KS-14593, LIST 1
MESSAGE REGISTER CAMERA
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the KS-14593, List 1 message register camera used for photographing message registers.

1.02 This section is reissued to include additional requirements and procedures covering the motor-solenoid switch and cam release mechanism. Detailed reasons for reissue will be found at the end of the section.

1.03 The KS-14593, List 1 message register camera consists of the KS-14593, List 2 message register camera, shown in Fig. 1, and the KS-14594 power unit shown in Fig. 2.

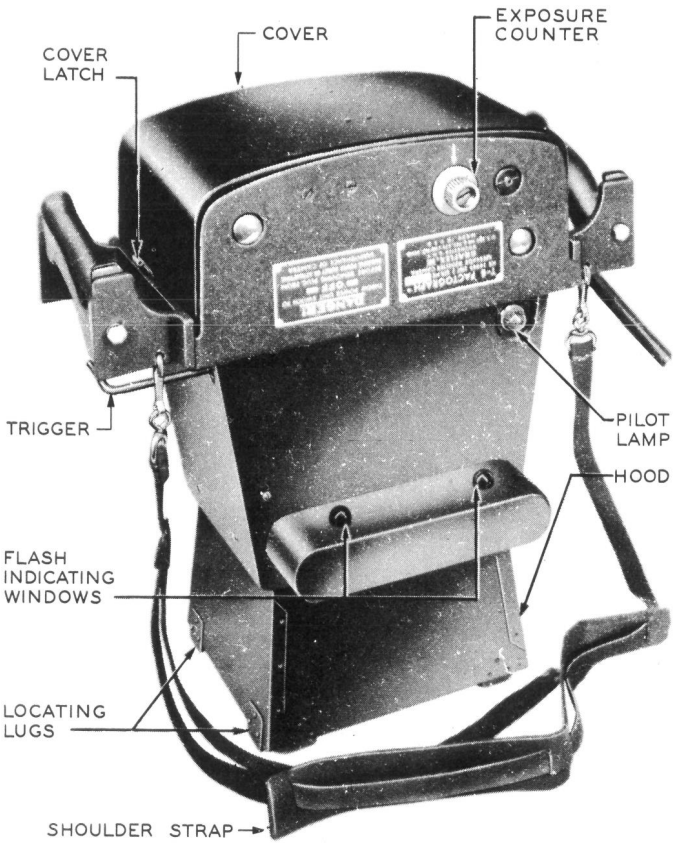


Fig. 1 – KS-14593, List 2 Message Register Camera

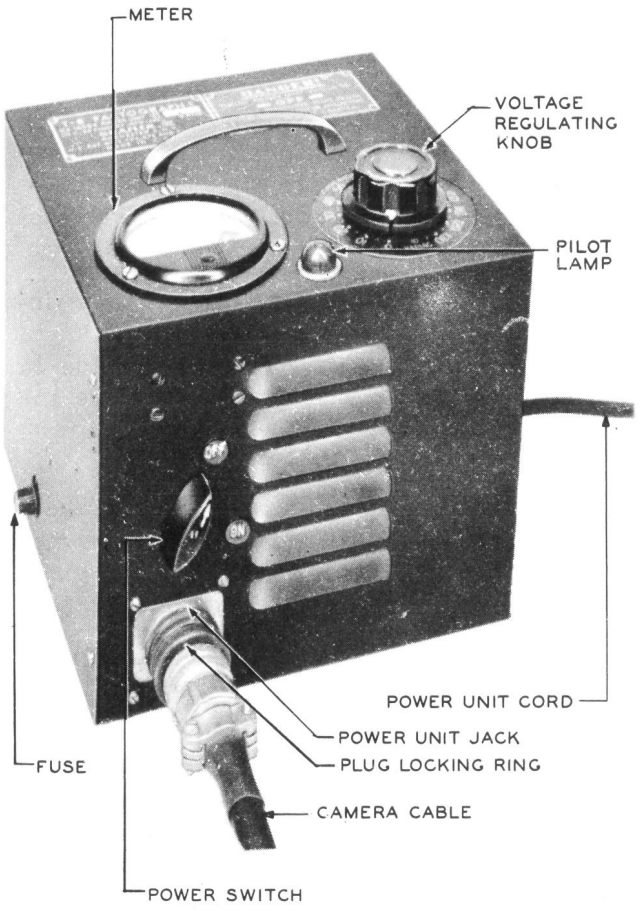


Fig. 2 – KS-14594 Power Unit

1.04 The power for operating the mechanism and lighting the flash lamps of the message register camera is supplied by the power unit which in turn is connected to a 110-volt ac source of power. The flash lamps, which operate upon discharge of the condensers in the power unit, flash for an interval of approximately 1/800 second. A meter on the power unit is provided to indicate the range of voltage to be used when photographing message registers. A pilot lamp indicates when the power is on.

1.05 Referring to the mechanical schematic of the camera, Fig. 7, a cassette loaded with unexposed paper is mounted at the trigger side of the camera. The paper is drawn from this

cassette over the end-of-paper switch, under the guide plate, over the top of the image chamber, under the pressure follower, and over the metering roller. After passing over the metering roller, the paper is wound on the core of a second cassette. The core of the latter cassette and the metering roller are driven by a motor as shown in the figure. The end-of-paper switch is held operated by the paper being drawn from the cassette. A cutout near the trailing end of the paper releases the switch to stop operation of the camera as the paper is exhausted. Two flash lamps are mounted in the camera hood to illuminate the registers being photographed. The pilot lamp on the camera indicates when each successive exposure may be made.

1.06 During operation of the camera the principal elements shown in Fig. 7 function in sequence as outlined below. The designations in parentheses after the circuit elements are the same as those shown in the circuit diagram, Fig. 8.

→ (1) With the end-of-paper switch (SW-4) held
→ operated by the paper, pulling the trigger operates the trigger switch (SW-6) which closes the circuit to the solenoid (SL-1).

(2) As the solenoid (SL-1) operates, it rotates a bell crank which is linked to the shutter operating arm and to the switch actuating and cam release rod. This mechanism opens the shutter and operates the lamp switch (SW-3), which causes the lamps (L-1A, L-1B) in the camera hood to flash.

(3) Operation of the switch actuating and cam release rod extends the slider tension spring. This spring connects the slider to the lamp switch actuating collar which moves with the rod. When the tension of this spring overcomes the inertia of the slider and the restraining action of the cam lever delay magnet, the slider moves with the rod and operates the cam release lever. This disengages the arm of the lever from the metering roller cam permitting rotation of the metering roller. During rotation of the roller, the lever arm rides on the top of the cam. The lever also operates the motor-solenoid switch (SW-5) which closes the circuit to the motor (M-1) and opens the circuit to the solenoid. The solenoid releases, and the retractile spring on the switch actuating and cam release rod returns the rod to its normal position closing the shutter.

(4) Operation of the motor rotates the metering roller and take-up cassette core, which winds exposed paper into the cassette and draws unexposed paper over the image chamber.

(5) As the metering roller completes one revolution, the cam release lever arm drops to the low portion of the metering roller cam, stopping rotation of the cam and roller. At the same time, the lever releases the motor-solenoid switch, opening the motor circuit.

(6) The sequence outlined above constitutes one operation of the camera. A relay (RL-1) in the camera circuit prevents closure of the solenoid circuit to start a second operation of the camera until the trigger is released. Additional operations of the trigger will not start a second operation of the camera until the metering roller has completed one revolution and the motor-solenoid switch has released.

1.07 Reference shall be made to Section 020-010-711 for additional information necessary for the proper application of the requirements listed herein.

1.08 ***Asterisk*** **(*):** Requirements are marked with an asterisk when to check for them would necessitate 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.

1.09 In order to check all requirements except requirement 2.01(a) and 2.02(a) it is necessary to unlatch and remove the camera cover.

1.10 In order to check requirements 2.11 and 2.14 to 2.16, inclusive, it is necessary to prepare the camera for operation as follows. Move the switch on the power unit to the OFF position and set the voltage regulating knob to ZERO. Insert the plug on the camera cable into the jack on the power unit and manually tighten the plug locking ring. Insert the plug on the power unit cord into the proper 110-volt ac receptacle. Unlatch and remove the camera cover. Block the end-of-paper switch in the operated position by swinging the switch finger downward with a 3-inch length of KS-6320 orange stick

and wedging the stick in the opening below the guide plate. Turn the power unit switch to its ON position. Set the voltage regulating knob on the power unit so that the indicator of the associated meter is set as specified in the requirement.

1.11 ***One drop of oil,*** for the purpose of this section, is the amount of oil released from a piece of No. 22 bare tinned copper wire after it has been dipped 3/4 inch into KS-6232 oil and quickly removed.

2. REQUIREMENTS

2.01 *Cleaning*

(a) Fig. 3 — The reflectors, lens, and filter shall be cleaned when necessary.

