

*Westar*  
PROJECTORS

INSTRUCTION MANUAL

WESTREX COMPANY LTD.  
LONDON

# Westar

projectors

## INSTRUCTIONS

### FOR

TYPES 2001-E, F, G & H

WESTREX COMPANY LIMITED,

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## WESTAR PROJECTOR OPERATING INSTRUCTIONS

### INDEX

<u>Section</u>	
1.	- <u>GENERAL INFORMATION</u>
1.02	} Projector Coding - Definition
1.03	
1.05	Lens Holder
1.06	Forward Support
1.07	Anamorph Attachments
1.08	Arc Lamp Aperture
1.08	} Aperture Plate
1.10	
1.09	Moving Part of Gate
1.11	Sprockets
1.12	Magnetic Reproducer Attachment
1.13	Thide Changeover Device
1.14	Changing from Single to Double Shutter
1.15	Water-cooled Gate
1.16	Projector Controls
2.	- <u>INSTALLATION</u>
2.01	Unpacking
2.02	Cleaning Projector when new
2.03	Mounting the Projector
2.04	} Fitting the Projector Drive
to	
2.08	
2.09	Checking Film Alignment
2.10	Connecting the Threading Lamp
2.11	Connecting Supply to Water-cooled Gate
2.12	Aligning the Arc Lamp
2.13	Fitting the Lens
	Filing the Aperture Plate
3.	- <u>THREADING THE FILM</u>
4.	- <u>LUBRICATION &amp; ADJUSTMENT</u>
4.01	Lubrication
4.02	Intermittent
4.03	Plain Bearings
4.04	Gears
4.05	Routine of Lubrication
4.06	To Time the Shutter
4.07	To Adjust the Removable Part of the Gate
4.08	To Adjust the Fixed Part of the Gate
4.09	To Adjust the Gate Opening
4.10	To Remove the Intermittent
4.11	To Replace the Intermittent
4.12	To Adjust the Focusing Mechanism
4.13	To Set the Pad Roller Arms
4.14	To Set the Intermittent Shoe Assembly
4.15	To Set the Height of the Automatic Fire Shutter
4.16	To Adjust the Shutter Shaft
4.17	To Adjust the Gear Mesh of Upper and Lower Sprocket Shaft Assemblies
4.18	Main Drive Assembly
4.19	Westar Upper & Lower Spool Boxes
4.20	Tools Supplied with Projector
4.21	Lubricants Supplied with Projector

## INDEX (CONTINUED)

GENERAL EQUIPMENT BULLETINSAPERTURE PLATESAPERTURE PLATES, ADDENDUM 1MAINTENANCE INSTRUCTIONS -

<u>Section</u>	
1.	- <u>GENERAL</u>
1.02	Special Tools
2.	- <u>MAINTENANCE</u>
2.01	To dismantle the Intermittent
2.02	To remove the Sprocket Shaft
2.03	To remove the Cam Shaft
2.04	To assemble the Cam Shaft
2.05	To assemble the Sprocket Shaft
2.06	To assemble the Intermittent
2.07	To remove the Lens Holder
2.08	To replace the Lens Holder
2.09	Replacing the Gate Knob Spring
2.10	To dismantle the fixed part of the Gate
2.11	To assemble the fixed part of the Gate
2.12	Changing Upper or Lower Sprocket
2.13	To remove the Shutter
2.14	Projector Horizontal Drives
2.15	Projector Vertical Drive
2.16	To remove the Shutter Shaft
2.17	To replace the Shutter Shaft
2.18	To remove the Vertical Shaft
2.19	To replace the Vertical Shaft

REPLACEMENT PARTS

Drawings LS0-9705 to LS0-9714, LS0-9735

1. GENERAL

1.01 These operating instructions are written primarily for the Operator and provide operating, lubrication and routine adjustment information.

1.02 The Westar Projector is coded in four basic types:-

2001-E - Single Shutter  
 2001-F - Double Shutter  
 2001-G - Single Shutter with water-cooled gate  
 2001-H - Double Shutter with water-cooled gate

and is adaptable to practically all types of film reproducers.

1.03 The projector is designed to be driven either by the vertical shaft or by a horizontal gear drive.

The identifying code number of the projector for association with a variety of reproducers is shown in the following table.

DRIVES FOR WESTAR PROJECTORS		
FILM REPRODUCER	TYPE OF DRIVE	WESTAR PROJECTOR CODE NO.
Westrex 2002	Flexible shaft to projector vertical shaft.	2001-E, 2001-F, 2001-G, 2001-H (see 7, Fig.2).
Westrex Universal Base	Gear Box type 712AE Mod. 444 and horizontal drive assembly with driving dogs.	2001-E/1, 2001-F/1, 2001-G/1, 2001-H/1 (see Figs. 5 & 5A).
Westrex 206 and TA-7400	Gear drive. Horizontal drive assembly with driving sleeve.	2001-E/2, 2001-F/2, 2001-G/2, 2001-H/2 (see Fig.5).
Westrex TA-7500	Chain drive. Horizontal drive assembly with driving sleeve.	2001-E/2, 2001-F/2, 2001-G/2, 2001-H/2.
Westrex 2003	Chain drive. Horizontal drive assembly with driving sleeve.	2001-E/3, 2001-F/3, 2001-G/3, 2001-H/3.
R.C.A. MI-9001 MI-9030 to MI-9060 MI-1040 to MI-1077	Gear drive. Horizontal drive assembly with driving sleeve.	2001-E/2 Mod.674, 2001-F/2 Mod.674, 2001-G/2 Mod.674, 2001-H/2 Mod.674.

1.04 The Westar projector is designed on the unit assembly principle; the vertical shaft, shutter shaft, horizontal drive, intermittent movement and upper and lower sprocket drives can be removed from the main frame casting as individual units.

1.05 The lens holder has been designed to take lenses of 2.781 inches (70.7 mm) fit diameter in a lens adapter with a pre-focus stop. For standard prints with optical sound track a lens adapter with an eccentric bore is used. For CinemaScope prints with magnetic sound tracks a lens adapter with a concentric bore is used. Some lenses are not suitable for a lens adapter with a pre-focus stop, and for this type a lens stop ring is available.

- 1.06 Lenses in the longer focal length range having an appreciable back focus may have all their overhanging weight forward of the lens clamp. A forward support is available for such cases, which forms part of the lens clamp assembly and provides an additional clamp external to the main frame of the projector.
- 1.07 Mounting attachments for anamorph optics have been designed to mount on the front of the projector. This is the only addition or modification to the projector required for the projection of CinemaScope films with either optical or magnetic recording.
- 1.08 The gate heat shield assembly has been designed to accept an arc lamp aperture of  $f/1.9$ . The gate is made in two parts; the rear part is mounted on the main frame, and carries the framing aperture and the removable picture aperture plate. The aperture plate (9, Fig.1) is instantaneously removable and is accurately located in place by a retaining plate. This part of the gate also carries the film guides, runners and guide roller assembly.
- 1.09 The moving part of the gate is mounted at the rear of the lens holder casting on a sliding tube. The gate pads are long and heavy and are designed to give uniform pressure over the entire film contact surface.
- 1.10 A standard aperture plate (9, Fig.1) is provided, coded 77498. Full details of this aperture and method of use are given in the accompanying General Equipment Bulletin "Projector, 2001 - Aperture Plates".
- 1.11 The projector is fitted with sprockets for film with small perforations and will therefore run magnetic and photo track prints.
- 1.12 To fit a Westrex 2004 Magnetic Reproducer to a Westar Projector it is only necessary to remove the upper spool box roller holder, mount the reproducer in place and replace the roller holder on the top of the magnetic reproducer.
- 1.13 Facilities are provided for fitting the Thide picture changeover device to the projector.
- 1.14 A single shutter projector already in use may be modified to double shutter at the theatre by means of a set of parts. A set of parts is also available for conversion of 2001-E or F Projectors to provide a water-cooled gate.
- 1.15 The water-cooled gate (1, Fig.6) projector, coded 2001-G or H, requires connection to a water supply giving a rate of flow of 0.8 to 1.2 pints (0.5 to 0.7 litres) a minute. The pressure drop required across the inlet and outlet nozzles of the projector (2, Fig.6) to produce this rate of flow is about 2 lbs per square inch (0.14 Kgm per square cm). The water flow can be obtained from the mains or by the use of a closed circuit pump and cooling unit.
- 1.16 The following external controls are provided on the front of the projector.

Focus  
Frame  
Shutter (or travel ghost control)

The framing lamp switch is located on the top of the projector (2, Fig.2).

## 2. INSTALLATION

- 2.01 Unpack the projector and remove any trace of packing material which may have got into the mechanism during shipment.
- 2.02 Thoroughly clean off the protection grease from sprockets, rollers, gate and all parts of the film path. If carbon-tetrachloride or a similar cleaning solvent is used DO NOT use solvent on the gears or shafts where it might enter the ball bearings.
- 2.03 Mount the projector on the reproducer set. In the base of the projector there are six fixing holes. Two are tapped  $3/8$ " Std. Whit. (for the standard American mounting); the other four are clearance holes for mounting directly on reproducer sets by four  $3/8$ " Std. Whit. socket head cap screws. In line with the rear  $3/8$ " tapped mounting hole there is a safety screw whose head prevents the mounting screw from damaging the adjacent gear.
- 2.04 For vertical shaft drive a short flexible shaft with a coupling at each end (7, Fig.2) is connected between the vertical shafts of the 2002 Reproducer and projector, the couplings being fixed to the shafts by cap screws and lock nuts.
- 2.05 A steel spring washer and a plain steel washer are tied to the shutter knob. These must be inserted under compression between the top coupling of the flexible shaft and the lower ball bearing of the projector with the plain washer next to the ball bearing.
- 2.06 For horizontal drive (Fig.5) loosen the two screws fixing the Tufnol gear (3, Fig.5), also the four screws in the outer collar.
- 2.07 With Universal Base insert the drive shaft (Fig.5A) so that the two dimples line up with the two pointed screws in the collar and tighten first these screws, then the flat ended screws. Finally tighten the two screws fixing the gear.
- 2.08 With reproducers using gear or chain drive proceed as in 2.06 above, then insert shaft with reproducer drive gear or sprocket as far as possible. Tighten the two pointed screws into the space between pinion teeth, or into the dimples, whichever are present. Tighten first the pointed screws, then the flat ended screws. Finally tighten the screws fixing the gear.
- 2.09 When the projector has been mounted on the reproducer and the drive has been assembled, check the film alignment. Lubricate the projector before running it - see Sections 4.01-4.05 on Lubrication.
- 2.10 Connect the threading lamp (6, Fig.1). A flexible conduit for the lamp supply and a small fuse box (normally 2 Amp. fuses) for mounting on the pedestal or front wall are provided. The conduit has a plug and fittings for entry into the front of the projector (5, Fig.2). If the conduit is to pass towards the rear of the projector, use the two clips provided below the door on the non-operating side. A 125 V, 15 W, SBC lamp is normally provided and is suitable for 110 V supply. A 250 V, 15 W, SBC lamp is also available.
- 2.11 If the projector is a 2001-G or H with a water-cooled gate, connect the inlet and outlet nozzles with suitable flexible hose pipe to the water supply - see Section 1.15.
- 2.12 When the projector has been checked by running, align the arc lamp with the gate aperture.

2.13 Fit the lens in the projector and centre the projected image on the screen. File the aperture plate to the required ratio - see Section 1.10.

### 3. TO THREAD THE FILM

3.01 The film path is shown in Fig.1.

To open the gate give the large knob (1, Fig.1) a quarter turn to the right; the knob will remain locked in that position. The gate is closed by pushing the knob. If the knob is given a full half turn to the right a second locking position will be found. This is normally used only to remove the gate - see Section 4.09.

3.02 By a twisting action with finger and thumb open the upper pad roller arm (5, Fig.1), the lower pad roller arm (21, Fig.1) and the intermittent shoe (19, Fig.1).

3.03 Check with the framing knob (24, Fig.1) that the framing mechanism is in the central position. Turn the mechanism by hand until the intermittent sprocket stops moving - no further.

3.04 Thread the film through the roller holder on the top of the projector, under the upper sprocket and over the upper pad roller, through the gate, under the intermittent sprocket, under the lower pad roller, and over the lower sprocket to the sound reproducer. The upper and lower pad rollers in the open position serve as guides for setting the film loop above and below the gate; typical loop sizes are shown on Fig.1. Immediately above the aperture plate on the fixed part of the gate is mounted a framing aperture, which is spaced precisely two frames above the projector aperture.

3.05 Hold the film in the gate, close the intermittent shoe, and close the gate by pushing the knob (1, Fig.1). Finally close the upper and lower pad rollers (5 and 21, Fig.1) again using the finger and thumb in a twisting action.

### 4. LUBRICATION AND ADJUSTMENT

4.01 Lubricants - the following lubricants must be used.

2009-A Oil for the intermittent, upper and lower sprocket bearings and various parts of the mechanism as specified below.

32081-A Grease for all gears.

32082-A Grease for lubricating the vertical shaft at the sliding gear (8, Fig.2).

Do not oil or grease with projector running.

Do not oil the ball bearings. They are factory filled and require no additional lubrication.

4.02 Intermittent (12, Fig.1; 2, Fig.4)

Fill the intermittent with 2009-A Oil through the oil cup (11, Fig.1 and 2, Fig.4) until it shows half-way up the window (14, Fig.1) and check daily. There will be no oil level indication with the projector running. Lubricate with 2009-A Oil the outrigger bearing of the intermittent and the face of the collar (10, Fig.1).

### 4.03 Plain bearings

The plain bearings fitted to the upper (3, Fig.1) and lower (22, Fig.1) sprocket drive assemblies are of the oil-impregnated type but must be replenished with 2009-A Oil. The bearings of top and bottom Westar spool boxes should also be lubricated with 2009-A Oil.

### 4.04 Gears

Apply a smear of 32082-A Grease on the vertical shaft at the sliding gear (8, Fig.2). Before the grease is applied clean the gear sleeve and the shaft of any deposit by wiping and using a little 2009-A Oil while operating the framing knob. This cleaning procedure with 2009-A Oil is particularly important during the early operating days of the projector. After greasing, move the gear up and down a few times by the framing knob (24, Fig.1).

All gears must be kept lubricated with a minimum amount of 32081-A Grease.

4.05 The following lubrication routine should be followed.

#### Each day

Check intermittent oil level (Section 4.02), and oil intermittent outrigger bearing. Check grease on sliding gear on vertical shaft (Section 4.04) and re-grease with 32082-A Grease if necessary.

#### Twice a week

A few drops of 2009-A Oil in each oil cup and on plain bearings (Sections 4.02 and 4.03).

Grease all gears with 32081-A Grease (Section 4.04), using a minimum of lubricant.

#### Once a week

After cleaning apply a drop of 2009-A Oil to the focusing, fire shutter, and framing mechanisms, the gate opening mechanisms (including the tube actuating pin), pad roller arms, upper and lower spool box bearings and the friction washer of the Westar take-up.

The art of lubrication is "little and often". Lack of attention to lubrication will ruin the projector - on the other hand excessive lubrication is to be deprecated.

### 4.06 To time the shutter

To check the timing, remove the red glass from the shutter guard by pressing it in with the thumb and pushing upward. The indicator bar (1, Fig.3), is used for timing the shutter. Turn the projector slowly by hand while watching the intermittent sprocket. When the sprocket has advanced exactly two teeth from its stationary position, stop the projector; this must be done very accurately. If the notch in the shutter blade (2, Fig.3) is now exactly opposite the indicator bar the shutter is in time. If not, check if the shutter can be corrected by adjusting the knob marked "Shutter" in the front of the projector.

If a change of setting is necessary, first move the shutter timing mechanism to the centre of its travel by the shutter knob, then loosen the two screws in the shutter boss (3, Fig.3) and rotate the

shutter until the notch and indicator are in line. Tighten the screws and check by running film; eliminate any travel ghost by means of the shutter knob.

#### 4.07 To Adjust the Removable Part of the Gate

To inspect the removable part of the gate give the knob (1, Fig.1) a full half turn to the right, where there is the second locking position. (With certain lenses, due to very short back focus distance between lens and film, it may be necessary to remove the lens in order to use the second gate locking position). Loosen the holding screw (26, Fig.1). The assembly can now be withdrawn towards the fixed part of the gate. (The extent of the gate opening can be adjusted if necessary, see Section 4.09).

The pressure of the gate pads can be adjusted over a wide range, through coil springs (2 and 23, Fig.1). After a little experimenting, the best operating pressure will be found for any condition of film; it is suggested that until the optimum pressure is found, the adjusting nuts should be about mid-position. A safety feature lies in the limit stops provided, since the adjusting nuts cannot be tightened so as to lock the film. It is desirable to operate with as little pressure as possible on the pads while still maintaining a steady picture. The lighter the pressure, the less the wear on the intermittent sprocket, pads and film.

#### 4.08 To Adjust the Fixed Part of the Gate

Remove the shield by releasing the two captive screws (8, Fig.1). Loosen the screws securing the fixed part of the gate. The film runners must be lined up slightly forward of the sprocket. Place a straight edge against the face of the runner and let it extend down to the sprocket. The assembly should now be adjusted so that the straight edge is approximately two film thicknesses ahead of the sprocket. Then tighten the holding screws. Replace the shield.

The gate assembly may be removed for inspection by removing the securing screws.

