D E P A R T M E N T O F T H E A R M Y T E C H N I C A L M A N U A L

TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

CAMERA, COPYING, MOBILE PROCESS

208-VOLT, 3 PHASE, 60 HERTZ

24 x 30 INCH

CONSOLIDATED INTERNATIONAL

MODEL 1969 NSN 3610-00-400-7588

MODEL 1969 NSN 3610-01-067-8926

This copy is a reprint which includes current pages from Changes 2 through 5.

H E A D Q U A R T E R S , D E P A R T M E N T O F T H E A R M Y

APRIL 1971

SAFETY PRECAUTIONS

Keep the arc lamp cables and the vacuum flexible hose on the skid of the camera to allow for walking clearance.

Always keep the camera rail free of tools and equipment to permit movement of copyboard and lensboard.

Disconnect the electrical plug from the transparency holder before reversing position of the copyboard.

Remove the crank handle from the camera immediately after raising the camera into the correct operating position.

Keep the lens capped or in the lens box when not in use. Avoid touching the surface of the lens.

After using the focusing glass and before attempting to close the vacuum back, return it to the open position.

Keep all accessory equipment beyond the swinging radius of the focusing glass and vacuum back.

Be sure that film or copy loaded on vacuum back, copyboard, or transparency holder is being held flat and centered.

Before transporting to a new location, be certain the external power supply cable is disconnected from copying camera.

Before moving the vacuum back, be sure that it is in operating position and that locking knobs are tight.

Do not leave old carbons inside arc lamp housing or ash tray. Shock to the operator or damage to the arc lamp may result if carbon stubs are left in the lower section of the chamber.

Avoid removal of carbons from arc lamp when hot or warm, as serious burns may result. Wait until carbons cool.

If carbons in arc lamps transmit excessive heat, check for deficiencies.

Continuous checking of the arc lamp carbons for dampness is necessary as dampness will cause overheating when in operation.

Avoid looking at arc lamp when lit, as serious damage to the eyes will result.

Changes in force: C2, C3, C4 and C5

CHANGE

No. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 December 1987

**Operator, Organizational, Direct Support and
General Support Maintenance Manual**

**CAMERA, COPYING, MOBILE PROCESS, 20 VOLT, 3 PHASE
60 HERTZ, 24 X 30 INCH, CONSOLIDATED INTERNATIONAL
MODEL 1969, NSN 3610-00-400-7588
MODEL 1969M, NSN 3610-01-067-8926**

TM 5-3610-220-14, 12 April 1971, is changed as follows:

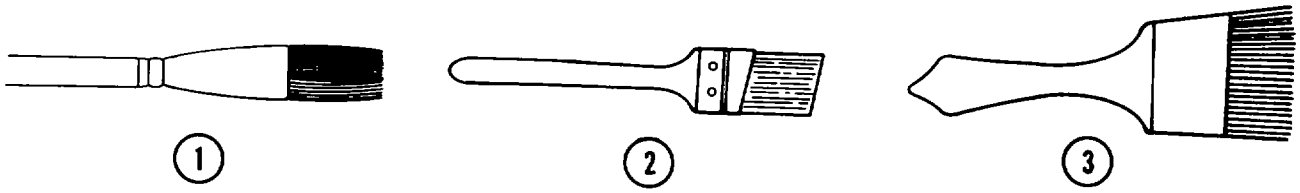
Page ii, Table of Contents. Appendix E title is changed to read "Expendable/Durable Supplies and Materials List."

Page 1-1, paragraph 1-1d. Lines 7 and 8 are changed to read "U.S. Army Troop Support Command, ATTN: AMSTR-MCTS."

Page 1-1, paragraph 1-2. Change "TM 38-750" to "DA PAM 738-750."

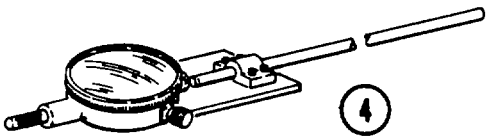
Page A-1, Appendix A. Paragraph A-3, change "TM 38-750" to "DA PAM 738-750."

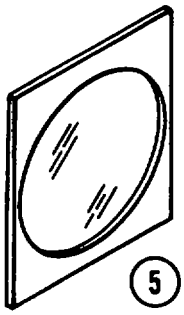
Appendix B, Section III is superseded as follows:

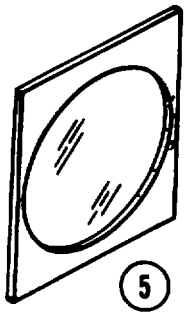


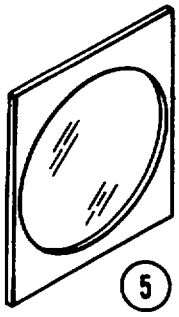
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
1	8020-00-619-8929	Brush, Artist's (06608) 13308-K	ea	2
2	7920-00-205-0565	Brush, Camel Hair	ea	1
3	7920-00-205-1427	Brush, Lens (19139) 149 9714	ea	1

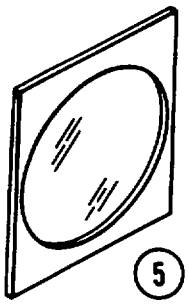
Section III BASIC ISSUE ITEMS - Cont

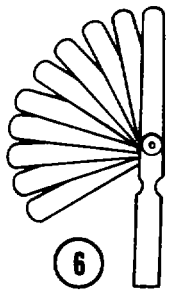






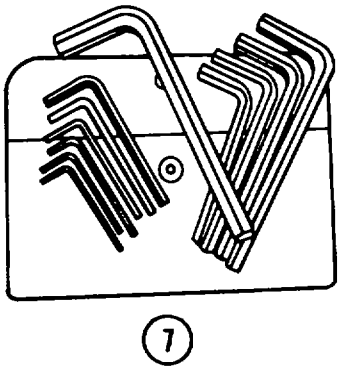


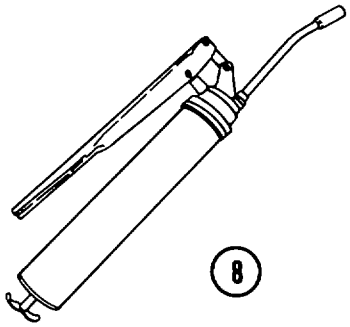


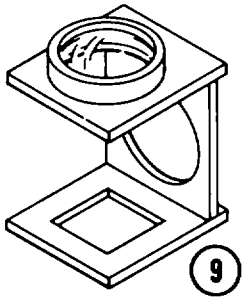


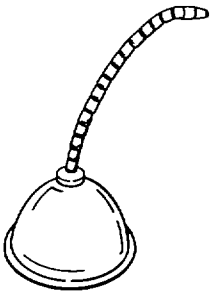
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
4	5210-01-044-0937	Dial Indicator and Trammel Assembly (83113) 2010-114	ea	1
5	6760-00-141-6764	Filter, Light, Photographic Lens: Blue (19139) 149 4368	ea	1
5	6760-00-141-6765	Filter, Light, Photographic Lens: Green (19139) 149 4442	ea	1
5	6760-00-286-8544	Filter, Light, Photographic Lens: Red (19139) 149 4178	ea	1
5	6760-00-141-6751	Filter, Light, Photographic Lens: Yellow (19139) 149 4061	ea	1
6		Gage, Gap Setting (55719) FB310B	ea	1

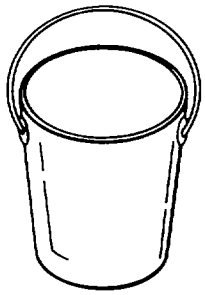
Section III BASIC ISSUE ITEMS - Cont

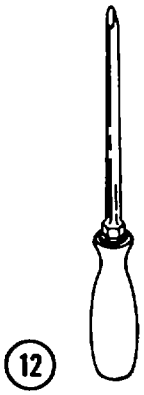






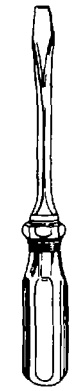


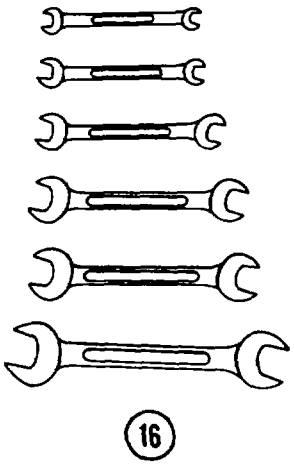




(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
7	5120-00-595-9244	Key Set, Socket Head Screw (70276) 84606	ea	1
8	4930-00-253-2478	Lubricating Gun (77335) 30-116	ea	1
9	6650-00-255-8268	Magnifier, Monocular (94480) 12-064-10	ea	2
10	4930-00-537-8977	Oiler, Hand (77335) 50-123	ea	1
11	7240-00-137-1608	Pail, Utility (19272) 4 gal.	ea	1
12	5120-00-234-8913	Screwdriver, Cross Tip, No. 2 (55719) SSDP42	ea	1

Section III BASIC ISSUE ITEMS - Cont





(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
13	5120-00-227-7356	Screwdriver, Flat Tip (55719) SSDE 66	ea	1
14	5120-00-227-7362	Screwdriver, Flat Tip (78525) 66-172	ea	1
15	5120-00-288-7803	Screwdriver, Flat Tip, Cabinet (96508) S3161	ea	1
16	5120-00-148-7918	Wrench Set, Open End, Fixed (81348) GGG-W-636	se	1

Appendix E. Title is changed to read "Expendable/Durable Supplies and Materials List."

Appendix E. Paragraph E-1 is superseded as follows:

E-1. SCOPE.

