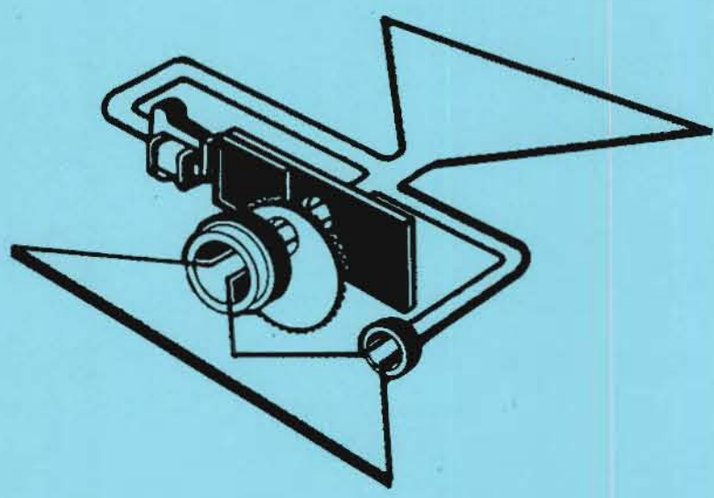
REPAIR MANUAL

AUTOMATIC SHUTTERS FOR USE ON POLAROID LAND 400-SERIES CAMERAS

JUNE 1971



POLAROID CORPORATION / REPAIR DEPARTMENT / WALTHAM, MASSACHUSETTS

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I - PRINCIPLES OF OPERATION

Like any camera shutter, the function of the Polaroid shutters described in this manual is to control the light focused onto film. Each shutter performs its light-controlling function with the aid of an electronic circuit capable of measuring light. When a shutter is opened, allowing film in a camera to be exposed to light, the circuit measures that light and closes the shutter after the film has been sufficiently exposed.

To gain an understanding of how these shutters work, a typical operating sequence will be presented, describing each shutter action in its order of occurrence. A complete electrical description will then follow the operating sequence.

Since the two shutters to be described in this manual are similar in many respects, the operating sequence and electrical description will be applicable to both. Section II of this manual will point out the significant differences between the shutters.

A. MECHANICAL

Four components (Fig. 1-1) form the basis of the automatic camera shutter: They are the aperture selector, the opening shutter blade, the closing shutter blade and the electronic module.

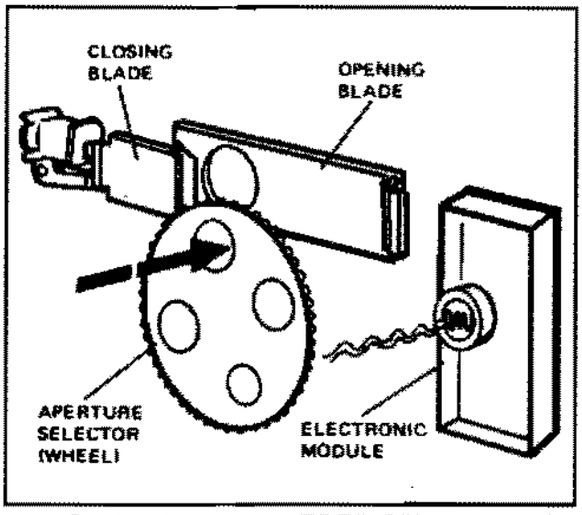

FIGURE 1-1 BASIC SHUTTER COMPONENTS

The aperture selector controls the amount of light allowed to enter the camera at any given instant, the opening blade controls the start of the exposure time (period of time that the film is to be exposed to the light), the closing blade cuts off the light reaching the film at the end of the exposure time and the module circuits determine the length of exposure time (the time at which the closing blade is made to close).

In operation, the shutter is first cocked by depressing the cocking arm (Fig. 1-2). As the arm is de-

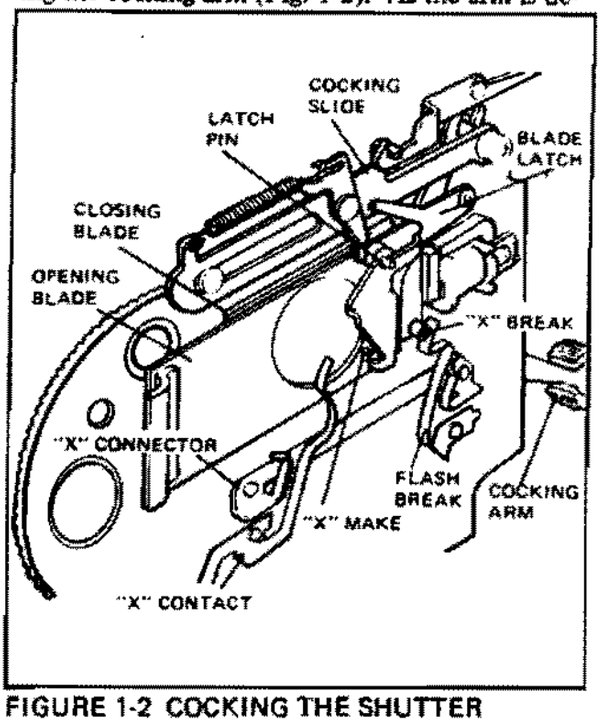

FIGURE 1-2 COCKING THE SHUTTER

pressed, it pulls the cocking slide, which in turn pulls the spring-loaded opening blade, toward the cocked position. As the opening blade moves, it carries the closing blade, also spring-loaded, along with it. When the opening blade had been moved far enough, a latch pin on the blade forces the spring-loaded blade latch down, until the pin passes a shoulder on the latch. With the pin beyond the latch shoulder, the latch snaps back up, securing the pin and holding both shutter blades in the cocked position.

NOTE: When the shutter blades are being cocked, a pin ("X" make) on the opening blade allows a set of spring contacts ("X" contact-"X" connector) to open, while a pin ("X" break) on the closing blades forces a set of spring contacts (flash break – "X" connector) to close. These contacts are part of the flash circuit and come into play when a flash attachment is being used with the camera. The function of these contacts is explained in the electrical description.

In addition to holding the blades in the cocked position, the blade latch also performs another important function.

When the shutter is in the uncocked position, the latch holds the timing switch (S2) open (Fig. 1-3).

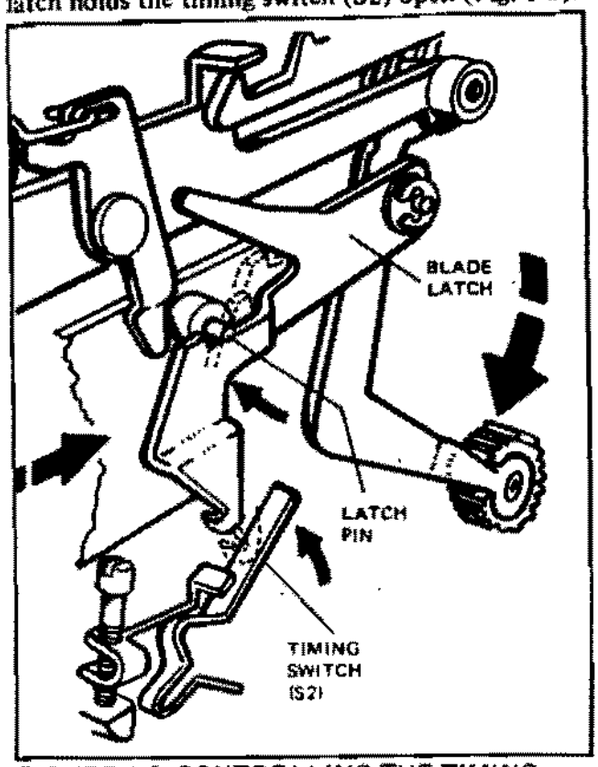

FIGURE 1-3 CONTROLLING THE TIMING SWITCH

However, when the shutter is cocked and the latch has snapped up to secure the latch pin, the blade latch allows the spring-loaded, timing switch (S2) to close. With the timing switch closed, the electronic circuit is prepared to start its light-measuring function, which will begin as soon as the shutter is tripped.

After the blades have been secured at their cocking positions, the cocking arm is depressed further, until the cocking slide becomes secured in its cocked position (Fig. 1-4) by the slide latch, much like the blades were secured.

When the cocking slide is secured by the slide latch, the overtravel arm is forced firmly against the shoulder of the cocking pin, and the closing blade is forced firmly against an electromagnet. With the arm firmly against the pin, a strain is exerted on the overtravel arm spring. (It is the arm spring that initiates the mechanical action of the shutter after it is tripped). At this point, the shutter is cocked, and is ready to be tripped.

Tripping (Fig. 1-5) occurs by manually pressing the shutter-release knob. (The shutter-release

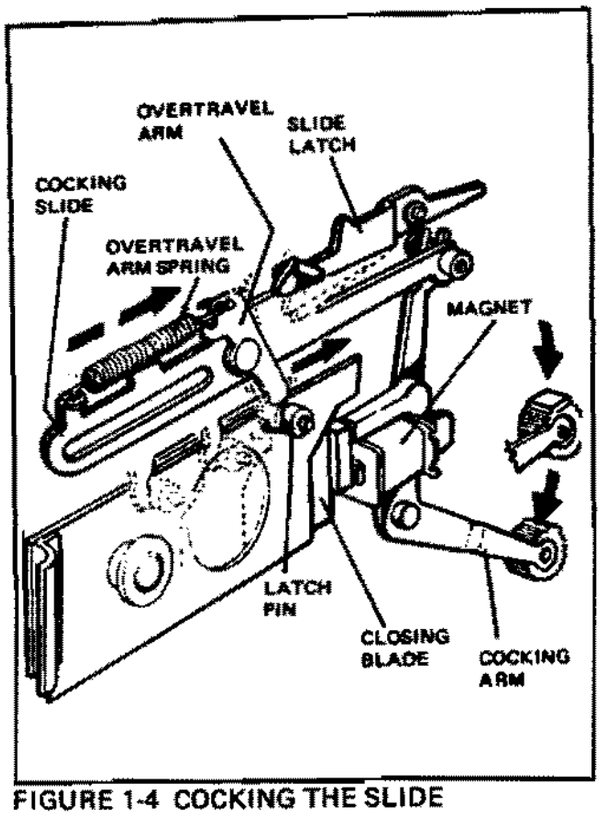

FIGURE 1-4 COCKING THE SLIDE

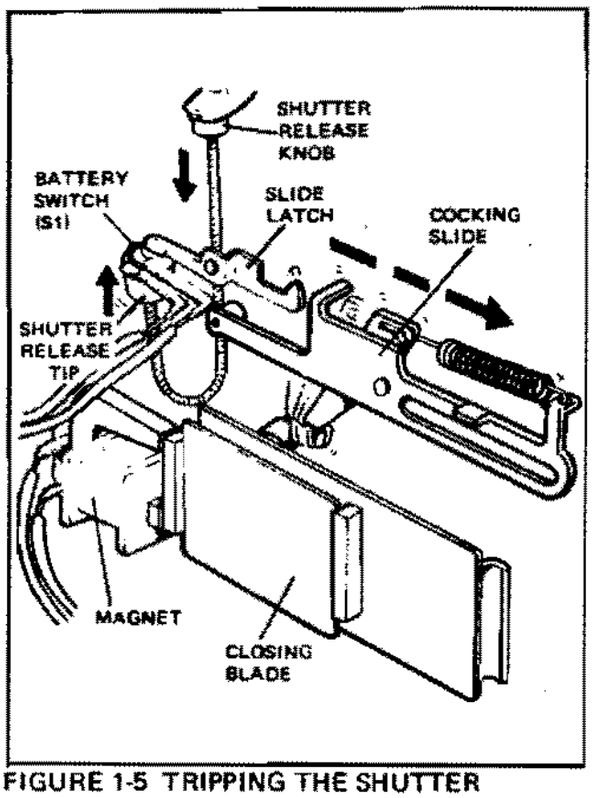

FIGURE 1-5 TRIPPING THE SHUTTER

knob is part of a cable assembly, which is built into the body of the camera.) When the knob is pressed, the shutter-release tip is forced up, closing the battery switch (S1), and tripping the slide latch. The battery switch (S1) is closed slightly before the slide latch is tripped. Closing S1 completes a circuit, through the module, which energizes the electromagnet; the magnet now holds the closing blade in its cocked position.

When the slide latch is tripped, the cocking slide is released and snaps forward. The snapping motion of the slide is caused, first, by the force exerted by the overtravel spring through the overtravel arm, and then, by the force of the spring-loaded cocking arm. As the cocking slide moves forward, a roller on the slide strikes the tang on the blade latch, and forces the blade latch down (Fig. 1-6).

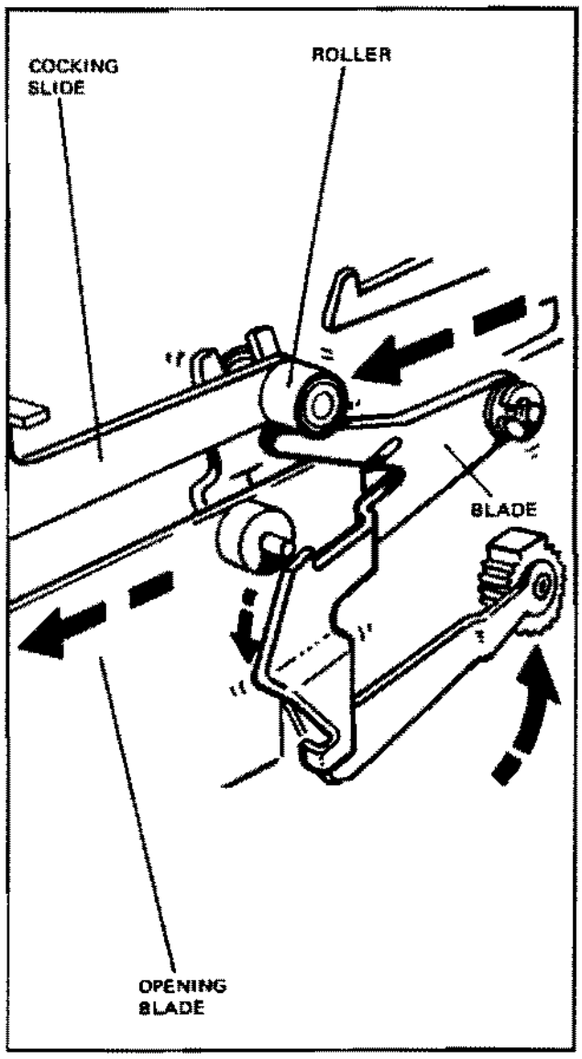

FIGURE 1-6 RELEASING THE OPENING BLADE

At this point, the opening blade has been released, allowing the negative to be exposed; the timing circuit has been activated, allowing the photocell to measure the average scene light and control exposure time; and the closing blade is being held open by the now energized electromagnet. All that remains is for the closing blade to close, completing the picture-taking (exposure) sequence.