#### 4.09 To Adjust the Gate Opening

If the position of the lens when focused permits, the opening at the first locking position can be increased. Open the gate to the first locking position. Then loosen the two set screws (top and bottom) behind the gate operating knob, and turn the whole knob and sleeve assembly clockwise. Find by trial a setting at which the gate (still in the first locking position), is satisfactorily clear of contact with the lens, then tighten the two screws. If it is decided to adopt the new position permanently, drill small dimples in the sleeve at the points marked by the screws. In exceptional cases, when the lens is in focus, it may not be possible to open the gate even to the first locking position as normally set, and the gate opening must be reduced. Move the lens forward temporarily, and open the gate to the first locking position. Then proceed as above, but move the knob and sleeve assembly anti-clockwise to find the new setting. Under these conditions it will be necessary to move the lens forward in order to use the second position when taking out the gate for inspection.

#### 4.10 To Remove the Intermittent (12, Fig.1)

Remove the flywheel on the non operating side of the projector. Frame the intermittent carriage into its lowest position and then raise it 1/16". Remove the film gate (Section 4.07). Loosen the four screws

(17, Fig.1) holding the intermittent. Since these four screws are hardened and have large heads, a small screwdriver should be used to avoid risk of breakage. Turn the intermittent about an eighth turn to a clockwise direction until the cut-outs (18, Fig.1) in the intermittent cover are in line with the holding screws and then withdraw.

Do not attempt internal repairs or adjustments to the intermittent.

#### 4.11 To Replace the Intermittent

Set the shutter adjustment mid-way by the shutter knob, and move the framing carriage to its lowest position, less 1/16". When fitting a new intermittent, loosen the stop screw (13, Fig.1). This stop, when finally set, permits the intermittent to be removed and replaced without readjustment of the gear mesh.

Remove the red glass from the shutter guard by pressing it in with the thumb and pushing upward. Rotate the mechanism by hand until the notch in the shutter blade is in line with the bottom of the aperture of the glass retainer. Take the intermittent in the hands and rotate the gear on the cam shaft until the sprocket advances exactly two teeth; at this point the hole for the flywheel screw is vertical.

Insert the intermittent with four cut-outs (18, Fig.1) in line with the locking screws (17, Fig.1) and the fifth cut-out in line with the bottom of the film gate runner. Turn the intermittent counter-clockwise so that its gear meshes with the driving gear on the vertical shaft. Continue turning the intermittent until these two gears press lightly together with no backlash. Tighten any two opposite locking screws using a small screwdriver to avoid risk of breakage. Push the stop plate (15, Fig.1) against the stop (16, Fig.1) and tighten the stop screw (13, Fig.1). Now loosen the two locking screws previously tightened and turn the intermittent clockwise to give 3/64" clearance between stop plate and stop. Hold the intermittent in this position and tighten the four locking screws (17, Fig.1). Loosen screw (13, Fig.1), push stop plate against stop and re-tighten screw. The slot in the stop plate is off centre and it may be necessary to rotate the plate through 180° to push it against the stop. Replace the flywheel and make sure that its screw is tight. Refill the intermittent with 2009-A Oil, (Section 4.02), and check oil level before running.

#### 4.12 To Adjust the Focusing Mechanism

The tightness of the screw thread of the focusing knob shaft can be adjusted by the screw (25, Fig.1). Do not use this adjustment to give friction to the focus knob; friction should be provided by the spring washer and twin locknuts on the shaft.

#### 4.13 To Set the Pad Roller Arms

The upper and lower pad rollers must be adjusted so that there is a clearance of just over two thicknesses of film between the pad roller and the sprocket in order to pass lapped film joints without damage. To do this, loosen the stop screw (7, Fig.1) of the upper pad roller and back it out of contact with the stop. Slacken the two small screws securing the mounting flange of the assembly; this allows a slight adjustment of the arm. Set the arm so that the roller contacts the sprocket under slight tension and tighten the two screws. Adjust the stop screw until the roller just fails to grip two layers of film round the sprockets.

**4.14 To Set the Intermittent Shoe Assembly**

To adjust the shoe assembly of the intermittent sprocket loosen the set screw (1, Fig.4) and turn the shaft until the shoes just make contact with the sprocket, with little or no pressure. When film is in place it will depress the shoes by the thickness of the film. A fine adjustment can be made by the knurled nut (20, Fig.1 and 3, Fig.4). The setting is not critical; the clearance may be increased if desired. If the shoes are set too close to the sprocket, the picture may jump when a joint passes.

**4.15 To Set the Height of the Automatic Fire Shutter**

The height of the shutter should be adjusted so that while it does not intercept the light beam with the projector running, it does not touch the top of the shield. At the top of the governor on the vertical shaft there is set screw (1, Fig.2), which locks the governor to a groove in the shaft. Loosen this screw. The governor may now be raised or lowered, which will raise or lower the fire shutter. When the proper shutter height is obtained the governor set screw should be firmly tightened. Check that the shutter cuts the light off completely when down.

**4.16 To Adjust the Shutter Shaft**

The forward bearing of this shaft (i.e., the bearing next to the gear) is mounted in an eccentric ring; this enables the shaft to be adjusted relative to the vertical shaft in order to obtain accurate mesh. This adjustment is chiefly intended for use when the projector is first assembled, but it must be checked if a new gear is fitted. The method of adjustment is as follows. The eccentric ring is locked in position by two 2 BA set screws in the side of the bearing bracket (3, Fig.2). (To prevent interference, the screws are sealed in with wax). When these screws are slackened, the ring may be slowly turned by inserting an Allen wrench in one of the holes in the ring and levering against the shaft. Clockwise rotation increases the backlash between the gears, anti-clockwise decreases it. As a guide to the correct amount of backlash, hold the vertical shaft and gently turn the shutter boss to and fro. The backlash or play between the gears is correct when it gives a free movement of 1/16" to 1/8" at the tip of the shutter blade.

Re-tighten the set screws securely.

The eccentric ring and the bearing bracket are marked at the time of factory assembly to indicate the adjustment then found to be correct. Do not disturb this setting unless it is really necessary. The adjustment is intended to be used very rarely, e.g., when fitting a new gear.

**4.17 To Adjust the Gear Mesh of Upper and Lower Sprocket Shaft Assemblies**

These assemblies are mounted on detachable bearing plates, together with their roller arms. The upper assembly can be completely withdrawn after removing the four screws (4, Fig.1) holding the bearing plate, but the lower assembly requires the Tufnol gear (4, Fig.2) to be removed first. The method of mounting allows the gears to be adjusted slightly for backlash before finally tightening the four screws holding the bearing plate; the correct amount of backlash can be judged by referring to that which can be felt between the gears of the shutter shaft. On no account should the gears be run hard in mesh; a small amount of backlash should be present at all positions

as the gear is rotated. Finally tighten very securely the screws holding the bearing plate. After tightening, re-check the backlash before switching on the motor.

**4.18 Main Drive Assembly**

The drive (Fig.5) is mounted on a detachable bearing bracket, and the mesh of the gears (1 and 3, Fig.5) can be adjusted by slightly loosening the three screws (6, Fig.2 and 2, Fig.5) and sliding the bracket sideways, while keeping the toe of the bracket (on the extreme right) pressed down in contact with the main frame. The correct amount of backlash is as described above.

**4.19 Westar Upper and Lower Spool Boxes**

Keep the fire trap holders clean and free from film particles, especially the upper holder. If a roller fails to turn it will quickly develop a flat spot, resulting in film scratch. Check that the spool spindles have a small amount of endplay and adjust the collars if necessary. Note that there are two lubricators on the drive side of the lower spool box, one being just at the back of the pulley.

In order to cater for all spools, spindles are 5/16" diameter (American Standard). Spool adapters are available for British Standard spools and for a number of older types. Washers are sometimes required between adapter and spool box bearing, to obtain good film alignment. The take-up is designed for spools having a standard hub diameter of 4 inches and over.

Run the V belt as slack as is possible with safety; it should be easy to twist the belt through 180° with the fingers. Check that the belt idler pulley runs accurately in line with the belt. The pulley should float freely sideways, and show no tendency for its flanges to twist the belt.

**4.20 Tools Supplied with Projector**

68185 Oil Can  
63269 Wrench, 2BA x 4BA  
68290 Key Wrench, 5/32" A/F  
68291 Key Wrench, 3/16" A/F  
Wrench, 0.05" A/F  
Wrench 1/16" A/F  
Wrench 5/64" A/F  
Wrench 3/32" A/F  
Wrench 1/8" A/F  
Wrench 5/32" A/F  
Wrench 3/16" A/F  
Wrench 7/32" A/F  
Wrench 5/16" A/F

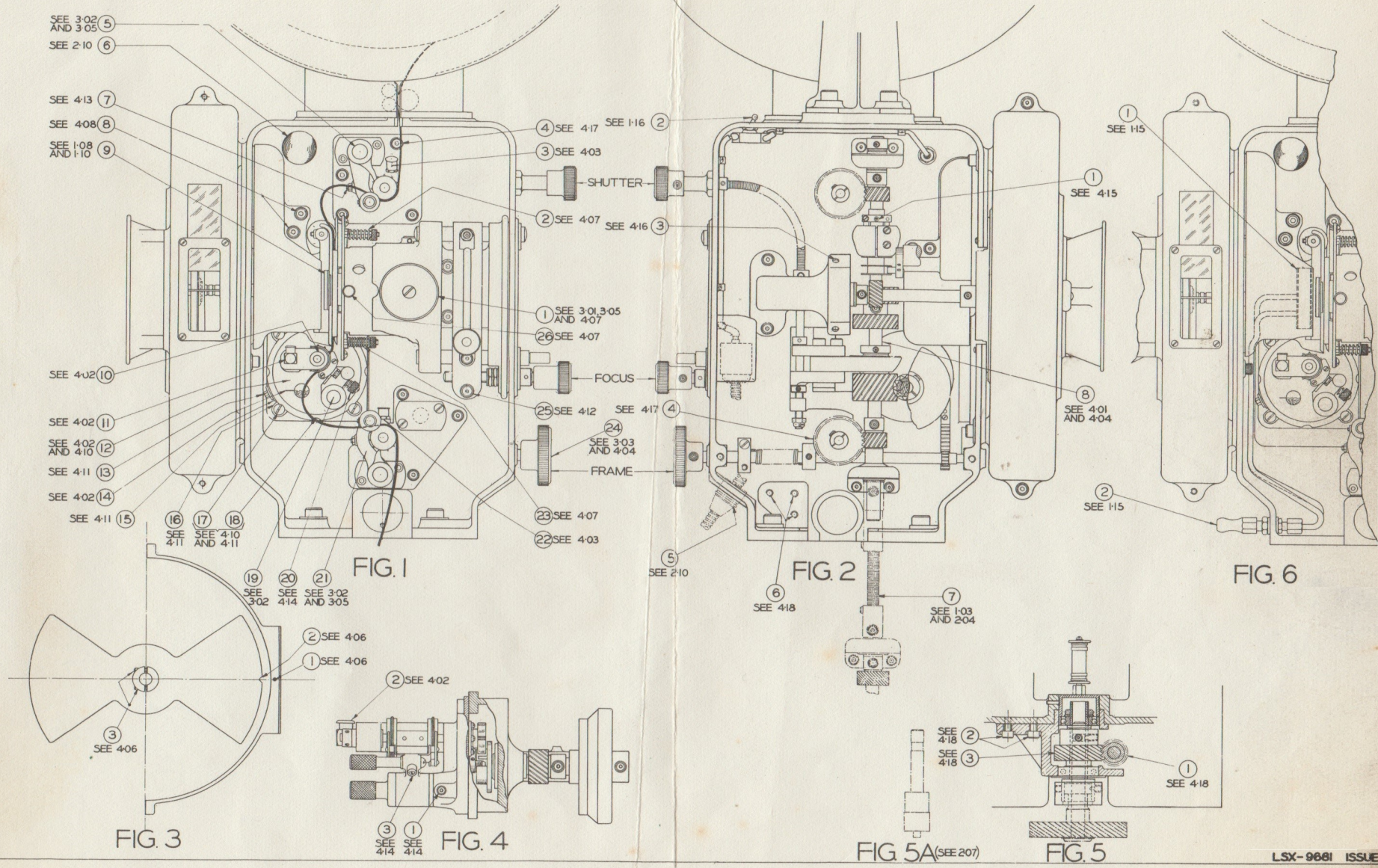
**4.21 Lubricants Supplied with Projector**

32081-A Grease, 2 oz Tube  
32082-A Grease, 1 lb Container  
2009-A Oil, 1 Quart Container

WESTAR PROJECTOR  
OPERATING INSTRUCTIONS  
INDEX TO FIGURE REFERENCES  
(SEE LSX-9681)

Fig.1	3.04	Fig.1, 25	4.12
Fig.1, 1	3.01, 3.05, 4.07	Fig.1, 26	4.07
Fig.1, 2	4.07	Fig.2, 1	4.15
Fig.1, 3	4.03	Fig.2, 2	1.16
Fig.1, 4	4.17	Fig.2, 3	4.16
Fig.1, 5	3.02, 3.05	Fig.2, 4	4.17
Fig.1, 6	2.05	Fig.2, 5	2.05
Fig.1, 7	4.13	Fig.2, 6	4.18
Fig.1, 8	4.08	Fig.2, 7	1.03
Fig.1, 9	1.08, 1.10	Fig.2, 8	4.01, 4.04
Fig.1, 10	4.02	Fig.3, 1	4.06
Fig.1, 11	4.02	Fig.3, 2	4.06
Fig.1, 12	4.02, 4.10	Fig.3, 3	4.06
Fig.1, 13	4.11	Fig.4, 1	4.14
Fig.1, 14	4.02	Fig.4, 2	4.02
Fig.1, 15	4.11	Fig.4, 3	4.14
Fig.1, 16	4.11	Fig.5, 1.03, 4.18	
Fig.1, 17	4.10, 4.11	Fig.5, 1	4.18
Fig.1, 18	4.10, 4.11	Fig.5, 2	4.18
Fig.1, 19	3.02	Fig.5, 3	4.18
Fig.1, 20	4.14	Fig.5A, 1.03	
Fig.1, 21	3.02, 3.05	Fig.6, 1	1.15
Fig.1, 22	4.03	Fig.6, 2	1.15
Fig.1, 23	4.07		
Fig.1, 24	3.03, 4.04		





## 1. GENERAL

## 1.1 Aperture Dimensions (Maximum)

## For Standard Film

0.825" wide x	0.600" high	-	1.375 Aspect Ratio
	0.497" high	-	1.66 Aspect Ratio
	0.471" high	-	1.75 Aspect Ratio
	0.446" high	-	1.85 Aspect Ratio
	0.412" high	-	2.00 Aspect Ratio

## For CinemaScope Photo Film

0.839" wide x 0.715" high - 1.17 Aspect Ratio

With anamorph the picture aspect ratio is  $1.17 \times 2 = 2.34$ 

## For CinemaScope Magnetic Film

0.912" wide x 0.715" high - 1.275 Aspect Ratio

With anamorph the picture aspect ratio is  $1.275 \times 2 = 2.55$ 

## 1.2 Description of Aperture Plates

Table A describes the two aperture plates which are currently in production.

Table B lists aperture plates which are at present available, but which will be superseded by the 77498 Aperture Plate when present stocks are exhausted.

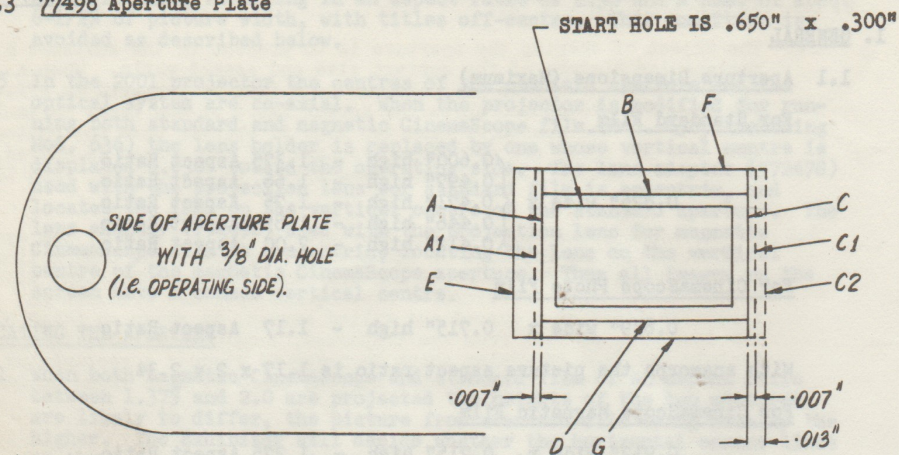
TABLE A

Code	Aperture	Corner Radius	Suitable for Picture Aspect Ratio	Description
75155	None	-	Any	Blank
77498	0.650" x 0.300"	0.005"	1.375 - 2.55	See Section 1.3

TABLE B

Code	Aperture	Corner Radius	Suitable for Picture Aspect Ratio	Description	See Section
73995	0.825" x 0.600"	0.005"	1.375	Maximum aperture	1.4
75105	0.825" x 0.600"	0.050"	1.375	Maximum aperture	1.4
76134	0.750" x 0.600"	0.050"	1.375	Keystone	1.5
77171	0.825" x 0.600"	0.050"	1.375	Keystone	1.5
77171	0.852" x 0.656"	0.005"	1.275	Scribed line	1.6
77231	0.832" x 0.555"	0.005"	1.275	0.912" x 0.715" Scribed line	1.7
77231	0.832" x 0.555"	0.005"	1.275	0.912" x 0.715"	1.7

## 1.3 77498 Aperture Plate



For standard film the scribed lines A and C show the maximum width of 0.825". Lines B and D indicate the maximum height of 0.497" for an aspect ratio of 1.66.

