Film-Tech

The information contained in this Adobe Acrobat pdf file is provided at your own risk and good judgment.

These manuals are designed to facilitate the exchange of information related to cinema projection and film handling, with no warranties nor obligations from the authors, for qualified field service engineers.

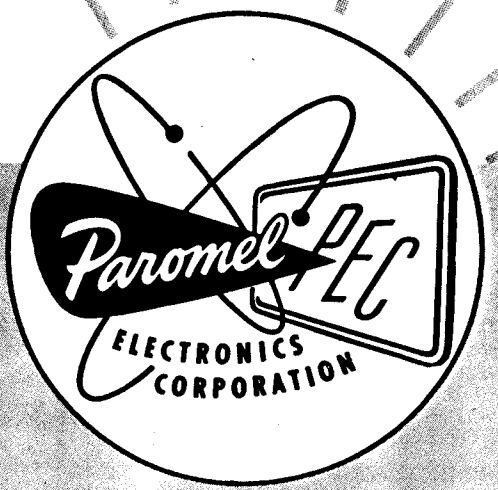
If you are not a qualified technician, please make no adjuatments to anything you may read about in these Adobe manual downloads

www.film-tech.com

DeVry 35mm Motion Picture

SOUND PROJECTION EQUIPMENT

TYPE D



PAROMEL ELECTRONICS CORPORATION

3956 W. BELMONT AVE. • CHICAGO 18, ILL.

U. S. A.

PHONE: AVENUE 3-4422 **CABLE: COPAROMEL**

INDEX

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF CHARTS

LIST OF WIRING DIAGRAMS

SECTION I --- INTRODUCTION

1. This Manual is issued as the basic Handbook for the equipment involved.
2. This handbook contains descriptive data and instructions for the installation, operation, maintenance and servicing of the "Type D" 35mm Sound Motion Picture Equipment formerly manufactured by the DeVry Corporation. Paromel Electronics Corporation is manufacturing improved versions of this "Type D" to accommodate the newer 35mm film techniques available.
3. Your P.E.C.-DeVry model may be one of these improved models. **IMPORTANT:** To assure your receiving the correct replacement parts for your P.E.C.-DeVry or DeVry equipment, **please always specify model number and serial number of Projector, Amplifier and Loudspeaker,** when ordering replacement parts.
4. It is recommended that the operator read this manual carefully before attempting to operate the equipment. It is also recommended that this manual be used as a guide when servicing the equipment.

SECTION II -- UNPACKING, INSTALLATION

A. UNPACKING

The equipment is packed according to standards for Navy shipments in containers so constructed as to insure acceptance by common or other carriers for safe transportation to the point of delivery. All containers are marked according to standards specified by the Navy.

When unpacked the equipment will conform to that shown in Figure 1, and as described in paragraphs 1, 2, 3 and 4 below.

1. PROJECTOR

The projector proper, less feed magazine, is packed in the largest container. Upon arrival unpack carefully and set the projector in an upright position.

Inside the sheet metal lamphouse, in a corrugated carton is the 1000 watt Mazda lamp. This lamp is to be inserted into its socket. See Installation, Projection Lamp, this Section.

In the lower projector magazine will be found the 25 ft. - 10 ft. duplex projector-amplifier power supply cable with twist lock polarized connection; the 5 ft. shielded photo electric cell cable, a 2000 ft. film reel and the front and rear projector tilting brackets. These brackets are to be installed to the projector. See Installation of Tilting Brackets, this Section.

In the upper projector case, packed in an envelope will be found the silent aperture mask. This mask is to be inserted into the projector aperture ONLY when showing SILENT FILMS. See Installation of Silent Aperture Mask, this Section.

2. AMPLIFIER AND SPEAKER

Upon unpacking the container marked Speaker-Amplifier, open the speaker door and carefully remove the amplifier. The 100 ft. speaker cable will also be found inside the speaker case.

3. FEED MAGAZINE, REEL

The feed magazine of 2000 ft. film capacity and one 1000 ft. film reel are packed in one container. The feed magazine is to be mounted to the projector. See Installation, Feed Magazine, this Section.

4. SPARE PARTS BOX

The spare parts and accessories are carefully packed in the spare parts box so as to prevent damage, corrosion or deterioration. An index sheet list of spare parts giving a complete itemized list of the contents of the box will be found on the inside of the cover. A similar index sheet list is included on the back of this manual.

B. INSTALLATION

1. PROJECTION LAMP

Lift the lamphouse cover free of the projector. Remove the lamp from the corrugated carton and insert the lamp into its socket. Note that there are two flanges on the lamp base. Insert the lamp into the lamp socket with the small flange toward the rear, press the lamp down and turn it a quarter turn to the right to lock into operating position. Do not apply excessive force to the lamp, as it may damage the socket. Since lamps furnished have pre-focused base, no adjustment of the light optical system is needed when inserting the lamp.

2. FEED MAGAZINE

Unscrew the two knurled locking nuts on top of the upper projector case. Fit the support bracket of the feed magazine over the threaded studs. Replace knurled nuts and tighten securely so as to rigidly hold the feed magazine to the projector case. See Figure 4, Page 21.

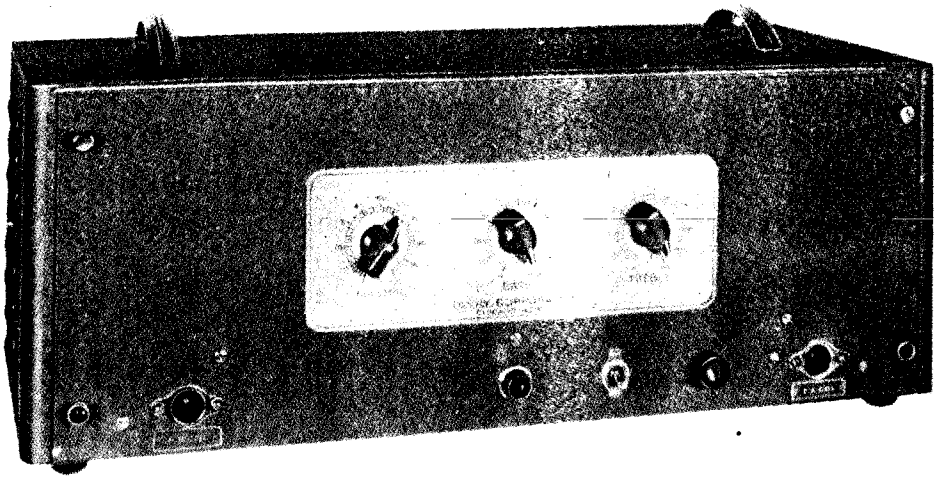
3. TILTING BRACKETS

The tilting brackets are mounted to the front and to the rear of the lower projector case. Place bracket under the case with the vertical part of the bracket over the threaded slot in the metal plate affixed to the case and insert and tighten the bracket to the case with the knurled locking nut.

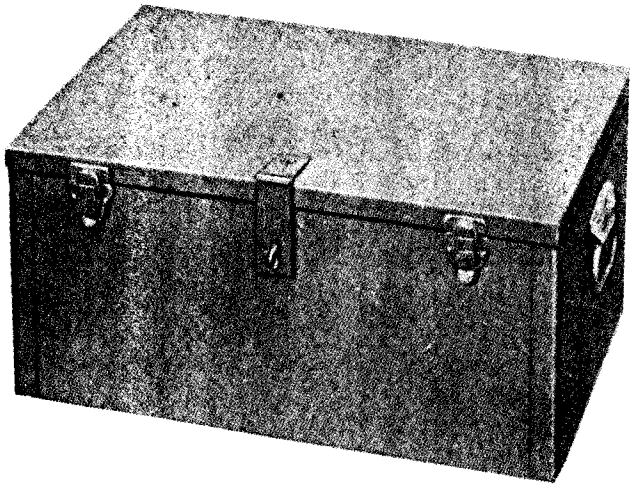
4. SILENT APERTURE MASK

The projector is shipped with a sound aperture mask in the aperture. In the event SILENT pictures are to be shown the sound mask is to be withdrawn and the silent aperture mask inserted in its place. To withdraw sound mask, grasp mask knob and pull out. To insert either mask, set mask into slot and push in until mask automatically locks in place. Before inserting mask be sure it is thoroughly cleaned of all dirt, dust, oil, emulsion deposits, etc.

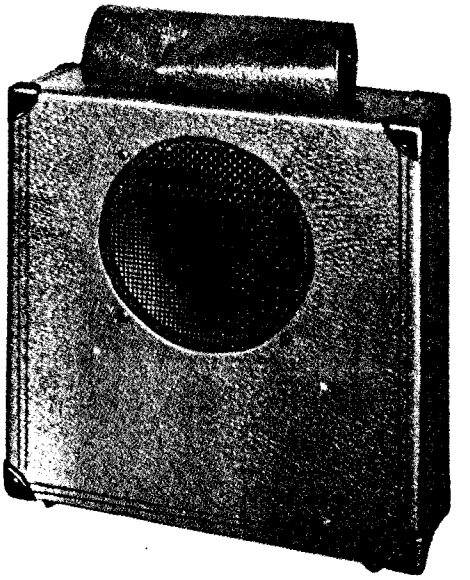
FIGURE 1---COMPLETE DEVRY MODEL "20" (NAVY TYPE "D")



DE VRY MODEL "2804" AMPLIFIER

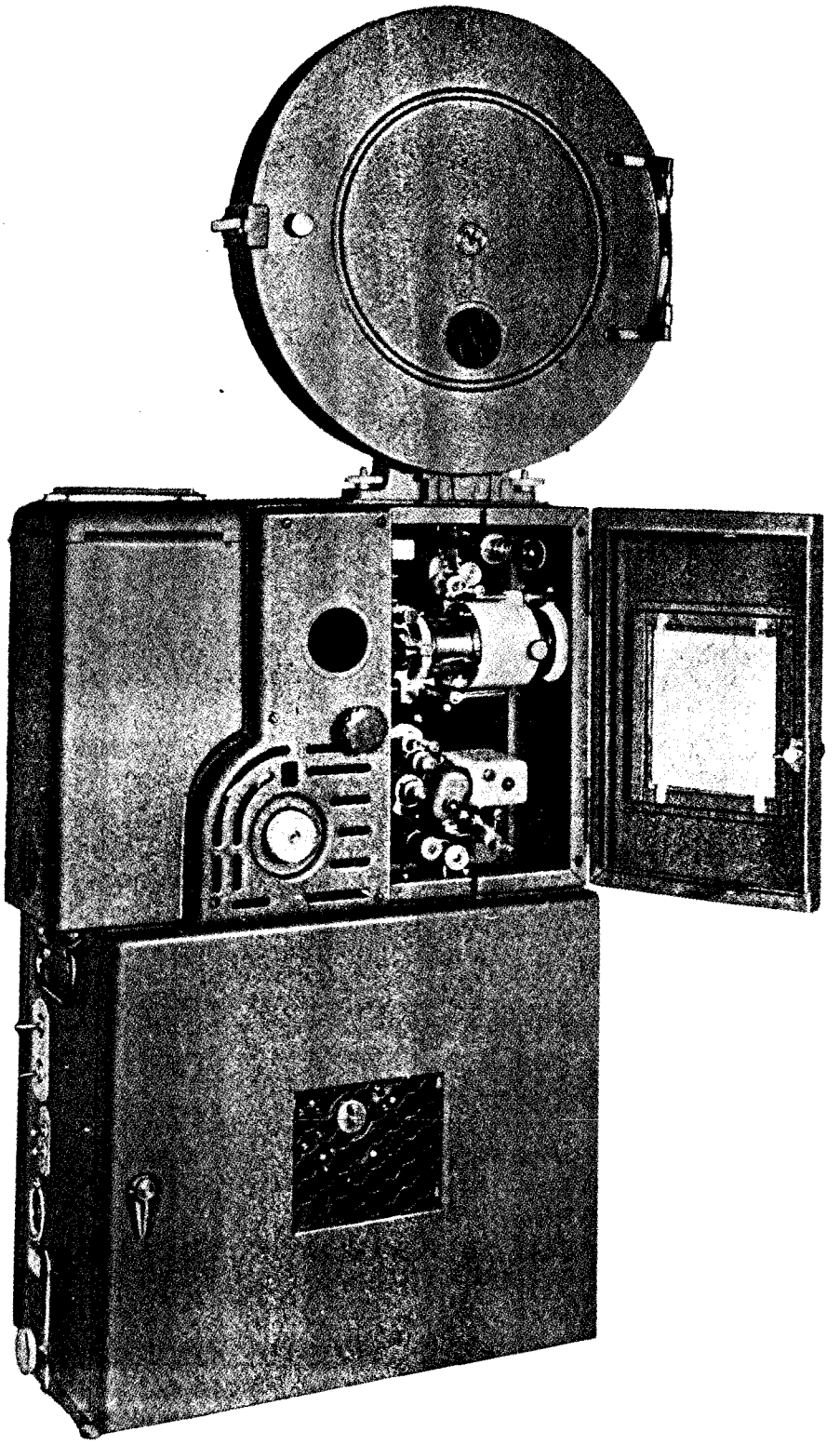


NO. "1099" SPARE PARTS AND BOX



DE VRY MODEL "1100" LOUDSPEAKER

35MM SOUND MOTION PICTURE EQUIPMENT



DE VRY "TYPE D" 35 MM. SOUND PROJECTOR

SECTION III -- DESCRIPTION

A. GENERAL DESCRIPTION

The Type "D" Sound Motion picture equipment, manufactured by the De Vry Corporation for the U. S. Navy consists of the units illustrated in Figure 1 on Pages 6 and 7.

1. PROJECTOR

The precision De Vry projector supplied is classed as a semi-portable type (Navy Type "D") and is designed and engineered expressly for the projection of 35 mm. sound motion picture films. Silent 35 mm. films may also be shown by removing the sound aperture mask and inserting the silent aperture mask. When silent films are shown the amplifier and loudspeaker naturally are not used.

The most important units of the projector consist of the feed magazine, the picture projection mechanism, the sound mechanism, the projector optical system, the driving mechanism and the take-up mechanism.

The upper and lower projector cases into which these units are housed or to which they are attached is made of heavy sheet steel, welded and bolted together. Hinged front and rear doors are provided in both the upper and lower case. Provisions are provided in the lower case for the operating switches and for the attachment of the tilting brackets for leveling and adjusting the projection angle.

All parts of the mechanism requiring close alignment; specifically, the picture projection, sound and driving mechanisms are mounted on a durable, rigid metal panel.

a. Feed Magazine

The feed magazine mounts to the upper projector case by means of two knurled nuts. The reel of film to be shown is placed on the spindle inside the magazine. The magazine will accommodate reels up to 2,000 ft. capacity, and no adjustments are necessary when changing from reels of one capacity to another.

b. Picture Projection Mechanism

The picture projection mechanism comprises the guide rollers, feed sprocket, feed sprocket idler, film gate and aperture, intermittent sprocket, intermittent and shutter mechanism.

The clarity and steadiness of the projected picture image depends on the accuracy and successful functioning of these parts. Corresponding care must be taken to keep these units clean, properly oiled and properly adjusted.

c. Sound Mechanism

The sound mechanism is that important part of the projector for translating the photographic record of the sound track on the film into audible sound. This mechanism consists of the film driven sound drum, the photo electric cell, exciter lamp, sound or slit lens. Correlated parts are the holdback sprocket, floating sound roller and the sound adjustment roller.

d. Projection Optical System

The projection optical system is the means by which the picture image is illuminated on the screen. It consists of the projector lamp, reflector, condenser lens system, aperture opening and projection lens. The lamp, reflector and condenser lenses are enclosed in a sheet metal lamphouse. Ventilation is provided in the lamphouse through a fan mounted to a motor.

The lamp, reflector and condenser lenses are accurately aligned at the factory and their respective positions should not be changed. All surfaces requiring cleaning or other attention are readily accessible without removing.

e. Driving Mechanism

The entire projector mechanism is driven by silent, endless metal chains running over sprockets. The main driving motor supplies all of the mechanical power required for operation.

f. Take-up Mechanism

Since film fed into the projector mechanism from the feed reel must be taken up at the same rate of speed, it can readily be understood why the take-up mechanism is an important part of the projector. The sound sprocket located beneath the exciter lamp housing takes up the film at the same rate of speed as the feed sprocket feeds the film into the mechanism. The take-up reel mounts to the spindle inside the lower case on the front side of the projector. This reel revolves and winds up the film.

2. AMPLIFIER

The amplifier supplied with the projector is classed as a AB-1 unit utilizing four stages. When operated on 110-120 volts, 50-60 cycle A.C., with tubes in A-1 condition, the amplifier will deliver approximately 30 watts of undistorted power to the loudspeaker so that audible sound can be reproduced for an audience of up to 1500 persons (utilizing one speaker).

Structurally the amplifier is assembled in a manner conductive to easy and rapid operation, maintenance and service.

3. LOUDSPEAKER

The loudspeaker or sound reproducing device is an A-12 permanent magnet type unit mounted into a seasoned hardwood case covered with durable marine treated imitation leather.

4. SPARE PARTS BOX

The spare parts box is made of rust-proof metal, painted in marine gray to withstand the rigors of sea duty. An index sheet listing the contents of the box will be found on the inside cover of the box as well as in the manual.

B. DETAILED DESCRIPTION

So as to help the operator to better understand the workings of motion picture equipment, we present in this section not only a complete description of the important projector elements, but the function of each as well.

1. FEED MAGAZINE AND FEED REEL

The feed magazine will accommodate reels up to 2,000 ft. capacity.

The feed reel containing the film to be projected is mounted on the shaft or spindle inside the upper magazine. This reel is free to rotate with the shaft which is retarded by a tension spring, thus allowing the film to be unwound at 90 ft. per minute by the action of the feed sprocket, operating at constant speed.

To insure that the reel will not feed faster than 90 ft. per minute, thus piling up the film in the magazine a friction brake or clutch is built into the feed shaft. This friction is adjustable so that the film may be run with the lowest tension that will permit successful operation.