When the average scene light has allowed the photocell to pass the correct amount of current through the timing circuit, the electromagnet is de-energized and the closing blade snaps shut. A picture has been taken, and the operating sequence of the shutter is now complete.

NOTE: When the closing blade snaps shut, it allows the flash break and "X"-connector contacts to open, breaking the flash circuit.

Forcing down the blade latch causes two events to occur: First, the blade latch releases the opening blade, allowing it to snap forward; light now passes through the aperture and the hole in the opening blade to expose the negative. Second, the blade latch strikes the timing switch (S2), forcing it to open. When S2 opens the timing circuit begins measuring the amount of light to which the negative is being exposed. The photocell, which is part of the electronic module, is exposed to the average light of the scene being photographed, and uses that light to control the flow of current through the timing circuit. The rate of current flow is directly related to the length of time that the negative is exposed. (A detailed description of the electrical action is contained in the electrical description following this section. Remember that the timing switch (S2) starts the electrical action, and the photocell controls it.)

NOTE: When the opening blade snaps forward, it closes the "X" and "X"-connector contacts. Closing those contacts causes the flash attachment to fire, if it is being used with the camera.

B. ELECTRICAL

Electrical functions will be described with respect to all associated mechanical action occurring within the shutter. In this way, you will not only become familiar with the circuits contained in the shutter, but you will also become familiar with the relationships of specific electrical and mechanical events. This description, as with the mechanical description, will be applicable to both shutter models.

Physical differences between the shutters are described in Section II of this manual.

This circuit is referred to as a two transistor trigger; it utilizes a photoconductive cell to control the length of time that an electromagnet is energized (Fig. 1-7). Power for the circuit is received from a 3 volt battery. Electrical action does not occur until after the shutter release knob is pressed. Also, before the release knob is pressed, the shutter must be cocked so that the closing blade is firmly against the electromagnet and timing switch, (S2), is closed.

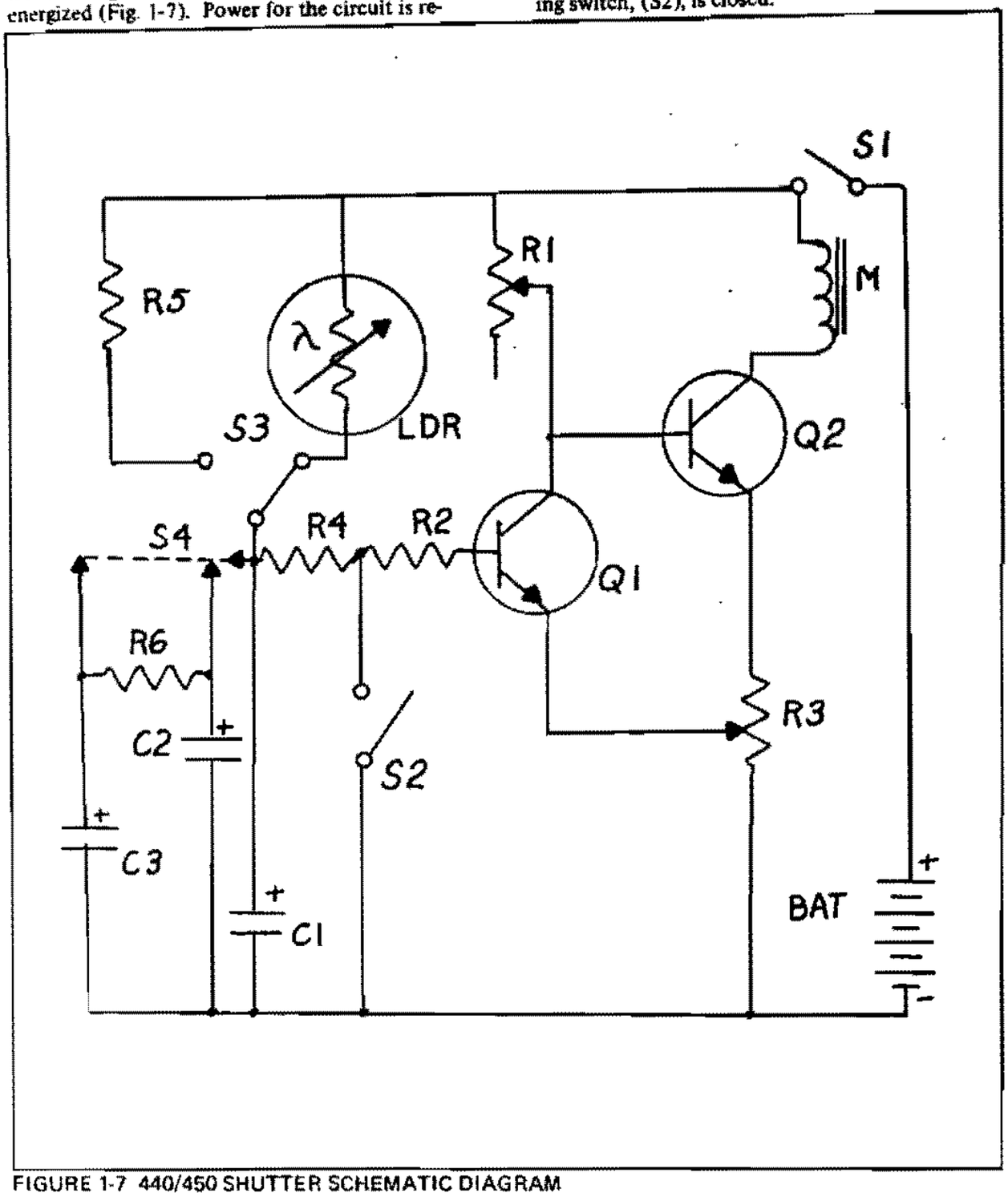

FIGURE 1-7 440/450 SHUTTER SCHEMATIC DIAGRAM

Pressing the shutter release knob closes battery switch, S1. Current is now applied to two circuits: the magnet-hold circuit and the capacitor by-pass circuit. In the magnet-hold circuit, current flows from the positive (+) side of the battery, through S1, to one side of the coil of electromagnet M, and, through variable resistor R1, to the base of transistor Q2. As soon as the current at the base of Q2 becomes high enough (almost instantaneously) Q2 is triggered. Current now flows through electromagnet coil M, the collector and emitter of Q2, and potentiometer R3, to the negative (-) side of the battery. The magnet-hold circuit is now complete, and the electromagnet holds the closing shutter blade in its open position.

In the capacitor by-pass circuit, current flows from the battery, through S1, photocell LDR, resistor R4, and timing switch S2, to the negative (-) side of the battery. With S2 closed, the timing capacitors C1 through C3 and resistor R6 are by-passed.

Shortly after S1 is closed by the pressing of the shutter release knob, the slide latch is tripped, releasing the cocking slide. The cocking slide now snaps forward, tripping the blade latch. Upon being tripped, the blade latch releases the opening blade and opens timing switch S2. The film is now being exposed to light, and the timing circuit is brought into operation. Opening S2 breaks the capacitor by-pass circuit, and reroutes the current to the timing capacitors and resistors. Current now flows from the battery, through S1, photocell LDR, and the selected timing capacitors, or capacitor/resistor combinations, to the negative (-) side of the battery. (We shall assume that capacitor C1 has been selected.)

NOTE: Selector switch 4, part of the aperture wheel, allows specific capacitor/resistor combinations to be selected, depending upon the type of film being used and the available light (aperture selection).

With capacitor C1 now receiving current, it begins to charge up at a rate determined by photocell LDR.

LDR acts like a variable resistance, which is controlled by the light shining upon it. If the light shining on LDR is dim, its resistance will be higher, and it will pass less current, and so on.

When C1 is fully charged, current can no longer enter it; now, the excess current is diverted, through resistors R4 and R2, to the base of Q1. When the current at the base of Q1 builds up to a high enough level, Q1 is triggered. Current now flows from the battery, through S1, variable resistor R1, the collector and emitter of Q1 and potentiometer R3, to the negative (-) side of the battery.

Since the collector of Q1 and the base of Q2 are connected (at the junction of R1), Q1 draws current from the base of Q2. When the current at the base of Q2 has been sufficiently reduced, Q2 is cut off; current can no longer flow through the collector and emitter of Q2. As a result, current no longer flows through the coil of electromagnet M, and the magnet is de-energized. With the magnet de-energized, the closing blade is released and snaps closed. The light exposing the negative is cut off, and a picture has been taken. When the pressure on the shutter release knob is removed, S1 opens, and all current is removed from the circuit. As soon as the shutter is recocked, capacitor C1 discharges through now-closed S2, and the circuit is prepared for another exposure sequence.

NOTE: In the flash circuit, switch Ss is closed by the closing blade when the shutter is cocked, while switch Sx is allowed to open by the opening blade. When the shutter is tripped, the opening blade snaps forward to close Sx, while Ss is still held closed by the closing blade, which is in the grip of the electromagnet. With both switches closed simultaneously, the flash circuit is completed and will cause a flash gun to fire, if one is being used with the camera. When the closing blade is released by the electromagnet, Ss is allowed to open and break the circuit. With the circuit now broken, there is no danger of a premature firing of the flash gun.

S3 is the flash compensation switch. In the 400-series shutters, a fixed time is required for flash since exposure variation is accomplished by the movable blinds on the flash gun. When the plug of the flash gun is inserted into the shutter, S3 transfers the timing capacitors and resistors from the photocell to resistor R5. Since the value of R5 is unaffected by light, the interval during which the shutter remains open is controlled by R5 and any of the resistor/capacitor combinations selected by the aperture wheel. The value of R5 is selected to provide correctly exposed pictures with the Model 490 Focused Flashgun.

II - COMPARISON OF SHUTTER MODELS

The principle of operation described in Section I is applicable to both shutter models. The application of these principles is not identical. The following paragraphs describe each of the two shutters in detail so that similarities and differences can be determined.

A. ELECTRONIC CIRCUIT DIFFERENCES

The electronic module for the Model 440/450 shutter is described in Section I. This shutter is employed in camera models 440 and 450 and is the more complex of the two shutters. Figure 2-1 is the schematic diagram of the simpler Model 420/430 shutter employed in camera models 420 and 430.

Comparison of Figures 1-7 and 2-1 will show the following differences:

1. Resistor R1 is variable on Figure 1-7 and fixed on Figure 2-1.
2. Variable resistor R3 on Figure 1-7 is replaced by two fixed resistors, R2 and R3, on Figure 2-1.
3. The resistor in series with the base of Q1 (R2 on Figure 1-7) has been deleted on Figure 2-1.
4. The time-determining components are limited to capacitor C1 and resistor R2 on Figure 2-1.
5. Capacitors C2 and C3, resistor R6, and switch S4 are not used on Figure 2-1.

From the foregoing it can be determined that:

1. Both shutters become fixed-speed devices when flash is employed (R5 and S3 appear on both schematics).
2. The shutter used on camera models 440 and 450 has a choice of three time-delay circuits to accommodate a variety of film-speed and subject-matter situations.
3. The simpler shutter used on camera models 420 and 430 contain a single time-delay circuit, and only a selection of one of two film speeds is available (by means of two aperture sizes).

The basic theory of operation is identical for the two circuits. The illumination-controlled photocell determines the length of time required to charge the Rc circuit (R4 and C1 on Figure 2-1). When the Rc circuit is charged, transistors Q1 and Q2 cut off the current flow through magnet M, and the shutter closing blade is released. The method by which these electronic functions are related to mechanical shutter operation is described in the following paragraphs.

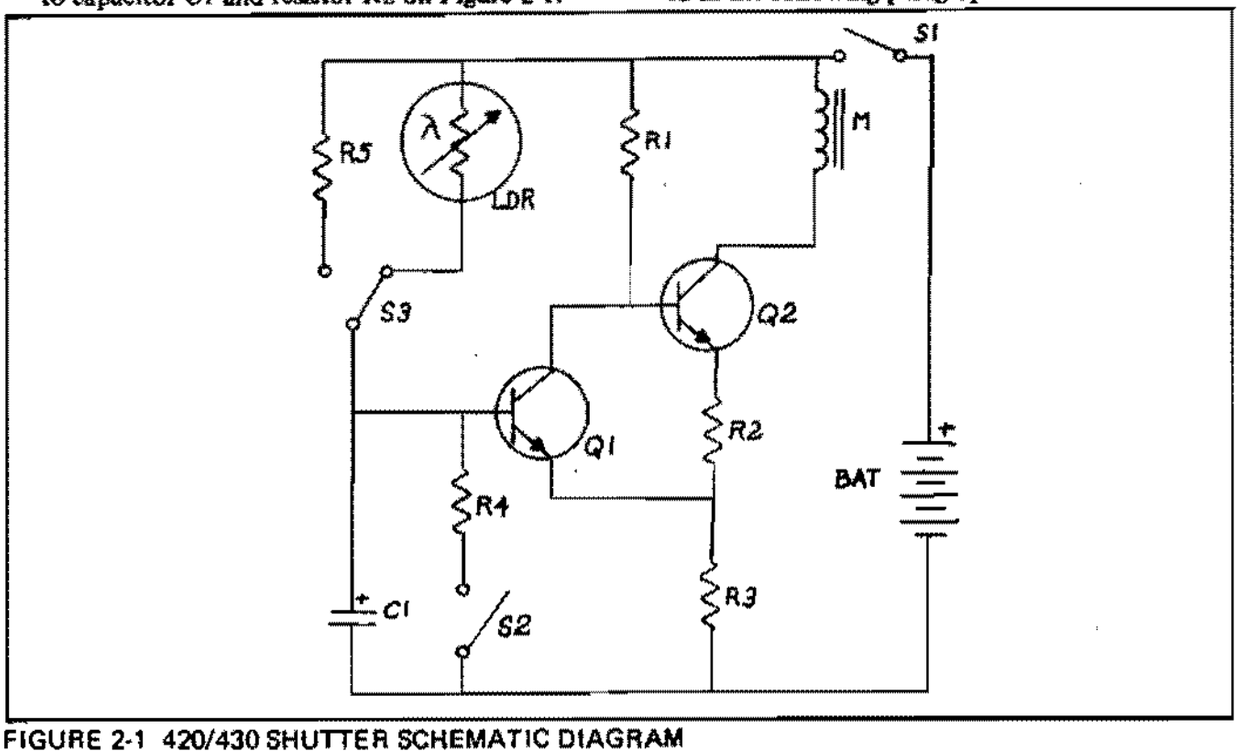

FIGURE 2-1 420/430 SHUTTER SCHEMATIC DIAGRAM

B. SHUTTER MODEL 440/450 (440 & 450 CAMERAS)

The Model 440/450 shutter is shown on Figure 2-2. Note that the aperture wheel contains eight apertures arranged in pairs. A pair consists of one large and one small aperture. Each pair is identified by a specific film speed. The pair is selected by manual rotation of the aperture wheel. Depending upon the position of the scene selector, either the large or the small aperture in the selected pair is placed in the optical path behind the lens. As desired, either the large or small aperture of the pair can be manually selected by the scene selector. A detent block and spring secures the aperture wheel at its selected position. A second detent spring (actuator detent, Figure 2-3 secures the aperture wheel at one of the two positions determined by the setting of the scene selector.

