

**TIMERS**  
**3-TYPE**  
**REQUIREMENTS AND ADJUSTING PROCEDURES**

**1. GENERAL**

- 1.01** This section covers 3-type timers.
- 1.02** This section is reissued to revise the requirements and procedures covering lubrication and to revise the list of tools, gauges, materials, and test apparatus. Detailed reasons for reissue will be found at the end of the section.
- 1.03** Reference shall be made to Section 020-010-711 covering general requirements and definitions for additional information necessary for the proper application of the requirements listed herein.
- 1.04 Asterisk (\*):** Requirements are marked with an asterisk when to check for them would necessitate the dismantling or dismounting of apparatus or would affect the adjustment involved or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons or its performance indicates that such a check is advisable.
- 1.05 Make-Busy Information:** Before checking or adjusting for any requirements on working equipment, make the associated circuit busy in accordance with approved procedures.
- 1.06** Checking or adjusting of the timer will be facilitated by performing these operations with the timer on the bench.
- 1.07 Preparation of KS-16832 L2 Lubricant:**<sup>↑</sup>  
This lubricant is provided in 2-ounce and 1-pint containers. A small wide-mouth container, such as the 2-ounce jar in which the lubricant is available, should be used as a receptacle from which to dispense the lubricant. If allowed to stand more than 1 day without agitation, the lubricant ingredients tend to separate; therefore, before each day's use, shake the container of

lubricant for approximately 30 seconds to insure mixing of the ingredients. The proper method of shaking the lubricant consists of repeated, rapid turning of the container to an upside down position and back to the upright position. If the lubricant from a 1-pint container is to be used, the lubricant must be mixed as just described before it is poured into the smaller container. Under storage conditions, the cover should be tight on the container.

**1.08 One dip of KS-16832 L2 Lubricant,** for the purpose of this section, is the amount of lubricant retained on the KS-14164 brush after being dipped into the lubricant to a depth of approximately 3/8 inch and scraped once against the side of the container as the brush is removed. ↓

**2. REQUIREMENTS**

**2.01 Cleaning:** Parts shall be cleaned when necessary in accordance with approved procedures.

**2.02 Lubrication**

(a) The parts listed in Table A shall be adequately lubricated with KS-16832 L2 lubricant at 2-year intervals. When lubrication is necessary, the lubricant shall be applied as covered in Table A. The recommended lubrication interval may be extended if periodic inspections have indicated that local conditions are such as to insure that the requirements will be met during the extended period. ↑

\* (b) **Retractable Spring:** If the retractile spring is removed from the timer for any reason, one dip of KS-16832 L2 lubricant shall be applied along the length of the spring after it is reassembled. ↓

(c) **Motor:** The motor shall be lubricated in accordance with the section covering lubrication of Telechron motors.

TABLE A

TYPE OF TIMERS	PART	AMOUNT
3A and 3B	Center Bearing Fig. 1(A)	1 dip
	Left End Bearing Fig. 3(A)	1 dip
	Micro Switch Hinge Pins Fig. 3(B)	1 dip distributed between the hinge pins of all Micro Switches. Lubricant shall be applied between the roller arms and cases of each side of each hinge pin.
	Core Gear and Motor Pinion Fig. 1(C) or 2(B)	1 dip distributed evenly over the periphery of the core gear.
3A	Right End Bearing Fig. 1(B)	1 dip divided between thrust washers at left side of bearing and shaft at right side of bearing.
	Micro Switch Roller Bearings Fig. 1(D)	2 dips distributed between the roller bearings of all Micro Switches. Lubricant shall be applied at each side of each roller.
3B	Right End Bearing Fig. 2(A)	1 dip
	Micro Switch Roller Bearings Fig. 1(D)	1 dip distributed between the roller bearings of all Micro Switches. Lubricant shall be applied at each side of each roller.