2. PICTURE PROJECTION MECHANISM

a. Guide Roller

The guide roller located just below the upper fire trap rollers is motivated by the passage of the film on its under surface. Its purpose is to minimize any side-sway of the film as it guides the film to the feed sprocket.

b. Feed Sprocket

This mechanism driven sprocket runs at constant speed and unwinds the sound film from the reel in the upper magazine at the rate of 24 frames per second or 90 feet per minute. It also maintains the "film loop" above the picture gate. The sprocket is of the 16-tooth type for operation of standard 35 mm. film and is so designed as to compensate for film shrinkage of up to 1.8 per cent.

c. Feed Sprocket Idler

In addition to this idler, there are two others of like construction incorporated in the sound projection mechanism, one for each sprocket.

The function of these idlers is to hold the film in engagement with the sprocket teeth.

d. Film Gate and Aperture Plate

The film or picture gate and aperture are next in importance to the film motivating mechanism (intermittent unit) for picture steadiness. The function of the film gate and aperture is to hold the film steady while a frame of it is being projected on the screen. Each succeeding frame must be held in the same position as its successor so as to afford sharp focus over the entire area of the picture.

(1) Film Gate

In the film gate the edges of the film are held under carefully adjusted tension by hardened and ground metal plates or shoes, between which the moving film slides. Gate tension is accomplished by steel springs which exert equal pressure on the film shoes.

The film gate is removable as a unit and consists of the following major parts (1) An Upper Tension Shoe located just above the aperture. This shoe holds the film between the side tension rollers, preventing any side sway of the film. (2) An Aperture Tension Shoe located at the aperture. The tension exerted by the shoe can be adjusted to compensate for new, old or oily prints, while the projector is in operation through the manipulation of the lock tension screw provided. (3) A Lower Tension Shoe, located just above the intermittent sprocket. This shoe prevents the film from buckling during the framing operation. (4) An Intermittent Sprocket Shoe, which extends one-quarter around the circumference of the intermittent sprocket, allowing for a four tooth contact of the film on the sprocket.

(2) Aperture Plate

The aperture plate is a metal plate with a rectangular opening called the aperture or aperture opening the size of the film picture, enabling the light to pass to and through the film, simultaneously confining the beam of light to the precise size required for illuminating the picture.

e. Intermittent Movement

The intermittent movement (often called the "heart" of the projector), incorporated in the DeVry projector, is of the Geneva Cross type, designed for a 90 degree turn of the cross for each revolution of the cam pin, and designed to turn through 90 degrees cross angle with a 90 degree pin mesh. The entire parts of this movement are assembled in one oil-tight housing. The unit is readily removable from the projector as a single unit without the use of special tools.

The intermittent movement and the shutter are so synchronized that the intermittent acts so as to move intermittent sprocket precisely one-fourth of a revolution when the light is cut off from the screen by the shutter. This cycle

of motion displaces one film picture from the aperture and substitutes the succeeding one, the whole cycle lasting one twenty-fourth of a second. In other words such a cycle occurs twenty-four times per second so that each one of twenty-four pictures is successively projected on the screen.

The accurate action of the intermittent makes it certain that each picture will remain perfectly still and perfectly flat over the aperture during its period of projection.

f. Intermittent Sprocket

The intermittent sprocket is part of the intermittent movement. All the other film sprockets incorporated on the projector except the hold-back sprocket revolve in unison, driven by the projector motor. The intermittent sprocket, however revolves intermittently, starting and stopping 24 times every second.

g. Shutter Mechanism

(1) Revolving Shutter

(a) If the revolving shutter were removed from the projector we would see a picture of very poor quality. The picture would be marred by a series of streaks of light. While the intermittent sprocket is in motion, the shutter intercepts the beam of light from the light source while the film is moving past the aperture opening, thus holding all film movement from the screen.

(b) When the intermittent sprocket stops the picture before the aperture the shutter moves out of the way and allows the light to pass through that picture to the screen, projecting one picture.

(c) The rotating shutter in the DeVry projector is of the single sectored type, approximately 50% open, and two interruptions by the shutter are made to each pull down by the intermittent sprocket.

(2) Safety (Fire) Shutter

The safety or fire shutter — located between the light source and picture mechanism is connected directly to the shutter mechanism. The purpose of this shutter is to close the aperture opening when the film speed drops below 50 ft. per minute, otherwise the intense heat from the light source would damage the film when the film is moving slowly or has stopped altogether.

h. Framing the Picture

Framing is accomplished by the rotation of the intermittent sprocket on its center, with the spacing between the aperture and intermittent sprocket constant. The framing area covers a range of at least two pictures. The framing device can be operated with the projector in operation without causing picture "jump" or distortion. The framing light — provided behind the framing aperture located six picture frames above the projector aperture allows for greater ease in framing before projecting the picture on the screen.

3. PROJECTION OPTICAL SYSTEM

The projection optical system consists of the projection lamp, the reflector, condenser lens system, film aperture and projection lens. The reflector, lamp and condenser lens system are meticuously aligned by the manufacturer and their relative positions should not be changed. All surfaces requiring cleaning or other attention are readily accessible without removing these parts from their mountings.

a. Projection Lamp

Light for projection is provided by a standard 1000 watt, 115 volt T-20 bulb medium C13 or C13D biplane filament prefocus base Mazda projection lamp. The lamp is enclosed in a sheet metal lamphouse which also houses a fractional horsepower motor with a fan at one end of its shaft to cool the parts inside.

b. Reflector

The metal reflector behind the projection lamp reflects the light emitted from the rear of the lamp and in so doing intensifies the direct light from the lamp.

c. Condenser Lenses

The set of condenser lenses in front of the projection lamp concentrate the light emitted by the lamp on the aperture.

d. Projection Lens

After the light passes through the film at the aperture it is focused by the projection lens onto the screen.

The lens holder or housing will accommodate either a Series I projection lens with its adapter or a Series II lens without adapter. The adapter for the Series I lens is furnished with the projector if a Series I lens is supplied.

The position of the lens carriage is adjustable for focusing by means of the focusing knob on the front end of the projector. Lenses of focal lengths ranging from 3½ to 9¼ inches can be used. At a given distance from the screen a lens having a longer focal length will decrease the size of the picture, and a lens with a shorter focal length will increase the size of the picture.

e. Aperture

The aperture as previously described is the rectangular opening the size of the film picture in the aperture plate. This opening enables the light to pass to and through the film, confining the beam of light from the projection lamp to the precise size required for illuminating the picture.

4. SOUND MECHANISM

As the film leaves the picture mechanism it is received by the sound mechanism. The sound mechanism is mounted on the same basic plate as the picture mechanism and consists of the following parts, which are explained in detail.

a. Rotating Sound Drum

The rotating sound drum is mounted on a shaft of sufficient size to prevent strain or excessive wear on the precision ball bearings upon which it rotates. A flywheel to effectively damp out "wows" or "flutter" is mounted directly to this drum.

The sound drum is driven by the wrap of the film around its surface. The inertia of the flywheel tends to keep the drum running at constant speed, thereby imparting a constant speed to the film as it passes the point of scanning; such a condition is vitally necessary for distortionless sound reproduction.

b. Photo Electric Cell

A photo electric cell is a device that passes electric current in direct proportion to the light falling upon it. The photo electric cell in the DeVry Model "2812" Projector is of the 3 pin highly sensitized type and operates on 60 to 70 volts. The cell is mounted on a substantial bracket inside the sound drum thereby eliminating the use of reflectors or prisms.

c. Exciter Lamp

The exciter lamp provides a source of constant intensity light. The exciter lamp used is a C-8 filament prefocused base lamp, one ampere, 6 volt, T-8 bulb.

d. Slit or Sound Lens

The slit or sound lens is mounted in a single barrel housing. Its function is to reduce the size of the light emitted by the exciter lamp into a very fine beam of light, a size sufficient for "scanning" the film sound track. The slit lens should never be tampered with. Adjustment on this apparatus requires a highly skilled service man. Failure of the entire sound system may result if this part is promiscuously handled.

e. Floating Sound Roller

As the film leaves the sound drum it passes under a floating roller. This roller prevents any transient changes of the film speed through the sound system. The roller is operated by a spring so that atmospheric conditions have little or no effect upon its operation.

f. Sound Adjustment Roller

This roller, located just before the rotating sound drum, is provided to permit the projection of sound film on which the sound track is not standardly located. Its function therefore is primarily one of adjustment. In the event that the sound track is not in perfect lateral alignment with the slit lens as the film passes over the sound drum a simple adjustment of this roller will remedy the situation.

5. DRIVING MECHANISM

All moving parts of the projector mechanism (except the sound drum and holdback sprocket) are driven by means of silent, endless metal chains running over sprockets. This driving system provides a smooth transmission of power with the necessary flexibility and mechanical dampening required so as to obtain uniformity and consistency of speed.

The chains and sprockets are so designed that the chain cannot slip off the sprocket even when running with slack in the chain. Spring loaded easily adjustable idler rollers maintain the correct tension on the chains at all times.

6. FILM TAKE-UP MECHANISM

The take up mechansim, comprising the take up (sound) sprocket, the take up reel and the film take up device, is responsible for winding up the film that passes through the projector.

a. Take-up (Sound) Sprocket

This sprocket located below the exciter lamp housing runs at a constant speed of 90 ft. per minute. Its function is to keep the film moving to the take-up at a constant speed and to prevent the slightly jerking motion imparted to the film by the lower film reel from being transmitted to the sound mechanism.

b. Take-up Reel

The take-up reel mounts to the spindle provided in the lower projector case. This reel, unlike the feed reel, is not free running. Its speed of necessity must be variable, not constant, in order to wind up the continuous flow of film from the projector at the proper speed.

c. Take-up Device

The spindle on which the feed reel mounts is driven by the projector drive mechanism through an endless metal chain through a friction clutch or "take-up" device. The tension in this device is set by the factory to the proper point and cannot be changed.

7. MISCELLANEOUS PROJECTOR UNITS

a. Threading Lamp

The pilot or threading lamp is provided to illuminate the film handling mechanism while threading. The "ON-OFF" switch for this lamp is located on the lower projector case.

b. Film Strippers

Metal film strippers are used to prevent the film, if and when it tears, from wrapping itself around the sprocket, causing more damage to itself against the sprocket teeth.

c. Fire Trap Rollers

This is a fire safety device. The rollers prevent any fire which may start in the projector from traveling up into the upper magazine or down into the lower magazine. The film passes through two sets of these rollers, as it leaves the feed magazine and enters the projection mechanism, also as the film leaves the projection mechanism and enters the take up reel in the lower case. The rollers are so spaced that while they allow the film to pass through — fire won't.

d. Holdback Sprocket

This sprocket which is film driven is provided to prevent the intermittent action of the film below the gate from entering the sound system. The steadying action imparted to the film at this point also helps to maintain the lower "film loop" and to help maintain the necessary steady tension on the film in order to rotate the sound drum.

8. AMPLIFIER

The DeVry Model "2804" Amplifier, supplied with the DeVry Model "2812" (Navy D) 35 mm. projector, is a four stage audio frequency amplifying unit that is complete in itself. It operates on 50-60 cycle A.C. (alternating current) at voltages from 110 to 120.

The four stages of amplification are arranged in the following order.

First Stage

One 6J7 tube connected as a pentode, acting as a voltage amplifier and feeding through the volume control to the second stage.

Second Stage

One 6F5 tube operating as a triode, acting as a voltage amplifier with a small amount of gain.

Third Stage

One 6N7 tube operating as a driver and connected to the primary of the input transformer, employing the method of parallel feed with no current passing through the primary winding of the driver transformer.

Fourth Stage

Two 6L6 tubes operating as a Class AB-1 and connected in push pull with the output transformer, coupled to the loudspeaker unit.

The secondary of the input transformer is split into two sections. The grid return of each winding is connected back through a tertiary winding on the output transformer, and the center tap of the tertiary winding returns to a resistor which is connected in the high voltage return, which employs somewhat of a semi-fixed bias on the 6L6 grids of approximately -22.5 to -25 volts. This method permits the use of inverse feed-back on the 6L6 tubes or output stage and likewise gives less distortion.

The utilization of inverse feed-back between the 6N7 driver tube plate and the 6F5 cathode used in conjunction with the treble tone control gives a varying amount of rise in the high frequency response, reaching about 9 D.B. (decibels) at 8000 cycles when the treble control resistance is all cut-out. When the resistance of the control is cut-in the amplifier is flat within 2 to 3 D.B. (decibels) to 10,000 cycles.

By employing a condenser and resistor across the primary of the input transformer to cut off the low frequency response below 300 cycles, the bass control serves the purpose only of still further reducing the amount of low frequency response when the resistance of the control is all cut-in.

The amplifier may be made flat on the low frequency response to about 50 cycles by removing the 75,000 ohm resistor from the primary of the input transformer and replacing the coupling condenser with one of approximately .2 to .25 mfd. The amplifier will be flat only when the low frequency control resistor is all cut-out.

The DeVry Model "2804" Amplifier was designed and built to amplify the minute voltages in the photoelectric cell when the sound track on the film is scanned by the beam of light emitted by the exciter lamp and slit lens to a point where the resultant power is sufficient when translated by means of the loudspeaker to produce audible sound at a suitable listening level.

The amplifier supplies 75 volts D.C. (polarized voltage) to the photoelectric cell.

The amplifier and projector are connected by suitable cables.

The amplifier schematic wiring diagram will be found on **Page 35.**

The amplifier is provided with two photoelectric cell input receptacles, identified by the designation P. E. CELL below the receptacle. For single projector operation connect the P. E. Cell plug to either input.

a. Amplifier Controls, Switches, Fuse

All controls and switches are easily identified by the marked designations on the front amplifier panel.

(1) A. C. Power Switch

The power switch is designated by the words "OFF-ON". This switch controls the power supply for the amplifier.

(2) Master Control

The control identified by the designation MASTER below its knob is the main volume

control. The sound level of the amplifier may be regulated by means of this control regardless of the source of the input signal.

(3) Treble Control

This control is identified by the designation TREBLE below its knob. This control regulates the amount of high frequency response. No definite rule can apply as to the best setting because of the variation in film sound tracks and the acoustic conditions of the room in which the sound picture is to be shown.

(4) Bass Control

This control is identified by the designation BASS below its knob. This control regulates the amount of low frequency response. No definite rule can apply as to the best setting because of the variation in film sound tracks and the acoustic conditions of the room in which the sound picture is to be shown.

(5) Amplifier Fuse

The amplifier is protected by the fuse located on the front panel. This fuse is of 3 ampere capacity and it is important that if replaced that the new fuse used does not have a capacity greater than 3 amperes. To remove fuse, grasp fuse holder knob, press toward its base and turn counter-clockwise until it releases to expose the fuse.

(6) Pilot Light

The green pilot light, located on the front amplifier panel, will glow when the current is on. If fuse is blown this lamp will not light.

9. SOUND REPRODUCER (Loudspeaker)

The DeVry Model "1100" loudspeaker reproducer, furnished with the DeVry Model "2804" amplifier consists of a 12 inch permanent magnet type speaker mounted in a seasoned hardwood case covered with durable marine treated imitation leather.

A 100-foot speaker cable furnished is permanently attached to the speaker. Directions for connecting the loudspeaker to the amplifier will be found under the caption Interconnecting the Equipment, Section V.

While a "show" is on, no metal or other loose objects should be allowed to come in contact with the speaker or speaker case in order to prevent annoying vibrational rattles.

Although the speaker cone is somewhat water repellant it should not be allowed to become wet unnecessarily.

SECTION IV
PRINCIPLES OF MOTION PICTURE OPERATION

1. THE SECRET OF MOTION PICTURES

The primary aim of a motion picture show is to present a story in such a manner that the audience is not aware of the fact that the performance is an illusion.

a. Persistence of Vision

The human eye has the ability to retain upon its retina the impression of any light incident thereon for a small fraction of a second after the light itself has vanished. This "persistence of vision" makes motion pictures possible. Darkness is invisible except in contrast to light. The light upon the screen is the only thing that is visible or makes any impression on the eye. Looking at the screen we see certain shades of light thereon while, at the same time, certain portions of the screen surface are more or less invisible. It is the pattern formed by various shades of light that form the screen image.

b. Illusion of Motion

The moving picture we see on the screen is only an illusion of a moving image. Actually, it is a presentation to the eye of the images of a series of pictures taken in very rapid succession by the motion picture camera.

If a series of picture images, each one of which differs but slightly from the preceding image, is viewed in rapid succession by the eye, the brain retains an impression of the preceding image, blends it with the succeeding image, and we have the illusion of motion.

c. 35 mm. Sound Motion Picture Film

The standard 35 mm. motion picture film is a strip of celluloid 1.375 inches (1⅜ inches) wide by 0.0055 to 0.006 inches thick, one surface of which is coated with a photographic emulsion, 0.001 of an inch thick. At both edges of the film is a row of perforations or sprocket holes by means of which film is fed through the camera and the projector. There are eight sprocket holes to each frame of pictures, four in each side. There are sixteen frames and, therefore, 128 perforations, 64 to a side, to each foot of film.

In the taking of motion pictures the camera impresses a series of snap-shot photographs upon the negative film. The film moves through the camera at 90 feet per minute (for sound films only) so that 24 pictures are recorded every second. The pictures are later projected to the screen at the same speed. In each foot

of film there are 16 separate pictures or "frames," each "frame" occupying precisely ¾ of an inch in height.

The sound is photographically impressed on the film simultaneously with the photographing of the scenes—but on a separate negative or, as the news reels do, simultaneously on the same negative, or the sound can be added at separate intervals. In any case, the sound and the image are in synchronism when combined in the positive print which is used in projection.

(1) Film Leader

Each 35 mm. reel of film has a protective leader of either transparent or raw stock, 6 to 8 feet in length. Following this comes the Identification Leader which is 18 inches long, containing the type of print, number of reels and the title of the picture. Following is the Synchronization Leader, 13 feet, 3 inches long to where the actual picture starts. Three feet from the picture to the leader is marked with a large "3" and each foot down to 12 is marked with the corresponding footage numbers. The twelfth foot with the word "Start" instead of the number "12". The leader is used for threading and for synchronizing projectors for changeovers if two projectors are used.