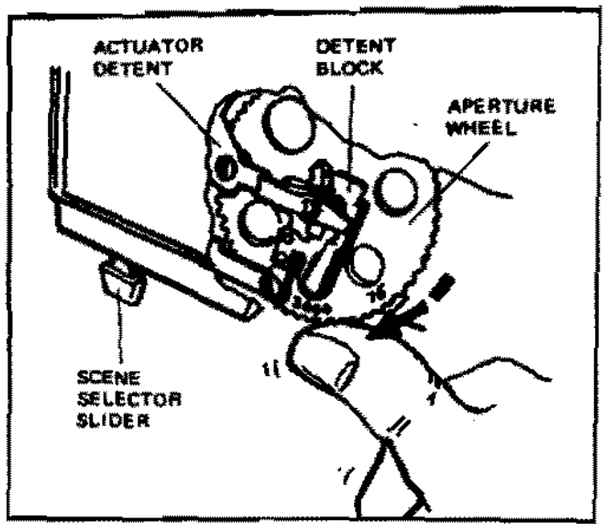

FIGURE 2-3 MODEL 440/450 APERTURE WHEEL

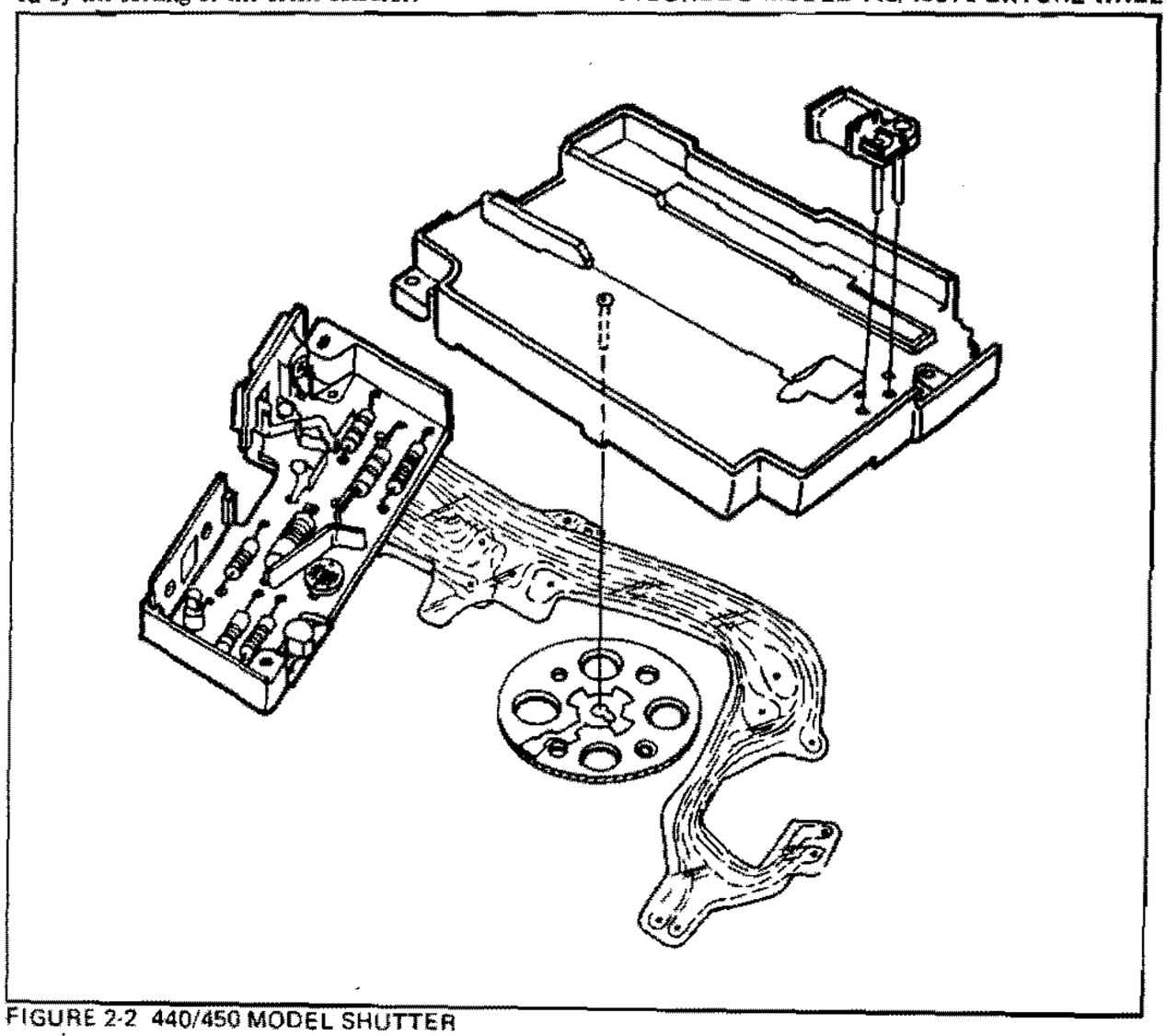

FIGURE 2-2 440/450 MODEL SHUTTER

In order to accommodate a wide latitude of film speeds and a variety of lighting situations, the shutter speeds as well as lens apertures must be adjustable. These adjustments are simplified by combining the switching of the timing components with the manual selections of the aperture. Molded into the back of the aperture wheel is a switch rotor (Figure 2-4).

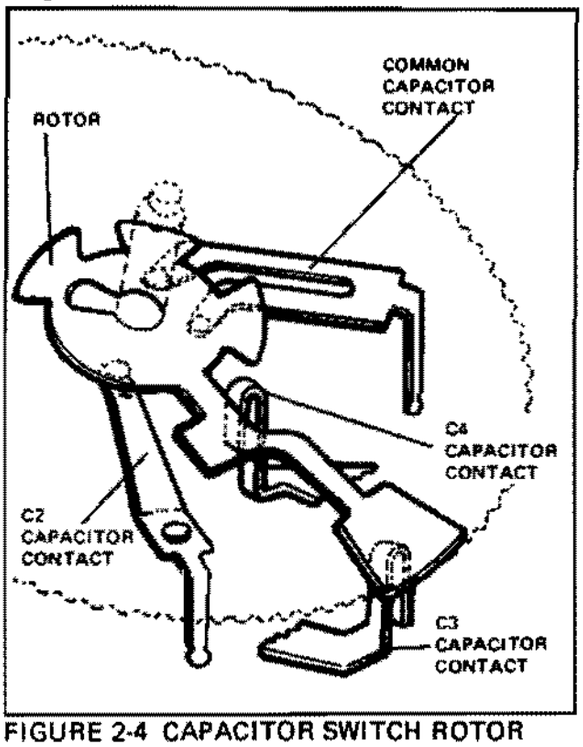

FIGURE 2-4 CAPACITOR SWITCH ROTOR

Attached to the base plate are the fixed contact points of the switch. When the aperture wheel has been set to accommodate the lighting situation, the switch rotor is in contact with the fixed contact that will place the correct resistor-capacitor combination into the shutter timing circuit. Having thus established the correct operating parameters, the photocell can correctly determine the precise length of time that the shutter will remain open.

The switch rotor and stationary contacts are represented by the arrowheads and dashed line designated S4 on Figure 1-7. The switch is illustrated on Figure 2-4.

On the 400-series shutters, switch S3 is a single-pole, double-throw switch. It is actuated by a stud on the flash connector. When the connector is inserted into the shutter, switch S3 disconnects the photocell from the timing circuit and connects resistor R5 in its place. On Model 440/450 shutters the rotary aperture switch continues to function. Only the light-measuring function is eliminated when flash is used because the Focused Flash provides the automatic illumination control based upon camera-to-subject distance.

The Model 440/450 shutter incorporates one additional major difference from the Model 420/430. In the Model 440/450, two variable resistors (R1 and R3, Figure 1-7) are used to provide a means of adjustment when the shutter is being calibrated. All of the resistors in the Model 420/430 shutter are of fixed value (Figure 2-1).

C. SHUTTER MODEL 420/430 (420 & 430 CAMERAS) (FIGURE 2-5)

The Model 420/430 shutter can be considered roughly similar to Model 440/450 in that the basic shutter action of the two models is identical. However, the Model 420/430 does not contain an aperture wheel, and its electrical circuit is simplified, allowing only one exposure time. The simpler model is equipped with a film speed slide (Figure 2-5) in lieu of the aperture wheel.

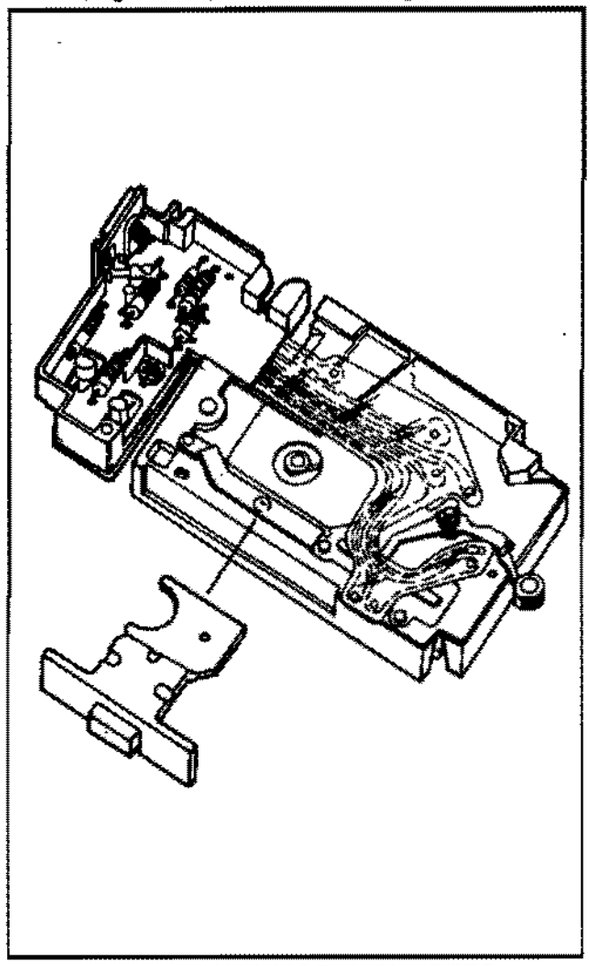
FIGURE 2-5 420/430 MODEL SHUTTER

The film speed slide performs that same function as that of the aperture wheel, except that it does not provide a capacitor switching function. By manually moving the slide to the left or right, two aperture selections can be made. One selection is for black-and-white, and the other is for color. When the slide is set for black-and-white, a small aperture is in place between the lens and film, and when the slide is set for color, the larger aperture is in the optical path.

The schematic (Figure 2-1) of the Model 420/430 shutter shows its simplified timing circuit.

A fixed resistor is used at R1 instead of the variable R1 employed in the 440/450. The potentiometer R3 in the 440/450 shutter is replaced by two fixed resistors, R2 and R3 in the 420/430 shutter. The timing circuit in the 420/430 shutter uses only one capacitor (C1) which provides identical electrical characteristics for color and black-and-white. In both shutter models S3 is the flash compensation switch which substitutes fixed resistor R5 for the photocell and permits the focused flashgun to determine the correct exposure.

III - COMPONENT SERVICING

Since this manual is concerned with the repair of electromechanically operated shutters, it is essential that you know how to identify, test, repair, adjust and replace certain electronic and mechanical components. In this section, methods will be given for identifying, testing and replacing resistors, capacitors and transistors, and for adjusting or replacing mechanical components, such as blades and aperture selectors. In addition, methods for correctly stringing jumper wires between terminal points on the flexible circuit will also be presented.

A. TESTING RESISTORS AND CAPACITORS

Resistors are identified by four color bands around the body, while capacitors are identified by two color bands around the body and by a disc shape. To test a resistor, unsolder one lead from the module (Fig. 3-1). Place the probes of

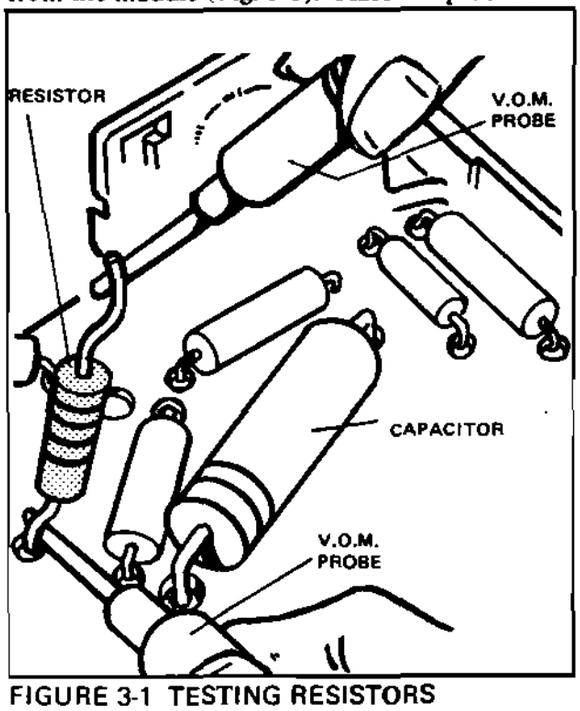

FIGURE 3-1 TESTING RESISTORS

a v.o.m., set at the correct scale, on each lead of the resistor. The v.o.m. should register the resistance of the resistor being measured. If the v.o.m. does not register at all, the resistor is open and should be replaced.

Capacitors are tested in a manner similar to testing resistors. Unsolder one lead from the module. Place the probes of a v.o.m., set at any resistance scale, on each lead of the capacitor. The v.o.m. will deflect slightly, and then slowly start to drop back; this indicates that the capacitor has been charged. Now reverse the probes on the capacitor leads. The v.o.m. will fully deflect, and then slowly drop back; this indicates that the capacitor has discharged. If the v.o.m. deflects and does not drop back, either before or after reversing the probe positions, the capacitor is shorted, and should be replaced. If the v.o.m. does not deflect at either position of the probes, the capacitor is open, and also, must be replaced.

B. REPLACING RESISTORS AND CAPACITORS

To replace resistors and capacitors, or in fact, to replace any component soldered into the module, the solder must be removed from the terminal points on the bottom of the module. The solder is removed with a vacuum (heat-vac) soldering iron. When replacing a component, trim and bend the leads to match those of the component removed, and insert the leads into the terminal holes from which the defective component was removed. Solder the new component in place.

C. REPLACING THE MAGNET

To replace the magnet (Fig. 3-2), unsolder the magnet terminals from the flexible circuit. Remove the two screws and nuts securing the magnet to the base plate, and lift off the magnet.

