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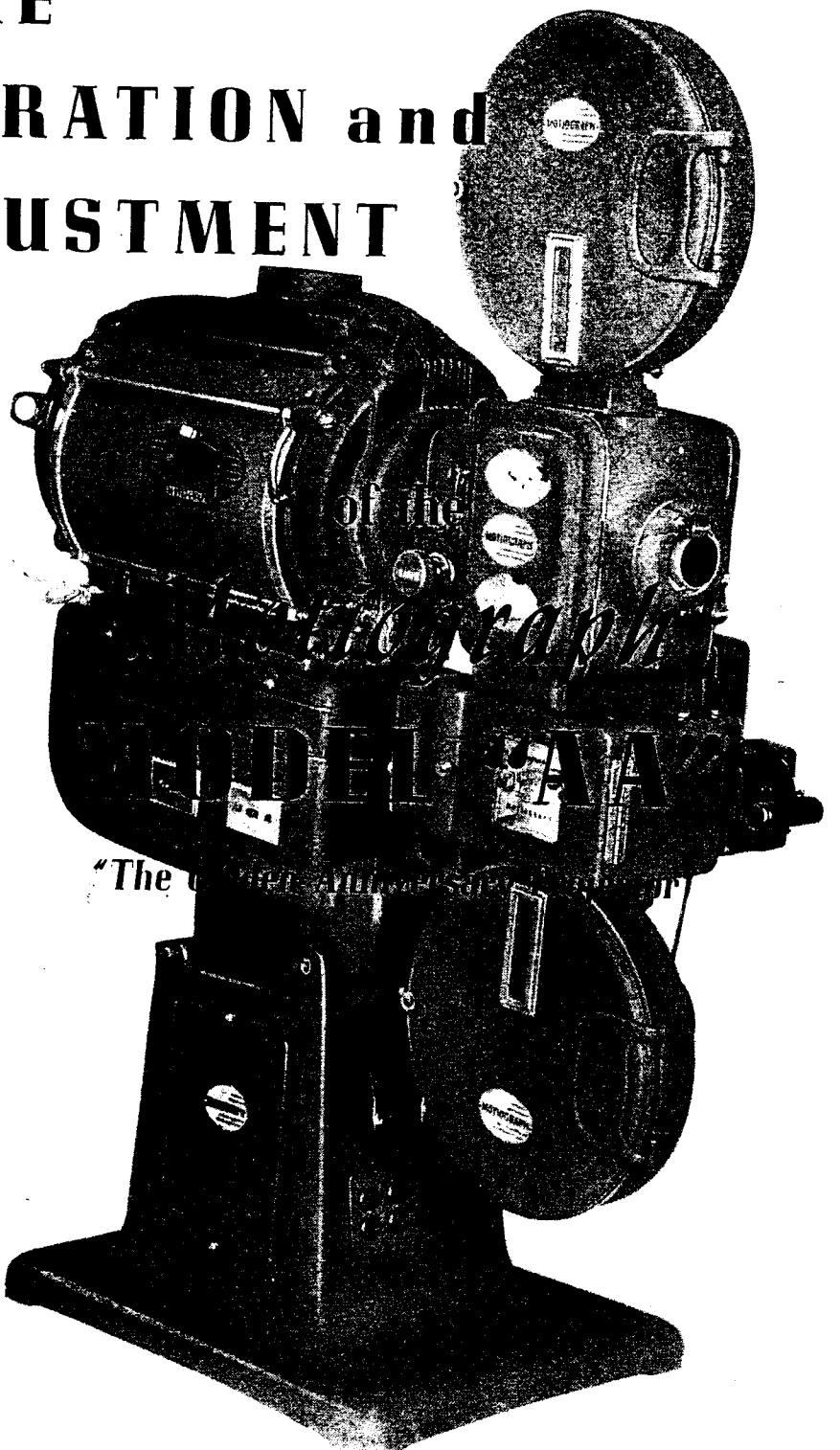
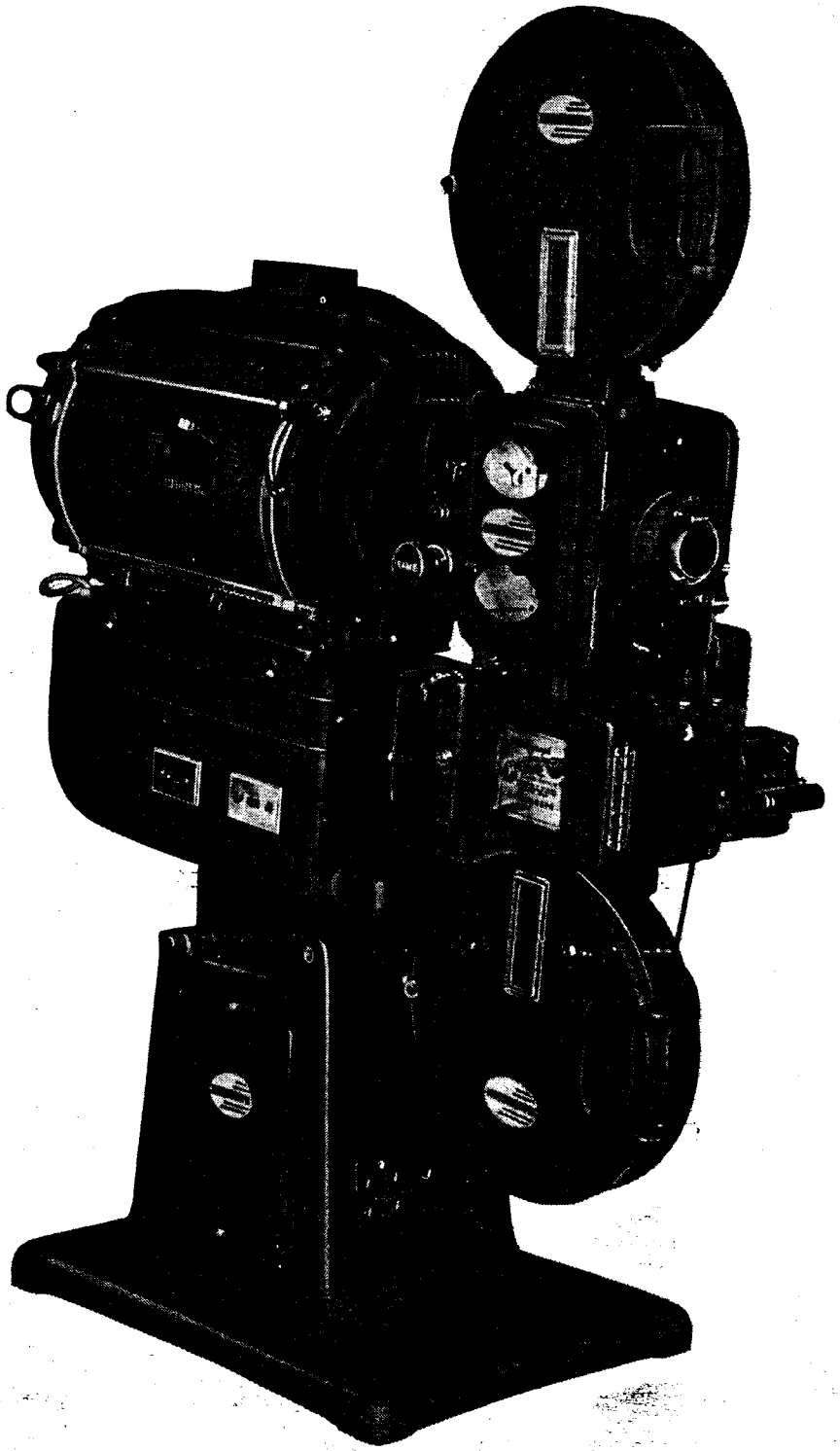
The CARE OPERATION and ADJUSTMENT of the



MOTIOGRAPH, INC.

4431 W. LAKE STREET CHICAGO 24, ILLINOIS



The
CARE, OPERATION
and ADJUSTMENT
of the
Motiograph
MODEL "AA"

The Motiograph "AA" may be expected to give flawless screen performance for its entire long lifetime with an absolute minimum of care and adjustment, and it should run for years before any part replacements are indicated.

The "AA" mechanism is of unit construction, and thus it is possible to replace any unit without removing the mechanism from the sound reproducer. All units can be removed so easily and quickly that the entire mechanism may be taken apart in a matter of minutes instead of hours. Replacement of any unit can also be made quickly, and as it can be put back into place in one way only, it is impossible to reassemble the mechanism incorrectly.

The tools required to completely disassemble the "AA" are six Allen wrenches, which are supplied with the "AA." (These can be replaced at any hardware or automotive supply store in the event of loss.) No wrenches, hammers, pin-pushers, broaches, reamers, or special tools are needed to take out and subsequently replace any unit of the "AA."

Care of the "AA"

The only daily care required is the dusting and cleaning of lens, shoes, tracks and aperture.

The projection lens can be removed by turning the "lens-lock" control at the front of the mechanism (Item 18, Fig. 1) several

turns counter clockwise. The stop (Item 13, Fig. 1) is set during original positioning of the lens in the carriage, so that after cleaning, the lens can be returned to its position of exact focus.

faulty fire-trap rollers, Motiograph has eliminated a source of film mutilation. The cleaning operations outlined, along with semi-annual lubrication in a few spots, are all the tasks that the projectionist is re-

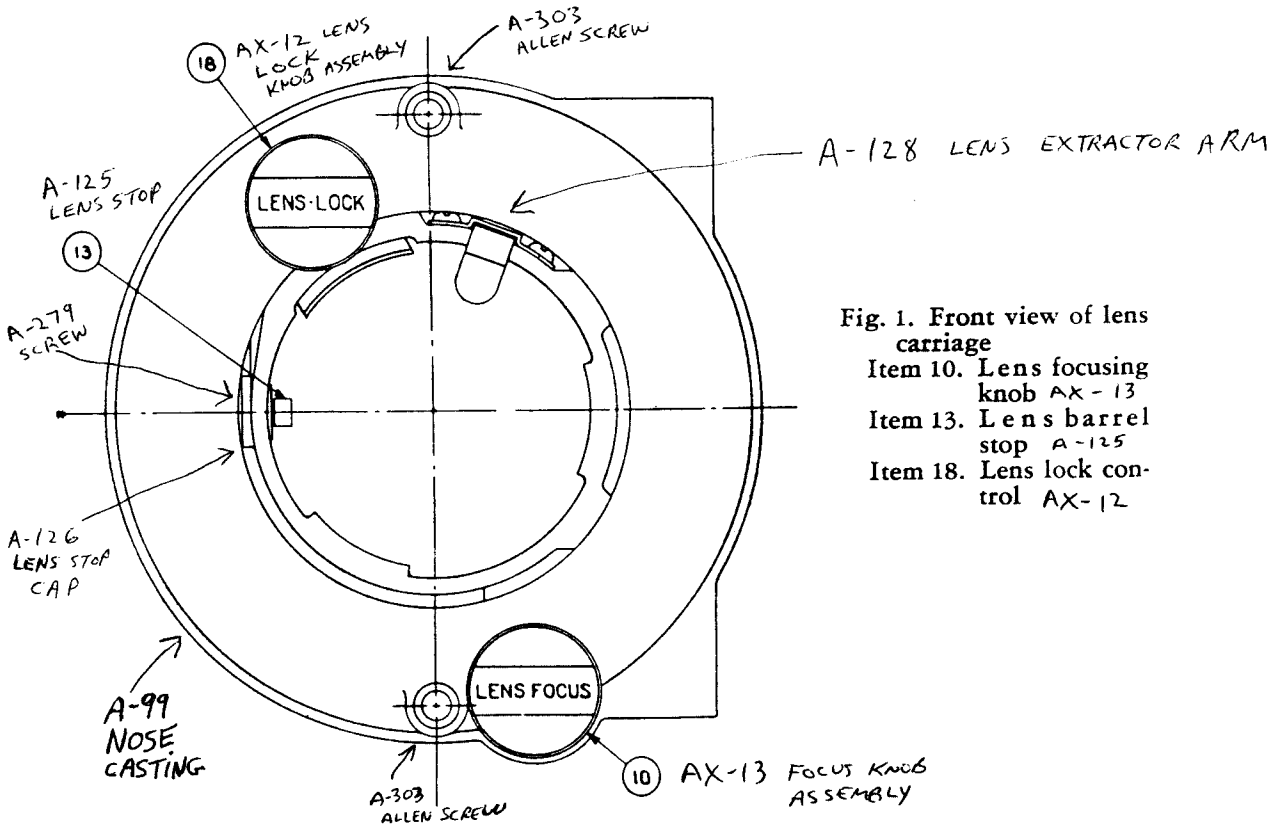


Fig. 1. Front view of lens carriage
Item 10. Lens focusing knob AX-13
Item 13. Lens barrel stop A-125
Item 18. Lens lock control AX-12

The film gate of the "AA" opens one full inch, which makes it possible to clean the shoes, tracks and aperture without removing any of these units. (Fig. 2.) When more careful cleaning is indicated, the aperture and tracks (which are one integral unit), and the tension shoes (again one unit) can be easily and quickly removed and replaced.

Projectionists, knowing how difficult it is to remove the fire-trap rollers in most upper magazines, will be glad to learn that the fire-trap rollers in the "AA" upper magazine can be removed for cleaning and replaced in a few minutes without removing the magazine from the mechanism. As much film damage originates from dirty, sticking or quired to perform to keep his Motiograph "AA's" operating at peak performance. As the following diagrams and instructions will show, it is easy to make any adjustments and replacements that might be indicated when wear ultimately comes.

Installation

The Motiograph "AA" projector mechanism can replace nearly any make and model of projector mechanism on any sound reproducer without the use of mechanism plates or adapters, and the same projector-sound reproducer driving apparatus may also be used. (Exceptions are that the "AA," like all other modern projectors, is not in-

terchangeable with the Powers or with the Motiograph "F," "H" and "HU" projectors, unless different projector-sound reproducer driving apparatus is obtained from the manufacturer of the sound reproducer.)