(b) The contacts of the relay shall be cleaned when necessary in accordance with the section covering cleaning of relay contacts and parts.

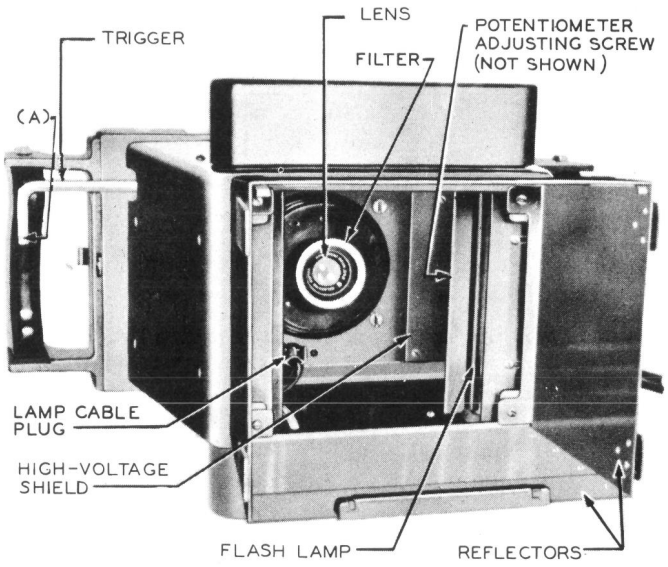


Fig. 3 – KS-14593, List 2 Camera Showing Lens and Reflectors

2.02 *Lubrication*

(a) Fig. 4(A) — The motor shaft bearing in the frame of the camera shall be adequately lubricated with KS-6232 oil. When lubrication is necessary, one drop shall be applied to the bearing.

(b) ***Recommended Lubrication Intervals:*** It is recommended that the motor shaft bearing be lubricated at intervals of 3 months. This interval may be extended if periodic inspections have indicated that local conditions are such as to insure that requirement (a) is met during the extended interval.

2.03 ***Position of End-of-Paper Switch:*** The switch contacts shall operate before the switch finger is swung downward to a point where the upper leg of the finger is 1/32 inch above the top of the guide plate.

Gauge by eye and ear.

2.04 ***Trigger Pull:*** Fig. 3A — The trigger shall operate with a pull of

Min 200 grams
Max 1200 grams

Use the No. 158A gauge applied adjacent to the end of the trigger.

2.05 ***Freedom of Movement of Solenoid Plunger and Associated Linkage:*** Fig. 4(B) — When the solenoid plunger is allowed to return from its operated position, after being manually operated, the plunger and associated linkage shall restore to their normal position without hesitation.

Gauge by eye.

*2.06 ***Position of Solenoid:*** Fig. 5(A) — The solenoid shall be positioned so that with the solenoid plunger held firmly in the operated position and with the play in the shutter linkage taken up in the direction to minimize the clearance between the shutter and the periphery of the shutter housing this clearance shall be

Min 0.094 inch

Use the 3/32-inch (0.094-inch diameter) twist drill.

To check the requirement, proceed as follows.

(a) Remove the image chamber from the camera as covered in 3.006.

(b) Remove the shutter plate mounting screws and washers using the 3-inch cabinet screwdriver. Remove the shutter plate and the spacers separating the shutter plate and housing at the mounting screw holes.

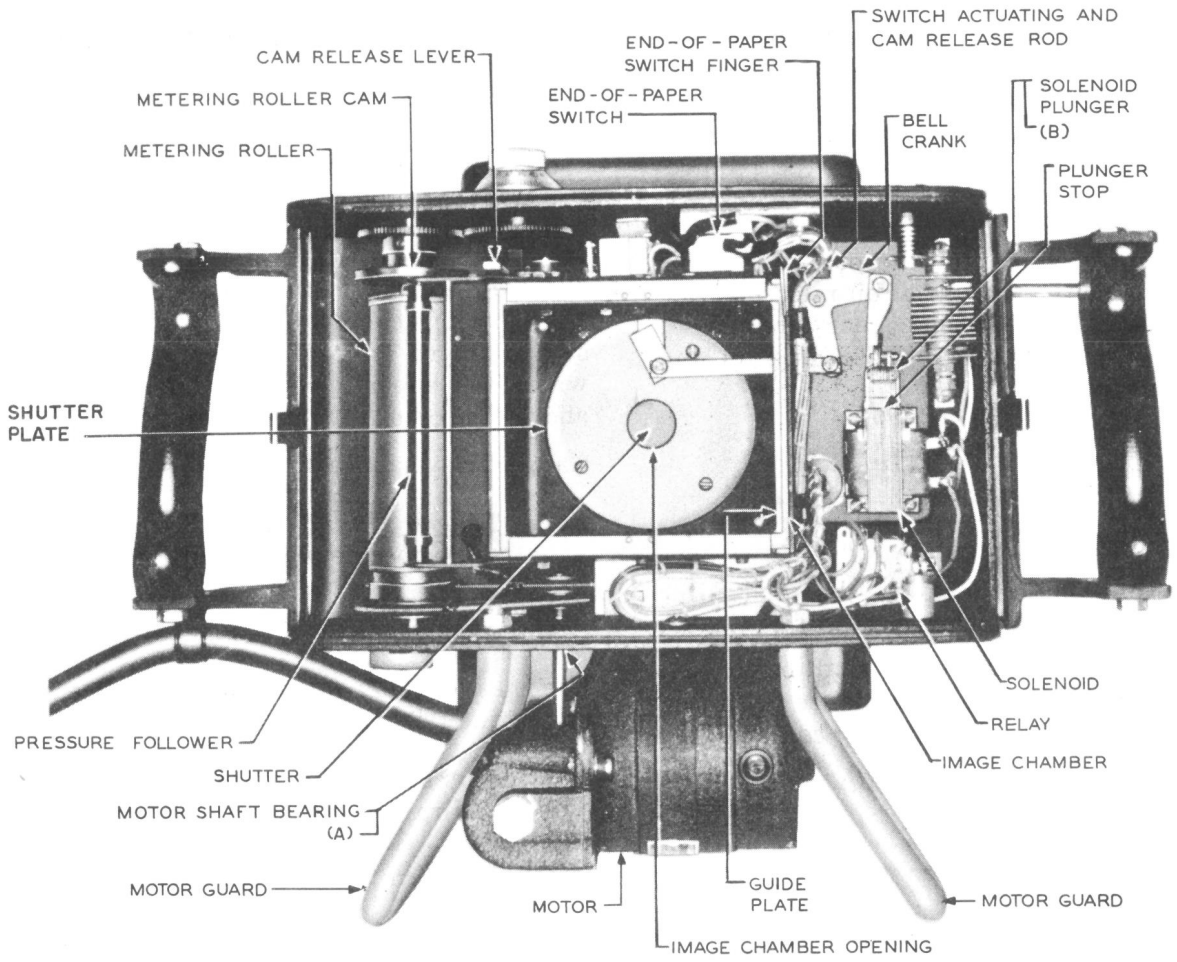


Fig. 4 – KS-14593, List 2 Camera — Cover Removed

(c) Disconnect the bell crank from the switch actuating and cam release rod. To do this, remove the snap ring from the pin connecting the parts and remove the pin.

(d) Temporarily mount the bell crank on its pivot pin in the camera. Connect the solenoid plunger link to the bell crank and the shutter link to the shutter operating arm.

(e) Push on the pin in the shutter actuating arm as shown in Fig. 5 to swing the shutter clockwise until the linkage moves the solenoid plunger against the solenoid core. Then, without exerting additional force on the shutter, check the clearance between the edge of the shutter and the point on the periphery of the shutter housing which is closest to the leading edge of the shutter. Use the shank of the 3/32-inch twist drill as a gauge as shown in the figure.

2.07 ***Position of Cam Release Lever Delay Magnet:*** Fig. 6(A) and (B)

(a) With the cam release lever against the face of the delay magnet, the vertical portion of the lever shall be parallel to the vertical edge of the image chamber.

Gauge by eye.

*(b) With the cam release lever against the magnet, the magnet shall engage the lever squarely.

Gauge by eye.

To check this requirement, remove the image chamber from the camera as covered in 3.006.

2.08** ***Position of Cam Release Actuating Slider: Fig. 6(C) — With the switch actuating and cam release rod in its normal position and

with the cam release lever against the delay magnet, there shall be perceptible clearance between the actuating surface of the slider and the cam release lever.

Gauge by feel.

To check the requirement, remove the image chamber from the camera as covered in 3.006. Apply pressure on the slider toward the left to check for clearance with the lever.

2.09 ***Position of Motor-solenoid Switch***

Test

(a) After having been operated, the motor-solenoid switch shall remain operated while the cam release lever rests on the high portion of the metering roller cam during rotation of the cam.

Gauge by eye and ear.

Check the requirement as covered in (c).