This appendix lists expendable/durable supplies and materials you will need to operate and maintain the Camera. This listing is for information purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (except Medical, Class V, Repair Parts and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-25A, Operator, Unit, Direct Support and General Support Maintenance requirements for Camera, Copying, Mobile Process, 208V, 60HZ, 3PH, 24 x 30-Inch, Model 1969.

Changes in force: C2, C3, and C4

CHANGE

NO. 4

HEADQUARTERS
DEPARTEMENT OF THE ARMY
WASHINGTON, D.C., 11 June 1982

Operator, Organizational, Direct Support and General Support Maintenance Manual CAMERA, COPYING, MOBILE PROCESS, 208 VOLT, 3 PHASE 60 HERTZ, 24 X 30 INCH, CONSOLIDATED INTERNATIONAL MODEL 1969, NSN 3610-00400-7588 MODEL 1969M, NSN 3610)14-067-8926

TM 5-3610-220-14, 12 April 1971, is changed as follows:

The title page and table of contents page are changed as shown above.

In the table of contents, in Chapter 4, after Section VII, add Section VII. 1 as follows:

Section VII.1. Maintenance of the Pulsed Xenon Lighting System. (Model 1969M).

In Chapter 6, after Section I, add Section I.1 as follows:

Section I.1. Vacuum Blower Assembly (Model 1969M).

Page iii. Add to List of Illustrations the following figures on the next line beneath each corresponding figure number.

Figure 1-1.1. Copying Camera, left side view (Model 1969M).
Figure 1-2.1. Copying Camera, right side view (Model 1969M).
Figure 1-7.1. Copying Camera, three quarter view from copyboard end (Model 1969M).
Figure 1-11.1. Copying Camera schematic wiring diagram (Model 1969M).
Figure 2-10.1. Nikor lenses in storage box (Model 1969M).
Figure 2-11.1 Nikor 19-inch lens, installed (Model 1969M).
Figure 2-11.2. Lamp control switch (Model 1969M).
Figure 4-6.1. Pulsed Xenon lighting system (Model 1969M).
Figure 4-7.1 Pulsed Xenon lighting unit (Model 1969M).
Figure 4-8.1. Lighting unit disassembly (Model 1969M).
Figure 4-9.1. Power supply assembly mounting brackets (Model 1969M).
Figure 4-10.1. Power supply assembly (Model 1969M).
Figure 4-11.1. Pulsed Xenon lighting system wiring diagram (Model 1969M).
Figure 6-2.1. Vacuum Blower Assy & Mounting Bracket (Model 1969M).
Figure 6-3.1.1 Vacuum Blower Assembly (Model 1969M).

Page 1-1. Chapter 1, Section I, General, is changed to read:

1-1. Scope.

This manual is for your use in operating and maintaining the copying camera, Consolidated International Model 1969 and Model 1969M. All information in this manual applies to both models except those items that are labeled Model 1969M.

1-2. Maintenance Forms and Records.
Maintenance forms and records that you are required to use are explained i- TM 38-750.

1-3. Destruction of Army Materiel to Prevent Enemy Use.

For instructions on the destruction of Army materiel to prevent enemy use refer to TM 750-244-3.

1-4. Administrative Storage.

For instructions on the administrative storage of equipment refer to TM 740-90-1.

Page 1-2. Add figure 1-1.1 and 1-2.1.

Page 16, Paragraph 18. After subparagraph i add subparagraph j as follows:

j. Pulsed Xenon Lighting System. The Lumax Model L1500L Pulsed Xenon Lighting System is comprised for four 1500 watt light units each with a 24 ft cable and one PS6-4UL power supply. The four light units are mounted on the copying camera, two on each side of the camera, and are supported by the camera arm assembly.

The Pulsed Xenon Light can be positioned to the correct distance and angle by adjusting the camera arm assembly and the light mounting yoke.

Page 1-6. After paragraph 1-3j add fig. 1-7.1, Copying Camera, three quarter view from copyboard end (Model 1969M).

Page 1-11. After figure 1-11, add figure 1-11.1, Copying Camera schematic wiring diagram.

Page 2-14. After paragraph 2-36,add paragraph 2-36.1 as follows:

2-36.1. Lamp Control Switch (Model 1969M).

A two-position toggle switch is located on standard in the gallery. It is used to operate the lamps either manually or automatically with the light exposure unit. The two positions operate as follows:

a. Manual position (toggle switch in up position). Allows operator to turn camera lamps on and off manually using the camera manual switches.

b. Automatic position (toggle switch in down position). Allows operator to turn camera lamps on and off automatically through the light exposure unit.

Page 4-17. In Chapter 4, after Section VII, add Section VII.1 as follows:

Section VII.1. MAINTENANCE OF THE PULSED XENON LIGHTING SYSTEM (MODEL 1969M)

4-31.1. Description.

On all 1969M models of the copying camera the copyboard is illuminated by four Pulsed Xenon light units which give a maximum area of uniform lighting. The pulsed xenon lights (1, fig. 4-6.1) are mounted on a mounting rod (3) which is fastened to the camera arm assembly (2). Each light unit is connected to the power supply assembly.

The Pulsed Xenon Light can be positioned to the correct distance and angle by adjusting the camera arm assembly and the light mounting yoke.

4-31.2. Xenon Pulsed Lamp.

a. Description. The Xenon pulsed lamp is a xenon gas filled 12-inch glass tube which is illuminated by a pulsed electrical current. Each lamp, Luma Model T12L1500, is 1500 watts. Both ends of the glass tube lamp are fitted with metal caps. The lamp clips into retainer clips in the xenon light housing.

b. Removal.

(1) Rotate light unit by loosening yoke knob (1, fig. 4-7.1) on light head; turn light head so that glass front is facing up. Tighten yoke knob.

(2) Remove screws (2) from four glass clips (3) and remove glass cover (4). Lift glass out.

(3) Remove lamp tube (5) by first disconnecting AMP connectors at each end of tube. Gently pry tube from retainer clips (6) and remove.

CAUTION

Avoid touching lamp tube as much as possible. Grease or dirt on surface of tube decreases the life span of the lamp. Wear white gloves when handling lamp.

CAUTION

Do not twist tube or it will break.

c. Installation.

(1) Install new tube by gently pushing each end of the tube into its retainer clip (6).

(2) Turn the tube (5) so that the tit in the center of the tube points in the opposite direction of the ceramic feedthru (2, fig. 4-8.1).

(3) Connect AMP connectors to the terminal.

(4) Install glass cover (4) and secure with retainer clips (3) and screws (2).

4-31.3. Ceramic Feedthru.

a. Description. The ceramic feedthru (2, fig. 48.1) is a small ceramic cylinder with a metal contact point in the center. The metal point makes contact with the glass side of the xenon tube lamp and lights the gas in the tube. Striking voltage is fed through the ceramic feedthru causing the pulsed effect.

b. Cleaning.

(1) Remove the lamp tube as instructed in paragraph 4-31.2 above.

(2) Lift out reflector (1) from the light unit housing (14).

CAUTION
Remove reflector with care; it blends very easily causing damage.

(3) Moisten a tissue (or cotton ball) with alcohol, and clean the surface of the ceramic feedthru on both sides of reflector.

c. Removal

WARNING
Make certain that Light Unit is disconnected from Power Supply before beginning ceramic feedthru replacement.

(1) Remove glass cover and lamp tube as instructed in paragraph 4-31.2 above.

(2) Remove reflector. (See b. above.)

(3) Unsolder wire going to ceramic feedthru (2, fig. 4-8.1) on the rear of the reflector.

(4) Use retainer ring pliers to remove retainer ring on rear-side of reflector, and slide ceramic feedthru (2) out of reflector (1).

d. Installation.

NOTE
Do not change position of clip ring on new ceramic feedthru, part No. A45W6. The position of the retainer ring is factory set.

(1) Insert new ceramic feedthru (2) from front of the reflector (1) so that the screw head is on the front side of the reflector.

(2) Install retainer ring over side "A" of ceramic feedthru. Place retainer ring as close against reflector as possible, using retainer ring.

(3) Loop wire, that was unsoldered in subparagraph c (3), through new solder lug. Close wire loop around solder lug so that wire is mechanically secure, and solder wire to the solder.

(4) Reinstall lamp tube and glass cover as instructed in paragraph 4-31.2.

(5) Connect the light unit to the Power Supply, and check for proper operation.

4-31.4. Pulse Transformer (T1201)

a. Removal

(1) Remove glass cover and lift out reflector from light unit housing. (See para 4-31.2.)

(2) Remove nut (4), fig. 4-8.1 and screw (5) from transformer retainer clip (6) and remove retainer.

(3) Disconnect wiring to transformer (3) and remove pulse transformer.

b. Installation.

(1) Place transformer (3) in position and connect wiring.

(2) Install transformer in retainer clip (6) and secure with screws (5) and nut (4).

4-31.5. Discharge Capacitor.

a. Removal

(1) Remove two nuts (7, fig. 4-8.1) and screws (8) that secure the capacitor and terminal strip (9) to the reflector (1).

(2) Disconnect wiring from capacitor and remove capacitor (9).

b. Installation

(1) Position capacitor (9) on the back side of reflector (1) and connect wiring.

(2) Secure capacitor (7) and terminal strip with two screws (8) and nuts (7) to the back side of the reflector (1).

4-31.6. Fan Motor.

a. Removal

(1) Remove glass cover and lift reflector from the light unit housing, paragraph 4-31.3.

(2) Remove screw that secures the rear fan mounting bracket (11, fig. 4-8.1) to the light unit housing (14).

(3) Unscrew two screws (10) that secure the rear bracket (11) to the fan motor (13). Remove the rear bracket (11).

(4) Loosen screw that secures wire to terminal strip. Tag and disconnect wires.

(5) Remove the fan motor (13) from the front fan mounting bracket by inserting a screwdriver through the fan guard and unscrew two screws (12) that secure fan to front mounting bracket (16).