To install the "AA," remove the framing knob and covers on the gear side of the mechanism. The mechanism may then be fastened to the sound reproducer with the machine screws furnished. Most modern sound reproducers require the use of two $\frac{3}{8}$"-16x$\frac{3}{4}$" cap screws installed from the sound reproducer into the mechanism base. With some sound reproducers, a shorter $\frac{3}{8}$"-16x$\frac{7}{16}$" cap screw is required in a hole nearest to the front of the mechanism so that the screw does not strike the lower gear of the mechanism. Certain older sound-

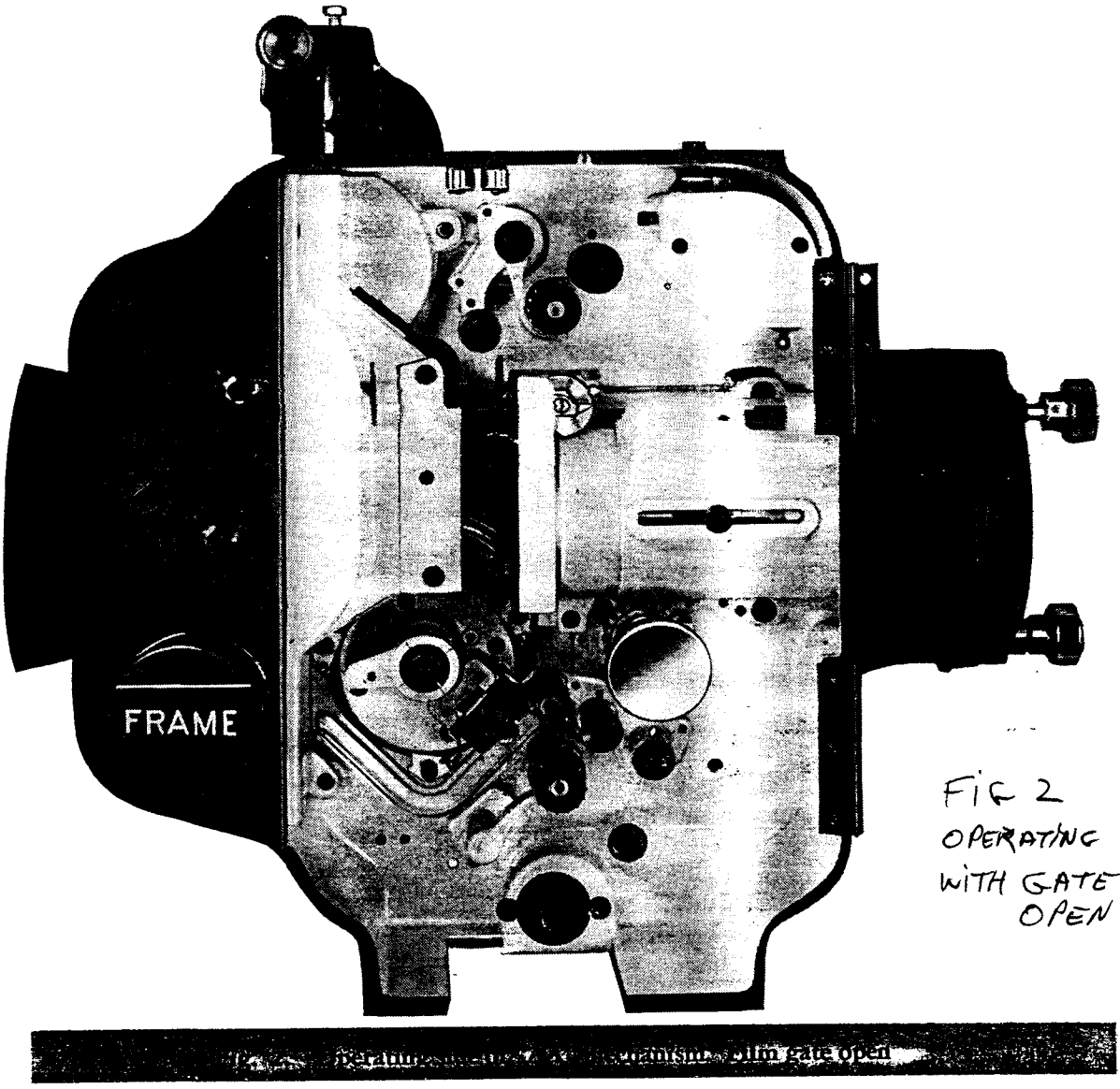


FIG 2
OPERATING SIDE
WITH GATE
OPEN

heads are designed to employ a $\frac{5}{16}$"-18x$\frac{7}{16}$" F. H. screw inserted through the base of the mechanism into the soundhead. In such cases, the lower feed sprocket drive gear and the steel gear that meshes with the drive

"AA" mechanism is employed with modern soundheads. When older soundheads with poorly machined castings are employed, some shims may be required between the mechanism and the soundhead.

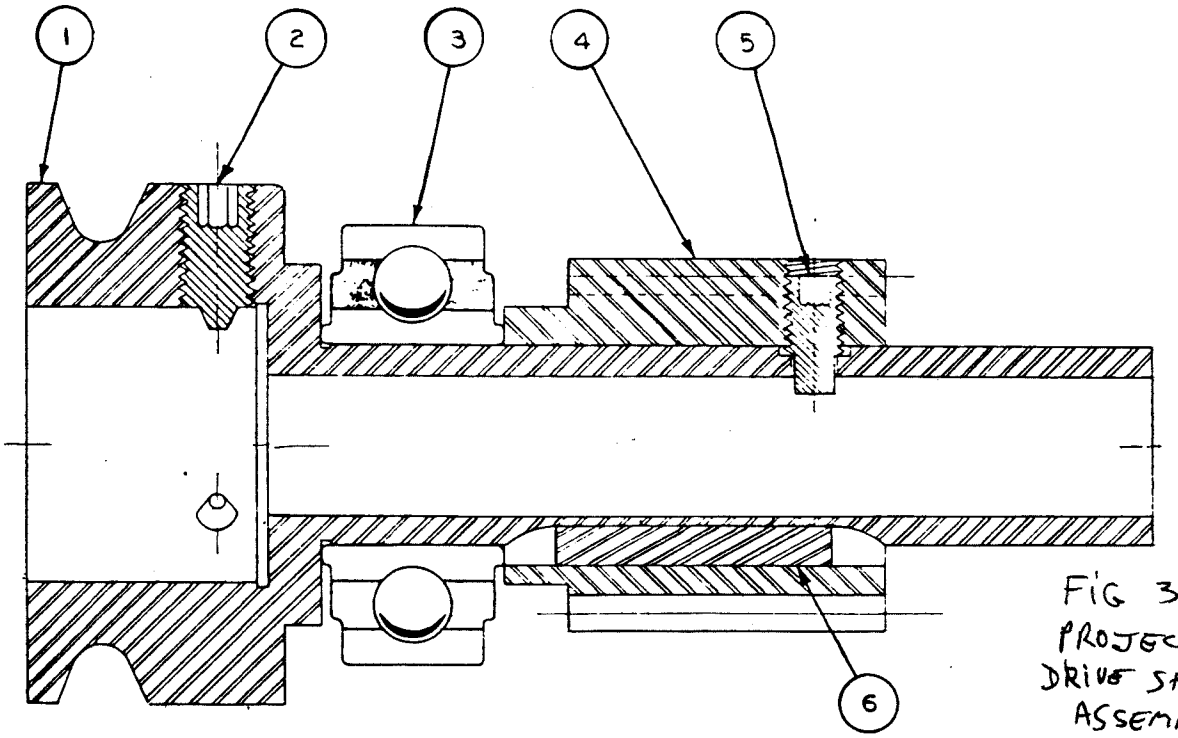


FIG 3
PROJECTOR
DRIVE SHAFT
ASSEMBLY

Item 1. Socket unit of drive shaft
Item 2. Three Allen screws that lock projector drive pinion in place in projector drive assembly
Item 3. Ball bearing
Item 4. Steel drive pinion
Item 5. Allen screw that locks soundhead drive shaft
Item 6. Key that locks pinion to shaft

pinion must be removed while installing the screw.

The bases of the "AA" mechanisms are carefully machined, as are the tops of most modern soundhead castings, so no shims are usually necessary to obtain proper clearance of projector drive gears when the

Remove the projector drive assembly from the mechanism by releasing the clamps on the lower portion of the center frame. The Allen screw (Item 5, Fig. 3), located between the teeth of the steel drive pinion (Item 4, Fig. 3), and the three Allen screws (Item 2, Fig. 3) located in the

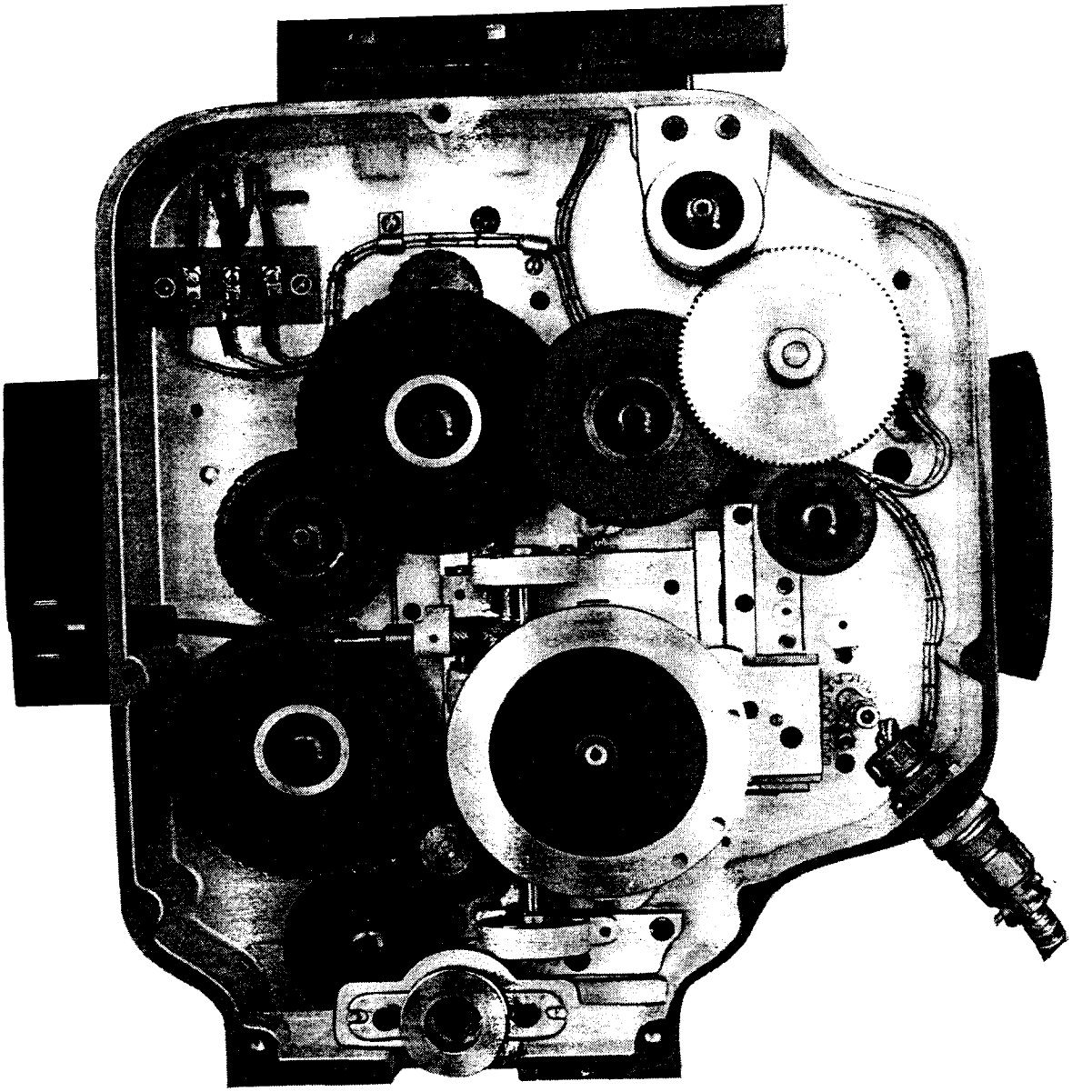


FIG 4 DRIVE SIDE WITH COVER REMOVED

socket unit (Item 1, Fig. 3) of the drive assembly, should be released sufficiently to enable the insertion of the soundhead's drive shaft. After insertion of the soundhead's drive shaft, the Allen screw (Item 5, Fig. 3) should be tightened against the flat of the soundhead's drive shaft. The three Allen screws (Item 4, Fig. 3) should be tightened simultaneously into the teeth of the pinion on the drive shaft. The entire projector drive assembly should then be inserted into the mechanism so that its steel