(b) As the cam release lever enters the low portion of the cam there shall be some movement of the lever before the switch releases, and after the switch releases there shall be further movement of the lever before the lever rests against the delay magnet.

Gauge by eye and ear.

Check the requirement as covered in (c).

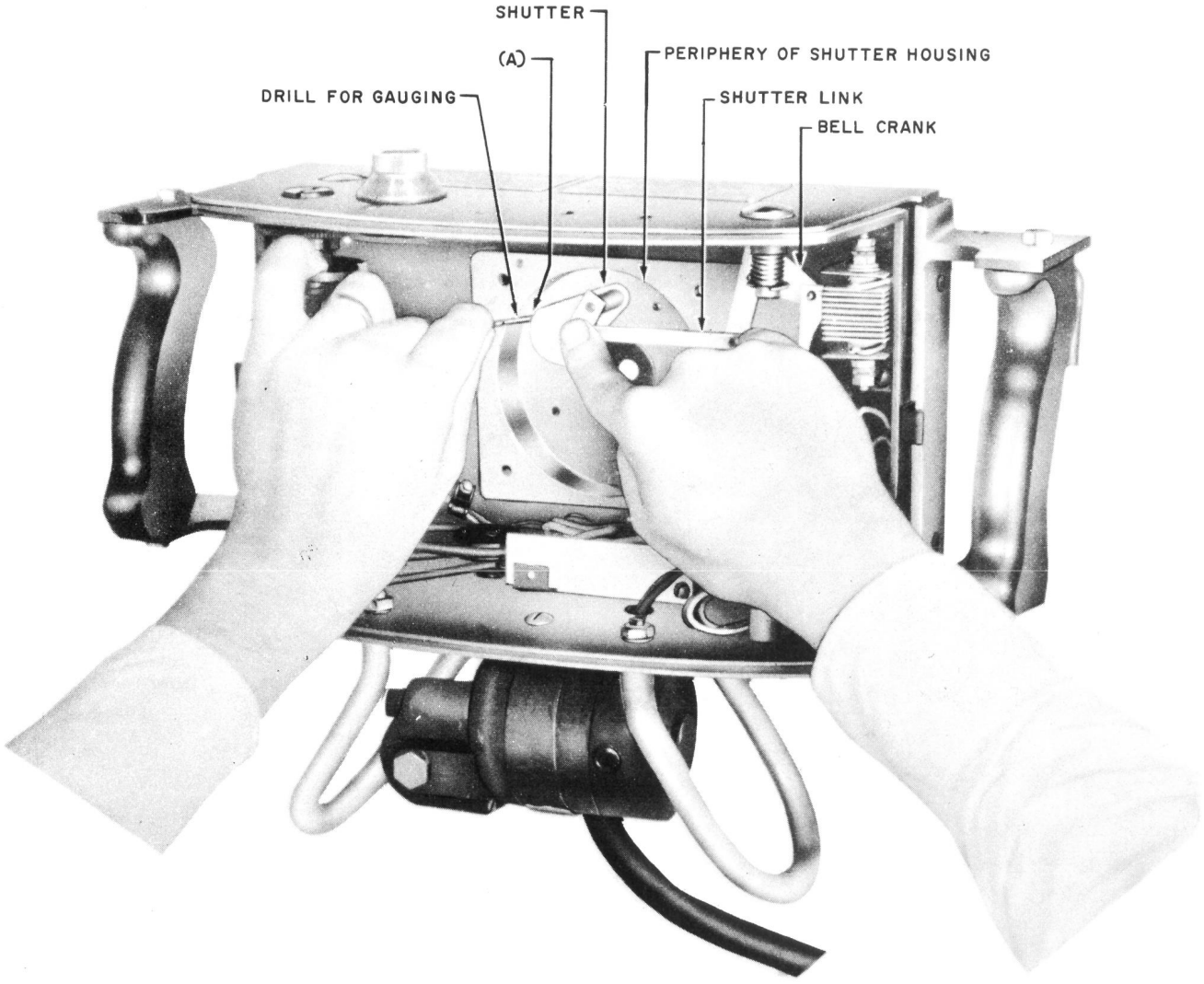


Fig. 5 – KS-14593, List 2 Camera — Clearance Between Shutter and Periphery of Shutter Housing

(c) To check requirements (a) and (b), proceed as follows. Manually operate the cam release lever to operate the motor-solenoid switch as indicated by the click. Hold the lever operated and rotate the metering roller cam clockwise, if necessary, just far enough so that the lever when released will rest on the high portion of the cam. Slowly release the lever and check whether the switch remains operated. Manually rotate the metering roller cam clockwise until the lever engages the low portion of the cam, noting when the switch releases as indicated by the click.

**Readjust:* The motor-solenoid switch shall be positioned so that it will release with a 0.010-inch thickness gauge between the cam release lever and the face of the delay magnet and will not release with a 0.030-inch thickness gauge between the lever and the face of the magnet.

Use the KS-6909 gauge.

To check the requirement, remove the image chamber from the camera as covered in 3.006. Manually operate the cam release lever to operate the switch as indicated by the click. Place the proper feeler of the KS-6909 gauge against the face of the delay magnet and slowly release the lever until it rests against the gauge, checking whether the switch releases as indicated by the click.

2.10 *Position of Cam Release Lever Front Stop*

Test

(a) When the cam release lever is operated manually, the motor-solenoid switch shall operate before the lever strikes its front stop.

Gauge by ear.

To check this requirement, slowly operate the cam release lever and listen for the click indicating operation of the motor-solenoid switch.

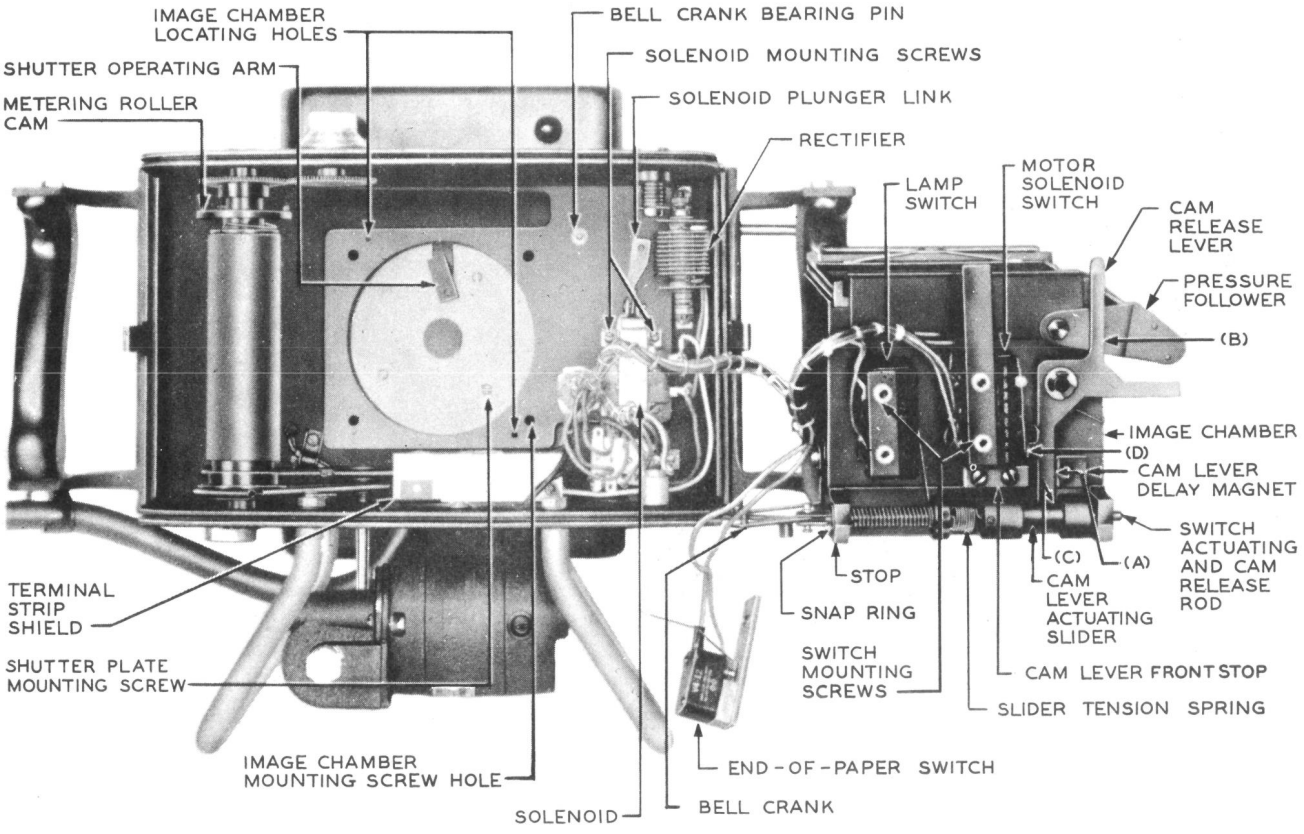


Fig. 6 – KS-14593, List 2 Camera — Image Chamber Removed From Camera

(b) With the cam release lever held against its front stop, the motor-solenoid switch actuator shall have some additional forward movement.

