

Film-Tech

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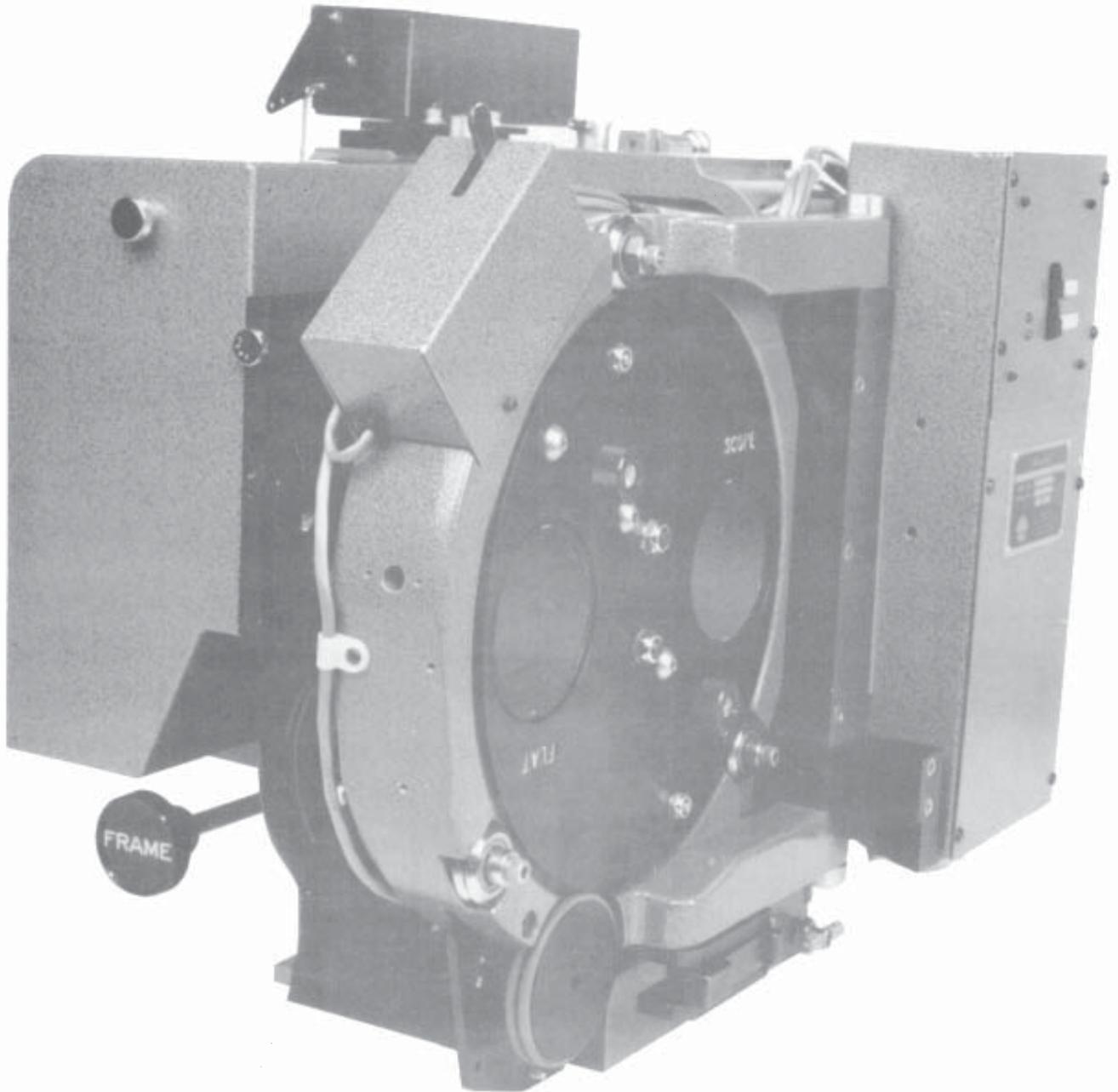
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Simplex[®] 35

PROJECTOR MECHANISM

INSTRUCTION BOOK



**STRONG
INTERNATIONAL**

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MODEL PR2000

Millennium

with TU2020/2030 Turret

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STRONG INTERNATIONAL
a division of Ballantyne of Omaha, Inc.
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PREFACE

THE SIMPLEX 35 PROJECTOR, Model PR2000, combining rugged construction with ease of operation, provides theatre owners with a superior mechanism, engineered to the high standards set for all Strong International products. The following design features illustrate why the Simplex 35 Projector is able to provide continuously excellent performance throughout its long operating life:

UNIT DESIGN

Unit method of design simplifies part replacement and maintenance. All units may be quickly removed and replaced. Components within a particular unit are just as easily handled.

SOUNDHEAD

Although the Simplex 35 Projector was designed for use with the Simplex 5 Star Soundhead, other soundheads may be used without loss of quality.

MAIN DRIVE AND IDLER GEAR ASSEMBLIES

The main drive gear and idler assemblies are easily installed, insure proper driving from the soundhead, and are adjustable.

OPTICS

A conical shutter, positioned close to the picture aperture, provides very high light efficiency. Optical design is compatible to modern xenon lamphouse systems.

LENS TURRET

The TU2020 Lens Turret is available in either Automatic (PR2000A) or Manual (PR2000M) configurations. The standard turret accommodates (1) each 2-25/32" Wide Screen (flat) and Anamorphic (CinemaScope) lens without use of a MagnaCom. A three-lens turret (TU2030) is available for the Model PR2000. Individual focus controls permit concise focusing of each lens independently.

FILM COMPARTMENT

The roomy film compartment permits ease of threading and cleaning. The lens turret is hinged and swings open for added convenience.

GEAR COMPARTMENT

The gear compartment has a removable cover, rounded corners, and an enameled finish which simplifies cleaning.

MAIN FRAME

The main frame casting forms a single unit with the base, top, and front that is noteworthy for its simplicity and strength.

FILM SPROCKETS

The upper feed and lower holdback sprockets, having twenty-four teeth each, reduce shaft speeds to prolong operating life, permit smoother wrap-around, and lessen the danger of splice breakage. Exclusive use of VKF® sprockets insures minimum film wear. The pad rollers are made of durable, lightweight nylon.

FILM TRAP

The film trap conforms to the curved film gate, and accommodates the multiple-aperture plate used with the TU2020 and TU2030. Film tension can be easily adjusted while the machine is running. The trap is readily removed and replaced for routine cleaning and maintenance.

FILM GATE

The curved gate, together with the film trap, controls the movement of the film past the aperture by five different tension settings. Gate curvature provides compensation for heat-induced warping of the film at the aperture, thus insuring a sharper image on the screen. Separate adjustment of the pivoting intermittent sprocket shoe pad minimizes picture “jump” with reduced gate tension for long print life. The film gate is easily removed, cleaned, and replaced.

INTERMITTENT MOVEMENT

The intermittent movement features a webbed starwheel for high strength, long life, and positive registration. The VKF® intermittent sprocket is adjustable, making absolute alignment possible.

LUBRICATION

A Spray-O-Matic Lubrication System, with a gear-driven oil pump, completely lubricates all moving components. The moving parts inside the gear compartment are visible through the glass panel in the full-vision oil-sealed cover. The intermittent movement lubricates itself by pump action, and the Spray-O-Matic system. An oil level sight glass in the film compartment permits a visual check of the oil level.

COOLING

The Simplex 35 Projector includes a standard air-cooled trap, and a water-cooled trap is available as a factory option. Additional trap cooling, if required with high-wattage xenon lamphouses, may be implemented by means of the optional G-7903 Shutter Housing Blower Assembly.

VKF® is a registered trademark of LaVezzi Precision, Inc. Elmhurst, Illinois

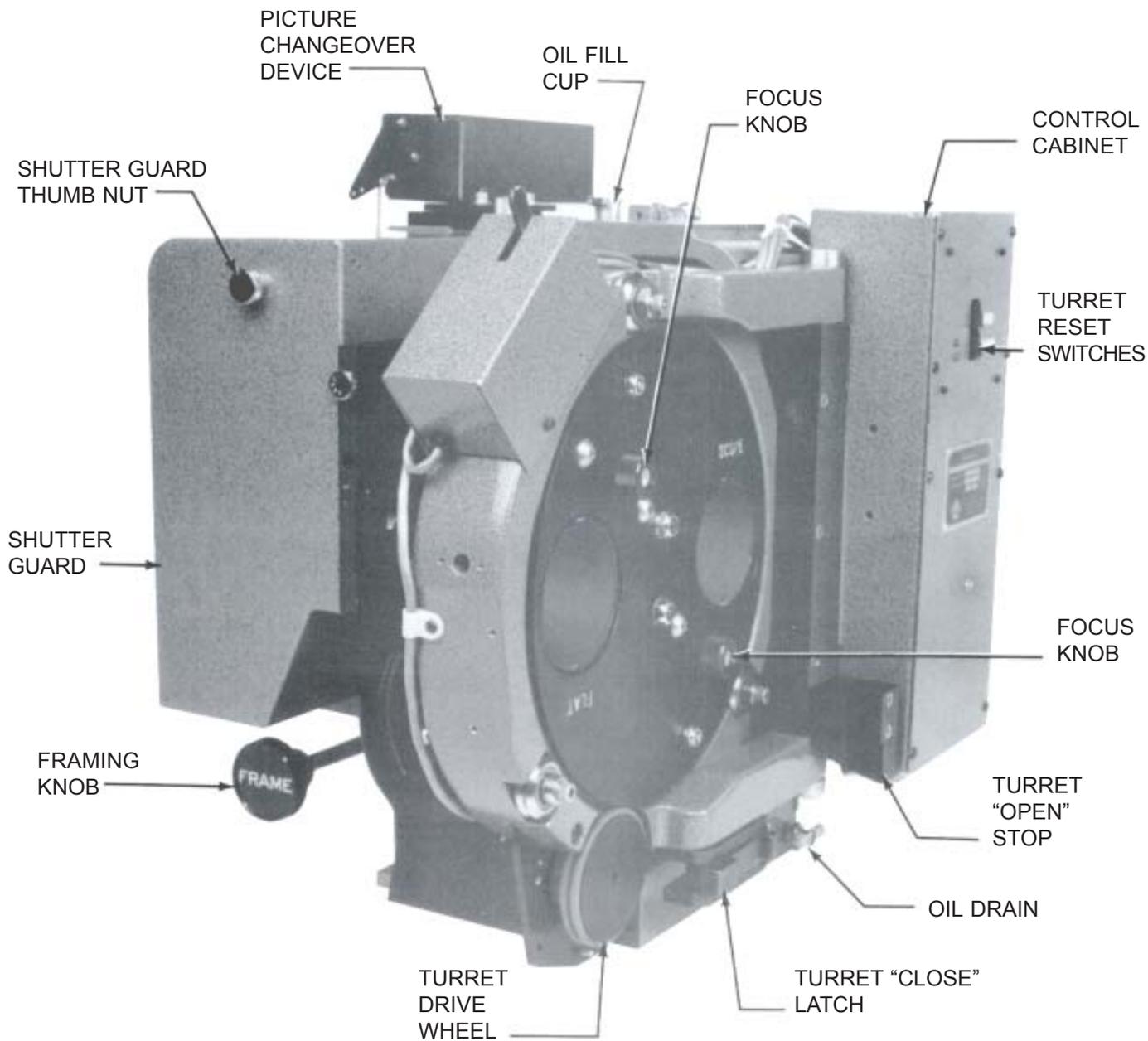


FIGURE 1

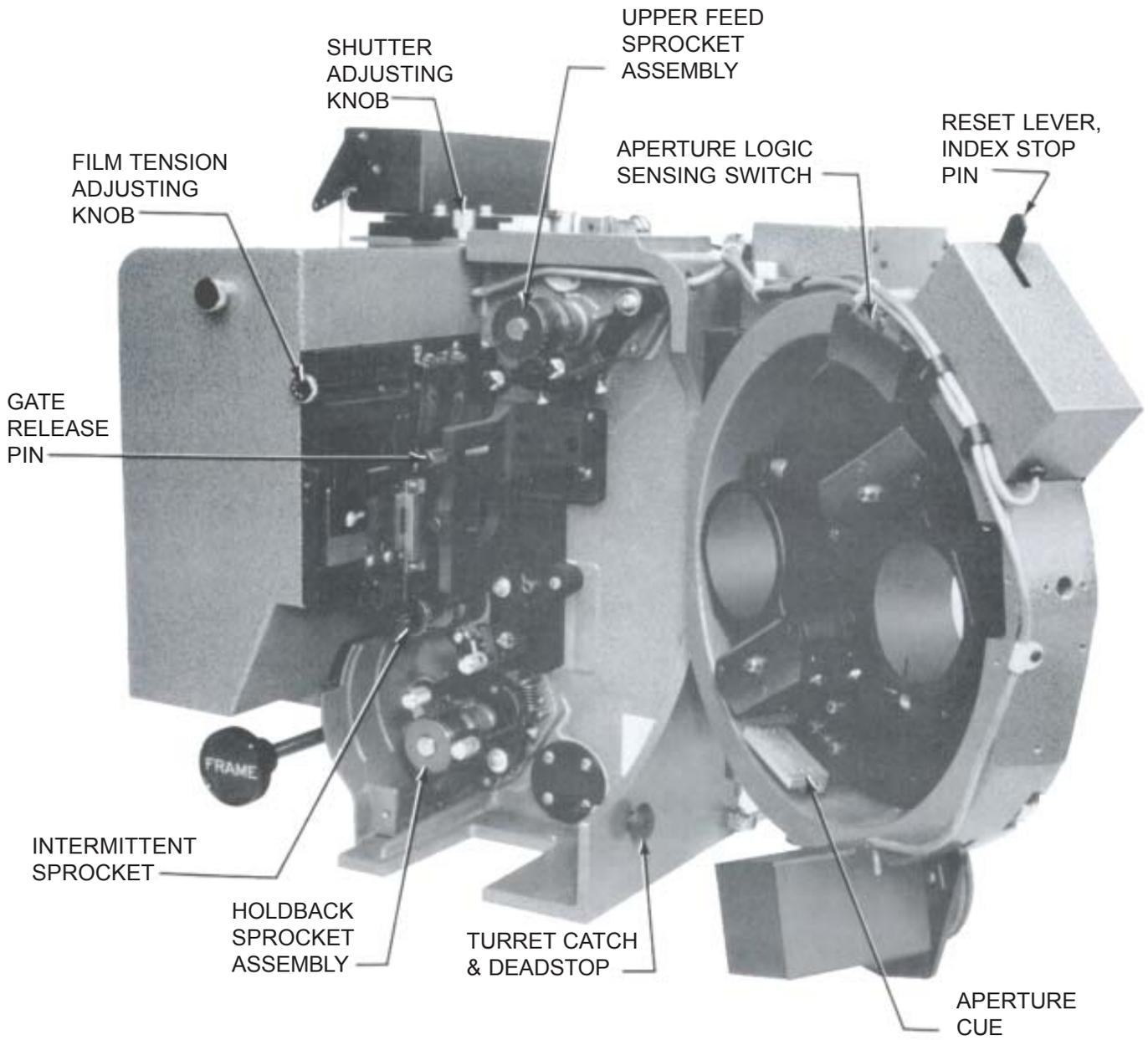


FIGURE 2

INSTALLATION

EACH SIMPLEX 35 PROJECTOR is carefully inspected and film-tested before leaving the factory. Carefully inspect the unit on receipt for any shipping damage, and file any damage claims with the carrier immediately. It is the responsibility of the *consignee*, not Strong International, to file such claims.

THE FOLLOWING RECOMMENDATIONS should be studied carefully prior to installation. Even if received mounted and prewired to a Strong console, it is advisable to review and inspect the following steps prior to energizing the system. Your Strong International Dealership may wish to assist in installing those projection booth products supplied by their firm.

UNPACKING

The Simplex 35 Projector is shipped in a sturdy wooden crate. TOP and OPEN THIS SIDE are marked on the carton. The projector is mounted to the base of the crate with (2) 3/8-16 hex head screws. If shipped as an "All-In-One" system (including 5 Star soundhead), the soundhead is mounted to the base of the crate with (2) 5/16-18 hex head screws.

An accessory kit is shipped with each Simplex 35 Projector. The kit includes the following:

- (1) Can Simplex Projector Oil
- (1) Oiler
- (1) Set Allen Wrenches

The tools and accessories are required for adjustments and routine maintenance after installation. Store them in a secure location in the projection booth.

MOUNTING

When not shipped as an "All-In-One" system, the projector must be mounted to the soundhead, after the soundhead has been installed to the projection pedestal or console. See Soundhead Manual.

The projector mounting bar (P-2396) is shipped with the 5 Star Soundhead. Mount the bar to the base of the projector using the (2) 3/8-16 socket head screws provided; position the *slotted* end of the bar at the rear (shutter) end of the projector. Mount the projector to the top of the soundhead with the mounting bar in the channel on the top of the soundhead casting. Attach the mounting bar to the soundhead casting using the (2) 5/16-18 hex head screws and washers supplied. A slight degree of tolerance between the mounting bar and the soundhead casting permits positioning the projector for smooth film feed between the projector and soundhead. When correctly positioned, securely tighten all mounting fasteners. Run the drive belt to the projector and tension the belt with soundhead idler assembly.

Terminals for the soundhead drive motor leads are provided in the projector control cabinet. See the following section detailing Electrical Connections.

LAMPHOUSE OPTICAL ALIGNMENT

Carefully follow the lamphouse manufacturer's instructions regarding correct optical alignment between the lamphouse and projector. The lamphouse is generally aligned to the projector aperture, but some consoles require positioning the projector and soundhead to the optical center of the lamphouse. **DO NOT** alter the film path between the projector and soundhead in the course of these adjustments. *Never* operate the lamphouse with the douser open unless the projector is running.

LAMPHOUSE LIGHT SHIELD

Light shields, or nose cones, supplied by the lamphouse manufacturer, may be installed between the projector shutter guard and the lamphouse snood. Make certain that the nose cone does not obstruct the rotation of the shutter. Trim or otherwise modify the nose cone as required.

ELECTRICAL CONNECTIONS

All electrical connections to the PR2000 terminate in the Control Cabinet mounted at the front of the projector adjacent to the turret hinge. Remove the (2) cover plates to expose the terminals.

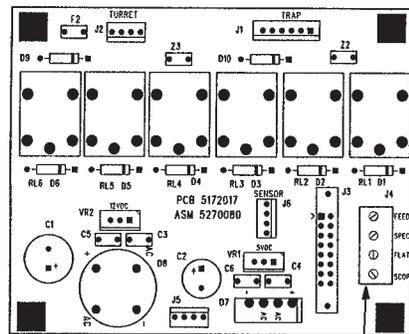
Input voltage is user-selectable by connecting the transformer plug to one of the two receptacles located on the top of the lower printed circuit board. Connect the plug to J7 for 110 volt operation, or to J8 for 220 volt. After selecting the voltage, apply AC phase and neutral to the (2) uppermost terminals on the right barrier strip. An earth ground must be connected to the ground terminal at the lower right of the lower printed circuit board. This AC input powers the turret controller, the turret and aperture motors, and the L.E.D. framing light.

The lower terminals of the right barrier strip allow connections from the automation controller to the picture changeover and the soundhead drive motor. The left barrier strip provides connection points to the devices. Voltage to these devices is generally supplied by, or switched through, the automation controller. All NEUTRAL connections are common.

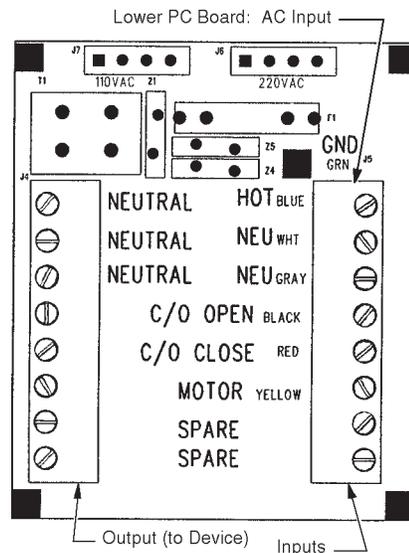
Picture Changeover

The Simplex 35 is normally supplied with either a G-2090 Essanay ("Zipper") or Strong International 120 V.AC (52-60325) or 230 V.AC (52-60326) picture changeover device. If ordered separately, connect the changeover leads as follows:

<u>G-2090</u>	<u>52-60325/6</u>
Blk - OPEN	Blk - OPEN
Brn - CLOSE	Red - CLOSE
Wht - COMMON	Wht - COMMON
	Grn - GROUND



Upper PC Board: Turret Inputs





NOTE: These changeover devices require an AC *pulse* to operate. Connecting the changeover device to a *sustained* AC circuit will **destroy** the electrical coil(s). Check carefully the instructions supplied with the automation controller and/or the (installer-supplied) switching circuit.