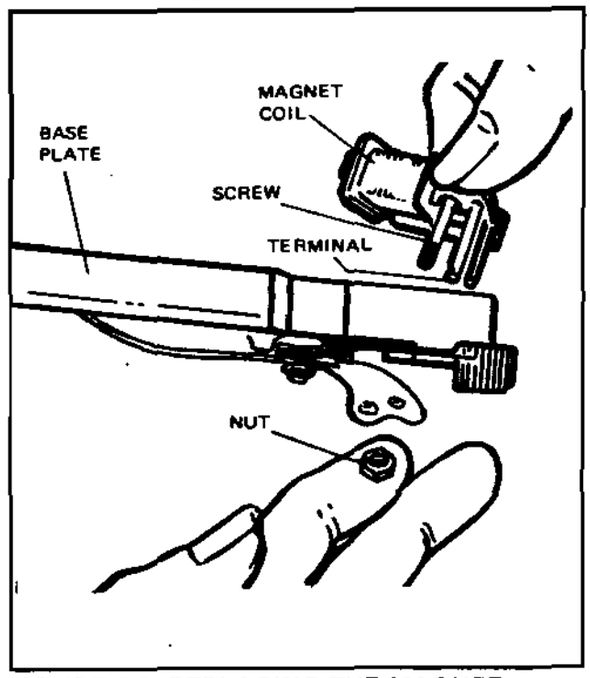

FIGURE 3-2 REPLACING THE MAGNET

On some older shutters, the magnet is secured to the base plate with rivets instead of screws and nuts. In that case, the rivets must be driven out with a punch to remove the magnet. When replacing a magnet, always secure it to the base plate with screws and nuts only; never use rivets.

The magnet coils can be replaced also. Just slide the coil off of the magnet, after the magnet has been removed from the base plate. A new coil can be slid on in place of the old. The terminals will have to be bent up to facilitate removing and replacing the coil.

D. REPLACING THE FLASH CONTACTS

To replace any of the flash contacts (Fig. 3-3),

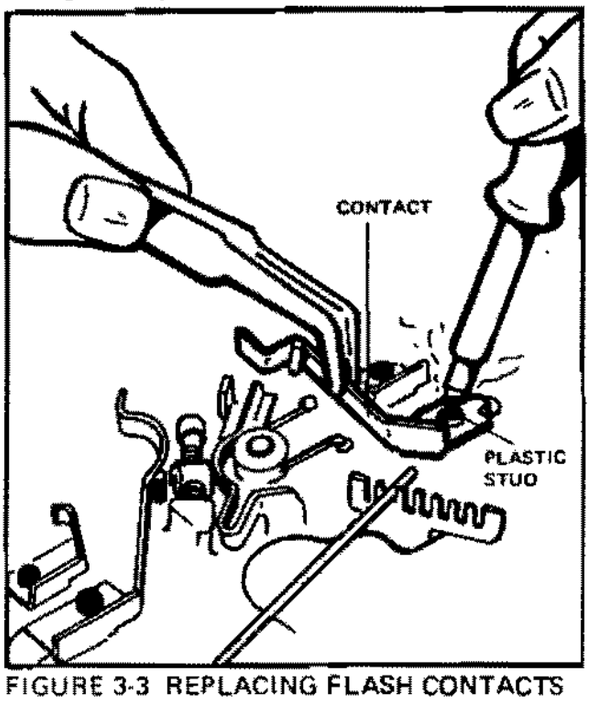

FIGURE 3-3 REPLACING FLASH CONTACTS

heat the plastic studs, securing the contacts to the base plate, with a soldering iron, while pulling the contacts with tweezers. Pull on the contact until the stud is soft enough to allow the contact to be pulled off of the base plate. Apply only enough heat to soften the stud. Do not apply so much heat that part of the stud melts away or becomes so misshapen that the replacement contact cannot be slipped onto it.

Slip a new contact over the stud, locating it in the position occupied by the removed contact. Hold the contact in position with tweezers, and melt the stud with a soldering iron until the new contact is secured to the base plate.

E. REPLACING THE SCENE SELECTOR AND APERTURE WHEEL

To replace the scene selector and aperture wheel on the 440/450 shutters, first unsolder the flexible circuit from the S1 contacts, the magnet contacts, the S2 contacts and the flash safety (Ss) contact (Fig. 3-4). Remove the "E" clips, secur-

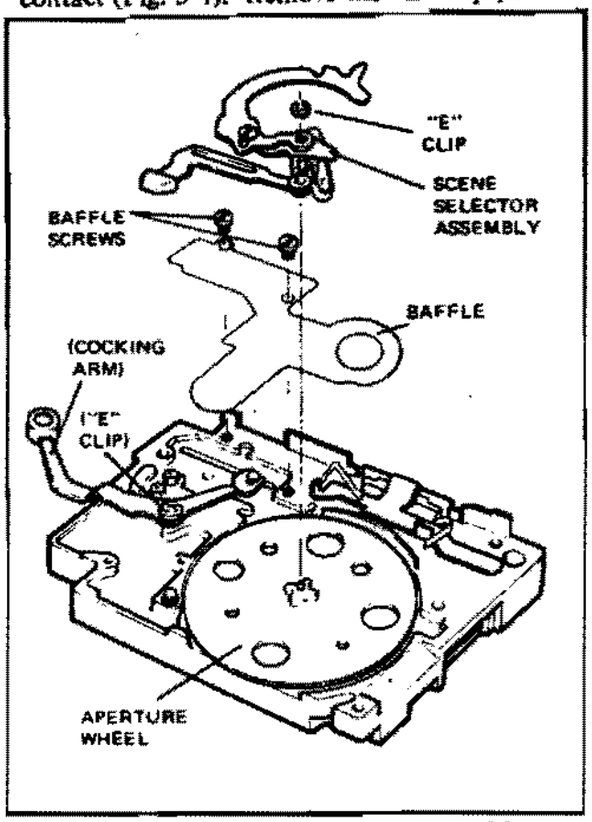

FIGURE 3-4 REPLACING SCENE SELECTOR AND APERTURE WHEEL

ing the scene selector slide and the aperture wheel. Lift off the scene selector assembly.

Remove the two screws securing the baffle, and lift off the baffle. (The baffle will have to be manipulated out from under the scene selector detent spring). At this point, the aperture wheel can simply be lifted off. To replace the scene selector and aperture wheel, reverse the above procedures.

NOTE: Notice the cocking arm, which is secured by an "E" clip. After the baffle has been removed, the cocking arm can also be removed, if necessary. Remove the "E" clip, lift up the cocking arm and spring and disconnect it from the cocking slide. You will have to remove the cocking arm when replacing the cocking slide (Paragraph F).

F. REPLACING THE BLADES AND COCKING SLIDE

To replace the shutter blades or cocking slide, first cock the shutter, and lift off the stop bracket cap (Fig. 3-5). Turn the base block over, and

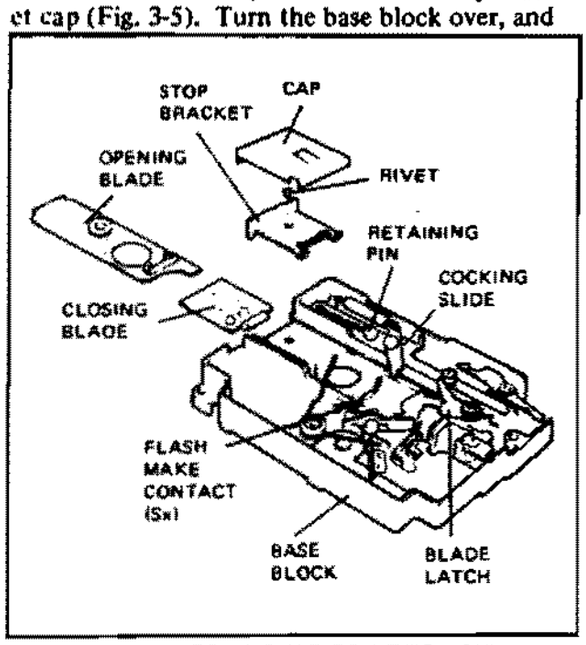

FIGURE 3-5 REPLACING BLADES AND COCKING SLIDE

drive out the rivet, securing the stop bracket, with a punch; slide out the stop bracket. Pry out the retaining pin, securing the cocking slide with a screwdriver. (If the cocking arm has been removed, as described in Paragraph E, the cocking slide may be lifted out at this point, otherwise the cocking arm is free to move to facilitate removing the blades.)

Lift the opening blade spring off of the opening blade, and manually lower the blade out of the base block. Raise the flash "make" contact (Sx) and cocking slide, as necessary, to facilitate removal of the blade. Now slide the closing blade out of the base block.

To replace the blades, or cocking slide, the reverse procedure is followed. Remember, when replacing the blades, the closing blade goes into the lower track in the base block, and the opening blade goes into the upper track. Also, the spring roller on the closing blade faces down, while the opening blade, spring roller faces up.

G. ADJUSTING THE TIMING SWITCH (S2)

Although this adjustment is simple and easy to perform, its importance to correct shutter operation cannot be over-emphasized. Learn this procedure well, because it is one which you will be required to perform many times. To adjust S2, depress the cocking arm until the pin on the opening blade is at the topmost portion of the blade latch (Fig. 3-6). **At that point the blade latch should force the S2 breaker to open very slightly.** Adjust S2 as necessary by turning the adjusting screw. Clockwise screw rotation will close the switch; counter clockwise will open it.

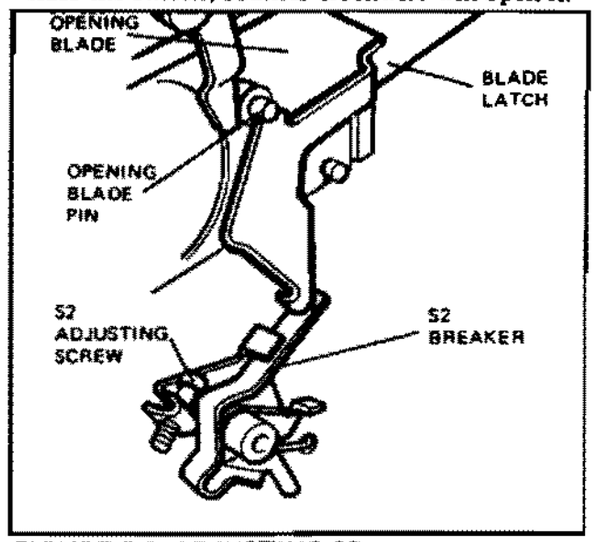

FIGURE 3-6 ADJUSTING S2

H. REPLACING THE 420/430 APERTURE SLIDE

To replace the 420/430 aperture slide (Fig. 3-7) soften the plactic stud, securing the end of the detent spring facing the module, with a soldering iron. Pry the spring up lightly, as heat is applied

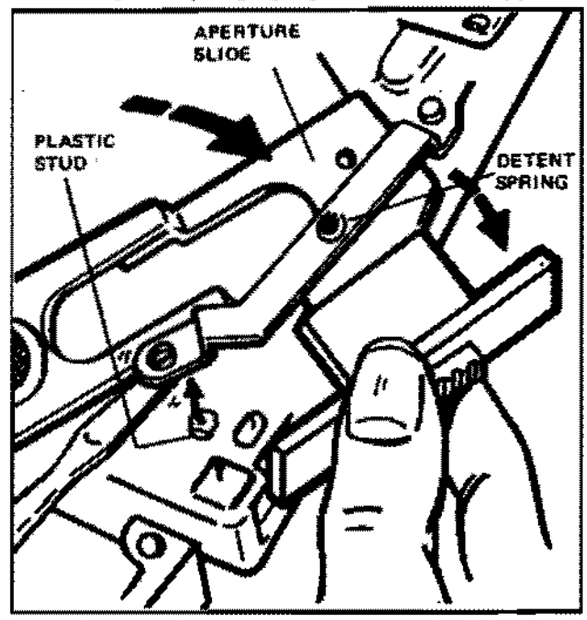

FIGURE 3-7 REPLACING APERTURE SLIDE

to the stud, until the end of the spring can be separated from the base block. When the end of the spring is free, the aperture slide can be slipped out as shown in the illustration, and a new slide can be inserted. After the new slide is in place, push and hold the spring in position on the plastic stud, and remelt the stud with a soldering iron. Hold the spring down until the plastic stud has hardened.

I. STRINGING JUMPER WIRES

Any number of jumper wires can be strung on the shutter, as long as they do not interfere with mechanical operation. A few examples of the application of jumper wires are shown in Figure 3-8, below. These examples are not to be considered as the only way to string jumper wires, but are only intended to be guides. However, jumper wires should not interfere with mechanical operation, and they should not be allowed to hang loosely unless absolutely necessary; wires can be taped to the flexible circuit, passed around, over or under mechanical components or strung in any manner possible, provided the above requirements are met.

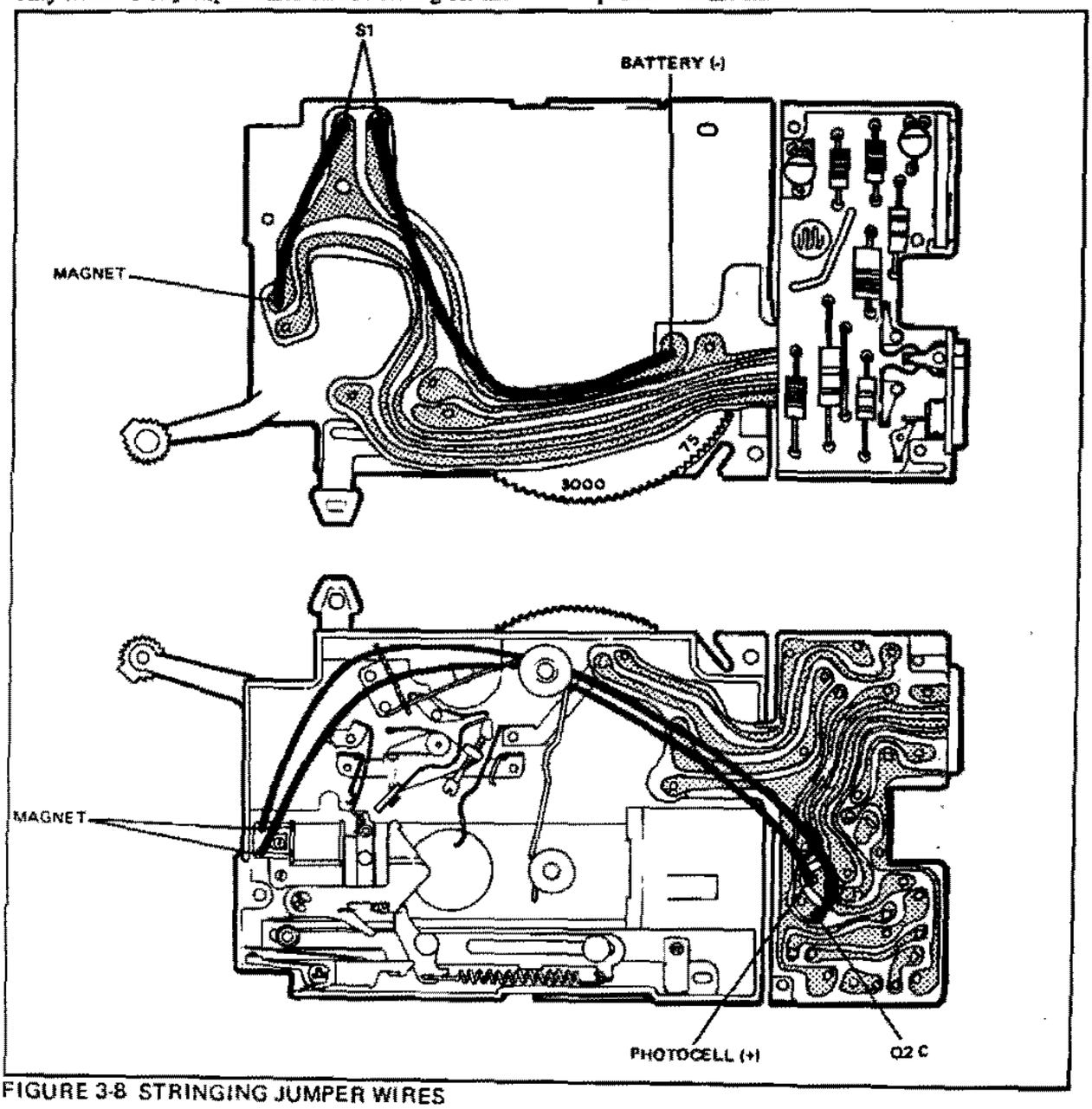

FIGURE 3-8 STRINGING JUMPER WIRES

IV - TROUBLESHOOTING (MODEL 440/450)

This section describes the procedures to be followed in testing the Model 440/450 shutter using either the Model D or Model C tester. Prior to performing the tests, the shutter must be examined for mechanical defects as described in paragraph A.