Gauge by feel.

To check this requirement, hold the cam release lever against the stop and press on the switch actuator with a KS-6320 orange stick to determine whether the actuator has further forward movement.

Readjust

*(a) The motor-solenoid switch shall operate when the cam release lever is manually operated against a 0.010-inch gauge held across the face of the lever front stop.

Use the KS-6909 gauge.

To check the requirement, remove the image chamber from the camera as covered in 3.006. Hold the 0.010-inch feeler of the KS-6909 gauge across the face of the stop, operate the cam release lever, and listen for the click indicating operation of the motor-solenoid switch.

*(b) Fig. 6(D) — With the cam release lever held against the lever front stop, the motor-solenoid switch actuator shall have additional travel of

Min 0.005 inch

Gauge by eye.

To check the requirement, remove the image chamber from the camera as covered in 3.006. Hold the cam lever against its stop and move the switch actuator to its fully operated position. Observe the clearance between the lever and the actuator at the closest point.

2.11 ***Release of Metering Roller Cam***

(a) With the camera prepared for operation as covered in 1.10, the indicator of the meter in the power unit set in the middle of the green range on the meter scale, and after the camera has been operated once by pulling the trigger, the following requirement shall be met. A pull of 525 grams applied to the cam release lever approximately 1/4 inch from the top of the lever in the direction to operate the lever shall not release the metering roller cam and a pull of 825 grams shall release the cam.

Use the No. 79B gauge.

*(b) With the image chamber removed from the camera and the specified pull applied to the cam release lever approximately 1/4 inch from the top of the lever in the direction to operate the lever, the cam release lever shall not leave the delay magnet with a pull of 450 grams and shall leave the magnet with a pull of 700 grams.

Use the No. 79B gauge.

To check the requirement, remove the image chamber from the camera as covered in 3.006.

*(c) With the image chamber removed from the camera, the cam release lever shall pull away from the delay magnet when the switch actuating rod is moved from its normal position in the direction to operate the lever.

Max 0.185 inch

Use the G-34354-A gauge.

To check the requirement, remove the image chamber from the camera as covered in 3.006. Insert the tapered end of the G-34354-A gauge between the snap ring on the actuating rod and its stop, with the flat side of the gauge against the stop so that the gauge straddles the rod. Slide the gauge between the snap ring and the stop until the snap ring rests on the 0.185-inch step of the gauge. Check whether the cam release lever has pulled away from the delay magnet.

2.12 ***Position of Lamp Switch:*** As the solenoid is operated manually, the lamp switch shall operate while some portion of the shutter blade is still visible through the image chamber opening, but with no more than 1/8 inch of the blade extending into the opening.

Gauge by eye and ear.

To check the requirement, operate the solenoid manually and observe the position of the shutter blade when the lamp switch operates as indicated by the click.

2.13 ***Sequence of Operation of Lamp and Motor-solenoid Switches:*** When the solenoid is operated manually, the lamp switch shall operate before the motor-solenoid switch.

Gauge by ear.

To check the requirement, first identify the characteristic click of each switch by operating the switch with the KS-6320 orange stick applied to

the switch actuator. Then operate the solenoid manually and check whether the click indicating operation of the lamp switch occurs before the click indicating operation of the motor-solenoid switch.

Note: Because of the different conditions obtaining during manual and electrical operation, it may be possible to operate the solenoid manually without causing the motor-solenoid switch to operate. If this is the case, rotate the cam release lever to its front stop checking for the click indicating operation of the motor-solenoid switch.

2.14 ***Operation Requirement:*** Fig. 4 — With the camera prepared for operation as covered in 1.10, and the indicator of the meter in the power unit set at 105 volts, the following requirement shall be met. When the solenoid is electrically energized against a 0.018-gauge (No. 74D gauge) held against the solenoid stop, the lamps shall flash while the shutter is open, and the motor shall drive the metering roller through one complete revolution and then stop.

Gauge by eye and ear.

Fasten the holder of the No. 74D gauge to a KS-6320 orange stick with a rubber band in order to provide an insulating handle for the gauge.

2.15 ***Pilot Lamp Timing:*** With the camera prepared for operation as covered in 1.10, and the indicator of the meter in the power unit set in the middle of the green range on the meter scale, pulling the trigger shall cause the pilot lamp to be extinguished and then to relight within 3 to 4 seconds.

Gauge by eye using the KS-3008 stop watch or a watch with a second hand.

2.16 ***Control of Solenoid Operation:*** With the camera prepared for operation as covered in 1.10, and the indicator of the meter in the power unit set in the middle of the green range on the meter scale, the following requirements shall be met.

(a) After an initial operation of the trigger and flash of the lamps, additional operations of the trigger shall not cause the lamps to flash a second time until the metering roller has completed one revolution.

Gauge by eye.

(b) The flash lamps shall flash only once and the metering roller shall advance through one revolution when the trigger is held operated.

Gauge by eye.

2.17 ***Quality of Photographs:*** The camera shall make 80 successive exposures of message registers with the indicator of the meter of the power unit set at either the minimum or maximum of the green range on the meter scale, and when processed, the finished photographs shall meet the following requirements.

(a) Successive photographs shall not overlap.

(b) Successive photographs of the same group of 25 registers shall be uniform.

(c) All numerals, including those of the designation strip, shall be legible.

(d) There shall be no objectionable light reflections or burns (dark spots) which obscure the register numerals.

To check the requirements, take and process the test photographs in accordance with the procedures covered in Section 030-335-501. If the office in which the camera is used has both 5- and 14-type message registers, photographs of both types should be included. Visually inspect the finished photographs to determine whether the requirements are met.

2.18 ***Speed of Camera Operation:*** The camera shall make successive exposures at intervals of 4 seconds or less with the indicator of the meter of the power unit set at 110V.

Gauge by eye using the KS-3008 stop watch or a watch with a second hand.

To check the requirement, load and operate the camera in accordance with procedures covered in Section 030-335-501, except set the indicator of the power unit at 110V. Pull the trigger and observe whether the exposure counter makes one revolution less one scale division on the counter within the specified interval.

3. PROCEDURES

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

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
418A	5/16- and 7/32-inch Hex. Open Double-end Flat Wrench

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
485A	Smooth Jaw Pliers
KS-2630	5/16-inch Hex. Socket Wrench
KS-6320	Orange Stick
KS-14162	No. 2 Artist's Show Card Brush
KS-14250, List 1	Flashlight [with one W1L cord equipped with No. 360A socket-type cord tip and KS-6780 connecting clip insulated by No. 108 cord tip (insulating tubing) and one W1M cord equipped with No. 360B socket-type cord tip and No. 411A test pick]
R-1005	Jeweler's Screwdriver
R-2653	No. 5 Bristo Setscrew Wrench ←
R-2670	3/32-inch Allen Socket Screw Wrench ←
R-2959	1/16-inch Allen Socket Screw Wrench
R-2966	No. 5 Stiff Artist's Brush ←
R-3193	9/32- and 11/32-inch Open Double-end Wrench
—	3/32-inch Twist Drill ←
—	1/8-inch Twist Drill (2 reqd) ←
—	3-inch Cabinet Screwdriver
—	4-inch Regular Screwdriver
—	5-inch Regular Screwdriver
—	No. 2 Phillips Screwdriver
—	Arkansas Stone, Hard, Norton HB13 (or equivalent)
GAUGES	
74D	Thickness Gauge Nest
79B	0-1000 Gram Push-pull Tension Gauge ←
158A	0-1400 Gram Gauge
KS-3008	Stop Watch (or watch with a second hand)
KS-6909	Feeler Gauge Nest ←
KS-14510, List 1	Volt-ohm-milliammeter ←
—	G34354-A 0.185-inch Forked Step Gauge (Graflex, Inc)
MATERIALS	
KS-2423	Cloth
KS-6232	Oil ←

CODE OR SPEC NO.	DESCRIPTION
MATERIALS	
KS-7860	Petroleum Spirits
—	Cellophane Tape (obtain locally) ←
—	Cotton Swabs (obtain locally)
—	Detergent (Dreft or equivalent)
—	Lens Paper [Eimer and Amend No. 11-996 or equivalent (obtain locally)]
—	No. 22 Bare Tinned Copper Wire ←

3.002 Reference to the mechanical schematic of the camera, Fig. 7, which shows the functional relationship of the various parts, and to the circuit diagram, Fig. 8, will aid in following certain of the procedures.