For CinemaScope photo the scribed lines F and G give the height of 0.715". The dotted lines A1 and C1 are not scribed, being only 0.007" outside lines A and C; they indicate the maximum dimension 0.839".

For CinemaScope magnetic the height is the same as for CinemaScope photo. The width is limited by scribed line E and dotted line C2 (not scribed) which is 0.013" outside line C.

## 1.4 73995 and 75105 Aperture Plates

The 73995 (square corners) and 75105 (rounded corners) plates have the maximum size aperture and are for use only where the effective projection angle is small. (The effective projection angle is the difference between the negative projection angle and the tilt of the screen.)

## 1.5 76134 Aperture Plate

The 76134 plate has a keystone aperture for use where the effective projection angle is less than 25 degrees.

## 1.6 77171 Aperture Plate

The 77171 plate has a guide line showing the maximum aperture usable with magnetic CinemaScope. The aperture is 0.030" undersize all round.

## 1.7 77231 Aperture Plate

The 77231 plate is for use with magnetic CinemaScope with steep effective negative projection angles when the top and bottom lines have to be heavily curved. The working margin inside the guide line is 0.090" at the top, 0.070" at the bottom and 0.030" at the sides.

2. SHAPING THE APERTURE

- 2.1 The object of shaping the aperture is to present to the audience a rectangular picture of the correct size and aspect ratio. When a rectangular aperture is projected on to a flat screen with an effective negative projection angle the aspect ratio of the image is smaller than that of the aperture. The top line is shorter than the bottom line and the sides are not perpendicular. If the screen is curved, the top and bottom lines of the image appear to be concave. (See ISA-9183)
- 2.2 On the screen, the image of the aperture is the converse of the aperture itself. The top edge of the aperture produces the bottom line of the image; the left edge of the aperture produces the right side of the image. If, therefore, a rectangular aperture produces an irregular image on a curved and tilted screen, as shown on ISA-9183, the aperture, as seen from the lamphouse, should be trimmed to approximately the same irregular shape in order to produce a rectangular image. The effect of horizontal masking lines is also shown on ISA-9183.

2.3 Magnification Factor

The amount to be filed from the plate to extend the image by a given distance may be estimated from the magnification factor.

Example 1 - Picture width 30'. Aspect ratio 1.66

$$\text{Magnification} = \frac{30 \times 12}{0.825} = 436$$

Alternatively, Throw 100'. Lens 2.75"

$$\text{Magnification} = \frac{100 \times 12}{2.75} = 436$$

Thus to widen or heighten the picture 8 inches file away  $\frac{8}{436}$  inch, or 0.018" (0.009" from each side.)

Example 2 - Magnetic CinemaScope picture 40' x 15'6"

$$\text{Horizontal magnification} = \frac{40 \times 12}{0.912} = 525$$

$$\text{Vertical magnification} = \frac{15.5 \times 12}{0.715} = 262$$

Thus to increase height by 8 inches file away a total of  $\frac{8}{262}$  inches = 0.030". To increase width 8 inches file away a total of  $\frac{8}{525}$  inches = 0.015" (0.0075" from each side.)

2.4 Vertical Centre Line

Because of the sound track, the centre of the picture on standard and photo CinemaScope film is 0.049" from the centre of the film. With magnetic CinemaScope film the offset in the same direction is only 0.019". The centre lines of the two pictures are therefore separated by 0.030". The centre lines of aperture plates cut for magnetic CinemaScope must also differ by 0.030" from those for standard and photo CinemaScope film. If this discrepancy were compensated by filing the magnetic CinemaScope aperture plate asymmetrically so that the vertical centres of both apertures coincided there would be a cut-off of the left magnetic CinemaScope image of 0.030" x the horizontal

amplification, resulting in an aspect ratio of 2.38 and a loss of about 6-1/2% of picture width, with titles off-centre. This condition is avoided as described below.

- 2.5 In the 2001 projector the centres of the standard aperture and the optical system are co-axial. When the projector is modified for running both standard and magnetic CinemaScope film (Mod. 630, including Mod. 636) the lens holder is replaced by one whose vertical centre is displaced 0.030" toward the operating side. The lens adapter (772478) used with the projection lens for standard film is eccentric, and locates the lens on the vertical centre of the standard aperture. The lens adapter (77249C) used with the projection lens for magnetic CinemaScope film is concentric, locating the lens on the vertical centre of the magnetic CinemaScope aperture. Thus all images on the screen have a common vertical centre.

3. LOCATING THE APERTURE

- 3.1 When both magnetic CinemaScope and standard film of an aspect ratio between 1.375 and 2.0 are projected the heights of the two pictures are likely to differ, the picture from standard film being usually the higher. The Exhibitor will decide whether the horizontal centre lines or the bottom edges are to be common, but the trend is towards a common bottom edge, thus avoiding the masking problem which would otherwise arise.

- 3.2 There are two ways of projecting both pictures on a common base line.

- (a) Both aperture plates may be cut with a common centre line, in which case the projector must be tilted between two predetermined positions, or -
- (b) The apertures may be cut so that the bottom edges of both pictures coincide.

For various reasons the centre of the magnetic CinemaScope aperture should coincide with the optical centre. If the height of the picture from the standard film is the greater, the picture should be raised by cutting the aperture lower, as in (b) above.

- 3.3 The dimension from the horizontal centre to the lower edge of the picture is calculated as follows -

$$\frac{h_1 \times T}{f_1} \dots\dots\dots (1)$$

Where  $h_1$  is the distance of the top edge of the aperture from the optical centre.

T is the throw

$f_1$  is the focal length of the lens

- 3.4 To align the bottom edges of both pictures the top edges of the apertures must be displaced from the optical centre so that -

$$\frac{h_1 \times T}{f_1} = \frac{h_2 \times T}{f_2} \dots\dots\dots (2)$$

Where  $h_2$  is the distance of the top edge of the second aperture from the optical centre.

$f_2$  is the focal length of the second lens.

Therefore  $h_1 = \frac{h_2 \times f_1}{f_2}$  ..... (3)

- 3.5 To locate the centre line of the standard aperture above or below the optical centre (which is also the centre line of the magnetic CinemaScope aperture) first determine the top line of the standard aperture by means of formula (3) as follows.

Example

Height of magnetic CinemaScope aperture 0.715", therefore top edge is 0.357" above centre.

Focal length of magnetic CinemaScope lens 4.75".

Standard picture aspect ratio 1.66.

Focal length of standard lens 2.75".

$$h = \frac{0.357 \times 2.75}{4.75} = 0.207$$

The top line of the standard (1.66 aspect ratio) aperture must therefore be 0.207" above the centre line. The total height of this aperture is 0.497", therefore the bottom line will be 0.290" below centre. Thus the horizontal centre of the standard aperture will be 0.042" below the optical centre. Note that if the dimension obtained from the above formula is greater than 0.249, the centre line of the standard aperture will be above that of the magnetic CinemaScope aperture.

4. FILING THE APERTURE

4.1 Tools

The following files should be obtained on loan from the Supervisor:-

- 1 - 4" File, hand - second cut
- 1 - 6" File, warding - bastard cut
- 1 - 14 cm File, Stubbs needle - No.2 cut
- 2 - 14 cm File, Stubbs needle, Barrett No.4 cut
- 2 - 14 cm File, Stubbs needle, Three Square No. 2 cut
- 1 - 77232 Tool (filing jig)

Also required are a straight edge and a scribe.

- 4.2 The screen should be masked or taped to show the picture outline for which the aperture plate is being cut. Black tape is preferable as spilled light is more easily seen on the screen than on masking. When checking progress, focus the aperture to get a sharp outline, bearing in mind that when ultimately the focus is changed back to the film the aperture image will be slightly out of focus and a little larger.
- 4.3 Where the small picture will be shown without masking special care should be taken to ensure straight lines free from burrs and irregularities. Chamfering the rear edges (nearest the lamphouse) will help to obtain clean outlines.

- 4.4 If convenient the best place to work is at a small table or shelf, where the filing jig can be supported, near the observation port. A small vice is helpful. Good lighting is essential. Some time should be spent in planning and preparation when several plates are to be cut.
- 4.5 First calculate the amount of metal to be removed (Section 2.3.) Rough out the top edge of the aperture (bottom line of picture), working from the centre outwards. Check frequently by trying in the gate without the backing plate, the arc running on low current and with some auditorium lighting. Next rough out the bottom edge and then both sides. Check frequently; it is easy when turning the plate to confuse the top and bottom edges. When final stages are reached insert the backing plate when checking.

5. ORDER OF PROCEDURE

- 5.1 First ascertain if the two picture sizes or masking lines have been decided. It is essential to determine the bottom masking line, also whether or not the two pictures, CinemaScope and standard, are to have a common base line.
- 5.2 If it is necessary to ascertain the maximum magnetic CinemaScope picture that can be obtained using the available lens with anamorph, insert an aperture plate having the maximum aperture (0.715" x 0.912") or project a magnetic CinemaScope film without using an aperture plate. One of the magnetic CinemaScope target films has a cross in the centre of each edge, the intersection of the cross marking the edge of the maximum picture. Having established this outline, tape off the rectangle (see LSA-9183.)
- 5.3 With the standard aperture, the lateral position of the screen image can be adjusted only by moving the machine. The magnetic CinemaScope image is, however, adjustable by means of the pivot device of the anamorph mounting bracket. The aperture plates should therefore be cut in the following order.
- (a) With the outlines of the standard and magnetic CinemaScope pictures taped on the screen, insert the undersized standard aperture plate in the first projector, also the appropriate projection lens in its 772475 adapter. Cut the aperture plate and if necessary correct the alignment of the machine.
  - (b) Repeat (a) for the second machine, finally moving the machine to precisely superimpose both images. After this, neither machine must be moved.
  - (c) Replace the aperture plate in the first projector by the undersized magnetic CinemaScope plate. Replace the projection lens by the appropriate magnetic CinemaScope lens in its 77249C adapter. Swing the anamorph into place and cut the magnetic CinemaScope aperture plate.
  - (d) Repeat (c) for the second machine, superimposing both magnetic CinemaScope images laterally.

5.4 Non-Westar Aperture Plates

Should it be necessary to assist in the preparation of Non-Westar aperture plates the information provided in this bulletin will help, but the plates should be measured before starting. It may be assumed that all such undersized apertures will be lined up horizontally in the manner described for Westar plates.

1. PURPOSE

1.1 To supplement the information given in Section 1.1 of the main bulletin.

2. GENERAL

2.1 Aperture Dimensions (Maximum)

Picture Aspect Ratio	Film	Aperture Plates (Vertical centre line on standard photo film optical centre)	See Section
2.31	CinemaScope (Perspecta) with 2/1 Anamorph	0.825" x 0.715"	-
2.00	Superscope (Photo) with 2/1 Anamorph	0.715" x 0.715"	2.2

2.2 Superscope Films

For Superscope films the 77498 Aperture Plate will be supplied.

2.3 Metroscope Films

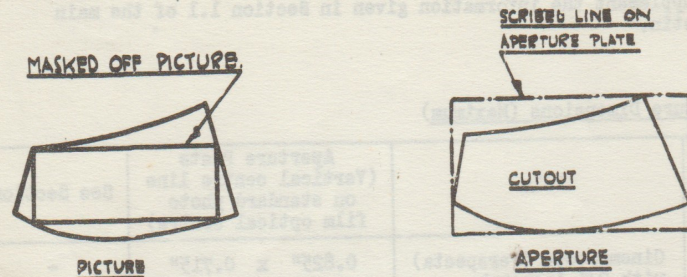
Metroscope is the distinguishing name of MGM wide screen films. They are not photographed with an anamorph and are projected by a short focal length lens symmetrically on the standard photo film vertical optical centre to obtain a wide picture. In general these films will have a Perspecta sound track.

2.4 All MGM films requiring anamorphic devices for projection will continue to be called CinemaScope.

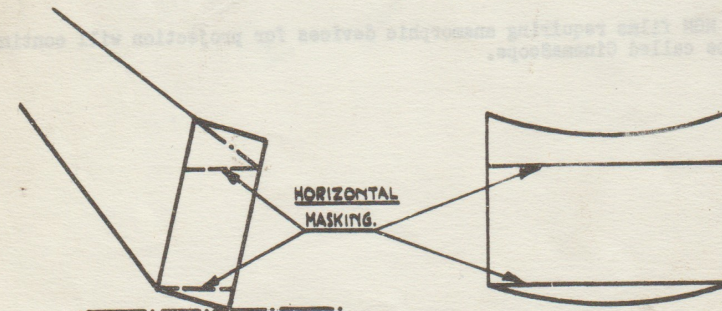


LSA-9183 is on the reverse side of this sheet.

REF. GEB "APERTURE PLATES"



The left picture (exaggerated) might result from projecting a rectangular aperture on a curved, tilted screen with the projector offset to the left. In order to obtain a rectangular picture on the same screen the aperture should be given the shape indicated on the right (looking from the lamp house). The aperture must be within the maximum rectangle permissible (scribed line).



SIDE & FRONT VIEW OF CURVED TILTED SCREEN.

It is becoming practice to use horizontal masking both top and bottom, giving a picture of constant height. The curve of the top of the aperture plate removes the light on the floor and on the screen below the mask (this involves no loss of picture height). The curve of the bottom of the aperture plate removes the light above the top mask. This does involve a loss of picture height.

LSA-9183

1. GENERAL

1.01 The information contained in this bulletin supplements the Operating Instructions and is for use when dismantling the projector. Reference should be made to the Operating Instructions for details of lubrication and minor adjustments for which the Operator is normally responsible.

1.02 Special Tools

The special tools listed below are used in maintenance.

69934 Hammer, Ball Pein  
LD-2835 Tool - Pin Extractor  
LD-2851 Tool - Film Alignment  
LD-2848 Tool - Intermittent Window  
LD-2854 Tool - Film Gate Alignment  
LD-3023 Tool - Screwdriver  
LD-3049 Tool - Drift  
TA-7093 Wrench, Shutter Shaft Housing

2. MAINTENANCE2.01 To dismantle the Intermittent (See LSR-9706)

When it is necessary to dismantle the intermittent for removal of the sprocket or for any other purpose the work should be done only where good clean working conditions exist. Spare gaskets and sealing washers must be available.

Before opening the intermittent, feel and note the action of the cam and cross when turned slowly, and check the end play of both shafts as a guide to reassembly. Check also that the two adjusting screws (Item 23) are seated; on reassembly very little adjustment will then be required.

To open, first remove one of the five screws holding the cover and drain out the oil. Turn the cam shaft until the sprocket is in a stationary position. Remove the other four screws from the cover.

Hold the case of the intermittent in one hand and the cover in the other and carefully pull them apart. Extreme care must be used to prevent damage to the cross and cam.

2.02 To remove the Sprocket Shaft

Push the two taper pins out of the hub of the sprocket using an LD-2835 Tool. The larger end of the taper is marked on the hub by a small nick. The tool has two screws; one with a short nose for starting to extract pins and one with a longer end for following through. The pins must be removed only by this method.

Remove the collar from the other end of the sprocket shaft. The shaft can now be withdrawn and the sprocket removed.

2.03 To remove the Cam Shaft

Remove screw (Item 18), bracket (Item 16) and spacer (Item 17). Remove gear (Item 4) and washer (Item 6) by unscrewing screw (Item 5). The cam shaft may now be withdrawn.

2.04 To assemble the Cam Shaft

Insert the cam shaft in the bush far enough to allow the washer and gear to be fitted. Then push the shaft home and while holding the gear, rotate the shaft to bring the screw holes in line. Insert and tighten the screw securely.

Replace the spacer, thrust bearing and screw, taking care that the ball seats centrally in the end of the shaft. Adjust bearing (Item 35A) to obtain free rotation of the shaft without end play.

2.05 To assemble the Sprocket Shaft

Insert the sprocket shaft into its bearings and check that it turns smoothly when fully home. With the larger end of the tapered holes uppermost partly withdraw the shaft and place the sprocket in position, with the larger end of its tapered holes also uppermost. Push the shaft home so that the holes are in line. Insert pins and press firmly home with the LD-2835 Tool, using the short nosed screw. Oil the face of the collar with 2009-A Oil, place it on the shaft and clamp in place so that the shaft turns freely but without end play.

2.06 To assemble the Intermittent

Wipe the mating faces of the case and cover with a piece of washed linen. Place the gasket on the case taking care not to obstruct any of the holes. Rotate the cam to the disengaged position and carefully replace the cover so that the locating pin enters its hole. The radius of the cam and cross should coincide. Loosely replace all fixing screws with cork washers, rotate the cover to engage the cross with the cam radius and lightly tighten the screws. The assembly should now rotate smoothly without binding or backlash when the sprocket is stationary.

Binding or backlash is eliminated by adjusting the two set screws (Item 23). To relieve binding, loosen the lower screw a fraction and tighten the upper screw by a corresponding amount. To remove backlash reverse the process.

Increase the tension on the five cover screws by about half a turn, tightening opposite screws in turn. Loosen both adjusting screws, securely tighten the cover screws and finally tighten, but do not over-tighten the adjusting screws. The intermittent may now be replaced in the projector (see Operating Instructions, 4.11).

2.07 To remove the Lens Holder

First remove the gate (Operating Instructions, 4.07) and lens. Move the lens carrier to its forward position and remove the two screws (LSO-9705, Item 40) securing the holder to the main frame. The unit can now be removed for inspection or cleaning.