(6) Remove the fan motor (13) with fan blades attached.

b. Installation.

(1) Position fan motor (13) on front mounting bracket (15) and line up mounting holes in fan motor to holes in mounting bracket. Secure fan motor to bracket with two screws (12).

(2) Connect wires to terminal strip.

(3) Place rear mounting bracket (11) in position and secure to fan motor (13) with two screws (10).

(4) Install mounting screw that secures mounting bracket (11) to light unit housing (14).

(5) Install glass cover and reflector per paragraph 4-31.3.

4-31.7. Power Supply Assembly.

WARNING

The Power Supply is connected to two (2) power circuits. Make sure both supply circuits are disconnected before servicing.

a. Description. The PS6-4UL power supply assembly supplies the power for the Pulsed Xenon Lighting System. It is equipped with four 1500 watt outlets, one for each light unit. The power supply assembly operates from a 220-240 volt single phase power line.

b. Removal.

(1) Remove four screws (1, fig. 4-9.1), washers (2), lock washers (3), and nuts (4) that secure the hold down bracket (5) to the Power Supply Assembly mounting bracket (6).

(2) Remove the hold down bracket (5).

(3) Disconnect the power supply and control wiring.

(4) Disconnect the four light unit connection lines.

(5) Remove the Power Supply Assembly.

c. Installation

(1) Place the Power Supply Assembly on to the mounting bracket (6).

(2) Connect the power supply and control wiring.

(3) Install the hold down bracket (5) and secure with four screws (1), washers (2), lock washers (3) and nuts (4) to the Power Supply Assembly Mounting bracket (6).

d. Power Supply Assembly Repair. To make repairs and replacements to the Power Supply Assemblies components, first remove the Power Supply Assembly Cover (7), by removing five screws on top side of cover and five on bottom side.

e. Circuit Board (Figure 4-10.1).

(1) Removal.

(a) Identify the bad circuit board by tracking back to connector.

(b) Remove four wires connected at the bottom of the circuit board, by rocking and pulling gently with needle nose pliers. Pull only on insulated barrel of connector. Do not force.

(c) Tag wires noting color and order for reassembly.

(d) Remove the two screws, nuts and washers ( ) from bottom of Power Supply that hold circuit board in place. Remove circuit board.

(2) Installation.

(a) Mount circuit board into Power Supply and secure with two screws. Make certain screws are firmly seated.

(b) Connect circuit board wires, noting wire colors and order as tagged at disassembly.

CAUTION

Do not adjust Trimpot on circuit board. Circuit board has been preset at the factory.

(c) Replace the fuse corresponding to the replaced circuit board.

f. 115 volt Relay (PR7A60) (Figure 4-10.1).

(1) Removal.

(a) Remove two screws, nuts and lock washers that secure the relay to the Power Supply Assembly housing.

(b) Disconnect wiring to the relay.

(c) Tag wires noting color and order for reassembly.

(d) Remove relay.

(2) Installation.

(a) Install relay in position in Power Supply and secure with two screws, washers and nuts.

(b) Connect wires, noting wire color and order as tagged at disassembly.

g. 230 Volt Relay (8502-SBO2-24017 (Figure 4-10.1).

(1) Removal

(a) Remove two screws, nuts and washers that secure the relay to the Power Supply housing.

(b) Tag wires noting color and order for reassembly and disconnect wires.

(c) Remove the relay from the Power Supply Assembly.

(2) Installation.

(a) Install relay in position in Power Supply and secure with two screws, washers, and nuts.

(b) Connect wires, noting wire color and order as tagged at disassembly.

h. Autotransformer Assembly (A3942-1).

(1) Removal

(a) Tag wires noting color and order for reassembly and disconnect wires.

(b) Remove four screws, lockwashers and nuts and remove the Autotransformer.

(2) Installation.

(a) Place Autotransformer in position and secure with four screws, lockwashers and nuts.

(b) Connect wires, noting wire color and order as tagged.

i. 7 Amp Choke (A3750 Rev. 8).

(1) Removal. Remove the four chokes as follows.

(a) Tag wiring noting color and order for reassembly and disconnect wiring.

(b) Remove four screws, lockwashers and nuts that secures the choke to the Power Supply housing and remove the choke.

(2) Installation. Install the four chokes as follows:

(a) Place the choke in position and secure to Power Supply housing with four mounting screws, nuts and washers.

(b) Connect wiring, noting wire color and order as tagged at disassembly.

j. Capacitor (PW951-5216). Refer to fig. 4-10.1. Remove and install the four capacitors as follows.

(1) Removal.

(a) Tag the four wire leads and disconnect.

(b) Remove two screws, lockwashers and nuts. Remove the main capacitor support bracket.

(c) Remove one screw, lockwasher and nut. Remove clip.

(d) Remove two screws, lockwashers and nuts and remove mounting clamp.

(e) Remove the capacitor from the Power Supply.

(2) Installation.

(a) Place capacitor in position with main support bracket in place. Secure support bracket to Power Supply Housing with two screws, nuts and lockwashers.

(b) Install the mounting clamp and secure with two screws, nuts and lockwashers.

(c) Install the clip and secure with screw, nut and lockwasher.

(d) Connect wiring noting wire color and order as tagged.

k. Receptacles (MS3102A-18-11S-639).

(1) Removal

(a) Remove two screws, lockwashers and nuts.

(b) Remove retainer.

(c) Pull the five pin female connector from the receptacle housing.

(d) Remove housing.

(2) Installation.

(a) Install the five pin female connector into the receptacle housing.

(b) Install retainer.

(c) Secure receptacle with two screws, nuts and lockwashers.

l. Timer Receptacle (5278).

(1) Removal.

(a) Tag and disconnect wiring.

(b) Remove two screws, nuts and lockwashers and remove receptacle.

(2) Installation.

(a) Place receptacle in position and secure with two screws, nuts and lockwashers.

(b) Connect wiring noting wire color and order as tagged.

m. Fan Motor (3-90-8184).

(1) Removal.

(a) Tag and disconnect wiring.

(b) Remove the fan motor by inserting a screwdriver through the fan guard and unscrew the two screws that secure the fan motor to the front mounting bracket.

(c) Remove the fan motor with the fan blades attached.

(2) Installation.

(a) Install the fan motor in position on the front mounting bracket and line up mounting holes in fan motor to those in the mounting bracket. Secure fan motor to bracket with two screws.

(b) Connect wires, noting wire color and order as tagged at disassembly.

Page 6-1. Chapter 6, after Section I, add Section I. 1 as follows:

Section I. 1. VACUUM BLOWER ASSEMBLY (MODEL 1969M)

6-4.1. Description.

Two vacuum blower Assemblies, Spencer Model VB-007S-D, are mounted side by side at the copyboard end of the camera. One vacuum blower assembly provides suction at the copyboard and the other provides suction at the vacuum back. The inlet of the blower assembly is connected to the copyboard by a flexible hose thus forcing all intaken air to be drawn through the copyboard. The other assembly is similarly connected to the vacuum back of the camera.

6-4.2. Removal.

a. Remove four mounting bolts (1, fig. 6-2.1) flatwashers (2), and lock washers (3), that secure the blower to the camera base.

b. Disconnect electrical power line (5).

(1) Remove screw (6) from motor junction box (7).

(2) Tag wires noting order for reassembly.

(3) Remove four wire screws and disconnect wires.

c. Disconnect conduit nut and remove conduit and wiring from motor.

d. Remove vacuum hose (10).

(1) Loosen clamp screw (8) and remove clamp (9).

(2) Pull hose free from blower.

e. Remove the blower assembly from the camera.

6-4.3. Disassembly.

CAUTION

Remove the stator assembly with care. Do not damage stator winding. Keep all parts clean. Do not overtighten bolts and screws.

NOTE

Shims are used to adjust the gap between the impeller and casing when disassembling, take care to note the quantity and location of each shim as they must be replaced in the same position to insure proper balance.

a. Remove four bolts (1, fig. 6-3.1) and spring washer (2) from the casting (12) and base (3). Remove the base (3).

b. Remove five bolts (4) and spring washer (5). Remove the side cover (6).

c. Remove two bolts (7) and lock washer (8). Remove guard plate (9). Remove impeller (10).

d. Remove four bolts (11) and spring washer (12). Remove casing (13) from bracket (27).

e. Remove two bolts (14) and washers (15) that secure bracket (27) to bearing over (29). Remove nut (16) and washer (17) from bearing cover stud.

f. Remove three bolts (18) and washers (19) that secure the bracket (27) to the Stator Assembly (26).

g. Remove three bolts (20) from the end cover (21) and remove the end cover.

h. Remove one bolt (22) from the outer fan and remove the outer fan (23).

i. Remove three bolts (24) from the outer cover (25), Stator Assembly (26) and bracket (27). Remove bracket (27) and outer cover (25) from Stator Assembly (26).

j. Remove shaft assembly (28) from stator housing. Remove key (29) from stator. Remove packing (30), shim (31), bearing (32) and bearing cover (33) from shaft (28). Remove bearing (34) from stator.

k. Remove one screw (35) from capacitor cover (36) and remove capacitor cover.

l Disconnect wiring and remove capacitors (37) from Stator Assembly.

m. Remove filter (44) and wire net (45) from Base (3).

6-4.4. Reassembly.

Reassembly the vacuum blower assembly in the reverse order of disassembly. Be sure to follow the CAUTION and NOTE instructions when reassembling the blower assembly.

Page 5-1. Chapter 5, Section I, General, is changed as follows:

5-1. General.

Instructions in this section and in succeeding sections of this chapter are published for the use of maintenance personnel responsible for direct support and general support maintenance of the copying camera. They contain information on maintenance which is beyond the scope of the tools, equipment, or supplies normally available to using organizations.

