

## KS-14741 PROGRAM TIMERS

### REQUIREMENTS AND ADJUSTING PROCEDURES

#### 1. GENERAL

**1.01** This section covers the requirements and adjusting procedures for the KS-14741 L1 through L10 program timers.

**1.02** This section is reissued to include the L9 and L10 program timers. Since this reissue is a general revision, arrows ordinarily used to indicate changes have been omitted.

**1.03** Requirements and adjusting procedures shall apply to all lists unless otherwise noted.

**1.04** 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.

**1.05** Before doing any maintenance work on the timer, take it out of service in accordance with approved procedures. Before removing the timer from its mounting, remove the timer fuse from the power distribution cabinet to disconnect the voltage supply.

**1.06** It will be necessary to remove the timer from its mounting when checking all requirements except requirements 2.10 and 2.12. The procedures for removing the timer are covered in 3.002. The procedures for setting it to the correct time of day are covered in 3.003 and to the correct day of the week in 3.004.

**1.07 *IN Position of a Time Selector Pin:*** A time selector pin is said to be in its IN position when it is in its innermost position with respect to the hour dial. In this position, the pin can operate the trip arm.

**1.08 *OUT Position of a Time Selector Pin:*** A time selector pin is said to be in its OUT position when it is in its outermost position with respect to the hour dial. In this position, the pin clears the trip arm.

#### 2. REQUIREMENTS

##### 2.01 *Cleaning*

(a) (*Not L3 or L8 Which Have Enclosed Switches*) The contacts of the day cutout, the trip arm, and the cam switches shall be cleaned when necessary in accordance with the section covering cleaning of relay contacts.

(b) Other parts shall be cleaned when necessary in accordance with approved procedures.

**Note:** All program timers manufactured after January 1974 have only enclosed switches; therefore, the switch contacts have no need of being cleaned.

##### 2.02 *Freedom of Movement*

(a) All shafts shall rotate without bind.

Gauge by eye and feel.

(b) The inner end of the minute hand hub shall not touch the minute dial when the shaft end play is taken up toward the rear of the timer.

Gauge by eye.

##### 2.03 *Synchronization of Minute Hand With Hour Dial:*

Fig. 1 (A)—When a time selector pin, directly above an hour designation on the hour dial, is in line with the 60 mark on the minute dial, the minute hand shall be in alignment with the 60 mark.

Gauge by eye.

To check this requirement, slowly rotate the cams (for L1, L2, L4 through L7, L9, and L10) or the minute hand shaft at the rear of the timer (for L3 and L8) clockwise (cw) until a pin directly above an hour designation on the hour dial is in alignment with the 60 mark on the minute dial. Use the R-8550, 6-inch steel scale to facilitate making this

alignment. Observe the position of the minute hand with respect to the 60 mark.

**2.04 Engagement of Trip Arm Switch Actuator and Lever: (Not L3 and L8)**—With the trip arm lever shaft end play taken up in either direction, the trip arm switch actuator shall overlap the lever by

Min 0.005 inch

Gauge by eye.

**2.05 Trip Arm Engagement**

(a) Fig. 2(A)—With the end play of the trip arm shaft taken up toward the rear of the timer and the time selector pins in the IN position, the pins shall overlap the trip arm tip by

Min 0.005 inch

Gauge by eye.

This requirement shall be checked at four time selector pins 90 degrees apart.

(b) Fig. 2(B)—With the end play of the trip arm shaft taken up toward the front of the timer and the time selector pins in the OUT position, the tip of the trip arm shall clear the end of the pins by

Min 0.015 inch

Gauge by eye.

This requirement shall be checked at four time selector pins 90 degrees apart.