Lens Turret

The MANUAL lens turret requires no electrical connections. Installer connections to the AUTOMATIC turret are made to the J4 terminals located on the upper printed circuit board in the control box adjacent to the turret on the front of the projector. The inputs (FEED, SPECIAL, FLAT, and SCOPE) are derived from an automation controller and/or other installer-supplied circuitry. NOTE: "SPECIAL" input applies only to a *third* lens in a three-lens turret.

LENS INSTALLATION

The lens barrels are individually marked to designate their screen format. The barrels of the standard two-lens turret are marked SCOPE (CinemaScope, or anamorphic) and FLAT ("wide screen," or non-anamorphic). Lens barrels on the three-lens turret are marked SC (CinemaScope), FL (Flat), and SP (Special). The lenses must be installed in their designated barrels for correct aperture logic. Magnacom lenses are not required in any configuration.

Rotate the turret to the SCOPE position. The automatic turret will index to this position after the SCOPE switch is pressed; the manual turret must be indexed by hand. Make certain the SCOPE aperture plate is in position. Center the focus adjustment screw, allowing equal travel forward and back. Insert the CinemaScope lens and anamorphic adapter into the SCOPE barrel. Start the projector, ignite the lamphouse, and project a picture to the screen. Move the lens inside the barrel until a sharply focused picture is projected, and the anamorphic correction is on the correct horizontal plane. Securely tighten the lens locking knob on the top of the SCOPE barrel. Close the lamphouse douser.

Reset the turret to FLAT format, and make certain the FLAT aperture is in position. Center the focus adjustment screw, and insert the FLAT lens. Open the lamphouse douser and move the lens inside the barrel until a sharply focused picture is projected. Tighten the lens locking knob above the FLAT barrel.

Repeat the above procedures as required for the "special" lens used in a three-lens turret. Once installed, DO NOT remove the lenses for cleaning. The turret is hinged, and opens to permit cleaning the rear surfaces of the lenses.

File the aperture plates to size the picture to the screen and/or masking. NOTE: When projecting a white light while filing apertures, close the lamphouse douser *frequently* to allow the lens to cool.

DO NOT attempt to correct "keystoning" by shimming the turret or offsetting the position of the lenses. The lenses *must* be positioned on optical center to project a satisfactory image.

START-UP PROCEDURES

ALL SIMPLEX PROJECTORS are carefully “run-in” at the factory before shipping. No “run-in” period at the installation site is required. Some gear whine may be noticed initially, but should disappear after a few hours of operation.

INITIAL OILING

One quart of Simplex Projector Oil is included in the accessory kit supplied with new equipment. USE ONLY GENUINE SIMPLEX PROJECTOR OIL IN THE MECHANISM. Use of other lubricants may inhibit oil pump operation and damage moving parts. Additional oil is available through authorized Strong International Dealers; order Simplex Part No. R-0059 for (1) quart quantities.

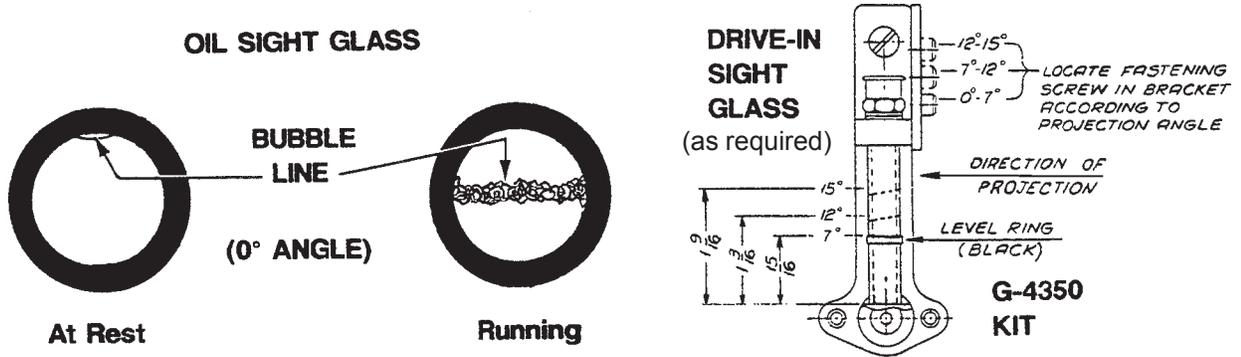

DO NOT, at any time, operate the projector without oil.


Add oil through the filler located at the top of the gear compartment cover. The oil level is visible through the sight glass inside the film compartment at the base of the main frame. When the projector is level (0 degree projection angle), the correct oil level should be nearly to the top of the sight glass, with a small air bubble visible at the top.

As the machine is tilted to a downward projection angle, the air bubble will disappear. When the machine is started, the visible oil level will drop, indicating that the pump is drawing the oil from the reservoir and circulating it throughout the gear compartment.

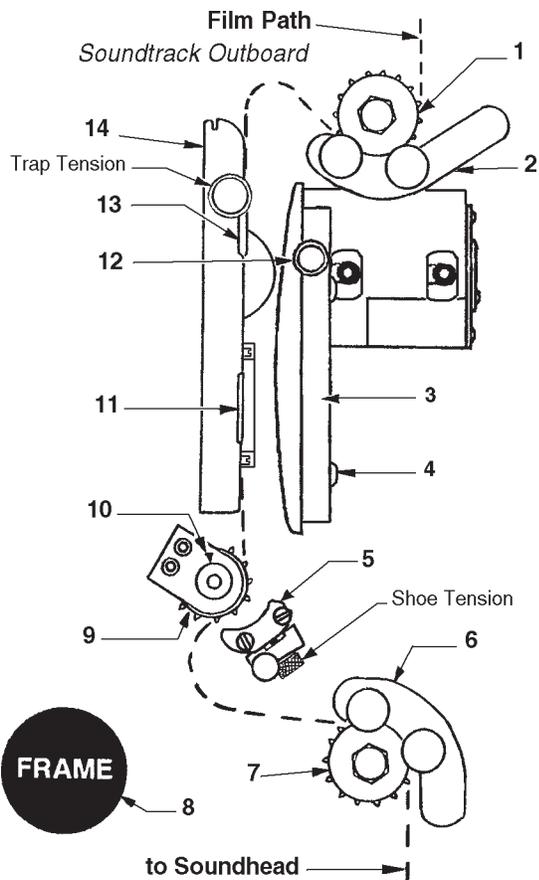
If the machine is to be used in an extreme upward projection angle, the oil level will drop, and may disappear when the machine is running. In this event, it is recommended to install a G-4350 Drive-In Oil Gauge Mounting Kit (see Parts Catalogue, Page 1-18). The main frame is drilled to accept use of this kit.

Rotate the soundhead flywheel by hand to turn the projector mechanism. It should turn freely and smoothly. Start the projector motor and run for at least one minute. Check for an oil splash against the gear compartment cover glass.



THREADING

Threading the projector *correctly* is one of the operator's most important duties. Careful attention during this operation pays off in improved performances and long print life.



Unlatch and open the turret. Rotate the framing knob (Item 8) to its center position (FRAME reading level, as shown). Using the soundhead flywheel, turn the mechanism by hand to rotate the intermittent sprocket (Item 9) to its "rest" position. In the "rest" position, the index mark (Item 10) will align with one of the painted white index lines on the intermittent shaft collar after the sprocket has completed a four-perforation step.

Open the pad roller assemblies (Items 2 & 6). Open the film gate (Item 3) by pulling the gate opening pin (Item 12). Slide the film gate forward to the threading position (as shown). Open the intermittent sprocket shoe pad (Item 5).

At this time, it is advisable to dismount the film gate pressure pad by sliding the gate to its full forward position, and removing the (2) button head screws (Item 4) using a 1/8 inch right angle allen wrench. Use a clean, dry cloth to wipe down all film-bearing surfaces of the gate and trap (Item 14). Replace the pressure pad, slotted end *down*, after cleaning. This procedure should be performed at least once every day.

Thread the film as illustrated. Engage first the intermittent sprocket (Item 9), and check for correct frame position at the framing aperture (Item 13). When correct, close the intermittent shoe pads (Item 5). Secure the gate by pushing the gate into the trap until the spring-loaded gate latching pin (Item 12) engages. Form two-finger loops above and below the gate as illustrated, and close the pad roller assemblies (Items 2 & 6).

Rotate the motor flywheel by hand to advance a few frames of film. *Do not* "inch" the mechanism by momentarily switching the drive motor on and off; in the event of a threading error, film may be damaged. Run fingers over each sprocket (Items 1, 7, & 9) to insure that the sprocket teeth are centered in the film perforations, and the film is centered between the flanges of the pad rollers. Check again the position of the film in the framing aperture (Item 13). With the intermittent sprocket in its "rest" position, a correct frame image in the framing aperture insures correct frame positioning in the picture aperture (Item 11). Use the framing knob (Item 8) or handle to correct misframes. Close and latch the lens turret.

Thread the soundtrack as instructed in the soundtrack manual. A slight degree of film tension is required above the feed sprocket (Item 1) and below the soundtrack. This measure prevents the film from snapping upon motor start.

INITIAL OPERATION

CLEAN ALL FILM BEARING SURFACES BEFORE EACH THREADING OPERATION. Check all sprocket teeth for hooks or burrs; replace if required. Keep all pad rollers clean and operating freely. Make certain the turret is set to the correct lens and aperture for the desired screen format. FLAT format is generally used for initial setup of the projection system.

The Film Trap Tension Knob is located at the top of the film trap, and is graduated in Steps 1 - 5. Rotate this knob counterclockwise to its stop. This setting ("1") indicates minimum trap tension. Thread film into the projector, ignite the lamp, and project a picture to the screen. Use of RP-40 test film is highly desirable for this stage of machine set-up. This test film may be purchased directly from the Society of Motion Picture and Television Engineers:

SMPTE Test Film Department
595 West Hartsdale Avenue
White Plains, New York 10607

Order: 35 PA-50 (50 ft.)
or 35 PA-200 (200 ft.)

Install the lenses and set focus as detailed in the preceding INSTALLATION section. File the apertures to fit screen parameters.

If the projected picture is unsteady, rotate the film trap tension knob clockwise one step at a time, while the film is running. Tighten the knurled knob on the intermittent shoe assembly *gradually* to remove picture "jump." Always adjust for the *minimum tension* required to project a steady picture. Excessive tension not only increases wear on parts, but in extreme cases may cause torn perforations and film breakage.

Check the projected picture for travel ghost. "Travel Ghost" is the term commonly applied to vertical streaking of lighter areas against a darker area, and is particularly noticeable during opening or closing titles and credits. If ghosting is apparent, rotate the shutter adjustment knob on the top of the projector until the ghosting disappears. If the ghost cannot be eliminated by means of this knob, see "Shutter Timing" in the ADJUSTMENTS AND REPLACEMENTS section of this manual.

The rotation travel of the lens turret is limited by the indexing stop pin mounted to the outer ring of the turret. The automated turret on the PR2000 includes a solenoid which pulls the pin when the turret is in motion. Two coil expansion springs seat the pin when the turret is at rest. When first energized, the autoturret will automatically index to FLAT mode, if not already in FLAT. The proximity switch on the turret ring will sense the cueing magnet mounted to the index stop bracket and set the correct aperture (one magnet mounted inboard = FLAT, one magnet mounted outboard = SCOPE, two magnets = SPECIAL).

In the event of a turret motor failure, the automatic turret can be operated manually until a replacement motor is obtained. It is advisable to de-energize the turret control until the replacement motor is installed. The dual aperture plate can be pushed in or pulled out manually to set the correct format.

MAINTENANCE

THE PROJECTOR MECHANISM should periodically undergo a careful and thorough inspection. A regular schedule of adjustments and replacement of wearing parts will insure long life and minimize downtime.

LUBRICATION

Drain and discard the projector oil after (6) months of initial operation, and at least annually thereafter. Clean the oil pump intake filter and the oil reservoir. Replace with genuine Simplex Projector Oil (Part No. R-0059) available from Strong International Dealers.

SPROCKETS

Clean sprocket teeth daily with a typewriter brush or used toothbrush (with softened bristles). Examine each sprocket carefully for wear, undercutting ("hooks"), and/or looseness. Replace as required. Assuming the projector is used for forward-running only, hooked sprockets can be re-used by reversing the sprocket on its shaft. Check the alignment of the intermittent sprocket.

PAD ROLLERS

Check pad rollers for grooves, flat spots, and/or looseness. Check rollers thoroughly to relieve binding; replace as required. Inspect alignment of pad rollers to sprockets; centered, flanges not rubbing, spaced (2) film thicknesses above sprocket face.

FASTENING HARDWARE

Check all fasteners for tightness. Normal operating vibration over prolonged periods may cause fasteners to loosen. Tighten as required.

FILM GATE

Remove all foreign matter (dirt, wax) by cleaning thoroughly. Examine film runners and intermittent shoes for wear; replace if required. Check alignment of intermittent shoes to intermittent sprocket faces. Check gate opening and closing slide for smooth operation; clean linear bearing to relieve binding. The gate mount is adjustable by means of slotted mounting holes; check periodically to insure secure gate closure.

FILM TRAP

Examine lateral guide rollers for grooves and binding. Clean carefully, adjust, or replace. Remove all foreign material from tension straps. Inspect for wear; replace if required.

To remove the trap from the main frame, cycle the aperture plate to FLAT. Loosen the wing-head, quarter-turn screw and raise the hinged portion of the aperture plate drive. Lifting the hinged plate will expose the slotted head of the trap mounting screw, and allow access for a flat-bladed screwdriver.

MAINTENANCE (continued)

LENS TURRET

Periodically check the condition of the (2) O-ring drive tires on the auto turret drive wheel. Clean the surfaces of the O-rings and replace if worn or cracked. DO NOT LUBRICATE. Check the tension of the motor mount expansion spring and replace if stretched.

The indexing plate of the lens turret rotates on (3) ball bearings mounted to the turret ring casting. The uppermost bearing is retained by means of an eccentric bushing, allowing a degree of adjustment. To adjust, loosen the socket head bearing screw, and increase or decrease bearing pressure by rotating the eccentric bushing with a 9/16 inch wrench. Do not apply excessive pressure; allow the index plate to rotate freely, but without “play” between the plate and ring.

On both AUTO and MANUAL turrets, the index stop is actuated by the (2) expansion springs mounted between the stop pin and the turret ring. Make certain these springs are correctly installed. Replace immediately if worn; the correct spring tension is required to seat the index stop pin. The index stops on the lens indexing plate are mounted with (3) screws each. Two of the mounting holes are slotted to provide a degree of fine adjustment of the lens position. Securely tighten all (3) screws when the lens is correctly positioned. See the following ADJUSTMENTS & REPLACEMENTS section for detailed information regarding lens alignment and positioning.

Magnets are mounted to brackets on the index stops to actuate the ring-mounted proximity switch and establish lens/aperture logic. Periodically clean the exposed surfaces of these magnets to insure good magnetic conduction. Keep mounting hardware tight to maintain correct alignment.

Clean the turret hinge to allow free operation. Make certain that the turret is fully closed when latched. The deadstop screw in the center of the turret catch can be adjusted to remove “play.” *Do not shim the turret, or offset the index stops* in an attempt to correct “keystoning.” Keep lenses on correct optical centers.

Clean the lenses as recommended by the lens manufacturer. Do not remove the lenses from the turret for cleaning; doing so would alter the preset focus of the lenses. Swing the turret open to the THREAD position for easy access to the rear surfaces of the lenses. Close and latch the turret after cleaning the lenses.

OVERALL APPEARANCE

Clean all enameled surfaces of the projector regularly. Oil-coated surfaces will attract and hold dust and film particles.