Pages 5-1 and 5-2. Chapter 5, Section II, Table 5-1, Troubleshooting, is changed as follows:

Table 5-1. Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. Vacuum back fails to hold film properly.	a. Improper selection of vacuum back valve ports.	a. Measure size of film and move valve handle to a position best suited to hold film on vacuum back.
	b. Opening in vacuum flexible hose.	b. Remove hose clamps at the vacuum back valve housing and suction pipe on camera skid, and remove flexible hose If opening in hose is comparatively small, make a temporary repair with electrical tape.
	c. Vacuum turbo-compressor defective.	c. Replace defective parts of vacuum turbo-compressor assembly (para 6-2) or vacuum turbo-compressor motor (para 6-6). Replace entire unit if necessary.

Table 5-1. Troubleshooting - Continued

Malfunction	Probable Cause	Corrective Action
2. Copyboard fails to hold copy properly,	a. Copyboard suction not directed properly.	a. Measure size of copy and turn operating knob to the correct position.
	b. Operating gate out of line.	b. Align operating gate on operating shaft (para 6-16. a.).
	c. Diverter valve plate not in closed position.	c. Diverter valve plate is in open position, permitting suction to the transparency holder and thereby lessening the vacuum to the copyboard. Push the diverter knob completely in.
	d. Clogged suction hole in copyboard.	d. Foreign matter in holes of copyboard causes an unequal distribution of suction. Remove copyboard front plate and clean (para 6-14. b.).
	e. Vacuum turbo-compressor defective.	e. Replace defective parts of vacuum turbo-compressor assembly (para6-2) or vacuum turbo-compressor motor (para 6-6). Replace entire unit if necessary.
3. Arc lamp flickers.	a. Gap between carbons too great to provide consistent lighting.	a. Adjust carbons (para 4-27.s.).
	b. Drafty conditions around operating location.	b. Eliminate all drafts around working area of cameras.
	c. Carbons of different lengths in holders.	c. Substitute carbons of same length or replace with new carbons (para 4-27. a.).
	d. Contacts in magnetic contactor not making proper contact.	d. Smooth badly pitted or burned contacts with a fine file (para 6-36). Replace defective parts (para6-360 if necessary.
	e. Defective sensing device.	e. If one lamp does not flicker, switch the cables from the operating lamp sensing device to suspected sensing device. If the lamp which did not flicker now does, replace the defective sensing device (para 6-37).

Table 5-1. Troubleshooting - Continued

Malfunction	Probable Cause	Corrective Action
4. Pulsed Xenon Light Unit IL1500L).		
	NOTE **Before assuming that a light unit or a power supply channel is out verify the condition by making sure that the suspect light does not work on any outlet If an outlet is suspect, check that no light unit works on that outlet If an outlet is bad, the power supply must be referred to high echelon for repair, since it does not contain any user serviceable parts.**	
	WARNING **Before beginning a tube replacement, make sure that the light unit is not connected to the power supply.**	
a. No light, fan runs normally.	a. Tube failure.	a. Replace tube.
	b. High voltage breakdown.	b. Refer to service technician.
	c. Trigger circuit failure.	c. Refer to service technician.
	d. Thermal safety circuit open.	d. Refer to service technician.
	e. Cover glass safety circuit open.	e. Unit MUST have cover glass, with safety pin place, to operate. Check that cover glass has safety pin epoxied to one edge. If pin is broken off, refer to factory. Pin must align with hole in flange for proper operation of safety circuit. When installing cover glass a "click" should be heard when safety switch is closed. Fasten cover glass in place with glass clip and screws.
b. Light stutters at start of exposure.	a, b, or c above.	a, b, or c above.
c. Light starts okay after 1 to 5 second delay.	a, b, or c above.	a, b, or c above.
	WARNING **Disconnect light unit form power supply before removing cover glass, or before servicing light unit in any way.**	

Table 5-1. Troubleshooting - Continued

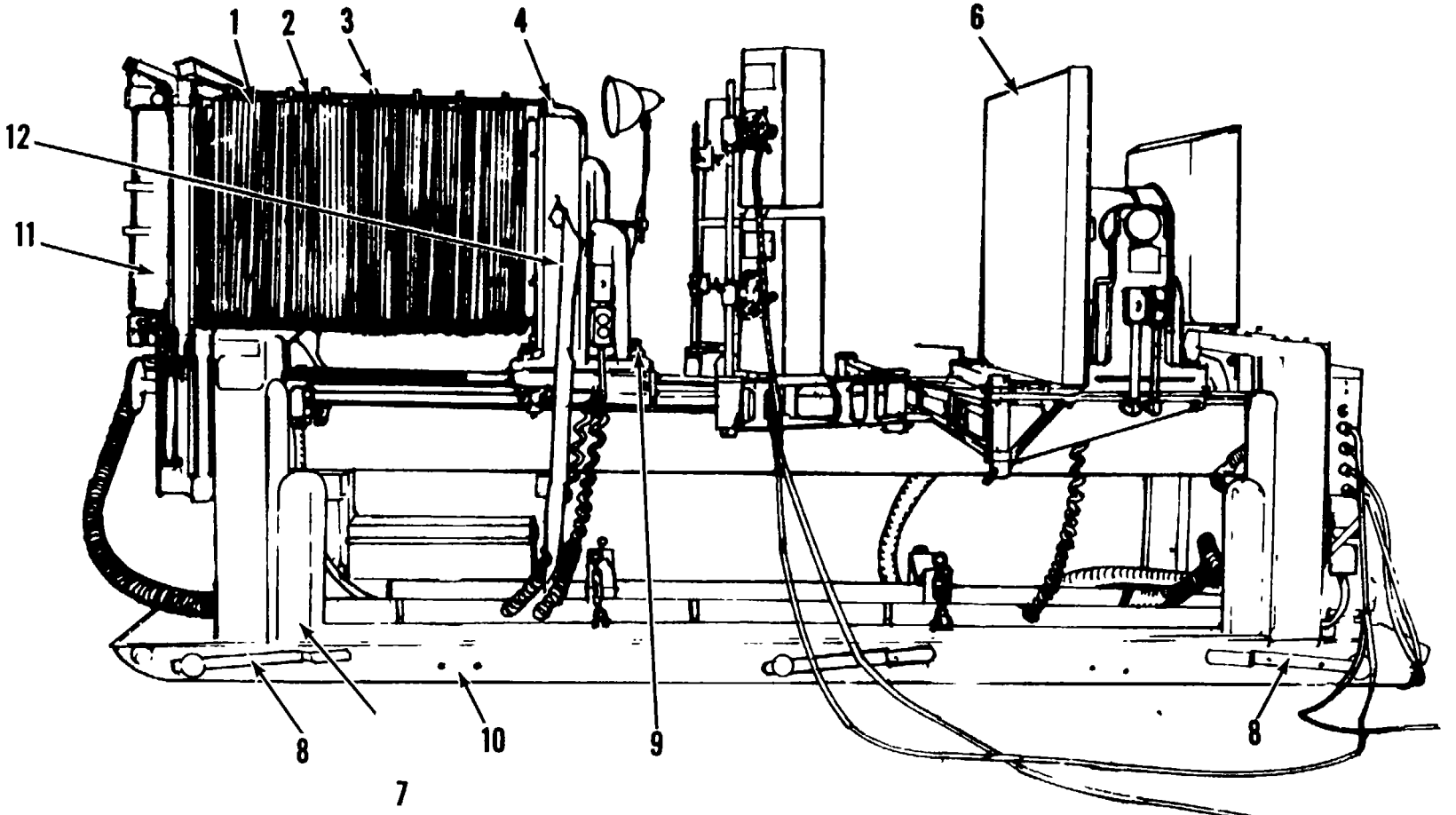
Malfunction	Probable Cause	Corrective Action
d. No light, fan runs normally. Buzzing sound is present.	a. Tube failure.	a. Replace tube
	b. High voltage breakdown.	b. Remove cover glass, disconnect one end of lamp, and insulate lamp-lead with tape Replace cover glass and dim room lights. Power-up this light unit only and look into lamp through fan hole for any visible arcing. If any is present, open unit up and improve spacing or repair broken insulation as required. (Consult factory)
e. No light, no fan, no buzzing sound.	Fan blocked, which caused thermal fuse to blow, or fan motor winding open.	Verify that fan turns freely by hand, and check continuity of fan motor. Winding should be 120 ± 20%.
f. Light unit blows fuse in power supply on a known "good" channel outlet.	Short in cable, connector or light unit.	Perform ohmeter check on cable connector pins as follows. PIN A - Lamp should be open to all other pins. PIN B - Common should read 120 to Pin C (fan) and 1 megohm to Pin D (trigger). PIN C - Fan should read 120 to Pin B, and 1 megohm to Pin D. PIN D - Trigger should read 1 megohm to Pin B and C. PIN E - Ground should read open to all pins.
5. Power Supply PS6-4.	**WARNING** **The power supply is connected to two (2) power circuits. Be absolutely sure the BOTH supply circuits are disconnected before servicing the power supply.**	
a. Outlet dead. Light unit does not produce light, and fan does not run when light unit is plugged.	a. Fuse blown due to circuit.	a. Replace circuit board and fuses. (Spare parts kit #A4368.)
	b. Fuse blown due to main capacitor short.	b. Disconnect one side of capacitor from circuit, and measure across capacitor with ohmeter. Meter should read open circuit after 5 seconds charge time (either direction).