**2.06 Trip Arm Switch Contact Closure: (Not L3 or L8)**

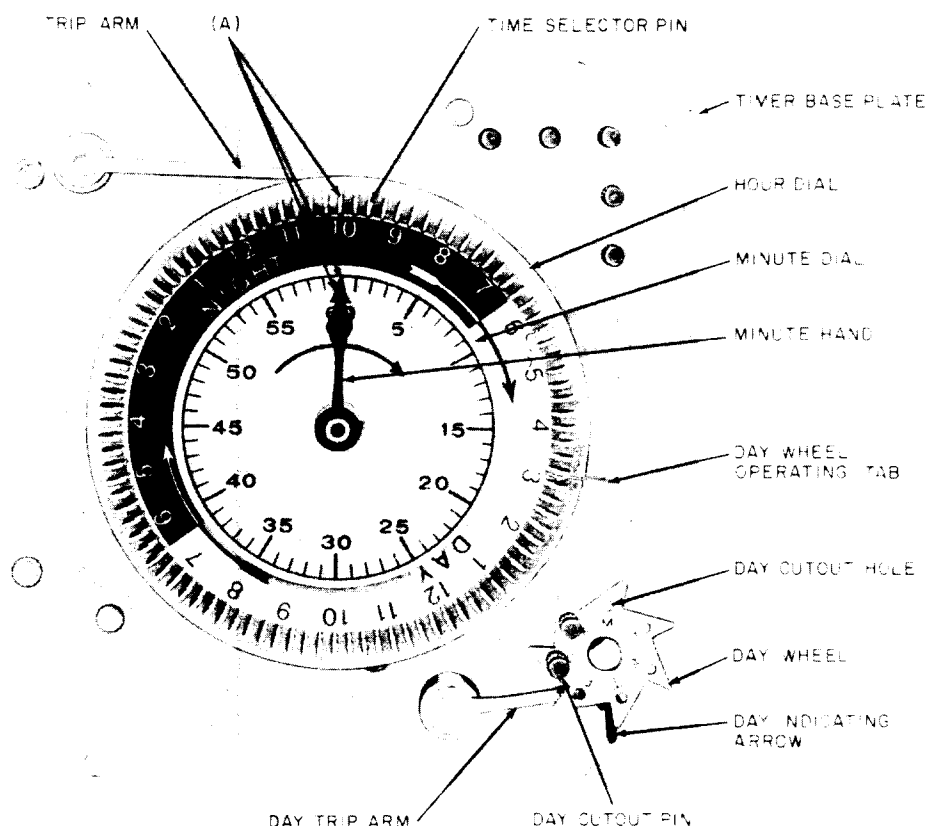


Fig. 1—KS-14741 Program Timer—Front View (L1 Timer Shown)

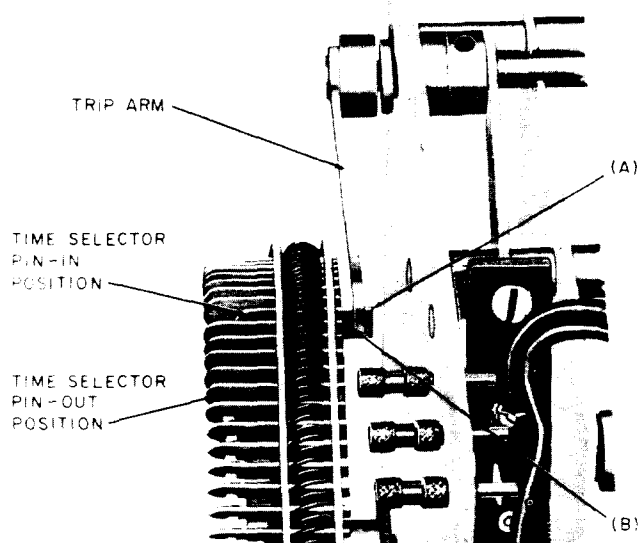


Fig. 2—Trip Arm Engagement

- (a) When the trip arm is operated by a time selector pin, the trip arm switch contact shall close

KS-14741 L1, L5, L6, L7, L9, L10	4 1/2 minutes ±2 1/2 minutes
KS-14741 L2, L4	8 minutes ±2 minutes

before the minute hand reaches 15, 30, 45, and 60 marks on the minute dial corresponding to the pin. This requirement is considered met if a satisfactory check is obtained with relation to the 60 mark.

Gauge by eye.

To check this requirement, push to its IN position a time selector pin that is directly above an hour designation and sufficiently to the left of the trip arm tip (as viewed from the front of the timer) so it does not touch the trip arm in this position.

Slowly rotate the cams cw, click by click, until the trip arm switch contacts just close. Observe the position of the minute hand with respect to the minute dial.

- (b) The trip arm switch contacts **shall remain closed** for

Min 10 minutes  
Max 12 minutes

as indicated by the movement of the minute hand with respect to the minute dial.

Gauge by eye.