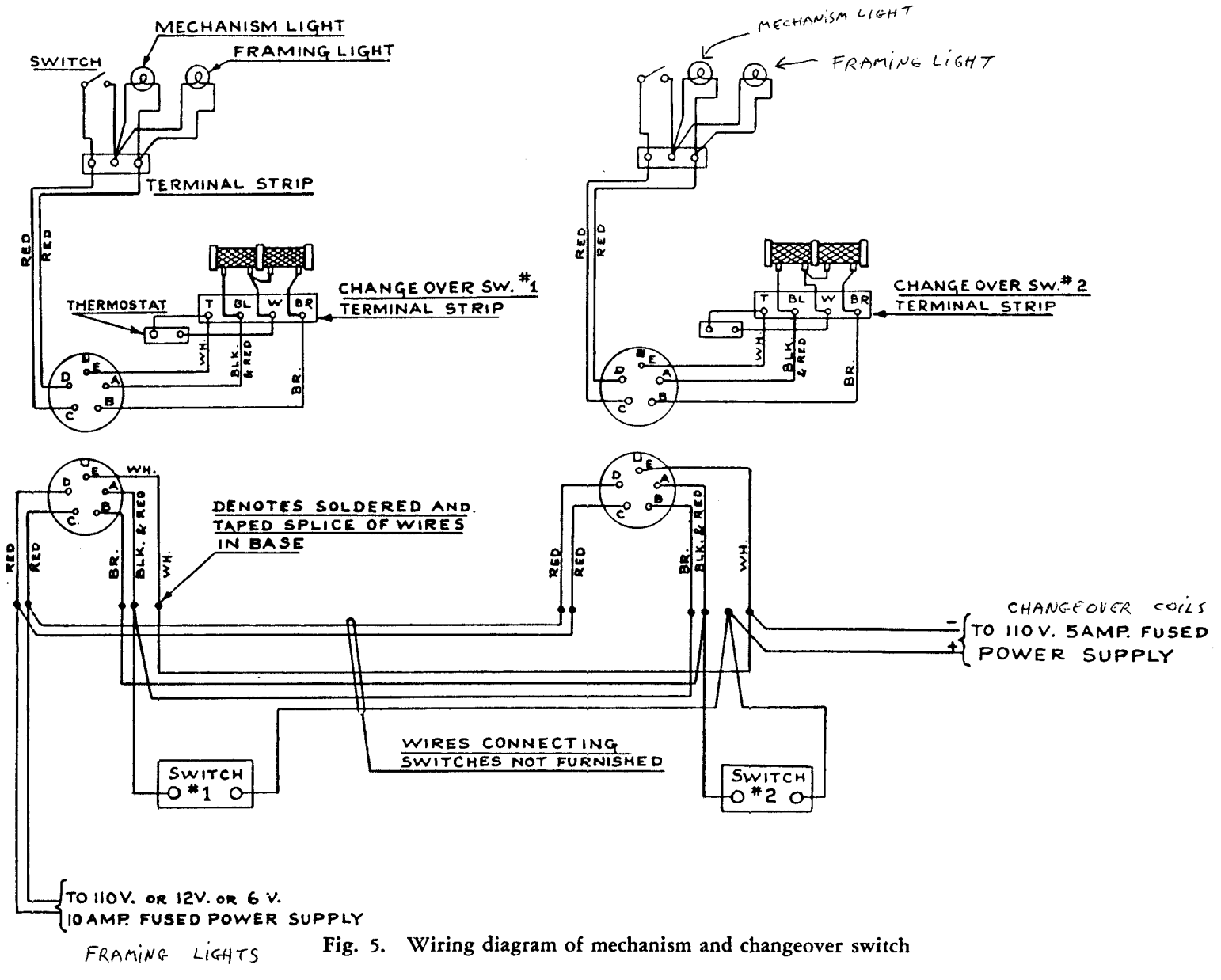


Fig. 5. Wiring diagram of mechanism and changeover switch

drive pinion meshes properly with its associated gear. The clamps should be tightened to hold the entire projector drive assembly rigidly in its proper position. The mechanism should then be turned over by hand to ascertain if the steel drive pinion of the projector drive assembly is in proper engagement with its associated gear.

After the sound reproducer and projector mechanism are coupled together, the covers and framing knob should be replaced.

Motiograph furnishes with its "AA" mechanism a removable fire-trap roller assembly upon which the upper magazine is mounted. When "AA" or other modern upper magazines are to be used, they are easily attached to the fire-trap roller assembly. When Motiograph Model "K" upper magazines are to be used, the fire-trap roller assembly furnished with the "AA" projector mechanism should be removed, as Motiograph Model "K" magazines have an inbuilt fire-trap roller assembly.

Motiograph "AA" lower magazines fasten to the soundhead in the conventional manner. The screws provided should be inserted in the soundhead, and then the lower magazine should be slipped into place, so that the fastening screws will engage the slots on the top of the lower magazine. The screws should then be tightened.

After the necessary connections of take-up and sound reproducer have been made, and before power is turned on, the mechanism should again be turned over by hand to make certain that all connections have been properly made. The "AA" mechanism and magazines will have been properly tested at the factory. but if by chance any adjustments are necessary, they should be effected as hereinafter described.

The wiring of the framing light, mechanism light and changeover is installed in the mechanism at the factory. It is not necessary, therefore, for any wiring to be done inside of the mechanism itself. The wiring diagram (Fig. 5) will clearly show the electrical connections to be made up to the mechanism.

Installing Lens

Open the lens lock on the front of the lens barrel (Item 18, Fig. 1). Loosen the lens stop-lock (Item 13, Fig. 1) on the side of the lens barrel. After getting the exact lens focus, set the lens stop up to the end of the lens jacket and lock it into position. Tighten the lens lock, and the lens will then be in exact position.

OPERATION AND ADJUSTMENT

Threading

1. Turn the framing handle so that the reference mark on its dial coincides with the "center" indicator marking. (See Fig. 16.)
2. Open the doors of the upper and lower magazines, mechanism, and sound reproducer.
3. Open the film gate, separate intermittent sprocket shoe, and the upper and lower pad rollers. (See Fig. 2.) The film gate is opened by pushing inward on the large knob just below the lens carriage while turning it clockwise about a half turn. The intermittent sprocket shoe assembly is opened by pushing away from the sprocket the two finger grips until the automatic latch functions.
4. Set the timing of the intermittent sprocket. This is accomplished by turning the mechanism over by hand to the point where the intermittent sprocket just begins to move, indicating that the cam pin is about to engage a star slot. Set the movable indicator cap in the outer intermittent sprocket bearing so that one of the four engraved lines on the cap will be in line with the single line on the locking

collar. This will enable the projectionist to know in later threading operations exactly when the cam pin is engaging one of the star slots. (See Fig. 2.)

5. Set the variable shoe tension indicator to the desired point, "LOW," "STD," or "HIGH." (See Fig. 2.) The "LOW" position provides a film tension of about 225 grams, suitable for new, green film. The tension in the "STD" position is approximately 375 grams, which is correct for film in average condition. The "HIGH" position increases the tension to around 675 grams to aid in flattening badly buckled older films.
6. Put the reel in the upper magazine and lock the reel latch. Pull down the film until the leader is just above the floor, and insert the film in the upper fire-trap rollers.
7. Close the upper magazine door. (This is important—it removes a fire hazard.)
8. Thread the film between the film guide roller and the upper feed sprocket.
9. Grasp the film with the thumb and fore-finger of the left hand about four inches below the upper feed sprocket, and place the film on the two pins on each side of the lighted framing aperture so that the picture is in exact frame.
10. While holding the film in place over the framing aperture, place the film in the film gate and over the intermittent sprocket; then close the intermittent sprocket shoe by pressing its actuating button. Press inward the large gate control knob to release its latch and thus close the film gate. The film, when released, will come up from the pins on the framing aperture and form the correct upper loop. Then close the upper pad roller. (When the film is placed in frame upon the framing aperture, it will automatically be in correct frame at the picture aperture.)
11. Make about a four inch lower loop and place the film under the lower pad rollers and over the lower feed sprocket and thence down to the soundhead. Close the pad rollers. (See Fig. 6 for complete threading diagram.)
12. Thread the soundhead and insert the film into the lower magazine. Close all doors.
13. Run the mechanism to the proper starting point on the film, stop it at that point, and you are all ready to go.

Lubrication

Lubrication of the "AA" mechanism is no problem, for no oil is required at any point. All gears and shafts run on grease-packed ball bearings which require no further lubrication for their long lifetime.

Grease-packed ball bearings are also used on both the star and cam shafts of the intermittent movement. The intermittent movement housing is equipped with a large grease reservoir which provides lubrication for the meshing of the cam pin and the star slots. The amount of grease in the movement reservoir will be more than sufficient to last six months under average projection conditions. The grease level should be checked periodically, and more grease inserted if necessary. To grease, merely remove the plug in the face of the movement housing (Item 5, Fig. 7) and use the grease gun provided, bringing the grease up to its proper level. (If an oversupply of grease is inserted, the surplus will come out of the vent on the gear side of the mechanism.)

The upper guide roller (Item 1, Fig. 7) and the film guide rollers (Items 3 and 4, Fig. 7) will probably require semi-annual filling of the grease reservoirs in their hollow shafts. This is accomplished by removing the Allen screws and shooting grease into the hollow shafts. The upper and lower pad rollers (Items 2, 6 and 7, Fig. 7) will

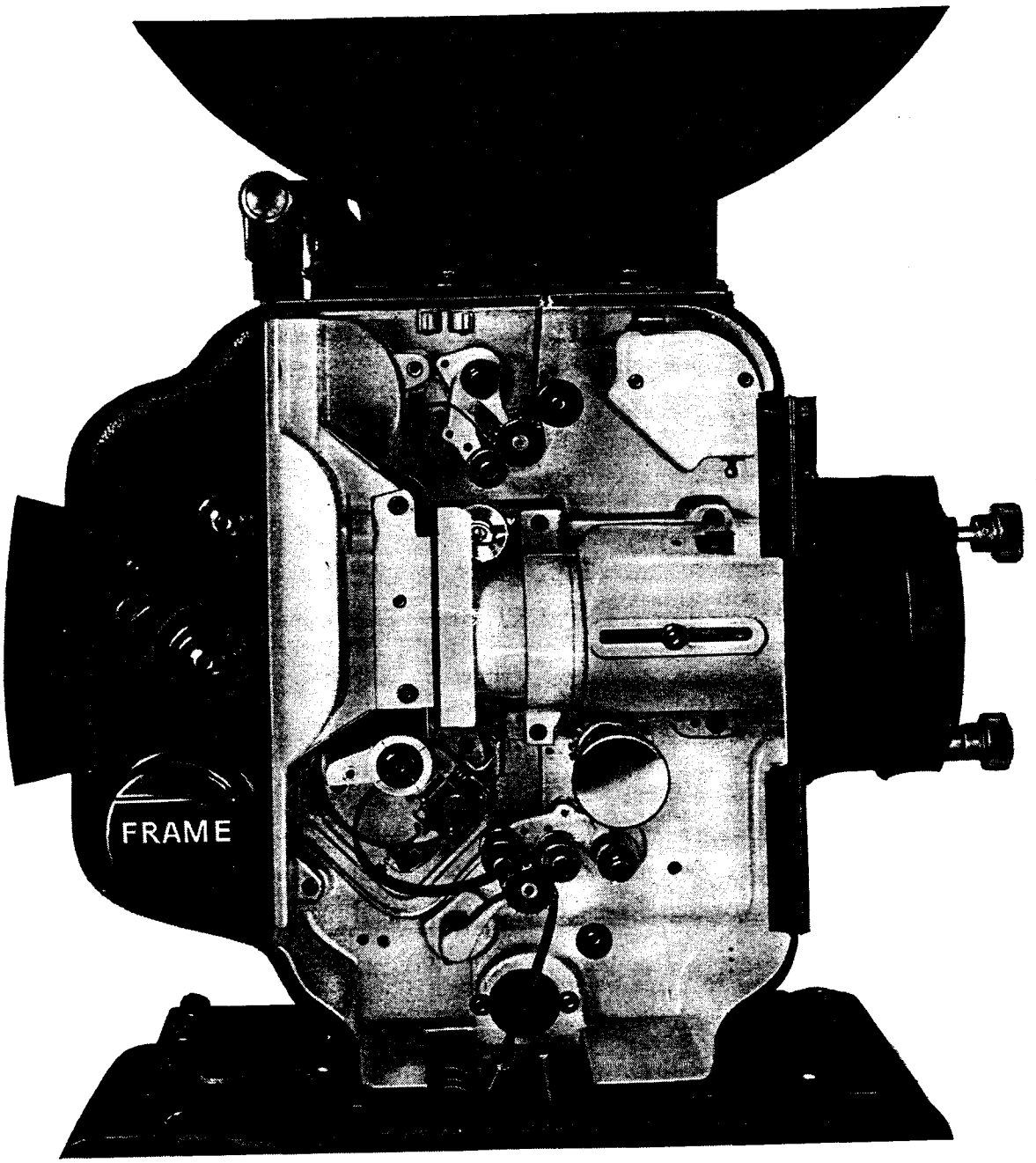


FIG 6 OPERATING SIDE WITH FILM THREADED

also require semi-annual lubrication. This is accomplished by removing their knurled knobs, and shooting grease into their respective hollow shafts.

Under practically all operating conditions there is no necessity for any extra

lubrication on the gear side of the projector. When delivered, the gear teeth will have been provided with a fine film of grease to aid in the running-in process. While it is not necessary to renew this film of grease, some projectionists will wish to renew it annually to assure continued quiet operation of the gears.