3.003 While working on the camera, power should be removed from the camera unless otherwise stated in the procedures.

3.004 If the procedures covered herein fail to correct or isolate troubles in the camera and power unit, the condition may be caused by a wiring defect in the camera or power unit. Check the camera with another power unit and the power unit with another camera, if a second power unit and camera are available in the area. This check should determine whether the trouble is in the camera or the power unit. Refer the matter to the supervisor for consideration of returning the camera and/or power unit to Graflex, Inc, Rochester 8, N.Y., for repairs.

3.005 ***Removing and Remounting Camera Hood***

(1) To remove the camera hood, place the camera so that it is supported on the motor guard. Reach into the hood and disconnect the lamp cable plug. Pull the filter off the lens and mount the lens cap, furnished with the camera, over the lens. Remove the mounting screws from the top and sides of the hood using the 3-inch cabinet screwdriver for the round head screw adjacent to the trigger switch, and the No. 2 Phillips screwdriver for all other screws. Turn the camera over so that the motor side is up and remove the remaining hood mounting screws with the No. 2 Phillips screwdriver. Remove the hood.

Caution: To prevent damage to the lens or trigger switch do not place the camera with the lens side down when the hood is removed.

(2) Remount the hood in the reverse order of removal covered in (1). Remove the lens cap and remount the filter. Reconnect the lamp cable plug.

3.006 *Removing and Remounting Image Chamber*

(1) To remove the image chamber first remove the camera hood as covered in 3.005. Referring to Fig. 6 remove the snap rings from the bell-crank bearing pin, from the pin which connects the solenoid plunger link to the bell crank, and from the shutter operating arm pin. To remove a snap ring, insert the blade of the R-1005 jeweler's screwdriver in one of the openings in the ring. Slowly turn the screwdriver toward the center projection of the ring to disengage the ring from the pin. Remove the ring. Remove the end-of-paper switch mounting screws using the 4-inch regular screwdriver. Use the R-3193 wrench to hold the nut on the screw nearer the trigger side of the camera while removing this screw. Swing the end-of-paper switch out of the way. Remove the four image chamber mounting screws from the lens side of the camera using the 5-inch regular screwdriver. Remove the image chamber from the camera, and place it in the position shown in Fig. 6.

(2) To remount the image chamber, remount the parts removed in (1), in the reverse order of removal. To remount a snap ring, position the ring with its opening against the groove in the pin. Place the blade of the 3-inch cabinet screwdriver against the outer edge of the ring opposite the center projection. Push the ring into position on the pin. Before securely tightening the image chamber mounting screws, insert the shanks of the 1/8-inch drills into the image chamber locating holes from the lens side of the camera, making sure that the drills enter the corresponding locating holes in the image chamber. With the drills in place securely tighten the image chamber mounting screws. Remove the drills and remount the camera hood as covered in 3.005.

3.01 ***Cleaning*** (Reqt 2.01)

(1) Wipe the reflectors with a clean KS-2423 cloth. If the reflectors are greasy, clean them with a cotton swab dipped in a mixture of warm water and a detergent such as Dreft (one teaspoonful of the detergent to one quart of water). Follow this with a cotton swab dipped in clean, warm water. After allowing the reflectors to dry, polish them with a clean KS-2423 cloth.

(2) Pull the filter off the lens. Clean the lens and filter with lens paper. No attempt should be made to clean the image chamber side of the lens. After cleaning, remount the filter.

(3) Clean the relay contacts in accordance with the section covering cleaning of relay contacts and parts.

3.02 ***Lubrication*** (Reqt 2.02)

(1) To lubricate the motor shaft bearing, place the camera with the motor upward. Using the No. 22 bare tinned copper wire apply one drop of KS-6232 oil to the motor shaft adjacent to the bearing in the frame. Allow the oil to run down into the bearing.

3.03 ***Position of End-of-Paper Switch*** (Reqt 2.03)

(1) Loosen the switch mounting screws slightly using the 4-inch regular screwdriver. Use the R-3193 wrench to hold the nut on the mounting screw nearer the trigger side of the camera while loosening this screw. Shift the position of the switch as required and securely tighten the screws.

3.04 ***Trigger Pull*** (Reqt 2.04)

(1) If the minimum requirement is not met, this may be due to a broken trigger switch retractile spring. Replace the trigger switch.

(2) If the maximum requirement is not met, this is probably due to bind in the trigger bearing. Refer the matter to the supervisor for consideration of returning the camera to Graflex, Inc, Rochester 8, N. Y., for repairs.

3.05 ***Freedom of Movement of Solenoid Plunger and Associated Linkage*** (Reqt 2.05)

(1) Clean all linkage points using a KS-14162 brush moistened with KS-7860 petroleum spirits. If this does not correct the trouble, proceed as follows.

(2) Remove the image chamber from the camera as covered in 3.006. Remove the shutter plate mounting screws and washers using the 3-inch cabinet screwdriver. Remove

the shutter plate and the spacers separating the shutter plate and housing at the mounting screw holes. Remove the shutter from the shutter bearing pin. Disconnect the bell crank from the switch actuating and cam release rod on the image chamber. To do this, remove the snap ring from the pin connecting the parts and remove the pin. Also, disconnect the shutter link from the bell crank by removing the snap ring which secures these parts together.

(3) Check for broken or distorted parts and replace parts if required.

(4) Using the KS-14162 brush apply a thin film of KS-7471 grease to the shutter bearing pin, the bell crank pivot pin, and the linkage pins on the shutter and bell crank.

(5) Remount the shutter and shutter plate as follows. Position a spacer over each shutter plate mounting screw hole in the frame of the camera. Carefully position the shutter plate so that the mounting screw holes in the plate are aligned with the spacers and screw holes in the frame. Insert and tighten the mounting screws, making sure that the washers under the heads of the screws are in place.

(6) Check that the shutter blade clears the shutter plate and the bottom of the shutter housing through its full stroke. If necessary, to secure this clearance remove the shutter and bend the blade slightly with the fingers as required. Remount the shutter and shutter plate and recheck the clearance.

(7) Remount the other parts that were removed in the reverse order of removal.

3.06 ***Position of Solenoid*** (Reqt 2.06)
3.07 ***Position of Cam Release Lever Delay Magnet*** (Reqt 2.07)
3.08 ***Position of Cam Release Actuating Slider*** (Reqt 2.08)
3.09 ***Position of Motor-solenoid Switch*** (Reqt 2.09)
3.10 ***Position of Cam Release Lever Front Stop*** (Reqt 2.10)
3.11 ***Release of Metering Roller Cam*** (Reqt 2.11)

(1) After completing adjustments for any of these requirements, recheck the requirement and check all of the associated requirements.

(2) ***Position of Solenoid:*** With parts removed or temporarily mounted as covered in the method of check for the requirement, reposition the solenoid as follows. Loosen the solenoid mounting screws with the 3-inch cabinet screwdriver. By pushing on the pin in the shutter actuating arm, swing the shutter clockwise against the shank of the 3/32-inch twist drill held between the edge of the shutter and the point on the periphery of the shutter housing which is closest to the leading edge of the shutter. Secure the drill to the housing in this position with a piece of cellophane tape. While holding the shutter against the drill, position the solenoid so that the solenoid plunger is held by the linkage firmly against the solenoid core. Tighten the solenoid mounting screws and nuts using the 3-inch cabinet screwdriver and the KS-2630 wrench. Positioning the solenoid to the minimum requirement as described above facilitates meeting requirement 2.14.

(3) ***Position of Cam Release Lever Delay Magnet:*** To reposition the cam release lever delay magnet, loosen the magnet mounting screw locknut on the inside of the image chamber using the KS-2630 wrench and loosen the mounting screw with the 3-inch cabinet screwdriver. Shift the magnet as necessary to meet the requirement and tighten the mounting screw and locknut.

(4) ***Position of Cam Release Actuating Slider:*** To reposition the cam release actuating slider, loosen the slider setscrew with the R-2653 wrench, slightly shift the slider on the end of the tension spring as required, and securely tighten the setscrew.

(5) ***Position of Motor-solenoid Switch:*** To reposition the motor-solenoid switch, loosen the switch mounting screws, using the R-2670 wrench, just sufficiently to shift the switch on its mounting. Shift the switch slightly as required and tighten the mounting screws.

(6) ***Position of Cam Release Lever Front Stop:*** To reposition the cam release lever front stop, loosen the stop mounting screw locknuts on the inside of the image chamber using the KS-2630 wrench and loosen the mounting screws with the 3-inch cabinet screwdriver sufficiently to shift the stop. Shift the stop slightly as required and tighten the mounting screws and locknuts.

(7) ***Release of Metering Roller Cam***

(a) If the cam releases at too low a pull with the image chamber in place in the camera, remove the image chamber as covered in 3.006 and check requirements 2.07(b) and 2.08. Make adjustments if necessary. Then check requirement 2.11(b). If this requirement is not met, replace the magnet.