A. INITIAL INSPECTION

Check to make sure that the blades function properly before making any exposure tests. Cock and trip the shutter while looking into the lens and listening for audible clicks as the blades move. Hold the release button down until both blades move. The opening blade should move first, followed by the closing blade, and two distinct clicks should be heard. Repeat this check at least three times on all speeds.

NOTE: Depending on the level of ambient light, the shutter speed may be too fast to permit the clicks to be correctly identified. If this be the case, repeat the check in the following manner:

Cover the photocell lens to block out the light. Depress the release button and listen for the first click. Continue depressing the button and remove the cover from the photocell lens. The second click should be heard as the closing blade moves.

If the blades function correctly, proceed with the shutter checks. If any blade malfunctions are evident, refer to the applicable Troubleshooting Guide and perform the corrective action indicated in the Guide.

B. CHECKING SHUTTER SPEEDS, MODEL D TESTER

When performing these tests, record all readings. Also record the settings of the light level selector and the scene selector. This data will be necessary to analyze any problems.

1. 75/50 Dull

a. Set the aperture wheel to 75 and the scene selector to "Bright Sun or Dull Day also Flash".

b. Cock the shutter and place the camera onto the exposure tester.

c. Swing the camera into position for testing.

d. Set the selector switch on the tester at 101.

e. Set the light-level wheel at 150/50.

f. Set the COLORPACK II switch at NORMAL.

g. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be between +0.4 and -0.3.

2. 75/50 Bright

a. Set the scene selector on the camera to "Bright Sun Only" and cock the shutter.

b. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be between +0.3 and -0.3 relative to the reading obtained in step 1g.

3. 75/800 Bright

a. Set the light level at "150/800" and cock the shutter.

b. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be between +4.0 and -0.2 relative to the reading obtained in step 2b.

4. 75/800 Dull

a. Set the scene selector to "Bright Sun or Dull Day also Flash" and cock the shutter.

b. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be between +0.5 and -0.3 relative to the reading obtained in step 1g.

5. 3000 Dull

a. Set the aperture wheel to 3000 and the scene selector to "Bright Sun or Dull Day and Flash".

b. Set the light-level wheel to "3000 INDOORS".

c. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be between +0.5 and -0.4 relative to the reading obtained in step 1g.

6. Checking Flash Switch S3 and Flashgun

a. Set the aperture wheel to 75 and the scene selector to "Bright Sun or Dull Day also Flash".

b. Set the light-level wheel at 150/50.

c. Set the COLORPACK II switch at NORMAL.

d. Insert the flashgun connector into the shutter, and then remove it.

e. Cock the shutter.

f. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be the same as the reading obtained in stop 1g.

g. Repeat steps d, e, and f three times.

h. Connect the flashgun to the shutter.

i. Cock the shutter.

j. Depress the footswitch and trip the shutter. The f-stop meter should register approximately full scale, +1.0 stop.

k. Remove the camera from the tester.

l. Connect a test flashgun to the shutter.

m. Trip the shutter, and check to see that the flash test bulb fires.

C. CHECKING SHUTTER SPEEDS, MODEL C TESTER

When performing these tests, record all readings. Also record the settings of the light-level selector and the scene selector. This data will be necessary to analyze any problems.

Before proceeding with the shutter tests, perform initial inspection as described in step A.

1. 75/50 Dull

a. Set the aperture wheel at 75 and the scene selector to "Bright Sun or Dull Day also Flash".

b. Cock the shutter and place the camera onto the exposure tester.

c. Swing the camera into position for testing.

d. Set the lever on the tester to 50 and position the COLORPACK II switch at NORMAL.

e. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be between +0.4 and -0.3.

2. 75/50 Bright

a. Set the scene selector on the camera to "Bright Sun Only".

b. Cock the shutter.

c. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be between +0.3 and -0.3 relative to the reading obtained in step 1e.

3. 75/800 Bright

a. Set the lever on the tester at 800 and cock the shutter.

b. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be between +0.4 and -0.2 relative to the readings obtained in step 2c.

4. 75/800 Dull

a. Set the scene selector to "Bright Sun or Dull Day also Flash" and cock the shutter.

b. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be between +0.5 and -0.3 relative to the reading obtained in step 1e.

5. Checking Flash Switch S3 and Flashgun

a. Set the aperture wheel at 75 and the scene selector to "Bright Sun or Dull Day also Flash".

b. Set the light-level wheel at 150/50.

c. Insert the flashgun connector and then remove it.

d. Cock the shutter.

e. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be within $\pm$ 0.15 f-stops of the reading obtained in step 1e.

f. Repeat steps c,d, and e three times.

g. Remove the camera from the tester.

h. Connect the flashgun to the shutter.

i. Cock the shutter.

j. Depress the footswitch and trip the shutter. The f-stop meter should register full scale, +1.0 stop.

k. Connect a test flashgun to the shutter. Trip the shutter and check to see that the flash test bulb fires.

V - PROBLEM ANALYSIS (MODEL 440/450)

Problem analysis consists of a step-by-step process of elimination of the probable causes of shutter problems. By utilizing the information gained through testing, a logical process of component examination can be followed until the component causing the problem is discovered and repaired or replaced.

NOTE: All part replacement or repair procedures are contained in Section III. Refer to that section as necessary, to perform the repairs mentioned in the analysis paragraphs below.

NOTE: Before making an analysis of any problems indicated as a result of testing, visually inspect the shutter for the following:

A. SOLDER CONNECTIONS

CHECK ALL SOLDER CONNECTIONS. Look for cold, poor or over-soldered joints and for excessively long component leads. Resolder and trim leads as necessary.

B. MECHANICAL BINDING

CHECK FOR MECHANICAL BINDS IN THE COCKING ACTION. Slowly depress the cocking arm several times; this motion should enable any mechanical binding to be felt or seen. Repair or replace defective components as necessary.

C. APERTURE WHEEL ALIGNMENT

CHECK THE ALIGNMENT OF THE APERTURE WHEEL. A large aperture in the wheel must be aligned with the right-hand edge of the aperture in the front light baffle (Fig. 5-1). Simply loosen the adjusting screw in the readout actuator and rotate the aperture wheel as necessary. Retighten the adjusting screw.

D. DETENT ACTION

CHECK THE DETENT ACTION OF THE READOUT INDICATOR AND APERTURE WHEEL. Simply move the scene selector back and forth, and rotate the aperture wheel several times. If excessive looseness is evident in either detent action, replace the aperture wheel and readout actuator assembly.

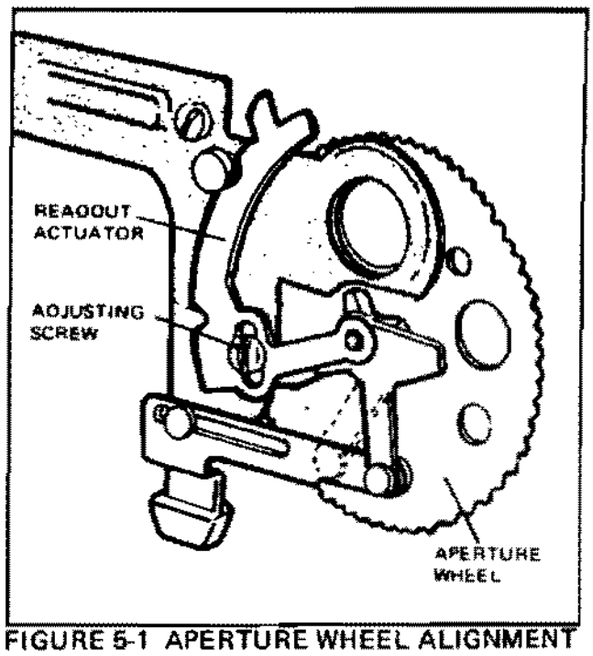

FIGURE 5-1 APERTURE WHEEL ALIGNMENT

E. FLASH SWITCH PERFORMANCE

CHECK THE FLASH SWITCHES. Start with the shutter uncocked; the flash-make (Sx) switch should be closed, and the flash safety (Ss) switch should be open (Fig. 5-2). Now cock the shutter; the Sx switch should now be open, and the Ss switch should be closed. If either switch does not function as described above, replace or adjust the defective switch.

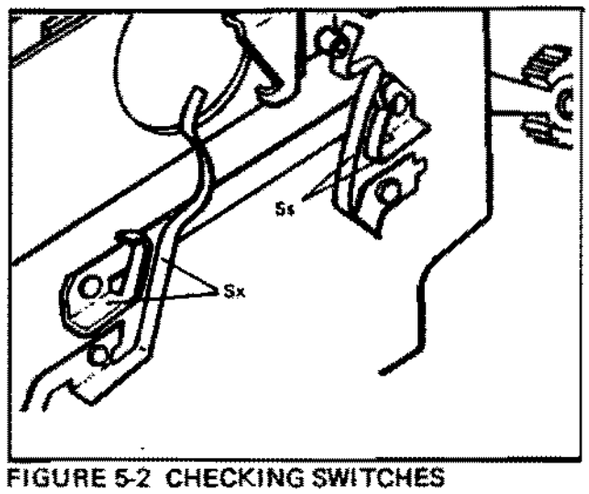

FIGURE 5-2 CHECKING SWITCHES

F. MAGNET CHECK

CHECK FOR RUST OR FOREIGN MATTER ON THE MAGNET KEEPER OR BLADES (Fig. 5-3). Clean or replace affected components as necessary. (Use a dry Q-tip to clean the components.)

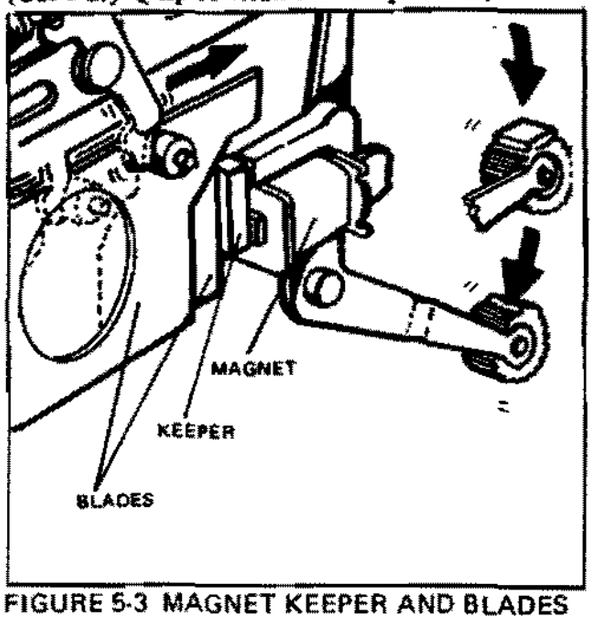

FIGURE 5-3 MAGNET KEEPER AND BLADES

G. MAGNET ALIGNMENT

CHECK THE ALIGNMENT OF THE MAGNET AND KEEPER. Cock the shutter slowly, until only the opening blade latches. Observe the keeper (attached to the closing blade) as it lines up with the magnet. The keeper should be parallel with the edge of the blade and with the poles of the magnet. Adjust or replace defective components as necessary.

H. COCKING SLIDE LATCH PIN

CHECK THE COCKING SLIDE LATCH PIN. If it is bent, the cocking slide will be released before S1 is closed. Straighten or replace as necessary.

I. S1 ADJUSTMENT

CHECK THE ADJUSTMENT OF THE S1 SWITCH. The upper contact of the S1 switch should be visible below the cocking latch when the shutter is cocked (Fig. 5-4). To make the upper contact

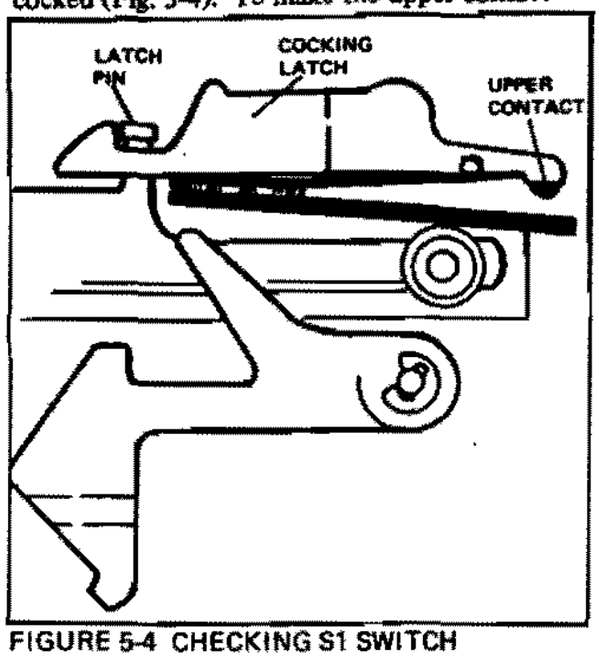

FIGURE 5-4 CHECKING S1 SWITCH

visible, if it is not, bend down the cocking slide latch pin so that the cocking latch will be moved enough to expose the contact. (Do not bend the pin too far, or a mechanical bind may occur.)