To check this requirement, push to its IN position a time selector pin that is directly above an hour designation and sufficiently to the left of the trip arm tip (as viewed from the front of the timer) so it does not touch the trip arm in this position. Slowly rotate the cams cw, click by click, until the trip arm switch contacts just close. Observe the position of the minute hand. Resume rotating the cams slowly until the contacts open. Observe the position of the minute hand and determine the elapsed time of contact closure.

## 2.07 Clearance Between Inner Cam and Motor Gear Housing: (Not L3 or L8) Fig. 3(A)—

With the end play of the camshaft taken up toward the front of the timer, the inner cam shall clear the motor gear housing by

Min 0.010 inch

Gauge by eye.

## 2.08 Engagement of Cam Switch Actuator and Cams: (Not L3 or L8)—

With the camshaft end play taken up in either direction, the cam switch actuator shall overlap both cams by

Min 0.010 inch

Gauge by eye.

## 2.09 Cam Switch Contact Closure: (Not L3 or L8) Fig. 4(A)

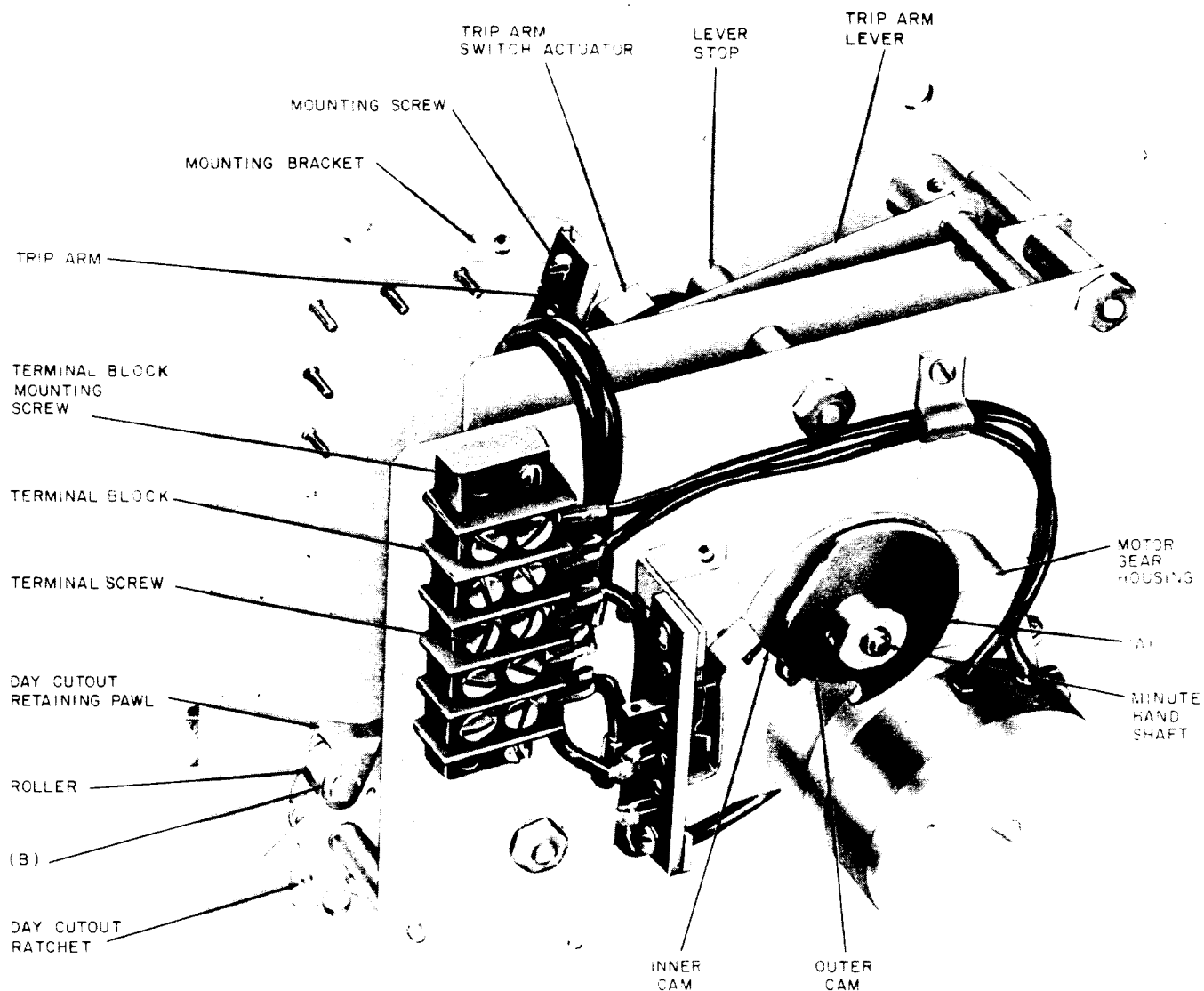


Fig. 3—KS-14741 Program Timer—Upper Rear View (L1 Timer Shown)