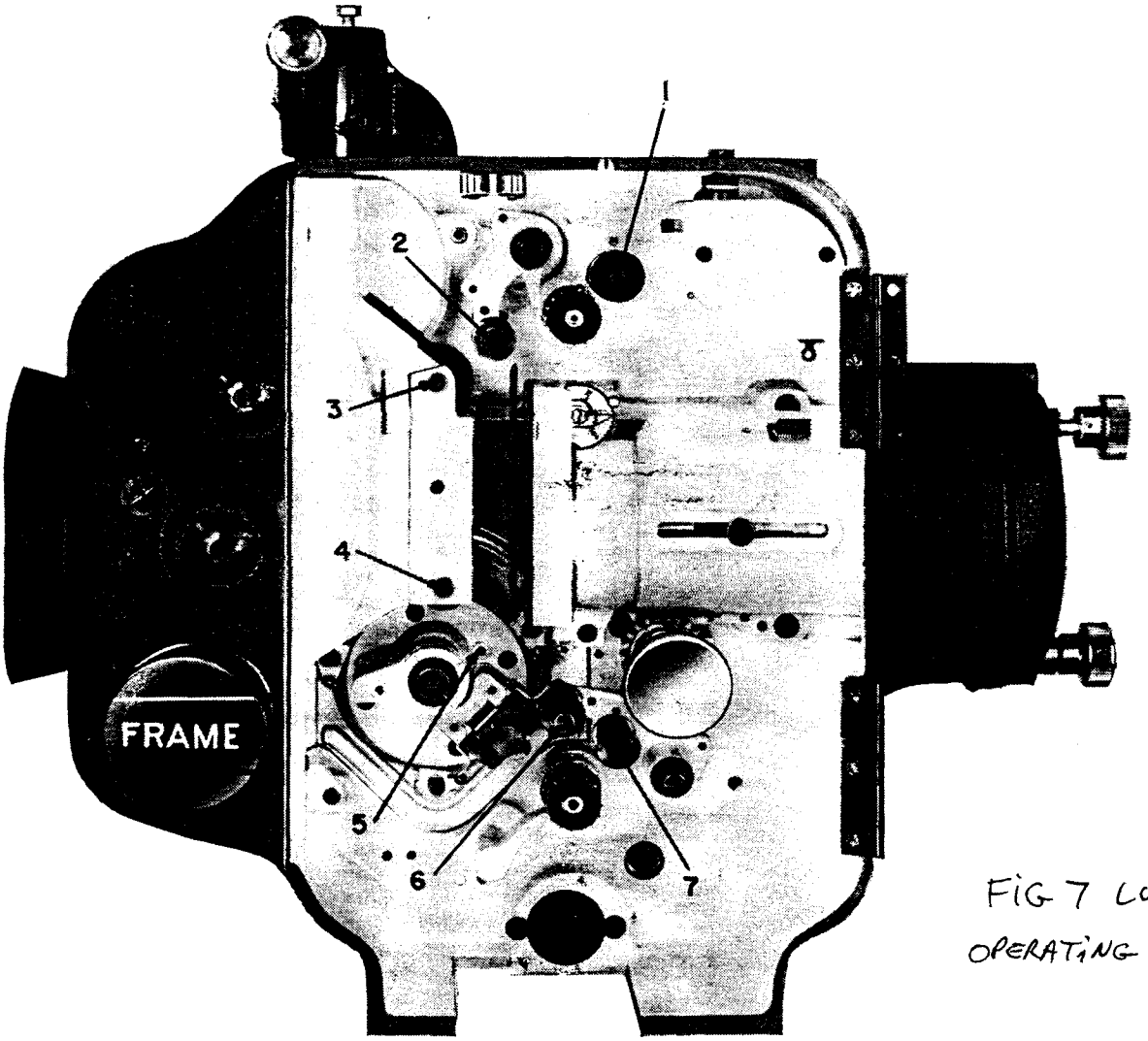
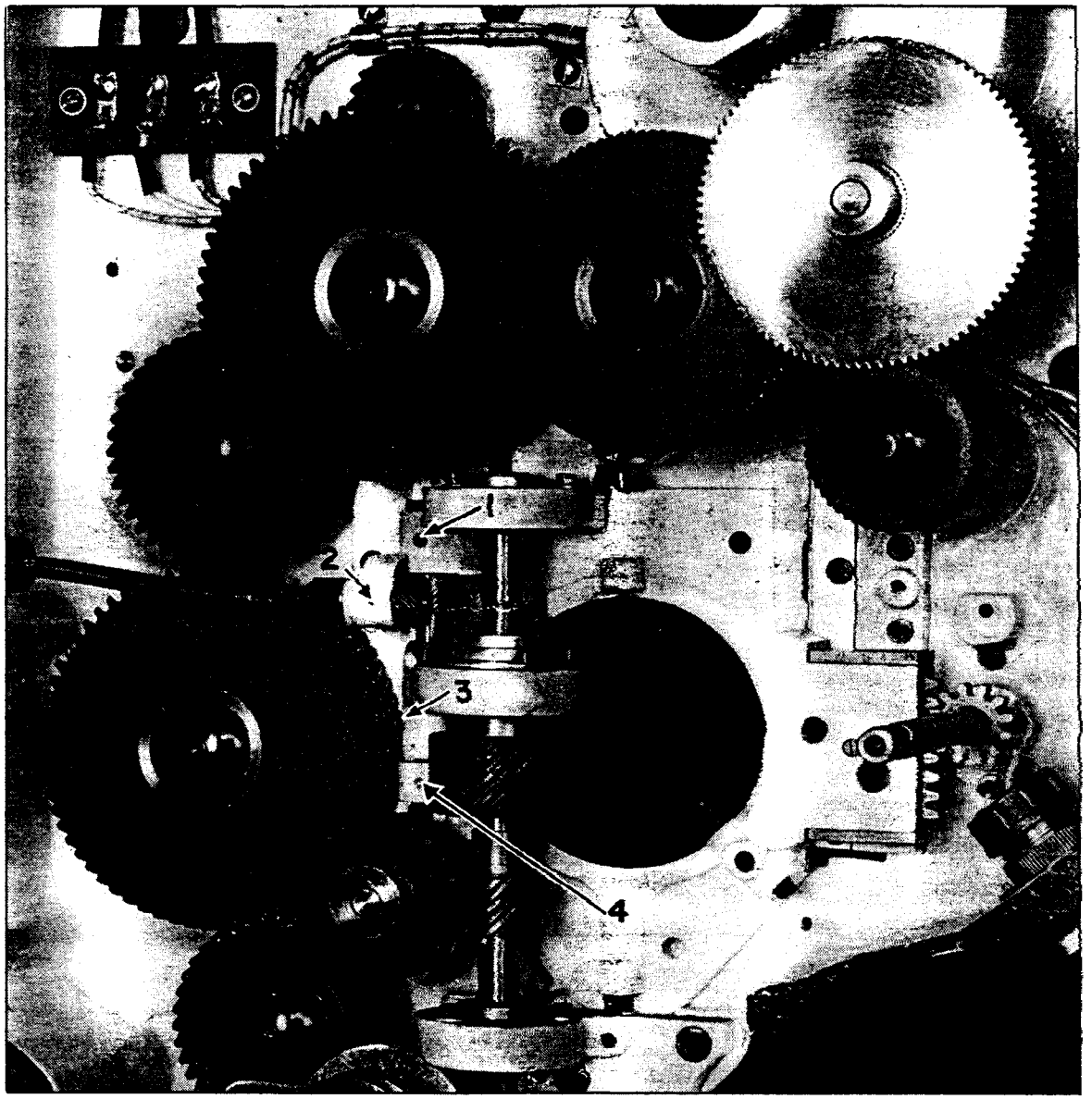


FIG 7 LUBRICATION OPERATING SIDE

Item 1. Upper guide roller
Item 2. Upper pad roller
Item 3. Upper film guide roller
Item 4. Lower film guide roller
Item 5. Intermittent movement grease plug
Items 6 and 7. Lower pad roller



Item 1. Hole to grease vertical shaft on timing adjustment
Item 2. Hole to grease gear on fine shutter-timing adjustment
Item 3. Hole to grease vertical shaft casting
Item 4. Hole to grease vertical shaft on timing adjustment

FIG. 8 LUBRICATION— GEAR SIDE

The only other lubrication task is to put some grease on the four points on the gear side of the inner shifting frame, as indicated on Figure 8, about once every six months.

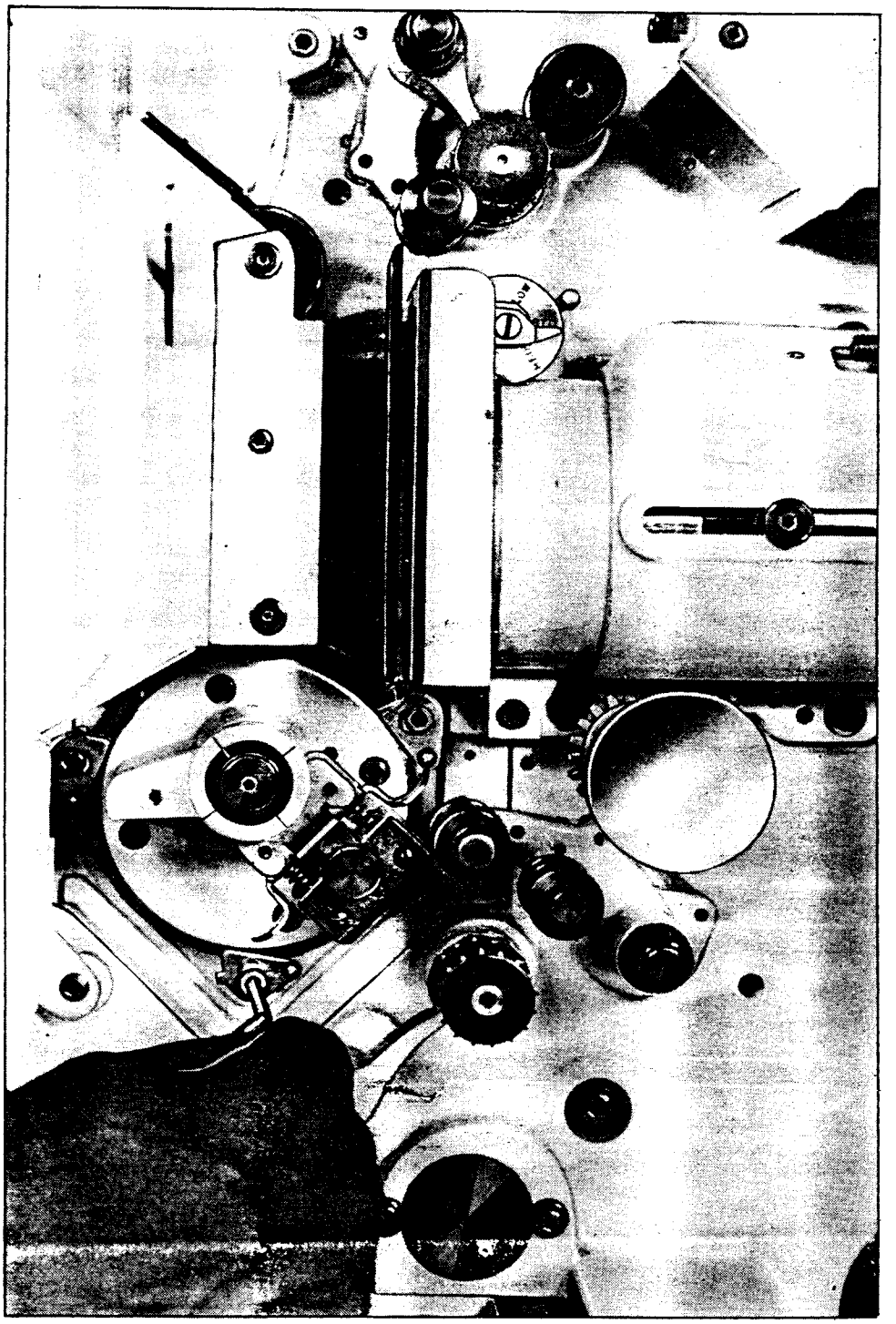


FIG 9 UNLOCKING INTERMITTENT

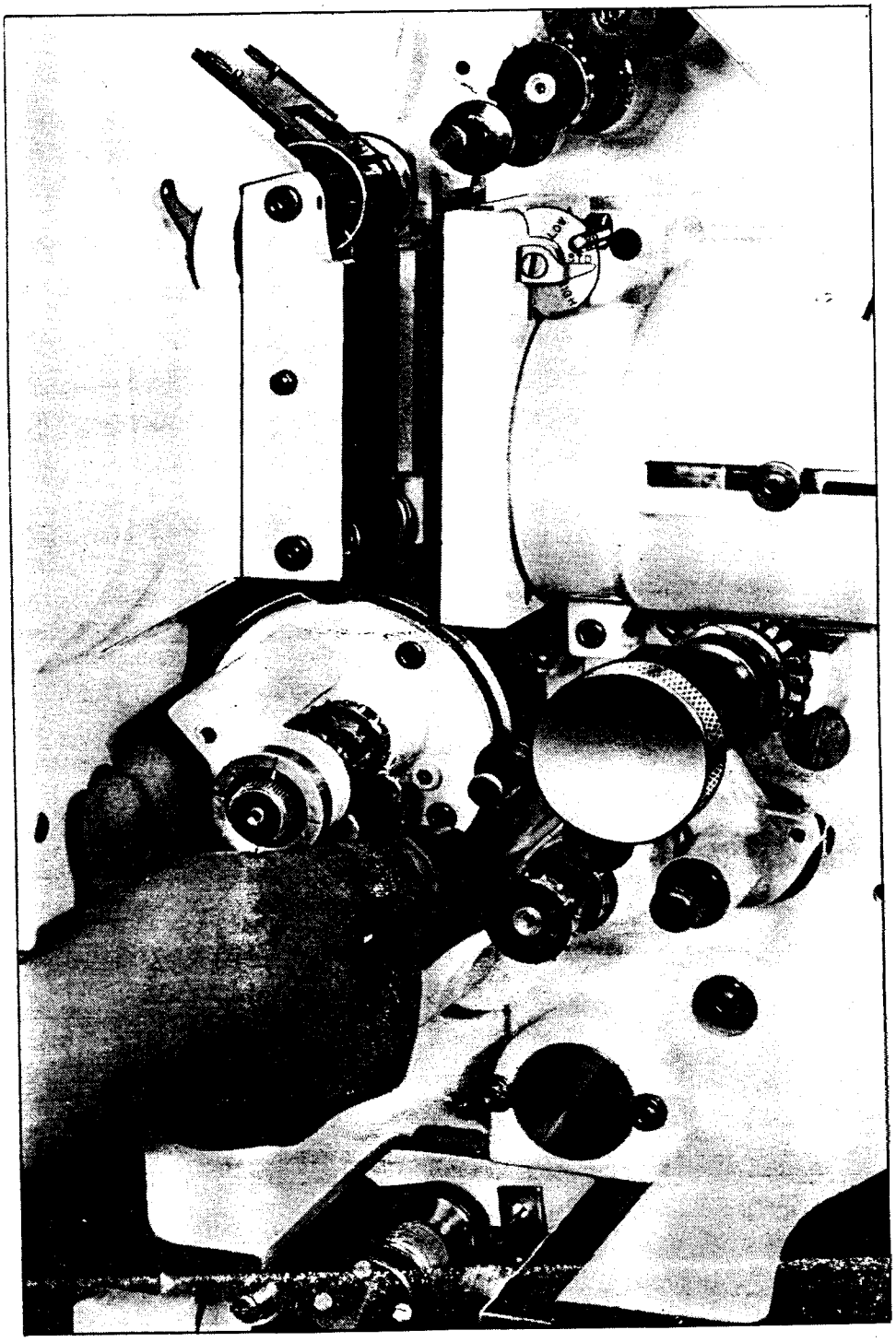


FIG 10 REMOVING INTERMITTENT

REPLACEMENT PROCEDURES

The Intermittent Movement

Removal and subsequent replacement of the intermittent movement is a very simple process that can be accomplished in a few minutes' time, as reference to the following procedure will clearly indicate:

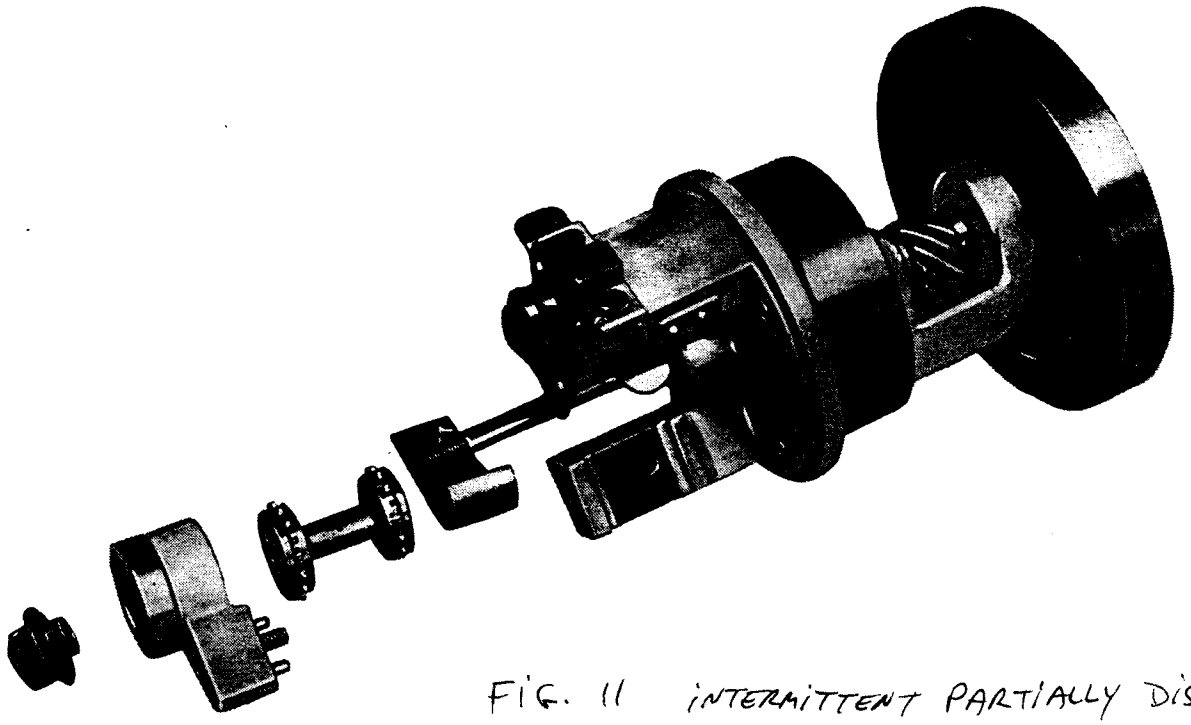


FIG. 11 INTERMITTENT PARTIALLY DISASSEMBLED

1. Remove the framing knob and covers on the gear side of mechanism.
2. Remove the fly-wheel on the intermittent movement by taking out the two Allen screws that lock the fly-wheel to the cam shaft.
3. Turn the framing knob to its "down" position.
4. Open the film gate and close the lower pad rollers.
5. Release (do not remove) the Allen screws on the three clamps that hold the movement in proper position, and push the clamps away from the movement. (Clamps are located on operating side of the mechanism. See Fig. 9.)
6. Rotate the movement to the right about one-quarter turn, which will free the balance wheel pinion and permit the movement case to clear the lower film guide roller. The movement can then be pulled out from the operating side. (See Fig. 10.)

The movement is replaced by reversing this procedure. When the intermittent movement is replaced, be sure that after insertion it is properly rotated so that the balance wheel pinion engages the movement drive gear and the movement case comes up tightly to the stop set in the inner shifting

frame assembly.

Sprockets

The upper and lower feed sprockets are removed by taking out the Allen screws in the hubs of the sprockets. They can then be reversed or replaced quickly.

The intermittent sprocket can be reversed or replaced without the necessity of removing the intermittent movement from the mechanism. To remove the intermittent sprocket, back out the tapered screw in the hollow star shaft until it comes to a full stop, release the two screws in the locking collar and remove the collar, take off the outboard bearing by removing the single fastening screw which holds it on its locating dowels, release the stripper anchoring set screw at the bottom of the same hole, and slip out the stripper to release the sprocket. (See Fig. 11.)

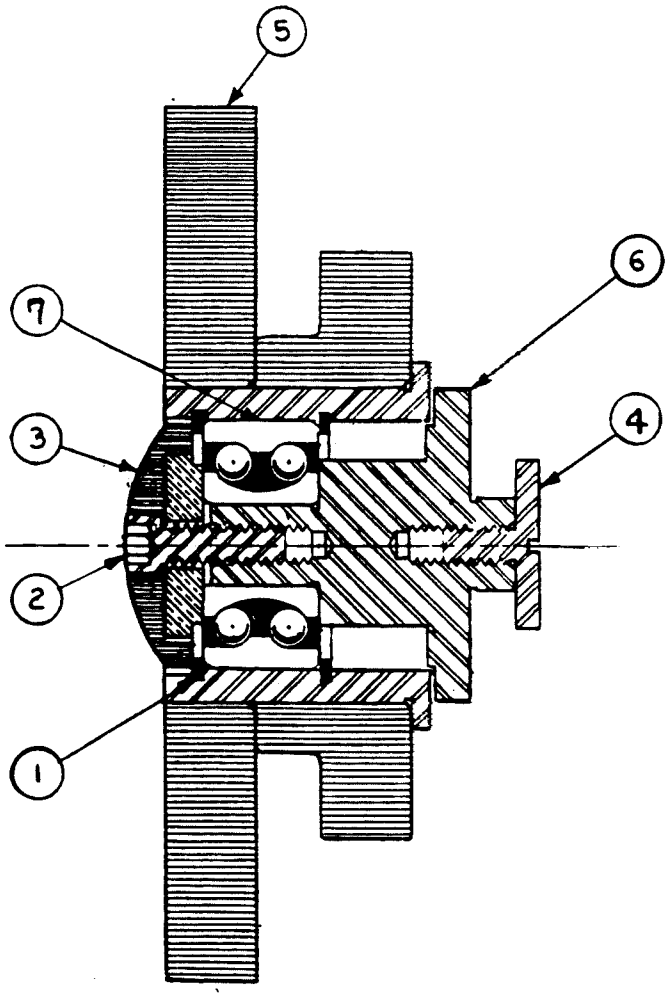


Fig. 12.
Item.1. Ball bearing retaining ring
Item 2. Allen screw locking gear to stud
Item 3. Decorative dust cap
Item 4. Screw fastening stud to center frame
Item 5. Gear
Item 6. Stud
Item 7. Ball bearing

Gears

Most gears in the gear train can be removed by simply loosening the Allen screw (Item 2, Fig. 12) in the face of the decorative dust-cap (Item 3, Fig. 12) that fastens the gear to its attendant shaft or stud. (Item 6, Fig. 12.)

To remove the steel gear that meshes with

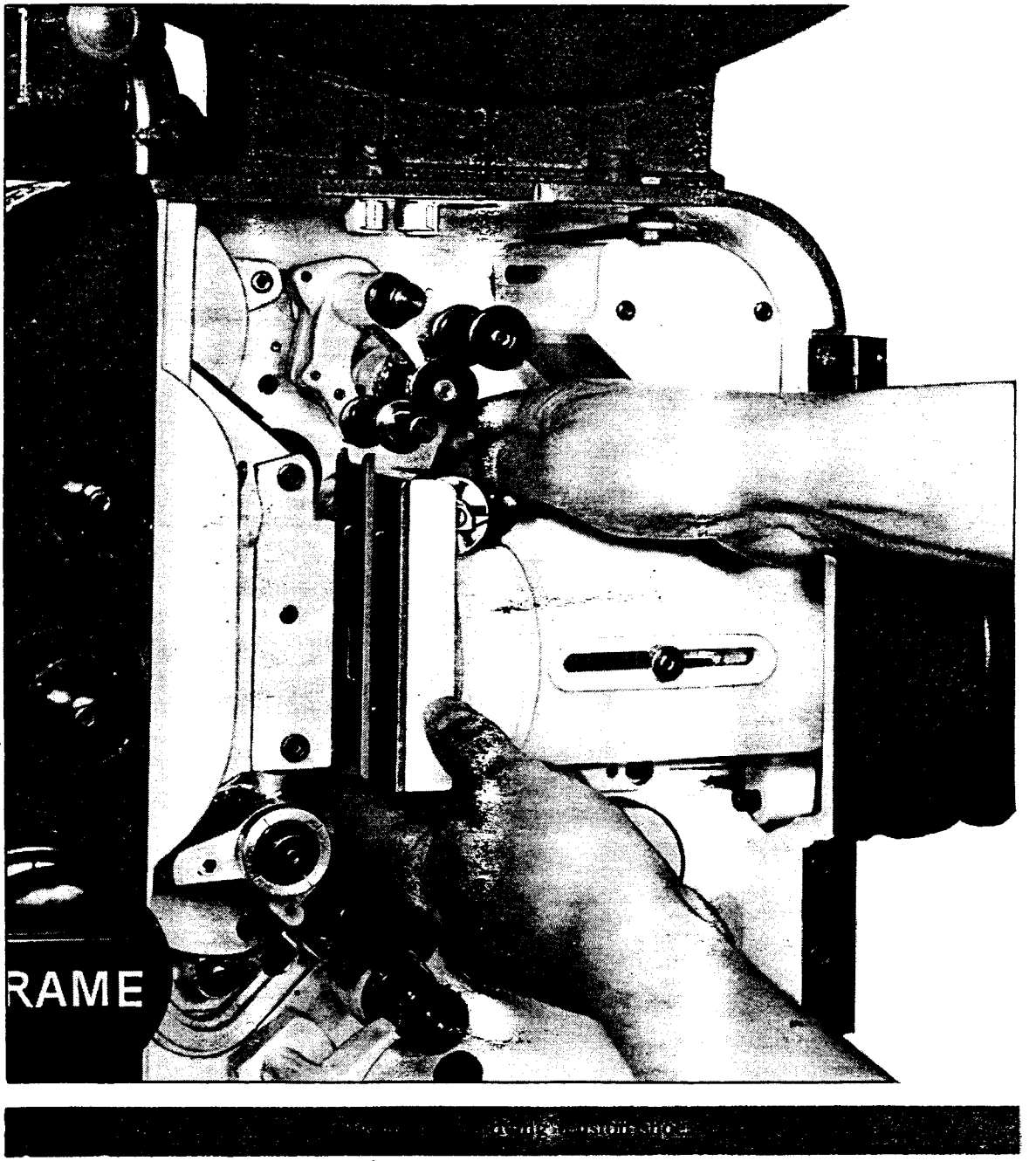


FIG 13 REMOVING TENSION SHOE

the drive pinion of the projector drive assembly, it is necessary to remove the Allen screw (on the operating side of the projector mechanism) located below and to the right of the lower feed sprocket. The gear and its attendant stud can then be removed.

Bearings

All gears run on double-row grease packed ball bearings (Item 7, Fig. 12). The

outer races of the bearings are locked to the hub of the gear by a simple retaining ring. To remove the bearing, simply squeeze the protruding ends of the retaining ring together, and the bearing will come out of the gear hub. As the ball bearings used will outwear even the long wearing gears of the "AA," there should be no necessity for bearing replacement prior to the time when gear replacements are indicated.

Shafts and Studs

Because the inner race of the ball bearing is securely locked to the gear, there is nothing turning on the shaft or stud, and consequently there is no wear on shafts and studs.

Lights

The framing light is replaced by removal of the cap on the top of the mechanism just