(b) If the cam fails to release at the pull specified with the image chamber in place in the camera, examine the cam and the end of the cam release lever for dirt or gummy deposits. If necessary, clean the parts using a KS-2423 cloth moistened with KS-7860 petroleum spirits and wipe with a clean, dry cloth. If this fails to correct the trouble, remove the image chamber from the camera as covered in 3.006 and check requirement 2.11(b). If this requirement is not met, replace the magnet. If the requirement is met, proceed as covered in (c).

(c) Smooth the end of the cam release lever and the associated surface on the metering roller cam with the Norton Arkansas stone HB13 as follows. Dip the full length of the stone in a container of water and then shake the stone to remove excess water. Rub the stone across the surface to be smoothed, taking care to hold the stone squarely against the surface. Use sufficient strokes to slightly polish the surface. Wipe the parts with a clean, dry KS-2423 cloth.

Note: After using the Arkansas stone, dip the full length of the stone in a container of water and then wipe it with a clean, dry KS-2423 cloth. Avoid handling the stone with the fingers as much as possible to keep the surface of the stone free of dirt and grease. When the stone is not in use, keep it in the box furnished with the stone.

(d) If the cam release lever does not pull away from the delay magnet when the switch actuating rod is moved 0.185 inch from its normal position, check for a broken or loose slider tension spring. If the spring is not broken or loose and if requirement 2.11(b) is met, replace the spring.

3.12 ***Position of Lamp Switch*** (Reqt 2.12)

(1) To reposition the lamp switch, slightly loosen the switch mounting screws using the R-2670 wrench from the inside of the image chamber. Shift the switch slightly as required using the head of the lower mounting screw to move the switch. Shifting the switch may be facilitated by placing the R-2670 wrench in the head of the screw. Tighten the mounting screws and recheck the requirement. Also check requirement 2.13.

3.13 ***Sequence of Operation of Lamp and Motor-solenoid Switches*** (Reqt 2.13)

(1) Check requirements 2.09 and 2.12 and adjust if necessary. If the requirement is still not met, replace the motor-solenoid switch.

3.14 ***Operation Requirement*** (Reqt 2.14)

(1) Failure to meet this requirement may be due to one or more of the following conditions.

Failure of the solenoid to operate

Failure of the lamps to flash

Failure of the motor to start

Failure of the motor to drive the metering roller.

Failure of the motor to stop

Procedures for correcting each of these conditions are covered below in (2) to (6), inclusive.

(2) ***Failure of Solenoid to Operate***

(a) ***Defective Solenoid:*** With power on the camera, apply the leads of the KS-14510, List 1 voltmeter to the terminals of the solenoid coil and pull the trigger. If there is power across the terminals and the solenoid does not operate, replace the solenoid. If there is no power across the solenoid terminals, proceed as covered in (b) to (f), inclusive.

Caution: Before proceeding as covered in (b) to (f), remove power from the camera.

(b) ***Improperly Positioned or Defective End-of-Paper Switch:*** Check requirement 2.03. If the requirement is met, manually operate the switch and check for closure of the contacts with the KS-14250, List 1 flashlight test leads applied to the switch terminals. Replace the switch if defective.

(c) ***Improperly Positioned or Defective Trigger Switch:*** Check for closure of the switch contacts as follows. Apply the

flashlight test leads to the solenoid terminal having the green lead and to the relay terminal nearest the terminal strip. Reach in through the hood and operate the switch manually. If the flashlight does not light, the switch is defective. Replace the switch. If the flashlight lights, the switch is incorrectly positioned. Remove the camera hood as covered in 3.005 and remount the trigger stop screw (round head screw). Loosen the switch mounting screws using the 3-inch cabinet screwdriver and No. 418A wrench. Position the switch so that it operates while the trigger is being pulled, and so that there is a slight additional movement of the switch actuator when the trigger arm is against the stop screw. Securely tighten the mounting screw. Remove the trigger stop screw and remount the hood as covered in 3.005.

(d) ***Normally Closed Relay Contacts Open:*** Check for continuity through these contacts by applying the test leads of the flashlight to the relay terminals having blue leads. If the contacts are open as indicated by failure of the flashlight to light, remove the relay as follows. Remove the relay bracket mounting screw with the 3-inch cabinet screwdriver. Hold the relay so that the contact springs are accessible, taking care not to damage the leads. Clean the contacts as covered in the section on cleaning relay contacts and parts, and recheck for continuity. If the contacts are open, adjust the movable spring, using the No. 485A pliers, and recheck for continuity.

(e) ***Defective Rectifier:*** Check the rectifier for a short-circuit by applying the test leads of the flashlight to the rectifier terminals. If the lamp lights, even dimly, replace the rectifier.

(f) ***Normally Closed Contacts of Motor-solenoid Switch Open:*** Check for continuity through the switch contacts in the solenoid circuit by applying the test leads of the flashlight to the end-of-paper switch terminal having the brown lead and the relay terminal nearest the terminal strip. If the contacts are open, as indicated by the failure of the flashlight to light, the switch either fails to release due to improper positioning or is defective. Check requirement 2.09 and make adjustments if required. Replace the switch if defective.

(3) ***Failure of Lamps to Flash***

(a) If either or both lamps fail to flash, check the camera with another power unit and the power unit with another camera, if a second power unit and camera are available in the area. This check should determine whether the trouble is in the camera or the power unit. If the trouble is in the camera and cannot be corrected by following the procedures covered below in (b) and (c), or if the trouble is in the power unit, refer the matter to the supervisor for consideration of returning the camera and/or power unit to Graflex, Inc, Rochester 8, N. Y., for repair.

(b) ***One Lamp Fails to Flash:*** If one lamp fails to flash, remove power from the camera and replace the lamp.

(c) ***Both Lamps Fail to Flash:*** If both lamps fail to flash, check the position of the lamp switch as covered in requirement 2.12. If this requirement is met, check for closure of the lamp switch contacts by applying the leads of the KS-14250, List 1 flashlight to the terminals of the switch and manually operating the switch. If the flashlight does not light, the switch is defective. Replace the switch. If the trouble is still not cleared, the trouble may be due to two defective lamps. Replace both lamps.

(4) ***Failure of Motor to Start***

Defective Motor

(a) Remove the terminal strip shield mounting screw and remove the shield. With the power on the camera, check for power across the motor as follows. Manually operate the cam release lever while applying the leads of the KS-14510, List 1 volt-ohm-milliammeter to the two terminals on the terminal strip nearest the relay end of the terminal strip. If there is power, the motor is defective. Replace the motor.

Motor-solenoid Switch Fails to Operate

(b) ***Metering Roller Cam Fails to Release:*** Check requirement 2.11(a). If this requirement is met, check for a broken or loose slider tension spring by manually operating the solenoid. If the spring is broken or loose, the slider will not move with the switch actuating and cam release rod. If

necessary, replace the spring or tighten the setscrews making sure that requirement 2.08 is met.

(c) ***Solenoid, Motor-solenoid Switch, or Cam Lever Stop Improperly Positioned:*** Check requirements 2.06, 2.09, and 2.10.

(d) ***Motor-solenoid Switch Defective:*** If the procedures covered in (a), (b), and (c) fail to correct the trouble, the motor-solenoid switch is probably defective. Replace the switch.

(5) ***Failure of Motor to Drive Metering Roller***

(a) ***Metering Roller Drive Spring Broken:*** Replace the spring.

(b) ***Cassette Binding:*** Replace the cassette.

(c) ***Drive Pulley Loose:*** Remove the drive spring. If the flat on the motor shaft is not facing upward, move the shaft to this position as follows. With power on the camera, operate the cam release lever and momentarily operate the end-of-paper switch finger until the flat in the motor shaft faces upward. Remove power from the camera. Securely tighten the pulley setscrew against the flat in the motor shaft using the R-2959 wrench. Remount the drive spring.

(6) ***Failure of Motor to Stop***

Metering Roller Drive Spring Broken

(a) Replace the spring.

Solenoid Fails to Restore

(b) Check requirement 2.05.

Motor-solenoid Switch Fails to Release

(c) ***Delay Magnet, Cam Release Actuating Slider, or Motor-solenoid Switch Improperly Positioned:*** Check requirements 2.07, 2.08, and 2.09.

(d) ***Motor-solenoid Switch Defective:*** If procedures covered in (a), (b), and (c) fail to correct the trouble, the motor-solenoid switch is probably defective. Replace the switch.

3.15 ***Pilot Lamp Timing*** (Reqt 2.15)

(1) Failure of the lamp to light may be due to a defective lamp, to the potentiometer adjusting screw (projecting through the high-voltage shield, Fig. 3) being turned too far in a clockwise direction, or to a defect in the timing network of the camera. Determine whether the lamp is defective by replacing the lamp. To do this, unscrew the lampcap, press the lamp inward, turn and withdraw it. Mount the new lamp in reverse order of removal. Remount the lamp cap. Replacement of the lamp or use of a different power unit may necessitate potentiometer adjustment as covered in (3) in order to meet the timing requirement.