2.08 To replace the Lens Holder

Check that the lens carrier is in its forward position. Fit the lens holder on to the dowel pins and replace without tightening the two screws. Replace and close the gate, adjust the position of the lens holder so that the gate butts firmly against its fixed portion when the gate opening knob (Operating Instructions 1, Fig 1) ends its travel and tighten securely the two screws.

If it is necessary to correct the vertical alignment of the gate loosen the screw (LSR-9711, Item 4) securing the eccentric pin with slotted head (Item 5) and rotate pin with LD-3023 Tool until the gate closes without fouling the flanges of the guide rollers and film guides. Tighten the screw.

2.09 Replacing the Gate Knob Spring

Close the gate. Remove the screw at the centre of the knob and pull off the knob. Remove the old spring.

Insert the new spring so that the end engages in one of the holes at the bottom of the recess. Hold the knob so that the slot is at right-angles to the flats on the shaft, and holding the gate closed engage the outer end of the spring in the nearest hole in the knob. With the knob on the shaft but not engaging the flats, rotate it a quarter turn to the right and push home to engage the flats. Replace the screw and tighten securely.

2.10 To dismantle the fixed part of the Gate

Unscrew the two captive screws (Operating Instructions 8, Fig.1) and remove the shield. Remove the three screws holding the gate casting to the main frame and withdraw the casting from its dowel pins. (If a water-cooled gate is fitted the water must first be turned off and the pipes disconnected.)

To remove the guide rollers for cleaning or replacement loosen the screw (LSO-9709, Item 46) and withdraw either pivot, leaving the other in place. The guide rollers may now be dismantled.

To remove the film guides and runners remove the retaining screws.

2.11 To assemble the fixed part of the Gate

Worn runners and guides may be changed to opposite sides or replaced, taking care that the runners are in contact with the raised centre portion of the casting, as these runners determine the location of the aperture plate.

Replace the guide rollers assembly and pivot. Tighten the screw. The roller should revolve freely without end play.

Replace the gate on its dowel pins and insert the three fixing screws just sufficiently tight to permit lateral movement. Place a straight edge, LD-2854 Tool, against the face of the runner to extend down to the outside land of the sprocket. Adjust the gate so that the straight edge is at least two film thicknesses (0.012") ahead of the sprocket. Tighten the screws and check clearance of sprocket and straight edge.

If the guides have been removed they must be aligned with the sprocket and upper guide roller, using the LD-2851 Tool. To do this it is first necessary to remove the lens holder (Section 2.07), and loosen the screws securing the guides. Apply the LD-2851 Tool to the intermittent sprocket so that the teeth are in the grooves with the body of the tool upwards in contact with the runners and lying between guides and flanges of roller. Press the side flange of the tool firmly against the outer face of the sprocket. In this position the side of the tool should be touching the face of the roller flange nearer the Operator. To adjust the roller to this position loosen both pivot set screws and while keeping the wrench in the far screw, with finger and thumb move the pivots and roller; tighten screws. Check that the roller spins freely without end play. Hold the tool firmly in contact with the sprocket, push the near side guide so that its centre contacts the tool and tighten the screws. Repeat for the far side guide. As a final check insert a length of film, preferably negative stock, and make sure that the sprocket teeth are not in contact with the sides of the perforations.

2.12 Changing Upper or Lower Sprocket

Remove the cap screw securing the sprocket to the shaft and withdraw the sprocket. Before fitting the replacement sprocket lightly smear the shaft with 2009-A Oil. The sprockets are reversible. If the holes in the sprocket and shaft do not line up, loosen the screw securing the Tufnol gear to the shaft and tap the shaft through to obtain alignment. When the screw securing the sprocket has been tightened the gear should be clamped to the shaft so that there is end play of approximately 0.003".

2.13 To remove the Shutter

There are two halves to the shutter guard. Remove the two screws (LSO-9705, Item 10) securing the half on the non-operating side. Remove two screws from inside gear compartment and one screw from inside the film compartment (LSO-9705, Item 34) fixing the other half. Loosen the two screws (LSR-9713, Item 62) and withdraw the shutter.

2.14 Projector Horizontal Drives

To remove drive first take off 712 Drive or chain if present. Withdraw three fixing screws (Operating Instructions 6, Fig.2) and remove unit.

To replace drive, reverse the above process. Before tightening, slide the bracket sideways towards the gear to obtain a correct mesh, at the same time pressing down the toe of the casting to the main frame. Tighten the three screws.

2.15 Projector Vertical Drive

To remove drive from projector remove lock nut and cap screw from top coupling of the flexible shaft. Loosen both set screws securing coupling to flexible shaft and slide coupling down.

2.16 To remove the Shutter Shaft

Remove the half shutter guard on the non-operating side (see Section 2.13). Remove four screws securing the rear bracket of the shutter shaft and two screws fixing the front bracket to the main frame. Holding a bearing in each hand carefully draw the assembly towards the rear to disengage the dowel pin, and remove the complete unit.

To replace the ball bearing or gear remove the two lock nuts at the end of the shaft and the cap screw fixing the gear. Before reassembly apply 32082-A Grease to the shaft at the location of the ball bearing. Screw the gear to the shaft and tighten the lock nuts securely.

2.17 To replace the Shutter Shaft

Apply a smear of 32082-A Grease to the shaft at the location of the rear ball bearing and to the outer surface of the front ball bearing. Slide the front mounting bracket on to its ball bearing, place the assembly in position and loosely insert the two screws securing the bracket, at the same time meshing the gears. Push the rear bracket along the shaft on to its dowel and insert the four fixing screws. Tighten all six screws and check the backlash between gears. For adjustment see Operating Instructions 4.16.

2.18 To remove the Vertical Shaft

Remove the shutter shaft, intermittent and projector drive as previously described.

Withdraw two screws (LSO-9707, Item 35) securing bearing of the sliding gear, also the four screws securing the top and bottom bearings. Carefully draw the shaft out. Any repairs necessary may now be made to the unit, but when reassembling care must be taken that the washers are replaced in the correct order.

2.19 To replace the Vertical Shaft

Slide the centre bearing into its bracket and the upper and lower bearings on to their dowels, taking care not to bend the shaft. Replace the four screws fixing the upper and lower brackets, also the two screws clamping the centre bearing bracket. Check the shaft for free rotation. Assemble the shutter shaft, intermittent and projector drive.

1. GENERAL

- 1.1 The reference numbers on the replacement parts drawings listed below identify the items on the accompanying stocklists.
- 1.2 Items marked \* are not separately replaceable.
- 1.3 When ordering parts, the correct coding and serial number of the projector must be quoted in full.
- 1.4 The differences between the various projectors and their components are shown in the following table. The figures referred to will be found on the drawings listed in the next Section.

2001 PROJECTOR	DESCRIPTION	SEE FIGURES (ITEMS IN BRACKETS)
C	Single Shutter (with detachable Roller and Sprocket Plate Assemblies). For drive from 2002 Reproducer.	1-15, 16 (1 to 47), 17, 18, 19 (101A), 22, 23.
C/1	As C but for drive from Universal Base.	1-15, 16 (1 to 48), 17, 18, 20, 21 (1 to 25), 22, 23.
C/2	As C but for drive from 206, TA-7400, TA-7500 and 2003 Reproducers.	1-15, 16 (1 to 47), 17, 18, 19 (101A), 21 (1 to 25), 22, 23.
D	As C but with Double Shutter.	1-15, 16 (1 to 47), 17, 18, 19 (101A), 24, 25.
D/1	As C/1 but with Double Shutter.	1-15, 16 (1 to 48), 17, 18, 20, 21 (1 to 25), 24, 25.
D/2	As C/2 but with Double Shutter.	1-15, 16 (1 to 47), 17, 18, 19 (101A), 21 (1 to 25), 24, 25.
E	As C but adapted for CinemaScope.	1-15, 16 (1 to 39, 41 to 47), 17, 18, 19 (101A), 22, 23.
E/1	As E but for drive from Universal Base.	1-15, 16 (1 to 39, 41 to 48), 17, 18, 20-23.
E/2	As E but for drive from 206, TA-7400, TA-7500 Reproducers.	1-15, 16 (1 to 39, 41 to 47), 17, 18, 19 (101A), 21-23.
E/3	As E but for drive from 2003 Reproducer.	1-15, 16 (1 to 39, 41 to 47), 17, 18, 19 (102A), 21 (1 to 25), 22, 23.
F	As E but with Double Shutter.	1-15, 16 (1 to 39, 41 to 47), 17, 18, 19 (101A), 24, 25.
F/1	As E/1 but with Double Shutter.	1-15, 16 (1 to 39, 41 to 48), 17, 18, 20, 21, 24, 25.
F/2	As E/2 but with Double Shutter.	1-15, 16 (1 to 39, 41 to 47), 17, 18, 19 (101A), 21, 24, 25.
F/3	As E/3 but with Double Shutter.	1-15, 16 (1 to 39, 41 to 47), 17, 18, 19 (102A), 21 (1 to 25), 24, 25.

2001 PROJECTORS WITH WATER COOLED HEAT SHIELDS

2001-C or D Projectors converted for water cooled heat shields are MOD. 589. For replacement parts for heat shields see Fig. 32, LSO-9735.

G	As E	} but with water cooled heat shield.	} See appropriate figure references and -  Add 32.  Omit 12, 16 (14A), 9 (45A, 55A to 57).
G/1	As E/1		
G/2	As E/2		
G/3	As E/3		
H	As F		
H/1	As F/1		
H/2	As F/2		
H/3	As F/3		

- 1.5 The following drawings are associated with this bulletin, and carry the figures shown.

DRAWING	FIG	ASSEMBLY
LSO-9705	16	Key to assembly
LSR-9706	1-4	Intermittent
LSO-9707	5	Framing Shaft
	6	Intermittent Carriage
LSO-9708	7	Doors & Cover
LSO-9709	8	Rollers and Holder (Fire Trap)
	9	Film Gate (Fixed)
	10	Pilot Lamp
	11	Plug & Switch (Pilot Lamp)
	21	Drive & Guide Roller
LSO-9710	12	Shield
	13	Fire Shutter
	22	Single Shutter Shaft
LSR-9711	14	Film Gate (Movable)
	17	Lens Holder
LSR-9712	15	Vertical Shaft
	18	Upper Sprocket & Roller Plate
	19	Lower Sprocket & Roller Plate (91253 & 91960)
	20	Lower Sprocket & Roller Plate (91265)
LSR-9713	23	Single Shutter Blade
	24	Double Shutter Blades
	25	Double Shutter Shaft
LSO-9714	26	Forward Support
	27	Flexible Drive Shaft
	28	Conduit
LSO-9735	32	Water Cooled Heat Shield



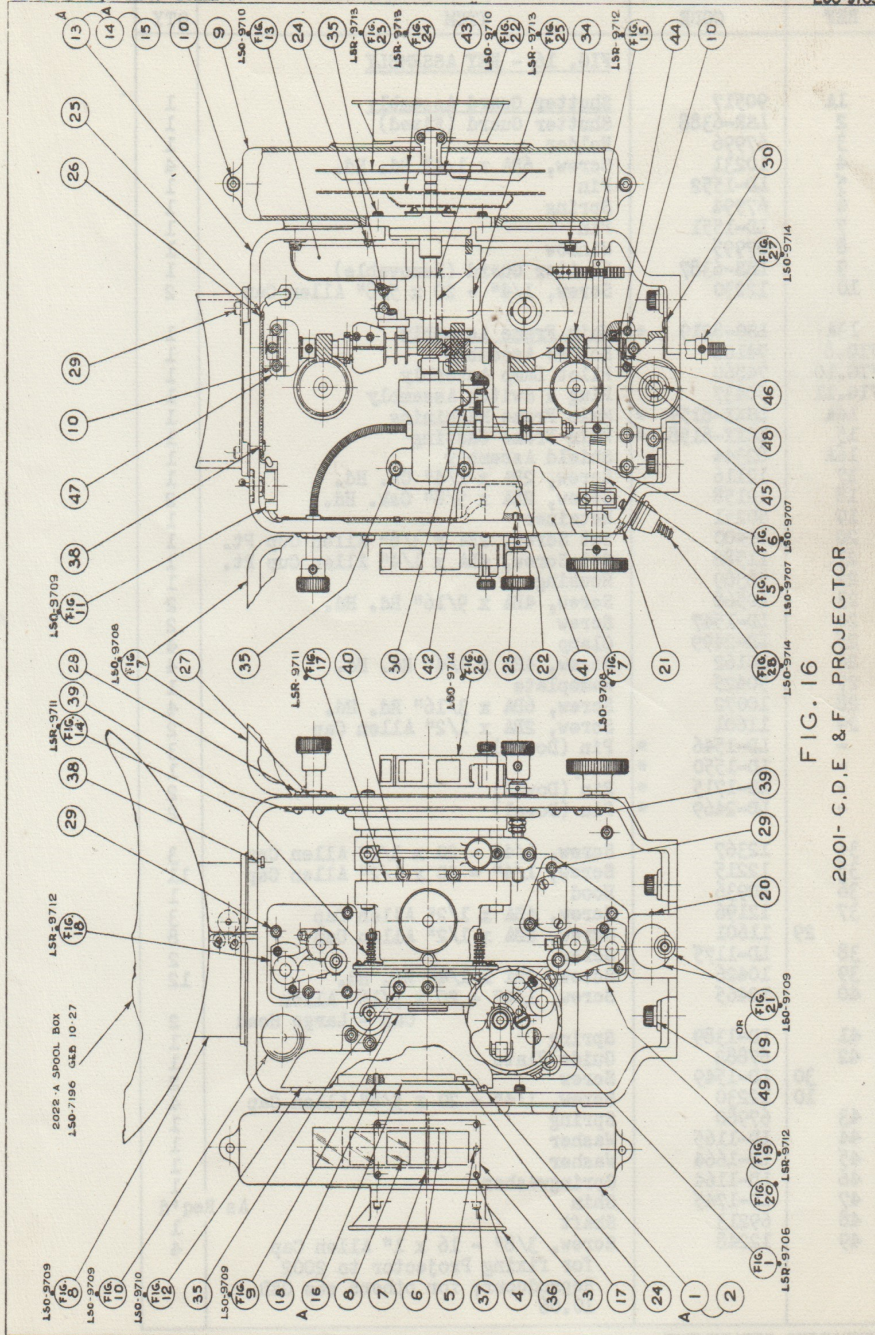
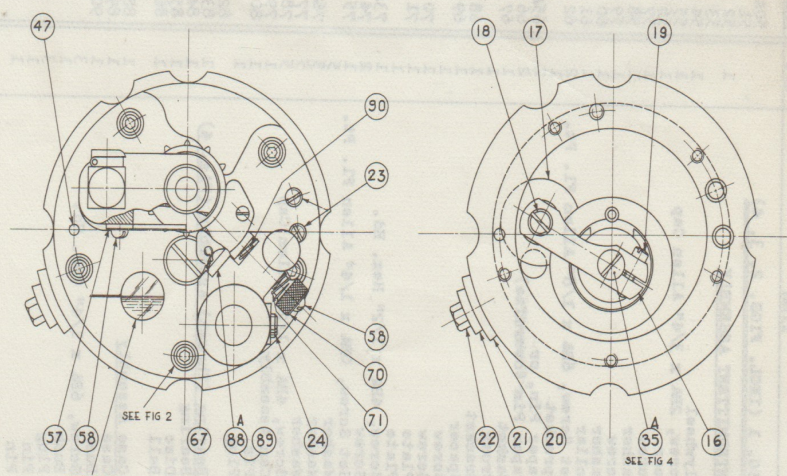
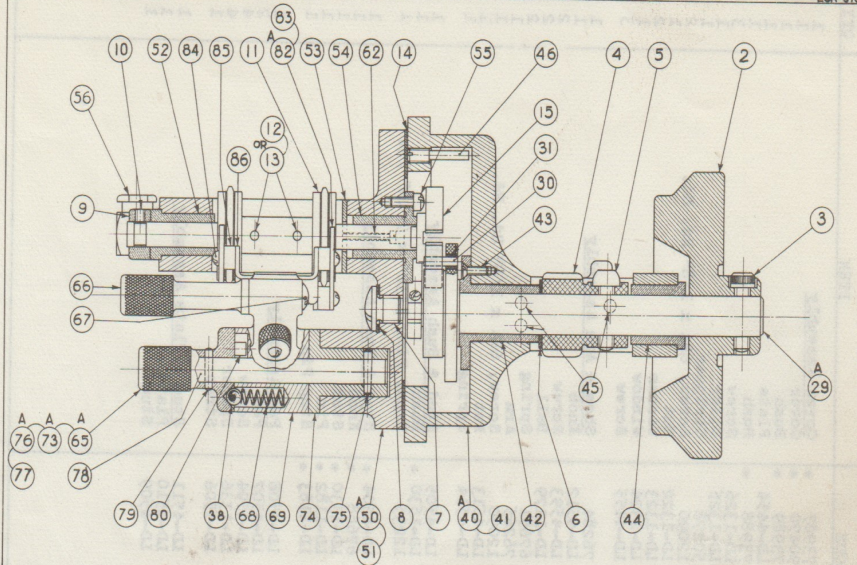