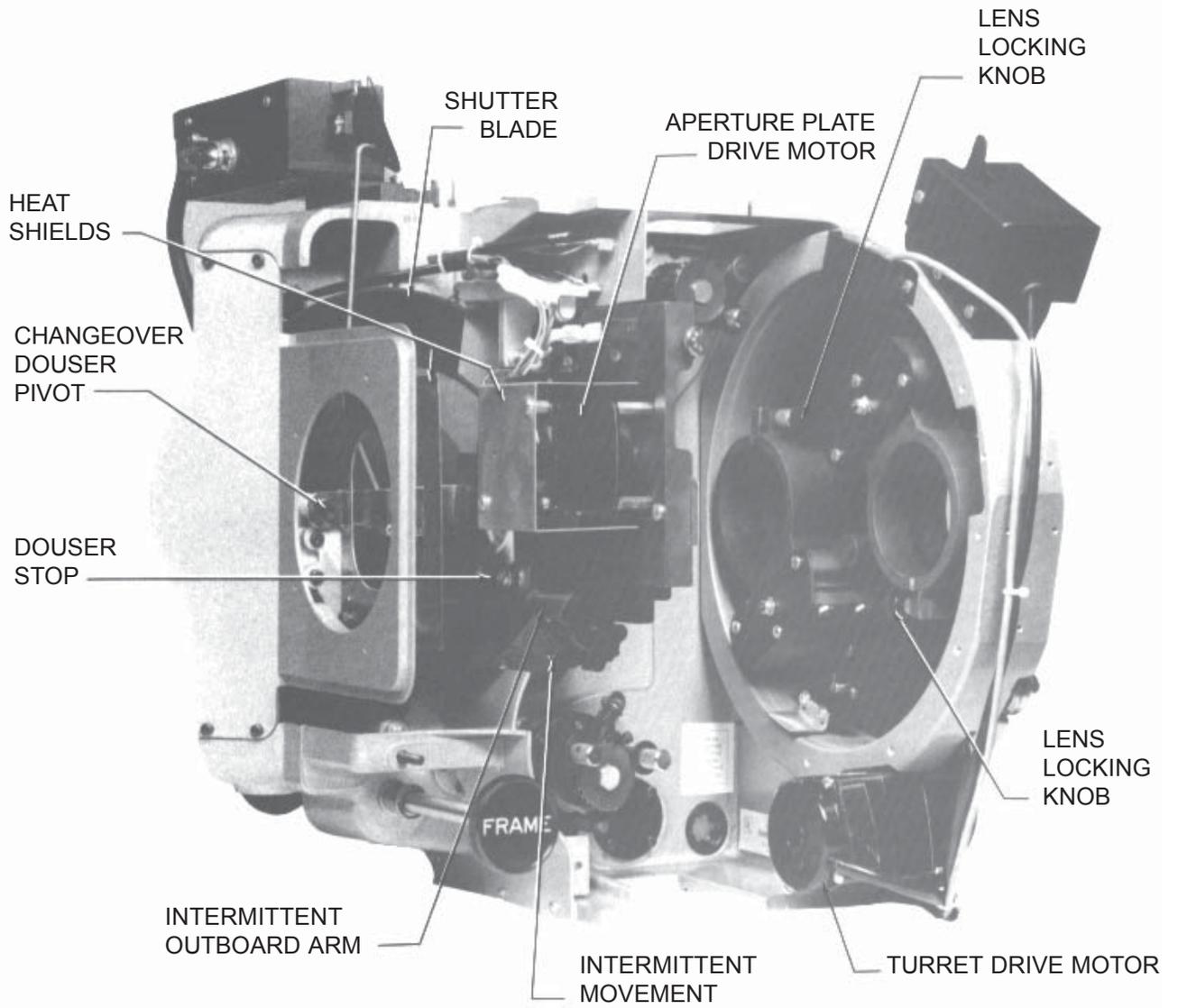


FIGURE 3

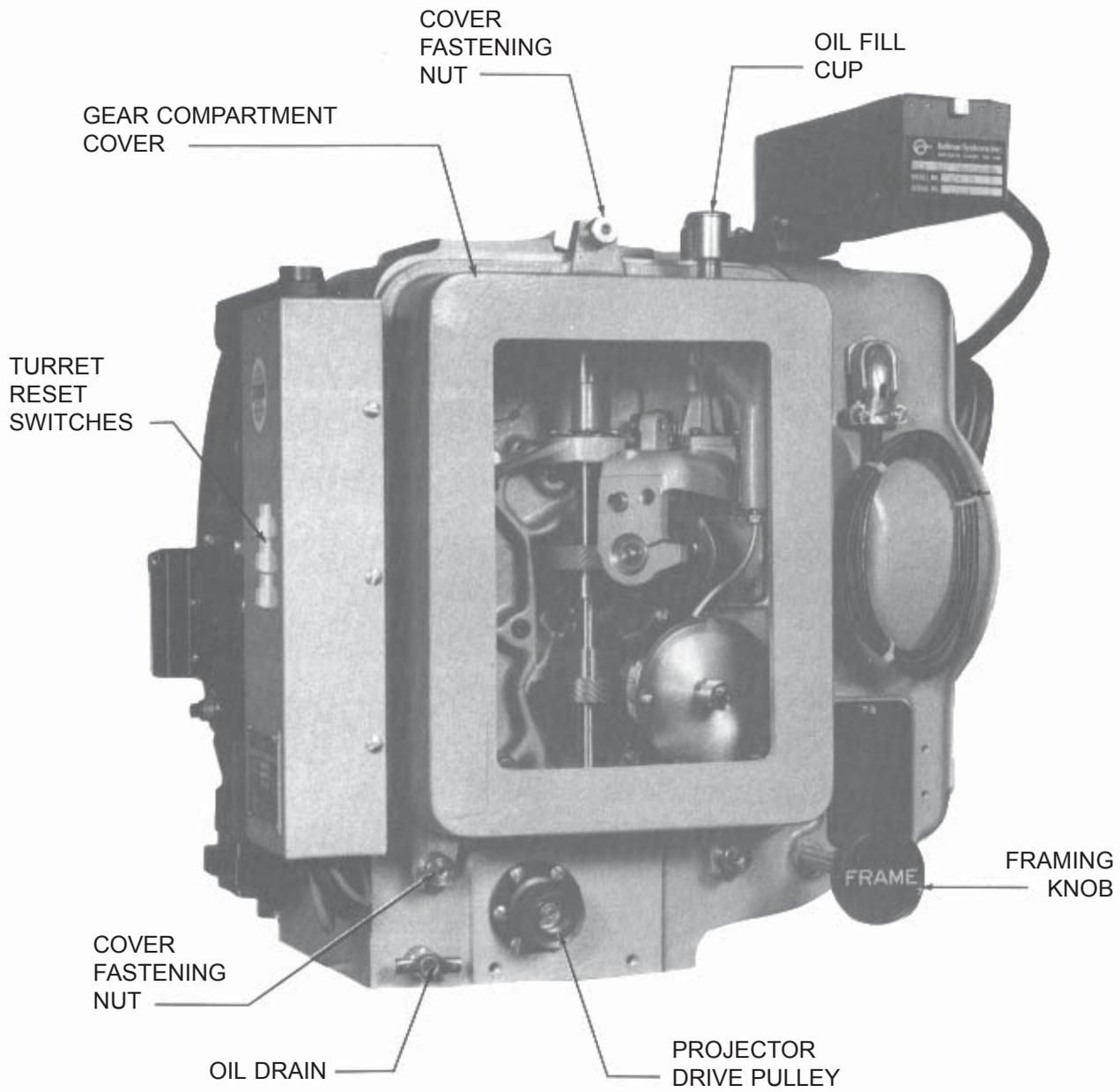


FIGURE 4

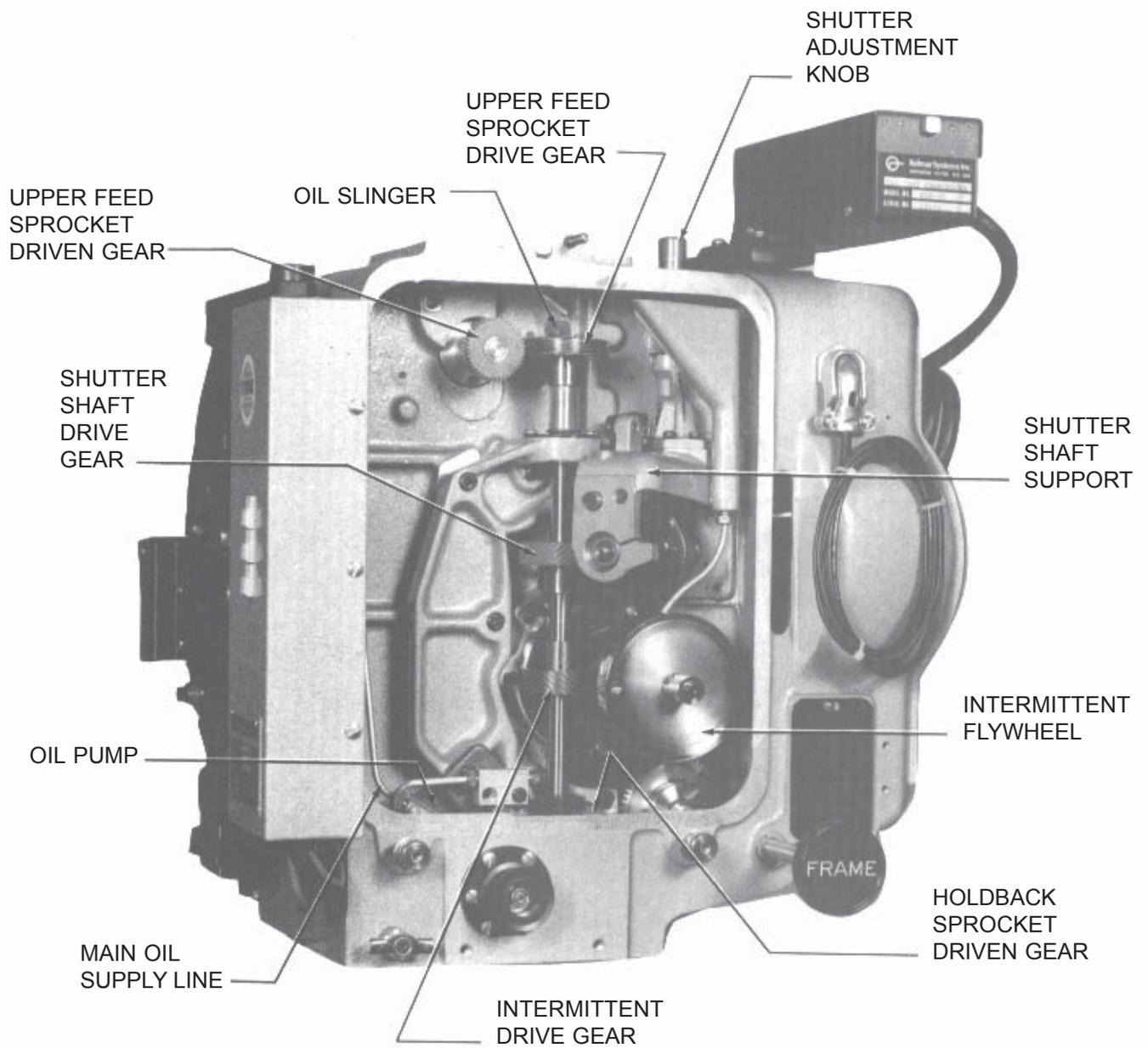


FIGURE 5

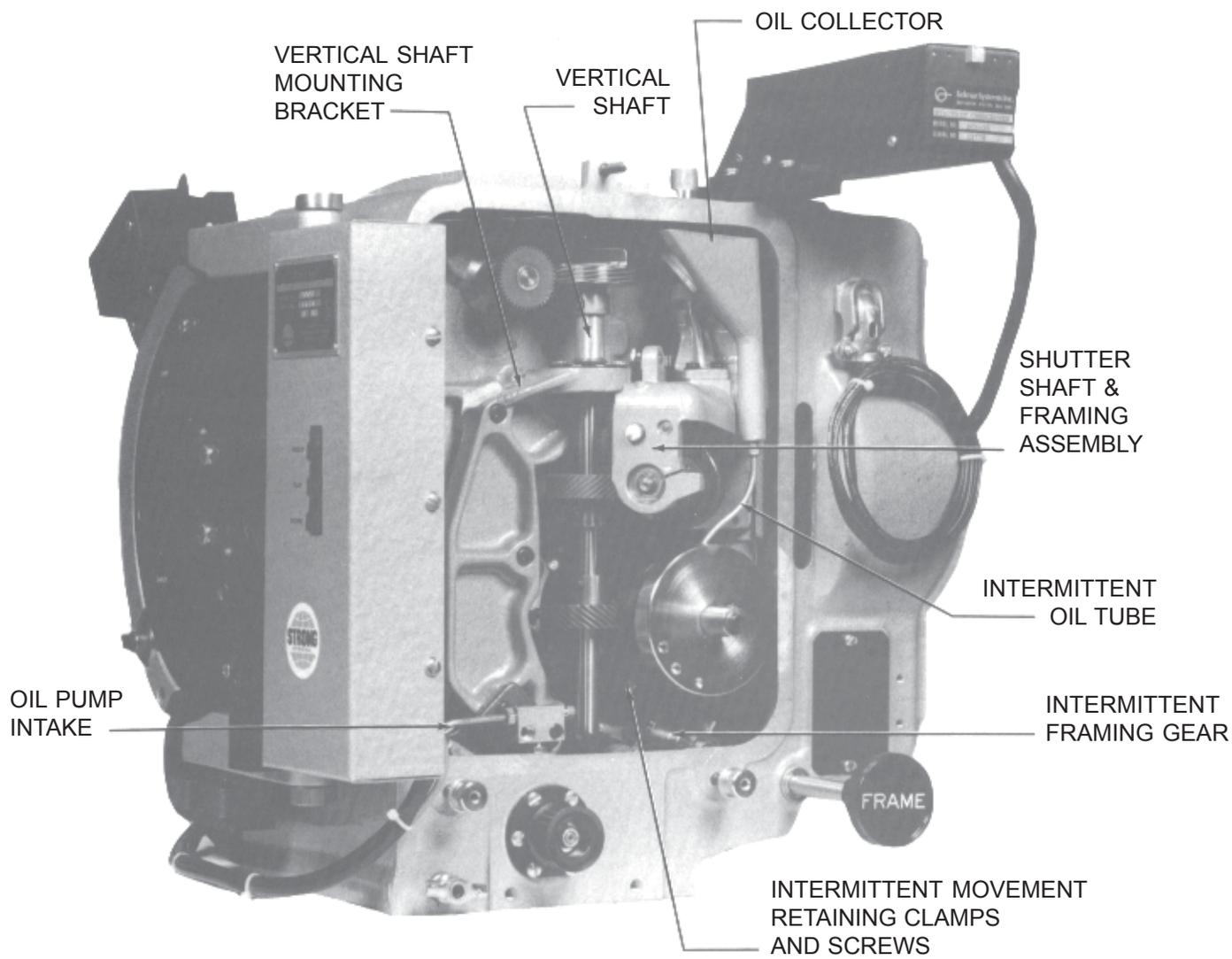


FIGURE 6

ADJUSTMENTS AND REPLACEMENTS

REFER TO THIS SECTION in conjunction to performing the steps in the MAINTENANCE section. Conscientious maintenance and service of the Simplex 35 Projector Mechanism will insure many years of excellent performance.

ADJUSTMENTS are quickly accomplished, and replacements performed, as all units and components are readily removed. Adjustments and replacements described below may be performed by qualified projection booth personnel. Any elements of maintenance and service not detailed below should be referred to an authorized Strong International Dealer.

INTERMITTENT SHOE REPLACEMENT

Open lens turret. Dismount the shoe pad assembly by removing the (2) keeper screws, stud, and coil spring. Replace worn components in *matched pairs* as required. Reassemble and remount. Close the shoes against the intermittent sprocket, and set the pad stop screw (see FILM GATE drawing, Item 7) to allow (1) film thickness of clearance between the shoes and the sprocket face. Tighten the lock nut.

FILM TRAP AND APERTURE CHANGER ASSEMBLY

Dismount the film gate and the shutter guard. To remove the trap from the main frame, cycle the aperture plate to FLAT. Loosen the wing-head, quarter-turn screw and raise the hinged portion of the aperture plate drive. Lifting the hinged plate will expose the slotted head of the trap mounting screw, and allow access for a common flat-bladed screwdriver. Loosen the captive mounting screw, unplug the aperture motor and framing light connectors, and remove the trap assembly from the film compartment.

To replace, make certain that the contacting surfaces on both the mounting plate and the trap casting are clean. Slide the film trap in so that it registers with the (2) dowel pins on the mounting plate. Securely tighten the captive screw. Plug in the aperture change motor and framing light. Lower the hinged plate over the aperture plate and secure using the quarter-turn fastener.

Check the alignment of the intermittent sprocket to the film trap (see INTERMITTENT MOVEMENT section following).

FILM TRAP LATERAL GUIDE ROLLERS

Dismount the film trap and associated components (see above). The (2) bearing blocks retaining the lateral guide rollers are slotted to permit adjusting the position of the rollers on the horizontal plane. Loosen the (2) socket head mounting screws and position the lateral guide rollers to center the film at the picture aperture. Allow adequate end play to permit free movement of the ball bearings. Check the bearings for proper rotation; lubricate as required using a minimum amount of sewing machine oil from an injection applicator. Wipe off excess oil.

Once the lateral guide roller position is correctly set, the position may be fixed by setting the brass stop plate (see Item 62 on the FILM TRAP Parts Drawing in Supplemental Parts List) to rest against the outboard bearing bracket (Item 12). After setting the stop plate, the lateral guide rollers can be removed, cleaned, and replaced, and the correctly centered position will be maintained.

PRESSURE STRAP REPLACEMENT

Dismount the film trap and associated components. Rotate the trap tension knob fully counterclockwise to position "1." Remove the (2) screws from each strap, and remove the straps. Replace with new straps and reassemble. NOTE: Project film to reset gate pressure (see START-UP PROCEDURES).

STUDIO GUIDE REPLACEMENT

Remove the film gate and open the turret assembly. Remove the (2) socket head screws and washers, and dismount the studio guide. Position and install the replacement studio guide; close the turret and replace the film gate.

APERTURE PLATE ADJUSTMENT

Gear mesh between the drive motor spur gear and the rack gear on the aperture slide can be set by loosening the (2) 10-32 socket head screws and moving the motor, on its mounting plate, up or down. The motor plate mounting holes are slotted for this purpose.

Horizontal travel of the aperture plate is also adjustable. The inboard stop is set by loosening the socket head screw inside the eccentric bushing adjacent to the aperture slide and rotating the bushing to the desired stop point. The outboard stop is fixed by positioning a set screw in the housing plate immediately below the aperture drive slide rod.

GEAR COMPARTMENT COVER REMOVAL

Remove the gear compartment cover only when absolutely necessary, and only after the machine has been at rest for at least (10) minutes to allow all oil to settle into the reservoir. Remove the (3) cover fastening thumb nuts. Make certain no foreign material deposits in the gear compartment while the cover is removed. Before replacing the cover, wipe all oil from the cover gasket and the mating surface on the projector main frame. Any oil remaining on these surfaces will provide an oil seepage path after the cover is replaced. Tighten all (3) thumb nuts equally and fingertight, just enough to form an oil-tight seal.

INTERMITTENT MOVEMENT REPLACEMENT

NOTE: Replacement Movement *must* be fitted with 51-48027 O-Ring on case as shown on Page 38.

1. Open the film gate. Rotate the framing knob (on the gear side) fully counterclockwise.
2. Set the shutter adjusting knob in mid-position. To locate mid-position, rotate the knob to its stop, and reverse 1½ turns.
3. Remove the gear compartment cover (see above).
4. Rotate the vertical shaft until the intermittent drive gear mounting screw is visible. Remove the mounting screw and slide the gear downward.
5. Loosen the (2) intermittent retaining clamp screws on the framing cam and position the clamps to clear the intermittent case.
6. Withdraw the intermittent assembly from the gear compartment side, taking care not to strike the intermittent oil feed tube positioned above the intermittent assembly.
7. Slide the replacement intermittent movement into position. The keyway in the intermittent case is aligned with the key in the framing cam.

INTERMITTENT MOVEMENT REPLACEMENT (continued)

8. Rotate the intermittent retaining clamps to retain the intermittent assembly and tighten the fastening screws securely.
9. Rotate the shutter counterclockwise (from the rear of projector) until its leading edge is exactly in line with the upper edge of the picture aperture (aperture just completely blocked).
10. Rotate intermittent flywheel until the intermittent sprocket turns clockwise; (1) of the (4) index lines on the outboard collar will align with the index line on the outboard bearing support arm.
11. Continue to rotate the flywheel in the same direction until the intermittent sprocket just begins to move.
12. Reverse rotation of the flywheel until the sprocket stops. Then, rotate the flywheel counterclockwise until the start of sprocket rotation is felt.
13. Continue to rotate the flywheel until the precise point at which the sprocket is about to move is reached. Retain that setting.
14. Raise the intermittent drive gear and rotate it tooth by tooth until it meshes with the intermittent driven gear. At this time, the mounting hole in the drive gear should align with the hole in the vertical shaft. Do not rotate the vertical shaft or driven gear. Replace the gear mounting screw.
15. Align the intermittent sprocket with the film trap (see below).

INTERMITTENT SPROCKET ALIGNMENT

Loosen the intermittent sprocket fastening screw and slide the sprocket, as required, until the outside face of the sprocket is flush with a straight edge (i.e. machinist's ruler) placed on the outside face of the lower holdback sprocket. Securely tighten the intermittent sprocket fastening screw. Thread a length of scrap film between the upper sprocket and the intermittent sprocket; set lateral guide rollers and studio guide as required.

INTERMITTENT SPROCKET REPLACEMENT

1. Remove film gate. Dismount shutter guard and film trap.
2. Rotate the framing knob to its extreme clockwise position to expose the intermittent sprocket film stripper mounting screw. Remove the screw and stripper.
3. Turn the projector mechanism by hand so that one of the collar index lines aligns with the index mark on the outboard arm, and the sprocket mounting screw is exposed.
4. Remove the intermittent sprocket mounting screw and nut.
5. Loosen the (2) intermittent outboard collar set screws and remove the collar.
6. Remove the (2) outboard arm socket head mounting screws and dismount the outboard arm.
7. Remove the worn intermittent sprocket. Slide the replacement sprocket onto shaft.
8. Position the intermittent outboard bearing arm on intermittent sprocket and start the (2) socket head mounting screws finger tight. Adjust the bearing arm, as required, so that the bearing is precisely centered with respect to the intermittent shaft. Tighten the (2) mounting screws.
9. Fasten the replacement intermittent sprocket to the intermittent shaft using the screw and nut supplied.
10. Slide the intermittent outboard collar on the intermittent shaft and align one of its index lines to the index mark on the outboard bearing arm. Pull the intermittent sprocket OUT while pressing the outboard collar IN, so that shaft end play is just perceptible.
11. Securely tighten the (2) collar set screws. Check that the shaft end play is just perceptible.
12. Replace intermittent sprocket film stripper.
13. Align the intermittent sprocket (see above).
14. Replace film trap and shutter guard. Install the film gate.

OIL PUMP FEED REVERSAL (Drive-In Theatre Operation; Upward Projection Angle)

See PARTS CATALOGUE, Page 1-20. Remove gear compartment cover. Remove compression nut, compression bushing, and oil line and filter from the left-hand side of the oil tube connector. Reconnect parts in sequence on the right-hand side, and tighten. Install the Drive-In Oil Gauge Assembly (G-4350) if desired (see PARTS CATALOGUE, Page 1-18).

FRAMING LIGHT REPLACEMENT

Remove shutter guard. Unplug and dismount L.E.D. Printed Circuit Board assembly from back of framing aperture; replace with new unit. Connect to wire harness; replace shutter guard.

FEED AND HOLDBACK SPROCKET ASSEMBLIES REMOVAL

From the film compartment side, remove the (4) socket head mounting screws retaining the sprocket assembly to the projector main frame. Withdraw the assembly from the film compartment. Make certain that the gasket is in the groove in the sprocket assembly casting.

When replacing, start the mounting screws finger tight. Position the assembly so that there is slight backlash between the meshing gears. The (4) mounting holes in the casting are sufficiently oversize to permit this adjustment. Tighten the mounting screws and check gear backlash. Adjust as required.

FILM SPROCKET REPLACEMENT

1. Remove (1) of the (2) film stripper mounting screws. Loosen the other mounting screw and rotate the stripper to clear the sprocket. NOTE: film stripper used on holdback sprocket only.
2. Open the pad rollers.
3. Remove the hex head sprocket fastening screw from the outboard end of the sprocket shaft and slide the sprocket from the shaft. Leave the spring washer and flat washer on the shaft.
4. Slide the replacement sprocket (G-6611) onto the sprocket shaft, aligning the key in the sprocket with the keyway in the shaft. Secure with the sprocket fastening screw.
5. Replace the film stripper.

FILM SPROCKET DRIVEN GEAR REPLACEMENT

1. Remove film sprocket assembly as a unit (see above).
2. Remove gear fastening screw and slide gear from shaft.
3. Slide replacement gear onto shaft. Insert the fastening screw, position the gear to allow slight end play, and securely tighten fastening screw.
4. Replace sprocket assembly and adjust for backlash (see above).

PAD ROLLER ASSEMBLY REPLACEMENT

1. Remove film sprocket assembly as a unit (see above).
2. Open pad rollers, compress actuating spring on the sprocket assembly so that the small hole in one arm of the forked spring guide is accessible. Pass a pin or paper clip through this hole to relieve the spring tension.
3. Remove pad roller assembly mounting screw and dismount pad roller arm.