(2) If the new lamp does not light after adjusting the potentiometer as covered in (3) and the flash lamps function, the trouble is probably due to a defect in the timing network of the camera. Refer the matter to the supervisor for consideration of returning the camera to Graflex, Inc, Rochester 8, N. Y., for repairs.

(3) If the timing is incorrect, adjust the potentiometer screw as follows. Make sure that the switch on the power unit is turned to OFF. Remove the hood from the camera as covered in 3.005. Using the 4-inch regular screwdriver, slightly turn the potentiometer adjusting screw counterclockwise to decrease, and clockwise to increase the time required for the pilot lamp to relight. Adjust the potentiometer so that the lamp relights 3 to 4 seconds after it is extinguished with power on the camera. Remount the camera hood as covered in 3.005.

Caution: Do not adjust the potentiometer screw with power on the camera.

3.16 ***Control of Solenoid Operation*** (Reqt 2.16)

(1) If part (a) of the requirement is not met, the trouble is due to failure of the motor-solenoid switch to operate. Proceed as covered in 3.14(4)(b).

(2) If part (b) of the requirement is not met, the trouble may be due to failure of the relay to operate or lock up. Proceed as covered in (a) to (d), inclusive.

Note: Irregular glowing or flashing of a lamp is usually due to a defective lamp, in which case the lamp should be replaced.

(a) ***Failure of Trigger Switch Contacts in Relay Circuit to Close When Trigger Is Pulled:*** Check closure of these contacts by pulling the trigger with the flashlight test

leads applied to the relay terminal with the red lead, and to the relay terminal which has the white lead and which is adjacent to the solenoid. If the flashlight does not light, replace the trigger switch.

(b) ***Failure of Motor-solenoid Switch Contacts in Relay Circuit to Close When Switch Is Operated:*** Check closure of these contacts as follows. Make sure that the cam release lever engages the low portion of the metering roller cam as shown in Fig. 7. Apply the flashlight test leads to the relay terminals with red and brown leads and manually operate the cam release lever. If the lamp does not light, replace the motor-solenoid switch.

(c) ***Relay Contacts Fail to Close:*** Remove the relay bracket mounting screw using the 3-inch cabinet screwdriver. Hold the relay in a position where the contact springs are accessible taking care not to damage the leads. If the contacts on the springs connected to the red and brown leads appear to close when the relay is manually operated, clean the contacts as covered in the section on cleaning relay contacts and parts. If the contacts do not appear to close when the relay is manually operated, adjust the movable contact spring, as required, using the No. 485A pliers.

(d) If the trouble cannot be cleared by following procedures (a) to (c), replace the relay.

3.17 ***Quality of Photographs*** (Reqt 2.17)

(1) Since the quality of the photographs depends on satisfactory processing as well as the mechanical adjustment of the camera, a list of defects which may appear in the photographs and their probable causes with recommended procedures for correction are covered in Part 4.

3.18 ***Speed of Camera Operation*** (Reqt 2.18)

(1) Failure to meet the requirement is probably due to one of the following conditions.

(a) Binding of paper as it leaves cassette. Replace cassette.

(b) Metering roller drive spring stretched. Replace spring.

(c) Loose drive pulley. Remove the drive spring. If the flat on the motor shaft is not facing upward, move the shaft to this position as follows. With power in the camera, operate the cam release lever and momentarily operate the end-of-paper switch finger until the flat on the motor shaft faces upward. Remove power from the camera. Securely tighten the pulley setscrew against the flat on the motor shaft using the R-2959 wrench. Remount the drive spring.

(d) Binding of solenoid plunger or associated linkage. Check requirement 2.05.

4. GENERAL INFORMATION

4.01 ***Analysis and Correction of Defects in Photographs***

DEFECT	PROBABLE CAUSE AND RECOMMENDED PROCEDURE FOR CORRECTION
1. Overlapping of Photographs	Paper slipping due to (a) Binding of paper as it leaves cassette. Indication of defective cassette. Replace cassette. (b) Glazing of metering roller surface. Replace roller.
2. Nonuniformity of Successive Photographs	(a) Camera held improperly while taking photographs. See Section 030-335-501. (b) Insufficient time interval allowed between exposures. See Section 030-335-501. (c) Change in line voltage. Reset voltage regulating knob on power unit. See Section 030-335-501. (d) Old or exhausted developer used or processor improperly prepared. See Section 030-335-501. (e) Defective paper.

DEFECT	PROBABLE CAUSE AND RECOMMENDED PROCEDURE FOR CORRECTION
3. Some Numerals Illegible	(a) Camera held improperly while taking photographs. See Section 030-301-301.
	(b) Unsatisfactory condition of message registers photographed. See Section 030-301-301.
	(c) Defective flash lamp or power unit. See 3.14(3).
4. Blurring of Right Edge of Numerals	(a) Metering roller cam releases at too low a pull. Check requirement 2.11(a).
5. Objectionable Light Reflections or Burns	(a) Flash lamp shield improperly positioned. See note.
	(b) Unsatisfactory condition of message registers photographed. See Section 030-301-301.
	(c) Loose flash lamp mountings. Reposition or replace flash lamp mounting grommets.
6. Photographs Too Light	(a) Filter improperly used. See Section 030-301-301.
	(b) Voltage incorrectly adjusted. See Section 030-301-301.
	(c) Improper adjustment of pilot lamp potentiometer. Insufficient time interval between exposures. See Section 030-301-301.
	(d) Old, exhausted, or improperly prepared processing solutions. See Section 030-301-301.
	(e) Temperature of processing solutions too low. See Section 030-320-701.
	(f) Defective paper.
7. Photographs Too Dark	(a) Filter not used. See Section 030-301-301.
	(b) Voltage incorrectly adjusted. See Section 030-301-301.
	(c) Temperature of processing solutions too high. See Section 030-320-701.
8. Brown or Yellowish Stains	(a) Old, exhausted, or improperly prepared processing solutions. See Section 030-301-301.
9. A Few Very Dark Photographs at End of Roll	(a) Too many exposures made on roll. See Section 030-301-301.
	(b) Failure to advance paper before removing cover after last photograph. See Section 030-301-301.
10. Part of Each Photograph Missing	(a) Lamp switch improperly positioned. (Shutter not fully open when lamps flash.) See 2.12.
11. One Side of Each Photograph Too Light	(a) One flash lamp not functioning. Defective lamp or power unit. See 3.14(3).
12. Dark Streak on Each Picture	(a) Defective cassette (light leaks). Replace cassette.
13. No Picture	(a) Lens cap left on. Remove cap.
	(b) Both lamps fail to flash. See 3.14(3).
	(c) Broken shutter. Replace shutter.
14. Double Exposure	(a) Check requirement 2.16(a).

Note: Refer the matter to the supervisor for consideration of returning the camera to Graflex, Inc, Rochester 8, N. Y., for repairs.

REASONS FOR REISSUE

1. To revise the description of camera operation to cover the cam lever actuating slider, tension spring, and the delay magnet (1.06).
2. To add definition of one drop of oil (1.11).
3. To add requirement covering lubrication of the motor shaft bearing (2.02).
4. To add requirement covering position of solenoid (2.06).
5. To add requirement covering position of cam release lever delay magnet (2.07).
6. To add requirement covering position of cam release actuating slider (2.08).
7. To add requirement covering position of motor-solenoid switch (2.09).
8. To add requirement covering position of cam release lever front stop (2.10).
9. To add requirement for release of metering roller cam (2.11).
10. To add requirement covering position of lamp switch (2.12).
11. To add requirement for sequence of operation of lamp and motor-solenoid switches (2.13).
12. To revise requirement covering relative position of solenoid, associated switches and shutter, and to designate this requirement, operation requirement (2.14).
13. To revise the list of tools, gauges, and materials (3.001).
14. To revise the procedure for removing and remounting image chamber (3.006).
15. To add procedure for lubricating the motor shaft bearing (3.02).
16. To revise the procedures for freedom of movement of solenoid and associated linkage (3.05).
17. To add procedure for positioning the solenoid (3.06).
18. To add procedures for positioning the cam release lever delay magnet, cam release actuating slider, motor-solenoid switch, and cam release lever stop (3.07-3.10).
19. To add procedure for release of metering roller cam (3.11).
20. To add procedure for positioning the lamp switch (3.12).
21. To add procedure for sequence of operation of lamp and motor-solenoid switches (3.13).
22. To revise the procedures for operation requirement [3.14(2)(a) and (f), (3)(c), (4)(a) and (b), and (6)(c)].
23. To revise procedure for control of solenoid operation [3.16(1) and (2)].
24. To revise information for analysis and correction of defects in photographs (4.01).