Table 5-1. Troubleshooting - Continued

Malfunction	Probable Cause	Corrective Action
	c. Fuse blown due to ground fault.	c. Disconnect main power plug. Replace any blown fuses in power supply. Measure resistance from either side of power line to chassi. Meter should read open circuit. If low resistance is read, one of the four chokes, or the tap transformer, are usually at fault, and can often be repaired. Consult factory.
	d. Fuse blown due to trimpot on circuit board being improperly adjusted by unauthorized personnel.	d. Readjust trimpot as follows: ONLY if you are SURE someone has changed the trimpot setting, Turn trimpot fully clockwise, then back counterclockwise 55. This should be close enough for normal operation. (60HZ, LUMAX ONLY.)
	e. Fuse blown due to loose fuse clip.	e. A loose fuse clip will overheat fuse, causing fuse to blow. Check clip for tight fit on fuse.
6 Outlet dead, but fan in light unit runs when plugged in.	Component failure on circuit board.	Replace circuit board and fuses. (Spare parts kit #A4368.)
7. Image distortion.	a. Copyboard not aligned with focusing glass.	a. Trammel four corners of copyboard with focusing glass for correct alignment of components. Check that focusing glass frame is firmly contacting at magnetic latches on both sides of frame.
	b. Lens not positioned correctly.	b. Check the lensboard counter readings. Determine if lens is screwed m the lens plate.
	c. Copy not placed on copyboard properly.	c. Remove copy and remount on copyboard, smoothing out wrinkles and folds.
	d. Lensboard or copyboard positioning counters not calibrated to lens.	d. Recalibrate camera to lens (para 5-5).

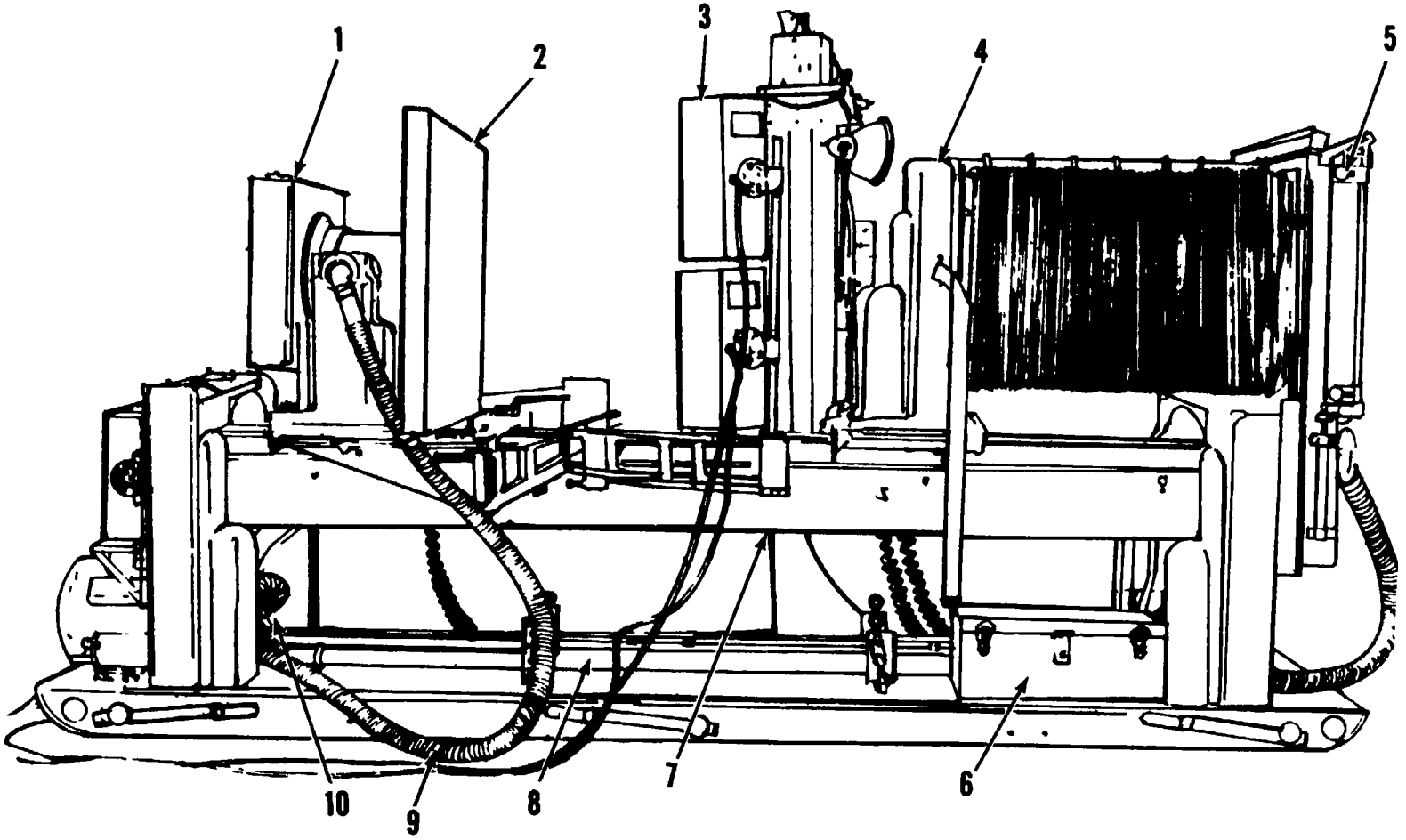
Table 5-1. Troubleshooting - Continued

Malfunction	Probable Cause	Corrective Action
	e. Distance of lensboard not related to same reduction ratio.	e. Recheck the focusing chart for correct lensboard and copyboard distance.
	f. Thick copy.	f. If copy has appreciable thickness, its thickness must be added to the copyboard counter readings in units of 1/100 inch.
8. Vibration or excessive noise during operation.	a. Impeller plates in vacuum turbo-compressor not positioned properly.	
	b. Dry oil felt wipers causing lensboard or copyboard to vibrate while under power.	b. Apply oil to wipers. Let the oil penetrate thoroughly before resuming operation.
	c. Compressor fan in turbo-compressor motor rubbing against rear end frame.	c. Align compressor fan on motor shaft (para 6-8.a.).
	d. Dry or burned-out bearings in turbo-compressor motors or drive motors.	d. Replace defective bearings with new ones (para 6-8 a. and 6-12.a.)
	e. Loose mounting hardware.	e. Locate loose hardware and tighten.
	f. Gear meshing.	f. Vibration or noise will result if drive gears are not fully meshed. If gears are dry, apply sufficient grease, or if foreign matter is impacted between the teeth, clean thoroughly, or if a tooth is damaged, dress off or replace gear (para 6-32.a.).



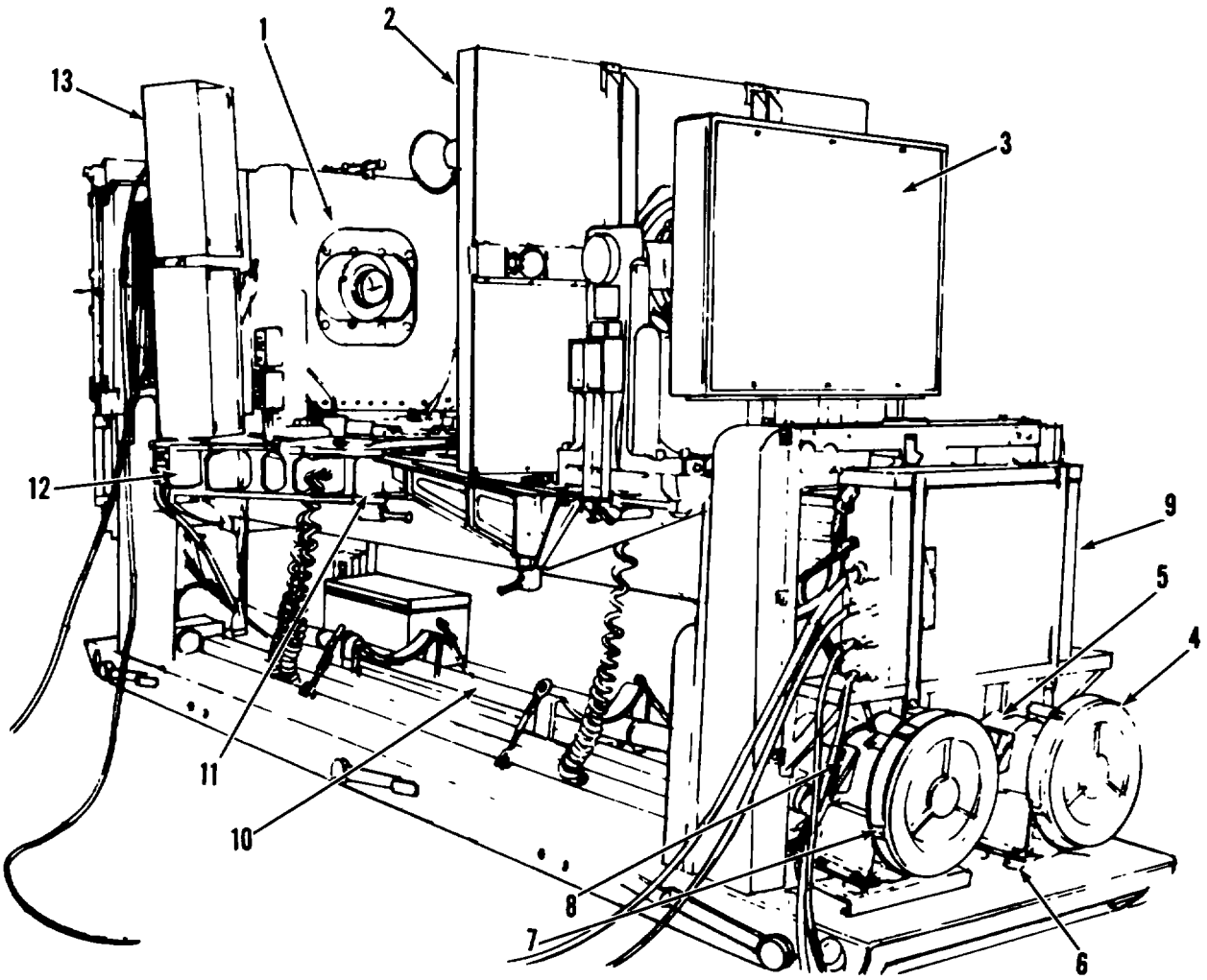
1 Bellows assembly
2. Tube support assembly
3. Roller carriers
4. Lensboard
5. Camera rail
6. Copyboard
7. Truss support assembly
8. Lift handle
9 Limit switch
10 Camera skid
11. Camera back
12 Bellows strap

Figure 1-1.1 Copying Camera, left side view (Model 1969M).