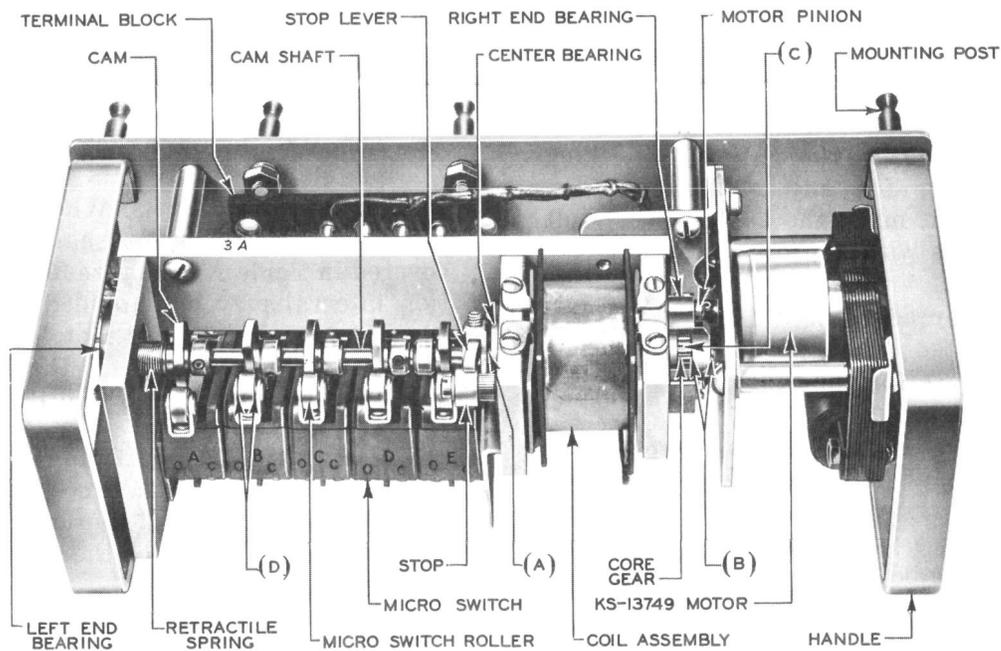


Fig. 1 - 3A Timer

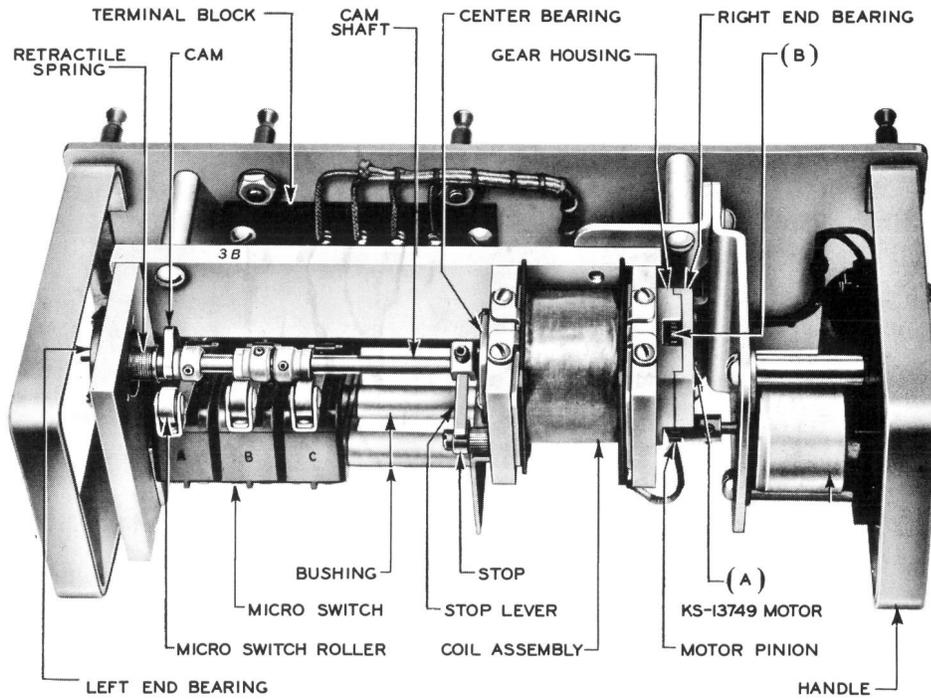


Fig. 2 - 3B Timer

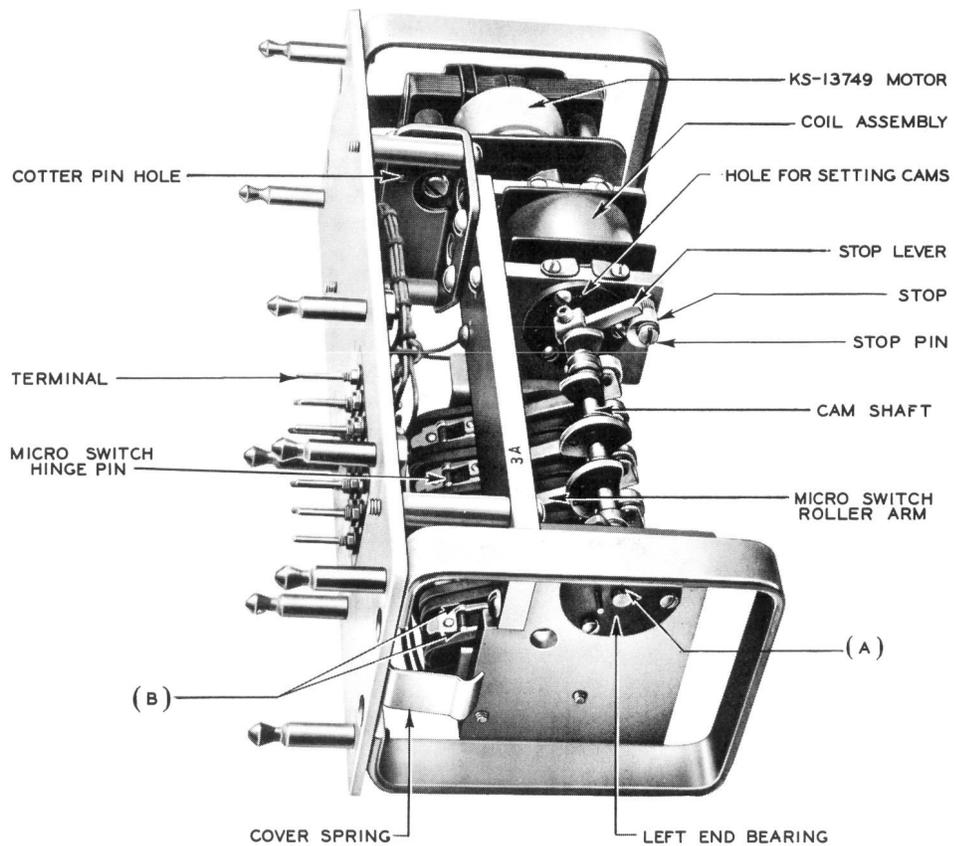


Fig. 3 - 3A Timer

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**2.03 Record of Lubrication:** During the period of installation a record shall be kept, by date, of lubrication and this record shall be turned over to the telephone company with the equipment. If no lubrication has been done, the record shall so state.

**2.04 Timer Mounting:** The timer shall enter its mounting plate freely and shall be held securely by the associated mounting plate springs.

Gauge by feel.

**2.05 Tightness of Timer Terminals and Locknuts:** The timer terminals shall be straight and shall be held tightly by the associated locknuts.

Gauge by eye and feel.

**2.06 Cover Spring Pressure:** The cover shall fit snugly.

Gauge by feel.

**2.07 End Play of Cam Shaft and Core**

(a) The cam shaft shall have end play.

Gauge by eye and feel.

(b) With the end play of the cam shaft taken up toward the right, the core gear shall have end play of

Min 0.005 inch

Gauge by eye and feel.

**2.08 Clearance Between Stop Lever and Cam Shaft Frame:** During rotation of the shaft, the end of the stop lever shall clear the cam shaft frame.

Gauge by eye and feel.

**\*2.09 Freedom of Movement of Cam Shaft:**

With the retractile spring disengaged and with the switch rollers clearing the cams, the shaft shall rotate freely in its bearings.

Gauge by feel.

