

INSTRUCTION MANUAL

CineKinetics 570

Projector Mechanism

Type 23-60075

Issue: 7/99

P R E L I M I N A R Y



STRONG INTERNATIONAL

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PREFACE

THE *CINEKINETICS 570* is a large-format motion picture projector manufactured for Special Venue applications by Ballantyne of Omaha, Inc. Picture stability of the five-perforation, 70mm frame is greatly enhanced by means of two intermittent movements; one above the picture aperture, and one below. This unique approach requires no film tension applied at the film gate, thus prolonging print life and reducing transport noise.

CONSTRUCTION of the rugged intermittent movements features a sturdy webbed starwheel and an oversize camshaft. All moving parts are immersed in an oil bath. Primary drive, applied to the lower intermittent movement, must apply 1440 rpm at the intermittent flywheel to achieve the 24 frame-per-second projection rate. Synchronization of the two movements is assured by means of timing belts. The brushless AC servomotor requires use of a motor speed controller.

A TWO-BLADED SHUTTER provides light cut-off directly behind the picture aperture to maximize lamphouse efficiency. The shutter drive gear train runs in an oil bath for constant lubrication..

THE LENS BARREL is securely anchored to the main frame, and features a fine vertical adjustment in addition to horizontal (focus) control. The barrel accommodates four-inch diameter lenses, and a reducer is available for use with 72mm diameter lenses.

A LIGHTED, ROOMY FILM COMPARTMENT simplifies the threading operation. Film-bearing parts subject to periodic replacement are mounted to subassemblies which are easily removed from the projector main frame. A replaceable aperture plate slides into the heat shield bracket behind the film gate.

PROVISION for two (installer-supplied) shaft encoders is made inside the drive compartment of the projector. The top and bottom sprockets of the threading path are film-driven to supply encoder input.

INSTALLATION

THE PROJECTOR MECHANISM is shipped in a sturdy wooden crate to prevent damage. It is secured to the crate using (2) 3/8-16 screws into the bottom plate, and a slotted 2x4 at the top of the crate restrains the eyebolt. Open the top of the crate, remove the 2x4 and the (2) screws, and hoist the projector from the crate using the eyebolt.

FOUR HOLES, tapped 3/8-16, are located on the back plate, and drilled in the standard pattern to permit mounting the CineKinetics projector to a conventional projection pedestal. After mounting the projector to the pedestal, the eyebolt may be removed.

NO VOLTAGE is applied directly to the drive motor. See the motor controller manual furnished separately for instructions regarding installation and operation.

A STEPDOWN TRANSFORMER (Part No. 81-64006) is furnished to supply 12 V.AC to the framing light. Wiring instructions are on the transformer; connect 120 V.AC to transformer terminals 1 & 4, and install jumpers between terminals 1 & 2 and 3 & 4. Connect the framing light leads to the 12 V.AC secondary output on terminals 5 & 8.

SHAFT ENCODERS mount the the brackets adjacent to the film-driven sprockets located at the top and bottom of the main frame. The bracket mounting screws pass through slotted holes to allow adjusting the degree of belt tension.

THREADING

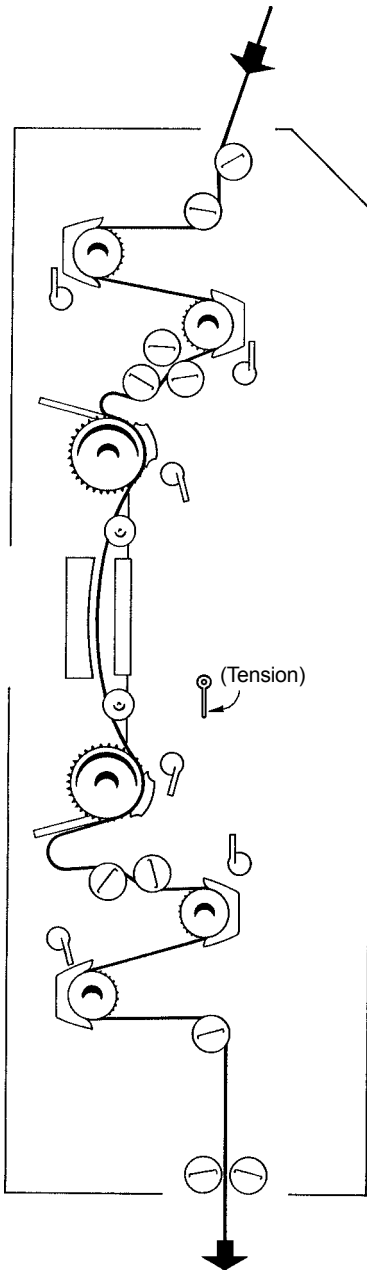
THREADING THE PROJECTOR correctly is one of the operator's most important responsibilities. The design of this projector makes no provision for correcting frame position after motor start, so the operator must exercise extreme care at this step.

THE MOTOR CONTROLLER includes a JOG switch which momentarily energizes the drive motor to advance a frame or two of film. Use the JOG switch, or inch the mechanism by hand, to bring both intermittent sprockets to their "locked" stage. Open the (6) detent arm assemblies to retract the sprocket shoes from the sprockets. The film gate can be opened to a slight degree by swinging the gate tension lever forward.

CLEAN ALL FILM-BEARING SURFACES prior to each threading procedure. Check rollers for free operation and remove film residue to prevent buildup.

THREAD THE FILM as illustrated. Center the picture frame over the opening of the aperture plate. Note the loop sizes at the intermittent sprockets. With the intermittents in their "locked" stages, the minimum (one-finger) loop is shown at the upper intermittent sprocket, and the maximum (two-finger) loop is shown at the lower intermittent sprocket. Close the film gate.

JOG OR INCH the mechanism to advance a few frames of film. Observe the film loops above and below the film gate. As the film feeds, the upper loop should grow to the maximum size as the lower loop reduces to minimum size. Check the aperture to verify correct framing. Run fingers over each sprocket to insure that the sprocket teeth are centered in the film perforations, and the film is centered across the sprocket face.



INITIAL OPERATION

IGNITE THE LAMPHOUSE, start the projector motor at projection speed, and open the lamphouse douser. Install the projection lens and move the lens inside the barrel until a sharply focused picture is projected. Tighten the lens clamp.

THE OPTIONAL LENS REDUCER (Part No. 22-60259), required for 72mm (outside) diameter lenses, should be attached to the lens prior to installation to the lens barrel. Tighten the (2) nylon set screws to secure the reducer to the lens.

OBSERVE THE PROJECTED PICTURE for steadiness and flatness of focal field. If the picture is unsteady, or if the film transport is excessively noisy, adjust the position of the film gate by moving the gate lever while observing the screen. If the movements have been correctly synchronized, the steadiest picture should produce the lowest transport noise.

VISIBLE STREAKING of lighter areas against a dark background is commonly called “travel ghost” and is most obvious during opening or closing credits and titles. This condition indicates that the shutter is not correctly timed. See the instructions regarding “Shutter Timing” in the following ADJUSTMENTS & REPLACEMENTS section.

THE POSITION OF THE FILM GATE is factory-set for a 0° (flat) projection angle. If the picture is difficult to focus because of a steep projection angle (i.e. in focus at the top of the screen, but out of focus at the bottom), the angle of the film gate can be shifted by loosening and re-setting the (2) eccentric brass cams above and below the gate mounting plate. Tilt the film gate until the picture is in focus top and bottom, and secure the cam mounting screws.

AN EXTREME SHIFT of the film gate may require a similar adjustment to the lens barrel. The knurled wheel above the lens barrel may be rotated to raise or lower the optical center of the lens barrel. Turning the wheel toward the front of the projector lowers the optical center, and turning the wheel toward the back of the projector raises the optical center.

FINE FOCUS CONTROL of the projection lens may change from day to day. A focus knob protrudes from the front of the projector for this adjustment.

MAINTENANCE

WITH PROPER MAINTENANCE, the CineKinetic Projector will deliver many years of trouble-free operation. Establishing a routine of regular cleaning and inspection requires little effort and will minimize downtime.

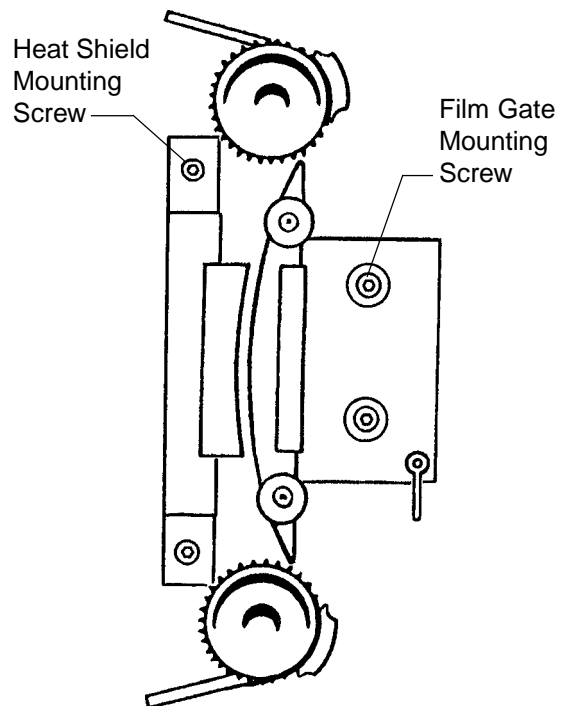
THE FILM PATH and all attendant film-wearing parts should be cleaned at least once daily. Using a typewriter brush, or a used toothbrush (with softened bristles), brush all sprocket teeth and remove any film residue or wax built up on the sprocket faces. Brush the inner surfaces of the sprocket shoes.

DISMOUNT THE FILM GATE and thoroughly clean the gate components using a clean lint-free cloth. Check the lateral guide rollers for free operation. Inspect all film-wearing parts and replace worn components as required. It is recommended to replace gate components in matched left and right pairs.

THE FILM GATE is easily dismounted by removing the (2) socket head screws and their washers and compression springs. Do not remove or re-position the brass cams above and below the film gate. The position of these cams will insure correctly locating the gate when re-installing.

STOP SCREWS, set at the factory, insure that the gate is correctly located when replaced. Slide the gate back toward the heat shield and aperture plate until the stop screws (see Figure 7, Item 17) touch the heat shield bracket.

OPEN THE GEAR COMPARTMENT DOOR and inspect the timing belts. If any of the belts exhibit wear (cracks, tears, eroded teeth), *replace all four*. See the detailed instructions in the following section.



ADJUSTMENTS & REPLACEMENTS

ESTABLISHING A ROUTINE of regular maintenance will insure dependable operation of the CineKinetic 570 projector and prolong print life. All projector components are designed for long service. Those parts most subject to wear, such as film-bearing pads and shoes, mount to readily-accessible subassemblies for ease of field replacement with a minimum of downtime.

MOST PROCEDURES OUTLINED BELOW can be performed by field service personnel using common hand tools. A Spacer Gauge is supplied with each projector to simplify field alignment of lateral guide rollers. The Intermittent Movements, because of their complexity, are best returned to the factory for service and adjustments. The assembly and testing of this unit require unique fixturing utilized by specially-trained technicians. Other items requiring factory assembly are so noted in the Parts List.