J. S2 ADJUSTMENT

CHECK THE ADJUSTMENT OF THE S2 SWITCH. Follow the procedure contained in Section III.

K. PHOTOCELL ALIGNMENT

CHECK THE PHOTOCELL FOR PROPER ALIGNMENT. The photocell must be seated flush in its socket. Adjust or replace the photocell, as necessary.

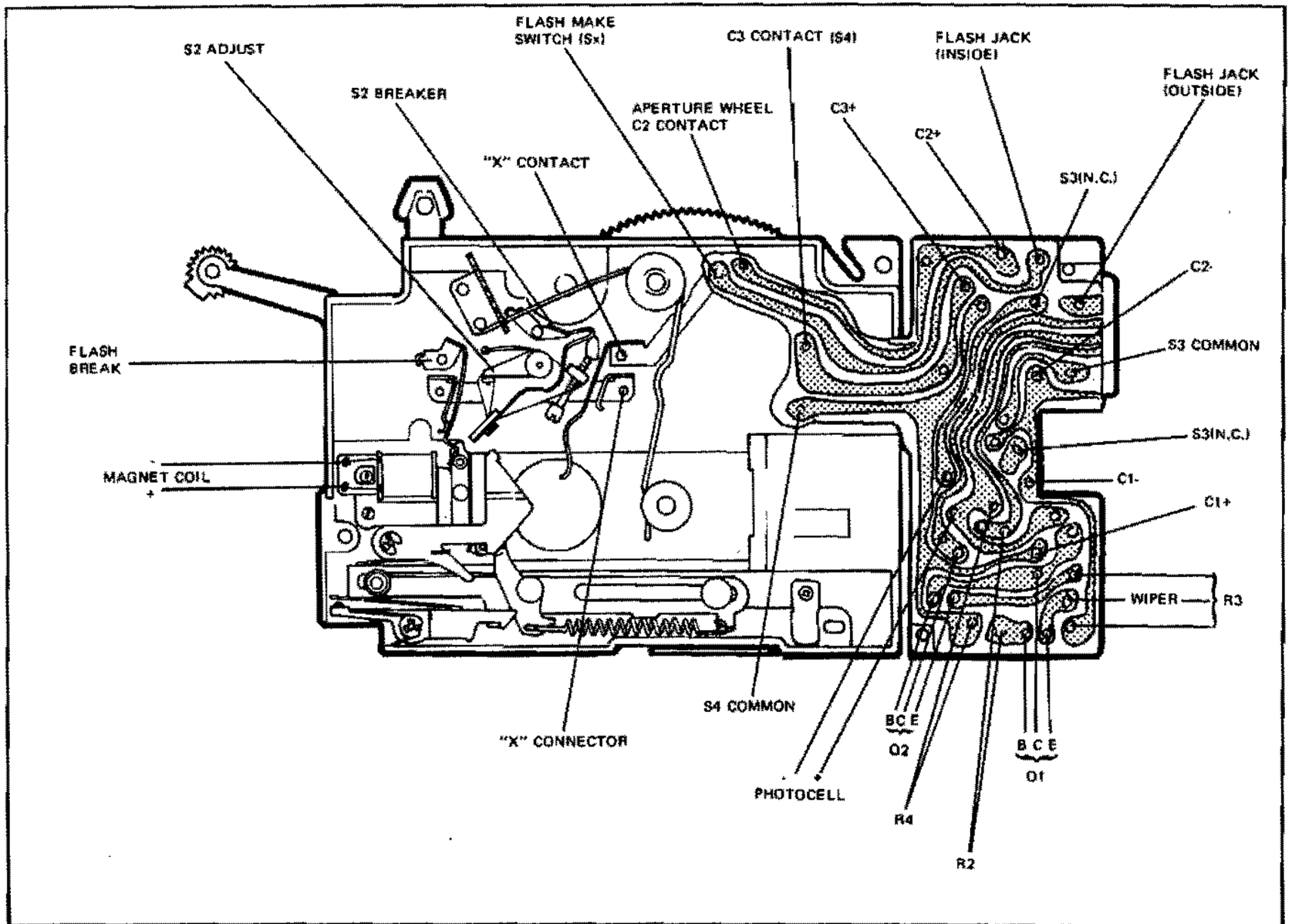

FIGURE 5-5 CHECK POINTS, 440 & 450 SHUTTERS

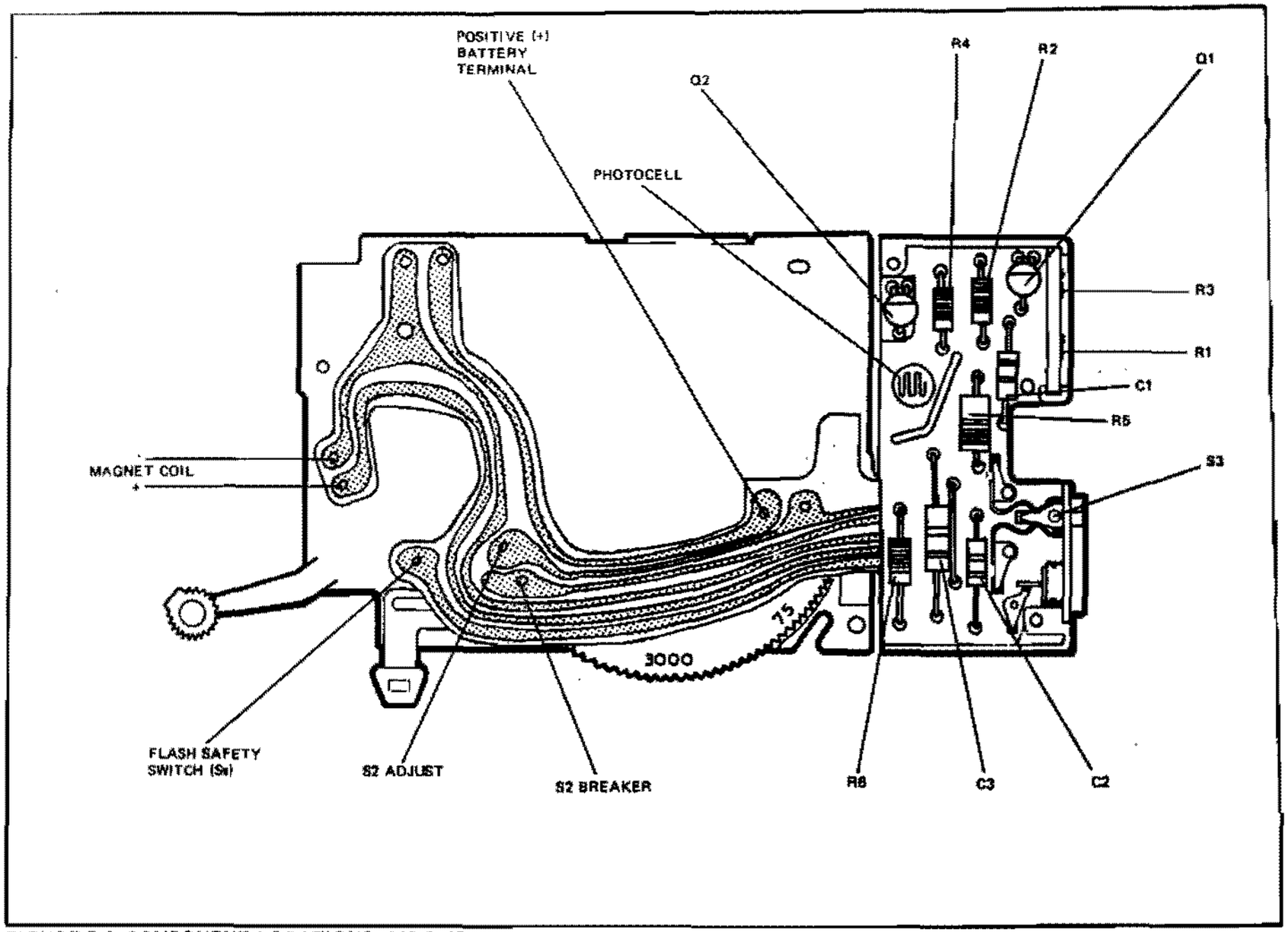

FIGURE 5-6 COMPONENT LOCATIONS, 440 & 450 SHUTTERS

L. TROUBLESHOOTING GUIDE (440/450 SHUTTERS)

Refer to Figure 5-5 for Point-to-Point Checks and to Figure 5-6 for Component Identification. This guide should be used only after a shutter has been tested.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Both blades close together on all speeds.	1. Rust or foreign matter on magnet, keeper or blades.	1. Clean or replace dirty or rusted components.
	2. Magnet and keeper misaligned.	2. Adjust magnet to realign it with the keeper.
	3. Bent cocking latch pin.	3. Straighten pin or replace cocking latch.
	4. S1 switch out of adjustment.	4. Adjust S1 switch.
	5. S2 switch out of adjustment.	5. Adjusr S2 switch.
	6. Open circuit between left S1 contact and magnet coil.	6. String a jumper wire between left S1 contact and magnet contact.
	7. Open S1 switch.	7. Clean switch contacts.
	8. Open circuit between white battery contact and right S1 contact.	8. String a jumper wire between the affected contacts.
	9. Open or incorrect magnet coil.	9. Replace magnet coil.
	10. Open circuits between bottom magnet contact and Q2 collector or between top magnet contact and positive (+) photocell contact.	10. String jumper wires between affected contacts.
	11. Open circuit between screw side of S2 and the negative side of C1.	11. String jumper wire between affected contacts.
	12. Open circuit between S2 breaker and R6-R2 common.	12. String jumper wires between affected contacts.
	13. Defective Q2 transistor.	13. Replace Q2.
	14. Defective Q1 transistor.	14. Replace Q1.
	15. Defective variable resistor R1.	15. Replace R1.
	16. Defective potentiometer R3.	16. Replace R3.
Second (closing) blade stays open on all speeds.	1. S2 switch out of adjustment.	1. Adjust S2 switch.
	2. Spring disengaged from 2nd blade.	2. Reattach spring to blade.
	3. Defective Q1 transistor.	3. Replace Q1.
	4. Shorted C1 capacitor.	4. Replace C1.
	5. Open switch S3.	5. Clean and adjust S3.
	6. Open, or cold-soldered, R6 resistor.	6. Replace or resolder R6.
	7. Defective photocell.	7. Replace photocell.

L. TROUBLESHOOTING GUIDE (440/450 SHUTTERS) cont'd

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Second (closing) blade stays open on all speeds. cont'd	8. Open, or cold-soldered, R2 resistor.	8. Replace or resolder R2.
	9. Defective R3 potentiometer.	9. Replace potentiometer block.
	10. Open circuit between Q1 emitter and R3 wiper.	10. String jumper wire between affected contacts.
	11. Open circuit between Q1 and collector and R1.	11. String jumper wire between affected contact.
	12. Open circuit between R1 and photocell.	12. String jumper wire between affected contacts.
Second blade stays open on all speeds except 3000 dull.	1. Defective C2 capacitor.	1. Replace C2.
75 dull very fast.	1. Open circuit between positive (+) C2 contact and aperture wheel (S4) C2 contact.	1. String jumper wire between affected contacts.
	2. Dirty or defective S4 switch.	2. Clean switch rotor and contacts and adjust contacts to touch rotor.
	3. Defective C2 capacitor.	3. Replace C2.
All speeds either too fast or too slow.	1. Incorrect trigger voltage.	1. Adjust R3 or replace photocell or both.
75/800 dull too fast or too slow.	1. S2 switch out of adjustment.	1. Adjust S2.
75/800 dull erratic.	1. Mechanical binding of blades.	1. Replace blades.
	2. Mechanical binding of cocking slide.	2. Lubricate cocking slide.
	3. Rust or foreign matter on magnet or keeper.	3. Clean magnet and keeper.
3000 dull too fast or too slow.	1. Defective C1 capacitor.	1. Replace C1.
	2. Defective photocell.	2. Replace photocell.
Blades close together on 3000.	1. Defective C1 capacitor.	1. Replace C1.
	2. Cold-soldered C1 capacitor.	2. Resolder C1.
f-stop meter does not repeat after inserting and removing flash plug.	1. Dirty or maladjusted S3 switch.	1. Clean and adjust S3.
Flash test bulb does not fire.	1. Open connection in flash circuit.	1. String jumper wires between flash safety switch and outside contact of flash jack, or between flash make switch and inside contact of flash jack, or both.

L. TROUBLESHOOTING GUIDE (440/450 SHUTTERS) cont'd

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Flash test bulb does not fire. cont'd	2. Dirty or defective flash make (Sx) or safety (Ss) switches.	2. Clean or replace switches.

If, as noted during testing, the shutter remains open when the flash plug is inserted:

1. Check Resistor R5.
2. Replace or resolder R5 as necessary.
3. Check switch S3.
4. Clean and adjust contacts as necessary.

VI - TROUBLESHOOTING (MODEL 420/430)

This Section describes the procedures to be followed in testing the Model 420/430 shutter using either the Model D or Model C tester. Prior to performing the tests, the shutter must be examined for mechanical defects as described in paragraph A.

A. INITIAL INSPECTION

Check to make sure that the blades function properly before making any exposure tests. Cock and trip the shutter while looking into the lens and listening for audible clicks as the blades move. Hold the release button down until both blades move. The opening blade should move first, followed by the closing blade, and two distinct clicks should be heard. Repeat this check at least three times on all speeds.

NOTE: Depending on the level of ambient light, the shutter speed may be too fast to permit the clicks to be correctly identified. If this be the case, repeat the check in the following manner:

Cover the photocell lens to block out the light. Depress the release button and listen for the first click. Continue depressing the button and remove the cover from the photocell lens. The second click should be heard as the closing blade moves.

If the blades function correctly, proceed with the shutter checks. If any blade malfunctions are evident, refer to the applicable Troubleshooting Guide and perform the corrective action indicated in the Guide.

B. CHECKING SHUTTER SPEEDS, MODEL D TESTER

When performing these tests, record all readings. Also record the settings of the light level selector and the scene selector. This data will be necessary to analyze any problems.

1. 75/50 (COLOR/50)

a. Set the camera aperture slide to COLOR. Cock the shutter.

b. Install the camera on the exposure tester.

c. Set the tester selector switch to 101.

d. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be between +0.4 and -0.3.

2. 75/800 (COLOR/800)

a. Cock the shutter.

b. Depress the footswitch and trip the shutter. The f-stop meter should read between +0.6 and 0.0 relative to the reading obtained in step 1d.

3. Checking Flash Switch S3 with Flashgun

a. Set the light level selector to 75/50.

b. Set the camera aperture slide to COLOR.

c. Insert the flashgun connector into the shutter, and then remove it.

d. Cock the shutter.

e. Depress the footswitch and trip the shutter. The reading on the f-stop meter should be within ± 0.15 f-stops of the reading obtained in step 1d.

f. Repeat steps c, d, and e three times.

g. Connect the flashgun to the shutter.

h. Cock the shutter.

i. Depress the footswitch and trip the shutter. The f-stop meter should register full scale, +1.0 stop.