(2) Film Trailer

At the end of each reel is an opaque Runout Trailer, 3 feet in length. The next 1½ feet comprises the Identification Trailer which contains the "End of Reel", number of reel and title of picture. The last 6 or 8 feet consist of either transparent or raw stock for the protective trailer.

(3) Film Cue Marks

The film cues are for use only when operating two projectors. The cues on the film are circular opaque dots, printed in the upper right hand corner of four consecutive frames. These markings are for the purpose of indicating to the operator the proper time to perform the operations necessary to change the picture and sound from one projector to the other when two projectors are used.

Approximately 12½ feet from the end of the picture the Motor Cue appears. Seven seconds later (10¾ feet) the Changeover Cue appears. It is necessary for the operator to pay close attention when the cues are to appear on the screen as their duration is only $\frac{1}{6}$ of a second in duration.

d. What the Projector Does

(1) Feed the film to be shown into the picture projection mechanism from a feed reel placed in the feed magazine at the same rate of speed as was taken by the camera; namely, 90 ft. per minute.

(2) Move the film, one picture at a time, between the light source and the projection lens, and to hold the film before the lens for a short interval of time so that the lens can focus an enlarged duplicate of each individual picture of the film on to the screen. Twenty-four of these pictures must be projected in this way, each second.

(3) Illuminate the film picture.

(4) Translate the photographic record of the film sound track into electrical impulses which are amplified and converted into sound energy by the loudspeaker. This is the task of the projector sound mechanism which is primarily the exciter lamp, photo-electric cell and an optical slit called the slit or sound lens.

(5) Wind up the film that has passed through the projector onto another reel, called the take-up reel, which is placed on the spindle or shaft in the lower projector case. The film is wound up at the same rate of speed as fed to the mechanism, namely, 90 ft. per minute.

SECTION V -- TECHNICAL DATA

A. POWER CONSUMPTION

Unit	Apparent Wattage	Amperes	Power Factor	True Wattage
*PROJECTOR DRIVE MOTOR (Running)	197	1.7	90%	177.3
PROJECTOR VENTILATING MOTOR	67	.6	90%	60.3
PROJECTION LAMP (Including Threading Lamp)	1025	9	100%	1025
EXCITER TRANSFORMER	16.8	.15	90%	15.12
AMPLIFIER				185
			Total True Wattage —	1462.72

*The Momentary Starting Current of the Projector Drive Motor is 17 Amperes or 1900 Watts. The power line should be sufficient to carry this starting current with a minimum voltage drop. Any extension cord other than that furnished with the projector should be of No. 14 gauge wire or larger.

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.)

B. DIMENSIONS AND WEIGHTS

(Dimensions are Approximate — Do not Include Knobs, Tilting Brackets, etc.

Unit	Weight	Height	Width	Length
PROJECTOR (Including Feed Magazine and 2000 Ft. Reel)	172 lbs.	51½" to Top of Feed Magazine	10¾"	19⅝" (At Base) (22" Lamphouse to Front of Case)
				26½" Lamphouse to Front of Mag. Horz. Dim.
AMPLIFIER	32 lbs.	8"	8¾".	20¼".
SPEAKER (Including 100 Ft. Speaker Cable)	40 lbs.	22¼"	11"	21½"
SPARE PARTS BOX (Complete with Spare Parts & Accessories)	106 lbs.	15"	18"	30"

NOTE: The Optical Center of Projector is 26½ inches, less Tilting Bracket.

C. TUBE COMPLIMENTS OF AMPLIFIER

Type	Quantity	Part No.
6J7	1	4301
5U4G	1	4310
6N7GT/G	1	4314
6SF5	1	4362
6L6G	2	4327

D. 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	1
Threading Lamp	10 watt, 115 volt, S-11 bulb, candelabra base.	411	1
Aperture Framing Lamp	110 volt, 2 candle power, T7 bulb, candelabra base.	413	1
Projection Lamp	Standard 1000 watt, 115 volt Mazda lamp. T20 bulb, medium C-13 or C-13D biplane filament, prefocused base.	479	1
Photo Electric Cell	CE-25, small 3 pin highly sensitized P. E. cell — 60-70 volts.	4453	1

IMPORTANT INFORMATION CONCERNING THE SCREEN CHART AT THE RIGHT ➡

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.
(Copyrighted)

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

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 computaiton—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

MORE DATA ON LENS-SCREEN CHART.

SECTION VI -- PREPARATION FOR USE

1. PLACEMENT OF PROJECTOR

The projector should be placed on a substantial table or base at a height that will give full screen coverage, bearing in mind that the best reflected screen image is obtained by having the projector mounted slightly higher than the center of the screen so that as much light as possible is reflected into the audience. This condition is optional for short "throws". By adjusting the tilting device the proper projection angle can be obtained. Too great an angle of projection is to be avoided as it causes a distortion known as "keystoning", the top of the picture being compressed, the bottom distended.

2. PLACEMENT OF AMPLIFIER

The ideal position for the amplifier is to the right and slightly to the front of the projector. The distance the amplifier can be placed from the projector is limited to the length of the photo electric cell cable supplied.

In order to allow for a free circulation of air around the amplifier tubes which operate at fairly high temperatures it is recommended that the amplifier be placed in a position that allows for ample ventilation. Never set the amplifier on, over or near a radiator.

3. LOUD SPEAKER PLACEMENT

It is not necessary or desirable to place the loud speaker behind the screen unless a special sound screen of the perforated type is used. If this is done with an ordinary screen, a great deal of sound will be lost, and distortion will take place. The proper position for the speaker is at one side of, and on a level with the center of the screen, or just below the screen. The side position is usually a little better, as it allows the speaker to be directed downward toward the center of the audience, which gives a better distribution of sound.

The speaker should never be placed on the floor, as this concentrates all of the sound on the first one or two rows of the audience, giving them, as well as all the rest of the audience a very unnatural effect. The important thing is to place it so that the sound may proceed directly from the speaker to each person in the audience just as the light must proceed directly from the screen to each person in the audience.

When a special sound screen of the perforated type is available, the speaker is placed behind the center of it, facing down toward the center of the audience, the purpose of this arrangement being to heighten the illusion that the sound comes directly from the screen image.

Fasten the flap covering the speaker grill to the top of the case with the snap buttons.

4. GENERAL CONDITIONS

No portion of your audience should be placed too close to the screen, for obvious and well known reasons. The least distance that allows good results depends, of course, on the size of screen and length of throw used.

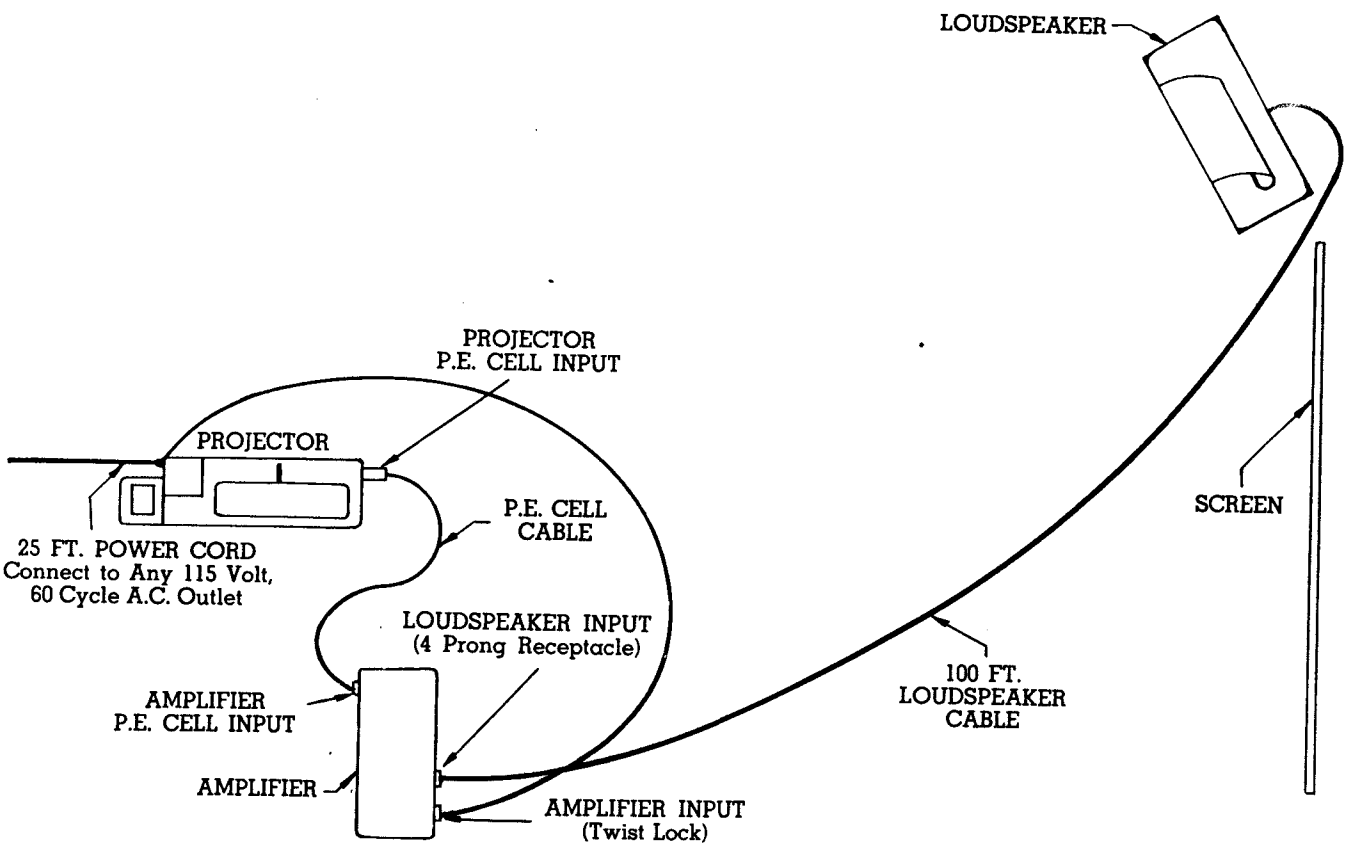
It is equally important to see that none of your audience is too close to the projector. The ideal condition is to have a sound-proof booth. The next best thing is to have the machine on a balcony or otherwise placed so as not to be either too visible or too audible. Remember that the less conscious the audience is of the presence of any of the machinery of projection, the more complete will be the illusion created by the picture and the sound. Sometimes it will be found possible to place the machine in an adjoining room and project through a glass window. It must be remembered, however, not to project through a poor grade of window glass, and to have any glass that is used spotlessly clean, or the picture will suffer. The darker the room, the brighter and clearer the picture, and likewise it is true that the quieter the room, the more distinct and clear the sound will be.

The acoustics of the room in which you show your film will more often than not be out of your control. However, when a choice of rooms is possible, it is well to avoid those which have a large amount of reverberation due to smooth, hard walls, lack of hangings, etc. The most important condition in this respect is how well filled the room is with people. A large room with very few people in it will be very "hard" and have an unpleasant amount of reverberation, whereas a smaller room comfortably filled will be free from this annoying effect.

5. INTERCONNECTING EQUIPMENT

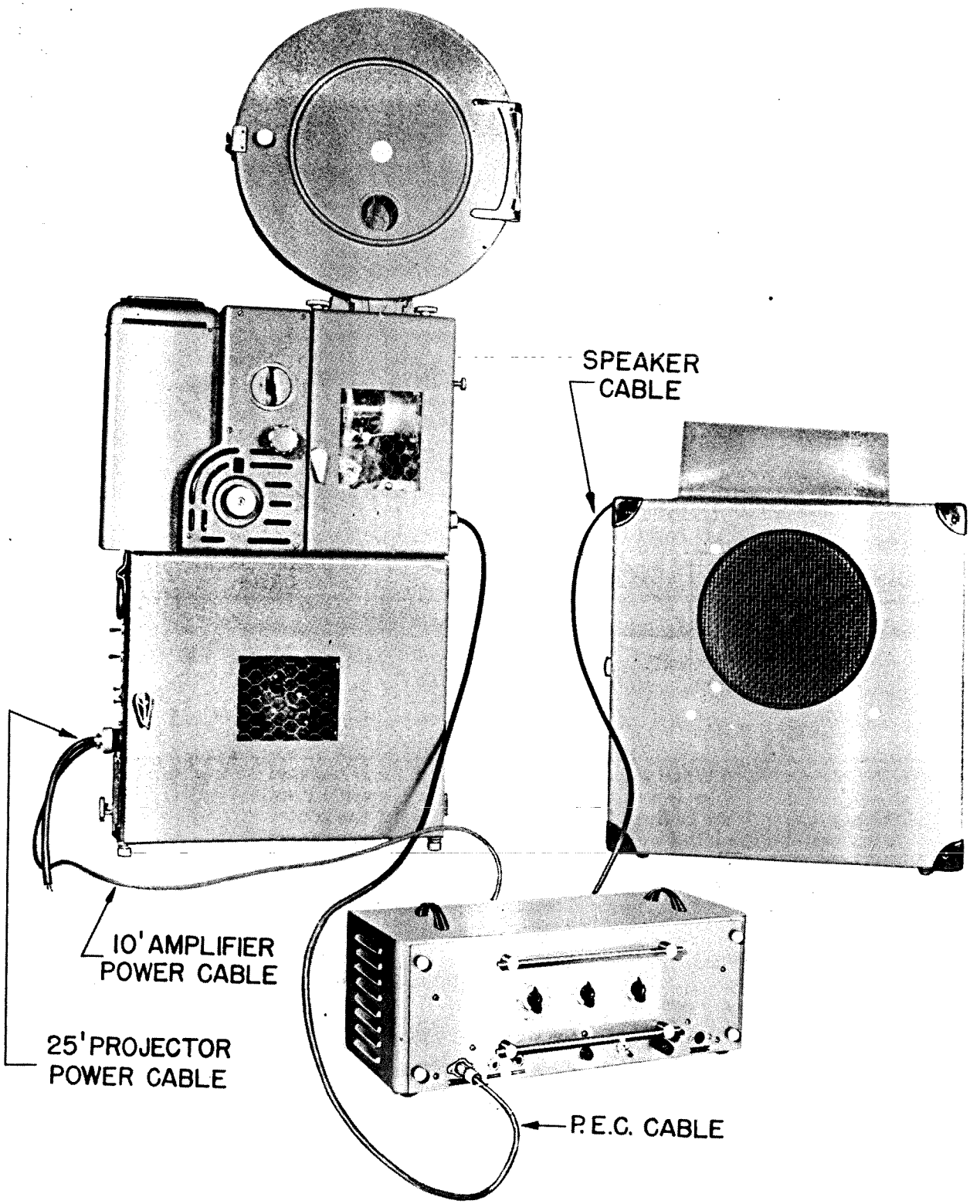
Refer to Figs. 2 & 3. The end of the 25 ft. projector power cord with the large female twist lock plug is to be inserted into the receptacle provided on the rear of the lower projector case. The shorter length of cable with the twist lock plug connects to the receptacle at the rear of the amplifier. Opposite end of 25 - 10 ft. duplex projector-amplifier power cord connects to power supply, 115 volts, 60 cycle A.C. This hook-up supplies power for operating the projector as well as its amplifier. One end of the photo electric cell cable is to be inserted into the receptacle at the front of the upper projector case and locked into place with lock ring mounted to socket. Opposite end of P. E. Cable is to be inserted into either one of the two P. E. cell receptacles on the front panel of the amplifier. The speaker plug is to be inserted into the 4 prong receptacle at the rear of the amplifier.

FIGURE 2--ARRANGEMENT OF AND INTERCONNECTION OF PROJECTOR, AMPLIFIER AND LOUD SPEAKER



When a special sound screen of the perforated type is available, the speaker is placed behind the center of it, facing down toward the center of the audience, the purpose of this arrangement being to heighten the illusion that the sound comes directly from the screen image.

FIGURE 3 -- INTERCONNECTING THE PROJECTOR AMPLIFIER AND LOUDSPEAKER



SECTION VII -- OPERATION OF EQUIPMENT

1. OPERATING THE SWITCHES

The necessary switches for operating the projector are conveniently located on the rear of the lower projector case. There are four switches, one each for the projector motor, projection lamp, exciter and threading lamps.

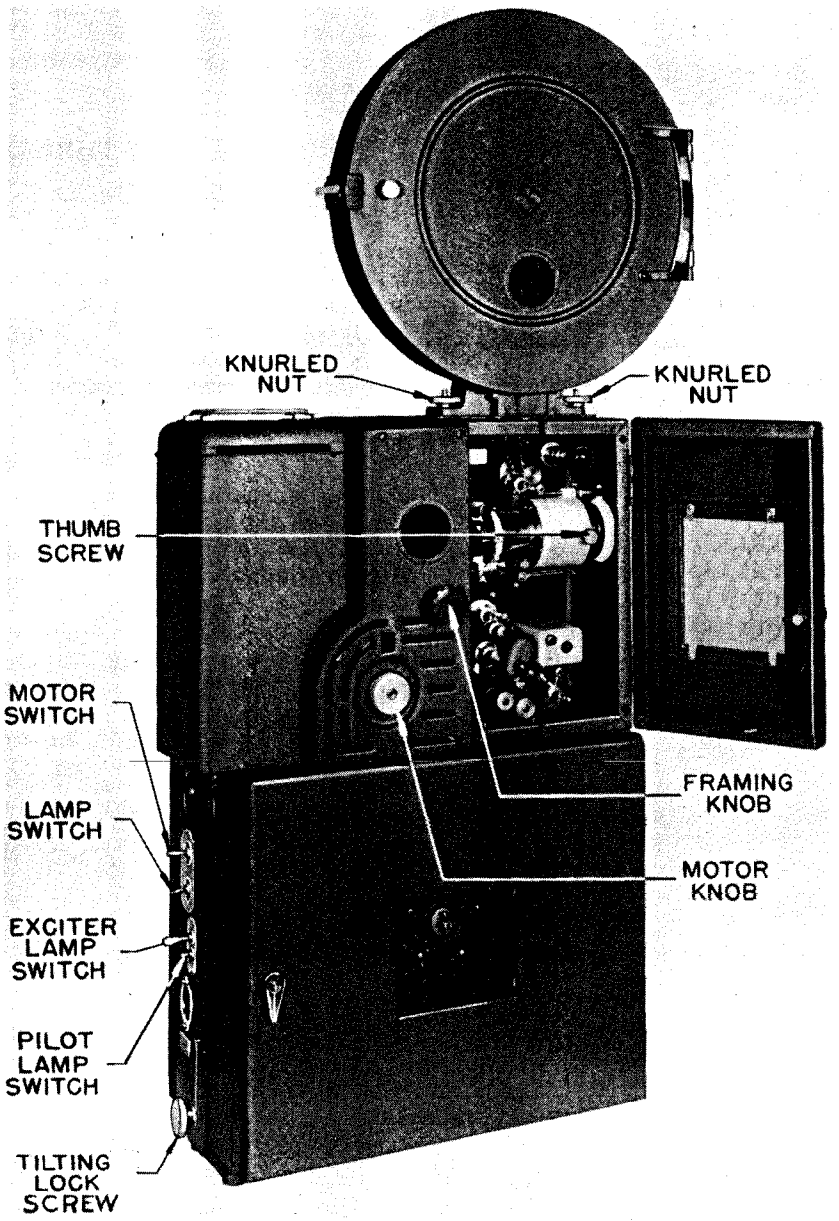
The lamp switch is dependent on the motor switch. The lamp will not light with the motor switch in the "OFF" position. This is a safety arrangement to prevent the film from burning while it is stationary in the projector.