(a) The contacts shall close

KS-14741 L1, L5, L9	1 1/2 minutes ±1/4 minute
KS-14741 L2, L4	5 minutes ±1/4 minute
KS-14741 L6, L7, L10	0 minutes ±1/4 minute

before the minute hand reaches the 15, 30, 45, and 60 mark on the minute dial. This requirement is considered met if a satisfactory check is obtained with relation to the 60 mark on the minute dial.

Gauge by eye.

To check this requirement, slowly rotate the cams cw, click by click, until the contacts just close. Observe the position of the minute hand with respect to the minute dial.

- (b) The cam switch contacts shall remain closed for

KS-14741 L1, L2, L4,	Min 3 minutes
L5, L6, L7, L9	Max 4 minutes
KS-14741 L10	Min 1/4 minute
	Max 3/4 minute

as indicated by the movement of the minute hand with respect to the minute dial.

Gauge by eye.

To check these requirements, slowly rotate the cams cw, click by click, until the contacts just close. Observe the position of the minute hand. Resume rotating the cams slowly until the contacts open. Observe the position of the minute hand and determine the elapsed time of contact closure.

#### **2.10 Day Wheel Operating Tab Mounting:**

The day wheel operating tab shall be held securely in its slot in the hour dial.

Gauge by eye.

#### **2.11 Position of Day Cutout Ratchet:**

Fig. 3(B)—The ratchet shall be centrally located with respect to the roller of the day cutout retaining pawl.

Gauge by eye.

**2.12 Position of Day Wheel:** With the day wheel operating tab engaging a tooth of the day wheel and the end play of the day wheel shaft taken up in either direction, the day wheel operating tab shall overlap the tooth by

Min 0.015 inch

Gauge by eye.

#### **2.13 Engagement of Day Cutout Operating Pawl and Day Cutout Pin**

- (a) With the operating pawl resting on a day cutout pin and with the day wheel shaft end play taken up toward the front of the timer and the operating pawl shaft end play taken up toward the rear of the timer, the pin shall overlap the pawl by

Min 0.010 inch

Gauge by eye.

- (b) With the operating pawl resting on a day cutout pin and with the day wheel shaft end play taken up toward the rear of the timer and the operating pawl shaft end play taken up toward the front of the timer, the pawl shall clear the end of the threaded portion of the pin by

Min 0.010 inch

Gauge by eye.

#### **2.14 Engagement of Day Cutout Switch Actuator and Lever: (Note L3 or L8)**

Fig. 4(B)—With the day cutout lever shaft end play taken up in either direction, the day cutout switch actuator shall overlap the lever by

Min 0.010 inch

Gauge by eye.

#### **2.15 Day Cutout Switch Contact Break:** Fig. 4(C)

- (a) When the day cutout operating pawl is operated by a cutout pin on the day wheel, the switch contacts shall open