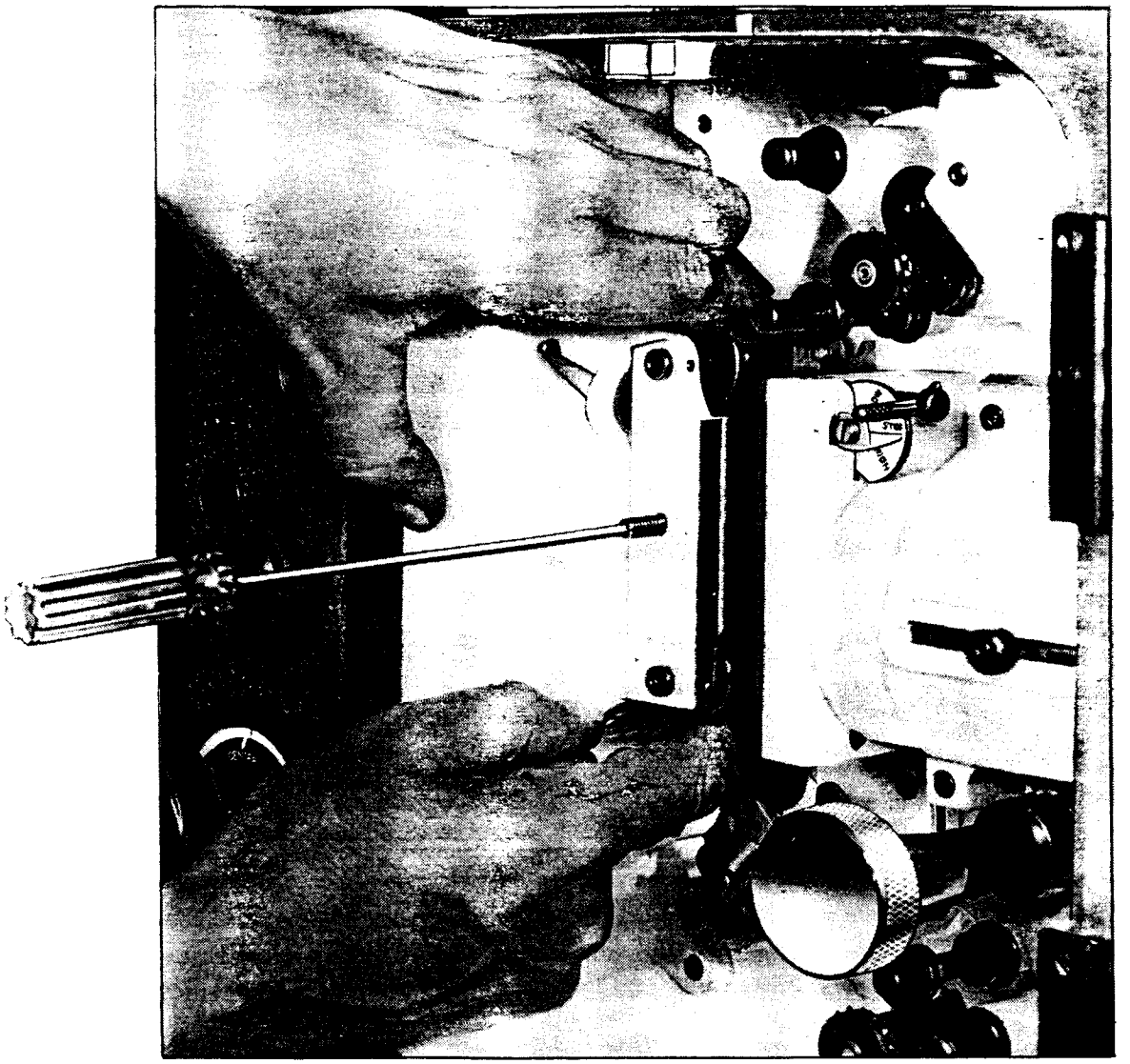
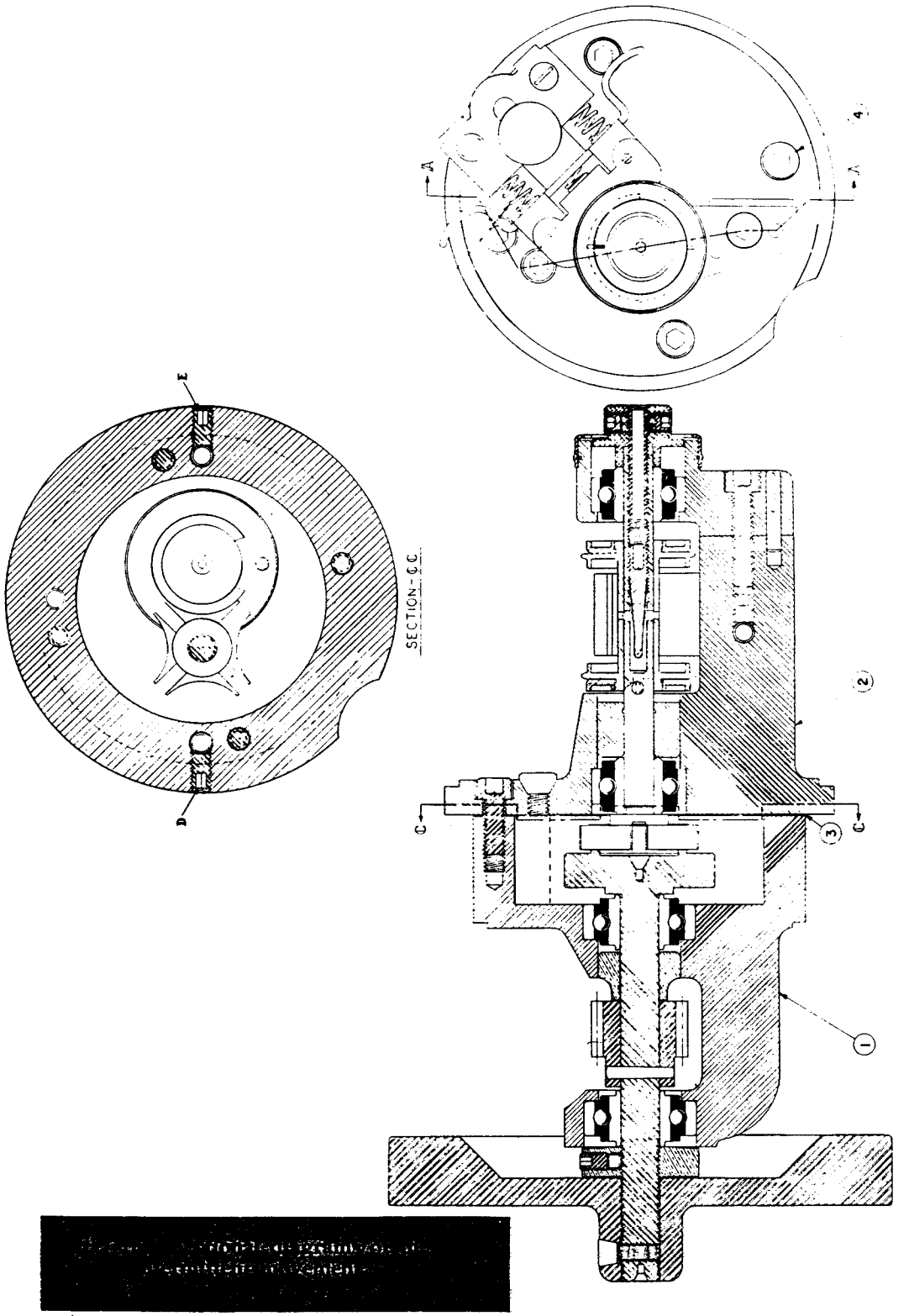


FIG 14 REMOVING APERTURE AND TRACKS



Item 1, Section AA. Movement housing casting
Item 2, Section AA. Movement housing casting
Item 3, Section AA. Gasket between housing castings
Item 4, Section A. Screws holding castings together
Items D and E, Section CC. Adjusting set screws

FIG 15 SECTIONAL DIAGRAM OF INTERMITTENT

over the double shutter. The mechanism light is removed by taking out the two Allen screws that hold the cover of the light diffusing fixture. (See Fig. 13.) The mechanism lighting system is designed for 115 volt operation. Where local regulations prohibit standard lamps, low voltage lamps operating from a step-down transformer can be utilized.

Tension Shoe Removal

To remove the tension shoe unit for routine cleaning or replacement, pull back the plunger at the top of the gate body and then push up on the shoe unit and lift out. (See Fig. 13.) It is even more easily replaced by entering the studs on the tension shoe unit into the two gun locks on the face of the gate body and pushing the shoe downward until it locks shut.

Track and Aperture Removal

The tracks and aperture of the "AA" mechanism are one integral unit. This unit is removed by backing out the single, long, cone-point socket head screw which anchors the unit to the support casting. (See Fig. 14.)

Adjusting the Intermittent Movement

The two major movement housing castings (Items 1 and 2, Section AA, Fig. 15) are held firmly together with a gasket (Item 3) by four socket head cap screws (Item 4, Section A). Holes for these screws in the casting, (Item 2) are somewhat larger than the screw diameters, and this casting is movably pinned to the (Item 1) casting at a point just to the right of the upper screw hole (Section CC, Fig. 15). The two set screws (Items D and E of Section CC) set into the rim of the Item 2 casting, bear against pins fixed in the Item 1 casting, and extend into clearance holes in the Item 2 casting. It is thus possible to accurately adjust the clearance between the cam ring and the star radius surfaces by means of set screws D and E after slightly loosening the main fastening screws (Item 4).

Adjusting the Changeover

The electrical changeover device includes thermostatic protection for the operating coils. To speed the action of the changeover, turn the adjusting screw on the top of the changeover to the left. To slow the action, turn to the right.

Timing the Shutter

Timing of the double-shutter of the "AA" (Fig. 16) is a relatively simple matter and can be effected in a few minutes without the use of special tools and devices, using merely three of the Allen wrenches provided with the mechanism.

Following is the shutter timing procedure:

1. Turn the fine shutter timing control knob to a point where the two pinions are in the center of their travel.
2. The inner shutter rotor is locked to its drive shaft by a cone-type clutch, which is released by loosening the socket screw in the center of the bearing cap just above the framing control (as shown in Fig. 16). The clutch screw that locks the outer shutter rotor to its drive shaft is located in the center of the shutter drive gear (on the gear side of the mechanism). These screws should be released (not removed) until both rotors revolve freely.
3. Insert an Allen wrench through the small reference hole in the face of the housing under the bearing, and revolve the inner rotor until the wrench enters into a drilled reference hole in the end of the inner shutter rotor. Then insert another Allen wrench through the small reference hole located in a small boss just below the shutter drive gear, and revolve the outer shutter rotor until the wrench enters the drilled reference hole in the end of the outer

shutter rotor.

4. Leave the wrenches inserted in their respective reference holes. Turn the mechanism over by hand to the point where the movement's cam pin is about to engage a star slot, as shown by alignment of the markings on the intermittent sprocket shaft's locking collar and on the position indicator cap surrounding it. (As a further check on the sprocket position, the projectionist may prefer to place his finger on the sprocket as it is turning, so that he can actually feel the cam pin engaging a star slot.)

5. Tighten both clutch screws, and remove the wrenches. Both shutters will then be in correct time. This timing arrangement is quite accurate, but any small errors in timing between shutter and movement can be compensated during operation by the variable fine shutter timing control located at the front of the mechanism.

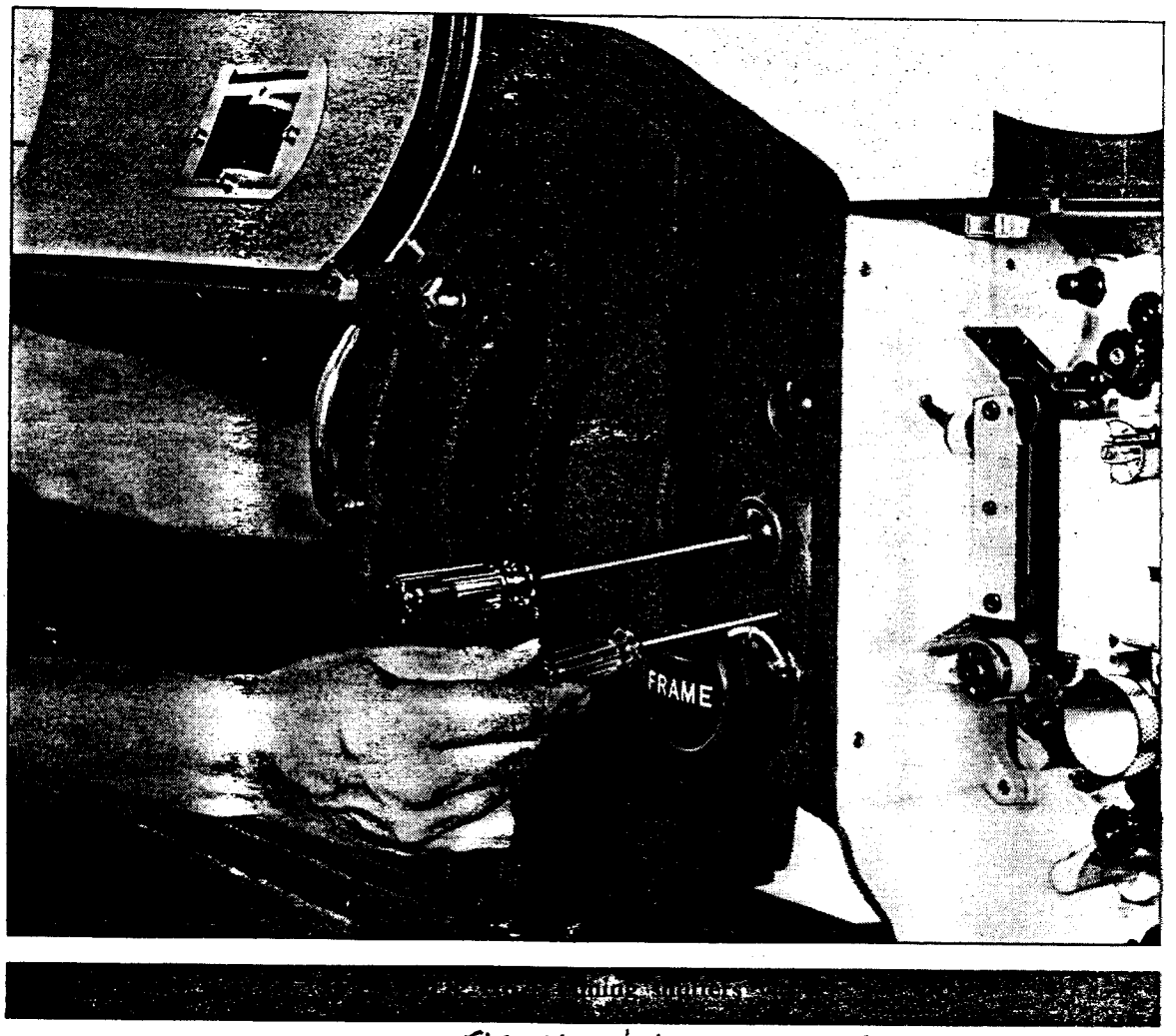


FIG. 16 TIMING SHUTTER

Pad Roller Adjustment

First loosen the lock screw (Item 1, Fig. 17). Then turn the screw (Item 2,

Fig. 17) until the rollers are separated from the lower feed sprocket by an amount equal to two thicknesses of film. Be sure the rollers turn freely, and then lock them into position by tightening the screw (Item 1, Fig. 17). If greater or less tension in opening and closing of the entire pad roller assembly is desired, loosen the screw (Item 3, Fig. 17). To increase tension, turn the screw (Item 7, Fig. 17) to the right. To decrease tension, turn the screw to the left. The upper pad roller (not illustrated) is similarly adjusted.

has been made for many years.

Completely eliminated on the "AA" upper magazines is the familiar spring tension device of the old style upper magazine with its inefficient adjustment provisions. The reel shaft tension device on the "AA" magazine is fully enclosed, and its few working parts run in a bath of oil which should last for many months without change or addition.