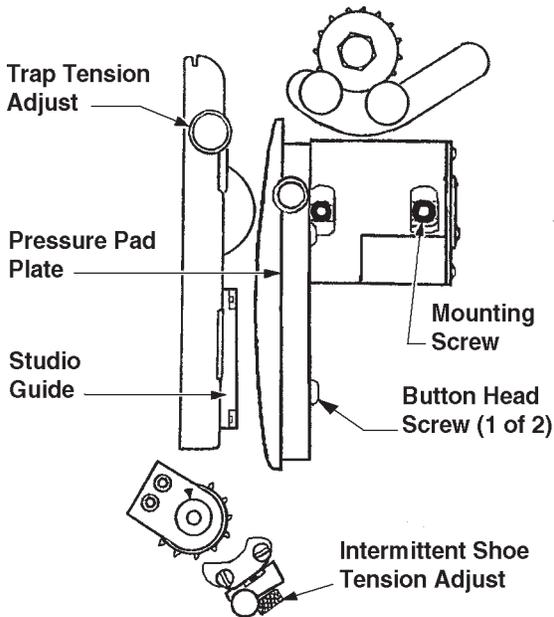
PAD ROLLER ASSEMBLY REPLACEMENT (continued)

4. Replace worn components as required, reassemble, and remove the pin from the spring guide. Spacer washers, if used, are retained in their original positions. Make certain that the pad rollers are centered directly over the film sprocket.
5. Position pad roller arm adjusting screw on the sprocket assembly casting so that, with (2) thicknesses of film between the sprocket and pad rollers, both pad rollers just rotate. Ensure that the adjusting screw locknut is then securely tightened.
6. Reinstall sprocket assembly and adjust for backlash (see above).

SHUTTER TIMING (See Inside Back Cover)

1. Place the shutter adjusting knob in its mid-position. To locate mid-position, rotate the knob to its stop, and reverse 1½ turns. Remove the shutter guard.
2. Turn the projector mechanism by hand so that the index mark on the intermittent outboard bearing arm is centered *between* two of the collar index lines.
3. Loosen the (2) socket head shutter hub clamping screws. With the screws loosened, the shutter blades should rotate freely on its shaft.
4. Hold the motor flywheel to “freeze” the mechanism, so the shutter shaft remains stationary. Rotate the shutter to the fully closed position (one blade completely covering the film aperture).
5. Tighten the (2) hub clamping screws while the shutter shaft remains stationary.
6. Replace the shutter guard. Project a picture and check the screen; a slight adjustment of the shutter fine adjustment knob on the top of the projector may be required to eliminate travel ghost (see preceding START-UP PROCEDURES).

FILM GATE PRESSURE PAD & SUPPORT REPLACEMENT



1. Open the turret. Dismount the gate pressure pad runner by removing the two 10-32 button head cap screws using a 1/8 inch right-angle allen wrench.
2. To remove the sliding gate pressure pad support assembly, dismount the pressure pad. Close the film gate. Slide back to the “thread” position to expose the mounting screw heads. Remove the (2) socket head mounting screws and pull the assembly out of the film compartment.
3. To replace the film gate assembly, install to the mounting plate using the (2) socket head mounting screws. Do not secure the screws until aligning the gate to the trap. Replace the pressure pad runner.
4. Close the film gate and check the alignment between the gate and trap. The pressure pad plate must be parallel to the trap studio guide. Set the spacing between the gate and the trap by placing a 3/16" allen wrench (or similar spacer) between the studio guide and the pressure pad plate with the film gate closed. Securely tighten the (2) mounting screws.
5. Replace the pressure pad runner. The pressure pad mounts to the plate with (2) screws; note *slotted* end of pad at the bottom. Close and latch the turret.

SHUTTER REPLACEMENT

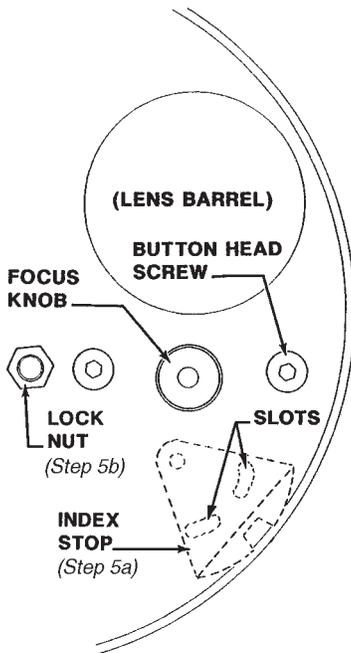
Remove the shutter guard. Disconnect the linkage to the changeover douser. Remove the (4) socket head mounting screws from the rear cover casting, and dismount the cover. Loosen the (2) shutter hub clamping screws and dismount shutter. Install the replacement shutter and set shutter time as detailed in the preceding section. Replace the rear cover, douser linkage, and shutter guard.

AUTOMATIC LENS TURRET

1. Check for correct contact between the turret drive tire and the driven indexing plate. Clean surfaces to prevent dust and dirt build-up; replace O-ring tire(s) if cracked or worn. *Do not lubricate.*
2. Clean the grooves in the (3) indexing plate ball bearings. The top bearing is mounted to an eccentric bushing to permit adjustment; take up any slack as required.
3. Check the (2) coil expansion springs on the index stop pin. Replace with new, matched pair if stretched or worn. Check the expansion spring on the motor mount and replace if stretched.
4. A headless set screw in the center of the turret catch (mounted to the main frame) acts as a deadstop for turret closure. Tighten this screw as required to remove any play from the turret when closed, yet allowing the turret to latch securely. Tighten the 1/4-20 hex nut to lock this adjustment.

NOTE: *Do not attempt to correct "keystoning" by setting this deadstop screw to offset the projection lenses. Lenses must remain on optical center for correct focus.*

LENS POSITIONING

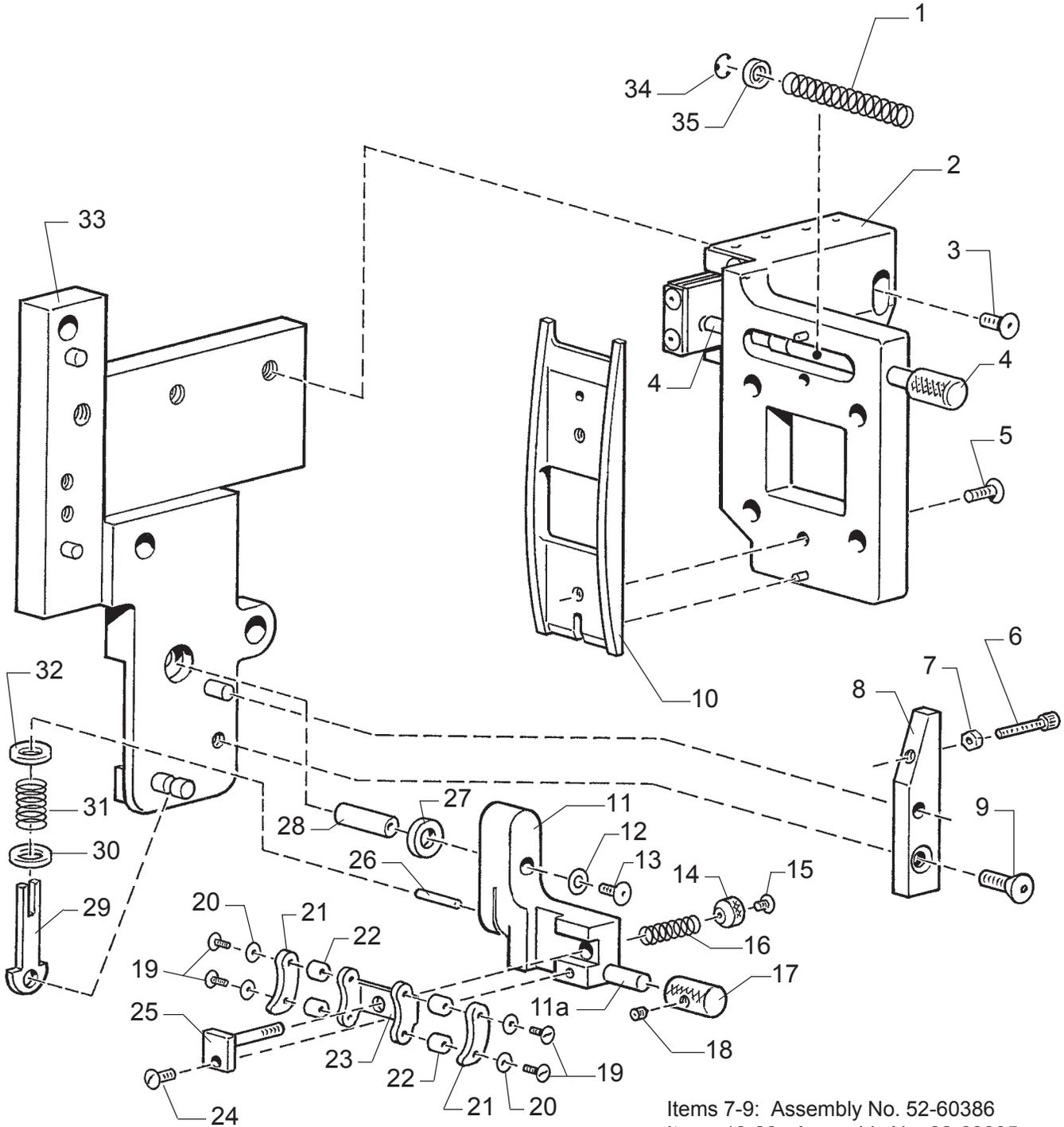


5. Periodically check lens positions and correct as required. Project RP-40 Test Film to the screen and alternate between formats. If the picture shifts up and down, or left to right between formats, the lenses must be re-positioned.
- 5a. The index stops are mounted to the lens indexing plate with (3) screws. Two of the screw holes are slotted to permit fine adjustment of the lens position. Adjust the up-and-down position of the picture on the screen by loosening the (3) mounting screws and turning the slot-headed eccentric stud. When correct, securely tighten the (3) mounting screws.
- 5b. Left-to-right positioning of the picture on the screen is adjusted by loosening the (2) button head socket screws adjacent to the lens (on either side of the focus knob). When slightly loosened, rotate the large lock nut using a 1/2 inch wrench. This moves the eccentric adjustment. Securely tighten the (2) button head screws when the picture is correctly positioned.
6. If a lens change fails to occur when cued, press the desired override switch (FLAT, SCOPE, or SPECIAL) on the turret control box. Check the condition of the cuing material; foil tape may be worn, or bar code information may be obscured by scratches or dirt. Check for faulty cue detector or failed contact in automation controller.
7. A malfunction in aperture/turret logic indicates a problem in the turret control board. Consult the factory. There are *no user-serviceable components* on the printed circuit board.
8. Periodically check the condition of the magnets mounted to the index stops. These magnets are sensed by the proximity switch on the turret ring to determine aperture logic. A single magnet mounted *inboard* denotes FLAT, a single magnet on the *outboard* edge denotes SCOPE, and two magnets (inboard and outboard) indicate SPECIAL (TU2030 only). The magnets are to be positioned close enough to the proximity switch to permit accurate detection, but should not obstruct turret rotation.

AUTOMATIC LENS TURRET (continued)

9. Two L.E.D. indicators on the control cabinet display operation of the aperture-sensing proximity switch. When the upper L.E.D. is illuminated, the proximity switch is sensing the inboard magnet, and setting the FLAT aperture. The lower L.E.D. glows when the proximity switch senses the outboard magnet, and actuates the SCOPE aperture. Both L.E.D.'s glowing simultaneously indicates that the proximity switch senses two magnets, thereby setting the SPECIAL aperture (third lens, when used). Failure of the L.E.D. and/or failure of the aperture to cycle means that the magnets or the proximity switch are loose or out of alignment; adjust as required. Periodically clean the surfaces of the magnets to allow good conduction.

FILM GATE ASSEMBLY

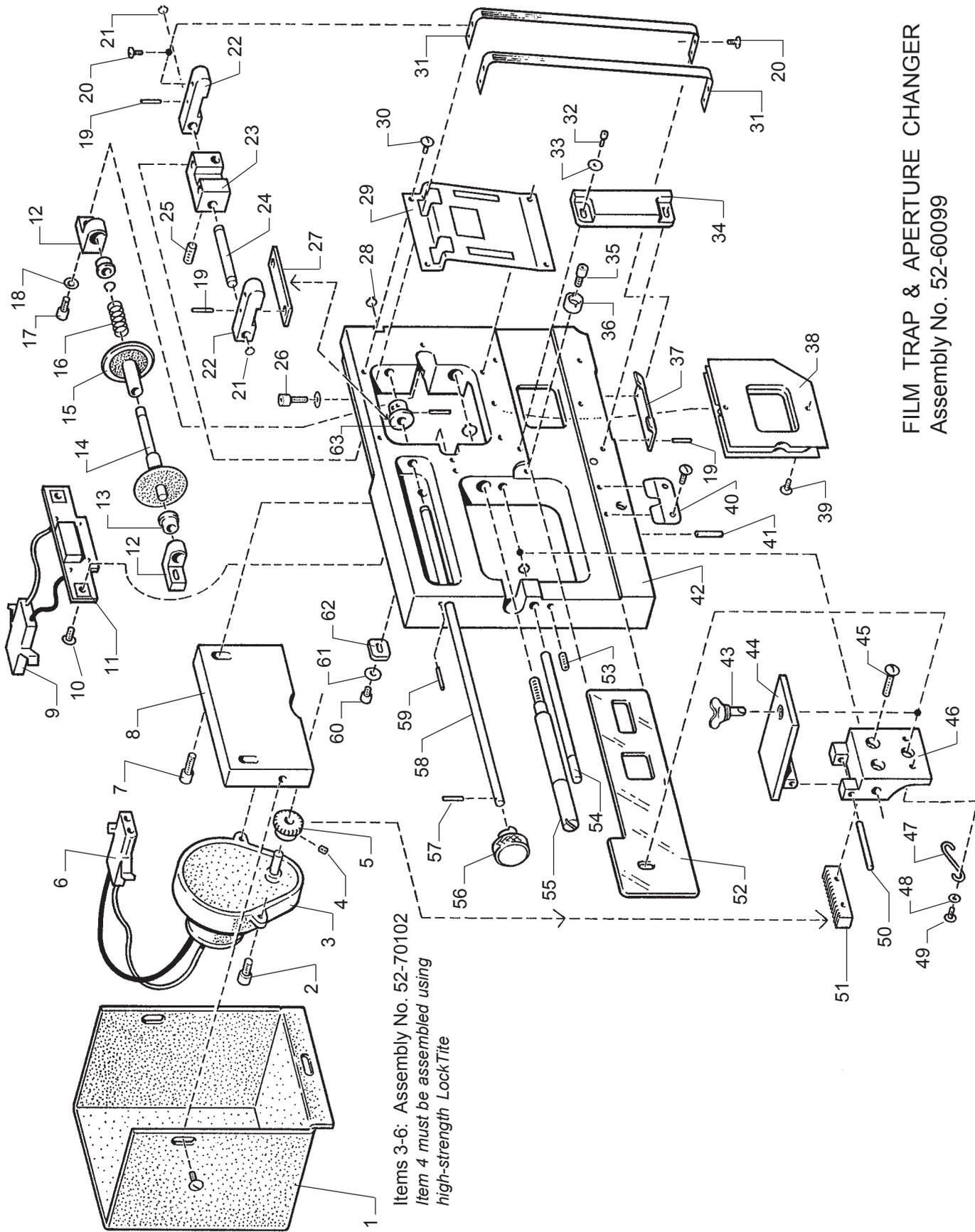


Items 7-9: Assembly No. 52-60386
 Items 19-23: Assembly No. 82-60005

FILM GATE ASSEMBLY

Parts List

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	SG-2406	Compression Spring (81-58016)
2	P-10230	Film Gate Support & Linear Bearing Assembly (52-00201)
3	SC-2408	Mounting Screw, Gate Assembly (81-51020; 2 req'd.)
4	ST-2410	Gate Locating Pin Assembly (82-20362)
5	4100629	Screw, 10-32 x 5/8" Button Head (2 req'd.)
6	4081000	Screw, 8-32 x 1" Stainless Steel Socket Head
7	4088001	Lock Nut, 8-32 Hex
8	P-10189	Arm, Pad Stop Adjustment (52-20780)
9	4250750	Screw, 1/4-20 x 3/4" Flat Head
10	P-4068	Pressure Pad (51-98114)
11	P-10126	Pivot Arm, Intermittent Shoe Pad (51-98321)
11a	P-10128	Arm Opening Shaft (52-20761)
12	P-4986	Fender Washer, #10 (52-40102)
13	4110500	Screw, 10-24 x 1/2" Stainless Steel Socket Head
14	NU-0046	Knurled Nut, Tension Adjust (81-35006)
15	SC-0708	Stop Screw, 3-48 x 1/8" Round Head (81-51042)
16	SG-2511	Compression Spring (81-58017)
17	P-3134	Knurled Knob (51-28003)
18	4080120	Set Screw, 8-32 x 1/4"
19	4040275	Screw, 4-40 x 3/8" Pan Head (4 req'd.)
20	4047101	Flatwasher, #4 (4 req'd.)
21	PA-0195	Outer Sprocket Shoe (82-00093; 2 req'd.)
22	SA-0033	Spacer, Sprocket Shoe (82-20444; 4 req'd.)
23	PA-0194	Inner Sprocket Pad (81-98097)
-	C1-BB-28	Sprocket Pad & Shoe Assembly (Items 19-23; 82-60005)
24	4060253	Screw, 6-32 x 1/4" Socket Head
25	C1-BB-27	Stud & Pad Assembly (82-00054)
26	21-37008	Dowel Pin, 1/8 x 1/2"
27	4137101	Washer, 5/16" I.D. x .005" Thick
28	P-10127	Pivot Stud (52-20760)
29	P-1443	Spring Guide (52-00082)
30	P-1442	Spring Retainer (51-98054)
31	P-5166	Compression Spring (51-58016)
32	P-1442	Spring Retainer (51-98054)
33	52-60378	Base Plate & Pins
-	4110622	Mounting Screw, Upper; 10-24 x 5/8" Socket Head (1 req'd.)
-	4110750	Mounting Screw, Lower; 10-24 x 3/4" Socket Head (2 req'd.)
34	RI-0618	Retaining Ring (81-48007)
35	SA-2442	Spacer (51-56012)



Items 3-6: Assembly No. 52-70102
 Item 4 must be assembled using
 high-strength LockTite