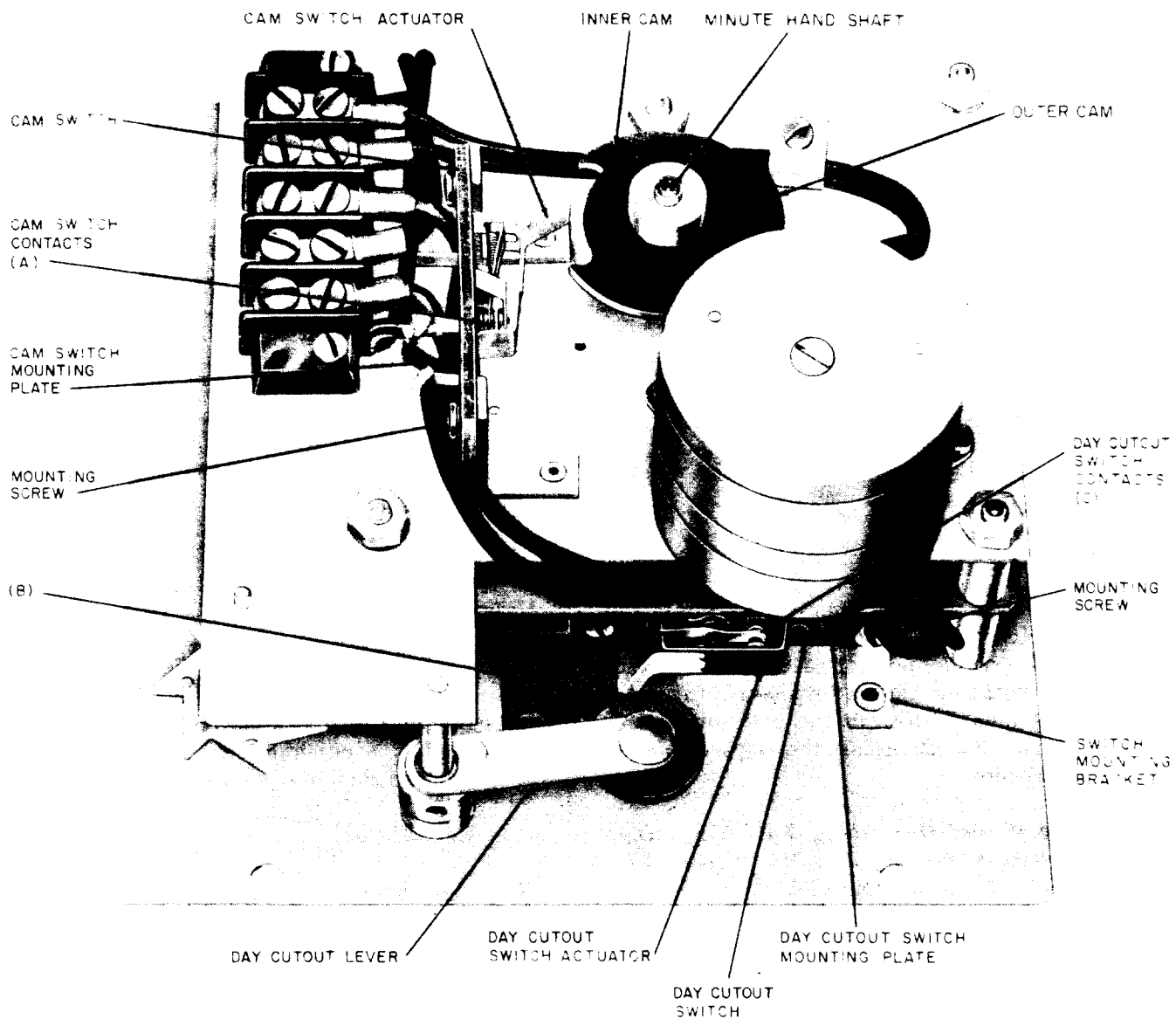
Min 11:30 PM

Max 12:00 Midnight

as indicated by the position of the minute hand with respect to the minute and hour dials.

Gauge by eye.

To check this requirement, screw a pin in the day cutout hole which is nearest to the top edge of the operating pawl, moving the pawl slightly away from the hub, if necessary, to insert the pin. Make sure insertion of the pin does not



**Fig. 4—KS-14741 Program Timer—Lower Rear View (L1 Timer Shown)**

open the day cutout switch contacts. If the pin opens the contacts, place the pin in the next hole above the pawl. Then slowly rotate the cams (for L1, L2, L4 through L7, L9, and L10) or the minute hand shaft at the rear of the timer (for L3 and L8) cw, click by click, until the contacts just open. Note on the minute and hour dials the indicated time when the contacts opened.

**Caution:** To avoid damage to the motor driven gear train, manually hold the day

**trip arm in the off position while installing day cutout pins.**

- (b) After the day cutout switch contacts have opened, the retaining pawl roller shall drop over the top of a ratchet tooth to complete the advance of the day wheel one step.

Gauge by eye.

- (c) With cutout pins in two adjacent day cutout holes, the day cutout switch contacts shall

remain open during the interval in which the pawl leaves the first pin and engages the second.

