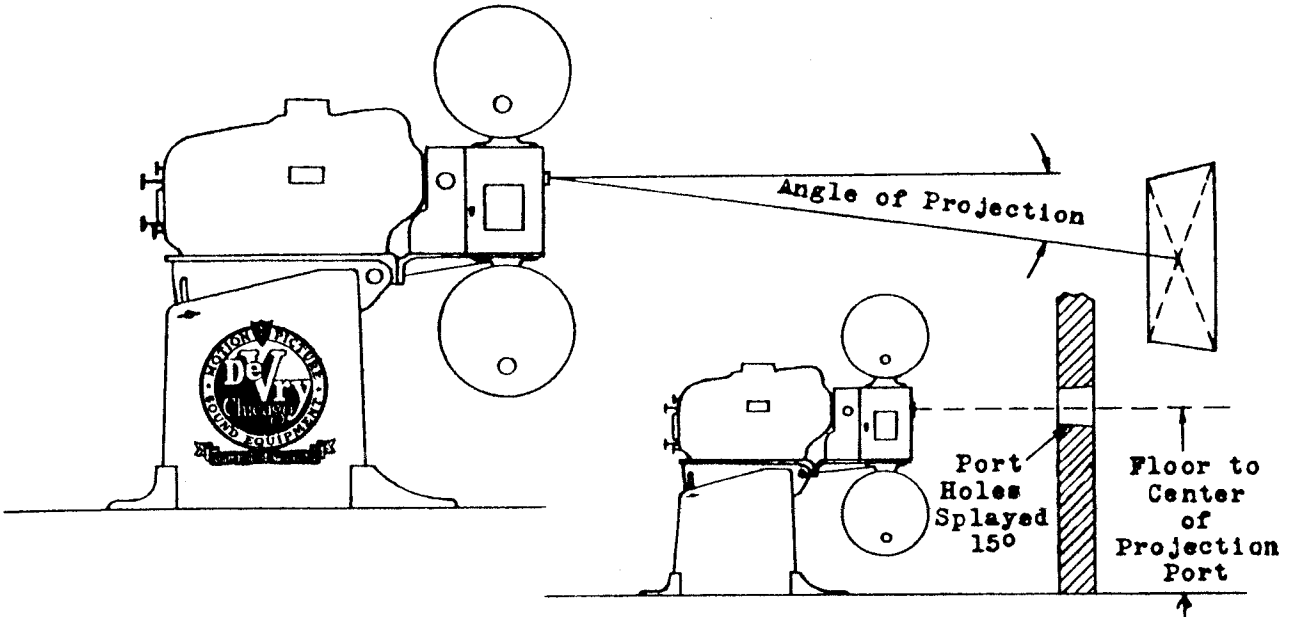
Code	Part Number	Description
R1	4088	250,000 ohm potentiometer
R2	4205	240,000 ohm 1/2 watt resistor
R3	10834	150 ohm 1/2 watt resistor
R4	4068	250 ohm 1/2 watt resistor
R5	4068	250 ohm 1/2 watt resistor
R6	4068	250 ohm 1/2 watt resistor
C3	15913	25 mfd. 50 volt condenser
C4	15394	8 mfd. 250 volt condenser
C5	15394	8 mfd. 250 volt condenser
C6	15394	8 mfd. 250 volt condenser
C7	15394	8 mfd. 250 volt condenser
V1	4359	117N7GT tube
V2	415	120 volt 6 watt lamp
S1	4519	Single pole switch
J1	4047	2 circuit jack long
L1	4188	8" P.M. speaker
T1	12401	Output transformer
T2	12419	1:1 isolating transformer
F	4539	1 ampere fuse