2. FOCUSING

Snap the motor and lamp switches to the "On" position. (Switches are located at the rear of projector). See Figure 4. With the light being projected on the screen, loosen the knurled tilting lock screw (Fig. 4) and raise the projector until the light is centered on the screen. Lock tilting bracket in this position. It will greatly facilitate the film frame alignment if the lens is adjusted to near focus while the light is being projected. This is done by loosening the thumb screw (Figure 4) and turning focusing knob, which is on front of projector just above lens port, until the projected image of the aperture on the screen is sharp and distinct. Snap lamp and motor switch off.

To increase the size of the picture, move the projector away from the screen; to decrease the size of the picture, move the projector closer to the screen. Also see lens chart Pg. 15.

FIGURE 4



3. THREADING

Refer to Figures 5 and 6

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 Pilot Light Switch (located on rear of projector, (See Figure 4) to the ON position. This lights both the Threading Lamp "A" and Aperture Framing Lamp.

c. Open upper Fire Guard "B" by placing right index finger under top of case and moving the metal guard to your left.

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 Figure 6 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 out the knob on end of idler and raise idler up and away from the holdback sprocket "L". Form a LOWER LOOP OF FILM of about the size shown in Figure 6 and pass film over and around the holdback sprocket "L". After checking to see that film engages all sprocket teeth, lock idler back into position over the sprocket.

g. Pass film under the Sound Adjustment Roller "M", over the Rotating Sound Drum "N", snugly under the Floating Roller "O", over and between the Sound Sprocket "P" and Idler "Q". Open Idler "Q" just as you did the other idlers. After checking to see that all film perforations fully engage the sprocket teeth, reset the idler into place over the sprocket.

h. Then pass the film over the Stationary Roller "R". Open the Lower Fire Guard "S" by moving this metal safety device to the left and pass the film down through the Fire Roller "T" into the take-up magazine, and securely fasten the film to the hub of the take-up reel, turning reel in a clockwise direction to take up and film slack.

4. CHECKING FILM THREADING

Always check the film path after threading the projector by slowly turning the projector mechanism by hand. To do this, turn motor knob (Figure 4) in a clockwise direction, as indicated by arrow on knob. If knob turns freely and film travels through mechanism without undue strain, and "Loops" are retained, projector is threaded properly.

5. FRAMING THE FILM

After checking the film threading the next step is to see that the "film is in frame." This means having one complete picture at the aperture opening before projecting the picture on the screen. Check this by holding film with finger against aperture opening just above the guide rollers, observing whether one complete picture frame is covered at this point after intermittent sprocket is in its still position. If not, turn framing knob until this is accomplished. Turn Pilot Switch "OFF", close door.

FIGURE 5 -- THREADING DIAGRAM

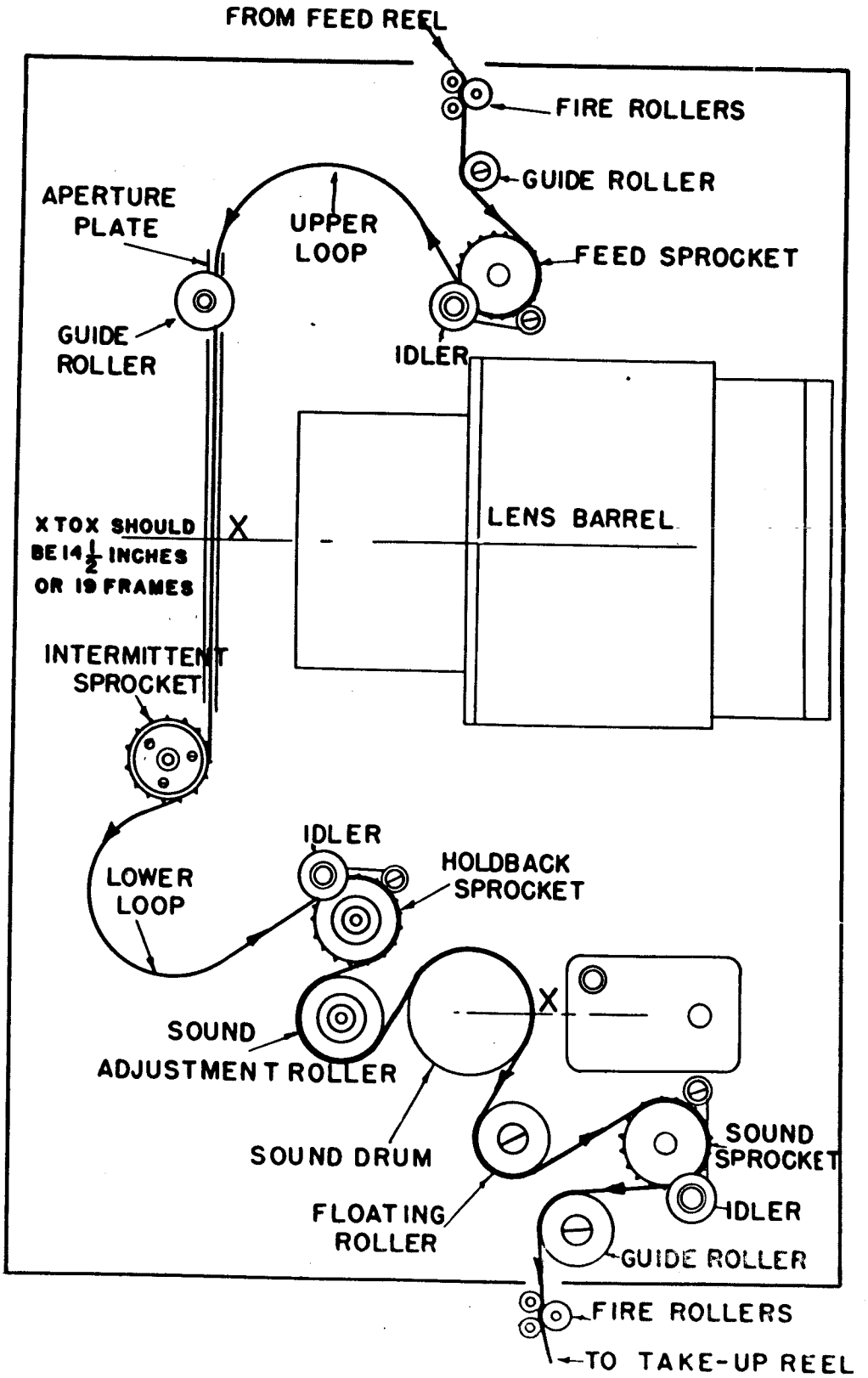
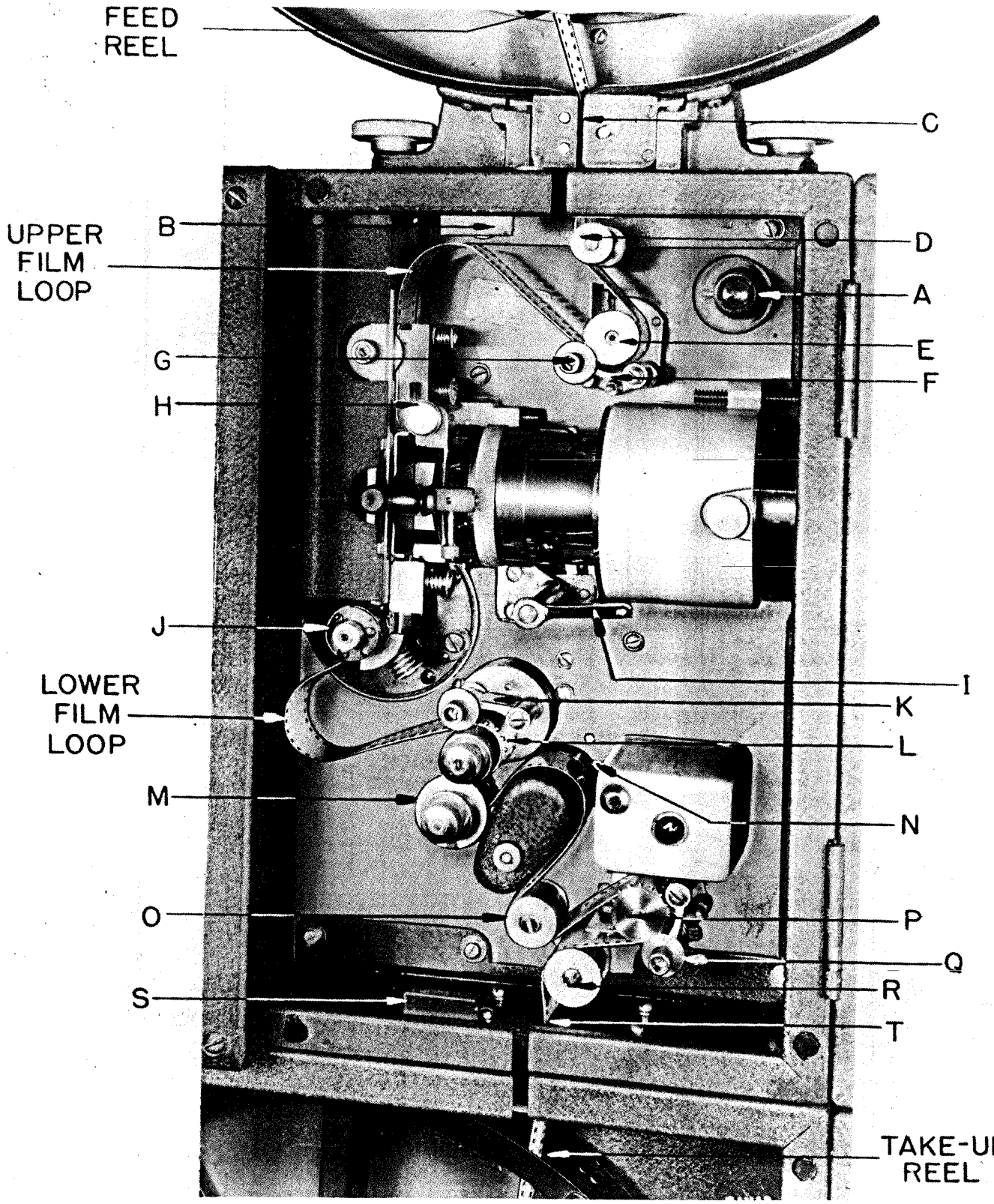
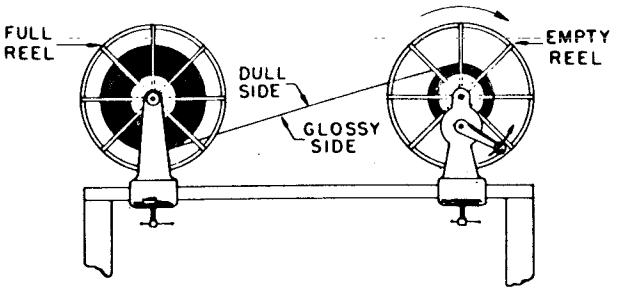


FIGURE 6 -- THREADING ILLUSTRATION



6. REWINDING FILM



After the reel of film has been projected through the machine, it will be wound on the take-up reel with the beginning of the picture at the hub of the take-up reel. Therefore, it will be necessary to rewind the film on another reel to get the start of the film on the outside of the reel. The rewinding device shipped in the spare parts box is used for this purpose.

This hand driven rewinder consists of two elements, one with a revolving spindle geared to the hand crank, the other with a retarding shaft with which the reel turns. The two rewinder elements should be clamped to a bench or table so that the film travels from one reel to the other in a straight line.

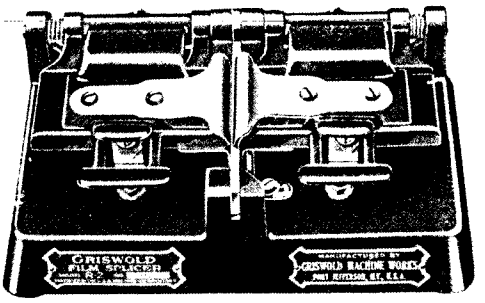
The film should not strike the flanges of the reels. The left hand should be held against the reel of film that is being rewound so that it will not release the film faster than the other reel takes it up.

The rewinding should be done at a uniform speed with just enough tension to keep the reel from which the film is traveling from overrunning the reel on which it is being wound, which is the reel being driven by the hand crank. This is done to prevent the upper turns of the film from tightening up and slipping on the turns underneath, as this would scratch the picture surface.

When ready to rewind, place an empty reel on the right hand or geared element of the rewinder. Remove the full reel from the magazine and holding it in the same relative position, place it on the left hand rewinder element. The film will then be positioned so that it comes off the full reel from underneath, with the dull or emulsion side up and the shiny side down.

Carry the film straight across and over to the top of the empty reel. Fasten film to hub of the reel. Revolve the crank handle (in a counterclockwise direction) so that the empty reel will revolve in a clockwise direction. Continue to crank until all film is rewound. Rest the hand lightly on the full reel to keep it from overrunning. Be sure to use an empty reel on the crank end the same size or larger than the full reel which is being rewound.

7. SPLICING FILM



Follow the instructions carefully. By so doing you will do quicker and better quality of work.

Swing upper jaw of right clamp up against stop. Swing left clamp (comprising upper and lower jaws) back against stop.

Place film emulsion side up on lower right jaw with dividing line over center of lower shear blade, bring upper jaw down on film.

Bring down left film clamp cutting film, raise right film clamp with film.

Swing upper jaw of left film clamp back against stop. Place other section of film, emulsion side up, on lower left jaw, with dividing line over center of lower shear blade, bring upper left jaw down on film.

Bring down right clamp to cut film and swing it back again to stop.

With dampened felt disc moisten emulsion on film held by left film clamp overlapping lower shear blade. This is not absolutely necessary but is especially advisable on old film.

WITH THE BRUSH END OF SCRAPER DOWNWARD, insert lip between guide and lower shear blade, incline scraper direction of travel, scrape emulsion from center of film off edge each way (the brush on scraper is for use in removing any particles of emulsion which may remain on the film after scraping).

With the left hand raise the left clamp with film so that film is about ¼" above lower shear blade. While film is being held in this position, apply cement with one stroke of brush, then bring left clamp down on stop and immediately bring right film clamp carrying other section of film down on stop.

After allowing a few seconds for the initial set of cement, raise upper jaws of right and left film clamps and wipe off surplus cement.

The film is now spliced and may be removed and wound in the reel.

The cement guard attached to the upper left jaw should not protrude below the lower face of the jaw and should be spaced fully 1/64" from the left edge of the lower shear blade. This guard is to prevent applying cement where not needed.

8. PROJECTION ROUTINE CHART

To be followed after equipment is set up, interconnected, and power connection made to 115 volt, 60 cycle A.C. outlet.

Step 1 - - -	**Turn Amplifier Power Switch to the "ON" Position** This will enable the tubes to reach normal operating temperature before the picture is shown. When the amplifier is "ON" the green pilot lamp will light up. Be sure the switch labeled "MASTER", which is the main volume control, is turned all the way down.
Step 2 - - -	**Focus the Lens for Sharp Picture Image** Turn the motor switch to the "ON" position. Turn the lamp switch to the "ON" position. Loosen the knurled tilting lock and raise the projector until the projected light is centered on the screen. Loosen the knurled clamping screw on the lens mount and focus the lens by turning the focusing knob until the light image is sharp over the entire screen area. Tighten the knurled clamping screw.
Step 3 - - -	**Turn Lamp and Motor Switches to "OFF" Position**
Step 4 - - -	**Turn Pilot Lamp Switch to the "ON" Position** This lights the lamp on the main projector mechanism panel and facilitates the threading of the projector. It also lights a lamp behind the framing aperture to facilitate the "framing" of the film.
Step 5 - - -	**Place Roll of Film into Feed Magazine** Be sure the reel is placed on the feed spindle in such a way that the emulsion (dull) side of the film faces outward, with the image upside down and the film coming off the left side of the reel so that the reel will turn in a counter clockwise direction.
Step 6 - - -	**Thread the Film through the Projector** Follow carefully the threading directions given in the OPERATING SECTION of this manual.
Step 7 - - -	**Check the Threading of the Film** This is important. The projector must be properly threaded before starting the machine or serious damage will occur to the film. Follow film checking directions given in OPERATING SECTION of manual.
Step 8 - - -	**Frame Film at Framing Aperture** The framing aperture is located just above the upper guide roller in the film gate. If one complete picture or frame is centered in this aperture when intermittent sprocket is not moving, one complete picture will likewise be centered in the picture aperture. If the picture is not in frame follow framing film directions given in the OPERATING SECTION.
Step 9 - - -	**Turn Pilot Lamp Switch to "OFF" Position** This will extinguish the pilot lamp and aperture framing lamp, which are not needed during the projection of the picture.
Step 10 - - -	**Close the Doors on the Projector** During operation the projector door in the lower case and the door in the upper case should be closed.
Step 11 - - -	**Turn Exciter Lamp Switch to "ON" Position** This will light the exciter lamp in the sound pick up system.
Step 12 - - -	**Turn Motor Switch to "ON" Position** The motor will attain proper operating speed (3450 r.p.m.) in 3 seconds.
Step 13 - - -	**Turn Lamp Switch to "ON" Position**
Step 14 - - -	**Regulate the Amplifier Controls** Turn the knob labeled "MASTER" which controls the sound volume to the point where sufficient volume of sound is being reproduced by the loudspeaker for the size of the room and the audience. Regulate the "BASS" and "TREBLE" controls to the points where the sound, both voice and music, is at its best.