LUBRICATION

1. INITIAL OILING: Use only the special projector oil supplied with the unit (Ballantyne Part No. 21-98126). The CineKinetic projector is shipped with all oil reservoirs filled. Remove the oil fill plugs on the intermittent movements and on the top of the shutter gearbox and verify that the oil level reaches the fill ports. Add oil as required.
2. DAILY OPERATION: When the projector motor is energized, the oil level will rise and become visible in the (3) breather tubes connected to the movements and to the shutter gearbox. Air bubbles will be visible in the shutter gearbox sight glass. *Never* operate the CineKinetic projector without oil.
3. CHANGE THE OIL after six months of normal operation. Brass drain plugs are located on the bottoms of the intermittent movement cases and on the bottom of the shutter gearbox adjacent to the driven gear. After draining the oil, carefully clean up any spillage, and replace the drain plugs. Fill the reservoirs with 21-98126 oil.
4. The horizontal sprocket shaft assemblies include sealed, pre-lubricated ball bearings. If these assemblies are dismantled in the course of replacing component parts, add a drop or two of light machine oil to the inner races of the ball bearings before rebuilding the assembly.

SHUTTER TIMING

1. Rotate the lower intermittent flywheel by hand while observing the lower intermittent sprocket. After the intermittent steps to a "locked" stage, place a stationary object next to one sprocket tooth

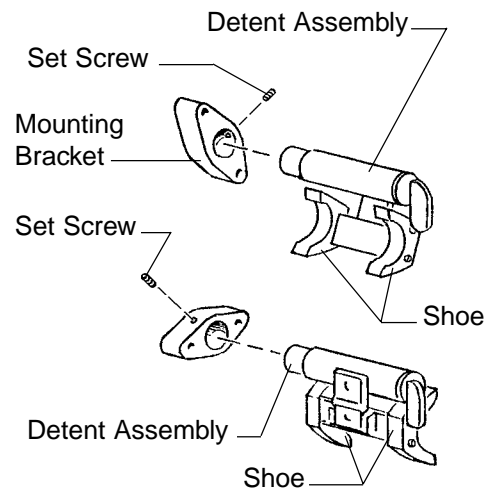
SHUTTER TIMING (continued)

2. Slowly rotate the intermittent flywheel while watching the marked sprocket tooth. Allow the intermittent sprocket to advance *two and one-half teeth*, and stop.
3. Loosen the (2) socket head clamping screws in the shutter hub, allowing the shutter to rotate freely on the shutter shaft as the mechanism remains stationary.
4. Turn the shutter on its shaft until one shutter blade completely covers the picture aperture. While the mechanism remains stationary, tighten the (2) shutter hub clamping screws.
5. Inch or “jog” the projector and make certain that the shutter blade does not touch the sheet metal cabinet or the stainless steel heat shield.
- 6 Repeat Steps 1 & 2 to verify correct shutter timing.

REPLACEMENT OF SPROCKET SHOES

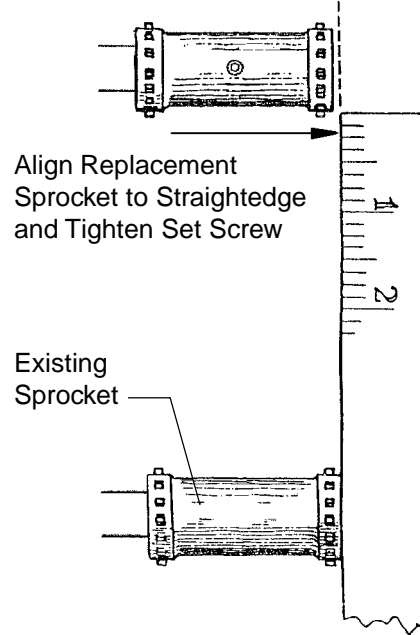
Always replace sprocket shoes in matched pairs. Intermittent sprocket shoes and feed sprocket shoes are not interchangeable. Furthermore, feed sprocket shoes are paired as *inboard* and *outboard* sets.

1. Close the sprocket shoe detent assembly against the face of the sprocket. Using a 90°, 1/8" allen key, loosen the 1/4-20 set screw at the base of the detent assembly and remove the detent assembly from the main frame.
2. Dismount the worn shoes and replace with new shoes. Note intermittent shoes are interchangeable (inboard and outboard), whereas feed sprocket shoes are undercut and must be installed as either inboard or outboard (undercut to the center of the sprocket).
3. Return the detent assembly to its main frame mounting bracket. Using a length of scrap film, set the gap between the replacement shoes and the face of the sprocket: (1) film thickness for intermittent shoes or (2) film thicknesses for feed sprocket shoes. When the gap is set, tighten the set screw to secure the detent assembly to the main frame bracket.
4. Open and close the detent assembly to check for correct operation. Observe the gap between the sprocket shoe and the sprocket face and correct as required.



FEED SPROCKET REPAACEMENT

1. Replace sprockets one at a time. Alignment of replacement sprockets must be made relative to the position of existing sprockets.
2. Open the sprocket shoe detent assembly. Loosen the set screw in the center of the sprocket and slide the worn sprocket from the shaft.
3. Install the replacement sprocket. Using a straightedge, such as a six-inch machinist's scale, align the outside edge of the replacement sprocket to the outside edge of the adjacent feed sprocket. Tighten the sprocket set screw.
4. Using a length of scrap film, verify the (2) film thickness gap between the sprocket shoe and the face of the replacement sprocket. Correct spacing as required.

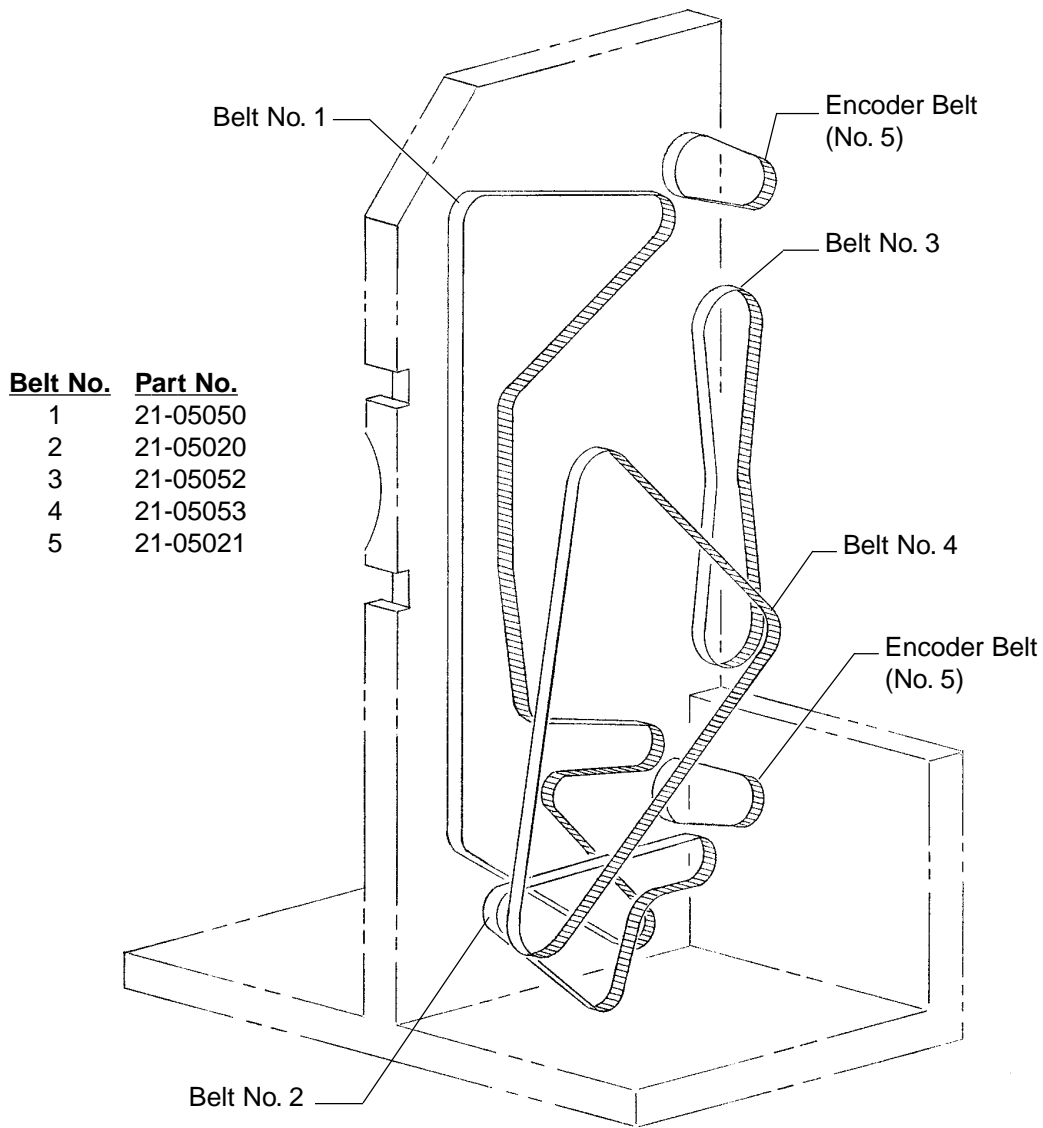


INTERMITTENT SPROCKET REPLACEMENT

1. Using a 1/16" allen key, remove the (2) button head screws and dismount the film stripper/loop chute located adjacent to the intermittent sprocket. Rotate an intermittent flywheel to index the movement to a "locked" stage with the head of the sprocket mounting screw accessible.
2. Using a 3/32" allen key. Loosen, but do not remove, the brass set screw securing the thumb screw at the end of the outboard bearing arm. Loosen the thumb screw.
3. Dismount the outboard bearing cap by removing the (2) socket head cap screws using a 5/32" allen key.
4. Remove the intermittent sprocket mounting screw and hexnut. Slide the worn sprocket off the intermittent shaft.
5. Slide the replacement sprocket onto the intermittent shaft. Install, but do not tighten, the sprocket mounting hardware (screw and hexnut).
6. Install the outboard bearing cap to the end of the outboard arm. Gradually tighten the (2) socket head mounting screws while rotating the intermittent flywheel to allow the bearing to center on the intermittent shaft.
7. Tighten the thumb screw fingertight only to remove end play from the outboard bearing. Secure this setting by tightening the brass set screw. NOTE: Do not use pliers or any hand tool to tighten the thumbscrew beyond fingertight. Overtightening the thumb screw can lead to intermittent damage.
8. Thread a length of scrap film into the film gate between the intermittent and the lateral guide rollers. Slide the intermittent sprocket in and out until the film lies flat on the gate runners with the perforations centered on the sprocket teeth. Verify correct framing and securely tighten the sprocket mounting screw and hexnut.
9. Install the loop chute.