To check this requirement disengage the retractile spring from the pin on the A cam and hold the switch rollers away from the cams with the fingers. Rotate the cam shaft a few times manually.

**2.10 Freedom of Switch Movement**

(a) The switch rollers shall turn freely on their bearings.

Gauge by feel.

(b) The switch roller arms shall move freely on their hinge pins.

Gauge by feel.

**2.11 Cam and Switch Roller Engagement:**

The cams shall rest approximately on the center of their associated Micro Switch rollers.

Gauge by eye and feel.

**2.12 Gear and Pinion Engagement**

(a) **Gear Mesh:** With the end play of the core taken up toward the clutch coil and the end play of the motor shaft taken up toward the motor, the left edge of the motor pinion shall be approximately in line with the left edge of the teeth of the core gear.

Gauge by eye.

(b) **Backlash:** The backlash between the motor pinion and the core gear shall be

Min Perceptible

Max 0.015 inch

Gauge by eye and feel at four points 90 degrees apart around the periphery of the core gear.

To check this requirement hold the motor pinion stationary with a screwdriver inserted between two teeth of the pinion. Insert a second screwdriver between two teeth of the core gear. Move this gear back and forth and observe the amount of backlash between gear and pinion, using an adjacent edge of the right bearing housing as a reference line as shown in Fig. 4(A). Operate the motor from the power supply to rotate the core gear for checking backlash at the positions specified.

**2.13 Cam Shaft Restoring Spring Tension:**

Fig. 5 — The cam shaft shall restore to normal against a pressure of

Min 40 grams

Use the 70J gauge applied at the end of the stop lever when the stop lever is in a vertical position.

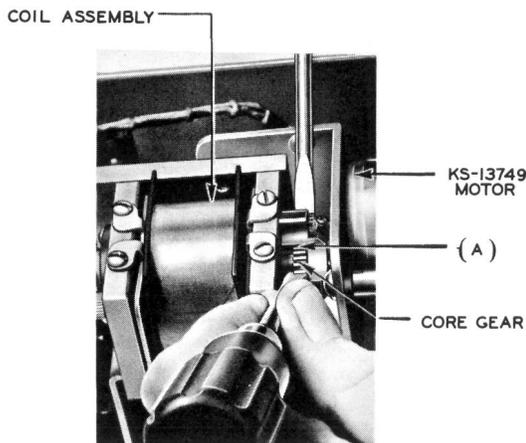


Fig. 4 – Method of Checking Backlash

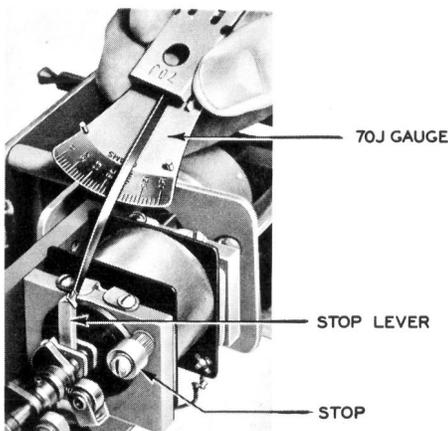


Fig. 5 – Method of Checking Cam Shaft Restoring Margin

**2.14 Motor Torque:** Fig. 6 — With the shaft rotating under control of the motor energized on 22 volts, the motor shall not stall when a pressure of

**Test** — Min 75 grams  
**Readjust** — Min 150 grams

is applied to the end of the stop lever in a direction opposing rotation at the time the stop lever is in a vertical position.

Use the 79C gauge.

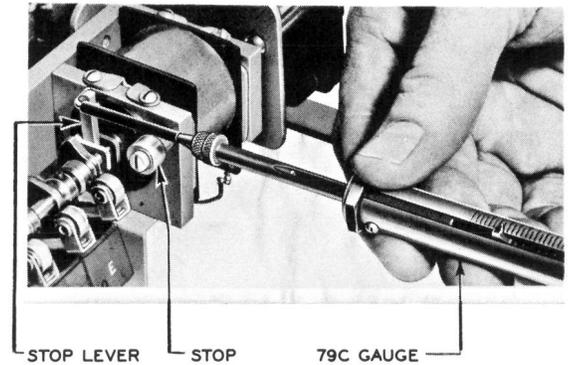


Fig. 6 – Method of Checking Motor Torque

**2.15 Timing Requirements**

**3A Timers**

(a) The A switch contacts shall open in  
 Max 2 seconds  
 after the shaft starts to rotate.  
 Use the KS-3008 stopwatch.