SECTION VIII -- CLEANING - LUBRICATION

A. 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. CONDENSER LENSES

The condenser lenses should be cleaned periodically, depending upon the use of the equipment. Clean with a soft lintless cloth saturated with a mixture of half grain alcohol and water and dry with a soft cloth. When replacing, exercise care to keep fingerprints from lenses. The removal of the condensers is not always necessary because the inner surfaces are not subject to dirt. Therefore, the outer surfaces can be cleaned without parts removal.

4. REFLECTOR

It is not necessary to remove the reflector from its mounting for cleaning. Use a soft clean cloth or Kleenex dampened with carbon tetrachloride or half grain alcohol mixed with water and wipe the reflector surface until clean, being careful not to scratch its surface or to leave fingerprints.

5. 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.

6. 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.

7. FILM GUIDE RAILS (Aperture)

Clean every day. Use cloth dampened with carbon tetrachloride and lightly rub each rail in vertical direction until clean. Before attempting to clean, remove film gate assembly as directed in Parts Replacement Section.

8. FILM PRESSURE SHOES (Film Gate)

Clean every day. Remove film gate assembly as directed in Parts Replacement Section, and rub all film pressure shoes with a clean cloth saturated with carbon tetrachloride until clean.

9. 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 exercised 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.

10. 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 dampenend with carbon tetrachloride.

11. 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.

12. PROJECTOR CASE

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

13. MOTION PICTURE FILM

Film can be cleaned as it is being rewound by passing it through a soft clean cloth saturated with a good cleaning solution, such as carbon tetrachloride.

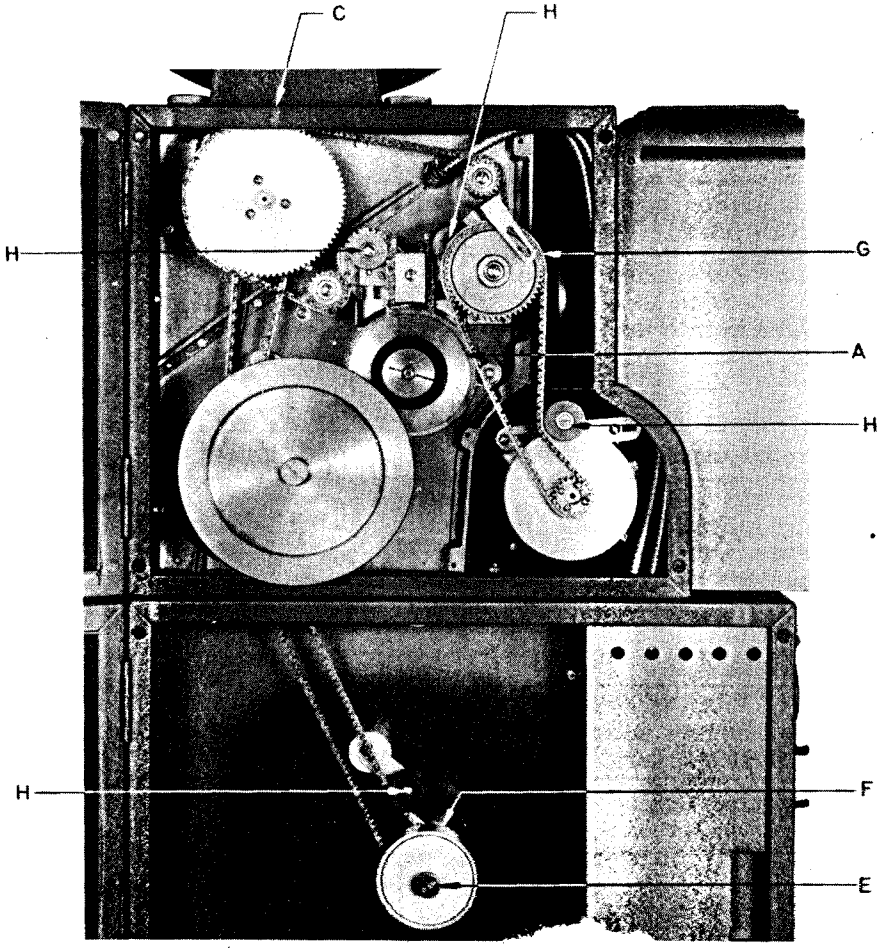
14. AMPLIFIER

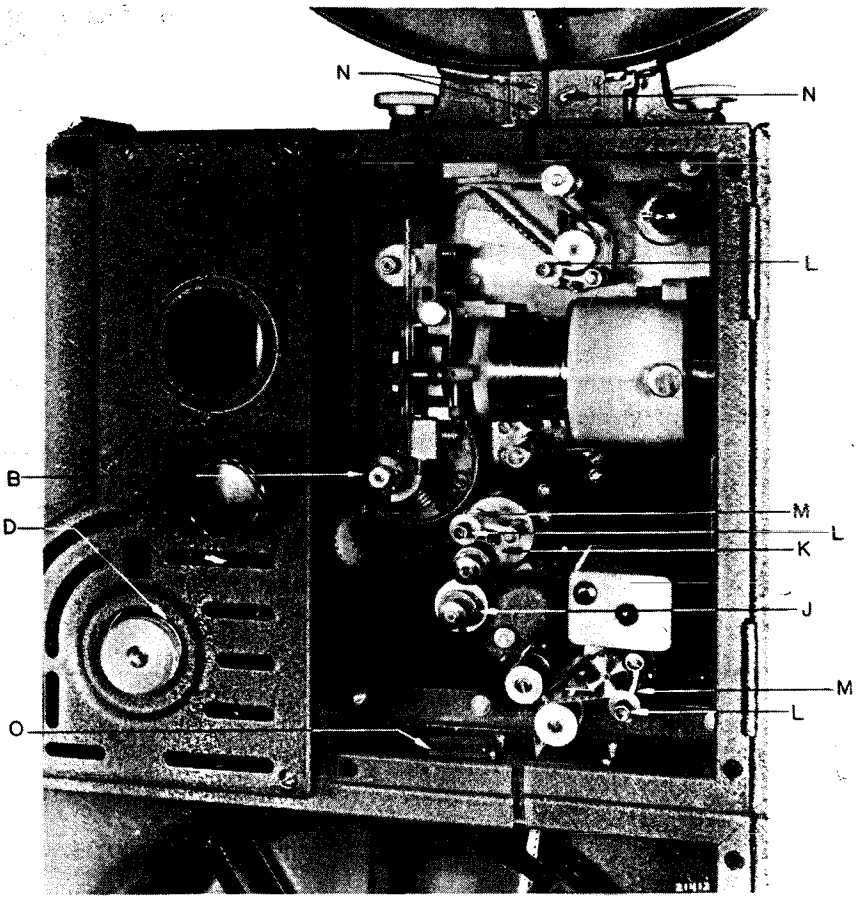
All switches, controls, socket prongs, etc., should be kept scrupulously clean, if not the dirt or dust combines with the moisture in the air and creates poor contacts, leakage in wiring or between terminals, resulting in the reproduction of disturbing noises in the loud speaker. Clean amplifier with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

B. LUBRICATION CHART

Parts to Lubricate	When to Oil	Where to Oil	Type Lubrication	Comment
Intermittent Unit	Watch oil level each 8 hour interval of operation.	Oil Cup "A" on rear of Projector Mechanism.	ONLY USE A-1 GRADE Machine Oil. See Specifications at Left.* Use oil specified as other oils will quickly bind up intermittent movement.	Change oil every 100 hours of operation. Do NOT flush out the oil well with kerosene or other liquids.
***Specifications of the Oil To Be Used in Intermittent Unit** Flash Point not less than 360° Pour Point not more than 0° F. Viscosity - Sayboldt Universal at 100° F. Range from 145 to 155 seconds.				
End Bearing on Sprocket Intermittent	Every 8 hours of operation.	Press oil can against star wheel outer bearing "B" and let oil flow in.	Same as specified for intermittent unit.	Oil sparingly to avoid over flow.
Feed and Sound Sprocket Shafts	Every 8 hours of operation.	Oil Cup "C" at top of Projector Case.	Light Machine Oil—10-SAE or similar.	Fill Oil Cup.
Drive Motor	Every 8 hours of operation.	Oil Cup "D" at each end of motor. Remove stationary door to place oil in front oil cup.	Light Machine Oil, 10-SAE or similar.	Oil sparingly.
Take-up Bearing	Every 8 hours of operation.	Remove knurled screw "E" marked Oil. With pressure oil can force small amount of oil into center or shaft.	Light Machine Oil—10-SAE or similar.	Oil sparingly. Also place drop of oil between spacer and bearing "F" marked with red paint.
Shutter Assembly	Every 100 hrs. of operation.	Oil hole "G" marked with red paint.	No. 0 Cup Grease.	Use sparingly.
Ventilating Motor	Every 100 hrs. of operation.	Oil shaft between fan and motor housing. Not shown on illustration.	Light Machine Oil—10-SAE or similar.	Oil sparingly.
Chain Idler Rollers	Every 8 hours of operation.	Drop of oil between screw and roller "H". Oil other side of roller.	Light Machine Oil 10-SAE or similar.	Oil very sparingly.
Sound Adjustment Roller	Every 8 hours of operation.	Oil hole "J" on roller marked with red paint.	Light Machine Oil—10-SAE or similar.	Oil very sparingly.
Holdback Sprocket	Every 8 hours of operation.	Oil hole "K" on sprocket marked with red paint.	Light Machine Oil 10-SAE or similar.	Oil very sparingly.
Film Sprocket Idler Rollers	Every 8 hours of operation.	With very small oil can, place drop of oil between lock nut and front roller "L", also between casting and rear roller "M". Likewise for each fixed roller.	Light Machine Oil 10-SAE or similar.	Oil very sparingly. Remove excess oil.
Feed Magazine Shaft	Every 100 hrs. of operation.	Oil cup at top of shaft housing, magazine rear.	No. 0 Cup Grease.	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 "N" 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 hrs. of operation.	Place small amount of grease between case and bottom of guard.	No. 0 Cup Grease.	Remove excess.

Illustration for Lubrication Chart





SECTION IX -- TROUBLE SHOOTING

a. 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.	1. Adjust tension of shoe. 2. Set eccentric adjustment on intermittent movement. If adjustment is exhausted, replace star and cam. 3. Check threading.
If film over-runs feed reel.	Improper tension on feed shaft.	Adjust tension of feed shaft.
"Color" on screen or uneven distribution of light.	1. Accumulation of dirt, dust, etc. on Optical System, lens, condenser, reflector. 2. Condenser - Reflector Assembly out of adjustment. 3. Discoloration of Mazda lamp or sagging of lamp filaments.	1. Clean projection lens, condenser lenses, reflector. 2. Adjust condenser - reflector and projector lamp. 3. Replace lamp.
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. 4. Excessive tension on holdback sprocket. 5. Excessive tension on feed shaft.	1. Adjust tension on shoe. 2. Reverse or replace sprockets. 3. Ease tension of take-up plungers. 4. Ease tension of sprocket. 5. Release tension.
Audible distortion in sound output.	1. Floating sound roller not functioning properly. 2. Accumulation of foreign substances on sound drum.	1. Correct tension of sound roller, lubricate bearing surface or replace roller. 2. Clean sound drum.
Decrease in sound volume.	1. Dirt, etc. on sound lens. 2. Sagging of exciter lamp filaments, discoloration of lamp. 3. Breakdown in electrical circuit.	1. Clean sound lens. 2. Insert new exciter lamp. 3. Check amplifier.
Overheating in lamphouse.	Ventilating fan not functioning properly.	Check ventilating motor, clean commutator, replace brushes or replace motor.
Exciter lamp fails to light.	1. Faulty transformer. 2. Faulty switch. 3. Faulty lamp socket. 4. Faulty lamp.	1. Insert new transformer. 2. Replace switch. 3. Repair lamp socket. 4. Replace lamp.
Inability to frame within a range of two picture frames.	Loss of synchronization between framing mechanism and intermittent movement.	Adjust framing device in relation to location of intermittent movement.
Scratches in film.	Accumulation of emulsion on film path.	Clean film path, rollers, rails, sound drum, etc.
Audible crackling noise in sound system.	1. Dirty commutator or worn brushes in ventilating motor. 2. Broken sound cable connection.	1. Clean commutator or replace brushes. 2. Replace or repair cable.

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.

B. TROUBLE SHOOTING -- AMPLIFIER

THE AMPLIFIER WIRING DIAGRAM IS ON PAGE 35.

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.

NOTE: For proper voltage readings for all tubes, see voltage chart printed 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 cycle.

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.

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 driver 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 tube , output tubes, plate voltage, etc.

b. If sound is okay from driver 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 found 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.

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 scrupulously clean at all times.

b. Improper alignment of sound track over sound drum.

c. Tension on holdback sprocket of projector too loose, causing slack in the film as it passes over sound drum.

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

e. Defective photo-electric cell.

f. Weak or partially shorted tube in sound system.

SECTION X
WIRING DIAGRAMS

A. Amplifier Schematic Wiring Diagram

B. Projector Schematic Wiring Diagram

As Wired at Factory for Operation from 115 Volt Alternating Current (A.C.) only.

C. Dual Loudspeaker Schematic Wiring Diagram

Shows how two Loudspeakers can be Operated from One DeVry Amplifier.

D. Projector Schematic Wiring Diagram

Showing how the Projector can be Re-Wired so as to Operate the PROJECTION LAMP from 115 Volt D.C. with a Switching Arrangement whereby the Projection Lamp cannot be energized without the Blower Motor in the Lamphouse Running.

NOTE!

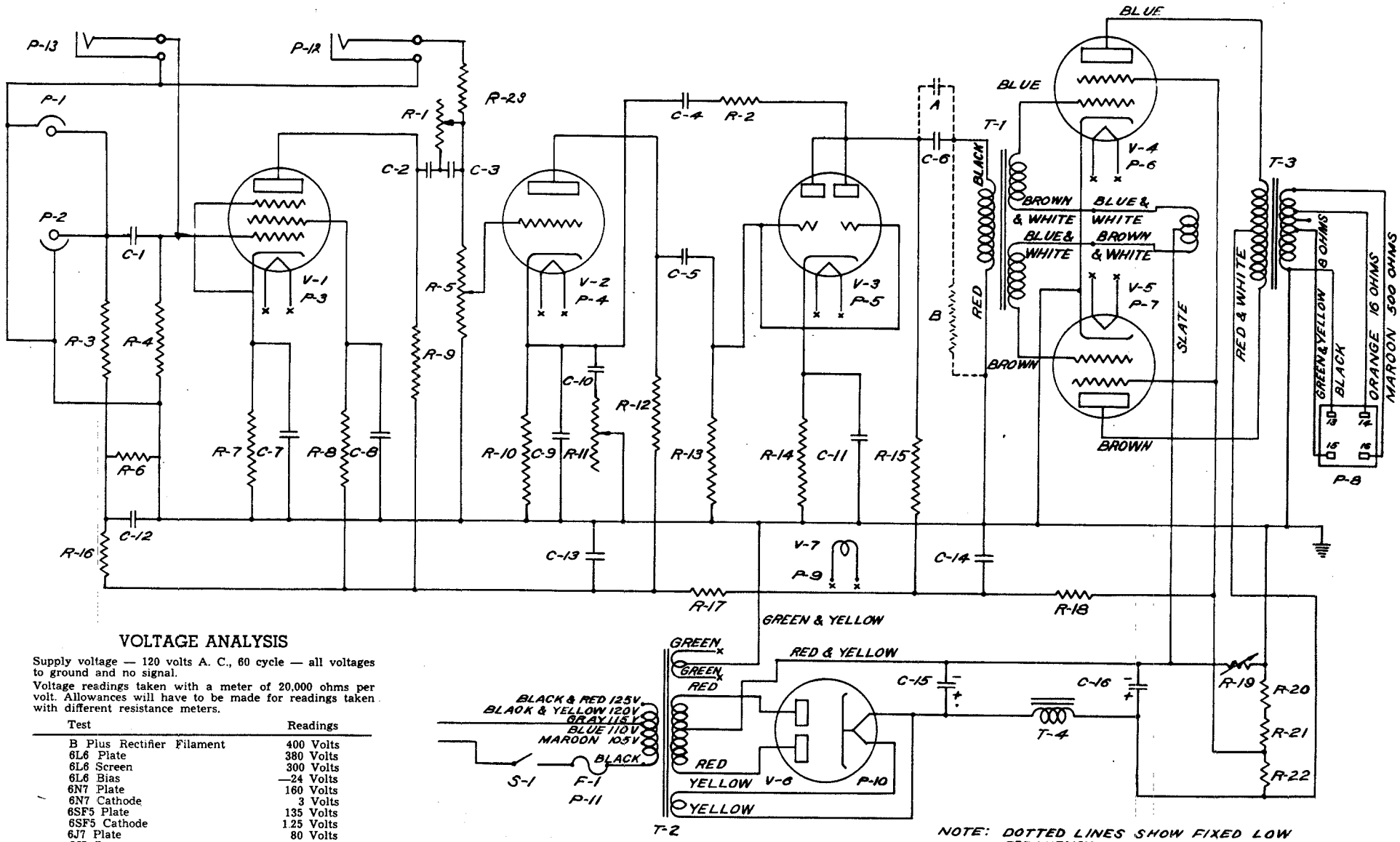
In the event that 115 Volt D.C. is the only power available it will be necessary to use a CONVERTER of approximately 1000 watts capacity to operate the electrical parts not operable on D.C.