TIMING BELT REPLACEMENT

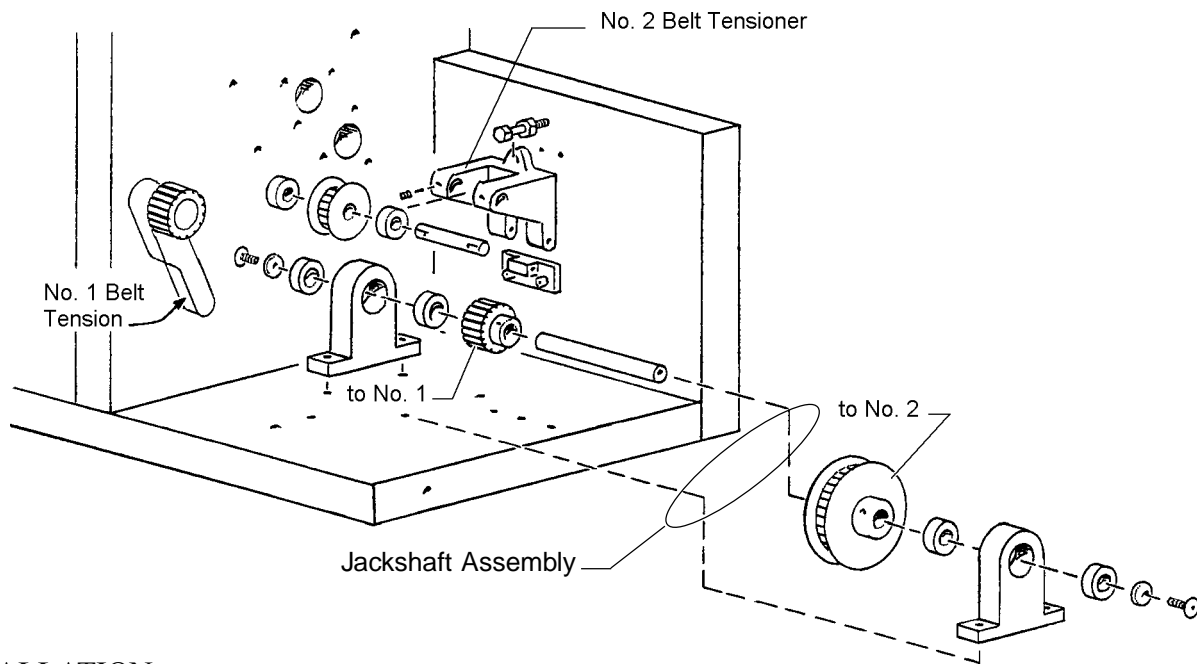
It is recommended that the four drive belts be replaced after six months of normal operation. Since all four belts are subject to the same wear, *all four* should be replaced at the same time. The (2) belts driving the (customer supplied) shaft encoders should be inspected for wear or cracks, and replaced if required.



TIMING BELT REPLACEMENT (continued)

REMOVAL:

1. Loosen the belt tensioner below the drive motor and remove the Number 4 Belt from the motor drive pulley, the lower intermittent pulley, and the shutter gearbox driven pulley.
2. Using a 5/32 inch allen key, dismount one of the (2) idler pulleys between the two intermittent movements and remove the intermittent timing belt (No. 3).
3. Dismount the No. 2 Belt tensioner pulley by loosening the shaft set screw and withdrawing the pulley shaft. Note the assembly sequence of spacers on the pulley shaft and re-assemble in the same sequence.
4. Loosen the socket head screw mounting the No. 1 Belt tensioner arm. With belt tension relieved, remove the (4) socket head screws securing the jackshaft assembly to the projector base plate and dismount the jackshaft. *Do not disassemble the jackshaft.* Remove the No. 1 Belt.



INSTALLATION:

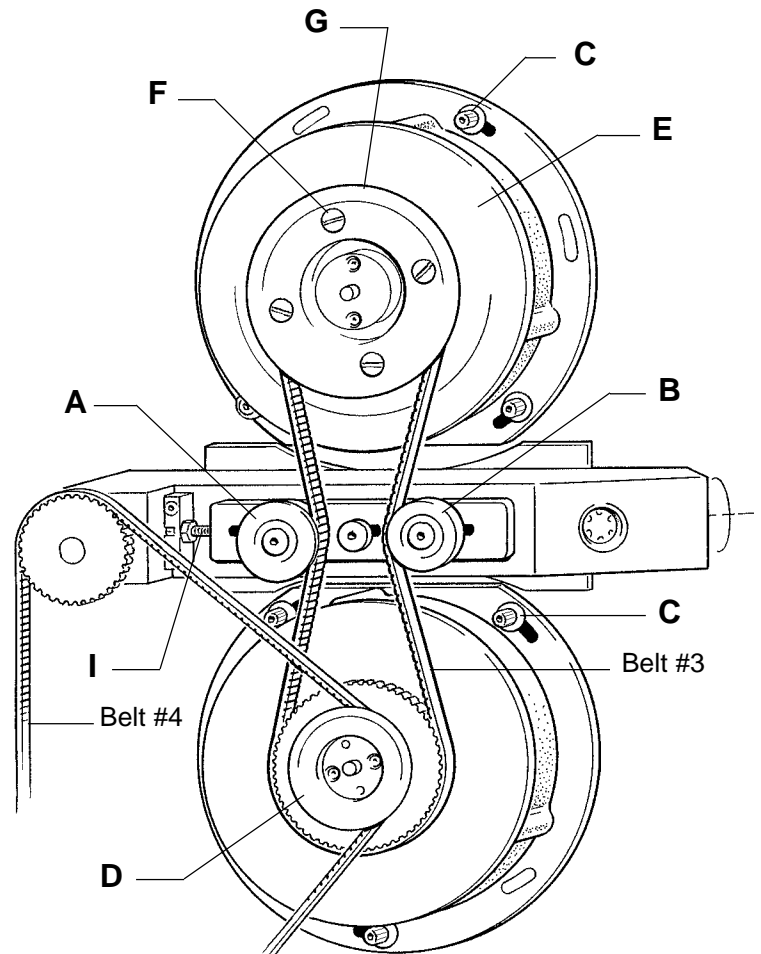
1. Re-install the jackshaft after first looping the replacement No. 1 Belt around the smaller pulley. Thread the belt through its drive path: (5) timing belt pulleys and (4) idler pulleys. Apply belt tension by pressing the tensioner arm as shown, and tighten the tensioner arm mounting screw.
2. Re-install the No.2 Belt tensioner pulley after first looping the replacement No. 2 Belt around the pulley. Duplicate the assembly sequence, replacing all spacers on the shaft with the pulley.
3. Loop the replacement *No. 4 Belt* around the inner drive motor pulley.

TIMING BELT REPLACEMENT (continued)

4. Thread the replacement No. 2 Belt to its (4) timing belt pulleys. Do not set the tensioner until first installing the No. 4 belt (following).
5. Replace the idler pulley between the intermittent movements. Install the No. 3 Belt as instructed in the SYNCHRONIZATION OF INTERMITTENT MOVEMENTS procedure immediately following.
6. Run the No. 4 Belt, from the drive motor (Step 3), around the shutter gearbox driven pulley and the outer timing belt pulley on the lower intermittent movement. Apply belt tension using the tensioner below the drive motor.
7. Time the shutter.

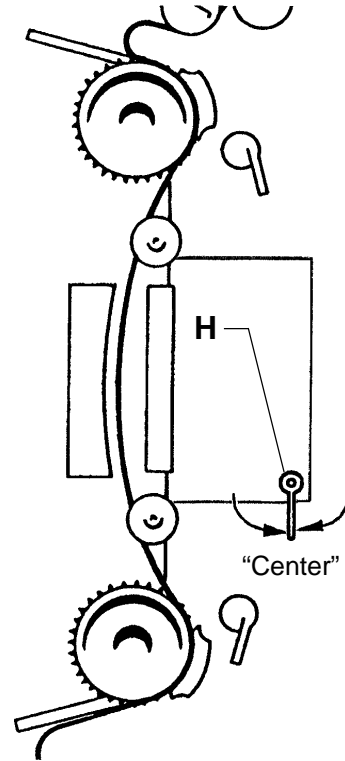
SYNCHRONIZATION OF INTERMITTENT MOVEMENTS

1. Rotate the intermittent flywheels and step both movements to a "locked" stage.
2. Loosen the screws mounting idler pulleys "A" and "B." Set the pulleys allowing a 2.125 to 2.25 inch (54 to 57mm) gap as measured center-to-center at the screw heads. Install the replacement timing belt between the two movements.
3. Loosen the (6) socket head screws "C" and rotate both movements until tension is applied to the timing belt. Tighten the socket head screws "C."
4. Thread a length of scrap film between the two intermittent sprockets. Loosen the lower intermittent sprocket mounting hardware. With the intermittent movement stationary, rotate the intermittent sprocket to align the lower frame line on the film to the bottom of the aperture opening. Make certain that the sprocket is still in horizontal alignment (in-and-out), and re-tighten the sprocket mounting hardware. Remove the film.



SYNCHRONIZATION OF INTERMITTENT MOVEMENTS (continued)

5. Rotate lower intermittent flywheel "D" while observing the lower intermittent sprocket. Rotate flywheel "D" until the lower intermittent sprocket *begins* its pulldown step. Stop the movement at this point and remove the timing belt.
6. Rotate the upper flywheel "E" until the upper intermittent sprocket *begins* its pulldown step. Stop the movement at this point, and re-install the timing belt.
7. With both intermittent sprockets stationary, loosen the (4) pan head screws "F." Hold flywheel "E" to prevent motion, and rotate pulley "G" to take up the belt slack. Secure the (4) screws "F."
8. Thread a length of scrap film between the two intermittent sprockets. Move gate lever "H" to the center of its travel. Loosen the mounting screw and locknut securing the upper intermittent sprocket. Rotate the upper intermittent sprocket until the film slack has been taken out.
9. Rotate both intermittent movements, and observe film tension at the gate. If the film gains slack at pulldown, loosen idler pulley "B" and move it toward the rear (toward shutter). Move idler "A" into the belt to take up belt slack.
10. If the film draws taut at pulldown, loosen idler pulley "A" and move it slightly forward (away from shutter). Move idler pulley "B" into the belt to take up belt slack.
11. Pulleys "A" and "B" can be moved simultaneously for fine adjustment by loosening the shoulder screw between the two pulleys and tightening or loosening the stop screw "I." Tighten the locknut after making fine adjustment to fix the setting.