1. Transparency holder
2. Copyboard
3. Pulsed Xenon lighting unit
4. Lensboard
5. Camera back
6. Tool box
7. Camera tube
8. Vacuum tube
9. Copyboard flexible hose
10. Vacuum back flexible hose

Figure 1-2.1 Copying Camera, right side view (Model 1969M).



1. Lensboard
2. Copyboard
3. Transparency holder
4. Vacuum Blower Assembly (Vacuum back)
5. Vacuum Blower Motor (Vacuum back)
6. Vibrator mount
7. Copyboard Vacuum Blower Assembly
8. Copyboard Vacuum blower Motor
9. Power supply (Pulsed Xenon lights)
10. Vacuum Suction Pipe
11. Center arm assembly
12. Free-end arm bracket
13. Pulsed Xenon lighting unit

Figure 1-7.1 Copying Camera, three quarter view from copyboard end (Model 1969M).

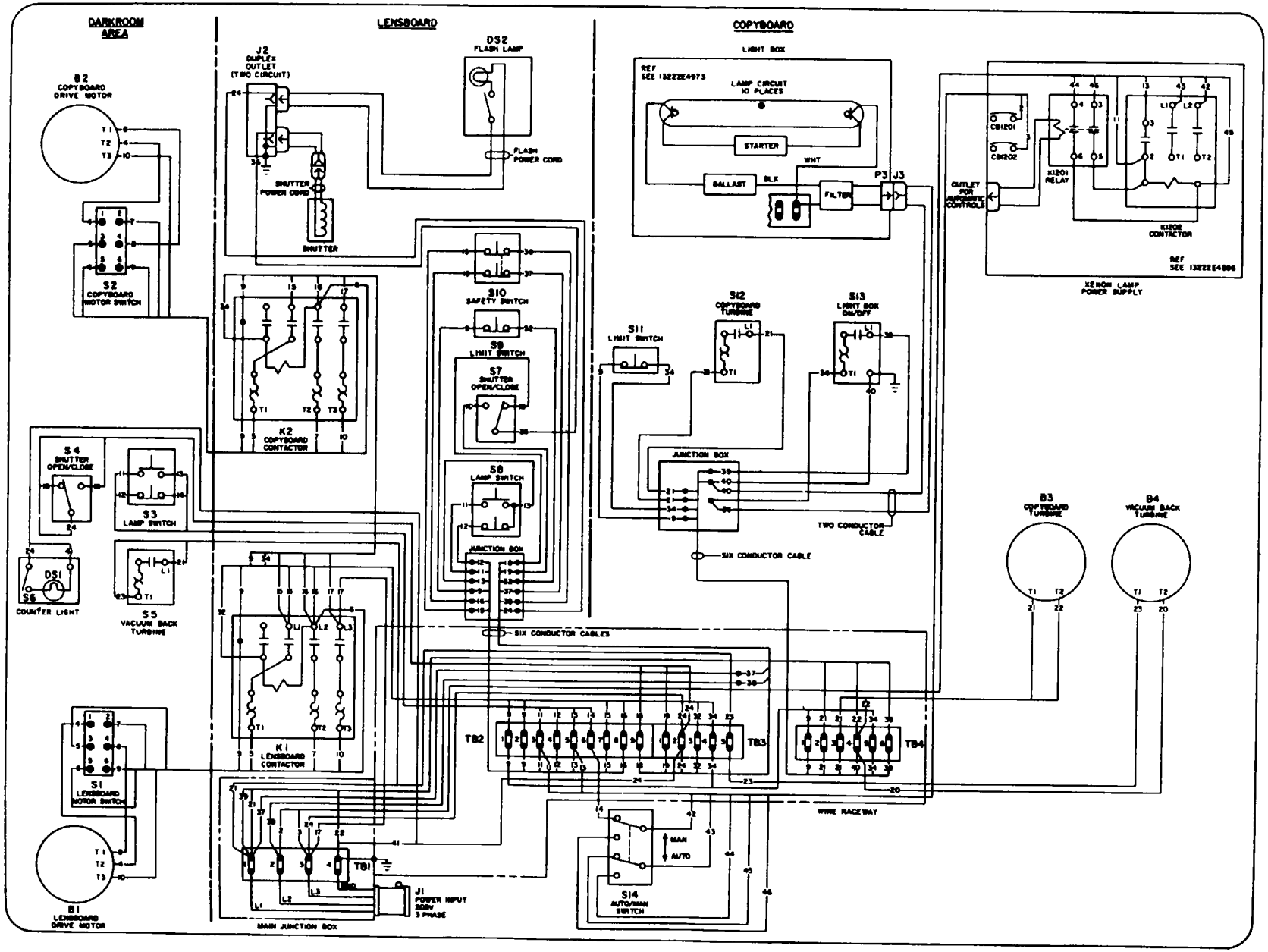
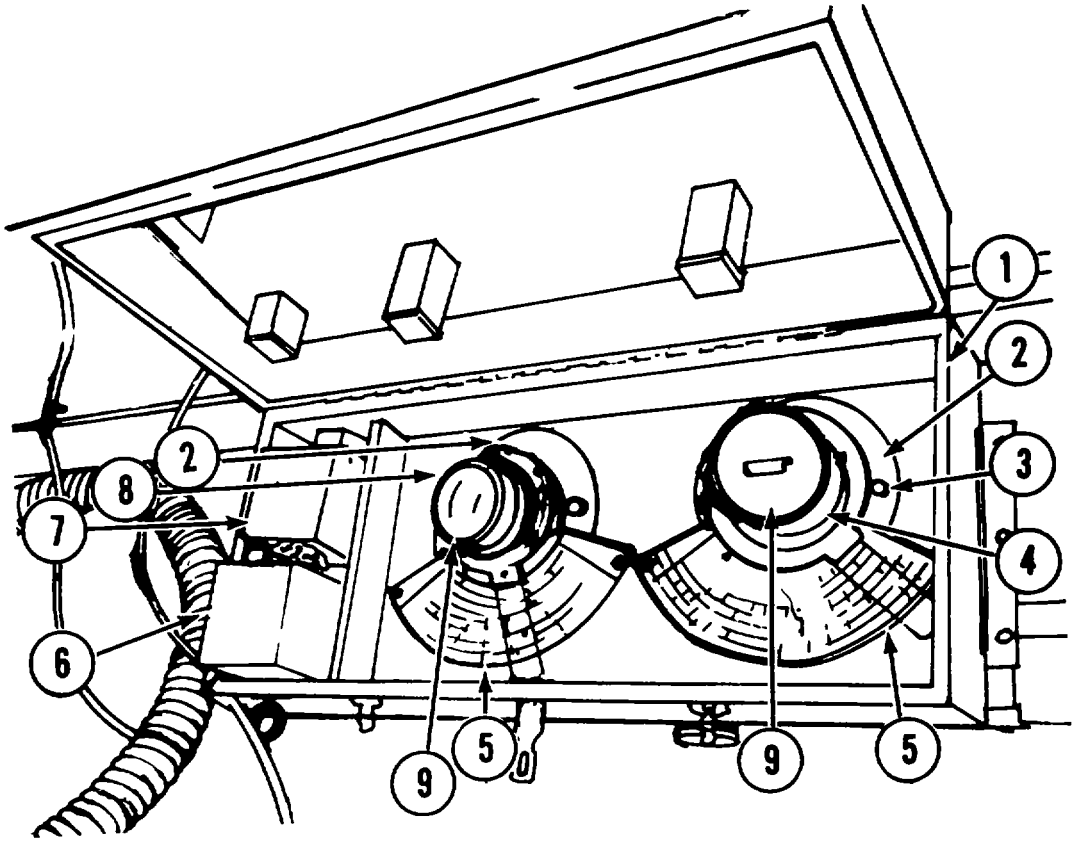
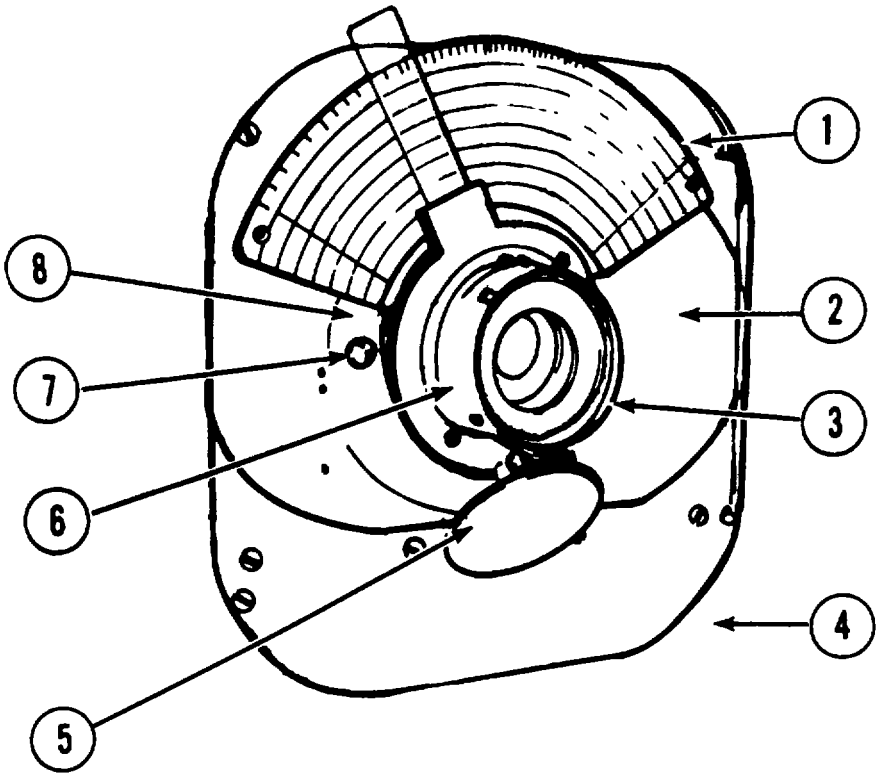


Figure 1-11.1. Copying Camera schematic wiring diagram (Model 1969M).