Code and Parts List for Model "2804" Amplifier

A Complete Parts List of Both Electrical and Mechanical Parts are given in the Parts Catalog Section.

Code	Part No.	
		CONDENSERS
C-1	4053	.005 mfd. 600 volt Condenser
C-2	3861	.1 mfd. 600 volt Condenser
C-3	3859	.00025 mfd. Mica Condenser
C-4	3862	.05 mfd. 600 volt Condenser
C-5	3861	.1 mfd. 600 volt Condenser
C-6	3836	.01 mfd. 600 volt Condenser
C-7	4157	10 mfd. 25 volt Condenser
C-8	3861	.1 mfd. 600 volt Condenser
C-9	4053	.005 mfd. 600 volt Condenser
C-10	4126	.02 mfd. 600 volt Condenser
C-11	4157	10 mfd. 25 volt Condenser
C-12	3861	.1 mfd. 600 volt Condenser
C-13	3863	20 mfd. 450 volt
C-14	3863	10 mfd. 450 volt — Equal to 10-10-10 mfd. 450 volt Condenser
C-15	3814	19 mfd. 575 volt
C-16	3814	19 mfd. 575 volt — Equal to 19-19 mfd. 575 volt Condenser
		FUSES
F-1	4085	3 Ampere Fuse
		SOCKETS AND PLUGS
P-1	4599	P. E. C. Plug Assembly
P-2	4599	P. E. C. Plug Assembly
P-3	4031	6 J 7 Tube Socket
P-4	4184	6 S F 5 Tube Socket
P-5	4121	6 N 7 Tube Socket
P-6	3882	6 L 6 Tube Socket
P-7	3882	6 L 6 Tube Socket
P-8	4081	4 Pin Speaker Receptacle
P-9	3935	Pilot Lamp Receptacle
P-10	4299	5 U 4 G Tube Socket
P-11	3964	Fuse Post
P-12	4569	Input Jack for Phono-Turntable
P-13	4569	Input Jack for Microphone
		RESISTORS AND CONTROLS
R-1	3815	9 Meg. ohm Bass Control
R-2	4205	250,000 Meg. ohm ½ watt Resistor
R-3	4197	500,000 Meg. ohm ½ watt Resistor
R-4	4197	500,000 Meg. ohm ½ watt Resistor
R-5	3827	250,000 Meg. Volume Control
R-6	4205	250,000 Meg. ½ watt Resistor
R-7	3847	1,000 ohm ½ watt Resistor
R-8	4024	1.5 Meg. ohm ½ watt Resistor
R-9	4205	250,000 Meg. ohm ½ watt Resistor
R-10	4029	2,500 ohm ½ watt Resistor
R-11	3816	50,000 ohm Treble Control
R-12	4198	100,000 ohm ½ watt Resistor
R-13	4205	250,000 Meg. ohm ½ watt Resistor
R-14	3847	1,000 ohm ½ watt Resistor
R-15	4026	20,000 ohm 1 watt Resistor
R-16	4197	5000,000 ohm ½ watt Resistor
R-17	4026	20,000 ohm 1 watt Resistor
R-18	4016	10,000 ohm 1 watt Resistor
R-19	3818	200 ohm 50 watt Variable Resistor
R-20	3819	2,500 ohm 50 watt Resistor
R-21	3819	2,500 ohm 50 watt Resistor
R-22	3817	1,000 ohm 25 watt Resistor
R-23	4197	500,000 ohm ½ watt Resistor
B	3851	75,000 ohm ½ watt Resistor
		SWITCHES
S-1	4519	Toggle Switch
		TRANSFORMERS AND CHOKES
T-1	3824	Input Transformer
T-2	3821	Power Transformer
T-3	3981	Output Transformer
T-4	3823	Choke 75 ohm
		TUBES AND LAMPS
V-1	4301	6 J 7 Tube
V-2	4362	6 S F 5 Tube
V-3	4314	6 N 7 GT/G Tube
V-4	4327	6 L 6 G Tube
V-5	4327	6 L 6 G Tube
V-6	4310	5 U 4 G Tube
V-7	400	6-8 volt Bayonet Base Panel Lamp

(A) AMPLIFIER SCHEMATIC WIRING DIAGRAM



VOLTAGE ANALYSIS

Supply voltage — 120 volts A. C., 60 cycle — all voltages to ground and no signal.

Voltage readings taken with a meter of 20,000 ohms per volt. Allowances will have to be made for readings taken with different resistance meters.

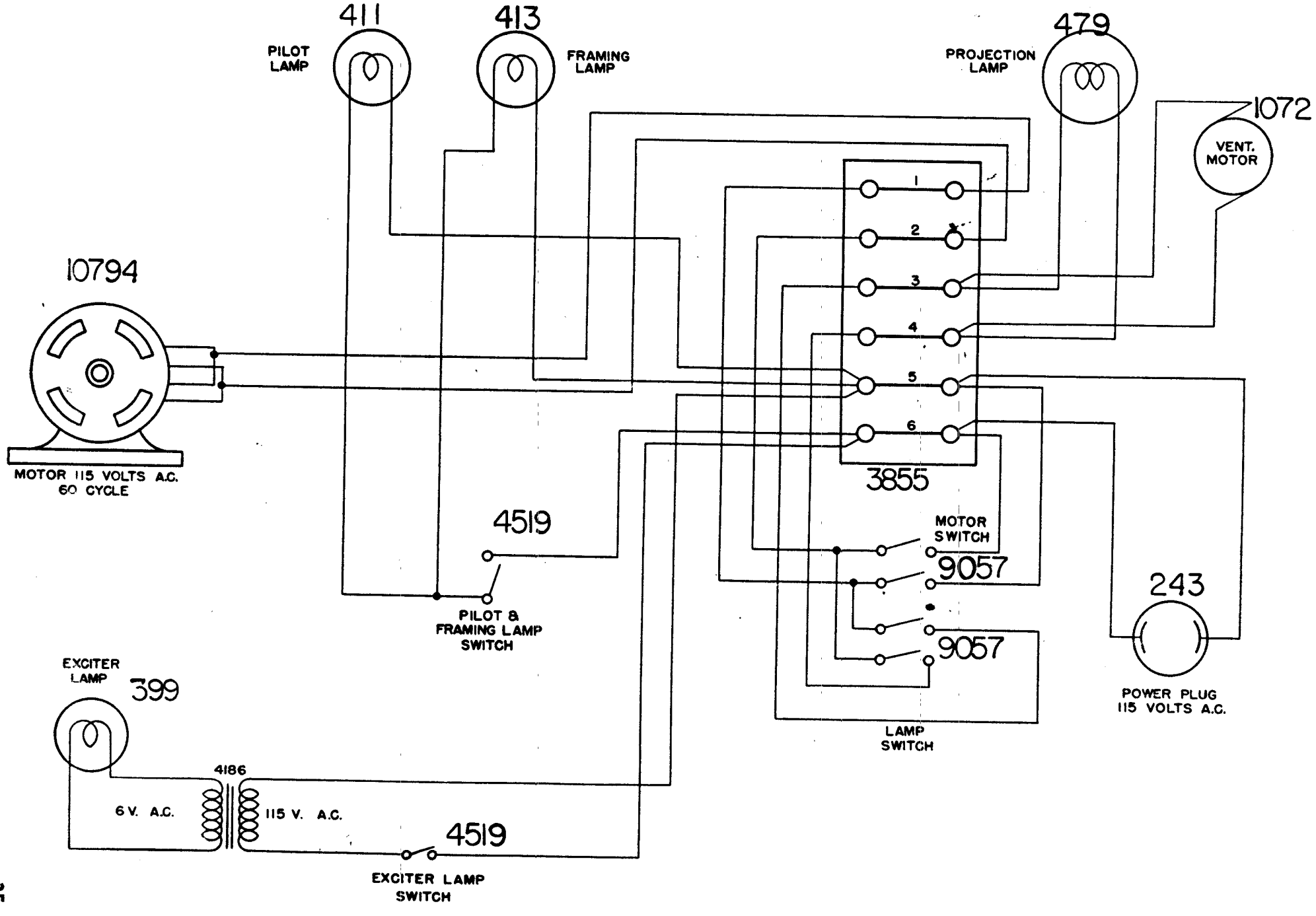
Test	Readings
B Plus Rectifier Filament	400 Volts
6L6 Plate	380 Volts
6L6 Screen	300 Volts
6L6 Bias	—24 Volts
6N7 Plate	160 Volts
6N7 Cathode	3 Volts
6SF5 Plate	135 Volts
6SF5 Cathode	1.25 Volts
6J7 Plate	80 Volts
6J7 Screen	20 Volts
6J7 Cathode	.5 Volts
Cell Voltage	55 Volts

NOTE: DOTTED LINES SHOW FIXED LOW FREQUENCY CUT OFF. ADDITION OF .2 MFD. CONDENSER "A" AND REMOVAL OF 75,000 OHM RESISTOR "B" RESTORES LOW FREQUENCY RESPONSE.

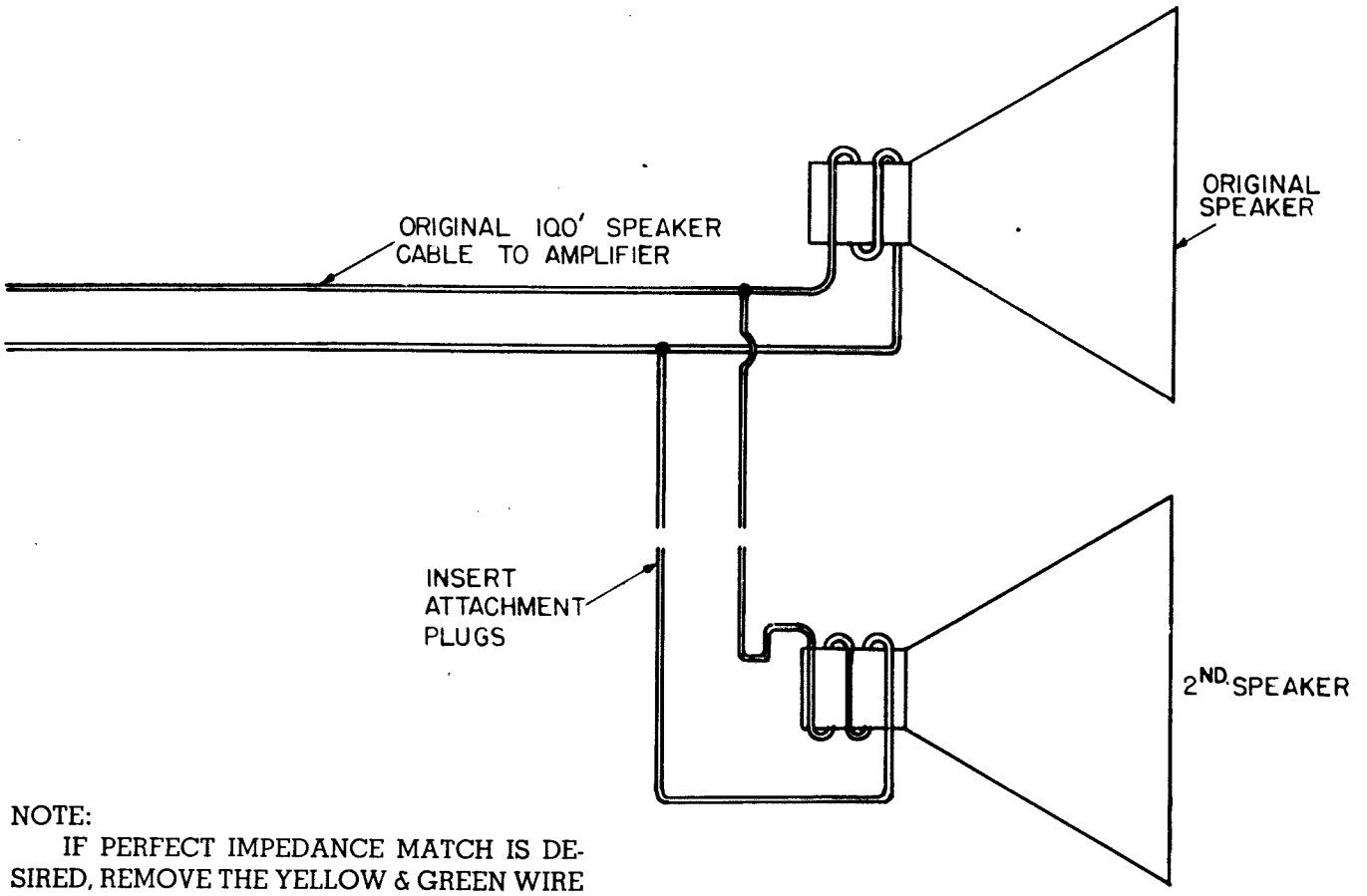
MODEL "2804" AMPLIFIER — REVISED 2-27-45
BEGINNING WITH SERIAL NO. 5589

(B) PROJECTOR SCHEMATIC WIRING DIAGRAM

(As Wired at Factory for Operation on A. C. Only)



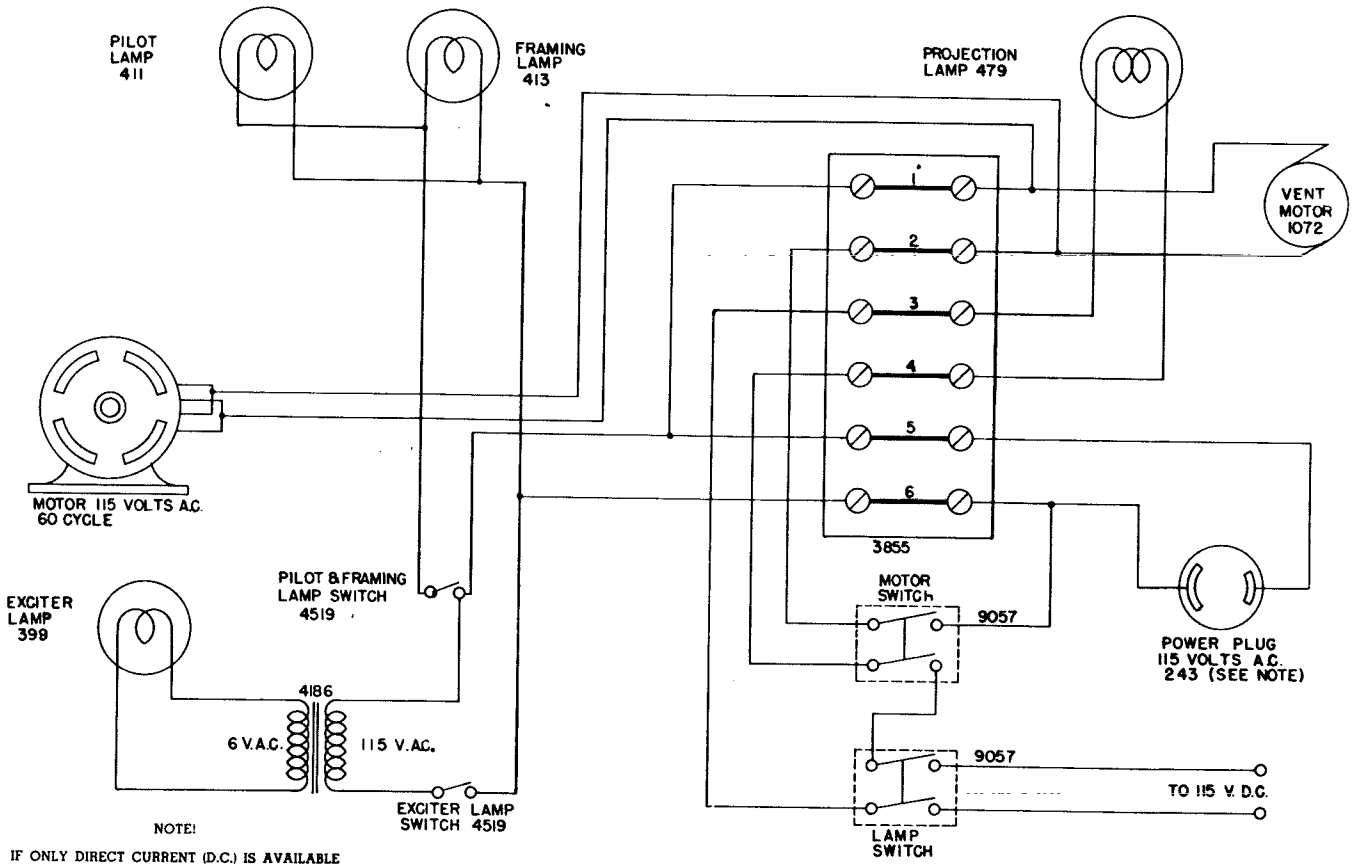
(C) SCHEMATIC WIRING DIAGRAM SHOWING HOW TWO LOUDSPEAKERS CAN BE OPERATED FROM ONE DE VRY MODEL "2804" AMPLIFIER



NOTE:

IF PERFECT IMPEDANCE MATCH IS DESIRED, REMOVE THE YELLOW & GREEN WIRE FROM 15 PIN IN AMPLIFIER AND ATTACH RED & YELLOW WIRE TO 15 PIN.

(D) SCHEMATIC WIRING DIAGRAM SHOWING HOW TO RE-WIRE THE PROJECTOR So That The PROJECTION LAMP Can Be Operated From DIRECT CURRENT (D.C.)



NOTE!

IF ONLY DIRECT CURRENT (D.C.) IS AVAILABLE A CONVERTER OF ABOUT 1000 WATT CAPACITY Will Be Required for Operation of Electrical Parts Not Operable on D. C.