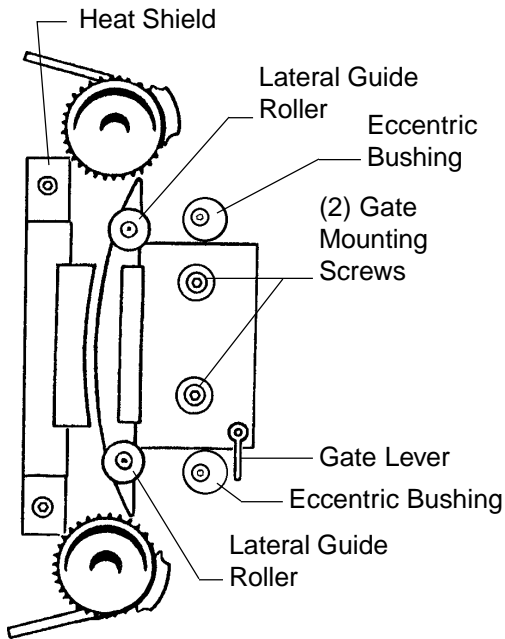


REPLACEMENT OF INTERMITTENT MOVEMENT

The upper and lower intermittent movements differ from one another in the location of oil fill and drain plugs, and in the configuration of driven pulleys. Specify UPPER or LOWER movement when ordering a replacement unit.

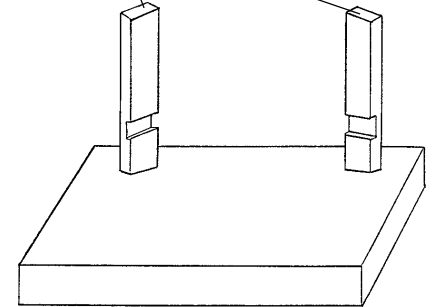
1. Remove the film stripper/loop chute from the intermittent sprocket outboard arm.
2. Dismount one of the two idler rollers (previous page, Items "A" or "B") and remove the timing belt. If replacing lower intermittent, loosen the belt tensioner below the drive motor to relax the drive belt tension.
3. Remove the (3) socket head 1/4-20 screws (previous page, Item "C"). Dismount the movement.
4. Install replacement movement. Synchronize the movements (see preceding), check belt tension, and time the shutter.

REPLACEMENT OF FILM GATE COMPONENTS



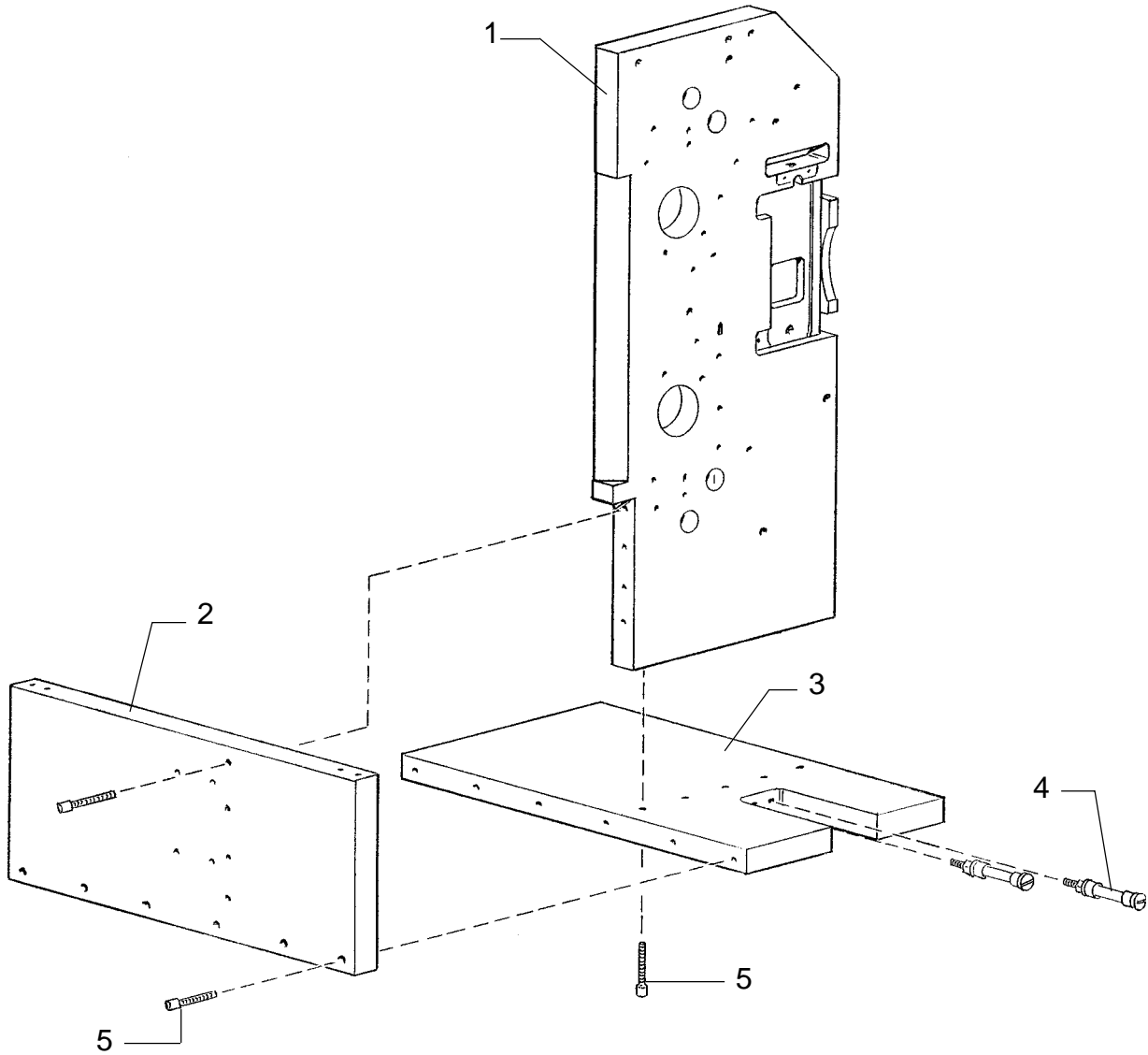
1. Carefully inspect the film-wearing surfaces on the gate. Gate runners should be parallel; no visible indications of undercutting across the flat surfaces. Lateral guide rollers should not display any cuts on their inner surfaces. Replace worn components as required.
2. Dismount the film gate by removing the (2) socket head mounting screws and their washers and compression springs. DO NOT alter the positions of the eccentric bushings or the stop screws (see Figure 7, Item 17).
3. Gate runners are secured to the gate bracket with (2) screws each (see Figure 7, Item 9). Replace gate runners in *matched pairs* (inboard and outboard) to insure even wear.
4. Each lateral guide roller is secured by a locknut (see Figure 7, Item 5). Lateral guide rollers are interchangeable, and may be rotated left-to-right to distribute wear.
5. Align the lateral guide rollers before installing the replacement gate runners. Place the film gate assembly on the alignment gauge with the runner slots facing the upright posts of the gauge. Loosen the lateral guide roller shaft clamping screws (see Figure 7, Item 13). Slide the guide roller shaft to allow the inner surfaces of the outboard guide rollers to rest against the machined surfaces on the tops of the upright posts. Re-tighten the guide roller shaft clamping screws.
6. See Figure 7, Items 15 & 16 before replacing gate runners. The right (outboard, Item 15) runner is identified by a hole drilled through the runner near the optical center. The outer sides of both runners are undercut top and bottom to allow clearance for the lateral guide rollers. Replace the runners as illustrated, and secure the mounting hardware (Item 9). Check the outboard lateral guide rollers for free movement, and adjust the outboard runner as required.
7. Re-install the film gate to the film compartment. Place the gate bracket between the eccentric bushings with the aligning pin (Figure 7, Item 18) in its slot. Slide the gate bracket back to rest the stop screws (Figure 7, Item 17) against the heat shield bracket.

Outboard Lateral Guide Rollers to rest on these machined surfaces



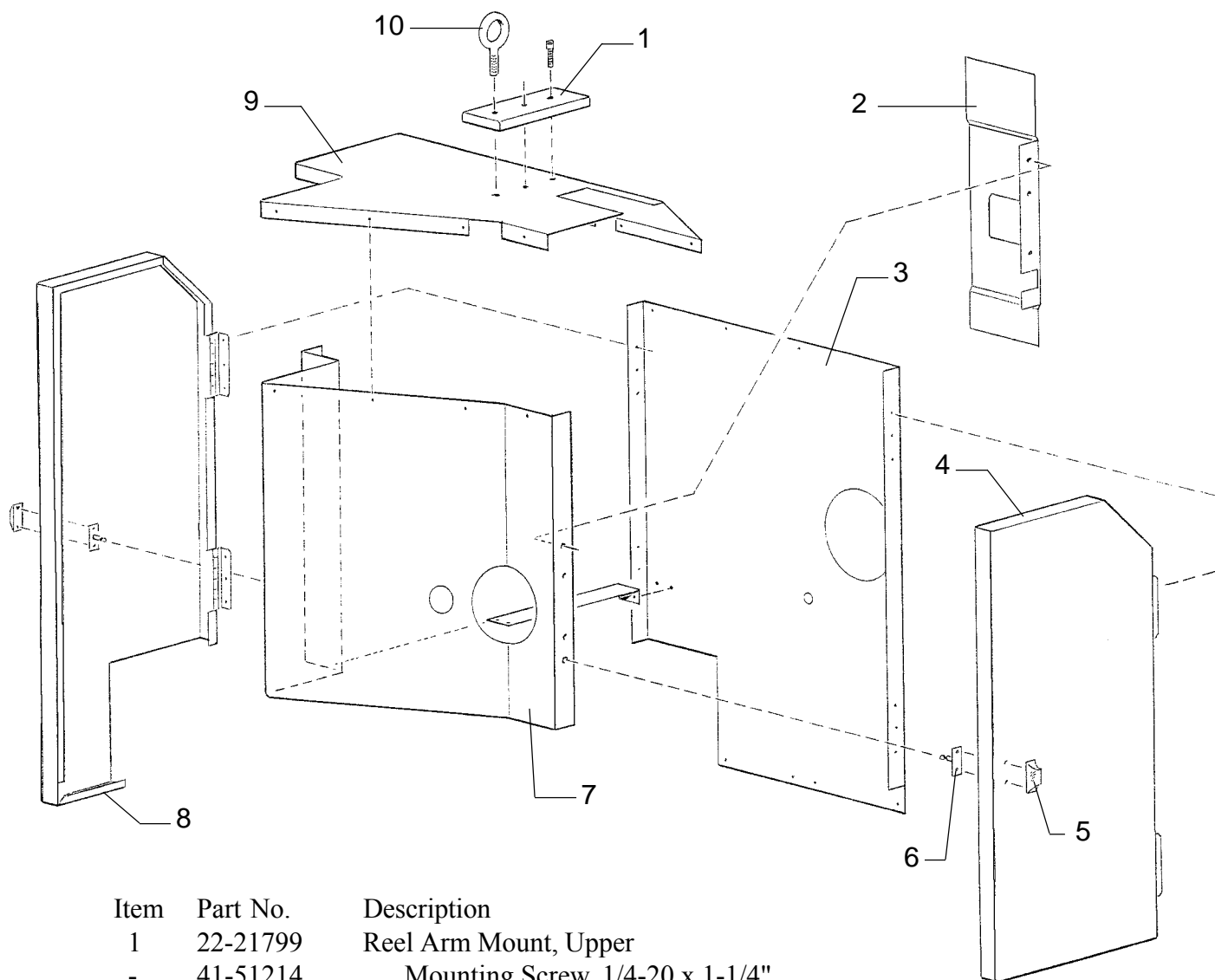
GATE ALIGNMENT GAUGE
Part No. 22-21814

FIGURE 1



| Item | Part No. | Description |
|------|----------|------------------------------------|
| 1 | 22-21774 | Main Frame Plate |
| 2 | 21-39033 | Back Plate |
| 3 | 21-39032 | Base Plate |
| 4 | 22-60699 | Roller Assembly |
| 5 | 41-51233 | Screw, 3/8-16 x 1-1/4" Socket Head |
| - | 41-37010 | Dowel Pin, 3/8" x 1-1/2" |