1. Lens storage box
2. Lens mounting plate
3. Mounting plate knobs (2)
4. 24'' (600 mm) Nikor lens
5. Exposure
6. Filter kit, 24'' lens
7. Filter kit, 19'' lens
8. 19'' (480 mm) Nikor lens
9. Lens cap

Figure 2-10.1. Nikor lenses in storage box (Model 1969M).



1. Exposure compensating device
2. Inner lens board frame
3. Lens
4. Front camera standard
5. Lens caps
6. Filter slot
7 Mounting knobs (2)
8. Lens mounting plate

Figure 2-11.1. Nikor 1-inch lens, installed (Model 199AM).

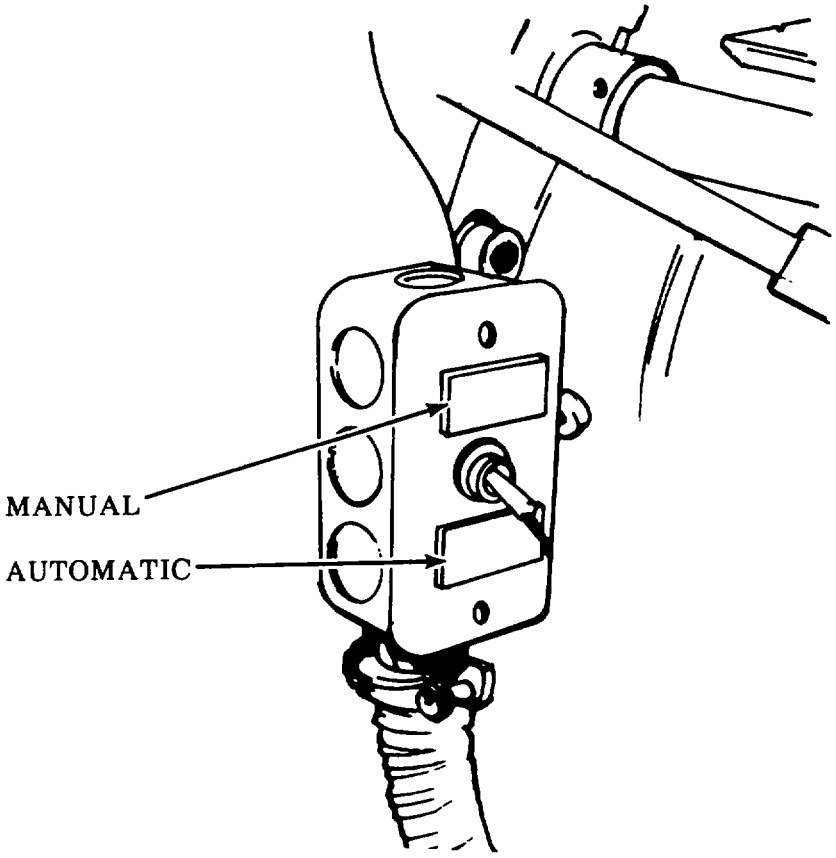
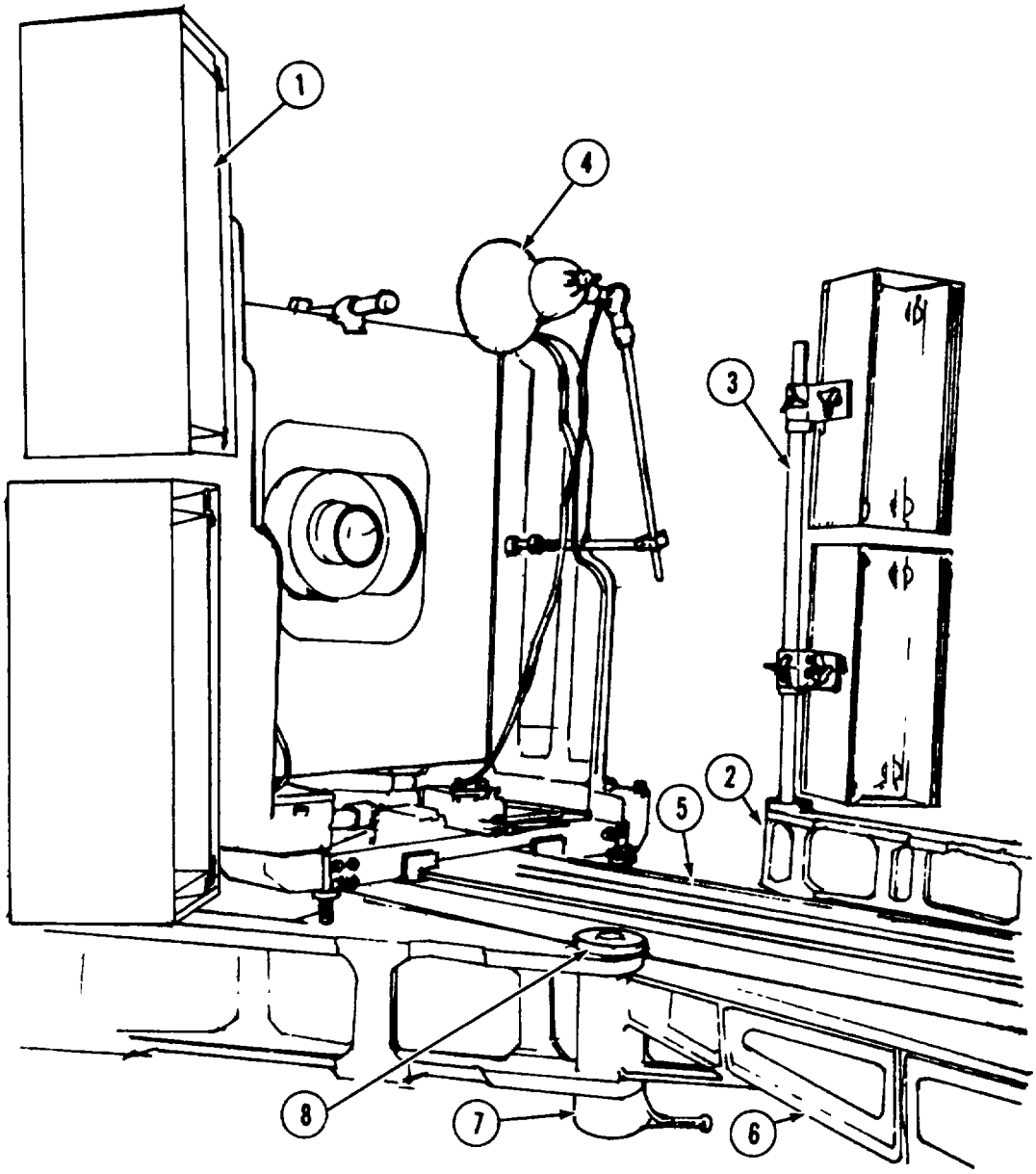
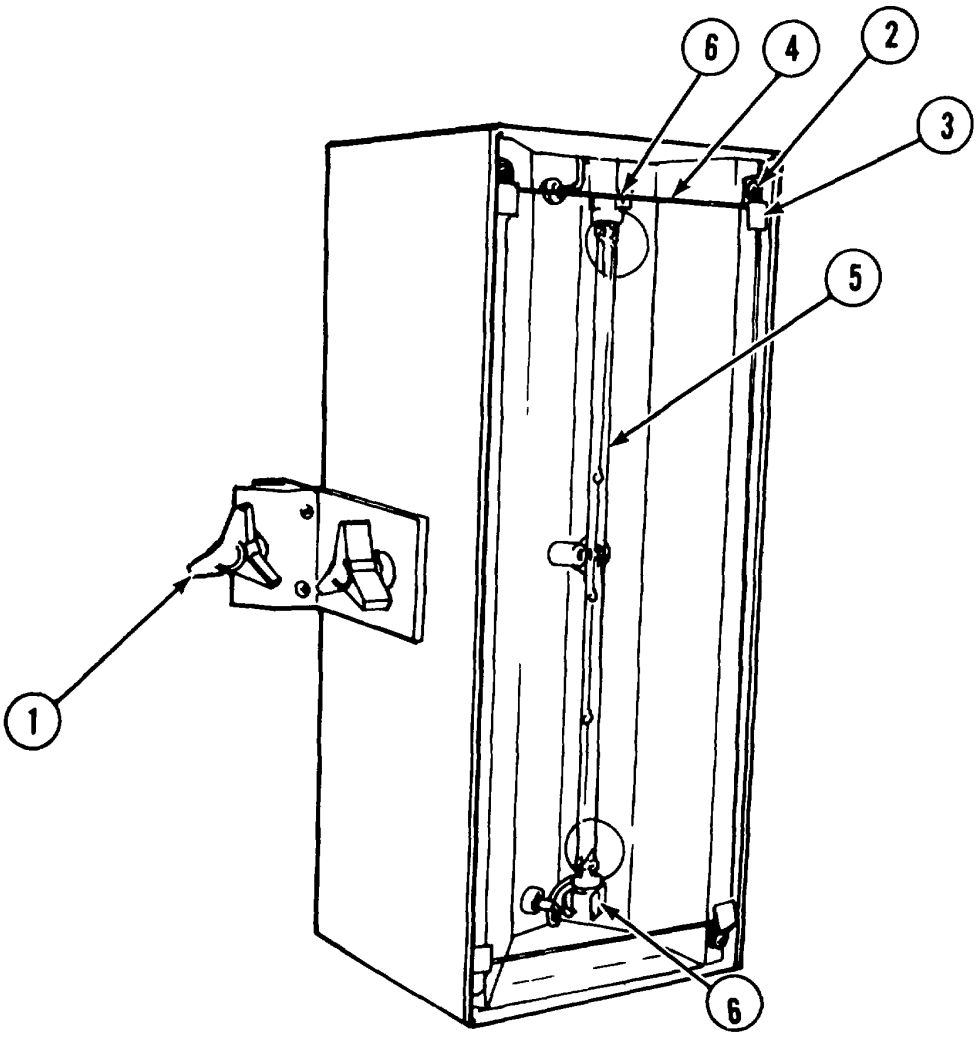