FILM TRAP & APERTURE CHANGER
 Assembly No. 52-60099

FILM TRAP & APERTURE CHANGER

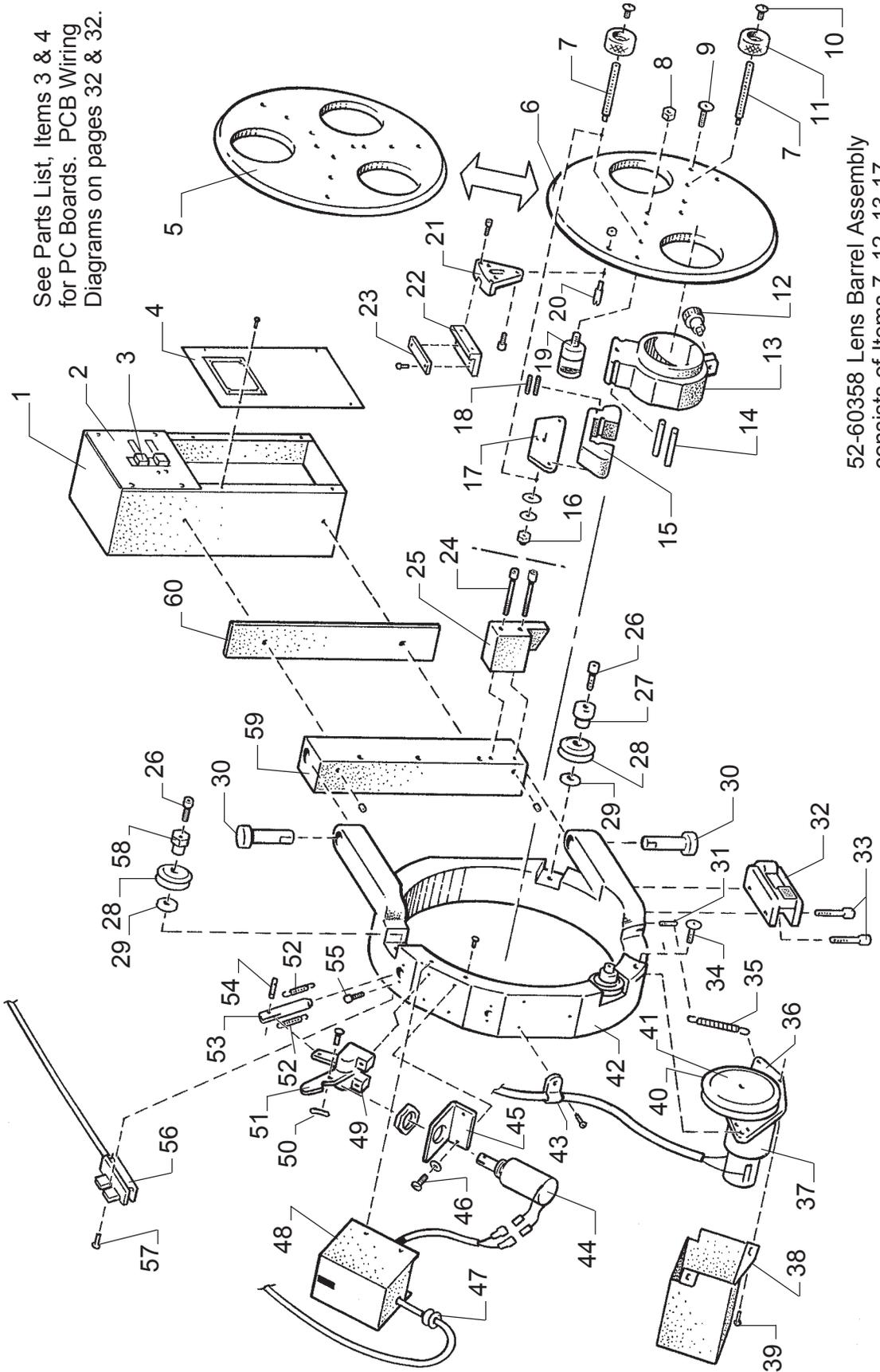
Parts List

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	P-8003	Motor Cover & Heat Shield (52-40251)
-	4060250	Mounting Screw, 6-32 x 1/4" Bind Head (2 req'd.)
2	4040252	Motor Mounting Screw, 4-40 x 1/4" Socket Head (2 req'd.)
3	52-70102	Aperture Plate Drive Motor Assembly, 12 V.DC, 72 rpm
-	52-00135	Wire Harness, Motor to Controller Cabinet
4	4060123	Set Screw, Spur Gear; 6-32 x 1/8"
5	GR-0304	Spur Gear, Aperture Plate Drive (82-20371)
6	21-40019	Molex Plug, Two-Pin (incl. with Item 3)
7	4100500	Screw, 10-32 x 1/2" Socket Head (2 req'd.)
8	P-8004	Motor Mounting Plate (52-20728 as shown; Dual Aperture)
-	P-10063	Motor Mounting Plate (52-20741 not shown; Triple Aperture)
9	21-40019	Molex Plug, (2) Pin (included with Item 11)
10	4040180	Screw, 4-40 x 3/16" Pan Head (2 req'd.)
11	P-10078	L.E.D. Framing Light Assembly (52-70075; includes Item 9)
12	P-8002	Bearing Bracket (52-20727; 2 req'd.)
13	51-04020	Ball Bearing (2 req'd.)
14	G-4435	Lateral Guide Roller, Fixed (51-52011)
15	P-4166	Lateral Guide Roller, Spring-Loaded (51-49012)
16	P-1701	Compression Spring (51-58020)
-	51-48008	Snap Ring, Spring Retainer (2 req'd.)
17	4040373	Screw, 4-40 x 3/8" Socket Head (2 req'd.)
18	4047101	Flatwasher, #4 (2 req'd.)
19	H-3108	Dowel Pin (4 req'd.) Order 51-37015
20	4020180	Screw, 2-56 x 3/16" (4 req'd.)
21	P-4089	Snap Ring (51-48008; 2 req'd.)
22	P-4073	Strap Tension Arm (52-20162; 2 req'd.)
23	P-4075	Block, Tension Arm Pivot Shaft (52-20164)
24	P-4074	Pivot Shaft, Strap Tension Arms (52-20163)
25	51-98211	Spring Plunger, Locking
26	4040252	Screw, 4-40 x 1/4" Socket Head (2 req'd.)
27	P-4079	Leaf Spring, Strap Tensioner (51-58033)
28	P-4089	Snap Ring, Cam Shaft (51-48008)
29	P-4071	Threading Guide (False Aperture; 51-98116)
30	4040180	Screw, 4-40 x 3/16" Pan Head Brass (4 req'd.)
31	P-4078	Tension Strap (51-42001; 2 req'd.) <i>Replace in Matched Pairs</i>
32	4020253	Screw, 2-56 x 1/4" Socket Head (2 req'd.)
33	P-5193	Flatwasher, #2 (51-70037; 2 req'd.)
34	P-10027	Studio Guide (52-20646)
35	4040252	Screw, 4-40 x 1/4" Socket Head
36	EC-0030	Eccentric Bushing, Aperture Plate Stop (81-37014)
37	P-4069	Tension Strap Support Plate (51-98115)

FILM TRAP & APERTURE CHANGER

Parts List (continued)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
38	G-2614	Aperture Heat Shield, Air Cooled (52-60037)
-	G-4400	Aperture Heat Shield, Water Cooled (52-40057; not shown)
39	4040180	Screw, 4-40 x 3/16" Pan Head (2 req'd.)
40	51-10013	Aperture Plate Clamping Spring
-	4080253	Mounting Screw, 8-32 x 1/4" Bind Head (2 req'd.)
41	21-37004	Roll Pin, 1/8 x 1/2"
42	P-8000	Base Plate, Machined (52-20725 as shown; Dual Aperture)
-	P-10044	Base Plate (52-20736 not shown; Triple Aperture)
-	P-10045	Plate Extension (52-20737 not shown; for P-10044)
43	ST-2474	Latching Stud, Wing Head (81-98121), with Item 47
-	BU-1366	Bushing (82-20448)
-	RI-0627	Stud Retaining Ring (81-40005)
44	CP-0921	Hinged Plate, Aperture Drive (81-10016)
-	51-37009	Dowel Pin (not shown)
45	4040620	Mounting Screw (for Item 51), 4-40 x 5/8" Bind Head (2 req'd.)
46	BR-1371	Slider Bracket, Aperture Drive (81-06030)
47	SG-2475	Catch Spring (81-37011), with Item 43
48	WA-0379	Washer, #3 (51-70037; 2 req'd.)
49	4030181	Screw, 3-48 x 3/16" Socket Head (2 req'd.)
50	PN-1294	Hinge Pin (81-37022)
51	RK-0562	Rack Gear, Dual Aperture Drive (81-98141)
-	P-10060	Rack Gear, Triple Aperture Drive (52-20738 not shown)
52	P-8005	Dual Aperture Plate, 52-20729 (52-20740 Undersize; 52-40277 Pinhole)
-	P-10043	Triple Aperture Plate (52-20735 not shown)
53	408037A	Set Screw, Aperture Plate Stop; 8-32 x 3/8"
54	RD-0626	Slide Rod, Dual Aperture Drive (82-20355)
-	P-10061	Slide Rod, Triple Aperture Drive (52-20739 not shown)
-	RI-0828	Retaining Ring, Slide Rod (81-48002)
55	P-1981	Trap Mounting Screw, Captive (52-20142)
-	P-1556	Retaining Ring, Captive Screw (51-48003)
56	P-4077	Knurled Knob, Trap Tension Adjust (52-00063)
57	H-3107	Knob Retaining Pin, 3/64 x 5/16" (51-37015)
58	P-9831	Cam Shaft, Trap Tension (52-20248)
59	H-3108	Roll Pin, .052 x 5/16" (51-37015)
60	4040252	Screw, 4-40 x 1/4" Socket Head
61	4107101	Flatwasher, #4
62	P-8001	Fixed Roller Bracket Stop Plate, Brass (52-20726)
63	P-4092	Tensioning Cam (51-98070)
-	H-3107	Retaining Pin, Cam (51-37015)
		TRIPLE APERTURE PLATE PARTS (NOT SHOWN)
	P-10069	Solenoid (52-20743 120 V.AC; 52-20767 12 V.DC)
	P-10062	Aperture Cam (52-20744)
	P-10068	Pivot Rod (52-20742)
	SG-2405	Spring (81-58018)
	82-20076	Pivot Lock



See Parts List, Items 3 & 4
for PC Boards. PCB Wiring
Diagrams on pages 32 & 32.

52-60358 Lens Barrel Assembly
consists of Items 7, 12, 13-17

TU2020, TU2030 LENS TURRET
P-10123 Millennium Type

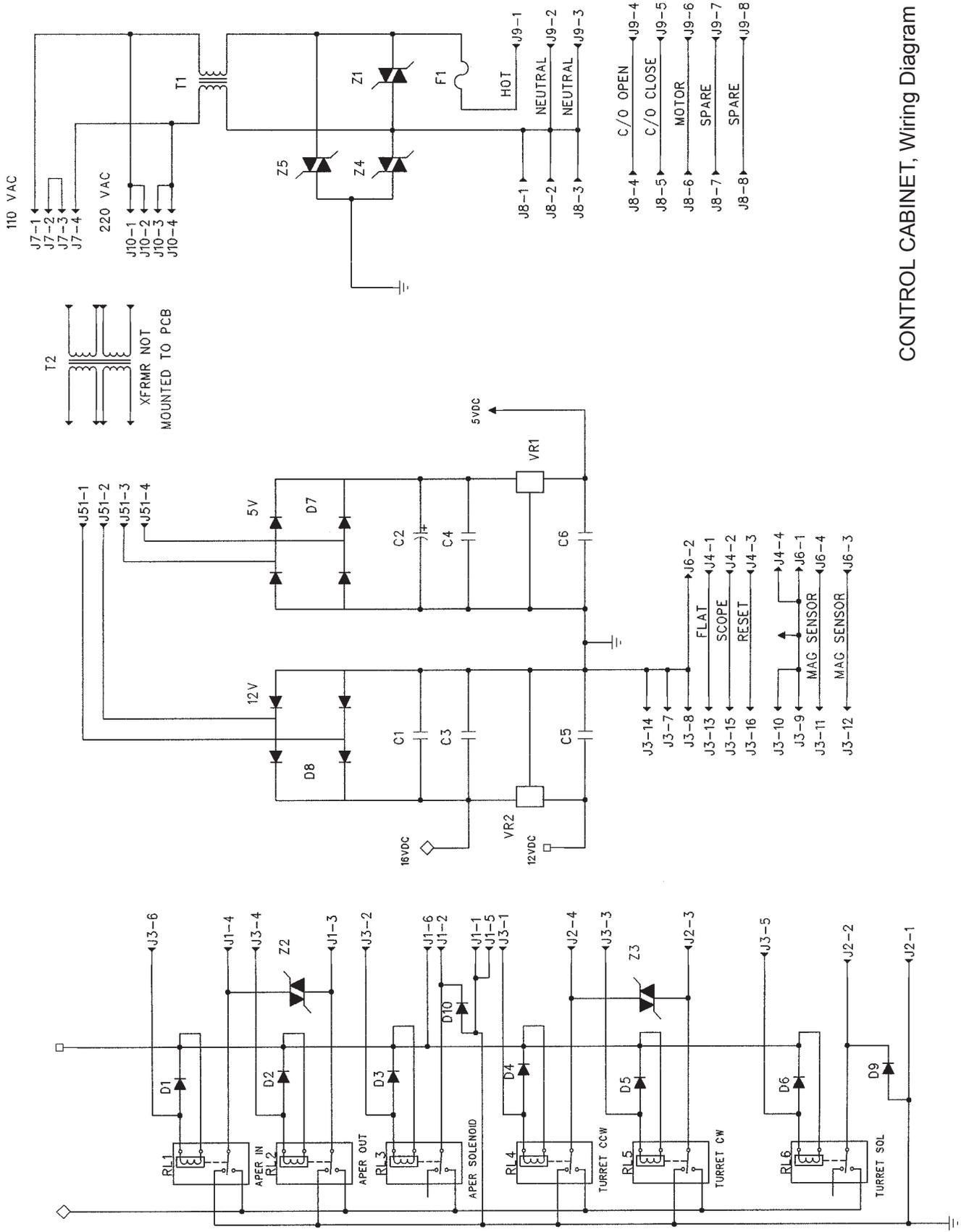
SIMPLEX LENS TURRET

Parts List

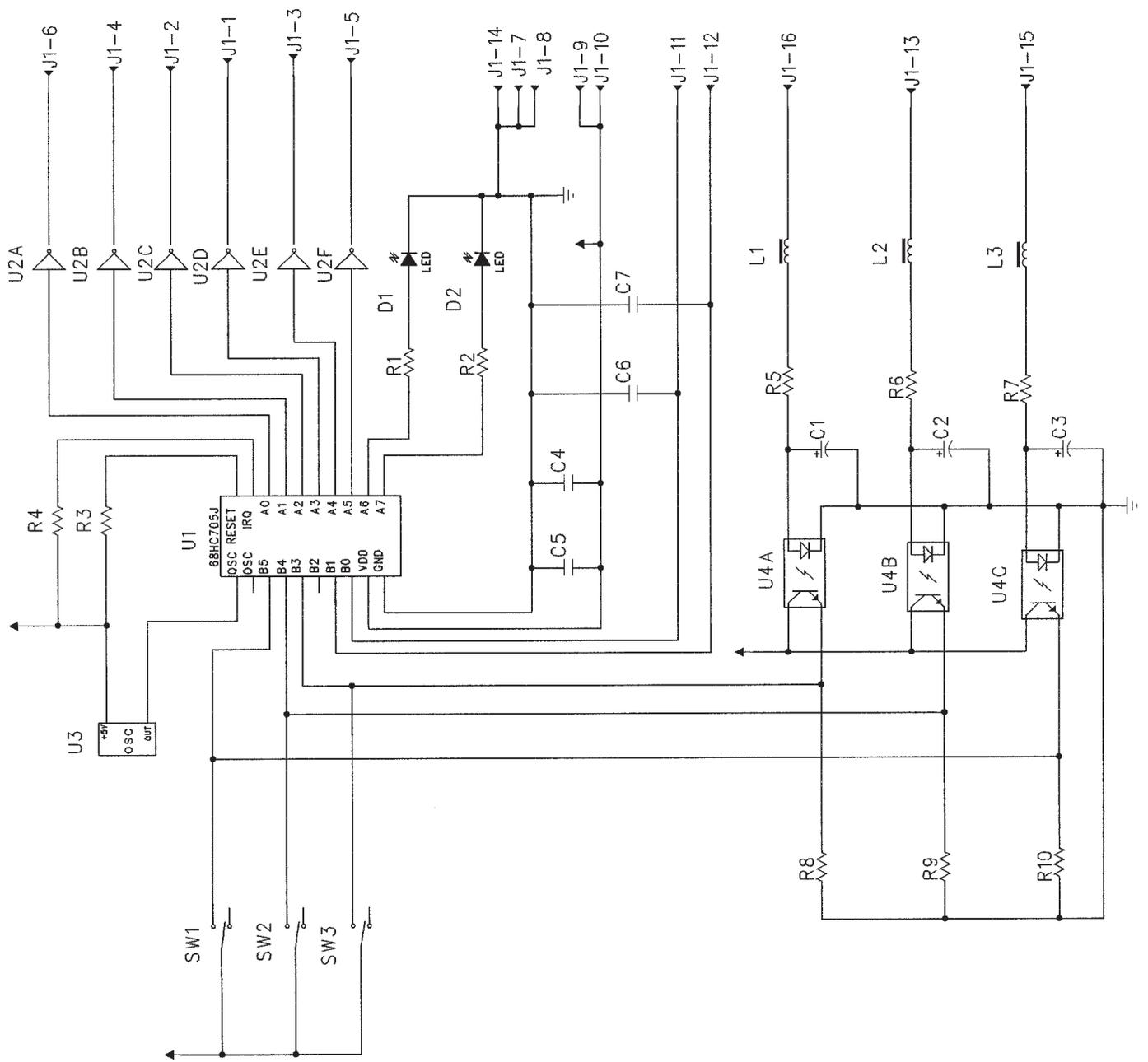
<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	P-10093	Cabinet, Printed Circuit Boards (52-40262)
2	P-10092	Upper Cover, Control Cabinet (52-40263 as shown; Two-Lens)
-	P- 10149	Cover, Control Cabinet; Three-Lens (52-402484 not shown)
3	51-61006	Switch, Lens Re-Set (with Printed Circuit Board)
-	52-70081	Turret Control PC Board, Two-Lens, 115/230 V.AC
-	52-70091	Turret Control PC Board, Three-Lens, 115/230 V.AC
-	52-70080	Relay PC Board Assembly (not shown; concealed by Item 2)
-	51-13006	Ribbon Cable
4	P-10091	Lower Cover Panel, Control Cabinet (52-40264)
-	P-10121	Transformer, T2 (52-70079 not shown)
-	52-70077	Power Distribution PC Board (not shown)
5	P-7776	Indexing Plate, Three-Lens (52-20599)
6	P-7847	Indexing Plate, Two-Lens (52-20662)
7	P-7764	Lens Focus Screw (51-52022)
8	4328002	Hex Nut, 5/16-24 NyLock
9	4320750	Button Head Screw, 5/16-24 x 3/4" Stainless Steel
10	4100371	Screw, 10-32 x 3/8" Pan Head
11	21-28010	Knob, Lens Focus Screw
12	21-28022	Knob, Lens Locking Screw
-	P-7905	Lens Locking Screw (52-20668 Two-Lens)
-	4101005	Lens Locking Screw (Three-Lens)
13	P-7779	Lens Barrel Casting (52-20766)
14	P-7772	Slide Rod, Lens Barrel (52-20596; 2 req'd.)
15	P-7778	Base Mount Casting, Lens Barrel (52-20765)
16	4068008	Lock Nut, Focus Screw; 6-32 Acorn
-	21-70028	Wave Spring Washer, #6
-	4067100	Flat Washer, #6 Stainless Steel
17	P-7780	Back Plate, Lens Base (51-29020)
18	4108002	Set Screw, 10-32 x 5/8" (2 req'd.)
-	4108001	Lock Nut, 10-32 Hex (not shown; 2 req'd.)
19	P-7775	Eccentric Screw, Horizontal Adjust (51-98354)
20	P-7789	Eccentric Screw, Vertical Adjust (52-20618)
-	4108002	Hex Nut, 10-32 NyLock
21	P-7790	Catch Bracket, Index Stop Pin (52-20619)
-	4100620	Bracket Mounting Screw, 10-32 x 5/8" Soc. Head (3 req'd.)
22	P-10119	Magnet Mounting Bracket (52-20755)
23	P-10122	Magnet (51-61017; 2 req'd. for Third Lens)
24	4040252	Mounting Screw, 4-40 x 1/4" Socket Head (2 req'd.)
25	P-7828	Pivot Stop Bracket (52-20628)
26	4251250	Screw, 1/4-20 x 1-1/4" Stainless Steel Socket Head
27	51-07012	Straight Bushing, Lower (2) Bearings
28	51-49010	Ball Bearing, Indexing Plate (3 req'd.)
29	4257102	Flat Washer, 1/4" (3 req'd.)
30	P-7765	Hinge Pin, Turret Ring (52-20603; 2 req'd.)
-	4250375	Set Screw, Hinge Pin Retaining; 1/4-20 x 3/8"

TURRET PARTS LIST (continued)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
31	P-7843	Spring Retaining Rod (52-20641)
32	G-7980	Turret Latch Assembly (52-60328)
-	P-7770	Latch (51-18017)
-	21-37038	Stop Pin
-	21-58038	Compression Spring
-	P-7771	Latch Plate (Order 52-60328)
-	P-7979	Strike Plate (Order 52-60328)
-	51-51011	Pivot Bolt
-	P-7774	Turret Catch (51-98353 not shown; mounts to Projector Main Frame)
-	4518006	Mounting Nut, Turret Catch; 1/2-13 Hex
-	4252002	Turret Deadstop Screw, 1/4-20 x 2" Headless
33	4100500	Mounting Screw, 10-32 x 1/2" Socket Head (2 req'd.)
34	51-51011	Shoulder Screw, Motor Mount Pivot
35	P-3045	Expansion Spring, Motor Tension (51-58039)
36	P-10115	Motor Mounting Plate (52-40269)
37	51-33030	Drive Motor, 12 V.DC
38	P-10148	Cover, Drive Motor (52-40485)
39	4060250	Cover Mounting Screw, 6-32 x 1/4" Pan Head (2 req'd.)
40	21-48001	O-Ring Drive Tire (2 req'd.)
41	P-7794	Drive Wheel Hub (52-20613)
42	P-7777	Turret Ring Casting (52-20637)
43	41-10005	Cable Clamp, 3/8" Nylon
-	4060250	Screw, 6-32 x 1/4" Pan Head
-	P-10104	Wire Harness, Motor & Solenoid (52-70083)
44	P-10116	Solenoid (52-70085, includes Nut & Lockwasher)
45	P-10124	Solenoid Mounting Bracket (52-40276)
46	4100374	Bracket Mounting Screw, 10-32 x 3/8" Socket Head (2 req'd.)
47	41-98002	Grommet
-	P-10104	Wire Harness, Motor & Solenoid (52-70083)
48	P-10117	Solenoid Cover, Welded Assembly (52-40275)
-	4060250	Cover Mounting Screw, 6-32 x 1/4" Pan Head
49	P-10118	Lever Mounting Bracket (52-20757)
-	4060256	Set Screw, 6-32 x 1/4"
-	4060502	Bracket Mounting Screw, 6-32 x 1/2" Soc. Head (2 req'd.)
50	01704000	Hitch Pin, 1/16" Diameter
-	P-7966	Clevis Pin, 1/8" Diameter (51-98254)
51	P-7785	Lever, Index Pin Re-Set (52-40220)
52	P-7786	Expansion Spring (51-58057; 2 req'd.)
53	P-7784	Index Stop Pin, Tapered (51-37030)
54	P-7787	Spring Tension Shaft, Grooved (52-20616)
55	4040252	Screw, Spring Retaining; 4-40 x 1/4" Socket Head (2 req'd.)
56	52-70078	Aperture Sensor Switch, Wired Assembly
57	4060250	Switch Mounting Screw, 6-32 x 1/4" Pan Head
58	51-07013	Eccentric Bushing (Top Bearing only)
59	P-10079	Mounting Bar, Turret to Main Frame (52-20747)
-	4251750	Bar Mounting Screw, 1/4-20 x 1-3/4" Socket Head
60	P-7890	Shim Strip, Control Cabinet (52-40219)