(b) The B switch contacts shall close in  
 Min 10 seconds  
 Max 13 seconds  
 after the A contacts open.  
 Use the KS-3008 stopwatch.

(c) The C switch contacts shall close in  
 Min 20 seconds  
 Max 23 seconds  
 after the A contacts open.  
 Use the KS-3008 stopwatch.

(d) The D switch contacts shall close in  
 Min 30 seconds  
 Max 33 seconds  
 after the A contacts open.  
 Use the KS-3008 stopwatch.

(e) The E switch contacts shall open the motor circuit in  
 Min 3 seconds

after the D switch contacts close and before the end of the stop lever strikes the E Micro Switch case.

Use the KS-3008 stopwatch.

Gauge by eye.

**3B Timers**

(f) The A switch contacts shall open in

Max 5 seconds

after the shaft starts to rotate.

Use the KS-3008 stopwatch.

(g) The B switch contacts shall close in

Min 120 seconds

Max 132 seconds

after the A switch contacts open.

Use the KS-3008 stopwatch.

(h) The C switch contacts shall not open until after the B switch contacts close but shall open before the A switch contacts re-close.

Gauge by eye.

**3A and 3B Timers**

(i) The A switch contacts shall close on restoration of the shaft with

Min 0.006 inch

between the stop and stop lever.

Use the KS-6909 gauge.

**Method of Check — Fig. 7**

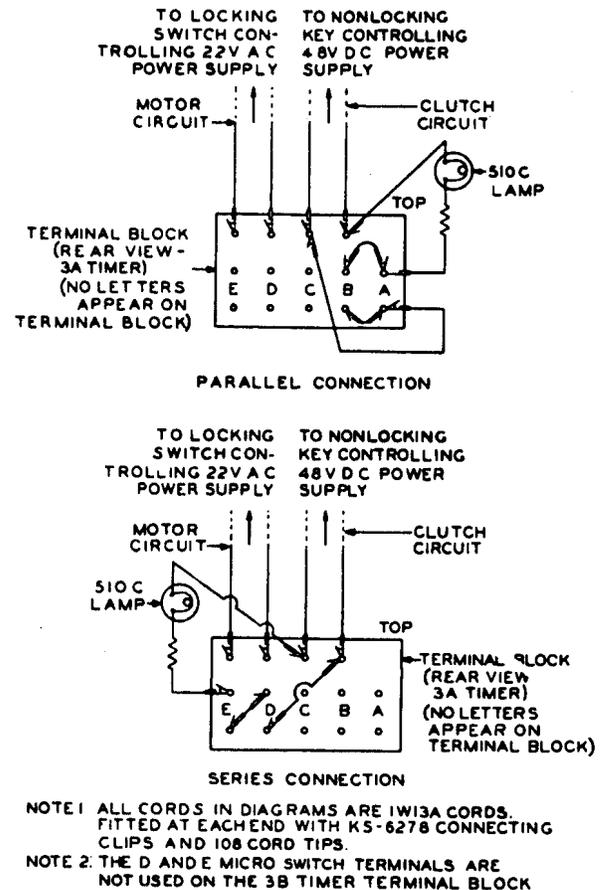
(j) Connect the motor terminals on the terminal block to a 22-volt ac power supply through a locking switch and the clutch terminals to a 48-volt dc power supply through a nonlocking pushbutton-type key.

(k) Connect the 510C test lamp and terminal block terminals as shown in Fig. 7 for parallel connections.

(l) Operate the locking switch to start the motor.

(m) Operate the nonlocking key before checking each cam setting and release it after each check is made to permit the cam shaft to restore to normal.