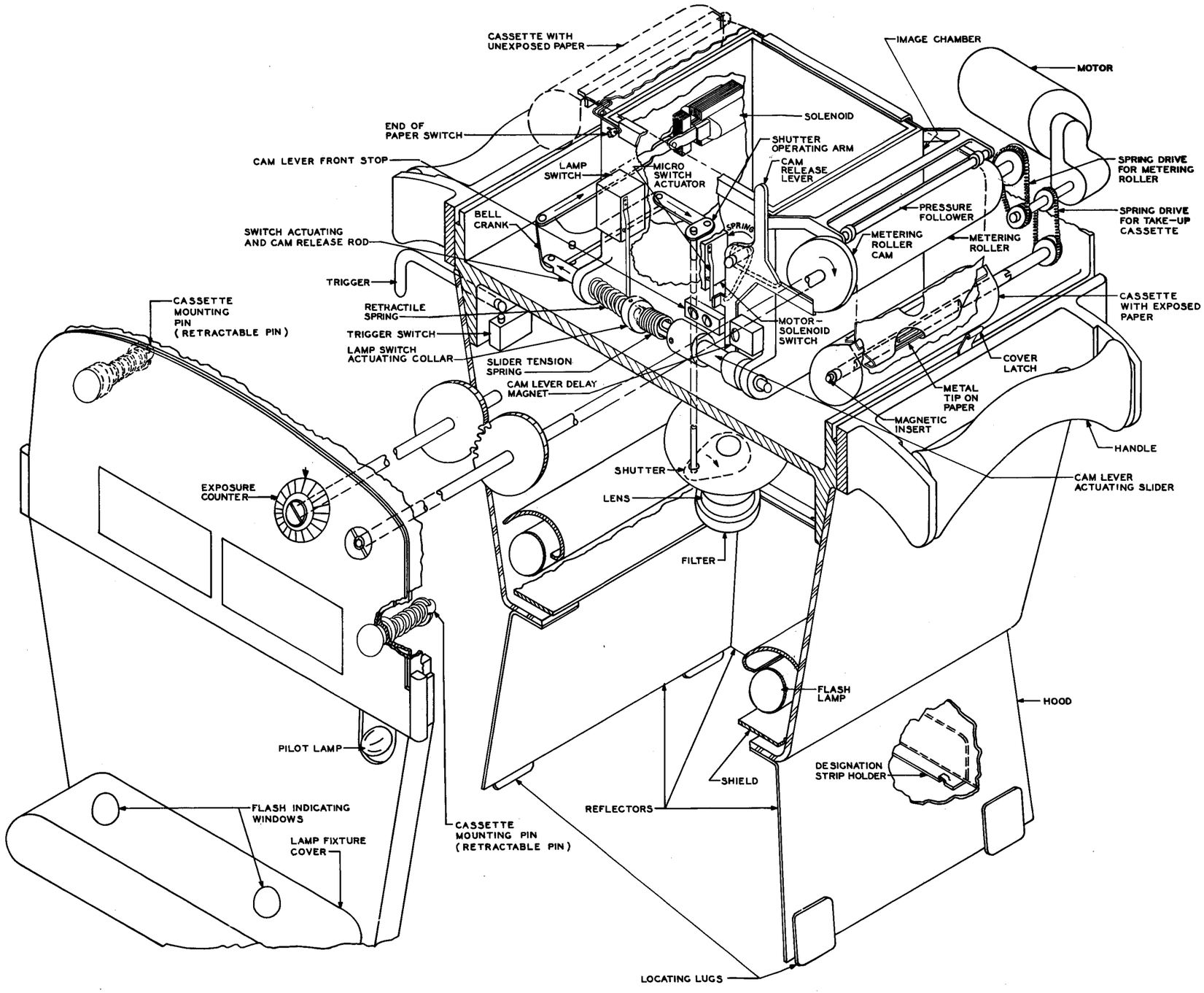
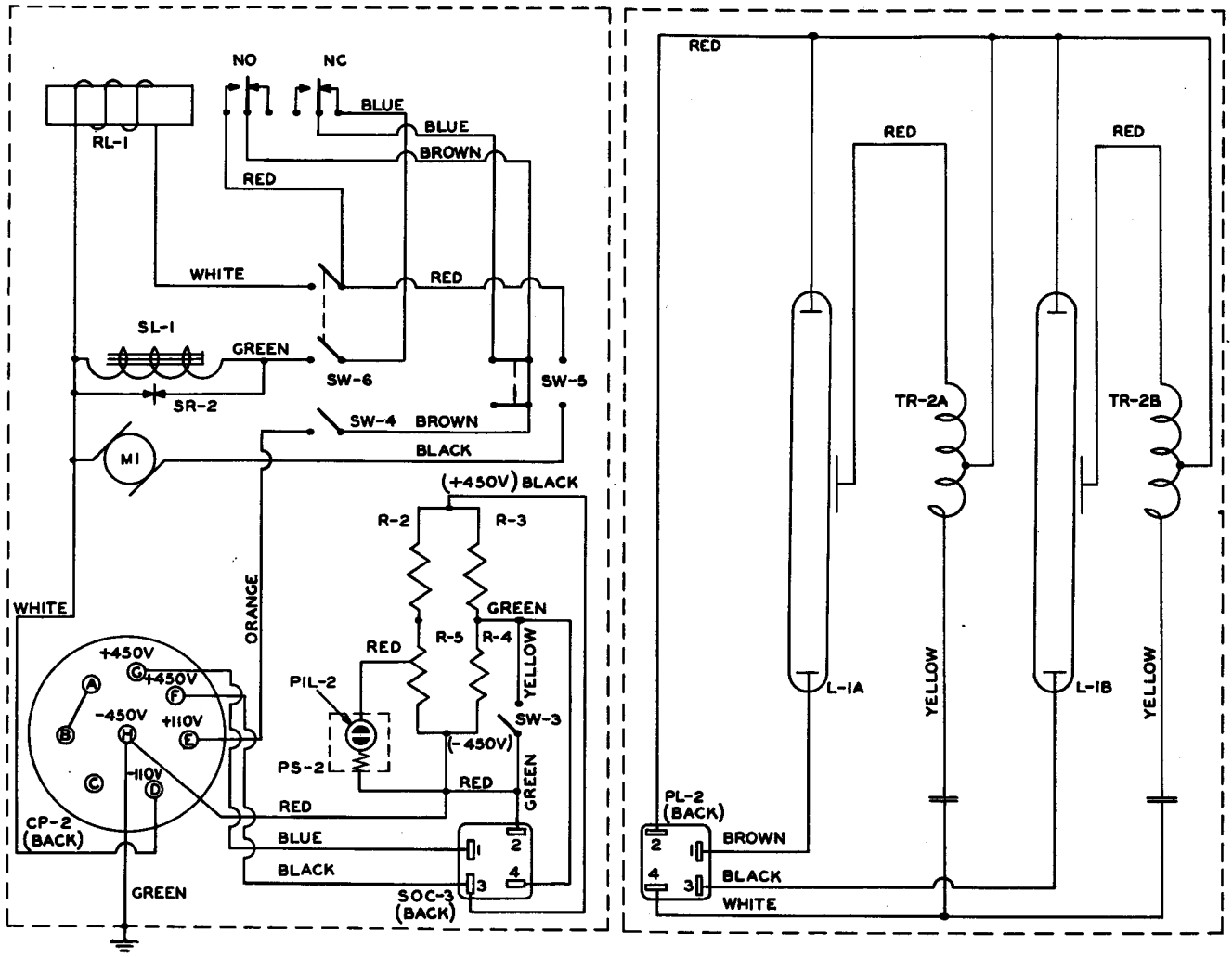


Fig. 7 – KS-14593 — Message Register Camera — Mechanical Schematic



SYMBOL	DESCRIPTION
M-1	MOTOR
SL-1	SOLENOID
SR-2	SELENIUM RECTIFIER (CONTACT PROTECTION)
SW-3	LAMP SWITCH
SW-4	END OF PAPER SWITCH
SW-5	MOTOR SOLENOID SWITCH
SW-6	TRIGGER SWITCH
RL-1	RELAY
R-2	1.5 MEGOHM RESISTOR
R-3	.51 MEGOHM RESISTOR
TR-2A	TRANSFORMER (LAMP TRIGGER COIL)

SYMBOL	DESCRIPTION
R-4	2.7 MEGOHM RESISTOR
R-5	0.5 MEGOHM RESISTOR
CP-2	CAMERA POWER CABLE
PIL-2	PILOT LAMP
PS-2	PILOT LAMP SOCKET
C-2A,2B	.22MFD CAPACITOR
SOC-3	LAMP CABLE SOCKET
PL-2	LAMP CABLE PLUG
L-1A	FLASH LAMP
L-1B	FLASH LAMP
TR-2B	TRANSFORMER (LAMP TRIGGER COIL)

Fig. 8 – KS-14593 — Message Register Camera — Circuit Diagram