FIGURE 2



| Item | Part No. | Description |
|------|----------|--|
| 1 | 22-21799 | Reel Arm Mount, Upper |
| - | 41-51214 | Mounting Screw, 1/4-20 x 1-1/4" |
| 2 | 22-41265 | Heat Shield |
| - | 41-51544 | Mounting Screw, 6-32 x 1/4" Black Oxide |
| 3 | 22-41233 | Front Panel |
| - | 41-51110 | Mounting Screw, 10-32 x 1/2" Phillips |
| 4 | 22-41241 | Access Door, Film Compartment |
| 5 | 31-28001 | Door Handle |
| 6 | 22-40074 | Door Catch |
| 7 | 22-41236 | Back Panel & Shutter Guard |
| 8 | 22-41242 | Access Door, Gear Compartment |
| 9 | 22-41237 | Top Cover |
| 10 | 21-51034 | Eye Bolt, 1/2-13 (replace with 41-51753 Cap Screw) |

PARTS LIST

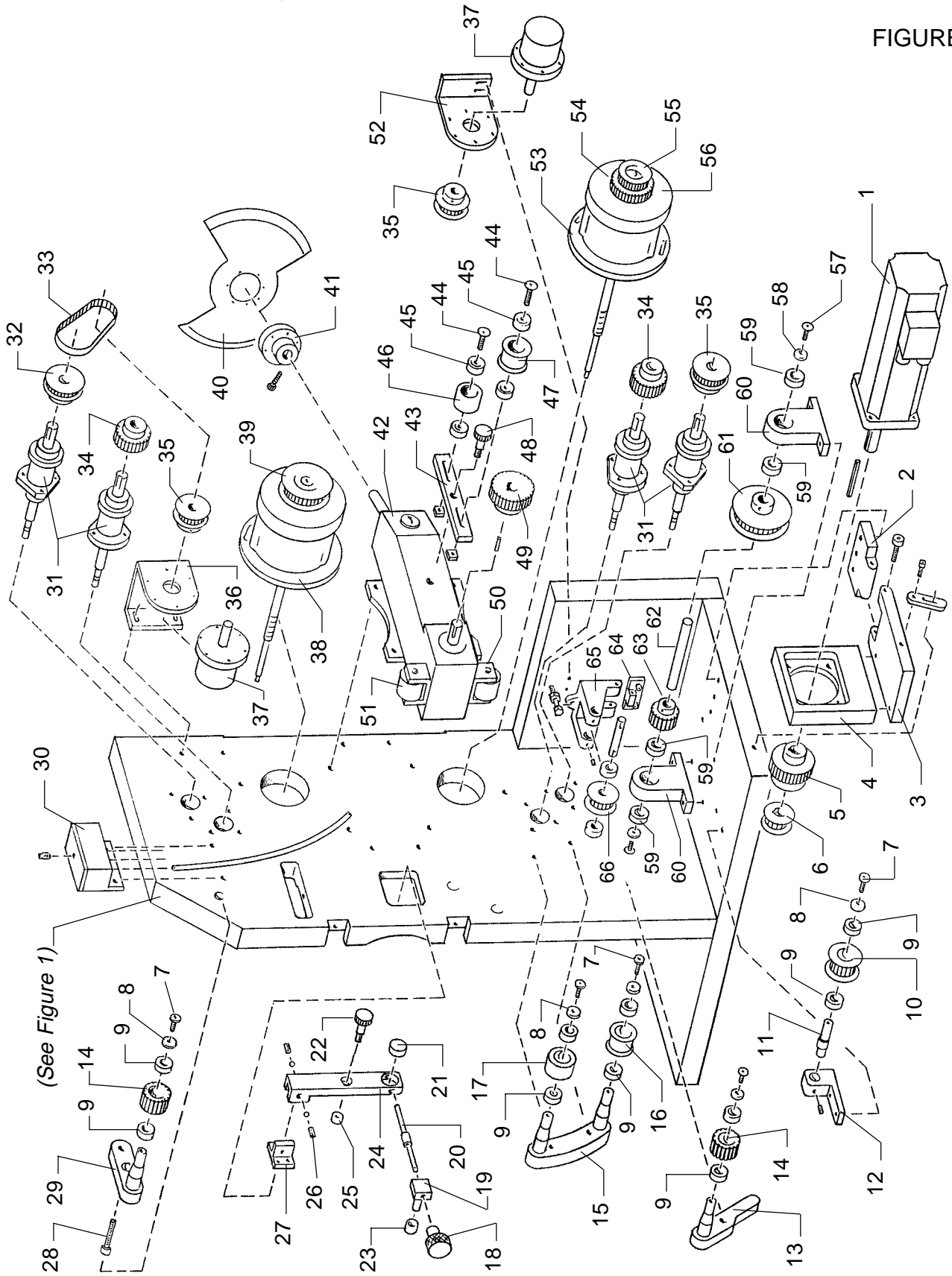
Figure 3

| Item | Part No. | Description |
|------|----------|--|
| 1 | 22-60259 | Lens Reducer, 4" to 72mm (Optional) |
| 2 | 22-60706 | Film Gate Assembly (see Figure 7) |
| 3 | 22-41260 | Aperture Retainer Plate |
| - | 22-41259 | Spacer Plate, Aperture Retainer |
| - | 41-51012 | Mounting Screw, 4-40 x 1/4" Button Head |
| 4 | 21-41261 | Aperture Plate |
| 5 | 21-41262 | Heat Shield Plate |
| 5 | 22-21817 | Heat Shield & Aperture Mounting Bracket |
| - | 51-98211 | Spring & Plunger Assembly |
| - | 21-56001 | Heat Shield Spacer (4 req'd.) |
| - | 41-51274 | Heat Shield Mounting Screw, 10-32 x 1/2" Button Head |
| 6 | 21-98653 | Detent Mount, Feed Sprocket (4 req'd.) |
| 6A | 21-98682 | Detent Mount, Intermittent Sprocket (2 req'd.) |
| - | 41-51220 | Mounting Screw, 1/4-20 x 5/8" |
| - | 41-51178 | Detent Set Screw, 1/4-20 x 1/4" |
| 7 | 22-60704 | Lower Intermittent Sprocket Shoe Detent Assembly* |
| 8 | 22-60702 | Lower Feed Sprocket Shoe Detent Assembly* |
| 9 | 22-60701 | Guide Roller Assembly |
| 10 | 21-59007 | Intermittent Sprocket |
| 11 | 21-98647 | Outboard Bearing Housing |
| - | 41-51607 | Mounting Screw, 10-32 x 5/8" |
| 12 | 22-20852 | Thumb Screw, Outboard Bearing |
| - | 41-51250 | Set Screw, 10-32 x 1/4" Brass |
| 13 | 41-51027 | Intermittent Sprocket Retaining Screw |
| - | 41-35044 | Hexnut, FlexLock |
| 14 | 21-04008 | Ball Bearing |
| 15 | 21-98648 | Spacer Arm, Outboard Bearing |
| 16 | 22-41345 | Film Stripper/Loop Chute |
| - | 41-51391 | Mounting Screw, 4-40 x 3/8" Button Head |
| 17 | 21-98630 | Housing, Starwheel Bushing |
| 18 | 21-48017 | O-Ring |
| 19 | 21-36016 | Oil Seal |
| 20 | 21-07029 | Starwheel Bushing (Order 21-52036) |
| 21 | 21-06042 | Roller Mounting Plate, Lower |
| - | 41-51208 | Mounting Screw, 10-32 x 1/2" |
| | * | <i>See Figure 8</i> |

PARTS LIST, Figure 3 (continued)

| Item | Part No. | Description |
|------|----------|---|
| 22 | 21-06041 | Roller Mounting Plate, Upper |
| - | 41-51208 | Mounting Screw, 10-32 x 1/2" |
| 23 | 21-98629 | Eccentric Cam, Brass |
| - | 41-51209 | Mounting Screw, 10-32 x 5/8" |
| 24 | 22-21774 | Main Frame Plate (see Figure 1, Item 1) |
| 25 | 82-70047 | Light Assembly, Film Compartment |
| - | 82-70008 | Light Shield, Glass |
| - | LP-0122 | Bulb, 12 V.AC |
| - | 82-70030 | Socket Assembly |
| - | 81-61012 | Toggle Switch |
| - | PE-1299 | Switch Plate, "On-Off" |
| - | 81-64006 | Stepdown Transformer, 120-12 V.AC (not shown) |
| 26 | 22-60701 | Feed Sprocket Shoe Detent Assembly* |
| 27 | 22-60702 | Feed Sprocket Shoe Detent Assembly* |
| 28 | 22-60703 | Upper Intermittent Sprocket Shoe Detent Assembly* |
| 29 | 21-98651 | Focus Transfer Arm, Lens Barrel (see Figure 4, Item 24) |
| 30 | 21-04041 | Pivot Bushing, Bronze |
| 31 | 21-98658 | Focus Bar |
| - | 41-51207 | Mounting Screw, 10-32 x 1/2" Flat Head |
| 32 | 21-98655 | Inner Gib |
| 33 | 21-52039 | Threaded Shaft, Lens Height Adjust |
| 34 | 21-28025 | Knurled Knob, Lens Height Adjust |
| - | 41-51189 | Set Screw, 1/4-20 x 3/4" |
| 35 | 21-98657 | Shaft Retainer |
| 36 | 21-98656 | Outer Gib |
| 37 | 21-98636 | Side Gib, Upper |
| 38 | 21-98664 | Lens Barrel |
| 39 | 21-28026 | Knurled Cap, Lens Clamping Screw |
| - | 41-51454 | Headless Set Screw, 1/4-20 x 1-1/4" |
| 40 | 21-39029 | Lens Barrel Mounting Plate |
| 41 | 21-98637 | Side Gib, Lower |
| 42 | 21-39026 | Side Plate, Lens Mount |
| | * | <i>See Figure 8</i> |