FIG. 16  
2001-C.D.E & F PROJECTOR

REF	CODE	ITEM	QTY
<b>FIG. 16 - KEY ASSEMBLY</b>			
1A	90517	Shutter Guard Assembly	1
2	LSR-6388	Shutter Guard (Fixed)	1
3	67996	Holder	1
4	10231	Screw, 6BA x 1/4" Rd. Hd.	4
5	LD-1552	Pin	1
6	67994	Spring	1
7	LD-1551	Pin	1
8	67995	Window	1
9	LSR-6387	Shutter Guard (Removable)	1
10	12230	Screw, 1/4" - 20 x 5/8" Allen Cap	2
13A	LSO-8219	* Main Frame Assembly	1
FIG.8	74108	Holder Assembly	1
FIG.10	74860	Pilot Lamp Assembly	1
FIG.11	50437	Plug & Switch Assembly	1
14A	LSXX-8159	* Main Frame Machining	1
15	LSXX-8158	* Main Frame Casting	1
16A	82344	Shield Assembly	1
17	12116	Screw, 2BA x 1/4" Ch. Hd.	1
18	12158	Screw, 2BA x 5/8" Csk. Hd.	2
19	50251	Retainer	1
20	11400	Set Screw, 2BA x 3/8" Allen Cup Pt.	1
21	11588	Set Screw, 4BA x 1/4" Allen Cup Pt.	1
22	76369	Housing	1
23	10568	Screw, 4BA x 9/16" Rd. Hd.	2
24	LD-1547	Screw	2
25	LD-2499	Clamp	4
26	10162	Screw, 4BA x 1/4" Rd. Hd.	4
27	50425	Nameplate	1
28	10072	Screw, 6BA x 3/16" Rd. Hd.	4
29	11601	Screw, 2BA x 1/2" Allen Cap	2
-	LD-1546	* Pin (Dowel)	3
-	LD-1550	* Stop	1
-	LD-1715	* Pin (Dowel)	2
-	LD-2469	* Pin (Dowel)	2
34	12367	Screw, 1/4" - 20 x 3/4" Allen Cap	3
35	12215	Screw, 1/4" - 20 x 1/2" Allen Cap	11
36	80936	Hood	1
37	12196	Screw, 4BA x 1/2" Allen Cap	3
29	11601	Screw, 2BA x 1/2" Allen Cap	8
38	LD-1175	Screw	2
39	10426	Screw, 2BA x 1/4" Rd. Hd.	12
40	12465	Screw, 1/4" - 20 x 7/16" Allen Cap - Large Head	2
41	LD-1389	Spring	1
42	67882	Guide Plate	1
30	LD-1549	Screw	1
10	12230	Screw, 1/4" - 20 x 5/8" Allen Cap	2
43	67980	Spring	4
44	LD-1165	Washer	1
45	LD-1664	Washer	1
46	LD-1164	Springwasher	1
47	LD-1745	Shim	As Req'd
48	69213	Shaft	1
49	12248	Screw, 3/8" - 16 x 1" Allen Cap for fixing Projector to 2002 Reproducer; for others see GEB 10.06	4



LSR-6328 MOD. 630 INTERMITTENT ASSEMBLY  
(2001-TYPE PROJECTOR) FIG. 1

REF	CODE	ITEM	QTY	REF	CODE	ITEM	QTY
1A	LSR-6328 Mod 630	<b>FIG. 1 (INCL. FIGS. 2, 3, 4.)</b> <b>INTERMITTENT ASSEMBLY</b>	1	50A	73987	Cover Assembly	1
2	73984	Flywheel	1	51	90470	Cover	1
3	12195	Screw, 2BA x 3/4" Allen Cap	1	52	73989	Bush	1
4	90472	Screw	1	53	LD-4454	Plate	1
5	ID-2699	Washer	1	54	73988	Bush	1
6	ID-1316	Screw	1	55	LD-1326	Screw	1
7	ID-1315	Screw	1	56	LD-1325	Oilier	1
8	ID-1314	Washer	1	57	50278	Stripper	1
9	ID-1311	Collar	1	58	12090	Nut	1
10	12209	Set Screw, 6BA x 1/8" Allen Fl. Pt.	1	59	LD-1322	Washer	1
11	71664	Sprocket	1	60	LD-1323	Washer	1
12	ID-1312	Taper Pin, or	1	61	LD-1324	Window	1
13	ID-1315	Taper pin (oversize)	1	62	LD-4455	Screw	1
14	73983	Gasket	1	65A	76284	Shoe & Arm Assembly	1
15	LSO-6331	Bracket	1	66	LD-4512	Knob	1
16	LD-1303	Spacer	1	67	LD-4593	Screw	1
17	LD-1304	Screw	1	68	LD-1179	Ball	1
18	LD-1302	Screw	1	69	67651	Spring	1
19	LD-1301	Plate	1	70	76265	Arm	1
20	67837	Plate	1	71	12090	Nut	1
21	ID-1305	Screw, 4BA x 1/2" Hex. Hd.	1	72	LD-4513	Screw, 6BA x 1/8" Rd. Hd.	1
22	12327	Screw	1	73A	LD-4505	Stud & Bush Assembly	1
23	LD-1310	Washer	1	74	LD-1330	Bush	1
24	12214	Set Screw, 6BA x 1/4" Allen Fl. Pt.	1	75	12237	Taper Pin, 3/32" x 7/16" lg.	1
25	LD-1306	Washer	1	76A	LD-4504	Stud & Knob Assembly	1
26	LD-1307	Washer	1	77	67668	Knob	1
27	LD-1308	Screw, 4BA x 1/2" Allen Cap	1	78	LD-1330	Stud	1
28	12196	Cam Assembly	1	79	LD-1182	Pin	1
29A	LSO-6330	Pin	1	80	LD-1183	Stop Pin	1
30	67838	Pin	1	82A	LD-4508	Pad Assembly	1
31	LD-1317	Plug	1	83	LD-4507	Pad	1
35A	LD-1327	Bearing (Thrust) Assembly (Fig. 4)	1	84	LD-4594	Screw	1
36	67840	Bearing	1	85	LD-1336	Spacer	1
37	LD-1328	Disc	1	86	LD-4506	Strap	1
38	LD-1179	Ball	1	88A	LD-4511	Stud & Plate Assembly	1
40A	73985	Case Assembly	1	89	LD-4510	Plate	1
41	90471	Case	1	90	LD-4509	Stud	1
42	73986	Bush	1				
43	12027	Screw, 6BA x 1/4" Csk. Hd.	1				
44	LD-1318	Bush	1				
45	LD-1319	Plug	1				
46	LD-1321	Pin	1				
47	LD-1273	Pin	1				

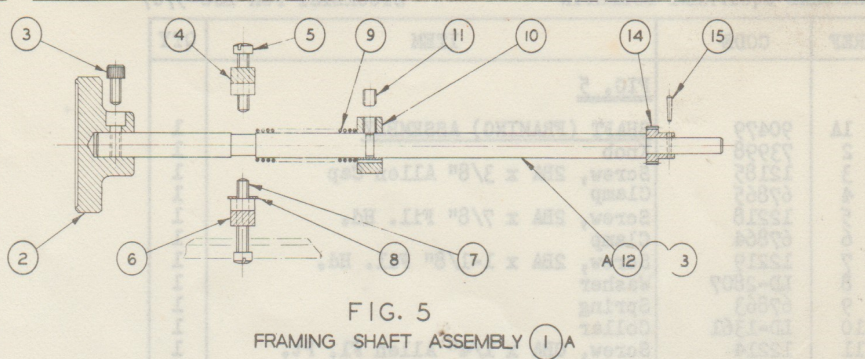


FIG. 5  
FRAMING SHAFT ASSEMBLY (1)A

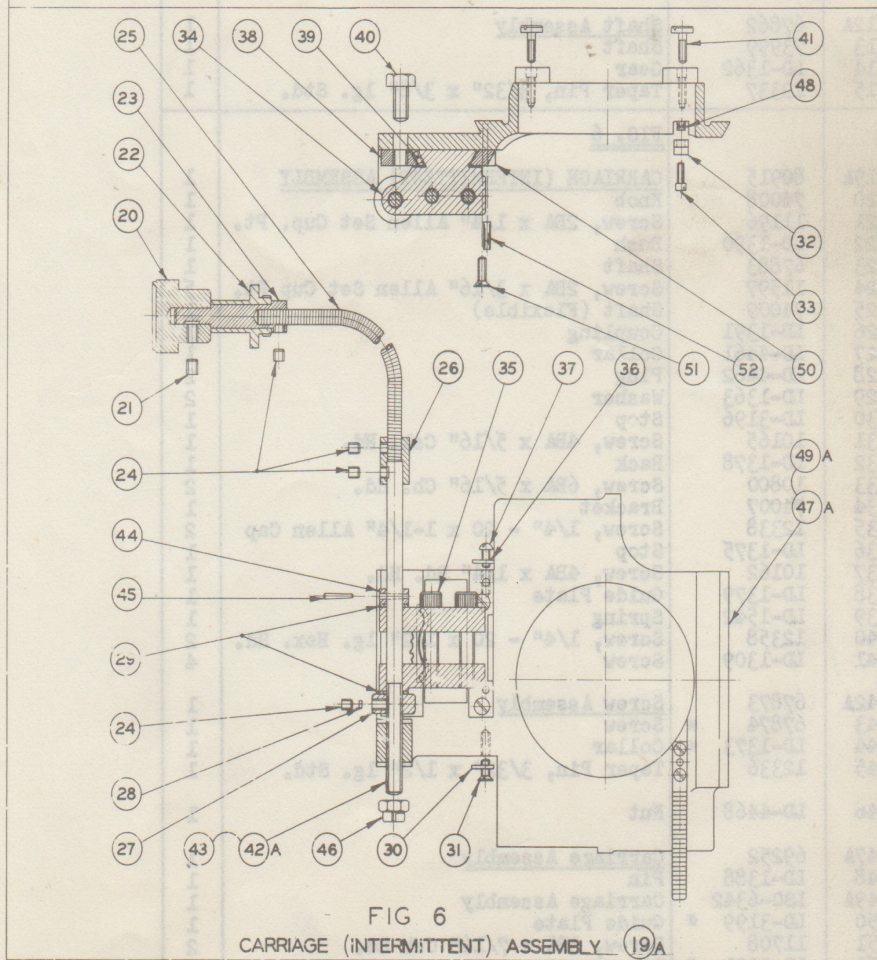


FIG. 6  
CARRIAGE (INTERMITTENT) ASSEMBLY (19)A

REF	CODE	ITEM	QTY
<b>FIG. 5</b>			
1A	90479	SHAFT (FRAMING) ASSEMBLY	1
2	73998	Knob	1
3	12185	Screw, 2BA x 3/8" Allen Cap	1
4	67865	Clamp	1
5	12218	Screw, 2BA x 7/8" Fil. Hd.	1
6	67864	Clamp	1
7	12219	Screw, 2BA x 1-1/8" Fil. Hd.	1
8	LD-2807	Washer	1
9	67863	Spring	1
10	LD-1361	Collar	1
11	12214	Screw, OBA x 1/4" Allen Fl. Pt.	1
12A	67862	Shaft Assembly	1
13	73999	Shaft	1
14	LD-1362	Gear	1
15	12337	Taper Pin, 3/32" x 3/8" lg. Std.	1
<b>FIG. 6</b>			
19A	80915	CARRIAGE (INTERMITTENT) ASSEMBLY	1
20	74008	Knob	1
21	11196	Screw, 2BA x 1/4" Allen Set Cup. Pt.	1
22	LD-1390	Bush	1
23	67883	Shaft	1
24	11597	Screw, 2BA x 3/16" Allen Set Cup Pt.	5
25	74009	Shaft (Flexible)	1
26	LD-1391	Coupling	1
27	LD-4461	Collar	1
28	LD-4462	Plug	2
29	LD-1363	Washer	2
30	LD-3196	Stop	1
31	10165	Screw, 4BA x 5/16" Csk. Hd.	1
32	LD-1378	Rack	1
33	10800	Screw, 6BA x 5/16" Ch. Hd.	2
34	74007	Bracket	1
35	12338	Screw, 1/4" - 20 x 1-1/4" Allen Cap	2
36	LD-1375	Stop	1
37	10162	Screw, 4BA x 1/4" Rd. Hd.	1
38	LD-1379	Guide Plate	1
39	LD-1542	Spring	1
40	12358	Screw, 1/4" - 20 x 1/2" lg. Hex. Hd.	2
41	LD-1309	Screw	4
42A	67873	Screw Assembly	1
43	67874	* Screw	1
44	LD-1373	* Collar	1
45	12336	Taper Pin, 3/32" x 1/2" lg. Std.	1
46	LD-4468	Nut	1
47A	69252	Carriage Assembly	1
48	LD-1388	Pin	1
49A	LSO-6342	Carriage Assembly	1
50	LD-3199	* Guide Plate	1
51	11708	Screw, 3BA x 7/16" Csk Hd.	2
52	LD-3200	* Pin	2

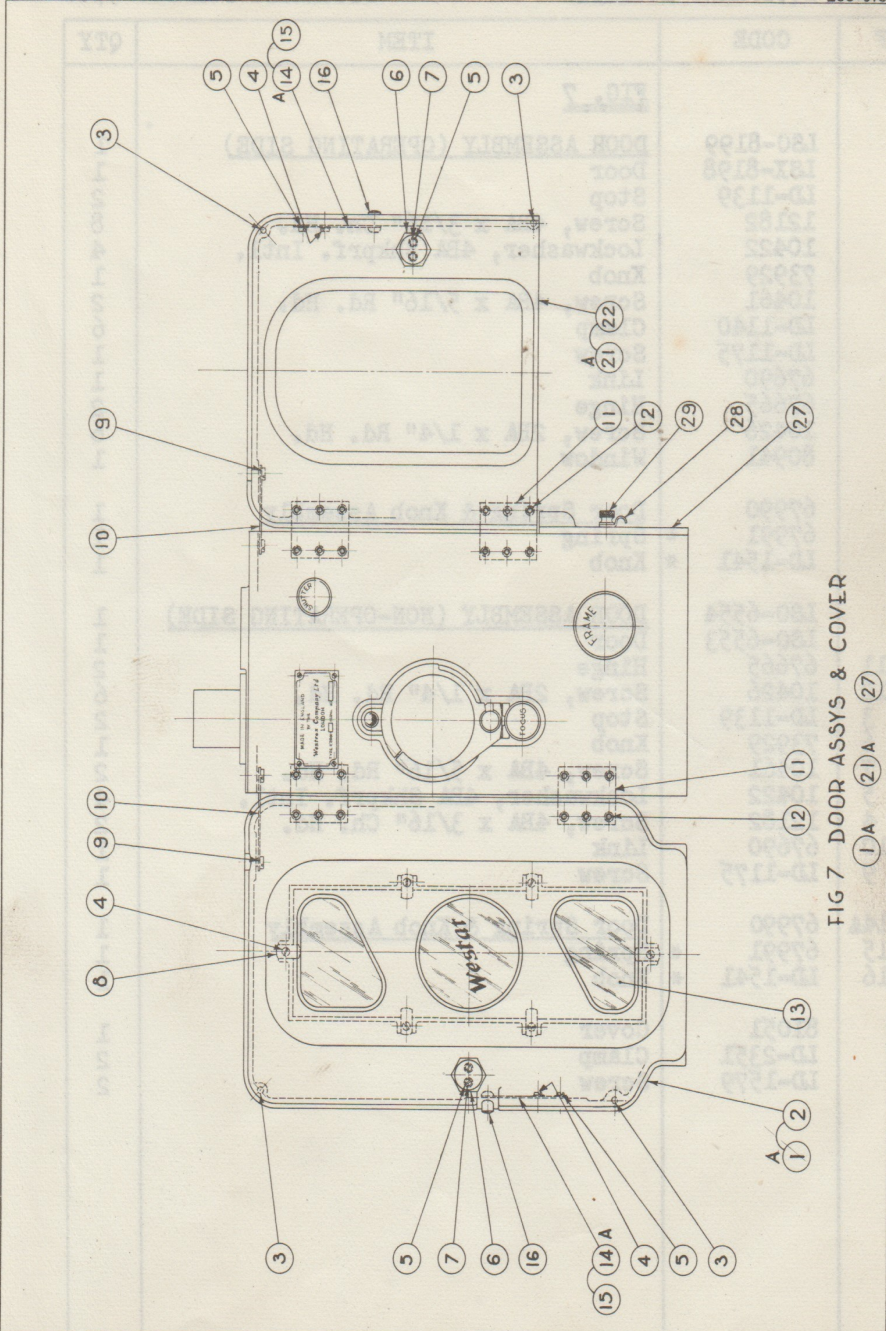


FIG 7 DOOR ASSYS & COVER  
①A ②1A ②7

REF	CODE	ITEM	QTY
		<u>FIG. 7</u>	
1A	LSO-8199	<u>DOOR ASSEMBLY (OPERATING SIDE)</u>	1
2	LSX-8198	Door	1
3	LD-1139	Stop	2
4	12182	Screw, 4BA x 3/16" Ch. Hd.	8
5	10422	Lockwasher, 4BA Shkprf. Intl.	4
6	73929	Knob	1
7	10461	Screw, 4BA x 5/16" Rd. Hd.	2
8	LD-1140	Clamp	6
9	LD-1175	Screw	1
10	67690	Link	1
11	67665	Hinge	2
12	10426	Screw, 2BA x 1/4" Rd. Hd.	6
13	80941	Window	1
14A	67990	<u>Door Spring &amp; Knob Assembly</u>	1
15	67991	* Spring	1
16	LD-1541	* Knob	1
21A	LSO-6554	<u>DOOR ASSEMBLY (NON-OPERATING SIDE)</u>	1
22	LSO-6553	Door	1
11	67665	Hinge	2
12	10426	Screw, 2BA x 1/4" Rd. Hd.	6
3	LD-1139	Stop	2
6	73929	Knob	1
7	10461	Screw, 4BA x 5/16" Rd. Hd.	2
5	10422	Lockwasher, 4BA Shkprf. Intl.	4
4	12182	Screw, 4BA x 3/16" Ch. Hd.	2
10	67690	Link	1
9	LD-1175	Screw	1
14A	67990	<u>Door Spring &amp; Knob Assembly</u>	1
15	67991	* Spring	1
16	LD-1541	* Knob	1
27	81051	Cover	1
28	LD-2351	Clamp	2
29	LD-1579	Screw	2