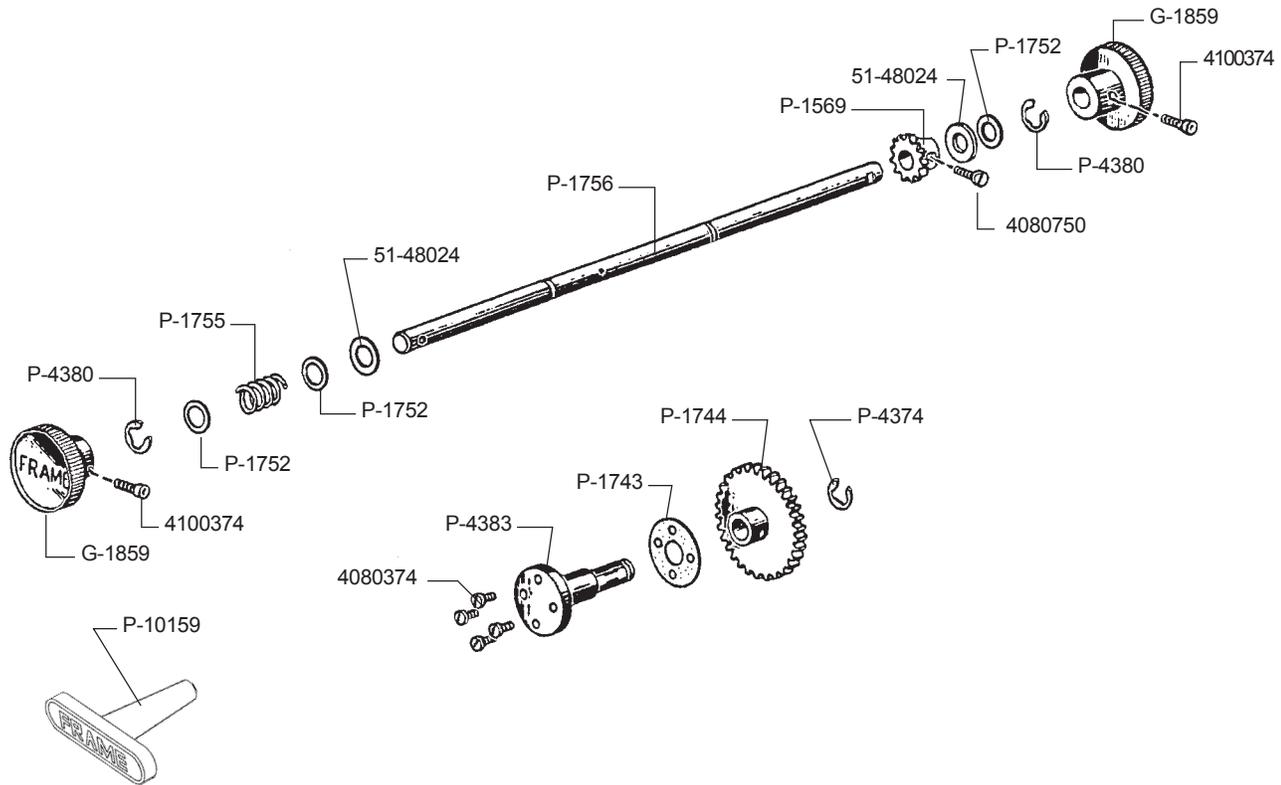


CONTROL CABINET, Wiring Diagram



TURRET CONTROL PRINTED CIRCUIT BOARD
Wiring Diagram

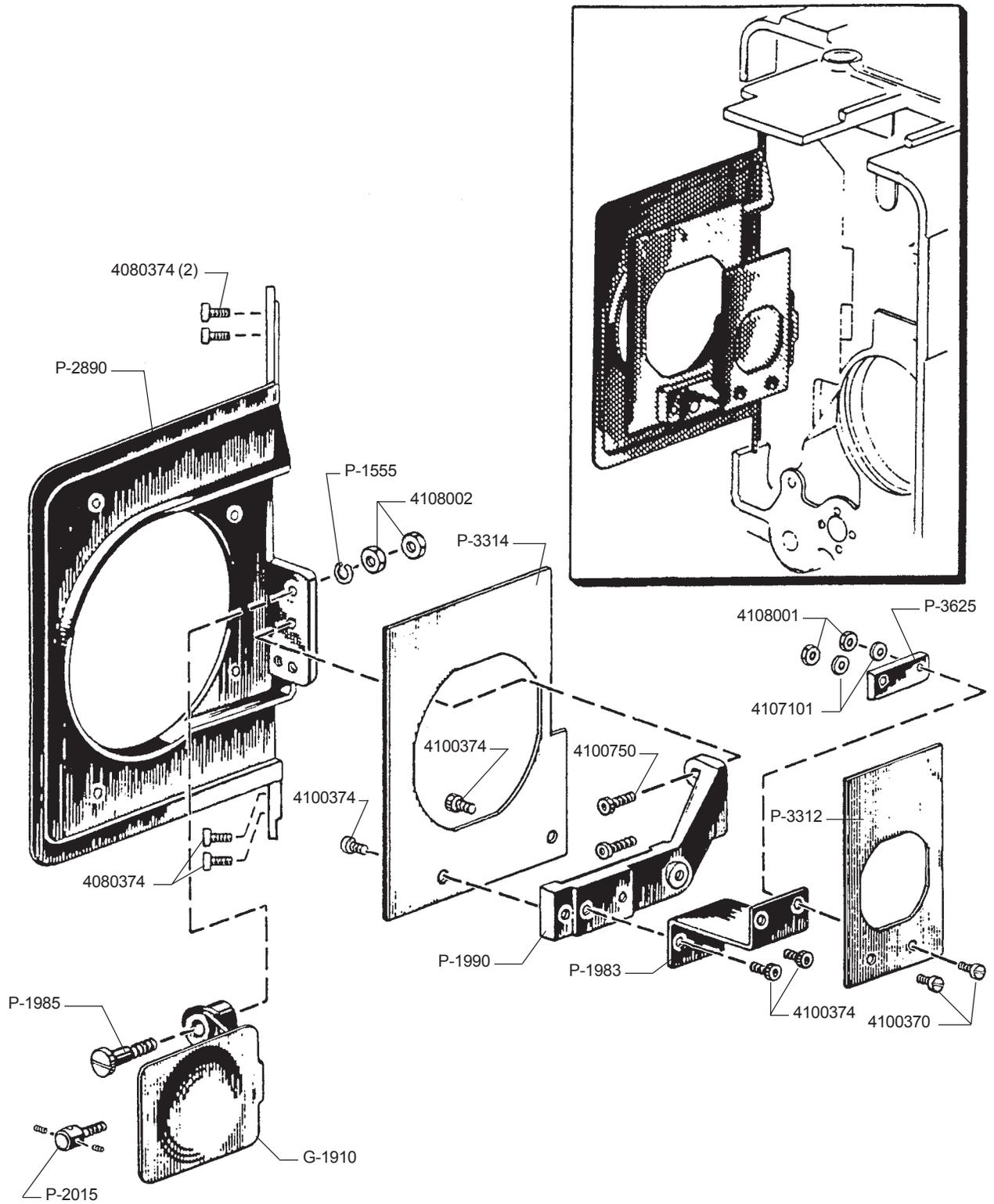
FRAMING SHAFT ASSEMBLY



G-1859	Framing Knob (51-28002)
P-1569	Framing Gear (51-23024)
P-1743	Gasket, Idler Gear Shaft (51-22007)
P-1744	Idler Gear (52-20459)
P-1752	Framing Shaft Friction Disc Washer (52-40122)
P-1754	Framing Shaft Gasket (51-22013)
P-1755	Friction Spring (51-58036)
P-1756	Framing Knob Shaft (52-20153)
P-4374	Snap Ring, Idler Gear (51-48010)
P-4380	Snap Ring, Framing Shaft (51-48004)
P-4383	Idler Gear Shaft (52-20168)
P-10159	Framing "T" Handle (51-28025; after January 1998)
4080374	Fastening Screw, Idler Gear Shaft
4080750	Framing Gear Fastening Screw
4100374	Collar Fastening Screw, Framing Knob
51-48024	O-Ring, Oil Seal (51-48024)

P-10159 Handle may be used to replace G-1859 Knob if desired; 4100374 Screw mounts either component.

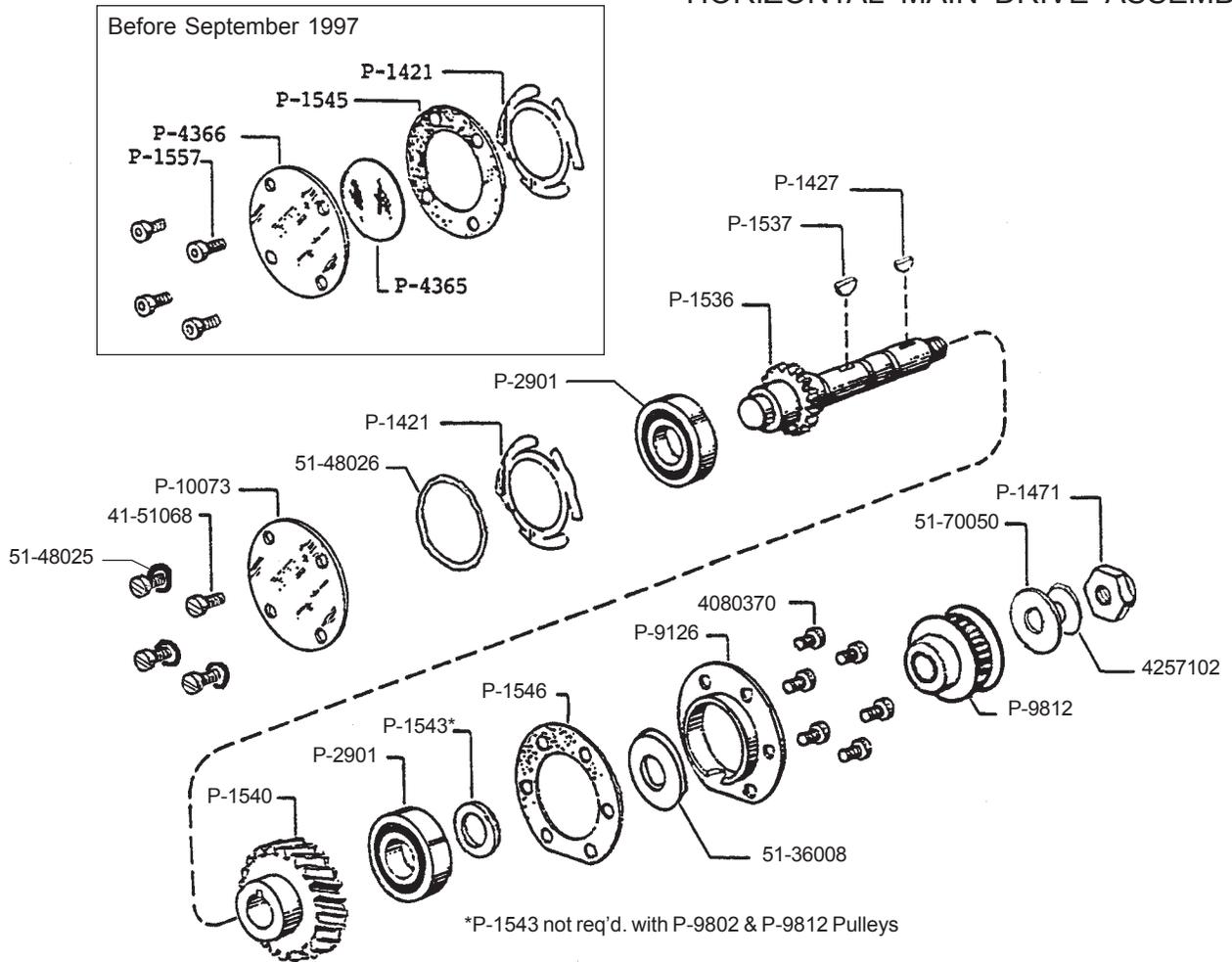
HEAT SHIELD & CHANGEOVER DOUSER



HEAT SHIELD & DOUSER
Parts List

G-1910	Douser Plate, Welded Assembly
P-1555	Lockwasher, Pivot Screw (as req'd.)
P-1983	Front Heat Shield Mounting Bracket
P-1985	Shoulder Screw, Douser Pivot
P-1990	Heat Shield Support Bracket
P-2015	Pivot Clamp & Set Screws, Douser Cable
P-2890	Rear Cover Casting
P-3312	Front Heat Shield
P-3314	Rear Heat Shield
P-3625	Douser Stop Plate
4080374	Fastening Screw, Rear Cover; 8-32 x 3/8" (4 req'd.)
4100370	Screw, 10-32 x 3/8" Button Head
4100374	Screw, Heat Shield Mounting Bracket; 10-32 x 3/8" (4 req'd.)
4100750	Fastening Screw, Support Bracket (2 req'd.)
4107101	Washer, #10
4108001	Hex Nut, 10-32
4108002	Hex Nut, Pivot Screw (2 req'd.)

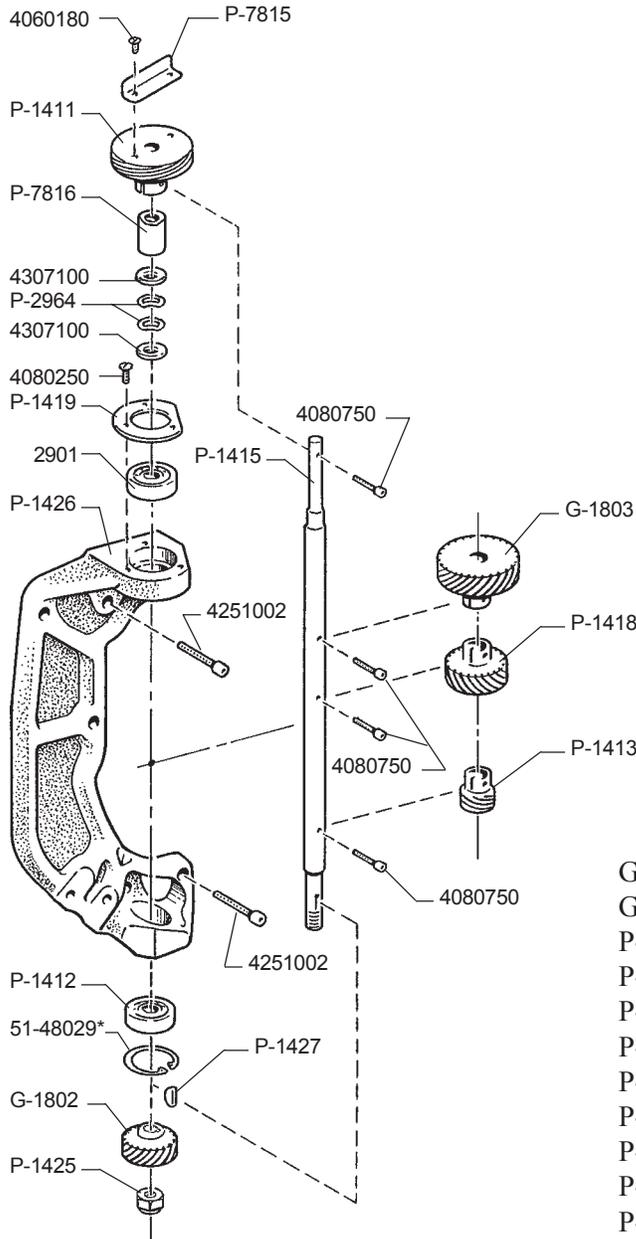
HORIZONTAL MAIN DRIVE ASSEMBLY



- | | | | |
|--------|--------------------------------------|----------|----------------------------------|
| P-1421 | Spring Washer (51-58040) | P-9129 | Ball Bearing Retainer (52-20336) |
| P-1427 | Key, Main Drive Pulley (51-27002) | P-9812 | Drive Pulley (51-43018) |
| P-1471 | Hex Nut, NyLock (51-35003) | P-10073 | Cover Plate (52-20745) |
| P-1536 | Main Drive Shaft & Gear (51-52021) | 4080370 | Retainer Screw (6 req'd.) |
| P-1537 | Key, Main Drive Gear (51-27004) | 4080507 | Screw, Truss Head (4 req'd) |
| P-1540 | Vertical Shaft Drive Gear (51-23023) | 4257102 | Steel Washer |
| P-1543 | Thrust Washer (52-20148; as req'd.) | 51-36008 | Oil Seal |
| P-1545 | Gasket (51-22003; before 9-97) | 51-48025 | O-Ring (4 req'd.) |
| P-1546 | Retainer Gasket (51-22004) | 51-48026 | O-Ring, Large |
| P-1557 | Screw, Socket Head (4080374) | 51-70050 | Teflon Washer |
| P-2901 | Ball Bearing (21-04021; 2 req'd.) | | |
| P-4365 | Spacer Disc (52-40044; before 9-97) | | |
| P-4366 | Cover Plate (51-98125; before 9-97) | | |
- NOTE: P-10073 & 51-48026
replace P-4366, P-4365, & P-1545

Replacement Oil Seal Kit for use with P-9812 Pulley: 52-60251

VERTICAL SHAFT
 Assembly No. 52-60304

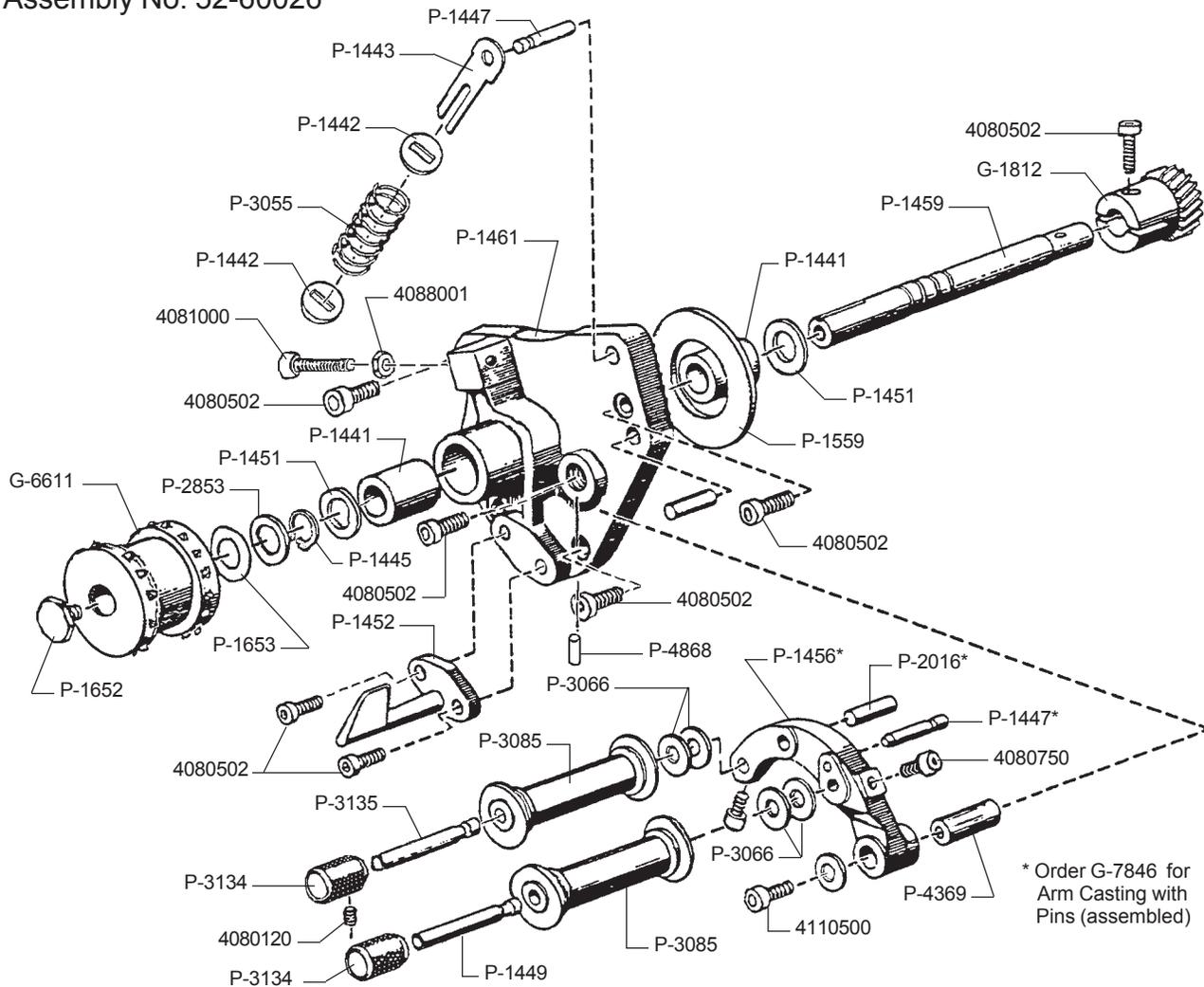


* Install Snap Ring with beveled side down

Immobilize Vertical Shaft (P-1415) by gripping metal hub of Gear (P-1418 or G-1803) with pliers when securing Nut (P-1425). Apply adequate spring preloading, but do not overtighten Nut.