METHOD OF WIRING PROJECTOR FOR OPERATING PROJECTION LAMP ON 115 VOLTS DIRECT CURRENT (D.C.)

← DUAL SPEAKER ARRANGMENT

SECTION XI -- ADJUSTMENTS

1. ADJUSTING THE LIGHT OPTICAL SYSTEM

(Refer to Master Drawing and Drawings on Pages 51-65 and 73.)

NOTE!

The Condenser and Reflector Assemblies in conjunction with the projection lamp and projection lens constitutes the optical train by which light is sent forward to the screen. It is meticulously set at the factory and this adjustment should never be tampered with.

In the event that the condenser lenses and/or reflector are replaced and the light on the screen is below maximum brilliance, the light optical system will require adjustment.

When performing any or all of the adjustments, bear in mind that a compromise between maximum illumination and equal distribution of the light on the screen is desirable.

a. Adjusting Condenser Assembly (1010)

(1.) Remove lamphouse (10925) by sliding it upward.

(2.) Remove the lamphouse baffle (2200).

(3.) Remove the red framer knob (2356).

(4.) Remove the stationary door (10911) by taking out the five door screws (10516).

(5.) Turn motor and lamp switches "ON". Exercise caution to keep fingers away from the rotating ventilating fan and shutter blade.

6.) Loosen the two set screws (685) which will free the assembly (1010) from its frame.

(7.) Move the condenser assembly (1010) as far forward as possible.

(8.) Move the assembly (1010) backward until position of maximum, although perhaps unequal, screen brilliance is reached. Caution: Keep clear of the rotating shutter blade.

(9.) Tighten the two set screws (685) to fix the condenser assembly in the position of maximum screen brilliance.

10.) Note that the adjustment of the condenser assembly (1010) must be effected in conjunction with that of the lamp socket assembly (2170) and reflector (583). Proceed by making the adjustment directed under "b," "c" and "d".

b. Lateral Adjustment of Lamp Socket Assembly (2170)

(1.) Loosen the four screws (881) which hold the lamp socket clamps to the lamp yoke support (2202).

(2.) Move the lamp assembly forward or backward until the position is reached where the light projected on screen is increased and equally distributed.

(3.) When making the adjustment bear in mind that the closer the projection lamp is set to the condenser lens system the more light this system will collect. Caution: The lamp bulb should not touch the condenser system.

(4.) Tighten the four screws (881) to fix the lamp socket assembly in the adjusted position.

c. Vertical Adjustment of Lamp Socket Assembly (2170)

(1.) Loosen the two clamp screws (8544) so as to free the lamp socket (1151).

2.) Move the lamp socket up or down until the light filament is optically centered so as to produce maximum screen illumination.

(3.) Make certain that the lamp filaments are perpendicular to the optical axis.

(4.) Tighten the two clamp screws (8544) to fix the lamp in the adjusted position.

(5.) Make adustment of reflector as directed under "d", if needed.

d. Adjustment of Reflector (583)

(1.) Loosen the two screws (881) which hold the reflector holder (10902) to the support (2202).

(2.) Move the reflector holder forward or backward until position is reached that gives increased and equal distribution of light.

(3.) Likewise, pivot the reflector assembly to get the vertical adjustment of the reflector.

(4.) Tighten the two screws (881) to fix the reflector in the adjusted position.

(5.) Reassemble by reversing procedure directed under 1, 2, 3, and 4, Paragraph 1, subdivision "a".

2. ADJUSTING TENSION OF FEED SHAFT SUB-ASSEMBLY (2393)

(Refer to Drawing on Page 63)

a. Ideal Condition

The tension on the feed shaft should be minimum but likewise sufficient to prevent the feed reel from releasing film faster than it is taken up by the feed sprocket.

b. To Increase Tension

(1.) Loosen the adjustment nut (1336).

(2.) Increase the tension on the spring (1105) as needed by turning the nut (1346) clockwise.

(3.) When proper tension is attained, tighten the nut (1336).

c. To Decrease Tension

(1.) Loosen the adjustment nut (1336).

(2.) Decrease the tension on the spring (1105) as needed by turning the nut (1346) in a counter-clockwise direction.

(3.) When proper tension is achieved, tighten the nut (1336).

3. ADJUSTING TENSION OF SHUTTER DRIVE CHAIN (2114)

(Refer to Drawing on Page 57)

a. To Reduce Slack

(1.) Loosen the two screws (798).

(2.) While holding the idler roller bracket sub assembly, move the entire idler roller assembly (2371) to the left to a point where excessive slack in the chain will be removed.

(3.) Be sure to leave a little slack in the chain because if the chain is too tight it will cause undue wear on the rollers, the shaft bearings and on the chain itself.

4. ADJUSTMENT OF FILM FEED SPROCKET (2217)

(Refer to Drawing on Page 77)

a. In the event that the sprocket becomes loose and goes "out of line" proper adjustment can be made by:

(1.) Centering the sprocket (2217) in relation to the stripper plate (1236) and adjust end thrust.

(2.) Tightening the set screw on the center of the sprocket. Before tightening this screw be sure it is in line with the "flat" on the shaft.
b. Periodically tighten the three screws (877) on the rear of the mechanism plate.

5. ADJUSTMENT OF FILM SOUND SPROCKET (2191)

(Refer to Drawing on Page 79)

a. In the event that the sprocket becomes loose and goes "out of line" proper adjustment can be made by:

(1.) Centering the sprocket (2191) in relation to the stripper plate (1236) and adjust the end thrust.

(2.) Tightening the set screw in the center of the sprocket. Before tightening this screw be sure it is in line with the "flat" on the shaft.
b. Periodically tighten the three screws (877) on the rear of the mechanism plate.

6. ADJUSTING TENSION OF APERTURE FILM SHOE SUB-ASSEMBLY (1038)

(Refer to Drawing on Page 81)

a. The tension springs (1039) on the aperture film shoe are meticuously adjusted before leaving the factory to accommodate new, old or oily prints. This precise factory adjustment minimizes the wear on the sprockets, guide rails and the film itself and assures a steady picture.

b. To Increase Tension

(1.) Release the lock tension screw (1047).

(2.) Turn the knurled nut (1045) clockwise to a point where the proper tension is exerted by the springs (1039) on the shoe.

c. To Decrease Tension

(1.) Release the lock tension screw (1047).

(2.) Turn the knurled nut (1045) counter-clockwise to a point where the proper tension is exerted by the springs (1039) on the shoe.

7. ADJUSTING TENSION OF TAKE-UP DRIVE CHAIN (2123)

(Refer to Figure 7 and Drawing, Page 83)

a. To Reduce Slack

(1.) Loosen the round head screw (838).

(2.) Move the idler spacer upward to a position where the idler roller (1458) exerts more tension on the chain (2123).

(3.) When proper tension is obtained, tighten the round head screw (838).

(4.) Be sure to leave a little slack in the chain because if the chain is too tight it will cause undue wear on the rollers, shaft bearings and on the chain itself.

8. ADJUSTING TENSION OF SOUND SPROCKET DRIVE CHAIN (2122)

(Refer to Figure 7 and Drawing, Page 73)

a. To Reduce Slack

(1.) Loosen the round head screw (838).

(2.) Move the idler spacer to a position where the idler roller (1458) exerts more tension on the chain (2122).

(3.) When proper tension is obtained, tighten the round head screw (838).

(4.) Be sure to leave a little slack in the chain because if the chain is too tight it will cause undue wear on the roller, shaft bearings and on the chain itself.

9. ADJUSTING THE TENSION OF THE HOLDBACK SPROCKET (621)

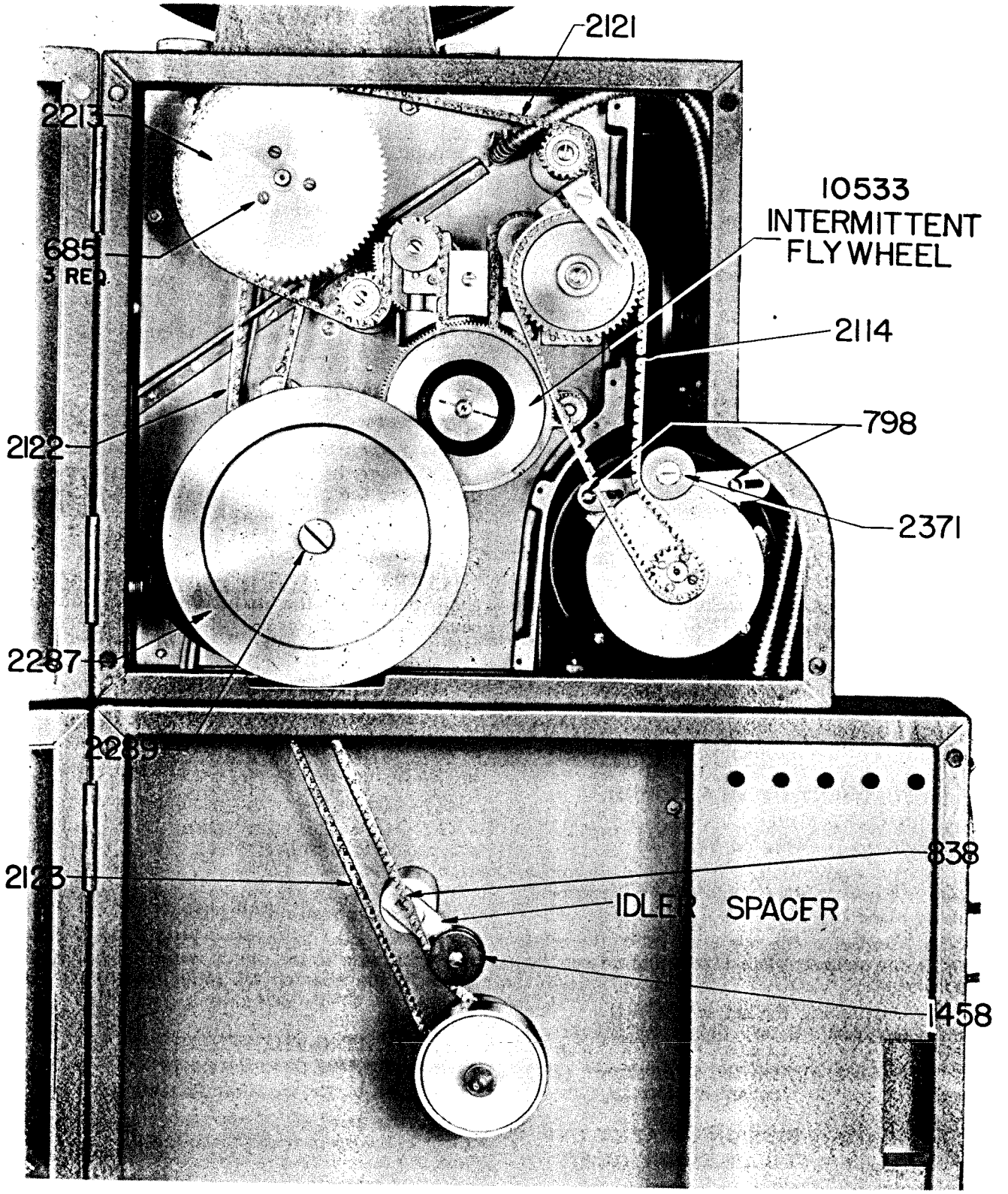
(Refer to Drawing on Page 105)

a. If the tension on the holdback sprocket (621) is incorrect it may tear the film. To adjust the tension on the sprocket:

(1.) Loosen the lock nut (1246).

(2.) Loosen or tighten the tension adjustment nut (1245) until the tension on the sproc-

FIGURE 7


2121
2213
10533
INTERMITTENT
FLYWHEEL
685
3 REQ.
2114
798
2122
2371
2287
2289
838
2123
IDLER SPACER
1458

ket spring (111) is reduced or increased to the proper point.

(3.) Tighten the lock nut (1246).

10. RETIMING THE SHUTTER

(Refer to Drawing on Page 97)

a. This is a delicate adjustment, therefore the directions as outlined below should be followed explicitly.

(1.) Remove red framing knob (2356).

(2.) Remove stationary door (10911) by taking out the five door screws (10516).

(3.) Thread film into the projector and frame the picture as directed in threading instructions.

(4.) Remove the two round head screws (922) and the bearing cap (2323), thereby exposing the shutter gear lock screw (2368) which has a LEFT HAND THREAD.

(5.) Using a long screw driver loosen the shutter lock screw (2368) by turning it in a clockwise direction. Meanwhile, hold the shutter chain sprocket (2327) located on the opposite side of the assembly.

(6.) By hand, turn the motor knob in a clockwise direction until exactly one-half frame of film is pulled down at the aperture opening.

(7.) Rotate the shutter on its shaft in its normal direction until the rib on the shutter blade (solid portion) lines up horizontally with the center of the aperture.

(8.) Tighten the shutter gear lock screw (2368) by turning it in a counter-clockwise dircetion. Replace shutter bearing cap, stationary door and red framing knob.

11. ADJUSTING THE SOUND ADJUSTMENT ROLLER (1243)

(Refer to Drawing on Page 106)

a. In the event that the sound track on the film does not line up laterally with the slit lens as the film passes over the sound drum annoying sound caused by the sprocket holes in the film being scanned by the slit lens will be reproduced by the loudspeaker. To correct this do the following:

(1.) Loosen the lock nut (1246).

(2.) Loosen or tighten the adjustment nut (1245) to move the roller (1243) in or out as may be needed to line up the sound track with the sound lens.

(3.) Tighten the lock nut. (1246).

12 ADJUSTING TENSION OF FLOATING FILM IDLER ROLLER (2351)

(Refer to Drawing on Page 100)

(1.) Remove the binder head screw (5222) from the idler stud (2346).

(2.) With film running through the projector turn the idler stud (2346) by inserting a screw driver in the slot provided for this purpose and turning either clockwise or counter-clockwise until the floating idler roller (2351) remains stationary half way between the maximum movement in either direction.

(3.) Replace the binder head screw (5222) into its former position in the idler stud (2346).

13. ADJUSTING THE TENSION OF THE SIDE TENSION ROLLERS (3338 and 3339) IN THE APERTURE PLATE ASSEMBLY

(Refer to Drawing on Page 109)

(1.) Remove any end play or end movement of the side tension roller shaft (3340) by loosening the aperture roller adjustment nut (1556) and turning the side tension adjustment screw (3335) until a position is reached where the shaft (3340) turns freely yet has no end movement.

(2.) While holding the screw (3335) in this position tighten the side tension adjustment nut (1556).

(3.) The correct location of the tapped side tension roller (3339) in relation to the mechanism plate should be 2.202 inches from the plate to the inside film guiding edge of the roller.

(4.) The roller position can be readjusted to this correct position by loosening the Bristo set screw (2416) and sliding the roller (3339) on its shaft (3340) until it is set 2.202 inches from the mechanism plate.

(5.) When the position is obtained, tighten the Bristo set screw (2416).

SECTION XII --- PARTS REPLACEMENTS

1. PROJECTION LAMP (479)

(Refer to Master Drawing, Rear of Book)

a. Removal

(1.) Remove the lamphouse (10925) by sliding it upward.

(2.) Similarily, remove the lamphouse baffle (2200).

(3.) Grasp lamp, turn in counter clockwise direction, meanwhile depressing the lamp gently, but firmly until lamp can be withdrawn.

b. Replacing

(1.) When inserting new lamp make sure that the large and small flanges of the lamp fit into their corresponding slots in the prefocused lamp socket.

(2.) Depress lamp in the socket and turn in a clockwise direction until the lamp locks itself into position.

(3.) No further adjustment is necessary, unless the accurate factory setting of the lamp socket has been disturbed. In this event adjust the lamp socket as directed under Adjustments.

2. CONDENSER ASSEMBLY (1010)

(Refer to Master Drawing and Page 53)

a. Removal

(1.) Remove lamphouse (10925) by sliding it upward.

(2.) Similarily, remove the lamphouse baffle (2220).

(3.) Remove projection lamp, as directed under Paragraph 1, this section.

(4.) Loosen the two screws (685) which will free the 1010 condenser assembly.

(5.) Remove the 1010 condenser assembly by sliding it toward the rear until free.

b. Replacing

(1.) Insert new assembly and reverse above procedure. Exercise caution in handling the assembly so as not to scratch or dirty the condenser lenses. See Adjustments.

3. PRISMATIC CONDENSER LENS (499)

(Refer to Drawing on Page 53)

a. Removal

(1.) Remove the condenser assembly (1010) as directed under Paragraph 2, this section.

(2.) Remove the retainer ring (1170) and withdraw the lens from the housing (1182).

b. Replacing

(1.) When inserting lens be sure the convex surface of the lens faces the inside of the condenser assembly (1010).

(2.) Replace the retainer ring (1170).

(3.) Return the entire assembly (1010) into its proper position in the condenser frame (10901).

(4.) Replace lamp as directed under "b" Paragraph 1, this section.

4. PARABOLIC CONDENSER LENS (587)

(Refer to Drawing on Page 53)

a. Removal

(1.) Proceed as directed under Paragraph 2, this section.

(2.) Remove the condenser spacer (1169) from the condenser housing which will free the lens.

b. Replacing

(1.) Insert lens with the convex surface facing the inside of the condenser assembly (1010).

(2.) Replace condenser spacer (1169), condenser lens (499) and retainer ring (1170).

(3.) Return the entire assembly (1010) into its proper position in the condenser frame (10901) as directed under Paragraph 2, this section.

(4.) Replace lamp as directed under "b" Paragraph 1, this section.

5. REFLECTOR (583)

(Refer to Drawing on Page 51)

a. Removal

(1.) Remove lamphouse (10925) by sliding it upward.

(2.) Similarly remove the baffle (2220).

(3.) Remove lamp as directed in Paragraph 1.

(4.) Remove the top reflector clip (2299) held in place by the nut (981) and washer (291) and withdraw the reflector.

b. Replacing

(1.) Insert the reflector into the lower two reflector clips (2299) and secure it into position by replacing the top reflector clip.