(n) **A Cam Setting:** Check the time of closure of the Micro Switch contacts associated with the A cam from the point at which the key is operated to the point of extinguishing of the 510C test lamp.



**Fig. 7 — Circuits Used When Checking Timing Requirements**

(o) **B Cam Setting:** Check the time from opening of the A Micro Switch contacts to the closure of the B Micro Switch contacts which is determined from the extinguishing to the relighting of the 510C test lamp.

(p) **C and D Cam Setting (3A Timer):** Transfer the connections from the terminals associated with the B Micro Switch to those associated with the C or D Micro Switch depending on which cam is to be checked, then follow the same procedure as covered in (o) for the B cam setting.

(q) **E Cam Setting (3A Timer) and C Cam Setting (3B Timer):** Remove the connections from the A, B, C, and D terminals, if connected, and connect as follows. On 3A timers, connect the 510C test lamp and terminals D and E as shown in Fig. 7 for series

connections. On 3B timers, connect the B and C terminals in the same manner. Check the time from the closure of the D contact (3A timer) or B contact (3B timer) to the opening of the E contact (3A timer) or C contact (3B timer). This time is determined from the lighting to the extinguishing of the 510C test lamp.

(r) Remove all connections.

**3. ADJUSTING PROCEDURES**

**3.001 List of Tools, Gauges, Materials, and Test Apparatus**

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
403A	5/32- and 3/16-Inch Hex. Double-End Socket Wrench
417A	1/4- and 3/8-Inch Hex. Open Double-End Flat Wrench
510C	Portable Lamp [Equipped with a W2BL Cord (48V)]
565A	90 Degree Offset Screwdriver
566A	45 Degree Offset Screwdriver
KS-14164	Brush
R-2959	1/16-Inch Allen Socket Screw Wrench
R-2961	0.050-Inch Allen Socket Screw Wrench
—	Combination Pliers
—	P-Long-Nose Pliers
—	3-Inch C Screwdriver (or the replaced 3-inch cabinet screwdriver)
—	6-Inch C Screwdriver (or the replaced 6-inch cabinet screwdriver)
—	4-Inch E Screwdriver (or the replaced 4-inch regular screwdriver)
—	No. 56 Twist Drill (0.0465 inch)
<b>GAUGES</b>	
70J	0-150 Gram Gauge
79C	0-200 Gram Push-Pull Tension Gauge

CODE OR SPEC NO.	DESCRIPTION
<b>GAUGES</b>	
KS-3008	Stopwatch
KS-6909	Thickness Gauge Nest
<b>MATERIALS</b>	
KS-2423	Cleaning Cloth
KS-7860	Petroleum Spirits
KS-16832 L2	Lubricant
<b>TEST APPARATUS</b>	
— (7 required)	893 Cord [3 feet long, equipped with two 360A tools (1W13A Cord), one KS-6278 Connecting Clip, and one 108 Cord Tip]

**3.002** Where reference is made in the procedures to the use of an Allen wrench, select the proper size Allen wrench from among those listed in 3.001.

**3.01 Cleaning (Reqt 2.01)**

(1) **Cover:** Clean the inside of the cover by wiping it with a piece of clean KS-2423 cloth.

(2) **Bearings, Gear, and Pinion:** Clean these parts with a KS-14164 brush which has been dipped in KS-7860 petroleum spirits, applying the brush at the points specified for lubrication in requirement 2.02. Manually operate the cam shaft a few times and then wipe off excess petroleum spirits and foreign matter with a clean, dry KS-2423 cloth. Relubricate the parts as covered in 3.02.

**3.02 Lubrication (Reqt 2.02)**

(1) Make sure the container of KS-16832 L2 lubricant has been shaken as covered in 1.07.

(2) Before lubricating the parts, clean as covered in 3.01.

(3) Lubricate parts as covered in requirement 2.02.

(4) After lubricating the Micro Switch roller bearings, wipe off any excess of lubricant from the contact surfaces of the rollers and cams with a clean, dry KS-2423 cloth.