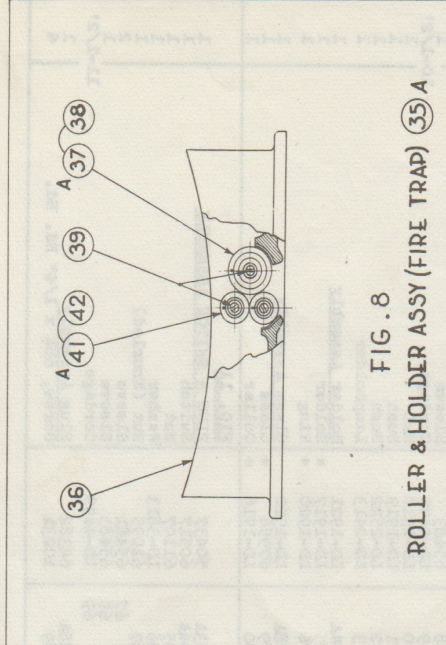


FIG. 8  
ROLLER & HOLDER ASSY (FIRE TRAP) 35A

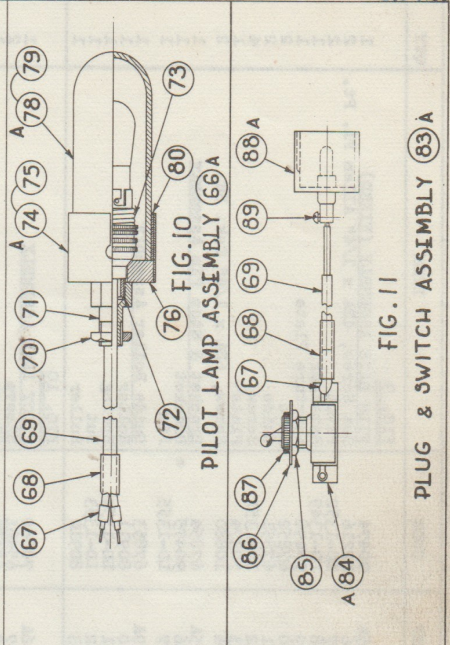


FIG. 10  
PILOT LAMP ASSEMBLY 66A

FIG. 11  
PLUG & SWITCH ASSEMBLY 83A

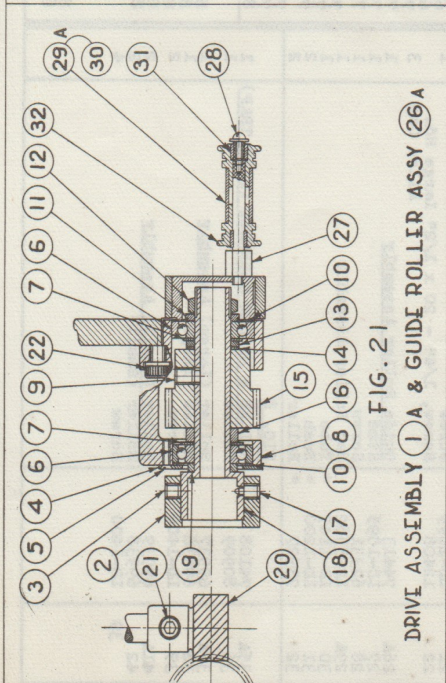


FIG. 21  
DRIVE ASSEMBLY 1A & GUIDE ROLLER ASSY 26A

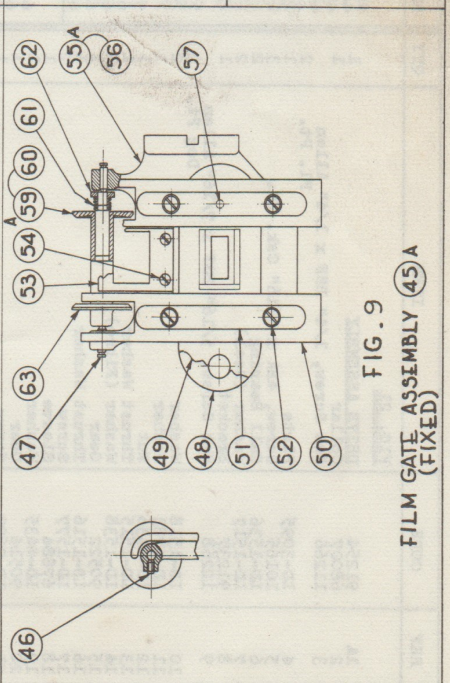
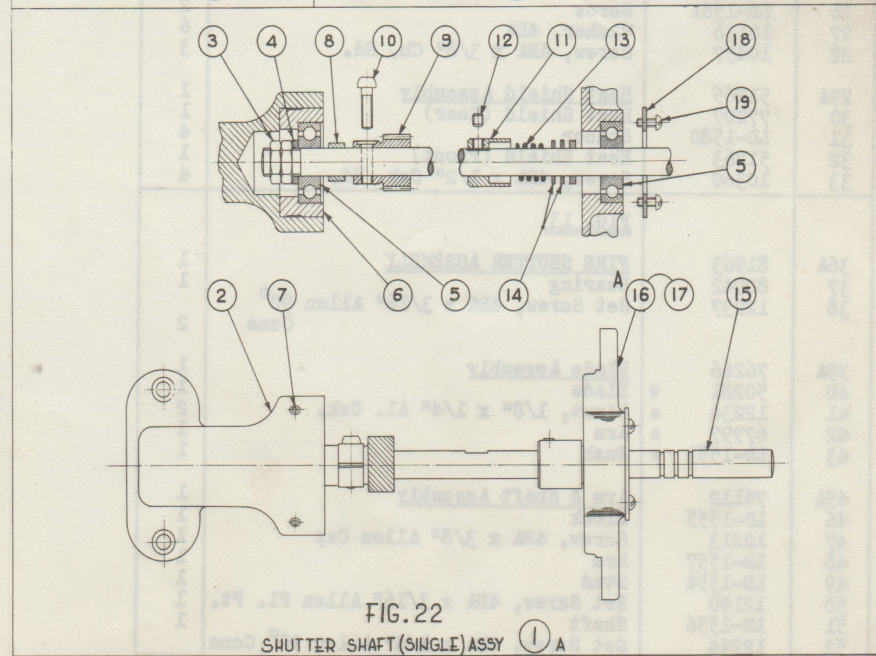
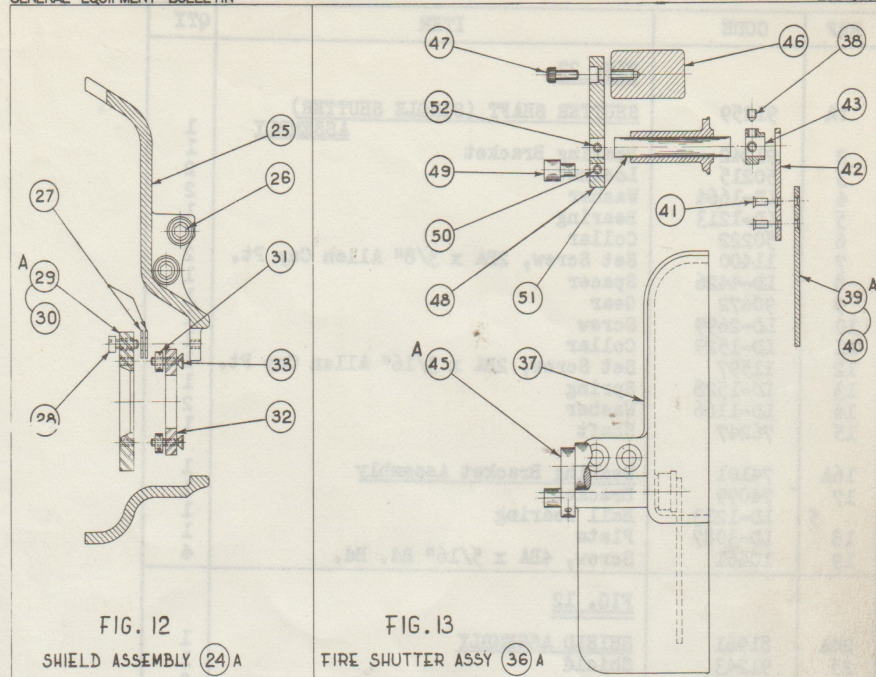


FIG. 9  
FILM GATE ASSEMBLY 45A  
(FIXED)

REF	CODE	ITEM	QTY	REF	CODE	ITEM	QTY
1A	91254	FIG. 21	1	45A	90474	FIG. 9	1
2	68007	DRIVE ASSEMBLY	1	46	12216	FILM GATE ASSEMBLY (FIXED)	1
3	11266	Collar	2	47	13152	Set Screw, 4BA x 1/4" Allen Fl. Pt.	2
4	ID-3095	Set Screw, 1/4" BSF x 1/4" Allen Fl. Pt.	1	48	77498	Pivot	1
5	10165	plate	3	49	67852	Retainer	1
6	ID-1536	Ball Bearing	2	50	67851	Aperture Plate	2
7	ID-1517	Washer (Seal)	2	51	ID-1351	Guide	2
8	91237	Bracket (Seal)	2	52	50374	Shoe	4
9	12268	Set Screw, 5/16" BSF x 7/16" Allen Dog Pt.	1	53	10880	Plate	2
10	ID-1518	Washer	2	54	67854	Screw, 6BA x 1/4" Csk. Hd.	1
11	ID-4783	Washer	2	55A	90475	Bracket & Stop Pin Assembly	1
12	ID-4436	Nut	1	56	ID-1355	Bracket	1
13	ID-1315	Thrust Washer	1	57A	67853	Pin	1
14	ID-1538	Washer (Fibre)	1	58	80911	Guide Roller Assembly	1
15	90522	Gear	1	59	ID-1354	Roller	1
16	ID-1516	Thrust Washer	1	61	ID-1353	Spring	1
17	ID-1577	Sleeve	1	62	80910	Net	1
18	67884	Washer	1	63		Roller	1
19	ID-4435	Gear	1	66A	74860	FIG. 10	1
20	90514	Screw, 1/4" - 20 x 1/2" Large Hd.	1	66	65481	PILOT LAMP ASSEMBLY	1
21	ID-2699	Screw, 1/4" - 20 x 1/2" Large Hd.	1	68	65483	Sleeve	2
22	12408	Allen Cap	1	69	ID-4499	Cordage	10-1/2"
26A	74413	Guide Roller Assembly	3	70	ID-1318	Washer	1
27	ID-1895	Stud	1	71	ID-1319	Bush	1
28	62331	Screw	1	72	ID-2422	Lampholder	1
29A	ID-5562	Pad Roller Assembly	1	73	ID-2413	Holder Assembly	1
30	ID-1147	* Tube	1	74A	ID-1921	Holder	1
31	ID-1200	* Bush	1	75	ID-1917	Ring	1
32	73927	* Roller	2	76	ID-1920	Holder	1
35A	74108	FIG. 8	1	77A	ID-1922	Glass Assembly	1
36	80909	ROLLER & HOLDER ASSEMBLY (FIRE TRAP)	1	77	67956	Glass	1
37A	69937	Holder	1	80	ID-1916	Collar	1
38	69936	Roller (Large) Assembly	1	83A	50437	FIG. 11	1
39	ID-1400	Roller (Large) Screw	1	84A	60517	PLUG & SWITCH ASSEMBLY	1
41A	69939	Roller (Small) Assembly	2	85	61107	Switch	1
42	69938	Roller (Small) Screw	2	86	ID-3813	Nut	1
39	ID-1400	Screw	4	87	61095	Washer	1
				67	65481	Sleeve	1
				68	65483	Sleeve	1
				69	ID-4499	Cordage	11-1/2"
				88A	68382	Plug Assembly	1
				89	10231	Screw, 6BA x 1/4" Rd. Hd.	4



REF	CODE	ITEM	QTY
		<b>FIG. 22</b>	
1A	91259	<b>SHUTTER SHAFT (SINGLE SHUTTER) ASSEMBLY</b>	1
2	91242	Bearing Bracket	1
3	50215	Locknut	2
4	LD-1664	Washer	2
5	LD-1213	Bearing	1
6	50222	Collar	1
7	11400	Set Screw, 2BA x 3/8" Allen Cup Pt.	2
8	LD-4426	Spacer	1
9	90472	Gear	1
10	LD-2699	Screw	1
11	LD-1529	Collar	1
12	11597	Set Screw, 2BA x 3/16" Allen Cup Pt.	1
13	LD-1528	Spring	1
14	LD-1166	Washer	2
15	76247	Shaft	1
16A	74101	<b>Bearing Bracket Assembly</b>	1
17	74099	Bracket	1
18	LD-1213	Ball Bearing	1
19	LD-3087	Plate	1
19	10461	Screw, 4BA x 5/16" Rd. Hd.	4
		<b>FIG. 12</b>	
24A	81961	<b>SHIELD ASSEMBLY</b>	1
25	91243	Shield	1
26	LD-1581	Screw	2
27	10136	Washer, 4BA	6
28	10457	Screw, 4BA x 3/8" Ch. Hd.	3
29A	51265	<b>Heat Shield Assembly</b>	1
30	77207	Heat Shield (Rear)	1
31	LD-1580	Spacer	4
32	51263	Heat Shield (Front)	1
33	10360	Screw, 4BA x 1/2" Csk. Hd.	4
		<b>FIG. 13</b>	
36A	81963	<b>FIRE SHUTTER ASSEMBLY</b>	1
37	80942	Bearing	1
38	12237	Set Screw, 4BA x 3/16" Allen 90° Cone	2
39A	76266	<b>Blade Assembly</b>	1
40	50281	* Blade	1
41	12234	* Rivet, 1/8" x 1/4" Al. Csk.	2
42	67997	* Arm	1
43	LD-1553	* Bush	1
45A	74112	<b>Arm &amp; Shaft Assembly</b>	1
46	LD-1555	Block	1
47	12213	Screw, 4BA x 3/8" Allen Cap	1
48	LD-1557	Arm	1
49	LD-1554	Stud	1
50	12190	Set Screw, 4BA x 3/16" Allen Fl. Pt.	1
51	LD-1556	Shaft	1
52	12244	Set Screw, 4BA x 1/4" Allen 90° Cone	1

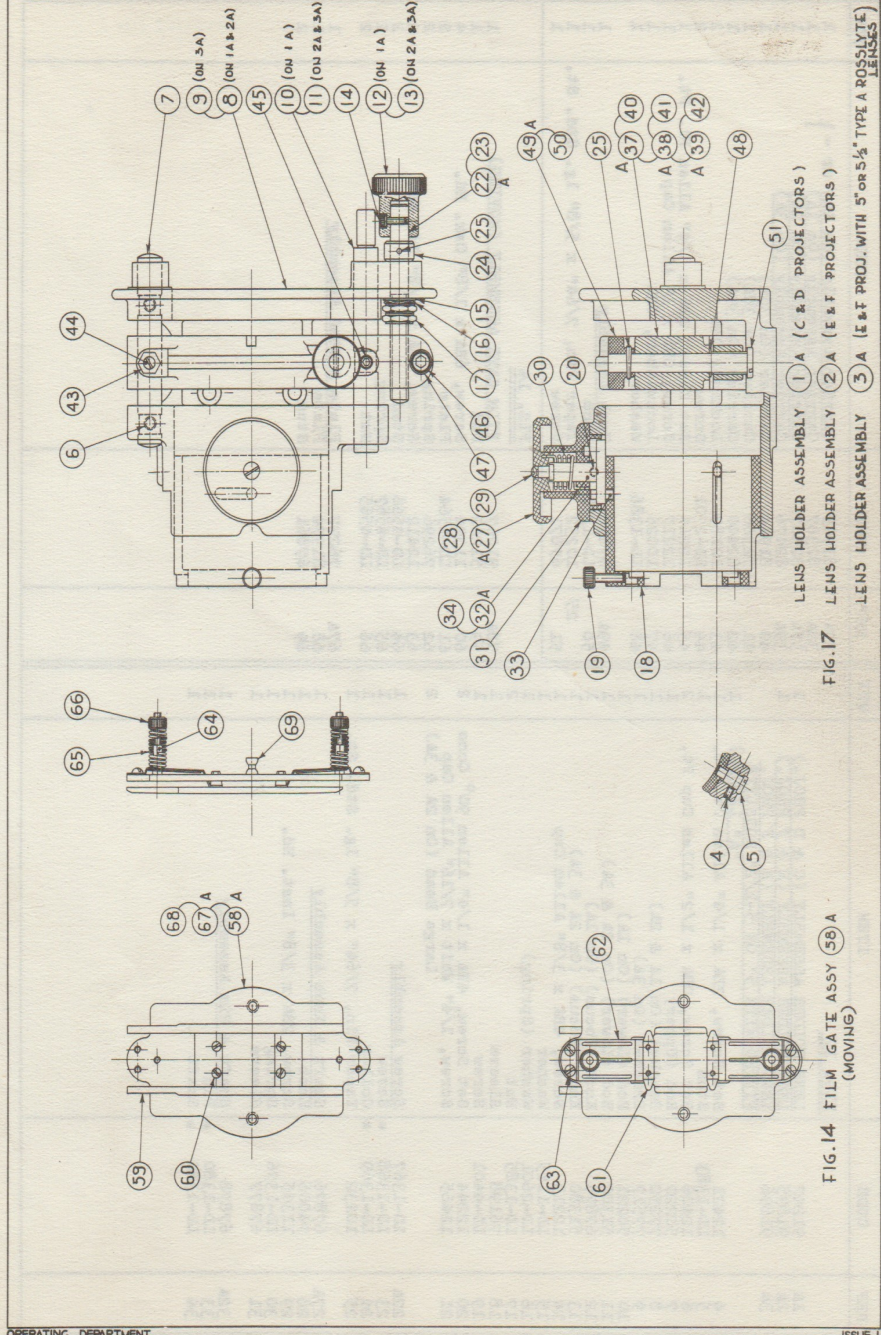


FIG. 14 FILM GATE ASSY (59) A (MOVING)