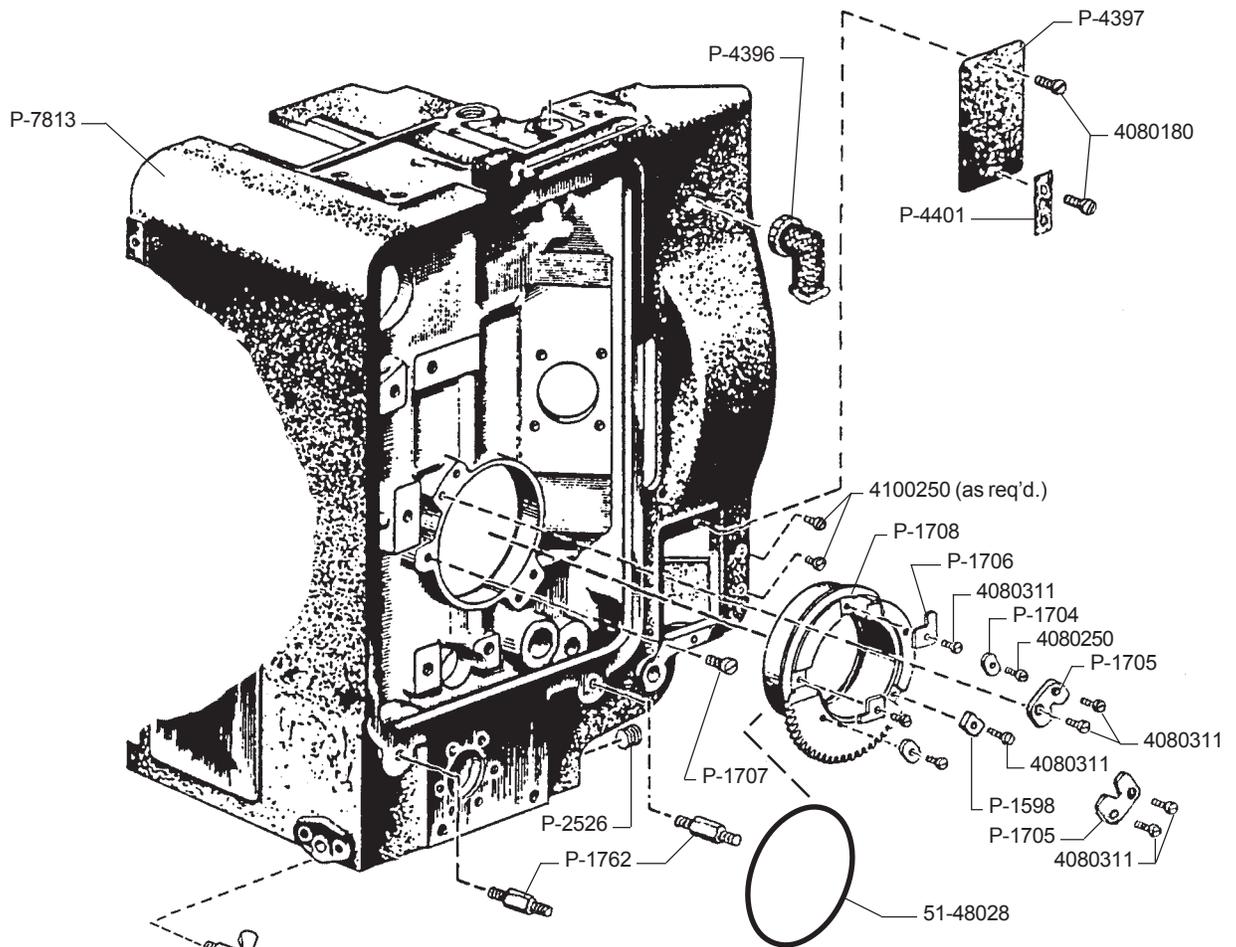
- G-1802 Main Drive Gear (51-23008)
- G-1803 Shutter Drive Gear (51-23009)
- P-1411 Feed Sprocket Drive Gear (51-23010)
- P-1412 Lower Ball Bearing (51-04009)
- P-1413 Holdback Sprocket Drive Gear (51-23017)
- P-1415 Vertical Shaft (51-52016)
- P-1418 Intermittent Drive Gear (51-23018)
- P-1425 Nut, Main Drive Gear (51-35011)
- P-1426 Bracket Casting (52-00045)
- P-1427 Key, Main Drive Gear (51-27002)
- P-2964 Loading Spring (51-58024; 2 req'd.)
- P-7815 Oil Slinger (52-40181)
- P-7816 Gear Spacer (52-20625)
- 2901 Upper Ball Bearing (21-04021)
- 4060180 Fastening Screw (2 req'd.)
- 4080250 Fastening Screw (3 req'd.)
- 4080750 Fastening Screw (5 req'd.)
- 4251002 Fastening Screw (5 req'd.)
- 4317100 Thrust Washer (2 req'd.)
- 51-48029 Retaining Ring

G-1809 HOLDBACK SPROCKET
 Assembly No. 52-60026



G-1812	Driven Gear (51-23007)	P-2016	Pad Roller Arm Stop Pin (52-20417)
G-6611	Sprocket & Key, Type VKF® (51-59005)	P-2853	Bearing Washer (51-70024)
P-1441	Sleeve Bearing (51-04015; 2 req'd.)	P-3055	Coil Spring (51-58025)
P-1442	Spring Retainer (51-98054; 2 req'd.)	P-3066	Spacer Washer (51-70007; 4 req'd.)
P-1443	Spring Guide (52-00082)	P-3085	Pad Roller (21-49004)
P-1445	Washer Retaining Ring (21-48001)	P-3134	Knob (52-00019; 2 req'd.)
P-1447	Spring Guide Pin (52-20045; 2 req'd.)	P-3135	Eccentric Shaft (51-98099)
P-1449	Straight Shaft (52-20102)	P-4369	Pivot Stud (52-20042)
P-1451	Bearing Washer (51-70005; 2 req'd.)	P-4868	Pin (51-37003)
P-1452	Film Stripper, Cast (52-20103)	P-4986	Arm Washer (52-40103)
P-1456	Pad Roller Arm (Order 52-60300)	4080120	Set Screw, 8-32 x 1/4"
P-1457	Travel Limit Pin (51-37007)	4080502	Fastening Screw, 8-32 x 1/2" (7 req'd.)
P-1461	Bracket Casting (52-00116)	4080750	Retaining Screw, 8-32 x 3/4" (2 req'd.)
P-1559	Gasket, Mounting Bracket (51-22016)	4081000	Pad Roller Arm Adjusting Screw
P-1652	Sprocket Retaining Screw (51-51033)	4088001	Adjustment Lock Nut, 8-32
P-1653	Spring Washer (51-70023)	4110500	Arm Mounting Screw, 10-32 x 1/2"

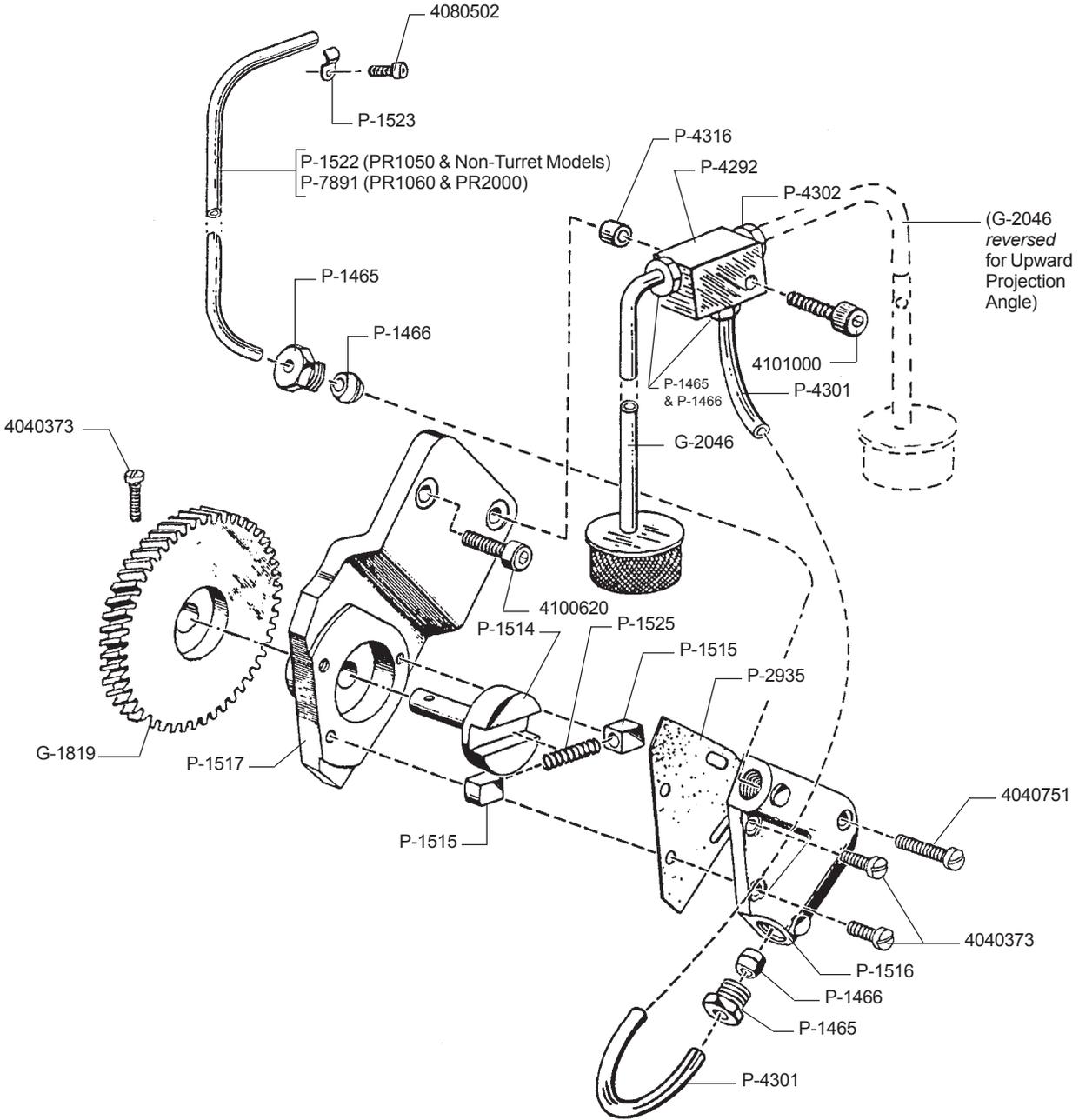
MAIN FRAME & FRAMING CAM



51-98201

- P-1598 Intermittent Locating Key (52-20418)
- P-1704 Intermittent Retaining Clip (51-98123; 2 req'd.)
- P-1705 Framing Cam Retainer Spring (51-10004)
- P-1706 Framing Cam Stop Plate (52-20152)
- P-1707 Intermittent Stop Screw (51-51041)
- P-1708 Framing Cam (52-00050)
- P-1762 Gear Compartment Cover Mounting Stud (52-20454; 3 req'd.)
- P-2625 Oil Drain Plug (51-38001; 2 req'd.)
- P-4396 Cable Connector, 90° (51-13001)
- P-4397 Cover Plate (52-40019)
- P-4401 Guide Plate, Water Lines (52-40135)
(req'd. on units with Water Cooled Trap *only*)
- P-9720 Oil Sight Glass (51-98200; not shown)
(Mounts inside Film Compartment)
- P-7813 Main Frame Casting (52-00028)
- 4080180 Fastening Screw, 8-32 x 3/16" Socket Head (2 req'd.)
- 4080311 Fastening Screw, 8-32 x 5/16" Socket Head (7 req'd.)
- 51-48028 Framing Cam O-Ring, 3½" Diameter
- 51-98201 Petcock, Oil Drain

G-1822 OIL PUMP
 Assembly No. 52-60027



G-1822 OIL PUMP ASSEMBLY

Parts List

G-1819	Driven Gear, Oil Pump (51-23022)
G-2046*	Intake Filter & Oil Tube Assembly (51-36002)
P-1465	Compression Nut (51-35007; 4 req'd.)
P-1466	Compression Bushing (51-07005; 4 req'd.)
P-1514	Oil Pump Drive Shaft & Rotor (51-98105)
P-1515	Oil Pump Impeller (51-98106; 2 req'd.)
P-1516	Housing Cover Casting (52-20114)
P-1517	Pump Housing, Cast (52-00001)
P-1522*	Oil Tube; PR1014, PR1020, PR1030, & PR1050 (52-60040)
P-1523*	Oil Tube Clamp (51-10005)
P-1525	Compression Spring, Impellers (51-58028)
P-2935	Cover Gasket (51-39019)
P-4292*	Three-Way Junction (51-98124)
P-4301*	Connecting Oil Tube (52-60044)
P-4302*	Closure Plug (51-40006)
P-4316	Mounting Spacer, Junction Screw (52-20166)
P-7891*	Oil Tube, PR1060 & PR2000 (52-60311)
4040373	Fastening Screw, 4-40 x 3/8" (3 req'd.)
4040751	Fastening Screw, 4-40 x 3/4"
4080502*	Fastening Screw, 8-32 x 1/2"
4100620*	Pump Mounting Screw, 10-32 x 5/8"
4101000*	Junction Mounting Screw, 10-32 x 1"

* Not Supplied with G-1822; *order separately*

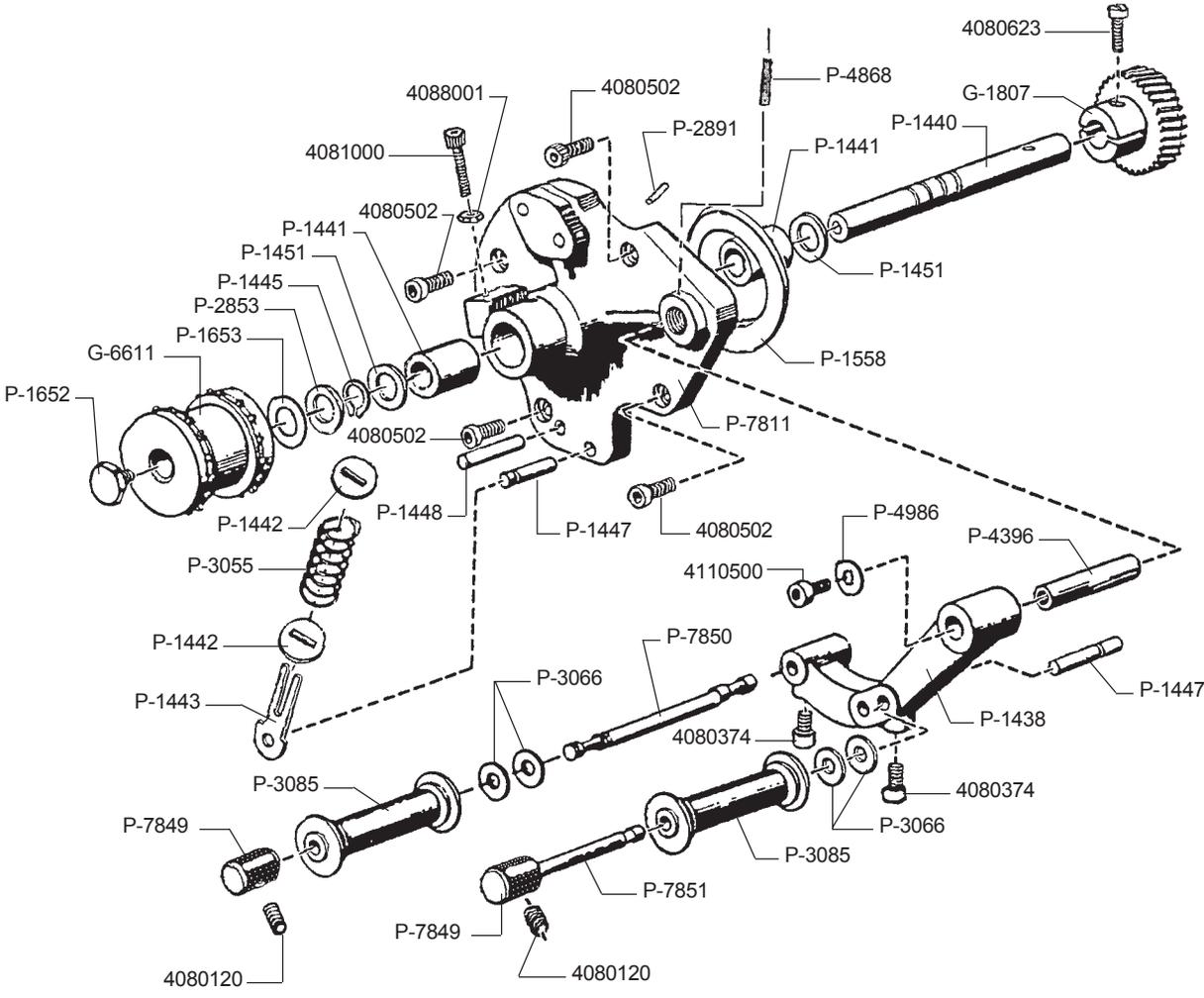
G-1815 SHUTTER & FRAMING ASSEMBLY

Parts List

P-1465	Compression Nut (51-35007)	P-1501	Compression Spring, Guide Rod (51-58003)
P-1466	Compression Bushing (51-07005)	P-1502	Pivot Screw, Adjusting Lever (52-20470)
P-1467	Roll Pin, Framing Rod (52-20105)	P-1504	Bearing Retainer Plate, Outer (52-20113)
P-1470	Spring Retaining Washer (51-70027)	P-1505	Shutter Shaft (52-20122)*
P-1472	Bracket Casting, Shutter Adjusting Shaft (52-20038)	P-1506	Snap Ring, Washer Retaining (11-48016)
P-1473	Pin, Shutter Adj. Gear (51-37002)	P-1560	Bracket Gasket (51-22012)
P-1474	Shutter Adjusting Gear (52-20107)	P-1826	Oil Collector Casting (52-20126)
P-1475	Shutter Adjusting Shaft (52-20074)	P-2013	Retaining Ring, Rear Bearing (51-48012)
P-1476	Shaft Compression Spring (51-58026)	P-2849	Intermittent Oil Feed Tube (52-00042)
P-1477	Retainer Plate, Stop Nut (52-40499)	P-2907	Spring Retaining Collar (52-20127)
P-1478	Stop Nut, Adjusting Shaft (52-20108)	P-2909	Compression Spring (51-58019)
P-1479	Framing Rod (52-20076)	P-2964	Loading Spring, Shutter Shaft (51-58024)
P-1480	Framing Rod Roller (52-20106)	P-2968	Spring Retaining Washer (51-70025)
P-1481	Shaft Ball Bearing, Rear (51-04014)	P-2969	Retaining Ring, Front Bearing (51-48013)
P-1482	Shaft Ball Bearing, Front (51-04008)	P-3672	Oil Seal, Shaft Bracket (51-36003)
P-1483	Spline Ball Bearing (51-04006)	P-4364	Flanged Spline (52-20251)*
P-1484	Shutter Shaft Mounting Bracket Casting (52-00078)	P-4381	Collar Retaining Ring (51-37012)
P-1485	Bearing Retaining Plate (52-00066)	P-4390	O-Ring (51-48005; 2 req'd.)
P-1486	Framing Rod Screw Gear (52-20109)	P-10224	Shutter Casting (52-20791, as shown)
P-1487	Adjusting Lever (52-00041)		Three-Bladed Shutter: P-2885 (52-00140)
P-1488	Slide Rod, Adjusting Spline Support Bracket (52-20110)	4040252	Fastening Screw, 4-40 x 1/4" (2 req'd.)
P-1489	Shutter Shaft Driven Gear (51-23020)	4040373	Fastening Screw, 4-40 x 3/8" (7 req'd.)
P-1490	Adjusting Spline Support (52-00029)	4060502	Guide Rod Retaining Screw, 6-32 x 1/2"
P-1491	Rod Compression Spring (51-58027)	4060751	Clamping Screw, Bearing; 6-32 x 3/4"
P-1492	Framing Rod Guide Screw (52-02448)	4067000	Lockwasher, Clamping Screw
P-1494	Shutter Shaft Spacer (51-98104)	4080375	Knob Fastening Screw, 8-32 x 3/8
P-1495	Pin, Driving Flange (52-20111)*	4080374	Slide Rod Fastening Screw, 8-32 x 3/8"
P-1496	Pin, Adjusting Lever 51-37010)	4080623	Clamping Screw, 8-32 x 5/8" (2 req'd.)
P-1497	Clamping Nut (52-20458; 2 req'd.)	4100500	Fastening Screw, 10-32 x 1/2" (6 req'd.)
P-1499-B	Guide Rod, Support Brkt. (52-20112)	4391	Retaining Ring (21-48037; early models)
P-1500	Shutter Adjusting Knob (51-28017)		