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### 3.03 *Record of Lubrication* (Reqt 2.03)

(No Procedure)

### 3.04 *Timer Mounting* (Reqt 2.04)

### 3.05 *Tightness of Timer Terminals and Lock-nuts* (Reqt 2.05)

(1) If the timer does not enter the mounting plate freely or is not held securely by the mounting plate springs, determine whether the connecting block springs are out of line with the terminals of the terminal block, the mounting posts are loose or bent, or the mounting plate springs have insufficient tension.

(2) If the connecting block springs are out of line with the terminals of the terminal block, loosen the connecting block mounting screws with the 3-inch C screwdriver. Insert the timer into its mounting plate and allow the connecting block to take the position in which it readily accommodates the terminals on the timer terminal block. Tighten the connecting block mounting screws securely.

(3) If a mounting post is loose, tighten the nut holding it to the timer baseplate with the 417A wrench. To tighten one of the mounting posts which secure the handles at either end of the timer, use the combination pliers applied to the post close to the timer base. Take care not to damage the posts more than necessary. If a mounting post is bent, replace the post.

(4) Manually adjust the tension of any mounting plate springs if necessary.

(5) Straighten a bent timer terminal with the P-long-nose pliers and tighten loose lock-nuts with the 403A wrench. In tightening the nuts, exercise care not to twist the connecting wires.

(6) If the terminal block is loose, tighten the screws holding it to the timer frame with the 565A and 566A offset screwdrivers.

### 3.06 *Cover Spring Pressure* (Reqt 2.06)

(1) If the cover does not fit snugly, manually adjust the tension of the cover springs.

### 3.07 *End Play of Cam Shaft and Core* (Reqt 2.07)

(1) If either the cam shaft or the core does not have end play, loosen the stop lever setscrew with the proper size Allen wrench and slide the stop lever assembly to the left or right until the end play requirement is met. Tighten the screw securely. Check requirement 2.15.

### 3.08 *Clearance Between Stop Lever and Cam Shaft Frame* (Reqt 2.08)

(1) If the stop lever touches the cam shaft frame when the cam shaft is rotated, loosen the stop lever setscrew with the proper size Allen wrench and slide the stop lever through its clamp to obtain the required clearance. Tighten the screw securely. Check requirement 2.15.

### 3.09 *Freedom of Movement of Cam Shaft* (Reqt 2.09)

(1) If the cam shaft binds this may be due to dirt in the bearings. Clean dirty bearings as covered in 3.01.

(2) If the cam shaft still does not rotate freely, binding may be due to a bent cam shaft or bearings which are out of line. In this case, refer the matter to the supervisor.

(3) After checking for freedom of movement of the cam shaft, retension the retractile spring as covered in 3.13.

### 3.10 *Freedom of Switch Movement* (Reqt 2.10)

(1) If a Micro Switch roller or roller arm binds, lubricate the roller bearing or hinge pin as covered in requirement 2.02.

(2) If a roller does not turn when engaged by its associated cam, there may be a film of oil on the contact surfaces of the roller or cam. In such a case, remove the oil with a clean, dry KS-2423 cloth.

(3) If the roller or roller arm still binds, replace the Micro Switch. Check requirement 2.15.

### 3.11 *Cam and Switch Roller Engagement* (Reqt 2.11)

- (1) To center a cam on its associated Micro Switch roller, loosen the two cam set-screws with the proper size Allen wrench exercising care not to rotate the cam on the shaft. Position the cam so that the contact surface of the cam will lie within the edges of the roller when the end play of the cam shaft is taken up first in one direction and then in the other, while the play of the roller is taken up in the opposite direction.
- (2) If a roller does not rest against its associated cam in all positions of the cam, the roller arm may be bent. In this case, refer the matter to the supervisor.
- (3) After repositioning cams, check requirement 2.15.