FIG. 17

LENS HOLDER ASSEMBLY 1 A (C & D PROJECTORS)  
 LENS HOLDER ASSEMBLY 2 A (E & F PROJECTORS)  
 LENS HOLDER ASSEMBLY 3 A (E & F PROJ. WITH 5" OR 5 1/2" TYPE A ROSSLYNTE LENSES)

REF	CODE	ITEM	QTY	REF	CODE	ITEM	QTY
1A	91247	LENS HOLDER ASSEMBLY (C & D PROJ.)	1	37A	81945	Carrier Assembly (On 1A)	1
2A	91895	LENS HOLDER ASSEMBLY (E & F PROJ.)	1	38A	82367	Carrier Assembly (On 1A) or - }	1
3A	91896	LENS HOLDER ASSEMBLY (E & F PROJ.)	1	39A	82476	Carrier Assembly (On 2A)	1
		FITTED WITH 5" OR 5-1/2" ROSSLYNTE LENSES)		40	81944	Carrier (On 3A)	1
4	12421	Set Screw, 2BA x 1/4" Allen Ov. Pt.	1	41	82366	Carrier (On 37A)	1
5	LD-1383	Stud	1	42	82440	Carrier (On 38A)	1
6	12406	Set Screw, OBA x 1/2" Allen Cup Pt.	1	43	10189	Locknut, OBA	1
7	50220	Rod (Upper)	1	44	LD-2701	Screw	1
8	77250	Bracket (On 1A & 2A)	1	45	12214	Set Screw, OBA x 1/4" Allen Fl. Pt.	1
9	77517	Bracket (On 3A)	1	46	12217	Screw, OBA x 1" Allen Cap	1
10	50221	Rod (Lower) (On 1A)	1	47	10026	Lockwasher, OBA	1
11	51302	Rod (Lower) (On 2A & 3A)	1	48	LD-1386	Washer	1
12	67879	Knob (Focus) (On 1A)	1	49A	67870	Knob Assembly	1
13	51380	Knob (Focus) (On 2A & 3A)	1	50	LD-1371	* Knob	1
14	12213	Screw, 4BA x 3/8" Allen Cap	1	51	10232	* Taper Pin, 7/64" x 5/8" lg. Std. St.	1
15	LD-1165	Washer (Spring)	1		67871	* Screw	1
16	LD-2601	Nut	1			FIG. 14	
17	LD-1385	Sleeve	1			FILM GATE ASSEMBLY (MOVING)	
18	76198	Screw	1	58A	91267	Pad	1
19	LD-4401	Set Screw, 4BA x 1/4" Allen 90° Cone	1	59	51262	Screw, 6BA x 1/8" Csk. Hd.	1
20	12244	Screw, 1/4" Whit x 7/16" Allen Cap	1	60	LD-4564	Plate	1
21	12465	Large Head (On 2A & 3A)	1	61	76296	Spring	1
22A	LD-1367	Screw Assembly	2	62	12412	Stud	1
23	LD-1368	* Screw	1	63	LD-4566	Screw, 4BA x 1/8" Rd. Hd.	1
24	LD-1369	* Collar	1	64	LD-4567	Spring	1
25	10232	* Taper Pin, 7/64" x 5/8" lg. Std. St.	1	65	LD-4565	Nut	1
27A	67876	Shaft & Knob Assembly	1	66	76297	Plate & Stud Assembly	1
28	74006	Knob	1	67A	81974	Plate	1
29	11345	Screw, 2BA x 3/8" Inst. Hd.	1	68	81974	Stud	1
30	LD-1376	Spring	1	69	67861	Stud	1
31	67877	Sleeve	1				
32A	67878	Shaft & Pin Assembly	1				
33	LD-1380	* Pin	1				
34	LD-1382	* Shaft	1				

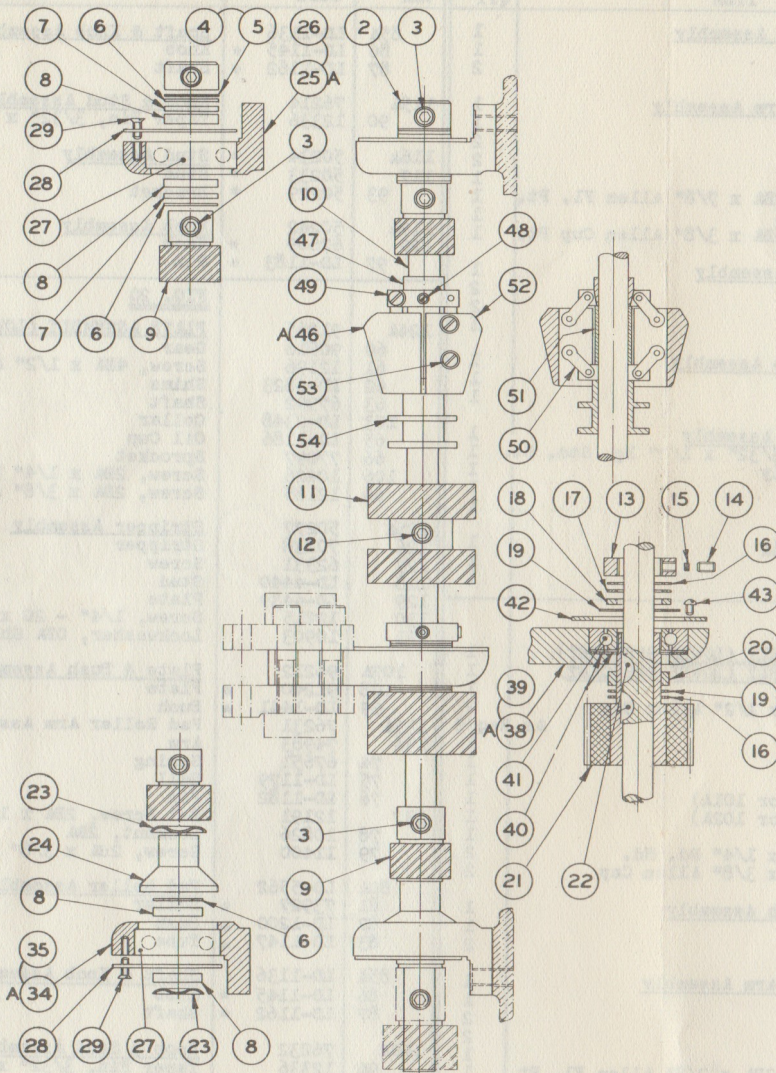


FIG. 15  
VERTICAL SHAFT ASSY. (1) A

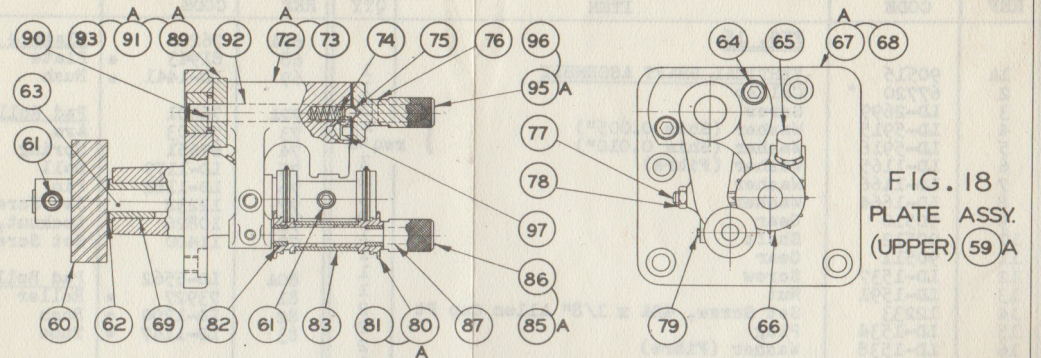


FIG. 18  
PLATE ASSY.  
(UPPER) (59) A

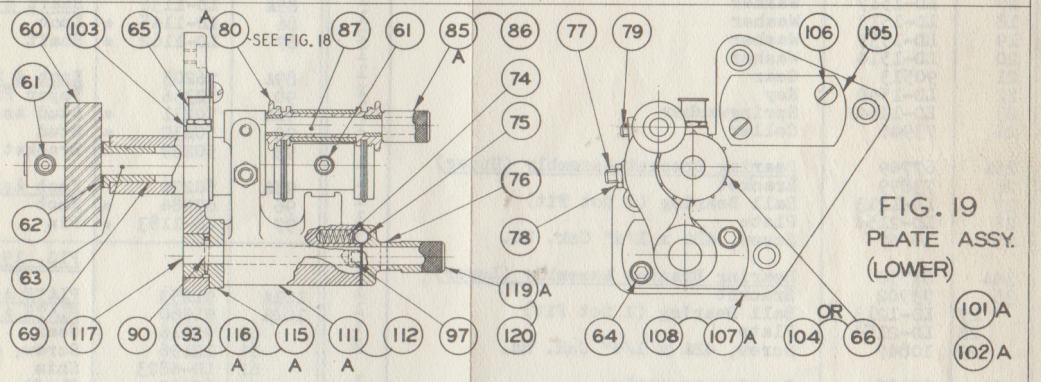


FIG. 19  
PLATE ASSY.  
(LOWER)

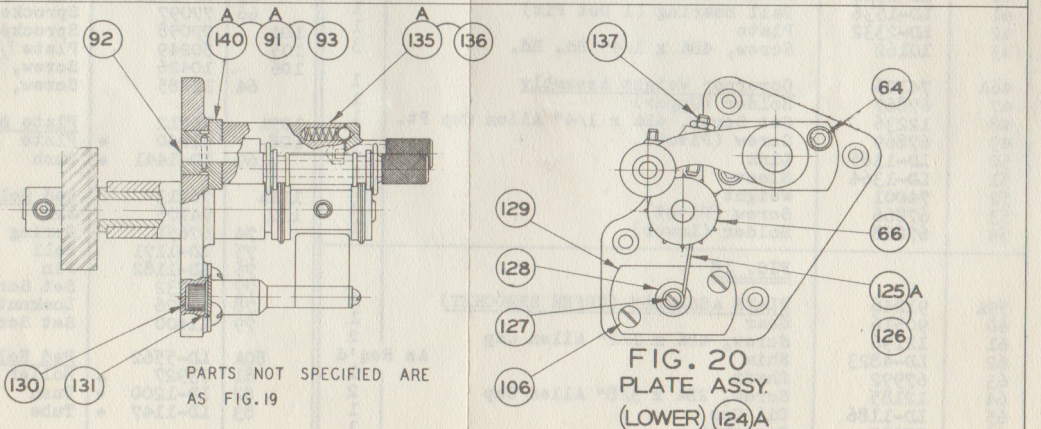


FIG. 20  
PLATE ASSY.  
(LOWER) (124) A



REF	CODE	ITEM	QTY	REF	CODE	ITEM	QTY	REF	CODE	ITEM	QTY
		<b>FIG. 15.</b>									
1A	90515	VERTICAL SHAFT ASSEMBLY	1	67A	76200	Plate & Bush Assembly	1	85A	LD-1136	Shaft & Knob Assembly	1
2	67720	Collar	1	68	81943 *	Plate	1	86	LD-1145 *	Knob	1
3	LD-2699	Screw	3	69	LD-1441 *	Bush	2	87	LD-1162 *	Shaft	1
4	LD-5915	Washer (Shim 0.005")	1	72A	76201	Pad Roller Arm Assembly	1	115A	76214	Knob & Stud Assembly	1
5	LD-5916	Washer (Shim 0.010")	1	73	74103	Arm	1	90	12336	Taper Pin, 3/32" x 1/2" lg. Std. St.	1
6	LD-1165	Washer (Fibre)	3	74	67651	Spring	2	116A	50234 *	Stud Assembly	1
7	LD-1166	Washer	2	75	LD-1179	Ball	2	117	50233 *	Stud	1
8	LD-1664	Washer	3	76	LD-1182	Pin	1	93	50229 *	Bracket	1
9	90510	Gear	2	77	12232	Set Screw, 2BA x 7/8" Allen Fl. Pt.	1	119A	50242	Knob Assembly	1
10	90512	Shaft	1	78	10826	Locknut, 2BA	1	120	67669 *	Knob	1
11	90511	Gear	1	79	11400	Set Screw, 2BA x 3/8" Allen Cup Pt.	1	97	LD-1183 *	Pin	1
12	LD-1537	Screw	1	80A	LD-5562	Pad Roller Assembly	1				
13	LD-1591	Nut	1	81	73927 *	Roller	2				
14	12233	Set Screw, 4BA x 1/8" Allen Cup Pt	2	82	LD-1200 *	Bush	2				
15	LD-1534	Plug	2	83	LD-1147 *	Tube	1				
16	LD-1538	Washer (Fibre)	2					124A	91265	PLATE ASSEMBLY (LOWER SPROCKET)	1
17	LD-1517	Washer	1	85A	LD-1136	Shaft & Knob Assembly	1	60	90516	Gear	1
18	LD-1513	Washer	1	86	LD-1145 *	Knob	1	61	12196	Screw, 4BA x 1/2" Allen Cap	2
19	LD-1539	Washer	2	87	LD-1162 *	Shaft	1	62	LD-4823	Shims	As Req'd
20	LD-1514	Washer	1					63	67992	Shaft	1
21	90513	Gear	1	89A	76203	Knob & Stud Assembly	1	103	LD-2348	Collar	1
22	LD-1540	Key	2	90	12336	Taper Pin, 3/32" x 1/2" lg. Std. St.	1	65	LD-1186	Oil Cup	1
23	LD-1164	Springwasher	1	91A	50231 *	Stud Assembly	1	66	77097	Sprocket	2
24	73946	Collar	1	92	50230 *	Stud	1	106	10426	Screw, 2BA x 1/4" Rd. Hd.	1
				93	50229 *	Bracket	1	64	12185	Screw, 2BA x 3/8" Allen Cap	2
25A	67749	Bearing Bracket Assembly (Upper)	1					125A	50277	Stripper Assembly	1
26	73899	Bracket	1	95A	50276	Knob Assembly	1	126	70238	Stripper	1
27	LD-1213	Ball Bearing (1 Dot Fit)	1	96	67984 *	Knob	1	127	62331	Screw	1
28	LD-2154	Plate	1	97	LD-1183 *	Pin	1	128	LD-4440	Stud	1
29	10847	Screw, 4BA x 1/4" Csk. Hd.	3					129	LD-4439	Plate	1
								130	12215	Screw, 1/4" - 20 x 1/2" Allen Cap	1
34A	67750	Bearing Bracket Assembly (Lower)	1					131	10903	Lockwasher, OBA Shkprf. Intl.	1
35	73902	Bracket	1								
27	LD-1213	Ball Bearing (1 Dot Fit)	1	101A	91253	PLATE ASSEMBLY (LOWER SPROCKET)	1	107A	96212	Plate & Bush Assembly	1
28	LD-2154	Plate	1	102A	91960	PLATE ASSEMBLY (LOWER SPROCKET)	1	108	91240 *	Plate	1
29	10847	Screw, 4BA x 1/4" Csk. Hd.	3	60	90516	Gear	2	69	LD-1441 *	Bush	2
				61	12196	Screw, 4BA x 1/2" Allen Cap	As Req'd	135A	76231	Pad Roller Arm Assembly	1
38A	67988	Bearing Assembly	1	62	LD-4823	Shim	1	136	74983	Arm	1
39	75071	Bracket	1	63	67992	Shaft	1	74	67651	Spring	2
40	LD-1518	Washer (Seal)	2	103	LD-2348	Collar	1	75	LD-1179	Ball	2
41	LD-1536	Ball Bearing (1 Dot Fit)	1	65	LD-1186	Oil Cup	1	76	LD-1182	Pin	2
42	LD-2332	Plate	1	66	77097	Sprocket (For 101A)	1	137	12191	Set Screw, 2BA x 1" Allen Fl. Pt.	1
43	10162	Screw, 4BA x 1/4" Rd. Hd.	3	104	77098	Sprocket (For 102A)	1	78	10826	Locknut, 2BA	1
				105	50249	Plate	2	79	11400	Screw, 2BA x 3/8" Allen Cup Pt.	1
46A	74106	Governor Weight Assembly	1	106	10426	Screw, 2BA x 1/4" Rd. Hd.	2				
47	67867	Holder (Upper)	1	64	12185	Screw, 2BA x 3/8" Allen Cap	2	80A	LD-5562	Pad Roller Assembly	1
48	12236	Set Screw, 4BA x 1/4" Allen Cup Pt.	1					81	73927 *	Roller	2
49	67869	Screw (Pivot)	4	107A	76212	Plate & Bush Assembly	1	82	LD-1200 *	Bush	2
50	LD-1365	Link	4	108	91240 *	Plate	1	83	LD-1147 *	Tube	1
51	LD-1364	Sleeve	1	69	LD-1441 *	Bush	2				
52	74001	Weight	2					85A	LD-1136	Shaft & Knob Assembly	1
53	67866	Screw (Pivot)	4	111A	76213	Pad Roller Arm Assembly	1	86	LD-1145 *	Knob	1
54	67868	Holder (Lower)	1	112	74105	Arm	1	87	LD-1162 *	Shaft	1
				74	67651	Spring	2				
				75	LD-1171	Ball	2	140A	76232	Knob & Stud Assembly	1
59A	91246	PLATE ASSEMBLY (UPPER SPROCKET)	1	76	LD-1182	Pin	1	90	12336	Taper Pin, 3/32" x 1/2" lg. Std. St.	1
60	90516	Gear	1	77	12232	Set Screw, 2BA x 7/8" Allen Fl. Pt.	1	91A	50231 *	Stud Assembly	1
61	12196	Screw, 4BA x 1/2" Allen Cap	2	78	10826	Locknut, 2BA	1	92	50230 *	Stud	1
62	LD-4823	Shim	As Req'd	79	11400	Set Screw, 2BA x 3/8" Allen Cup Pt.	1	93	50229 *	Bracket	1
63	67992	Shaft	1	80A	LD-5562	Pad Roller Arm Assembly	1	119A	50242	Knob Assembly	1
64	12185	Screw, 2BA x 3/8" Allen Cap	2	81	73927 *	Roller	2	120	67669 *	Knob	1
65	LD-1186	Oil Cup	1	82	LD-1200 *	Bush	2	97	LD-1183 *	Pin	1
66	77097	Sprocket	1	83	LD-1147 *	Tube	1				