C. CHECKING SHUTTER SPEEDS, MODEL C TESTER

To check Model 420/430 shutter speeds using the Model C tester follow the procedures outlined in paragraph B, this Section. With the exception of references to the selector switch, all of data given in paragraph B is applicable to paragraph C.

VII - PROBLEM ANALYSIS (MODEL 420/430)

Problem analysis consists of a step-by-step process of elimination of the probable causes of shutter problems. By utilizing the information gained through testing, a logical process of component examination can be followed until the component causing the problem is discovered and repaired or replaced.

NOTE: All part replacement or repair procedures are contained in Section III. Refer to that section as necessary, to perform the repairs mentioned in the analysis paragraphs below.

Before making an analysis of any problems indicated as a result of testing, visually inspect the shutter for the following:

A. CHECK SOLDER CONNECTIONS

CHECK ALL SOLDER CONNECTIONS. Look for cold, poor or over-soldered joints and for excessively long component leads. Resolder and trim leads as necessary.

B. MECHANICAL BINDING

CHECK FOR MECHANICAL BINDS IN THE COCKING ACTION. Slowly depress the cocking arm several times; this motion should enable any mechanism binding to be felt or seen. Repair or replace defective components as necessary.

C. APERTURE SLIDE BLOCK

CHECK THE DETENT ACTION OF THE APERTURE SLIDE BLOCK. Move the block back and forth several times. If excessive looseness is evident in the detent action, replace the block. Follow the procedure contained in Section III.

D. FILTER SCREEN

CHECK THE CONDITION OF THE COLOR FILTER SCREEN. If missing or defective, replace the aperture slide block. Follow the procedure contained in Section III.

E. FLASH SWITCH

CHECK THE FLASH SWITCHES. Start with the shutter uncocked; the flash-make (Sx) switch should be closed, and the flash safety (Ss) switch should be open (Fig. 7-1). Now cock the shutter; the Sx switch should now be open, and the Ss switch should be closed. If either switch does not function as described above, replace or adjust the defective switch.

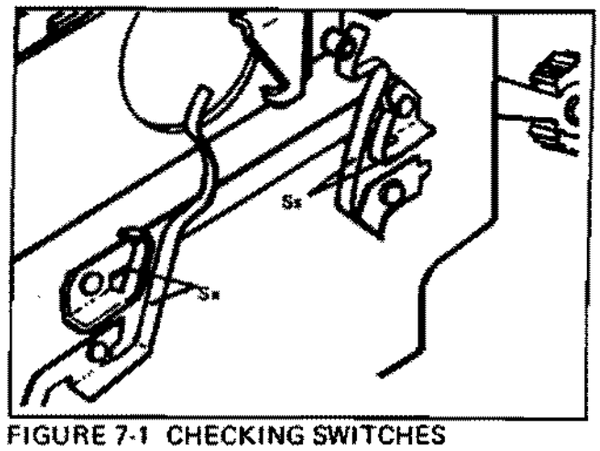

FIGURE 7-1 CHECKING SWITCHES

F. MAGNET CHECK

CHECK FOR RUST OR FOREIGN MATTER ON THE MAGNET, KEEPER OR BLADES (Fig. 7-2). Clean or replace affected components as necessary. (Use a dry Q-tip to clean the components.)

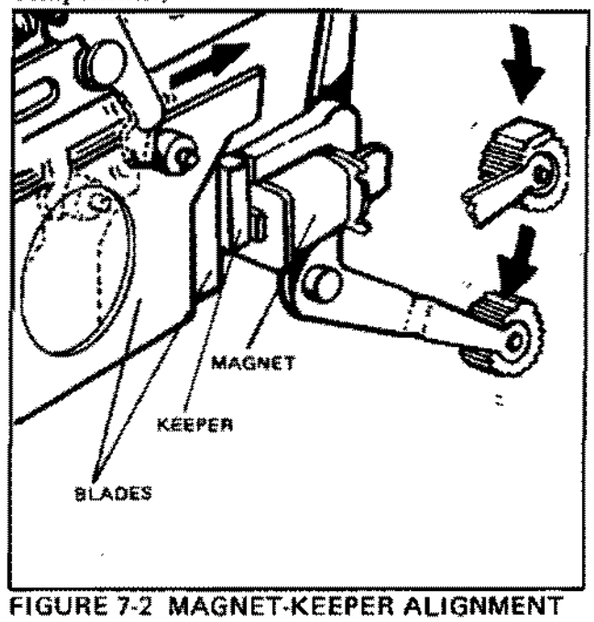

FIGURE 7-2 MAGNET-KEEPER ALIGNMENT

G. MAGNET ALIGNMENT

CHECK THE ALIGNMENT OF THE MAGNET AND KEEPER. Cock the shutter slowly, until only the opening blade latches. Observe the keeper (attached to the closing blade) as it lines up with the magnet. The keeper should be parallel with the edge of the blade and with the poles of the magnet. Adjust or replace defective components as necessary.

H. COCKING SLIDE LATCH PIN

CHECK THE COCKING SLIDE LATCH PIN. If it is bent, the cocking slide will be released before S1 is closed. Straighten or replace as necessary.

I. S1 ADJUSTMENT

CHECK THE ADJUSTMENT OF THE S1 SWITCH. The upper contact of the S1 switch should be visible below the cocking latch when the shutter is cocked (Fig. 7-3). To make the upper contact visible, if it is not, bend down the cocking slide latch pin so that the cocking latch will be moved enough to expose the contact. (Do not bend the pin too far, or a mechanical bind may occur.)

J. S2 ADJUSTMENT

CHECK THE ADJUSTMENT OF THE S2 SWITCH. Follow the procedure contained in Section III.

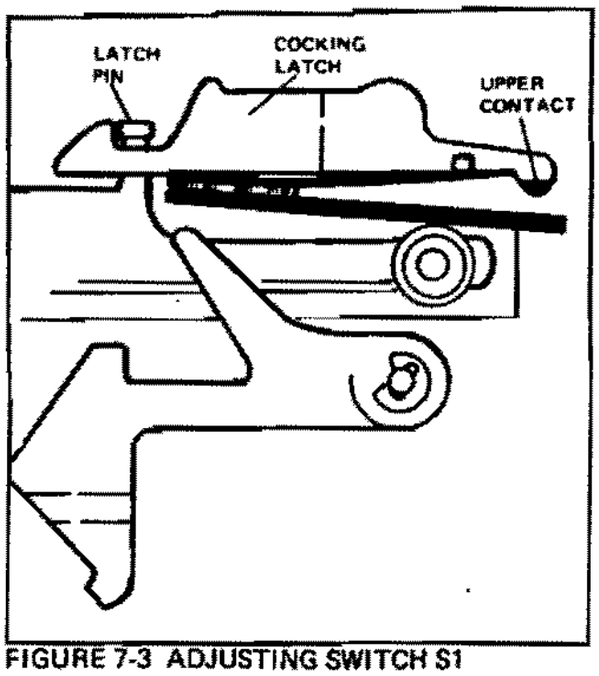

FIGURE 7-3 ADJUSTING SWITCH S1

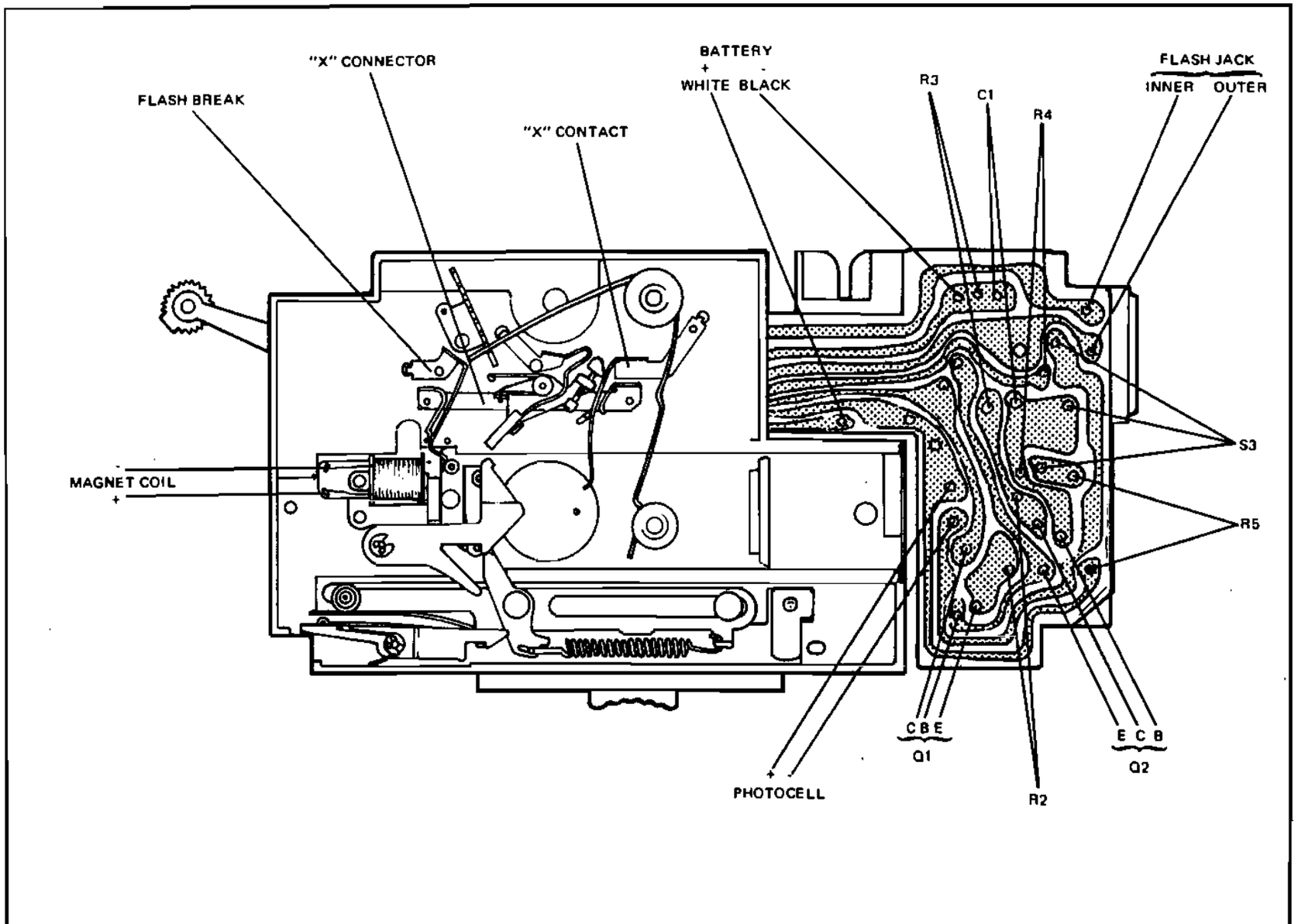

FIGURE 7-4 CHECK POINTS, 420 & 430 SHUTTERS

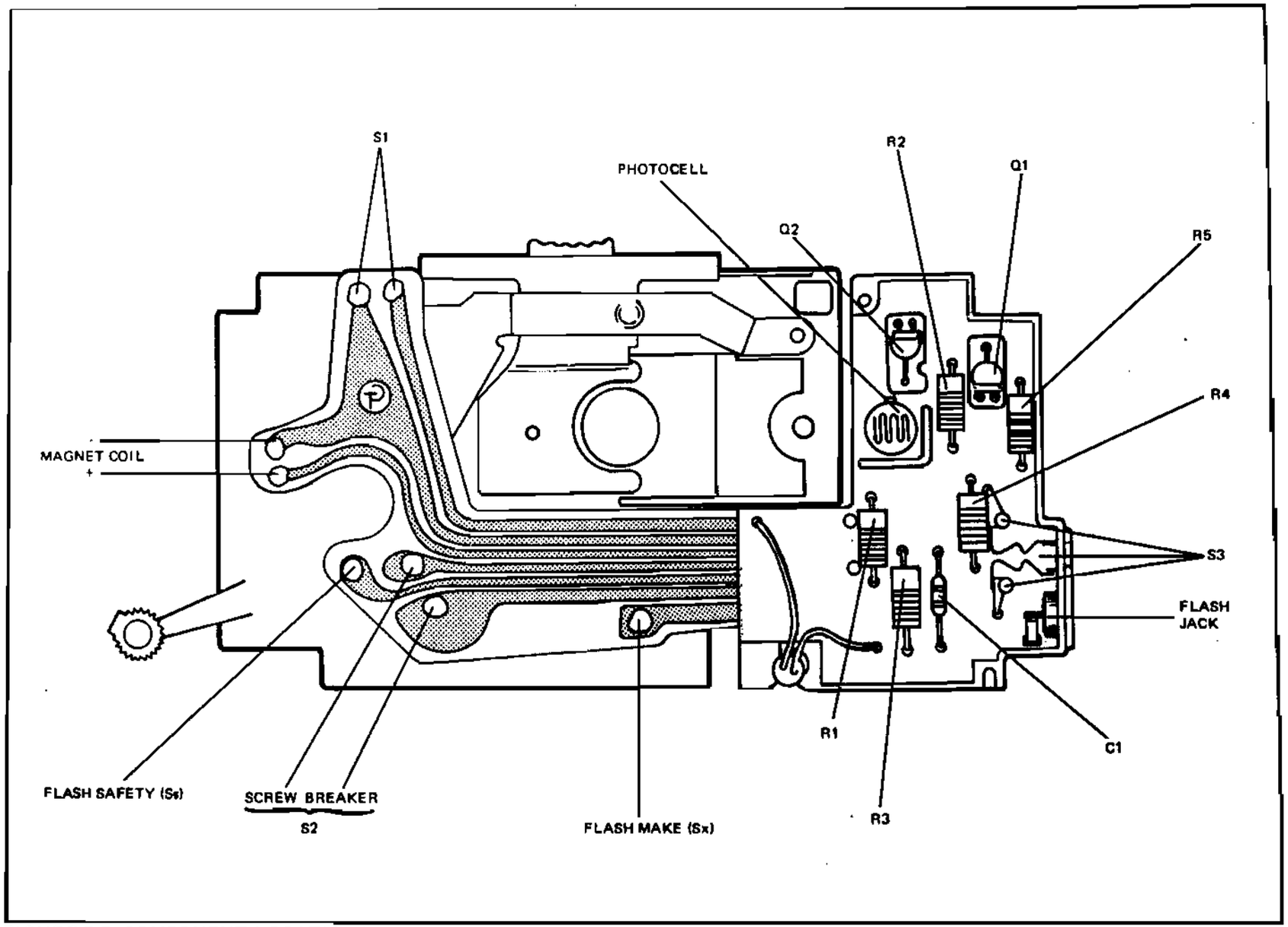

FIGURE 7-5 COMPONENT LOCATIONS, 420 & 430 SHUTTERS

K. TROUBLESHOOTING GUIDE (420/430 SHUTTERS)

Refer to Figure 7-4 for Point-to-Point Checks and to Figure 7-5 for Component Identification.
This Guide should be used only after a shutter has been tested.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Both blades close together on all speeds.	1. Rust or foreign matter on magnet, keeper or blades.	1. Clean or replace dirty or rusted components.
	2. Magnet and keeper misaligned.	2. Adjust magnet to realign it with the keeper.
	3. Bent cocking latch pin.	3. Straighten pin or replace cocking latch.
	4. S1 switch out of adjustment.	4. Adjust S1 switch.
	5. S2 switch out of adjustment.	5. Adjust S2 switch.
	6. Open S2 switch.	6. Clean switch contacts.
	7. Open circuit between left S1 contact and magnet coil.	7. String a jumper wire between left S1 contact and magnet contact.
	8. Open S1 switch.	8. Clean switch contacts.
	9. Open circuit between white battery contact and right S1 contact.	9. String a jumper wire between the affected contacts.
	10. Open or incorrect magnet coil.	10. Replace magnet coil.
	11. Open circuits between bottom magnet contact and Q2 collector or between top magnet contact and positive (+) photocell contact.	11. String jumper wires between affected contacts.
	12. Open circuit between screw side of S2 and negative (-) side of R4.	12. String jumper wire between affected contacts.
	13. Open circuit between S2 breaker and negative side of C1.	13. String jumper wire between affected contacts.
	14. Defective Q2 transistor.	14. Replace Q2.
	15. Defective Q1 transistor.	15. Replace Q1.
	16. Defective photocell	16. Replace photocell.
	17. Open, or cold-soldered, R2 and R3 resistors.	17. Resolder or replace resistors with 46Ω pot.
	18. Open, or cold-soldered, R4.	18. Resolder or replace R1.
	19. Open, or cold-soldered, R1.	19. Resolder or replace R1.
	20. Open, or cold-soldered, C1.	20. Resolder or replace C1.