The "AA" lower magazine is interchangeable with all other modern makes of magazines. It may be used with any projector mechanism or sound reproducer without changing its standard pulley or shaft, and it may be driven with modern V belts or round belts. The take-up is fully

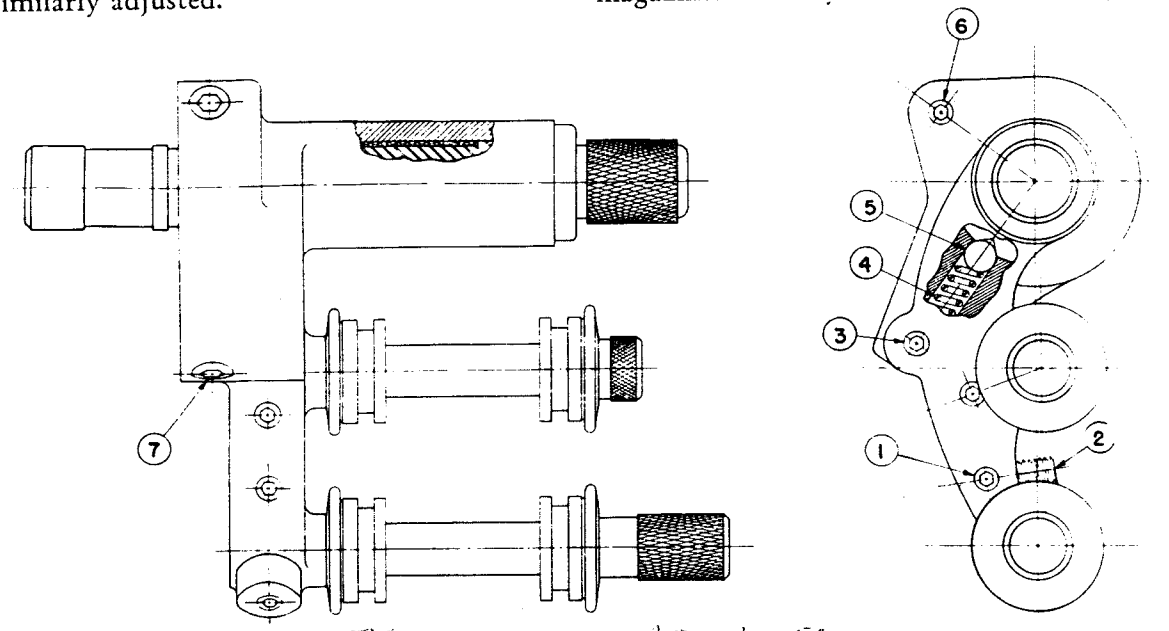


FIG 17 DOUBLE PAD ROLLER

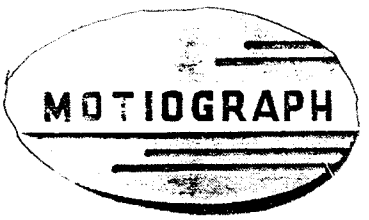
Item 1. Lock screw
Item 2. Adjustment set screw
Item 3. Lock screw
Item 4. Spring
Item 5. Ball bearing
Item 6. Lock screw
Item 7. Adjustment set screw

"AA" Magazines

The design of both the "AA" upper and lower magazines marks the first major improvement in magazine construction that

enclosed, and also operates in a bath of oil.

The adjustment of tension of both the upper magazine reel shaft and the friction take-up of the lower magazine is identical. To adjust, remove the slotted screw and its attendant gasket on the rear of the magazine. Release the lock set screw, and turn the center screw in the desired direction. (Turning the center screw to the right increases tension—turning the screw to the left decreases tension.) After the desired tension has been obtained, the set-screw should be locked, and the gasket and slotted screw should be replaced.



MOTIOGRAPH AA PROJECTOR

INSTRUCTION BOOK

C O N T E N T S

Most of the instructions and adjustments presented here are relatively easy to perform. They are nevertheless outlined in great detail to prevent any possibility of misunderstanding by the projectionist, whether or not he is experienced on Motiograph products. Figure numbers referred to in these instructions are found in our Illustrated AA Parts Book.

AA INSTRUCTIONS

#1 - REMOVING GEAR SIDE DOOR & LOWER COVER

1. Loosen lock screw in AX-52 Gear Side Framing Knob and slip off knob.

2. Remove three screws to take off AX-48 Gear Side Door.

3. Remove two screws to take off A-241 Lower Cover.

#2 - REMOVING INTERMITTENT SPROCKET (See Fig. 7)

Sprocket may be reversed or replaced without removing Intermittent Movement.

1. Insert hexagon wrench thru hole in center of A-28 Star Shaft Button and back out tapered screw in hollow Star Shaft till it comes to stop. (This operation should be done first in removing sprocket and last in replacing it; otherwise Star Shaft will be unsupported and subject to possible damage.)

2. Loosen two A-269 Socket Set Screws in A-28 Button and unscrew Button.

3. Remove A-293 Socket Cap Screw to remove outboard bearing end of AX-73 Casting.

4. Loosen A-283 Socket Set Screw to remove AX-76 Stripper.

5. AX-54 Intermittent Sprocket can now be slipped off AX-2 Star Shaft.

TO REPLACE SPROCKET, reverse procedure described above making sure that slot in end of sprocket engages A-36 Aligning Screw on Star Shaft. Tightening A-28 Button takes up end play in Star Shaft. In replacing this button, tighten to stop position and then back up 1/8th to 1/4th of a turn to avoid binding.

#3 - REMOVING INTERMITTENT MOVEMENT

1. Remove Gear Side Door (See Instruction #1).

2. Remove A-264 Tapered Screw and loosen A-356 Socket Set Screw in hub of A-16 Balance Wheel to remove wheel (Fig. 7).

3. Turn AX-51 Film Side Framing Knob (Fig. 2) to extreme right, loosen three A-285 Socket Cap Screws so that three A-46 Intermittent Clamps can be pushed aside (Fig. 3).

4. Rotate movement to right to disengage from gear train till curved recess in movement case is in line with A-121 and A-122 Lower Track Rollers (Fig. 1).

5. Intermittent Movement may now be withdrawn from film side of mechanism.

TO REPLACE MOVEMENT, reverse above procedure. When engaging movement with gear train, rotate to left till contact is made with A-357 Stop Screw (Fig. 4), making sure that cam pinion on movement is in mesh with timing gear on vertical shaft. When replacing Balance Wheel, A-356 Screw should lock against flat on threaded end of AX-67 Cam Shaft. Retime Shutter before replacing Gear Side Door. (See Instruction #7).

AA INSTRUCTIONS

(Adjustments described on this page are carefully made at the factory on all new or repaired movements. Instructions #4 and #5 are intended primarily for use of repairmen, or when replacement parts are installed.)

#4 - ADJUSTING END PLAY OF CAM SHAFT (See Fig. 7)

1. Remove Intermittent Movement from Mechanism (See Instruction #3).
2. Loosen the two A-284 Socket Set Screws, remove the four A-288 Socket Cap Screws and pull movement apart.
3. Loosen A-271 Socket Set Screw and adjust A-40 Cam Shaft Collar until end play of AX-67 Cam Shaft is at a minimum without bind. Check for end play by pushing and pulling Cam Shaft in and out. Check for bind by revolving shaft. Movement of shaft must be entirely free from bind.
4. When proper end play adjustment is achieved, tighten A-271 Screw. Recheck shaft to make sure adjustment was not disturbed by tightening of screw.
5. Re-assemble movement case.

(In dis-assembling movement during operation #2 above, the adjustment between the Cam and Star will be disturbed. It will then be necessary to correct this adjustment as described in Instruction #5 below).

#5 - ADJUSTING CAM AND STAR (See Fig. 7)

1. Loosen the two A-284 Adjusting Socket Set Screws in the outer flange edge of AX-73 Star Casting, approximately 1/2 turn. Loosen the four A-288 Socket Cap Screws in same casting, until light friction tight.
2. Turn A-16 Balance Wheel slowly until notch in A-28 Star Shaft Button comes to rest. Continue turning Balance Wheel in the same direction, roughly 135° of a revolution. At this point one of the 4 star radii will be centrally located on the circumference of the cam ring.
3. Grasp any two adjacent sprocket teeth with thumb and forefinger and attempt to rotate sprocket alternately clockwise and counter-clockwise. Any movement of the sprocket indicates excess play between star and cam.
4. To adjust cam and star, turn in A-284 Socket Set Screw (one greatest distance from sprocket), a fraction of a turn and recheck sprocket, as before, for rotary play. Repeat this procedure until all movement of sprocket has disappeared.
5. Rotate Balance Wheel four complete revolutions which will engage each of the 4 star radii on the Cam Ring to determine if a binding condition exists. This adjustment is important and utmost care must be taken that the movement operates freely.

5-a. If adjustment is too tight and Star Radii drag on the Cam Ring, loosen the A-284 Adjusting Screw, tighten and then loosen the other A-284 Screw (nearest the sprocket) to re-introduce play, and begin again at operation 4.

6. After adjustment between the star and cam is correct, tighten the four A-288 Socket Cap Screws first, then tighten the remaining A-284 Set Screw. Repeat operation 5 to be sure that tightening the screws did not change the adjustment.

#6 - ADJUSTMENT TO TAKE UP WEAR BETWEEN CAM PINION (ON MOVEMENT) AND TIMING GEAR (ON VERTICAL SHAFT)

1. Remove gear side door and lower cover (See Instruction #1).

2. Remove A-16 Balance Wheel (See Instruction #3, Operation 2).

3. Loosen A-283 Socket Set Screw in hub of AX-63 Gear (Fig. 4) and remove gear.

4. Loosen A-356 Socket Set Screw to permit A-357 Socket Set Screw (Fig. 4) to be loosened approximately two full turns.

5. Loosen the three A-285 Socket Cap Screws holding the three A-46 Intermittent Clamps (Fig. 3) on the film side of the mechanism. Loosen these screws just enough to permit the movement case to be turned in its mount.

6. From gear side turn movement clockwise till there is a minimum amount of backlash without bind between the mesh of the A-15 Cam Pinion (Fig.7) and the AX-28 Timing Gear (Fig. 5). In making this adjustment, hold the Cam Pinion firmly and rock the Timing Gear back and forth to detect play. When correctly adjusted there will be a very slight amount of backlash between gear and pinion.

7. When proper adjustment is achieved, note that A-46 Intermittent Clamps are in locking position, then tighten the three A-285 Screws.

8. Recheck backlash between Cam Pinion and Timing Gear to make sure adjustment did not change when A-285 Screws were tightened. If adjustment did change, it is because A-285 Screws were previously loosened too much and the adjusting procedure (Operations 5, 6 and 7) must then be repeated.

9. If adjustment remained unchanged, turn in A-357 Screw until it contacts movement casting (do not force), and tighten A-356 Screw.

10. Re-assemble AX-63 Gear, A-16 Balance Wheel, and gear side cover parts.

The above procedure for taking up wear usually involves tightening the mesh between the Cam Pinion and Timing Gear. When later a new replacement gear or pinion is installed, the mesh may be too tight causing a gear "growl". The same procedure is then followed for getting a proper adjustment.

#7 - TIMING SHUTTER

1. Remove Gear Side Door. (See Instruction #1).

2. Turn AX-11 Shutter Setting Knob (Fig. 4) till A-45 Sliding Bracket (Fig. 4) is in the center of its travel. (This is to allow travel either way for later correction of possible minor errors.)

3. Insert hexagon wrench through small reference hole located in the boss just below the AX-98 Gear, and revolve the Movement Balance Wheel until the wrench enters the drilled reference hole in the end of the Shutter Blade.

4. Loosen screw on AX-98 Shutter Drive Gear (Fig. 4) to disengage Shutter Blade from gear train.

5. Leaving wrench in holes, turn mechanism by hand till cam pin of movement is about to engage a star slot. Point of turn is indicated by beginning of motion of intermittent sprocket which may be determined by feel or by observation of motion of related markings on A-28 Star Shaft Button (Fig. 7).

6. Tighten screw on AX-98 Gear (reversing Operation 4) and remove hexagon wrench from reference holes.

7. Shutter is now in time with intermittent movement. Any small error which may have occurred in locating engagement point of cam pin (Operation 5) may be compensated, while the mechanism is running, by turning the AX-11 Shutter Setting Knob.

#8 - INSTALLING SOUNDHEAD DRIVE

(Special modifications and instructions are required for installing drives of a few discontinued old model soundheads.)

1. Remove Gear Side Door and Lower Cover (See Instruction #1).

2. Loosen two A-299 Socket Cap Screws (Fig. 4) holding two A-73 Slide Catches (Fig. 4) and push Catches aside to release entire AX-17 Mechanism Drive Shaft Assembly (Fig. 6).

3. Withdraw AX-17 Drive Shaft Assembly from mechanism.

4. Loosen A-72 Socket Set Screw (Fig. 6), three A-269 Lock Screws (not illustrated), and three A-71 Socket Set Screws (Fig. 6) to permit insertion of soundhead drive.

5. Insert soundhead drive shaft and pinion and tighten the A-72 Screw against the flat of the soundhead drive shaft. Then tighten the three A-71 Screws between the teeth of the soundhead drive shaft pinion. Lock the A-71 Screws in place by tightening the three A-269 Lock Screws.

6. Tighten A-451 Screw (furnished as a loose part) into threaded end of soundhead drive, till head of screw contacts shaft end of AX-17 Drive. This screw is furnished in all cases where soundhead drive is properly threaded; it serves as a safety lock to keep soundhead drive from slipping out of mechanism drive.

7. Entire drive assembly should then be inserted into mechanism, meshing the A-70 Drive Gear (Fig. 6) with its associated AX-34 Gear (Fig. 4). Be sure that the screw in the teeth of the A-70 Gear clears the AX-34 Gear. Return A-73 Slide Catches to their original clamping position and tighten the A-299 Screw (Fig. 4).

8. Turn mechanism by hand to be certain gears are properly meshed. Couple projector mechanism to soundhead and replace gear side covers and framing knob.

#9 - ADJUSTING LOCKING POSITIONS (OPEN AND CLOSED) OF FILM GATE ASSEMBLY

With Film Gate Assembly in closed position:

1. Remove A-107 Gate Knob (Fig. 2) by turning counter-clockwise.

2. Remove A-108 Gate Pinion Shaft (Fig. 1).

3. Slide AX-31 Sleeve, A-112 Spring, and A-110 Pinion (containing A-282 Clutch Hub) from A-108 Shaft (Fig. 1).

4. Place one AX-30 Plunger and Spring Assembly (Fig. 3) in top mounting hole (3 holes near A-108 Shaft hole). If using lens with short focal length, place remaining AX-30 Plunger and Spring Assembly in middle hole. If using lens with long focal length, place in bottom hole. (First position gives narrower gate opening; second position gives full gate opening. Very short focal lens is in focus nearer aperture and thus gives insufficient clearance for full opening.)