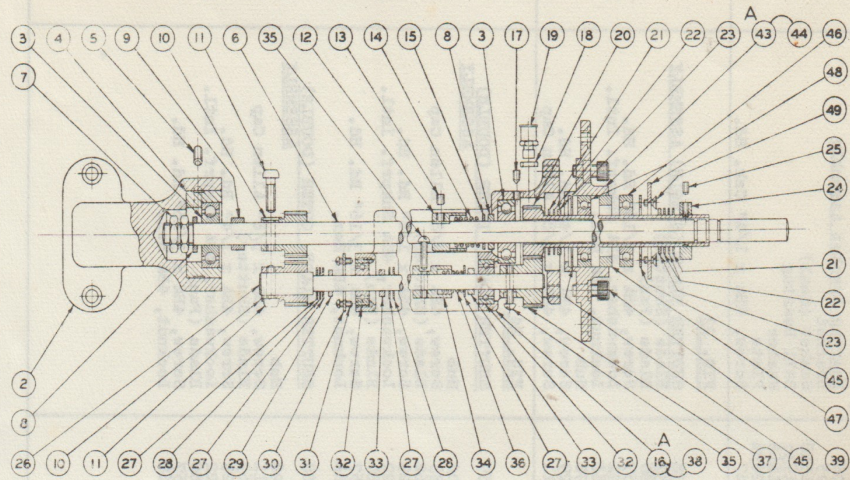


FIG. 25

DOUBLE SHUTTER SHAFT ASSY (1) A

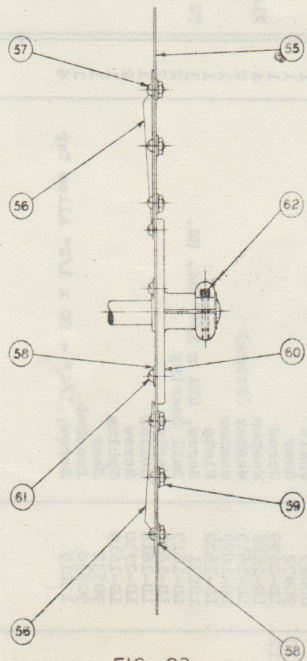


FIG. 23

SHUTTER BLADE (SINGLE) ASSEMBLY (54) A

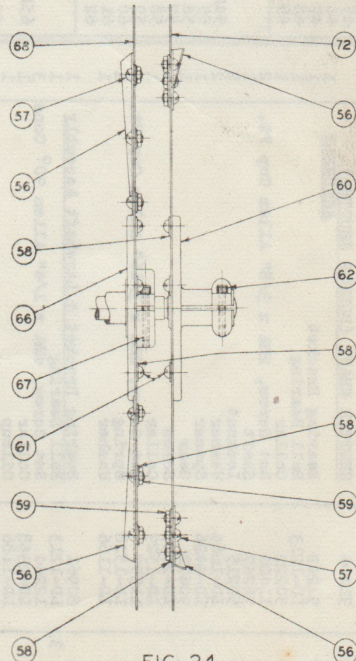


FIG. 24

SHUTTER BLADES (DOUBLE) ASSEMBLY (65) A

REF	QTY	ITEM	CODE	REF	QTY	ITEM	CODE	REF	QTY	ITEM	CODE
1A	1	SHUTTER SHAFT (DOUBLE SHUTTER) ASSEMBLY	91264	43A	1	Bearing Bracket Assembly	74206	54A	1	SHUTTER BLADE (SINGLE) ASSEMBLY	80938
2	1	Bearing Bracket	91242	44	1	Bracket	74205	55	1	Blade (Shutter)	80937
3	1	Ball Bearing	ID-1213	45	1	Collar	ID-1518	56	1	Blade (Fan)	76280
4	1	Set Screw, 2BA x 3/8" Allen Cup Pt.	50222	46	1	Set Screw, 2BA x 3/8" Allen Cup Pt.	ID-1536	57	1	Screw, 4BA x 3/16" Rd. Hd.	10057
5	1	Shaft	11400	47	1	Lockmit	ID-1666	58	1	Lockwasher, 4BA Shkprf. Intl.	10422
6	1	Washer	70215	48	1	Spacer	ID-2694	59	1	Lockmit, 4BA Hex.	11368
7	1	Lockmit	ID-1664	49	1	Gear	10847	60	1	Hub	74098
8	1	Washer	ID-4426					61	1	Screw, 4BA x 1/4" Rd. Hd.	10259
9	1	Collar	90472					62	1	Screw, 4BA x 5/8" Allen Cap	12211
10	1	Screw	ID-2699								
11	1	Collar	ID-1529								
12	1	Set Screw, 2BA x 3/16" Allen Cup Pt.	11597								
13	1	Spring	ID-1528								
14	1	Washer	ID-1166								
15	1										
16A	3	Bearing Bracket & Layshaft Assembly	80961	65A	1	SHUTTER BLADE, INNER (DOUBLE) ASSEMBLY	80959	71A	1	SHUTTER BLADE, OUTER (DOUBLE) ASSEMBLY	80960
17	1	Ball Bearing	ID-1213	66	1	Hub	74204	72	1	Hub	74098
18	1	Set Screw, 4BA x 1/4" Allen 90° Cone	12244	67	1	Blade (Shutter)	12433	61	1	Screw, 4BA x 5/8" Allen Cap	12211
19	1	Collar	ID-2348	68	1	Blade (Fan)	80962	62	1	Screw, 4BA x 1/4" Rd. Hd.	80963
20	1	Oilcup	ID-1186					63	1	Screw, 4BA x 1/4" Rd. Hd.	10259
21	1	Gear	90533					64	1	Lockwasher, 4BA Shkprf. Intl.	10422
22	1	Washer	ID-1538					65	1	Lockmit, 4BA Hex.	11368
23	1	Washer	ID-1339								
24	1	Collar	ID-1665								
25	1	Set Screw, 4BA x 1/4" Allen Cup Pt.	ID-1620								
26	1	Shaft	11588								
27	1	Gear	68052								
28	1	Screw	70472								
29	1	Washer	ID-2692								
30	1	Washer	ID-1615								
31	1	Washer	ID-1677								
32	1	Plate	ID-1622								
33	1	Screw, 6BA x 1/4" Rd. Hd.	10237								
34	1	Ball Bearing	ID-1617								
35	1	Collar	ID-1618								
36	1	Washer	ID-2730								
37	1	Screw	ID-1619								
38	1	Spring	90532								
39	1	Gear	90534								
		Bracket, 1/4" - 20 x 1/2" Allen Cap	12215								

REF	CODE	ITEM	QTY
1A	01894	STANDARD SUPPORT ASSEMBLY	1
2	1D-5644	Screw	1
3A	77239	Carrier Assembly	1
4	77236	Screw, 5/16" Allen Cap	1
5	12596	Screw, 5/16" Allen Cap	1
6A	51306	Block Assembly	1
7A	51304	Block (Upper)	1
8	51304	Block (Lower)	1
9	12596	Screw, 5/16" Allen Cap	1
12A	73963	DRIVE SHAFT (FLEXIBLE) ASSEMBLY	1
13	1D-1174	Coupling	1
14	12058	Screw, 5/8" x 3/4" Allen Cap	1
15	10826	Locknut, 2" x 2 1/2" Shim.	1
16	12836	Set Screw, 1/4" x 3/16"	1
17	10826	Locknut, 2" x 2 1/2" Shim.	1
18	1D-1170	Shaft Coupling	1
19	07721	Shaft Coupling	1
22A	74950	CONDUIT ASSEMBLY	1
23	48664	Conduit (Flexible)	1
24	65931	Conduit	1
25	65931	Conduit	1
26	68972	Set Grip Assembly	1
27A	68912	Set Grip	1
28	68912	Set Grip	1
29	68917	Set Grip Assembly	1
30	68917	Set Grip	1
31A	68917	Set Grip Assembly	1
32	68917	Set Grip	1
33	68917	Set Grip	1
34	68917	Set Grip	1
30	68967	Board Grip	1

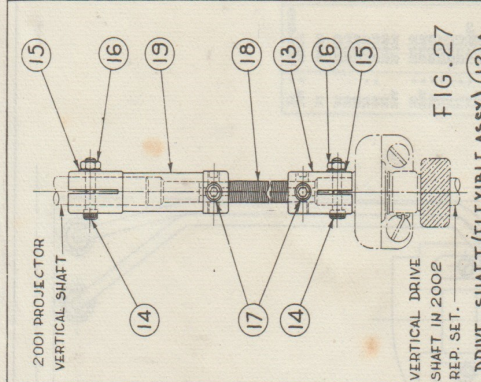


FIG. 26 FORWARD SUPPORT ASSEMBLY (1) A

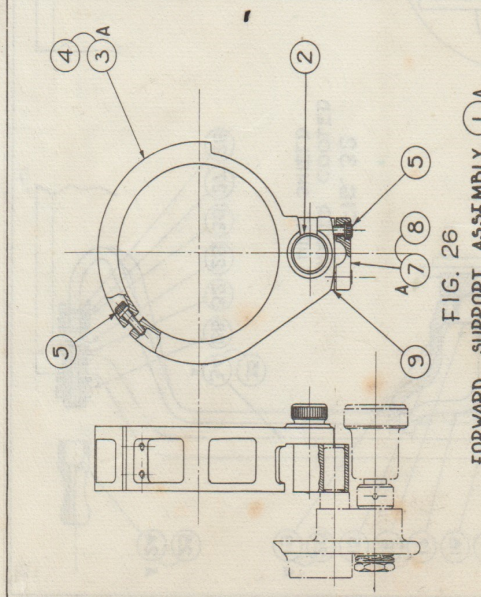


FIG. 27 DRIVE SHAFT (FLEXIBLE ASSY) (12) A

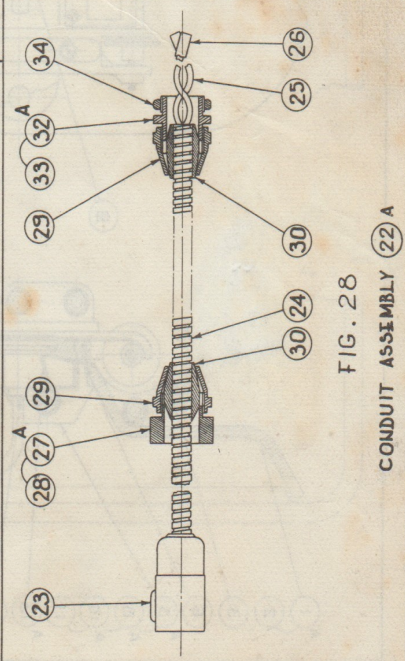


FIG. 28 CONDUIT ASSEMBLY (22) A

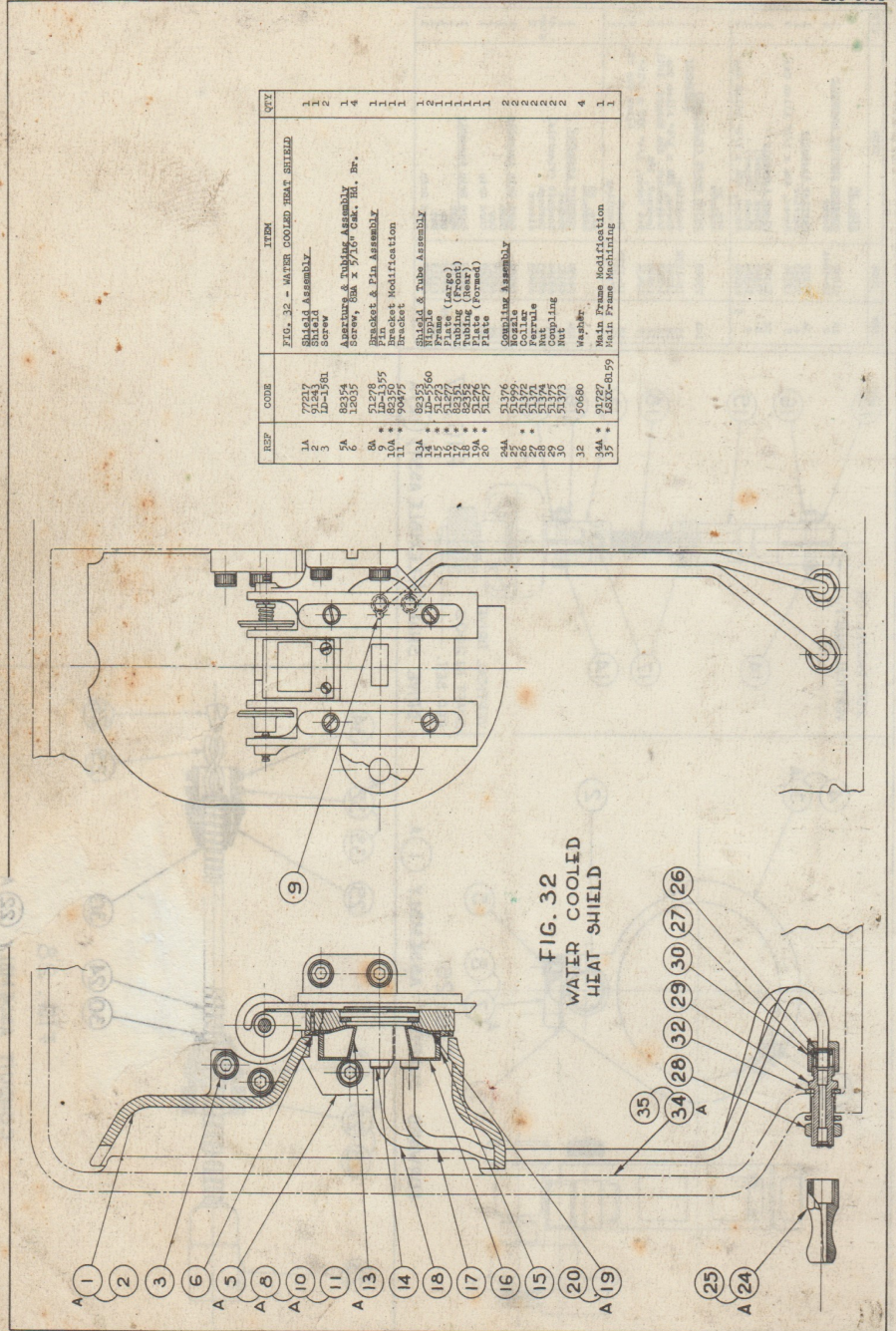


FIG. 32 WATER COOLED HEAT SHIELD

REF	CODE	ITEM	QTY
1A	77217	Shield Assembly	1
2	1D-1381	Screw	1
3	1D-1381	Screw	1
5A	82954	Assesing & Tubing Assembly	1
6	12835	Screw, 5/8" x 3/4" Cap, H. R.	1
8A	51278	Bracket & Pin Assembly	1
9	12-1335	Pin Bracket Modification	1
10	90475	Bracket	1
11	90475	Bracket	1
13A	82353	Shield & Tube Assembly	1
14	12-2560	Ripple	1
15	12-2560	Ripple	1
16	51277	Plate (Large)	1
17	51277	Plate (Small)	1
18	82352	Tubing (Steel)	1
19	51276	Plate (Formed)	1
20	51276	Plate (Formed)	1
21A	51376	Conduiting Assembly	1
22	51399	Socket	1
23	51372	Socket	1
24	51372	Socket	1
25	51374	Nut	1
26	51374	Nut	1
27	51373	Nut	1
28	51373	Nut	1
29	51373	Nut	1
30	50680	Washer	4
31A	91227	Main Frame Modification	1
32	91227	Main Frame Modification	1
33	12222	Main Frame Modification	1
34	12222	Main Frame Modification	1
35	12222	Main Frame Modification	1

FIG. 32 - WATER COOLED HEAT SHIELD