Gauge by eye.

To check this requirement, screw pins in two adjacent day cutout holes. Slowly rotate the day wheel counterclockwise (ccw) and note whether the day cutout switch contacts remain open as the pawl leaves the first pin and engages the second.

### 3. ADJUSTING PROCEDURES

#### 3.001 *List of Tools and Gauges*

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
33	11/32-inch hex. single-end socket wrench
485A	Smooth-jaw pliers
KS-14164	Brush
R-2559	Power test lamp
R-2959	Allen socket screw wrench
—	3-inch C screwdriver (or the replaced cabinet screwdriver)
AT-7860	B long-nose pliers
<b>GAUGES</b>	
R-8550	6-inch steel scale

#### 3.002 *Removing Timer From Mounting*

**Caution:** *Before removing the timer from its mounting, remove the timer fuse from the power distribution cabinet to disconnect the voltage supply.*

If the timer is provided with a rear cover on the mounting panel, remove the cover using the 3-inch C screwdriver. If the timer is in a cabinet of a wall- or column-mounted control panel, unlock the cabinet by depressing the button on the right and swinging the front portion of the cabinet outward.

Check that the power is removed from the timer using the R-2559 power test lamp. Apply the test lamp leads to the terminals of the terminal block to which the timer motor leads are connected. After removing the knurled thumb screws which secure the terminal block cover, tag and disconnect the timer leads and remove the timer from its mounting using the screwdriver and the 33 socket wrench.

**Note:** All program timers manufactured after May 1971 are provided with an insulating strip which covers the terminal block and protects personnel from hazardous currents. Refer to Section 030-157-801 for information on the KS-14741 L150 and L151 terminal insulator kits for older units.

#### 3.003 *Setting Timer to Correct Time of Day:*

With the timer connected in the circuit, turn the minute hand (Fig. 1) cw until the correct hour of the day or night on the hour dial is in line with the 60-minute mark on the minute dial. Then further turn the minute hand until it is in line with the mark on the minute dial indicating the correct number of minutes past the hour.

**Caution:** *Never rotate the hour dial by hand since this would damage the timer mechanism.*

#### 3.004 *Setting Timer to Correct Day of Week:*

Turn the day wheel (Fig. 1) ccw until the letter corresponding to the correct day of the week is directly in front of the day indicating arrow when the wheel comes to rest under control of its centering mechanism. Note that the letter X indicates Sunday.

#### 3.01 *Cleaning (Not L3 or L8) (Req't 2.01)*

- (a) Clean the switch contacts in accordance with the section covering cleaning of relay contacts. In the case of the trip arm switch contacts, note that these contacts are adjacent to the switch actuator. To gain access to the contacts of the trip arm and day cutout switches, it is necessary to remove the switches from their mounting brackets. To do this, remove the mounting screws and lockwashers using the 3-inch C screwdriver. Move the switch to an accessible position, being careful not to break the soldered connections. After cleaning the contacts, remount the switch. Check requirement 2.04 if the trip

arm switch was removed or requirement 2.14 in the case of the day cutout switch.

- (b) Clean other parts of the timer with a clean, dry KS-14164 brush.

**Note:** All program timers manufactured after January 1974 have only enclosed switches; therefore, the switch contacts have no need of being cleaned.

### 3.02 *Freedom of Movement* (Reqt 2.02)

- (a) If a shaft which has its end play controlled by a collar binds, reposition the collar to increase the end play using the R-2959 wrench to loosen and tighten the setscrew.
- (b) If a shaft which has no adjustable collar binds, refer the matter to the supervisor.
- (c) If the inner end of the minute hand hub touches the minute dial, reposition the hub as required using the R-2959 wrench to loosen and tighten the setscrew. Check requirement 2.03.

### 3.03 *Synchronization of Minute Hand With Hour Dial:* (Reqt 2.03)—If the requirement is not met, proceed as follows.

- (1) Rotate the minute hand cw until a time selector pin above an hour designation on the hour dial is in line with the 60 mark on the minute dial.
- (2) Loosen the minute hand setscrew with the R-2959 wrench.
- (3) Position the minute hand in line with the 60 mark on the minute dial.
- (4) Tighten the setscrew securely, taking care not to change the position of the minute hand on the shaft.
- (5) Check requirements 2.02(b), 2.06, 2.09, and 2.15(a).