(2.) Be sure reflector is clean, no dirt, dust or finger prints should be on its surface.

(3.) Adjust reflector if necessary as directed in the Section on Adjustments.

6. PROJECTOR LAMP SOCKET

(Refer to Master Drawing and Pages 51-53)

a. Removal

(1.) Remove the lamphouse (10925) by sliding it upward.

(2.) Similarly, remove the baffle (2220).

(3.) Remove the lamp.

(4.) Free the socket by loosening the two lamp socket clamp screws (8544).

(5.) Remove the two screws holding the bottom of the lamp socket to the socket.

(6.) Remove the two power wires from the lamp socket. CAUTION! Make sure NO POWER is being fed to the projector.

b. Replacing

(1.) Slip the lamp socket bottom of the new socket over the two power wires.

(2.) Connect the two power wires to the socket. No consideration need be given to polarity in making this connection.

(3.) Proceed with the assembling by reversing procedure given under removal of socket.

(4.) Adjust socket as directed in the Section on Adjustments.

7. VENTILATING MOTOR ASSEMBLY (1005)

(Refer to Drawing on Page 52)

a. Removal

(1.) Disconnect the two wires that run from the projector terminal strip in the lower case to the motor. See wiring diagram Page 37.

(2.) Remove the three screws (881). This frees the entire assembly (1005) consisting of motor, fan and bracket from mechanism.

b. Replacing

(1.) Reverse procedure outlined above.

8. VENTILATING MOTOR (1072)

(Refer to Drawing on Page 52)

a. Removal

(1.) Proceed as directed under Paragraph 7, above.

(2.) Remove the ventilating fan (2210) from the motor shaft by loosening the set screws on the fan and pulling the fan off the shaft.

(3.) Remove the motor bracket (7021) from the motor by unscrewing the three screws (806).

b. Replacing

(1.) Replace fan and bracket by reversing the procedure given under 2 and 3 above. Then reverse procedure given under Paragraph 7.

9. VENTILATING MOTOR BRUSHES (7262)

(Refer to Master Drawing and Page 52)

a. Removal

(1.) Remove lamphouse assembly (10925) by sliding it upward.

(2.) Loosen the three screws (881) holding motor assembly (1005) to case.

(3.) Unscrew the two black fibre brush holders at each end of the motor and remove the old brushes.

b. Replacing

(1.) Insert new brushes and reverse above procedure.

10. FRICTION TIPS (2151) AND SPRINGS (86) IN TAKE-UP ASSEMBLY

(Refer to Drawing on Page 55)

a. Removal

(1.) Unscrew the knurled screw marked "oil" (1114) and loosen the two set screws (841) on the friction plunger wheel (1466).

(2.) Place a piece of cloth over the entire assembly and hold it in this position so that the loose parts will not be lost and to prevent springs from causing personal injury.

(3.) Grasp the hub of the friction plunger wheel, while entire assembly is covered with the cloth and with the aid of a pair of pliers pull the friction plunger wheel off its shaft. This will release all friction tips and springs within the cloth.

b. Replacing

(1.) Insert the six friction plunger springs and tips in their proper holes and hold all six in this position so as to permit the mounting of the friction plunger wheel with tips and springs in their proper location.

(2.) Reverse above procedure, omitting use of the cloth.

11. FEED SHAFT SPRING (1105)

(Refer to Drawing on Page 63)

a. Removal

(1.) Place a piece of cloth over the feed shaft assembly to prevent spring from flying off and causing personal injury.

(2.) With cloth over assembly remove the two knurled nuts (1336 and 1346), the washer (9156) and the flange (1343).

(3.) Remove the spring from the shaft.

b. Replacing

(1.) Reverse removal procedure.

(2.) Adjust tension of spring as directed under Adjustments.

12. PROJECTOR DRIVE MOTOR (10794)

(Refer to Master Drawing and Page 57)

a. Removal

(1.) Disconnect the wires that run from the projector terminal box to the motor. See projector wiring diagram Page 37.

(2.) Remove the shutter driving chain (2114). This is done by loosening the screws (798) holding the chain idler roller sub-assembly (2371) in position and removing the chain from the motor chain sprocket (1304).

(3.) Remove the stationary door (10911) on the upper case by removing the five door screws (10516) and the framer knob (2356).

(4.) Remove the four nuts (994) and the four bolts (999) from the motor base and lift the motor from the case.

b. Replacing

(1.) Reverse procedure given above for removal.

(2.) Be sure to leave a little slack in the chain when replacing it over the chain sprocket and when tightening the two screws (798) on the roller bracket. Excessive chain tension causes undue wear on rollers and sprockets.

13. FILM FEED SPROCKET (2217)
(Refer to Drawing on Page 76)

a. Removal

(1.) Slightly bend the stripper plate (1236) away from the sprocket.

(2.) Loosen the set screw in the center of the sprocket and pull the sprocket off its shaft (2212).

b. Replacing

(1.) Reverse removal procedure but be sure that when replacing the set screw it is in line with the "flat" on the shaft. See Adjustments.

14. FEED SPROCKET IDLER (2390)
(Refer to Drawing on Page 76)

a. Removal

(1.) Loosen the screw (871) holding idler in place in the center of the idler arm stud (5183) and remove the idler.

b. Replacing

(1.) Reverse removal procedure.

15. SOUND SPROCKET (2191)
(Refer to Drawing on Page 79)

a. Removal

(1.) Bend the stripper plate (1236) away from the sprocket.

(2.) Loosen the set screw in the center of the sprocket and pull the sprocket off its shaft (2219).

b. Replacing

(1.) Reverse removal procedure but be sure that when replacing the set screw it is in line with the "flat" on the shaft. See Adjustments.

16. UPPER FILM SHOE (1429)
(Refer to Drawing on Page 81)

a. Removal

(1.) Remove the two screws (5220).

(2.) Slide the washers (968), springs (1431) and washers (965) off the stud (1593).

(3.) Unscrew the stud from the film shoe mounting plate (1185) and remove the upper film shoe (1429) from the plate.

b. Replacing

(1.) Reverse removal procedure.

17. APERTURE FILM SHOE (1038)
(Refer to Drawing on Page 81)

a. Removal

(1.) Remove the four screws (853), the lock tension screw (1047), the yoke retaining screw (1041) and nut (1045) and withdraw the gate bracket (1448) from the mounting plate (1185).

(2.) Withdraw the two tension springs (1039).

(3.) Remove the two screws (960) and pull the aperture film shoe from the plate.

b. Replacing

(1.) Reverse removal procedure.

18. LOWER FILM SHOE (2233)
(Refer to Drawing on Page 81)

a. Removal

(1.) Remove screw (5222), washer (968), spring (1431) and washer (965).

(2.) Unscrew the film shoe stud (1593) and remove the lower film shoe (2233).

b. Replacing

(1.) Reverse removal procedure.

19. INTERMITTENT SPROCKET SHOE (2228)
(Refer to Drawing on Page 81)

a. Removal

(1.) Remove screw (5220), washer (2225) and spring (2226).

(2.) Slide the intermittent sprocket shoe off the sprocket shoe stud (2227).

b. Replacing

(1.) Reverse removal procedure.

20. TAKE-UP CHAIN IDLER ROLLER (1458)
(Refer to Drawing on Page 83)

a. Removal

(1.) Remove screw (5220) and pull the idler roller (1458) from the stud (2256).

b. Replacing

(1.) Reverse removal procedure.

21. SOUND SPROCKET CHAIN IDLER ROLLER (1458)
(Refer to Drawing on Page 73)

a. Removal

(1.) Remove screw (5220) and pull the idler

roller (1458) from the stud (2256).

b. Replacing

(1.) Reverse removal procedure.

22. INTERMITTENT UNIT (10525)

(Refer to Figure 7 and Drawing, Page 89)

a. Removal

(1.) Grasp the red framing knob and turn to a maximum position in either direction.

(2.) Remove red framing knob (2356).

(3.) Remove the stationary door (10911) on the upper case by removing the five door screws (10516).

(4.) Remove the large flywheel (2287) by unscrewing the screw (2289) and pulling flywheel off its shaft.

(5.) Loosen the drive chain (2121) by removing the three screws (685) which hold the chain sprocket (2213) in position.

(6.) Pull the chain sprocket (2213) off its shaft which will free the drive chain (2121).

(7.) Loosen the two screws (10538) which hold the clamps (10540).

(8.) Turn clamps toward the center of the movement and tighten the screws (10538).

(9.) Open the film gate.

(10.) Grasp the intermittent flywheel and push the intermittent unit from its mount meanwhile holding the back end of the unit for steadiness and to prevent damage.

b. Repairing Intermittent Unit Parts

(1.) We recommend that if any of the main intermittent parts need replacement that a complete new unit be installed as few persons have the necessary experience to make adjustments and replacements as required for perfect operation. However, to make the manual as complete as possible we include the repairing and replacing of the main individual parts of the intermittent unit.

(2.) Fitting the Flywheel Shaft

The flywheel shaft (10532) should be inserted into the removable bearing with a sliding fit but without lateral movement. A split lap for lapping the bore of the bearing will be found in the spare parts box along with Arkansas powder. A small amount of oil and Arkansas lapping powder should be applied to the lap. A lathe is necessary for this operation. Great care must be used so that the bore is not overlapped. Same should be checked with the shaft several times during this process. A brush (found in spare parts box) used with Oleum Spirits or gasoline or any other good cleaning agent can be used to clean out the Arkansas powder after each lapping. If the slightest particle of this emery compound is left in the bore, the shaft will bind in operation.

(3.) Fitting the Cam (10536)

Follow the same procedure as given for fitting the Flywheel Shaft. However, if the bearings are worn oversized they should be replaced.

(4.) Fitting Flywheel Shaft (10532) and Intermittent Cam Sub Assembly (10536).

When new, the cam gears will fit tightly and must be lapped to fit. The same mixture of Arkansas powder and oil should be used. The flywheel shaft should be held in a lathe collet. With the cam gear in position, a small quantity of the abrasive should be applied evenly to the gears. The gears should then be run in mesh at slow speed. It is very important that the abrasive does not find its way into the bearings during this operation. After the gears have run in mesh for about a half-minute, they should be checked. It is very important that these gears are not lapped too much as this will result in back-lash.

After the gears have been lapped so that they run smoothly and without any high points or back-lash, they are ready for assembly into the intermittent case (10530). After all parts and bearings have been thoroughly cleaned with brushes, replace the flywheel shaft and cam shaft in their respective bearings. In order that they be placed back in the same mesh, the face of the flywheel shaft gear (10557) should be marked at the time they are lapped. The lock nuts for both shafts should be adjusted so that the shafts run freely but do not have any end play. The assembled case should now be allowed to run in while the arm (10537) is being assembled.

(5.) Assembling the Arm Sub Assembly (10537) with the Star and Sprocket Sub-Assembly (10531)

If either of the bearings in the arm (10537) (inner 10542 or outer 10543) are worn they should be replaced. Next, the star and shaft (10573) must be fitted to these bearings in much the same manner that the flywheel shaft and cam shaft were fitted. When this has been accomplished, check the sprocket (235) making sure it is a good push fit on the star shaft. If it fits too tightly, it should be opened slightly with the lap. The sprocket should absolutely not be forced onto the shaft. As these are very accurate parts, great care must be exercised that they are not sprung out-of-true.

After assembling the star in the bearings with the sprocket in place, place the aluminum collar (10570) on the end of the star shaft. After tightening this collar in place, the star shaft should turn freely and without end shake. Now the taper pin holes in the sprocket and star shaft must be reamed in line so as to allow the taper pins (10571) to seat properly and hold the sprocket firmly in place. A taper pin broach for this will be found in the Spare Parts Box. The film stripper (10550) is put on last.

The (10537) Intermittent Arm and (10531) Star and Sprocket Sub-assembly is now ready to be assembled to the (10530) case. Place the cover and arm over the opening of the case and make certain the star head is turned so that it will not come in immediate contact with the cam. There is a hole provided in the cover arm which should be fitted over the dowel pin (10547) on the case. With this eccentric, adjustment can be made between the star radii and the cam. Before tightening the case cover screws, make sure the adjustment between the star and cam is such as to allow free action without shake.

The unit is now ready for the running-in period. Place the assembled movement in the projector as directed under Replacing and allow to run for a period of three hours with the oil up to the oil line. If the unit is not assembled right or the parts misfit, it will be apparent during the break-in period.

c. Replacing Intermittent Unit (10525)

(1.) Note the exact position of the segmental framing gear (2279) and insert new or repaired intermittent unit in the same position as that occupied by the intermittent unit withdrawn, thereby retaining correct synchronization with the shutter mechanism. If synchronization is disturbed it will be necessary to retime the shutter. See Section on Adjustments.

(2.) To facilitate replacement of the intermittent unit use a screw driver or any blunt instrument and press back the friction plunger (2143)

(3.) Reverse removal procedure.

23. INTERMITTENT SPROCKET (235)

(Refer to Drawing on Page 91)

a. Removal

(1.) To remove the intermittent sprocket (235) it is necessary to remove the entire intermittent unit from the projector. Follow the directions given in Paragraph 22, this section.

b. Replacing

Reverse removal procedure.

24. SOUND DRUM SUB-ASSEMBLY (2361)

(Refer to Drawing on Page 92)

a. Removal

(1.) Remove screw (2289), flywheel (2287) and pull the sound drum out until free.

b. Replacing

(1.) Reverse removal procedure.

25. BALL BEARINGS IN SOUND DRUM (2293)

(Refer to Drawing on Page 92)

a. Removal

(1.) Remove sound drum as directed in Paragraph 24.

(2.) Remove flywheel bearing mount (10119) by removing the two screws (701) and the one screw (700).

(3.) With the aid of a brass or fiber rod tap bearings out of mount.

b. Replacing

(1.) When replacing bearings tap them gently into place and reverse removal procedure.

26. PHOTO ELECTRIC CELL (4453)

(Refer to Drawing on Page 95)

a. Removal

(1.) Unscrew cover lock knob (2140) from the photo cell bracket (2308).

(2.) Remove photo cell cover (10924).

(3.) Pull photo cell from its socket. (Firmly but gently).

b. Replacing

(1.) When inserting photo cell be sure that the three contacts on the cell line up with the three holes in the socket.

(2.) Reverse removal procedure.

27. SHUTTER ASSEMBLY (2330)

(Refer to Figure 7 and Drawing, Page 97)

CAUTION!

The shutter assembly is one of the most important units of the projector. This assembly is installed at the factory with meticulous accuracy by men of long experience with the aid of special tools. As such, replacements of individual parts of this assembly in the field is not recommended. It is unlikely that any parts will ever require replacement, but if they do, it is recommended that the entire assembly be sent to the De Vry factory for repair; the cost will be for those parts replaced, plus the usual labor charges.

a. Removal

(1.) Release fire shutter lever (2319) by unscrewing the lifting stud (3121).

(2.) Remove the shutter drive chain (2114) by loosening the two screws (798) and moving the chain idler (2371) to the right.

(3.) Remove chain from the shutter drive sprocket (2327).

(4.) Remove the main drive chain (2121) by unscrewing the three screws (685) and withdrawing the feed chain sprocket (2213).

(5.) Lift the chain (2121) from the sprocket.

(6.) Remove the shutter blade sub-assembly (2372) by loosening the two set screws (871) and pull shutter from its shaft.

(7.) Remove the four screws (685) and withdraw the shutter assembly.

b. Replacing

(1.) Reverse removal procedure.

(2.) If shutter is not in perfect synchronization with the intermittent unit, retime the shutter as directed in Adjustment Section.

28. EXCITER LAMP (399)
(Refer to Drawing on Page 99)

a. Removal

(1.) Remove exciter lamp cover (2134) by unscrewing the screw (10104).

(2.) Grasp lamp and turn in a counter clockwise direction until free.

b. Replacing

(1.) When inserting new lamp be sure that the three large holes in the lamp base correspond with the pins on the exciter lamp socket; turn lamp in clockwise direction until it locks in place.

(2.) Replace cover.

29. STATIONARY IDLER ROLLER (2349)
(Refer to Drawing on Page 100)

a. Removal

(1.) Remove screw (5222) and pull the roller from the stud (2346).

b. Replacing

(1.) Reverse removal procedure.

30. HOLDBACK SPROCKET (621)
(Refer to Drawing on Page 105)

a. Removal

(1.) Remove the two adjustment nuts (1245 and 1246).

(2.) Pull the sprocket cap (1332) and tension spring (111) off the shaft (1325).

(3.) Unscrew the extension screw (2375), remove the micarta washer (1328), and withdraw the sprocket.

b. Replacing

(1.) When inserting new sprocket, place it on the shaft without removing the thrust bearing (1307) located on the rear of the shaft.

(2.) Reverse removal procedure.

31. HOLDBACK SPROCKET IDLER (3607)
(Refer to Drawing on Page 105)

a. Removal

(1.) Remove screw (5222) and pull the idler off the stud (5183).

b. Replacing

(1.) Reverse removal procedure.

32. APERTURE PLATE ASSEMBLY (2404)
(Refer to Drawing on Page 109)

a. Removal

(1.) Remove the red framing knob (2356.

(2.) Remove the stationary door (10513) on the upper case by removing the five door screws (10516).

(3.) Remove the entire film gate assembly (2230).

(4.) Remove the two screws (684) and pull the entire aperture plate assembly (2404) from the mechanism.

b. Replacing

(1.) Reverse removal procedure.

33. APERTURE FILM RAILS (1143)
(Refer to Drawing on Page 109)

a. Removal

(1.) Remove the entire aperture plate assembly (2404) as directed under Paragraph 32, this section.

(2.) Remove the four screws (919) and the two screws (852) which will free the rails from the aperture assembly.

b. Replacing

(1.) Reverse removal procedure.

34. SIDE TENSION ROLLERS (3338 and 3339).
(Refer to Drawing on Page 109)

a. Removal

(1.) Unscrew the lock nut (1556) and the side tension adjustment screw (3335).

(2.) Loosen screw (2416).

(3.) Pull rollers and shaft from casting (10701).

b. Replacing

(1.) Reverse removal procedure.