SCHEMATIC WIRING DIAGRAM FOR DE VRY NO. 12111 PRE-AMPLIFIER



Code	Part Number	Description
R1	4020	1 meg. 1/2 watt resistor
R2	4020	1 meg. 1/2 watt resistor
R3	10835	1500 ohm 1/2 watt resistor
R4	4020	1 meg. 1/2 watt resistor
R5	4018	240,000 ohm 1 watt resistor
R6	4035	500 ohm 1/2 watt resistor
R7	4026	20,000 ohm 1 watt resistor
R8	10836	20,000 ohm 1/2 watt resistor
R9	4002	300,000 ohm 1/2 watt resistor
R10	4032	200,000 ohm 1/2 watt resistor
R11	4020	1 meg. 1/2 watt resistor
R12	3844	5000 ohm 1/2 watt resistor
R13	12417	250,000 ohm potentiometer
R14	4158	250,000 ohm attenuator
C1		.01 mfd. 500 volt mica condenser
C2	4548	.05 mfd. 600 volt oil condenser
C3	15506	.5 mfd. 600 volt oil condenser
C4	15506	.5 mfd. 600 volt oil condenser
C5	15913	25 mfd. 50 volt condenser
C6	15394	8 mfd. 250 volt condenser
C7	15394	8 mfd. 250 volt condenser
V1	4301	6J7 tube
V2	4301	6J7 tube

PROJECTION ANGLE CHART

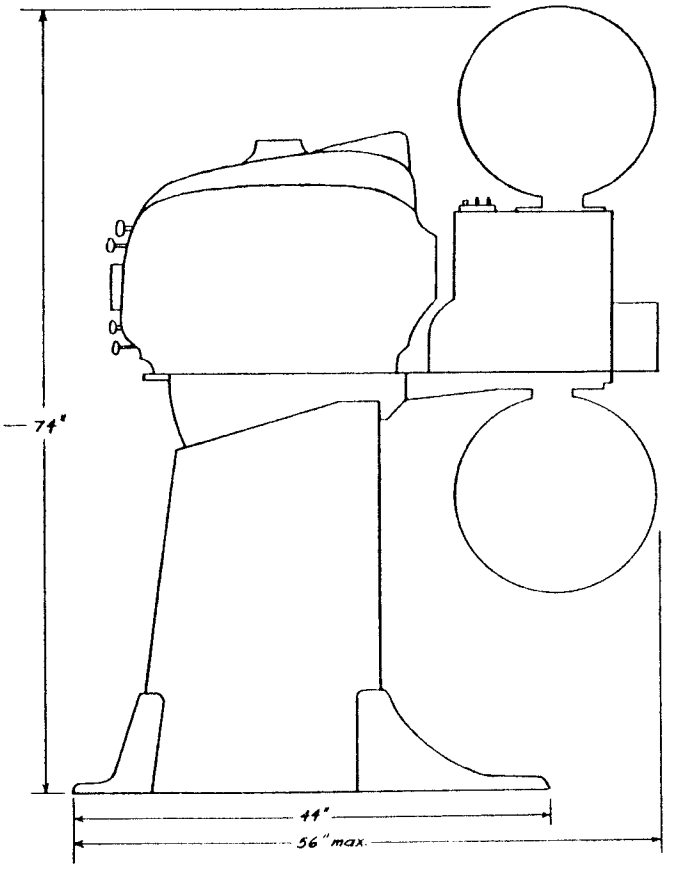


"12000 SERIES" BASE

Angle of Projection	Wall to Center Line of Base	Floor to Center of Port	Spot Port
-3	42"	50"	48"
-2	42"	49"	48"
-1	42"	48"	48"
0	42"	48"	48"
1	42"	47"	48"
2	42"	47"	47"
3	42"	46"	47"
4	42"	45"	46"
5	43"	45"	46"
6	43"	44"	45"
7	43"	44"	45"
8	43"	43"	44"
9	43"	43"	44"
10	44"	*48"	43"
11	44"	48"	43"
12	44"	47"	42"
13	44"	47"	42"
14	44"	46"	41"
15	44"	45"	41"
16	45"	45"	40"
17	45"	44"	40"
18	45"	43"	39"
19	46"	43"	39"
20	46"	42"	38"
21	48"	42"	38"
22	48"	41"	37"
23	48"	40"	37"
24	49"	40"	36"
25	49"	39"	36"

*On angles over 10°, add 6" block of concrete (approximate size of base) to raise projector height.

MAXIMUM OVERALL DIMENSIONS DE VRY "12000 SERIES" EQUIPMENT



WEIGHTS - DEVRY "12000 SERIES" PROJECTOR

Projector Head	Each Head	105 lbs. net
Projector Base	Each Base	265 lbs. net
Bracket-take up		26 lbs. net
Lower Film Magazine	Each Magazine	16.5 lbs. net
Upper Film Magazine	Each Magazine	12.25 lbs. net
Pre-Amplifiers	Each Pre-Amp	5 lbs. net