### 3.04 *Engagement of Trip Arm Switch Actuator and Lever (Not L3 or L8)* (Reqt 2.04)

- (a) If the requirement is not met, slightly loosen the trip arm switch mounting screws with

the 3-inch C screwdriver and shift the switch, as required.

- (b) If necessary to meet the requirement, reduce the end play of the trip arm lever shaft as follows. While holding the trip arm to prevent rotation of the shaft, loosen the lever setscrew with the R-2959 wrench, reposition the lever, and securely tighten the setscrew. Check requirements 2.02(a), 2.05(a), and 2.06.

### 3.05 *Trip Arm Engagement* (Reqt 2.05)

#### 3.06 *Trip Arm Switch Contact Closure* (Reqt 2.06)

- (a) If requirement 2.05 is not met, reposition the trip arm using the R-2959 wrench to loosen and tighten the setscrew. Check requirement 2.06.
- (b) If requirement 2.06 is not met, proceed as follows. (Reqt 2.06 excluded L3 and L8)
  - (1) Push to its IN position a time selector pin that is directly above an hour designation and sufficiently to the left of the trip arm tip (as viewed from the front of the timer) so it does not touch the trip arm.
  - (2) Rotate the cams cw until the minute hand is at the 57-minute mark for the L1, L5, L6, L7, L9, and L10 timers or at the 53-minute mark for the L2 and L4 timers.
  - (3) Loosen the trip arm lever setscrew with the R-2959 wrench.
  - (4) While holding the trip arm against the pin, reposition the trip arm lever until the contacts just close. Tighten setscrew securely.

**Note:** This adjustment will be facilitated by positioning the lever on the shaft with the wrench in the setscrew.

- (5) Recheck the requirement and requirements 2.02(a) and 2.05.

### 3.07 *Clearance Between Inner Cam and Motor Gear Housing (Not L3 or L8)* (Reqt 2.07)

**3.08 Engagement of Cam Switch Actuator and Cams (Not L3 or L8)** (Reqt 2.08)**3.09 Cam Switch Contact Closure (Not L3 or L8)** (Reqt 2.09)

(a) If the inner cam does not clear the motor gear housing, as required, loosen the inner cam setscrew with the R-2959 wrench and reposition the cams. Tighten the setscrew securely. Check requirements 2.08 and 2.09(a).

(b) If the cam switch actuator does not overlap the cams, as required, slightly loosen the cam switch mounting screws with the 3-inch C screwdriver. Shift the switch, as required, and securely tighten the screws. If it is necessary to shift the cams to meet the requirement, loosen the inner cam setscrew with the R-2959 wrench and reposition the cams. Tighten the setscrews securely. If the requirement is not met because of excessive separation between the two cams, loosen the outer cam setscrew and move the outer cam as close to the inner cam as possible. Tighten the setscrew securely. Check requirement 2.09.

(c) If the cam switch contacts do not close at the required time, proceed as follows. Rotate the cams until the minute hand is 1 1/2 minutes before the 60 mark on the minute dial. Loosen the inner cam setscrew with the R-2959 wrench, being careful not to rotate the shaft. While holding the minute hand stationary, rotate the cams cw until the contacts just close and then securely tighten the setscrew. This adjustment will be facilitated by rotating the cams with the wrench inserted in the inner cam setscrew. Recheck the requirement and also requirements 2.07 and 2.08.

(d) If the cam switch contacts do not remain closed for the required time, proceed as follows.

- (1) Rotate the cams, click by click, until the contacts close.
- (2) Observe the position of the minute hand with respect to the minute dial.
- (3) Resume rotating the cams, click by click, until the minute hand has advanced 3 1/2 minutes.

(4) While holding the inner cam stationary, loosen the outer cam setscrew with the R-2959 wrench, rotate the outer cam until the contacts just open, and tighten the setscrew.

**Note:** This adjustment will be facilitated by rotating the cam with the wrench inserted in the outer cam setscrew.

(5) Recheck the requirement and also requirement 2.08.

**3.10 Day Wheel Operating Tab Mounting:**

(Reqt 2.10)—If the operating tab is not held securely in its slot, remove the tab with the B long-nose pliers. Using the pliers, squeeze the prongs on the tab toward each other slightly, taking care to avoid excessive bending which might damage the prongs. Remount the tab in the slot.