FIGURE 4



PARTS LIST

Figure 4

| Item | Part No. | Description |
|------|----------|-----------------------------------|
| 1 | -- | Drive Motor (by Customer) |
| 2 | 21-98632 | Base Plate, Drive Motor Mount |
| - | 41-51229 | Mounting Screw, 5/16-18 x 1" |
| 3 | 21-39031 | Pivoting Plate, Drive Motor Mount |
| - | 21-51027 | Pivot Shoulder Bolt (to Item 2) |
| - | 21-98633 | Link, Belt Tensioner |
| - | 41-51222 | Link Screws, 1/4-20 x 3/4" |
| 4 | 21-98631 | Motor Face Plate |
| - | 41-51222 | Mounting Screw, 1/4-20 x 3/4" |
| 5 | 22-21746 | Drive Pulley |
| 6 | 22-21810 | Drive Pulley |
| 7 | 41-51595 | Screw, 10-32 x 1/2" Button Head |
| 8 | 41-70023 | Washer, #10 |
| 9 | 21-04023 | Ball Bearing |
| 10 | 22-21809 | Pulley |
| 11 | 21-52027 | Pulley Shaft |
| 12 | 21-06003 | Pulley Bracket |
| - | 41-51178 | Set Screw, Pulley Shaft |
| - | 41-51223 | Mounting Screw, 1/4-20 x 1" |
| 13 | 21-62016 | Lever, Belt Tensioner |
| - | 41-51223 | Mounting Screw, 1/4-20 x 1" |
| - | 21-41002 | Pulley Shaft |
| - | 41-51223 | Shaft Mounting Screw, 1/4-20 x 1" |
| 14 | 22-21804 | Pulley |
| 15 | 21-49026 | Arm, Idler Pulleys |
| - | 41-51223 | Mounting Screw, 1/4-20 x 1" |
| - | 21-41002 | Shaft, Idler Pulley |
| - | 41-51223 | Shaft Mounting Screw, 1/4-20 x 1" |
| 16 | 21-43006 | Flanged Idler Pulley |
| 17 | 21-43005 | Idler Pulley |
| 18 | 21-28005 | Focus Knob |
| 19 | 21-98634 | Focus Shaft Bearing Block |
| 20 | 21-51025 | Focus Screw |
| 21 | 21-35011 | Focus Bearing |
| 22 | 21-51027 | Shoulder Bolt, 3/8" x 1/2" |

PARTS LIST, Figure 4 (continued)

| Item | Part No, | Description |
|------|----------|---|
| 23 | 21-04041 | Bushing (2 each) |
| 24 | 21-98651 | Focus Transfer Arm |
| 25 | 21-04041 | Bronze Bushing |
| 26 | 41-51368 | Set Screw, 5/16-18 x 1/4" |
| - | 51-04010 | Steel Ball, 1/4" Hardened |
| 27 | 21-98658 | Pivot Bar, Focus Arm |
| - | 41-51207 | Mounting Screw, 10-32 x 1/2" Flat Head |
| 28 | 41-51344 | Screw, 1/4-20 x 1-1/4" |
| 29 | 21-98677 | Bracket, Pulley Shaft |
| - | 21-41002 | Shaft |
| - | 41-51223 | Shaft Mounting Screw, 1/4-20 x 1" |
| 30 | 21-98676 | Oil Overflow Reservoir |
| - | 41-51209 | Mounting Screw, 10-32 x 5/8" |
| - | 21-29025 | Lid, Oil Reservoir |
| - | 41-51394 | Lid Mounting Screw, 4-40 x 3/8" |
| - | 22-20614 | Breather Plug, Nylon |
| - | 22-60690 | Oil Line, Upper Intermittent Movement |
| - | 22-60709 | Oil Line, Shutter Gearbox |
| - | 22-60691 | Oil Line, Lower Intermittent Movement |
| - | 21-98023 | Hose Barb, Brass |
| 31 | 22-60708 | Horizontal Sprocket Shaft Assembly (see Figure 6) |
| - | 41-51209 | Mounting Screw, 10-32 x 5/8" |
| 32 | 22-21797 | Encoder Drive Pulley |
| 33 | 21-05021 | Encoder Drive Belt |
| 34 | 22-21828 | Sprocket Shaft Driven Pulley |
| 35 | 22-21798 | Encoder Driven Pulley |
| 36 | 22-60694 | Upper Encoder Bracket Assembly |
| - | 41-51209 | Mounting Screw, 10-32 x 5/8" |
| 37 | | Encoder (by Customer) |
| 38 | 22-60688 | Upper Intermittent Movement Assembly |
| - | 41-51223 | Mounting Screw, 1/4-20 x 1" |
| 39 | 22-21811 | Driven Pulley (incl. with Item 38) |
| - | 22-41150 | Pulley Flange |
| - | 22-21794 | Intermittent Flywheel (incl. with Item 38) |

PARTS LIST, Figure 4 (continued)

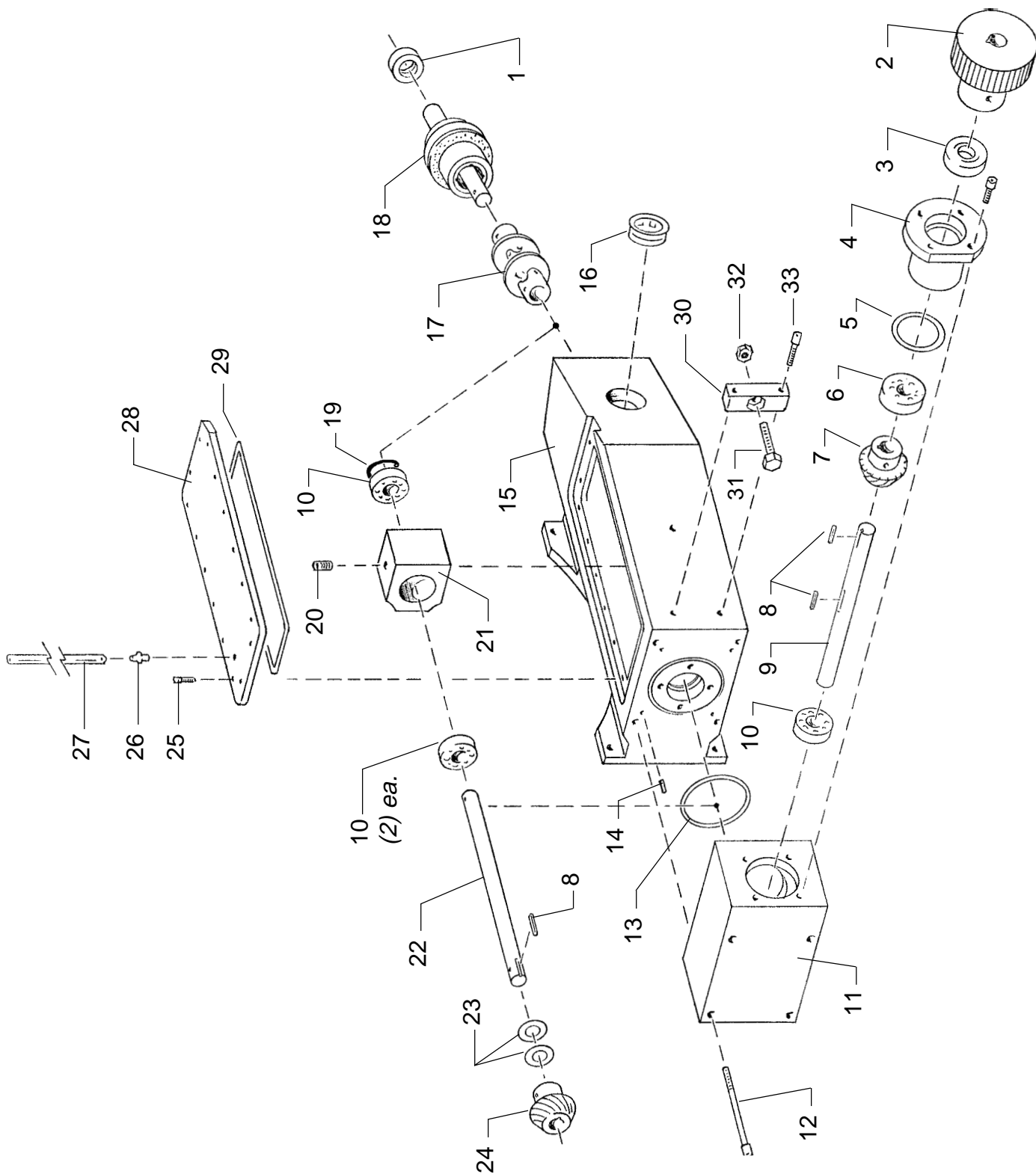
| Item | Part No. | Description |
|------|----------|---|
| 40 | 22-60008 | Shutter Blade Assembly (incl. Item 41) |
| 41 | 21-98626 | Shutter Hub |
| - | 41-51097 | Blade Mounting Screw, 10-32 x 3/8" |
| - | 41-51213 | Hub Clamping Screw, 10-32 x 1" |
| 42 | 22-60709 | Shutter Gearbox Assembly (see Figure 5) |
| - | 41-51209 | Mounting Screw, 10-32 x 5/8" |
| 43 | 21-98661 | Slide Bar, Idler Rollers |
| 44 | 41-51493 | Screw, 1/4-20 x 3/8" Button Head |
| - | 21-35012 | Square Nut |
| 45 | 21-04023 | Ball Bearing |
| - | 21-56006 | Bearing Spacer |
| - | 21-98660 | Bearing Shaft |
| - | 41-51190 | Set Screw, 1/4-20 x 1" |
| 46 | 21-43005 | Idler Pulley |
| 47 | 21-43014 | Idler Pulley, Flanged |
| - | 21-56006 | Bearing Spacer |
| - | 21-98660 | Bearing Shaft |
| 48 | 21-51027 | Shoulder Bolt, 3/8" x 1/2" |
| 49 | 21-21808 | Shutter Gearbox Driven Pulley |
| - | 21-27009 | Key |
| - | 41-51187 | Set Screw, 1/4-20 x 1/2" |
| 50 | 21-98635 | Bypass Roller Bracket |
| - | 41-51207 | Mounting Screw, 10-32 x 1/2" Flat Head |
| - | 41-51602 | Set Screw, Roller Shaft; 6-32 x 1/4" |
| 51 | 21-49007 | Bypass Roller |
| - | 21-04023 | Ball Bearing |
| - | 21-52022 | Roller Shaft |
| 52 | 22-60693 | Lower Encoder Bracket Assembly |
| - | 41-51209 | Mounting Screw, 10-32 x 5/8" |
| 53 | 22-60689 | Lower Intermittent Movement |
| - | 41-51223 | Mounting Screw, 1/4-20 x 1" |
| 54 | 22-21816 | Pulley Assembly (incl. with Item 53) |

PARTS LIST, Figure 4 (continued)

| Item | Part No. | Description |
|------|----------|--|
| 55 | 22-21816 | Pulley Assembly (incl. with Item 53) |
| 56 | 22-21794 | Intermittent Flywheel (incl. with Item 53) |
| 57 | 41-51575 | Screw, 14/-20 x 1/2" Button Head |
| 58 | 21-70032 | Bevel Washer |
| 59 | 21-04006 | Ball Bearing |
| 60 | 21-98638 | Jackshaft Bracket |
| - | 41-51223 | Bracket Mounting Screw, 1/4-20 x 1" |
| 61 | 22-21784 | Pulley |
| - | 41-51187 | Set Screw, 1/4-20 x 1/2" |
| 62 | 21-52026 | Pulley Shaft |
| 63 | 22-21805 | Pulley |
| - | 21-37038 | Roll Pin, 1/8" x 1" |
| 64 | 21-98649 | Mounting Bracket, Belt Tensioner |
| - | 41-51223 | Mounting Screw, 1/4-20 x 1" |
| 65 | 21-06002 | Tensioner Arm |
| - | 21-52029 | Pivot Shaft (to Item 64) |
| - | 21-52028 | Roller Shaft (to Item 66) |
| - | 41-51173 | Shaft Set Screw, 8-32 x 1/4" |
| - | 41-51225 | Tensioning Screw, 1/4-20 x 1-1/2" |
| - | 41-36016 | Locknut, 1/4-20 Hex |
| 66 | 22-21809 | Pulley |
| - | 21-04023 | Ball Bearing |

See Page 9 for Timing Belt Part Numbers.