* Order G-4364 Spline & Shaft Assembly (51-52019)

UPPER FEED SPROCKET & PAD ROLLERS
Assembly No. 52-60308



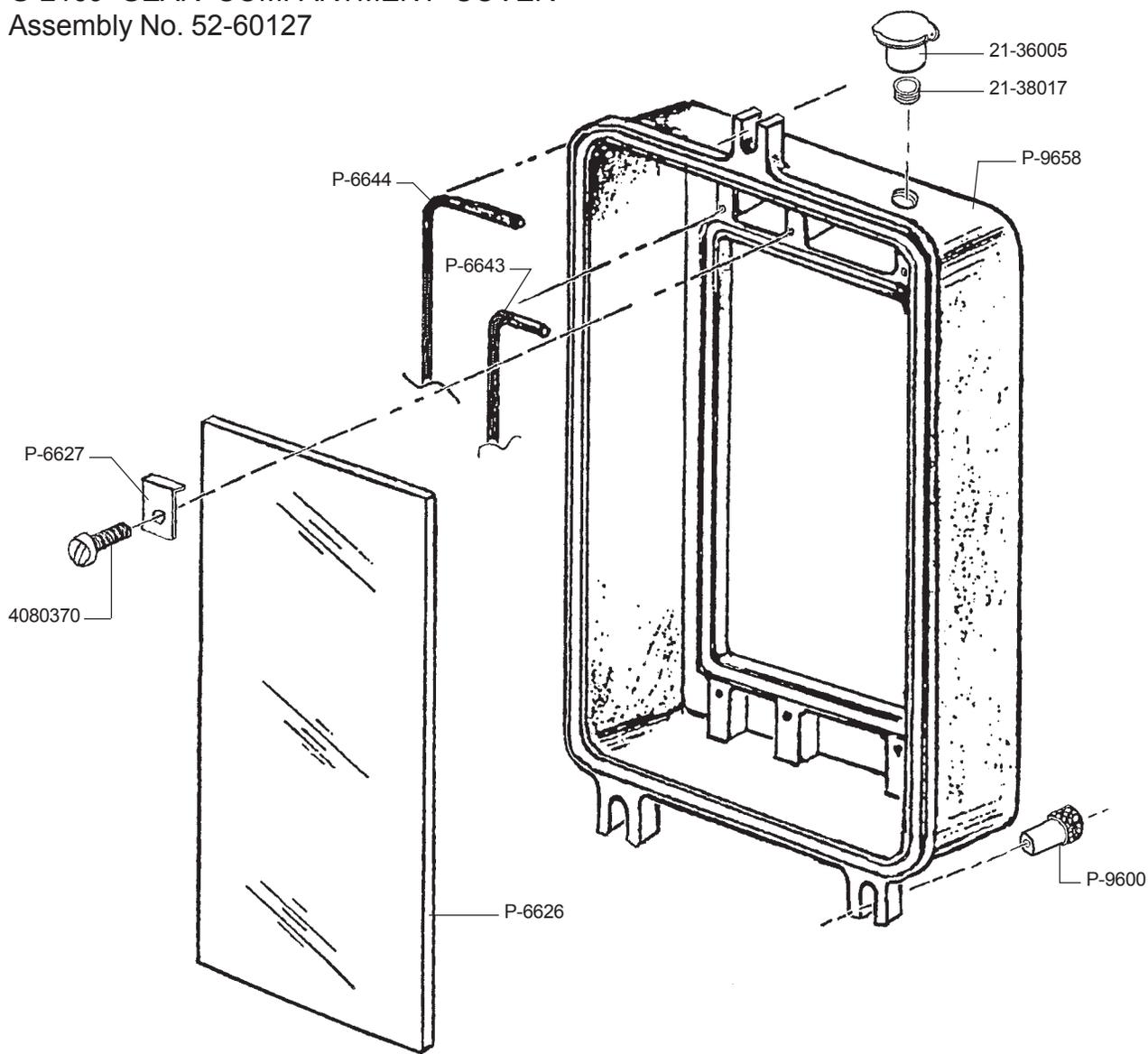
UPPER FEED SPROCKET ASSEMBLY

Parts List

52-60308	Upper Pad Roller Assembly, Complete; PR1060 & PR2000
G-1807	Feed Sprocket Driven Gear (51-23019)
G-6611	Sprocket & Key, Type VKF® (51-59005)
P-1438	Pad Roller Arm (52-00151)
P-1440	Sprocket Shaft (51-52017)
P-1441	Sleeve Bearing (51-04015; 2 req'd.)
P-1442	Spring Retainer, Pad Roller Arm (51-98054; 2 req'd.)
P-1443	Spring Guide (52-00082)
P-1445	Bearing Washer Retaining Ring (21-48001)
P-1447	Pin, Spring Guide (52-20045)
P-1448	Limit Pin, Arm Travel (21-37035)
P-1451	Bearing Washer (51-70005; 2 req'd.)
P-1558*	Gasket, Mounting Bracket (51-22015)
P-1652	Sprocket Retaining Screw (51-51033)
P-1653	Spring Washer (51-70023)
P-2853	Bearing Washer (51-70024)
P-2891	Bearing Wick (52-70024)
P-3055	Compression Spring, Pad Roller Arm (51-58025)
P-3066	Spacer Washer (51-70007; 4 req'd.)
P-3085	Pad Roller (21-49004; 2 req'd.)
P-4369	Pivot Stud, Pad Roller Arm (52-20042)
P-4868	Pin (51-37003)
P-4986	Pad Roller Arm Washer (52-40102)
P-7811	Bracket Casting, PR1060 & PR2000 (52-00145)
P-7849	Knob, Pad Roller Shaft (52-00192)
P-7850	Eccentric Shaft, PR1060 & PR2000 (52-20647)
P-7851	Straight Shaft, PR1060 & PR2000 (52-20648)
4080120	Set Screw, 8-32 x 1/4"
4080374	Retaining Screw, Pad Roller Stud; 8-32 x 3/8"
4080502	Mounting Screw, 8-32 x 1/2" (4 req'd.)
4080623	Gear Fastening Screw, 8-32 x 5/8"
4081000	Pad Roller Arm Adjusting Screw, 8-32 x 1"
4088001	Lock Nut, 8-32; Pad Roller Arm Adjustment
4110500	Fastening Screw, Pad Roller Arm; 10-32 x 1"

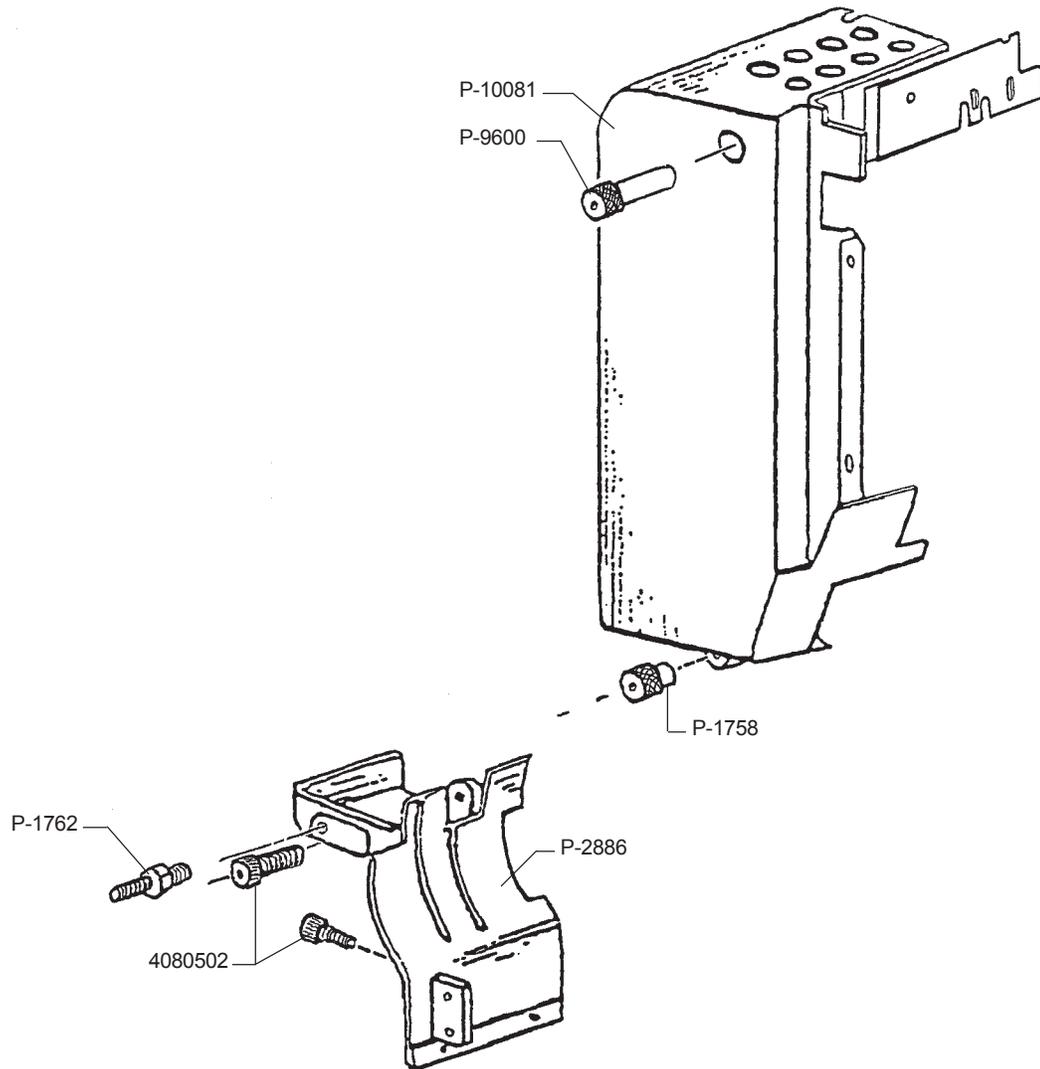
* Not included with 52-60308; *order separately*

G-2169 GEAR COMPARTMENT COVER
 Assembly No. 52-60127



- P-6626 Window Glass (51-18010)
- P-6627 Window Mounting Clip (52-40005; 8 req'd.)
- P-6643 Window Gasket (52-70007)
- P-6644 Cover Gasket (51-22019)
- P-9600 Knurled Nut (52-20410; 3 req'd.)
- P-9658 Gear Compartment Cover Casting (52-20435)
- 21-36005 Oil Fill Cup
- 21-38017 Close Nipple, Brass
- 4080370 Mounting Screw, Window Clip; 8-32 x 3/8" (8 req'd.)

SHUTTER GUARD

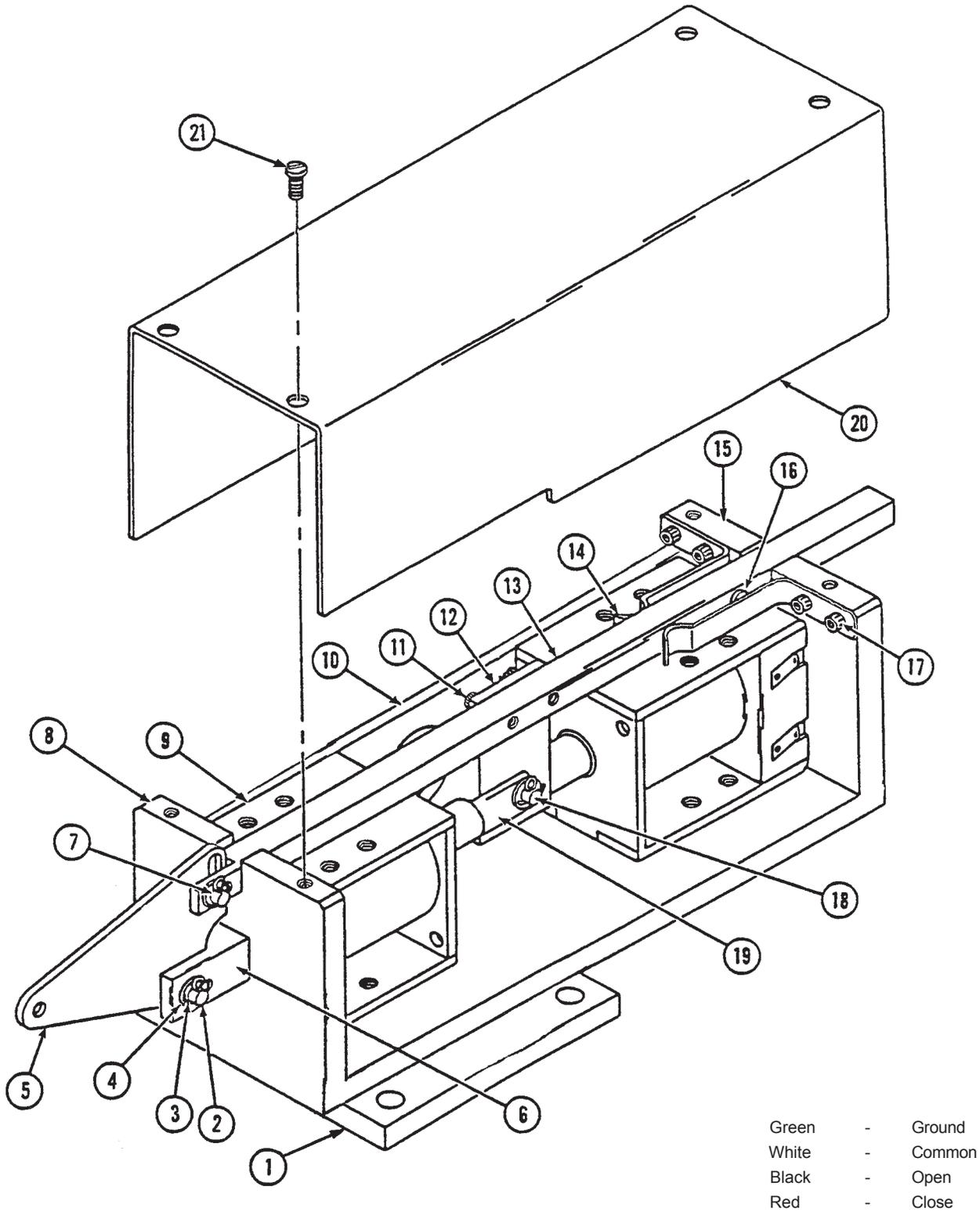


- | | |
|---------|--|
| P-1758 | Knurled Nut (51-35005) |
| P-1762 | Threaded Spacer (52-20454) |
| P-2886 | Lower Rear Cover Casting (52-20161) |
| P-9600 | Knurled Nut, Long Shoulder (52-20161) |
| P-10081 | Shutter Guard Welded Assembly (52-40260) |
| 4080502 | Mounting Screw, 8-32 x 1/2" |

G-9727 PICTURE CHANGEOVER DEVICE

Assembly No. 52-60325 (110 V.AC)

Assembly No. 52-60326 (220 V.AC)



G-9727 PICTURE CHANGEOVER

Parts List

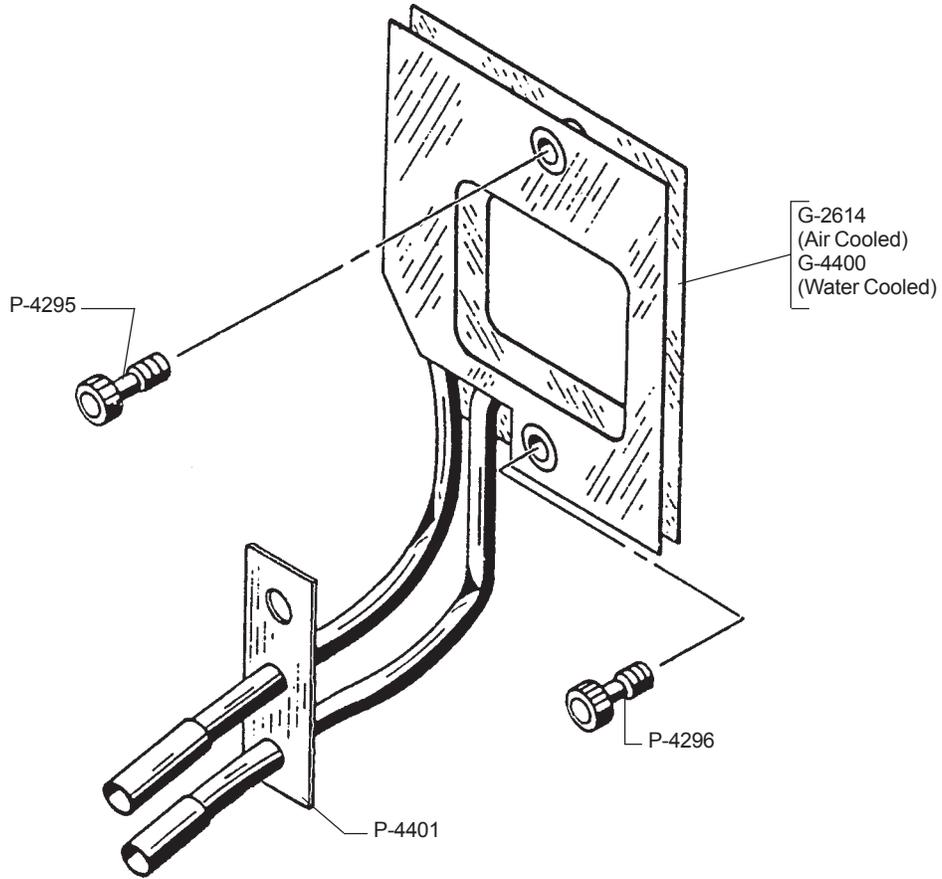
<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	P-7926	Base Plate (52-40233)
2	P-7966	Clevis Pin, 1/8" Diameter (51-98254)
3	01704000	Hitch Pin, 1/16" Diameter
4	4047101	Flatwasher, #4
5	P-7892	Bell Crank (51-98090)
6	P-7923	Pivot, Bell Crank (52-20677)
7	P-7966	Clevis Pin, 1/8" Diameter (51-98254)
8	P-7919	Bracket, Changeover Body (52-40231)
9	51-55005	Solenoid, 110 V.AC Coil (with 52-60325)
-	51-55006	Solenoid, 220 V.AC Coil (with 52-60326)
10	P-7919	Bracket, Changeover Body (52-40231)
11	4060372	Screw, 6-32 x 3/8" Socket Head
12	P-7925	Connector (52-40232)
13	P-7922	Push Rod (52-20676)
14	P-7920	Spring (51-58058)
15	P-7919	Bracket, Changeover Body (52-40231)
16	4040120	Screw, 4-40 x 1/8" Pan Head
17	4040250	Screw, 4-40 x 1/4" Pan Head
18	P-7966	Clevis Pin, 1/8" Diameter (51-98254)
19	51-55005	Solenoid, 110 V.AC Coil (with 52-60235)
--	51-55006	Solenoid, 220 V.AC Coil (with 52-60236)
20	P-7924	Cover (52-40235)
21	4060250	Screw, 6-32 x 1/4" Pan Head
	52-60235	Picture Changeover Assembly, Complete (110 V.AC)
	52-60236	Picture Changeover Assembly, Complete (220 V.AC)

NOT SHOWN

P-7968	Linkage, Douser Plate (52-40245)
4951-0371	Nylon Cable Clamp, 3/8" (41-10030)
41-13008	Cable Connector, 90°
51-71007	Cable, (4) Conductor, Type SO (6 feet required)

Douser Plate G-1910 (See p. 35) *not included* with G-9727 Changeover and must be ordered separately.

FILM TRAP HEAT SHIELD



- | | |
|--------|--|
| G-2614 | Heat Shield, Air Cooled (52-60037) |
| G-4400 | Heat Shield, Water Cooled (52-49057) |
| P-4295 | Heat Shield Mounting Screw, Upper (51-51054) |
| P-4296 | Heat Shield Mounting Screw, Lower (51-51058) |
| P-4401 | Guide Plate, Water Lines (52-40135) |
| | (See Page 41 for Location) |