5. Loosen the three A-273 Screws in A-110 Pinion, re-assemble on A-108 Shaft (omitting sleeve and spring) and screw shaft back into casting. Take care to turn pinion in such position that the punch marked tooth on pinion is in line with the punch mark on A-115 Gear Rack (Fig. 1), and turn clutch hub of pinion until first plunger assembled enters hole in hub.

6. Insert blade of large screw driver between two teeth of A-110 Pinion and, pivoting shank of driver on lower door hinge mount, rotate A-110 Pinion counter-clockwise until gate is completely closed. Hold in this position and tighten the three A-273 Screws.

7. Remove A-108 Shaft and A-110 Pinion from casting and re-assemble in proper sequence, AX-31 Sleeve, A-112 Spring, and A-110 Pinion, with clutch hub, on A-108 Shaft. (Pin of Sleeve must be assembled in hole of Clutch Hub.)

8. Screw A-108 Shaft with assembled components back into casting, again taking care that the punch marks on Pinion and Gear Rack are in line.

9. Replace A-107 Gate Knob and operate Gate several times to make sure adjustments have been properly made.

#10 - DISMANTLING FILM SIDE OF MECHANISM

1. Remove Lens Carriage

   (a) Remove two A-303 Socket Cap Screws holding A-99 Nose Casting (Fig. 2) to Main Housing.
   (b) Pull outward on Nose Casting to remove Lens Carriage from A-82 and A-83 V Rails (Fig. 1).

2. Close Film Gate and remove Gate Knob Assembly (See Instruction #9, Operations 1 and 2).

3. Remove Film Gate and Base Assembly.

   (a) Turn AX-51 Film Side Framing Knob (Fig. 2) to right to lower Intermittent Movement.
   (b) Remove four A-292 Socket Cap Screws holding A-76 Base Casting to center wall of Main Housing.
   (c) Shift Base Casting forward toward nose of mechanism, lift upward and roll casting outward.

4. Remove Fire Shutter Assembly

   (a) Remove set screw holding right end of Changeover Name Plate and swing name plate aside.
   (b) Loosen set screw holding upper end of Changeover Flexible Cable to disengage cable.
   (c) Remove four A-333 Socket Cap Screws (Fig. 1) holding A-152 Fire Shutter Casting (Fig. 7) to Main Housing and slide Casting out of Housing.

5. Remove Shutter Rotor

   (In later models A-198 Inner Rotor is eliminated, and A-197 Outer Rotor is superseded by AX-120 Rotor and Fan Assembly.)

   (a) Insert hexagon wrench through hole in rim of rotor and remove A-279 Socket Cap Screw holding hub of rotor to AX-45 Shaft (Fig. 3).
   (b) From film side push AX-45 Shaft inward till end of shaft is flush with center wall of Main Housing, enabling rotor to be lifted out of mechanism.

6. Remove Governor & Blower Assembly.

   (a) Remove AX-32 Red Retainer Cap from gear end of Governor Shaft.
   (b) Remove two A-301 Socket Cap Screws holding A-134 Bracket to Main Housing (Fig. 4).
   (c) Pull A-134 Bracket, A-252 Ball Bearing, and AX-97 Gear (Fig. 4) from gear end of Governor Shaft, and remove A-312 Woodruff Key from seat in shaft.
   (d) Pull from film side to remove Governor and Blower Assembly.

In reversing above procedure to re-assemble, be sure that while installing the Film Gate Knob parts the punch-marked tooth of the A-110 Pinion is in line with the punch-mark on the A-115 Rack.

#11 - LUBRICATION OF AA MECHANISM

The modern design of the AA mechanism eliminates the need for daily oiling of gears, bearings, shafts, and other moving parts. Occasional greasing is required for the intermittent movement, the gear tooth surfaces, and the film rollers.

The Motiograph Lubricants recommended here were carefully selected for best results in their various applications. (Motiograph guarantees cannot apply where substitute lubricants are used.)

LP-715 MOVEMENT GREASE

Remove A-383 Plug (Fig. 7) from movement case and fill case about halfway. Check grease level regularly. (Later movements have two A-383 Plugs. The second one, located below and to the left of the intermittent sprocket, serves as a grease level indicator. In filling these movements, remove both plugs and fill thru upper hole till grease begins to pour from lower hole.)

AX-1000 GEAR LUBRICANT

Brush lightly on gear teeth as mechanism is turned by hand. Be careful that loose bristles from brush do not stay on gears. Three applications are recommended during the first year, thereafter less frequently except under severe operating conditions.

AX-1016 "AERO" ROLLER GREASE

This light adhering grease will outlast oil several times; three applications annually will suffice. It is especially recommended for use as listed below:

PARTS TO BE LUBRICATED	PROCEDURE
A-119, A-120, A-121 and A-122 Film Rollers (Fig. 1)	Remove two A-270 Socket Set Screws (Fig. 1) and force grease through hole in two A-354 Pivots (Fig. 1)
A-183 Film Rollers (Fig. 1)	Remove A-188 (Fig. 2) and two A-176 Thumb Screws (Fig. 1) and force grease through exposed hole in Film Roller Shafts.
A-248 Idler Roller (Fig. 1)	Remove A-285 Socket Cap Screw (Fig. 1) and force grease through exposed hole in Shaft.

On the gear side, the AX-1016 Grease should be inserted through the hole in the A-45 Sliding Bracket (Fig. 4) and through the three nearby holes in the A-44 Inner Shifting Frame Casting. These holes can be best seen on Figure 5, just to the left of the A-59 Vertical Shaft.

#12 - ADJUSTMENT AND LUBRICATION OF AA MAGAZINES

AA UPPER MAGAZINE (See Fig. 8)

Tension Adjustment:

1. Loosen A-291 Socket Set Screw

2. To increase tension turn A-653 Knurled Adjusting Screw to right; to decrease tension turn A-653 to left.

3. When desired tension is achieved, tighten A-291 Screw.

Lubrication:

Remove four A-645 Socket Cap Screws to slide off A-605 Hub Casting. Clean out old grease from inside of hub and refill with AX-1000 GREASE once or twice yearly.

Refill oil cup on hub of Spider Casting three or four times a year with a few drops of LP-722 OIL. (If oil seeps through bearing, it indicates too much is being applied.)

AA LOWER MAGAZINE (See Fig. 9)

Tension Adjustment:

1. Remove A-632 Screw and A-633 Gasket.

2. Loosen A-284 Socket Set Screw.

3. To increase tension turn A-304 Socket Set Screw to right; to decrease tension turn A-304 to left.

4. When desired tension is attained, tighten A-284 Screw and replace A-632 Screw and A-633 Gasket.

Lubrication:

Apply a few drops of LP-722 OIL three or four times a year to oil hole in hub of A-610 Spider Casting and to hole under A-383 Plug in adjoining hub of AX-600 Pulley Casting.

Remove A-383 Plug from face of A-611 Take-up Cover, when plug is at lowest point of its rotation, to check grease level. If grease does not flow from hole, add amount needed. Normally, additional grease should be needed only once or twice yearly, but it can easily be checked more frequently. Use Motiograph LP-715 GREASE.

#13 - REMOVING UPPER FIRE TRAP ROLLERS (See Fig. 2)

Loosen A-409 and A-410 Socket Cap Screws located one at each end of A-397 Fire Trap Casting. From below, push out the AX-87 Roller Mounts. To remove AX-66 Rollers from the Mounts, remove one of the A-257 Flat Head Screws from either end to release the A-385 Side Plate from its doweled position. (These operations are performed without disturbing the mounting of the Fire Trap Casting or the Upper Magazine.)

#14 - REMOVING LOWER FIRE TRAP ROLLERS

Remove the six A-662 Socket Set Screws holding the AX-609 Lower Fire Trap Assembly and pull downward on Fire Trap Casting to remove. The AX-66 Fire Trap Rollers may be removed from the assembly by removing the CS-470 Roller Shafts.

#15 - POSITIONING LENS (See Fig. 2)

Turn AX-12 Lens Lock Knob counter-clockwise and insert lens in Carriage. Move lens back into carriage till it is in focus position and lock in place by tightening AX-12 Knob. Fine focus adjustment may be made after locking by turning AX-13 Lens Focus Knob in desired direction.

After lens is in focus position, automatic stop should be positioned by loosening A-279 Socket Cap Screw and moving A-125 Lens Stop into contact with end of lens. Tighten screw in contact position, so that lens may be removed at any time and readily replaced in focus position against stop. (Modern lenses may be rotated without affecting focus, so it is not necessary to notch the end of the lens at the point of contact with the stop.)

#16 - REMOVING GEARS

Most gears can be simply removed by loosening the A-288 Socket Cap Screw in the center of the AX-32 Red Retainer Cap and drawing the gears off their shafts or studs. Other gears are locked on their respective shafts by one or two set screws in the gear hub. To remove the AX-34 Gear (Fig. 4) do not take off the Red Retainer Cap but release the A-288 Socket Cap Screw mounting the A-389 Washer near the lower right hand corner of the film side of the mechanism. (See Fig. 1)

All gears in the AA mechanism either mount directly on ball bearings which fit on fixed studs, or are fixed on shafts which themselves revolve in ball bearings. Thus, nothing turns on the shafts or studs to wear them out. Ball bearings may be pressed out by removing the A-305 Snap Rings (Fig. 5) but in general the ball bearings may be expected to last as long as the gears, so most replacements will consist of complete Gear and Bearing Assemblies. (AX-1007 Snap Ring Pliers for easy removal of the Snap Rings are available from Motiograph dealers.)

#17 - REMOVING TRACK (See Fig. 1)

Back out the A-90 Track Lock Screw till it projects at least 1/2" from casting. Dislodge AX-5 Track by pressing forward simultaneously at each end. Track must first be moved forward in order to disengage dowel on back of track, then lifted out. (In standard mechanisms AX-5 is the combined Track and Aperture; in mechanisms equipped with removable "Studio" Apertures, the Track is AX-116. Removal procedure is the same for both types.)

#18 - REMOVING TENSION SHOE

Pull back A-336 Knob (Fig. 7) while lifting AX-7 Tension Shoe (Fig. 2) up and out. To replace insert two studs on Tension Shoe into matching holes in A-91 Cover Plate (Fig. 1) and press downward to lock in position. It is not necessary to pull back A-336 Knob when replacing Tension Shoe. Top end of tension shoe is indicated by stamped letters so that it may readily be inserted right side up.

#19 - ADJUSTING CHANGEOVER

To speed the action of the changeover, turn the adjusting screw on the top of the changeover counter-clockwise. To slow the action, turn clockwise.

#20 - ADJUSTING LOWER ROLLER BRACKET

Loosen A-269 Socket Set Screw (Fig. 1) locking A-278 Adjusting Screw (Fig. 2). Turn A-278 Screw until rollers are separated from lower feed sprocket by a distance equal to two thicknesses of film. Be sure rollers turn freely, then lock into position by tightening the A-269 Screw.

Tension in opening and closing of bracket may be changed if desired. Loosen A-276 Socket Set Screw (Fig. 1) locking A-345 Adjusting Screw (Fig. 2). To increase tension, turn A-345 Screw clockwise; to decrease tension, turn counter-clockwise. Tighten A-276 Screw after desired tension is achieved.

#21 - ADJUSTING UPPER ROLLER BRACKET

Procedure is the same as for lower roller bracket.

AA INSTRUCTIONS

THE FOLLOWING ADJUSTMENTS ARE MADE AT THE FACTORY AND SHOULD NOT BE NECESSARY TO REPEAT EXCEPT IN EVENT OF OVERHAULING WHERE MECHANISM WOULD BE COMPLETELY DISASSEMBLED.

#22 - ADJUSTING SPRING TENSION OF FRAMING MECHANISM

This spring tension adjustment is to compensate for the weight of the intermittent movement and is not to be confused with V-rail tension adjustment explained in Instruction #24.

1. Remove Gear Side Door (See Instruction #1), then replace AX-52 Gear Side Framing Knob.

2. Pull out on A-52 Framing Shaft (Fig. 5) until A-64 Pinion (Fig. 5) becomes disengaged from A-65 Gear Rack, (Fig. 4) and release shaft to permit A-53 Spring (Fig. 3) to uncoil to normal state.

3. Turn A-52 Framing Shaft counter-clockwise one-half of a complete revolution and push back into position, engaging gear with gear rack. It will be found helpful in engaging the gears to apply pressure inward on the rack which is mounted on coil springs. See that AX-51 Framing Knob is in horizontal position.

4. Tighten set screw in AX-51 Framing Knob.

#23 - SETTING FRAMING DIAL

1. Turn AX-51 Film Side Framing Knob (Fig. 2) until shifting frame is approximately midway of its travel.

2. Turn mechanism over by hand until indicating notch in A-28 Star Shaft Button (Fig. 7) comes to rest.

3. Thread film in mechanism and readjust shifting frame slightly, if necessary, until picture is centered in aperture.

4. Place knife blade or other pointed instrument on edge of A-330 Disc Indicator (through slot in bottom of A-329 Indicator Cover) and rotate disc until red indicating mark is in line with center mark on A-329 Cover (Fig. 2).

#24 - ADJUSTING SHIFTING FRAME V-RAIL TENSION

1. Loosen the four A-275 Screws, retaining A-51 V Rail (Fig. 5), until light friction tight.

2. Loosen the two A-270 Set Screws, then tighten two A-355 Set Screws (Fig. 4) in A-41 Outer Frame. Tightening of the A-355 Screws will force A-51 V Rail over against the Inner Shifting Frame and render same immovable.

3. Release each of the A-355 Set Screws a fraction of a turn taking care to turn each an equal amount, then check tension of framing. Repeat this procedure until required tension is obtained. In event the A-355 Screws are released too much and the framing tension is too weak to prevent creeping, turn the screws in slightly an equal amount.

4. When the proper framing tension is attained, tighten the two A-270 Set Screws, then tighten the four A-275 Cap Screws.