FIGURE 5

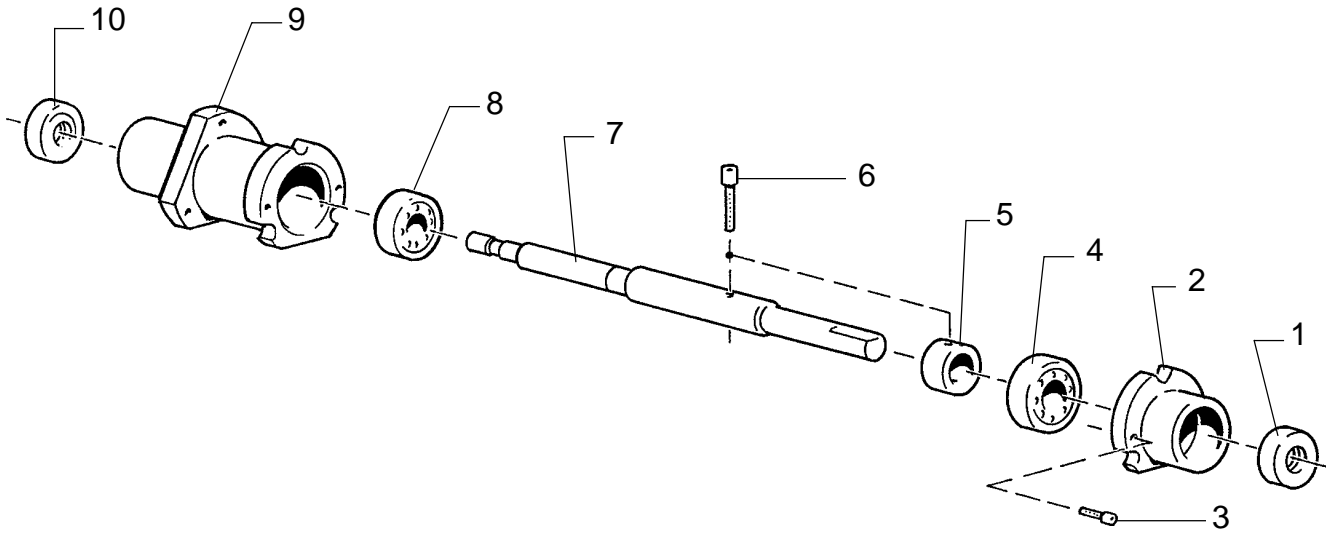


PARTS LIST

Figure 5

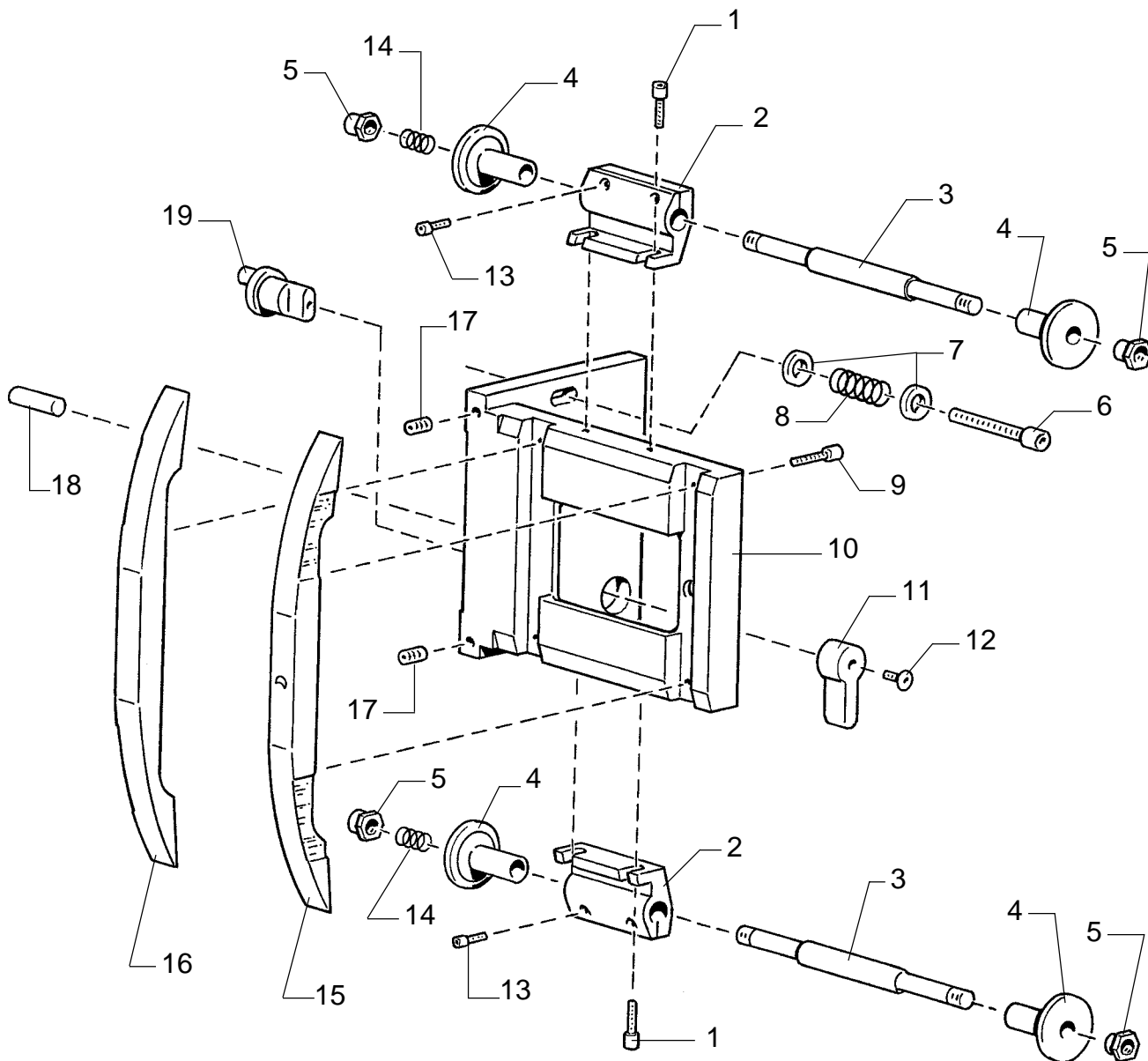
| Item | Part No. | Description |
|------|----------|--|
| 1 | 21-36013 | Oil Seal |
| 2 | 22-21808 | Gearbox Driven Pulley |
| 3 | 21-36013 | Oil Seal |
| 4 | 21-35013 | Bearing Housing |
| - | 41-51208 | Mounting Screw, 10-32 x 1/2" |
| 5 | 21-48033 | O-Ring |
| 6 | 21-04006 | Ball Bearing |
| 7 | 21-23056 | Bevel Gear |
| 8 | 21-27009 | Key |
| 9 | 21-52021 | Gear Shaft |
| 10 | 21-04005 | Ball Bearing |
| 11 | 21-98663 | Drive Transfer Housing |
| 12 | 41-51214 | Screw, 10-32 x 1-1/4" |
| 13 | 21-48032 | O-Ring Cord, 1/8" x 3-5/32" |
| 14 | 21-37008 | Dowel Pin, 1/8" x 1/2" |
| 15 | 21-98670 | Gearbox Housing |
| 16 | 51-98200 | Oil Sight Glass |
| 17 | 21-98673 | Universal Joint |
| 18 | 22-60700 | Shutter Shaft & Bearing Assembly |
| 19 | 21-48012 | Snap Ring, 7/8" O.D. |
| 20 | 41-51208 | Cap Screw, 10-32 x 1/2" |
| 21 | 21-98669 | Bearing Block |
| 22 | 21-52017 | Gear Shaft |
| 23 | 41-70024 | Spacer Washer (qty. as req'd.) |
| 24 | 21-23057 | Bevel Gear |
| 25 | 41-51394 | Screw, 4-40 x 3/8" |
| 26 | 21-98023 | Hose Barb, Brass |
| 27 | 21-26002 | Oil Line |
| 28 | 21-29024 | Lid, Gearbox Assembly |
| 29 | 21-48032 | O-Ring Cord, 1/8" x 14-1/2" |
| 30 | 21-98662 | Block, Fine Adjust Screw |
| 31 | 21-51026 | Fine Adjust Screw, Sync Belt |
| 32 | 41-35016 | Locknut, 1/4-20 Hex |
| 33 | 41-51209 | Mounting Screw, 10-32 x 5/8" |
| | | NOT SHOWN |
| | 21-40249 | Pipe Plug, Brass (Oil Fill, Oil Drain) |

FIGURE 6



| Item | Part No. | Description |
|------|----------|----------------------|
| 1 | 21-36010 | Oil Seal |
| 2 | 21-98641 | Cap, Bearing Housing |
| 3 | 41-51557 | Screw, 6-32 x 1/2" |
| 4 | 21-04002 | Ball Bearing |
| 5 | 21-11008 | Stop Collar |
| 6 | 41-51210 | Screw, 10-32 x 3/4" |
| 7 | 21-52007 | Sprocket Shaft |
| 8 | 21-04021 | Ball Bearing |
| 9 | 21-29022 | Bearing Housing |
| 10 | 21-36009 | Oil Seal |