K. TROUBLESHOOTING GUIDE (420/430 SHUTTERS) cont'd

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Second (closing) blade stays open on all speeds.	1. S2 switch out of adjustment.	1. Adjust S2 switch.
	2. Spring disengaged.	2. Reattach spring to blade.
	3. Defective Q1 transistor.	3. Replace Q1.
	4. Shorted C1 capacitor.	4. Replace C1.
	5. Open, or cold-soldered, photocell.	5. Replace or resolder photocell.
All speeds too fast or too slow.	1. Defective, or cold-soldered, C1.	1. Resolder or replace C1.
	2. Defective photocell.	2. Replace photocell.
Color speeds too fast.	1. Defective filter screen.	1. Replace aperture slide block
Blades remain open with flash plug in shutter.	1. Open, or cold-soldered, R5.	1. Resolder or replace R5.
	2. Open switch S3.	2. Clean and adjust S3.
f-stop meter does not repeat after flash plug has been inserted into and removed from shutter.	1. Defective S3 switch.	1. Clean and adjust S3.
Flash test bulb does not fire.	1. Defective flash circuit.	1. String jumper wires.
	2. Defective flash switches.	2. Clean or replace flash switch components.

VIII - PARTS

This section contains a listing of part numbers and nomenclature associated with the parts of the Shutters described in this manual. In addition, exploded drawings are also presented to show the relationship of all parts within a shutter.

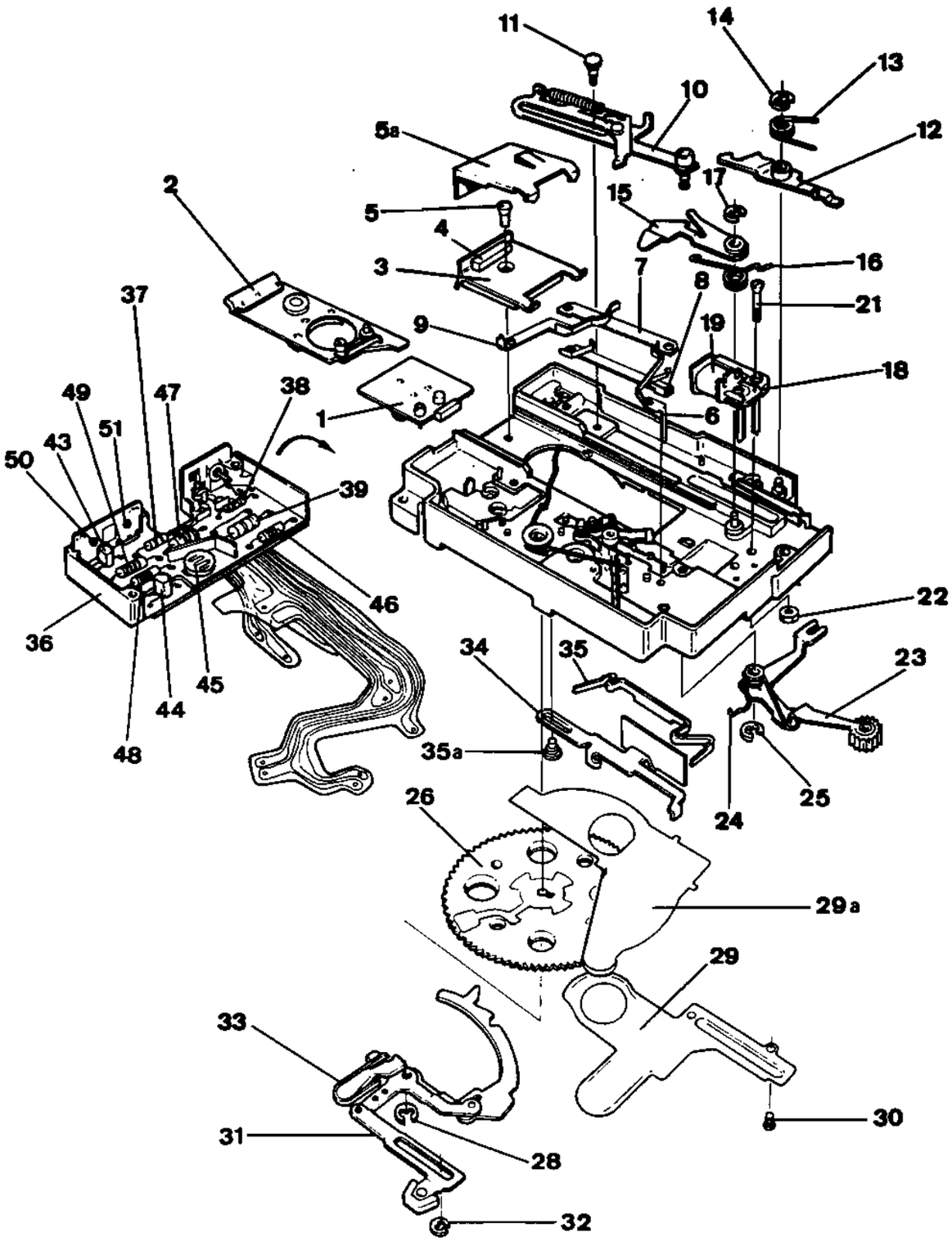

PLATE A – MODELS 440/450 SHUTTERS (FOR CAMERA MODELS 440 & 450)

PARTS LIST A

MODELS 440/450 SHUTTERS
(FOR CAMERA MODELS 440 & 450)

KEY NO.	PART NAME	PART NO.
–	Base Block & Electronic Marketing Block Assembly	704031
–	Base Block Assembly	704030
1	Closing Blade Assembly	146714
2	Opening Blade Assembly	146715
3	Closing Blade Stop Bracket Assembly	149782
4	Shock Pad	155133
5	Rivet	149844
5A	Cap, Stop Bracket	155376
6	X Contact	149627
7	Insulator, X Connector Strip	155292
8	X Connector Strip	149626
9	Flash Contact	149623
10	Cocking Slide Assembly	161113
11	Retaining Pin	168169
12	Cocking Slide Latch Assembly	149649
13	Cocking Slide Latch Spring	152501
14	Retainer Ring	155175
15	Blade Latch Assembly	149645
16	Blade Latch Spring	153513
17	Retainer Spring	155176
18	Magnet Assembly	172629
19	Magnet	149846
20		
21	Screw, Magnet	160545
22	Nut, Magnet	160546
23	Cocking Arm Assembly	220332
24	Spring, Cocking Arm	149864
25	Retainer Ring	155161
26	Aperture Wheel Assembly	704209
27	Deleted	Deleted
28	Aperture Wheel Retaining Ring	155160
29	Front Light Baffle	146862
30	Screw, Front Light Baffle	160464
31	Readout Actuator Assembly	178472
32	Retainer Ring	155161
33	Aperture Wheel Detent Block	157929
34	Readout Indicator	195918
35	Spring, Readout Window	157928
35A	Readout Indicator Slide Pin	153259
35B	Circuit Light Seal	160568
36	Electronic Marketing Block Assembly	704528
37	Capacitor (C-1)	704101
38	Capacitor (C-2)	704101
39	Capacitor (C-3)	704100
43	Transistor (Q1)	704201
44	Transistor (Q2)	704201
45	Photocell	278841
46	Resistor R6	
47	Resistor R5	
48	Resistor R4	
49	Resistor R2	
50	Resistor R3	704401
51	Resistor R1	704401

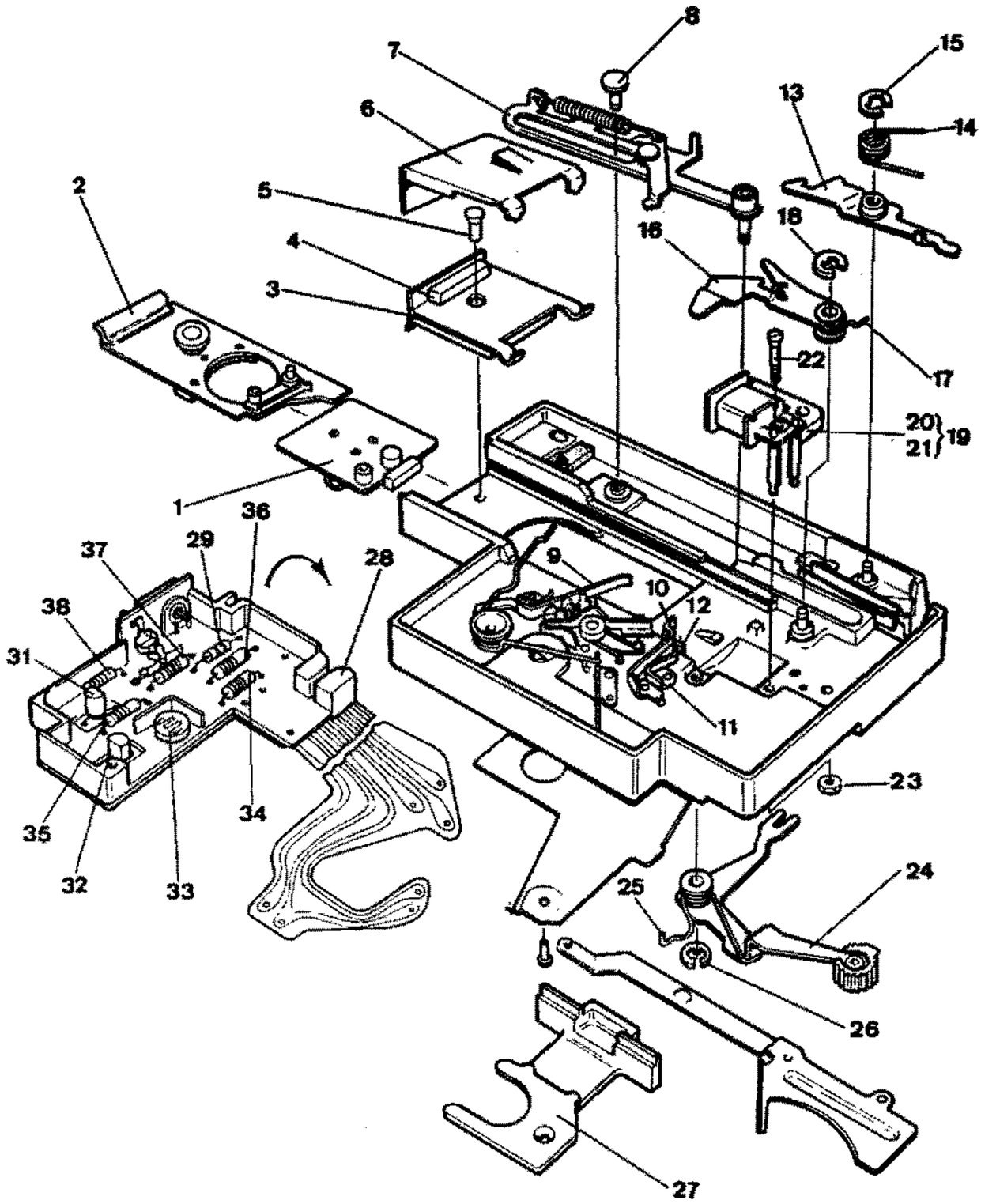

PLATE B – MODELS 420/430 SHUTTERS (FOR CAMERA MODELS 420 & 430)

PARTS LIST B

MODELS 420/430 SHUTTERS
(FOR CAMERA MODELS 420 & 430)

KEY NO.	PART NAME	PART NO.
—	Base Block & Electronic Marketing Block Assembly	704015
—	Base Block & Electronic Marketing Block Assembly	704016
1	Closing Blade Assembly	146714
2	Opening Blade Assembly	146715
3	Closing Blade Stop Bracket Assembly	149782
4	Shock Pad	155133
5	Rivet	149844
6	Cap, Stop Bracket	163125
7	Cocking Slide Assembly	161113
8	Retainer Ring, Cocking Slide	168169
9	X Contact	163075
10	X Connector Strip	149626
11	Insulator, X Connector Strip	155292
12	Flash Contact	149623
13	Cocking Slide Latch Assembly	149649
14	Spring, Cocking Slide Latch	152501
15	Retainer Ring	155175
16	Blade Latch Assembly	149645
17	Spring, Blade Latch	152513
18	Retainer Ring	155175
19	Magnet Assembly	172629
20	Magnet	149646
21		
22	Magnet Screw	160545
23	Magnet Nut	160546
24	Cocking Arm Assembly	161131
25	Spring, Cocking Arm	168038
26	Retainer Ring	155161
27	Film Speed Slide Assembly	704515
28	Electronics Marketing Block Assembly	704403
29	Capacitor (C-1)	704101
31	Transistor (Q1)	704201
32	Transistor (Q2)	704201
33	Photocell	278441
34	Resistor (R1)	
35	Resistor (R2)	
36	Resistor (R3)	
37	Resistor (R4)	
38	Resistor (R5)	