**3.11 Position of Day Cutout Ratchet** (Reqt 2.11).**3.12 Position of Day Wheel** (Reqt 2.12)**3.13 Engagement of Day Cutout Operating Pawl and Day Cutout Pin** (Reqt 2.13)**3.14 Engagement of Day Cutout Switch Actuator and Level (Not L3 or L8)** (Reqt 2.14)**3.15 Day Cutout Switch Contact Break** (Reqt 2.15)**Position of Day Cutout Ratchet**

(a) If the ratchet is not centrally located with respect to the pawl roller, loosen the ratchet setscrew with the R-2959 wrench. Reposition the ratchet and tighten the setscrew securely. Check requirement 2.15(a) and (b).

**Position of Day Wheel**

(b) If the operating tab does not overlap the day wheel teeth, as required, loosen the day wheel setscrew with the R-2959 wrench. Reposition the day wheel and tighten the setscrew securely. Check requirements 2.13 and 2.15(a) and (b).

**Engagement of Day Cutout Operating Pawl and Day Cutout Pin**

- (c) If the pawl does not engage the pin, as required, loosen the pawl setscrew with the R-2959 wrench and reposition the pawl. Tighten the setscrew securely. Check requirements 2.02(a) and 2.15(a).

**Engagement of Day Switch Actuator and Lever (Not L3 or L8)**

- (d) If the requirement is not met, slightly loosen the day cutout switch mounting screws with the 3-inch C screwdriver and shift the switch, as required. If necessary, loosen the lever setscrew with the R-2959 wrench and reposition the lever to reduce the shaft end play. Check requirements 2.02(a) and 2.15(a) if the latter adjustment was necessary.

**Day Cutout Switch Contact Break**

- (e) Failure to meet requirement 2.15(a) or (b) may be due to the day wheel operating tab being bent. If the tab is bent, straighten it using the 485A pliers. If failure to meet the requirement is not due to a bent tab, proceed as covered in (6) or (7).
- (f) If requirement 2.15(b) is not met, proceed as follows.
  - (1) Rotate the day wheel until the day cutout ratchet setscrew is accessible.
  - (2) Slightly loosen the ratchet setscrew so the ratchet is held lightly on its shaft. Use the R-2959 wrench.
  - (3) Rotate the minute hand until the indicated time is 12:00 AM.
  - (4) While holding the short side of a day wheel tooth against the operating tab, position the ratchet so the retaining pawl roller is resting on the tip of a ratchet tooth and is just about to drop over the short side of the tooth.
  - (5) Tighten the setscrew securely.
  - (6) Recheck the requirement and also requirements 2.11 and 2.15(a).

- (g) If requirement 2.15(a) is not met, first proceed as covered in (6). Then rotate the cams (for L1, L2, L4 through L7, L9, and L10) or the minute hand shaft at the rear of the timer (for L3 and L8) cw until the indicated time is 11:45 PM. Move the tip of the operating pawl away from the hub of the day wheel and screw a pin into the day cutout hole immediately to the left of the day indicating arrow. Release the pawl. Using the R-2959 wrench, slightly loosen the day cutout lever setscrew so the lever is held lightly on its shaft. While holding the pawl against the pin, set the level so the switch contacts just break. This setting will be facilitated by positioning the lever on the shaft with the wrench inserted in the lever setscrew. Securely tighten the setscrew. Recheck the requirements and also requirements 2.02(a), 2.14, and 2.15(c).

- (h) If requirement 2.15(c) is not met, proceed as follows.

- (1) Rotate the day wheel ccw until a cutout pin fully operates the day cutout operating pawl, and the day circuit retaining pawl roller has just dropped over the top of a ratchet tooth.
- (2) Hold the timer with the day cutout lever uppermost.
- (3) While holding the operating pawl against the pin with a finger and holding the lever stationary with the thumb, slightly loosen the lever setscrew with the R-2959 wrench.
- (4) Rotate the lever slightly toward the switch by means of the wrench inserted in the setscrew.
- (5) Securely tighten the setscrew.
- (6) Check that this position of the lever permits slight additional downward movement of the switch actuator.
- (7) If the switch actuator does not move downward, loosen the setscrew, rotate the lever slightly away from the switch, and tighten the setscrew securely, following the procedure described in (1) through (5).
- (8) Recheck the requirement and requirement 2.15(a).