### 3.12 *Gear and Pinion Engagement* (Reqt 2.12)

- (1) If the left edge of the teeth of the core gear are not approximately in line with the left edge of the teeth of the motor pinion when the end play of each is taken up as specified in requirement 2.12(a), reposition the motor pinion as follows. Connect the motor terminals to a power supply and allow the motor to rotate until the two setscrews are accessible. Loosen the setscrews with the proper size Allen wrench. Shift the motor pinion on the shaft as required, taking care to avoid bending the shaft or pulling the shaft out of the motor by placing excessive pressure on it. Tighten the setscrews securely. If difficulty is encountered due to burring of the shaft by the setscrews, remove the motor as follows to facilitate the procedure. While holding the motor, remove the motor mounting screws with the 4-inch E screwdriver. Taking care not to damage the wiring, place the motor in a position which provides access to the two motor pinion setscrews.
- (2) If the backlash requirement is not met, adjust by loosening the two motor mounting screws with the 4-inch E screwdriver and repositioning the motor. When proper backlash is obtained, tighten the motor mounting screws securely.

### 3.13 *Cam Shaft Restoring Spring Tension* (Reqt 2.13)

- (1) If this requirement is not met, retension the retractile spring as follows. Remove the screws in the left bearing with the 3-inch C screwdriver and release the tension on the spring. With one end of the untensioned spring hooked around the stop pin on the A cam and the other end around the stop pin on the left bearing, turn the bearing
  - 1-1/3 to 1-2/3 turns for 3A timers
  - 1 to 1-1/3 turns for 3B timers
 in the direction which tensions the spring, taking care during this procedure that the stop lever is against the stop. Replace the bearing screws and tighten them securely.
- (2) If the requirement still is not met, it is probable that the cam shaft binds, in which case proceed as covered in 3.09.

### 3.14 *Motor Torque* (Reqt 2.14)

- (1) If the motor torque requirement is not met, check to see if there is excess tension on the cam shaft retractile spring or if the cam shaft binds.
- (2) If there is too much tension on the retractile spring, proceed as covered in 3.13.
- (3) If the cam shaft binds, proceed as covered in 3.09.
- (4) If the motor torque requirement still is not met, replace the motor.

### 3.15 *Timing Requirements* (Reqt 2.15)

- (1) If the timing requirements are not met, this may be due to loose or improperly positioned stop and cams, defective Micro Switches, bind on the cam shaft, or slipping of the clutch.
- (2) If the stop or cams are loose or improperly positioned, reset them as covered in (3) through (6). These procedures give a definite setting for the A cam and approximate settings for the remaining cams by use of a series of holes in the center bearing and a No. 56 drill which may be inserted in the holes.

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(3) To set the A cam, insert the drill in the hole nearest the stop and permit the stop lever to rest against the drill. Loosen the cam setscrews with the proper size Allen wrench and rotate the cam until its associated Micro Switch operates. Hold the cam in this position and securely tighten the screws.

**Caution:** *While setting the A cam, hold the cam so that the cam shaft retractile spring cannot unwind.*

(4) To set the B, C, D, and E cams on 3A timers, insert the drill in the second, third, fourth, and fifth holes respectively, counterclockwise from the stop, and proceed as covered in (3).

(5) To set the B and C cams on 3B timers, insert the drill in the second and third holes respectively, counterclockwise from the stop, and proceed as covered in (3).

(6) To set the cam shaft in its normal position, loosen the stop screw with the 6-inch C screwdriver and position the eccentric stop so that requirement 2.15(i) is met. Tighten the screw securely.

(7) After setting the cams, check that requirement 2.15 is met. If any cam is still out of adjustment, loosen its setscrews and

shift the cam slightly as required. Tighten the setscrews securely.

(8) If a Micro Switch roller arm is bent or if any Micro Switch is otherwise defective, replace the Micro Switch.

(9) If the cam shaft binds, proceed as covered in 3.09.

(10) If the timing requirements still are not met, the clutch may slip. In this case, replace the coil assembly of the clutch.

**REASONS FOR REISSUE**

1. To omit information covering definition of one drop of oil (1.05 of previous issue).
2. To add information covering preparation of KS-16832 L2 lubricant [1.07 and 3.02(1)].
3. To add information covering definition of one dip of KS-16832 L2 lubricant (1.08).
4. To revise requirements and procedures covering lubrication (2.02 and 3.02).
5. To add Table A.
6. To revise List of Tools, Gauges, Materials, and Test Apparatus and to add an associated paragraph (3.001 and 3.002).