FIGURE 7



PARTS LIST

Figure 7

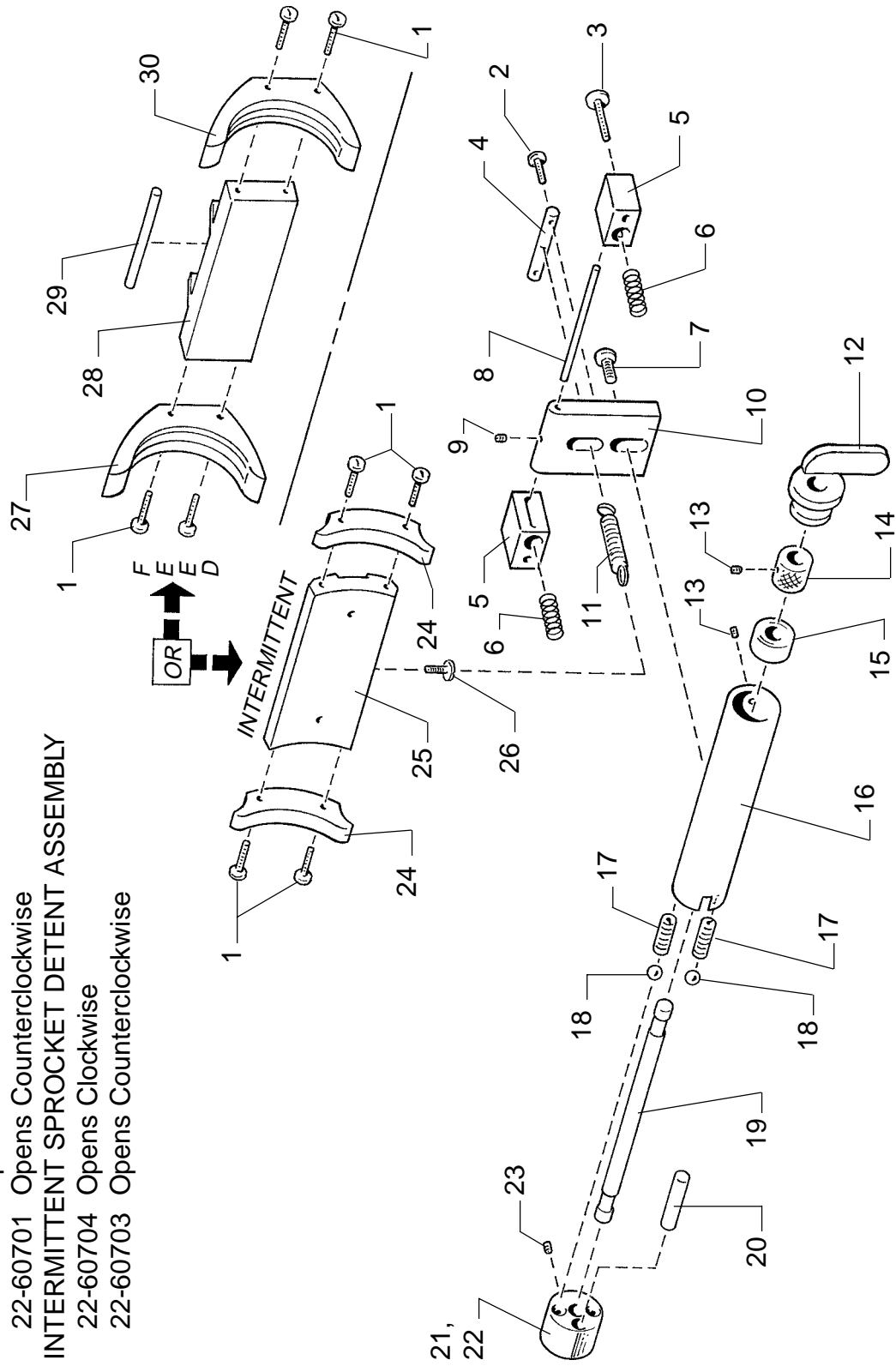
| Item | Part No. | Description |
|------|----------|------------------------------------|
| 1 | 41-51590 | Screw, 6-32 x 3/8" |
| 2 | 21-98659 | Clamp Bracket, Guide Roller Shaft |
| 3 | 21-52031 | Lateral Guide Roller Shaft |
| 4 | 81-49006 | Lateral Guide Roller |
| 5 | 82-00053 | Locknut |
| 6 | 41-51213 | Screw, 10-32 x 1" |
| 7 | 41-70050 | Flatwasher, #10 |
| 8 | 21-58040 | Compression Spring |
| 9 | 41-51389 | Screw, 4-40 x 1/2" |
| 10 | 21-06045 | Film Gate Bracket |
| 11 | 21-28006 | Gate Lever |
| 12 | 41-51371 | Screw, 8-32 x 1/2" Button Head |
| 13 | 41-51391 | Screw, 4-40 x 3/8" Button Head |
| 14 | 81-58019 | Compression Spring |
| 15 | 21-98683 | Gate Runner, Right (Outboard) |
| 16 | 21-98684 | Gate Runner, Left (Inboard) |
| 17 | 41-51188 | Set Screw, 1/4-20 x 5/8" |
| 18 | 11-37005 | Dowel Pin (staked into Main Frame) |
| 19 | 21-37041 | Cam, Gate Lever |

FEED SPROCKET DETENT ASSEMBLY

- 22-60702 Opens Clockwise
- 22-60701 Opens Counterclockwise

INTERMITTENT SPROCKET DETENT ASSEMBLY

- 22-60704 Opens Clockwise
- 22-60703 Opens Counterclockwise



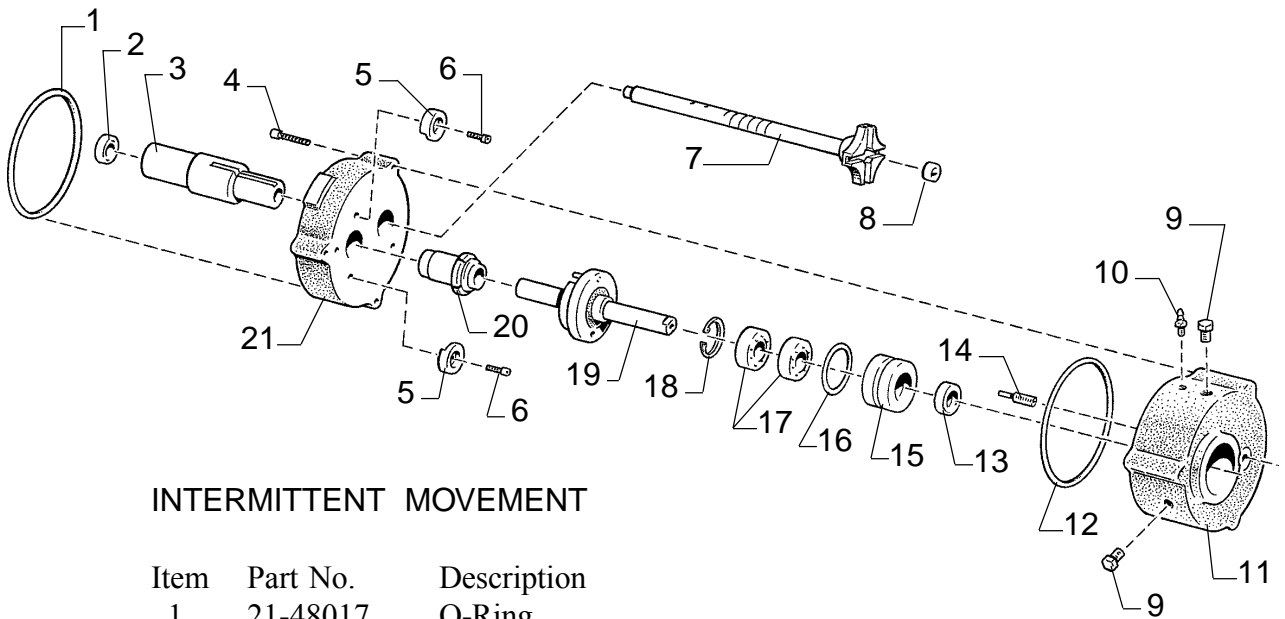
PARTS LIST

Figure 8

| Item | Part No. | Description |
|------|----------|---|
| 1 | 41-51021 | Screw, 4-40 x 1/2" Bind Head |
| 2 | 41-51007 | Screw, 2-56 x 3/8" Bind Head |
| 3 | 41-51195 | Screw, 4-40 x 5/8" Socket Head |
| 4 | 22-20309 | Spring Tension Shaft |
| 5 | 22-20307 | Spring Block |
| 6 | 21-58036 | Compression Spring |
| 7 | 21-21834 | Screw, 10-32 x 7/16" Button Head |
| 8 | 22-21612 | Pivot Shaft |
| 9 | 41-51373 | Set Screw, 4-40 x 1/8" |
| 10 | 22-20308 | Shoe Holder Arm |
| 11 | 21-58011 | Expansion Spring |
| 12 | 22-40427 | Detent Lever |
| 13 | 41-51170 | Set Screw, 8-32 x 1/8" |
| 14 | 22-00008 | Knurled Knob |
| 15 | 21-04003 | Ball Bearing |
| 16 | 22-20324 | Detent Arm |
| 17 | 31-58001 | Compression Spring |
| 18 | 31-04001 | Steel Ball, 3/16" |
| 19 | 22-20125 | Detent Shaft |
| 20 | 21-37003 | Dowel Pin, 3/16" x 7/8" |
| 21 | 21-98292 | Detent (Clockwise) |
| 22 | 21-98293 | Detent (Counterclockwise) |
| 23 | 41-51178 | Set Screw, 10-32 x 1/4" |
| 24 | 22-21887 | Intermittent Sprocket Shoe, 5 Perf, 70mm* |
| 25 | 22-20310 | Intermittent Sprocket Shoe Spacer Plate |
| 26 | 41-51016 | Screw, 4-40 x 1/4" Bind Head |
| 27 | 21-98672 | Feed Sprocket Shoe, Left (Inboard) |
| 28 | 21-98646 | Feed Sprocket Shoe Spacer Plate |
| 29 | 21-37023 | Pivot Shaft |
| 30 | 21-98640 | Feed Sprocket Shoe, Right (Outboard) |

* Not included with 22-60703 or 22-60704; order separately

FIGURE 9



INTERMITTENT MOVEMENT

| Item | Part No. | Description |
|------|----------|--|
| 1 | 21-48017 | O-Ring |
| 2 | 21-36018 | Oil Seal |
| 3 | 21-52036 | Starwheel Shaft Bushing (with Item 7) |
| 4 | 41-51214 | Screw, 10-32 x 1-1/4" Socket Head (3 req'd.) |
| 5 | 22-20122 | Bushing Retaining Washer |
| 6 | 41-51210 | Screw, 10-32 x 3/4" Socket Head |
| 7 | 21-52036 | Starwheel Shaft & Bushing (with Item 3) |
| 8 | 21-07029 | Starwheel Bearing & Bushing |
| 9 | 21-40249 | Plug Screw, Brass |
| 10 | 21-98023 | Hose Barb, Oil Line |
| 11 | 22-21795 | Intermittent Housing, Upper Movement |
| 11 | 22-21796 | Intermittent Housing, Lower Movement |
| 12 | 21-48017 | O-Ring |
| 13 | 21-36008 | Oil Seal |
| 14 | 21-37025 | Threaded Stop Pin, Starwheel |
| - | 41-35023 | Locknut, Stop Pin (not shown) |
| 15 | 22-20239 | Bushing, Intermittent Housing |
| 16 | 21-48004 | O-Ring |
| 17 | 21-04021 | Ball Bearing |
| 18 | 21-48023 | Snap Ring, Beveled |
| 19 | 21-52035 | Camshaft & Bushing (with Item 20) |
| 20 | 21-52035 | Camshaft Bushing (with Item 19) |
| 21 | 22-21778 | Intermittent Base Plate Casting |