Figure 2-11.2. Lamp control switch (Model 1969M).



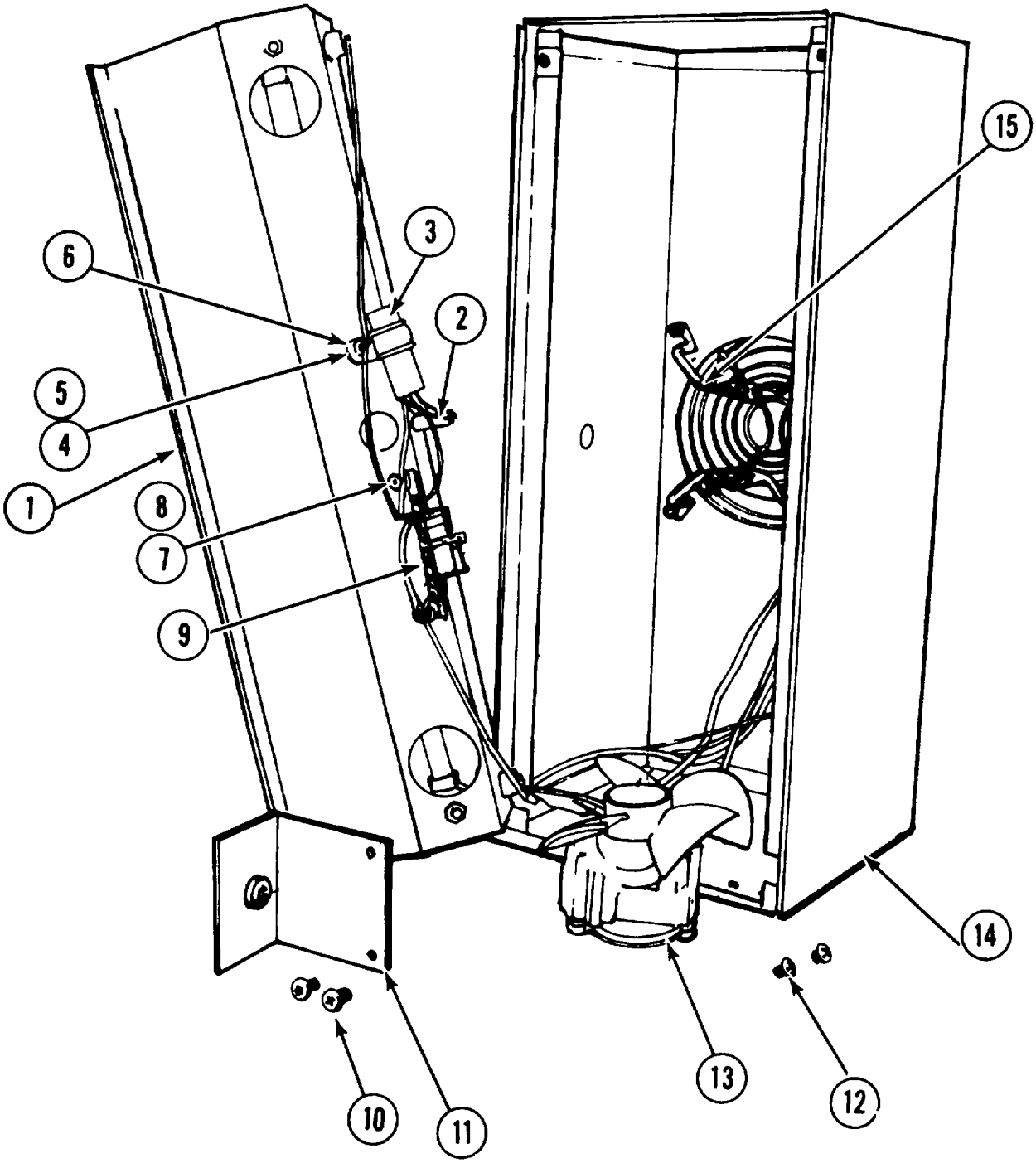
1. Pulsed Xenon light
2. Camera arm assembly
3. Mounting rod
4. Lamp reflector
5. Camera rail
6. Center arm bracket
7. Cap nut
8. Hinge pin

Figure 4-6.1. Pulsed Xenon lighting system (Model 1969M).



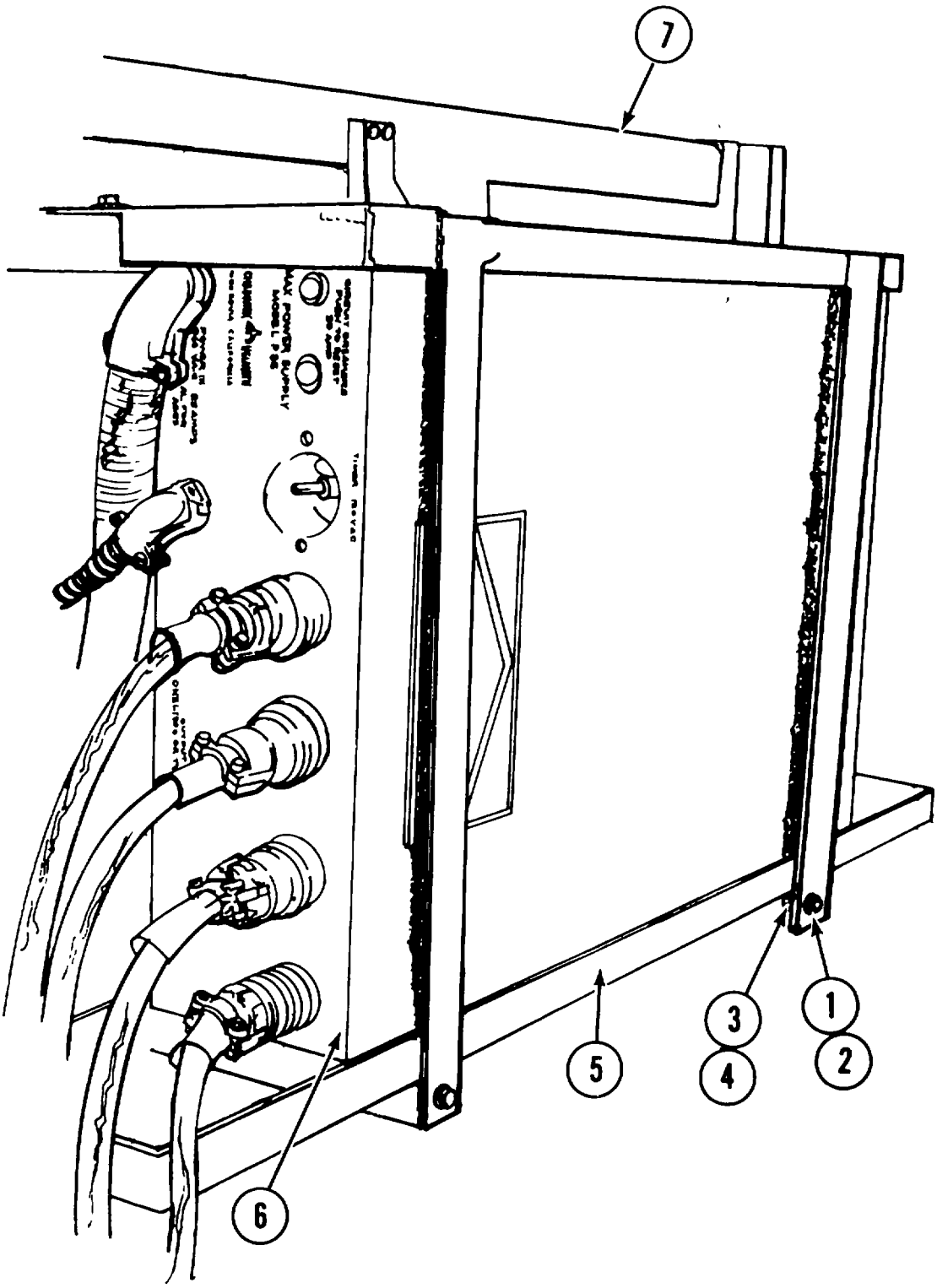
1. Yoke knob
2. Screw
3. Glass clip
4. Glass cover
5. Lamp tube
6. Retainer clip

Figure 4-7.1. Pulsed Xenon lighting unit (Model 1969M).



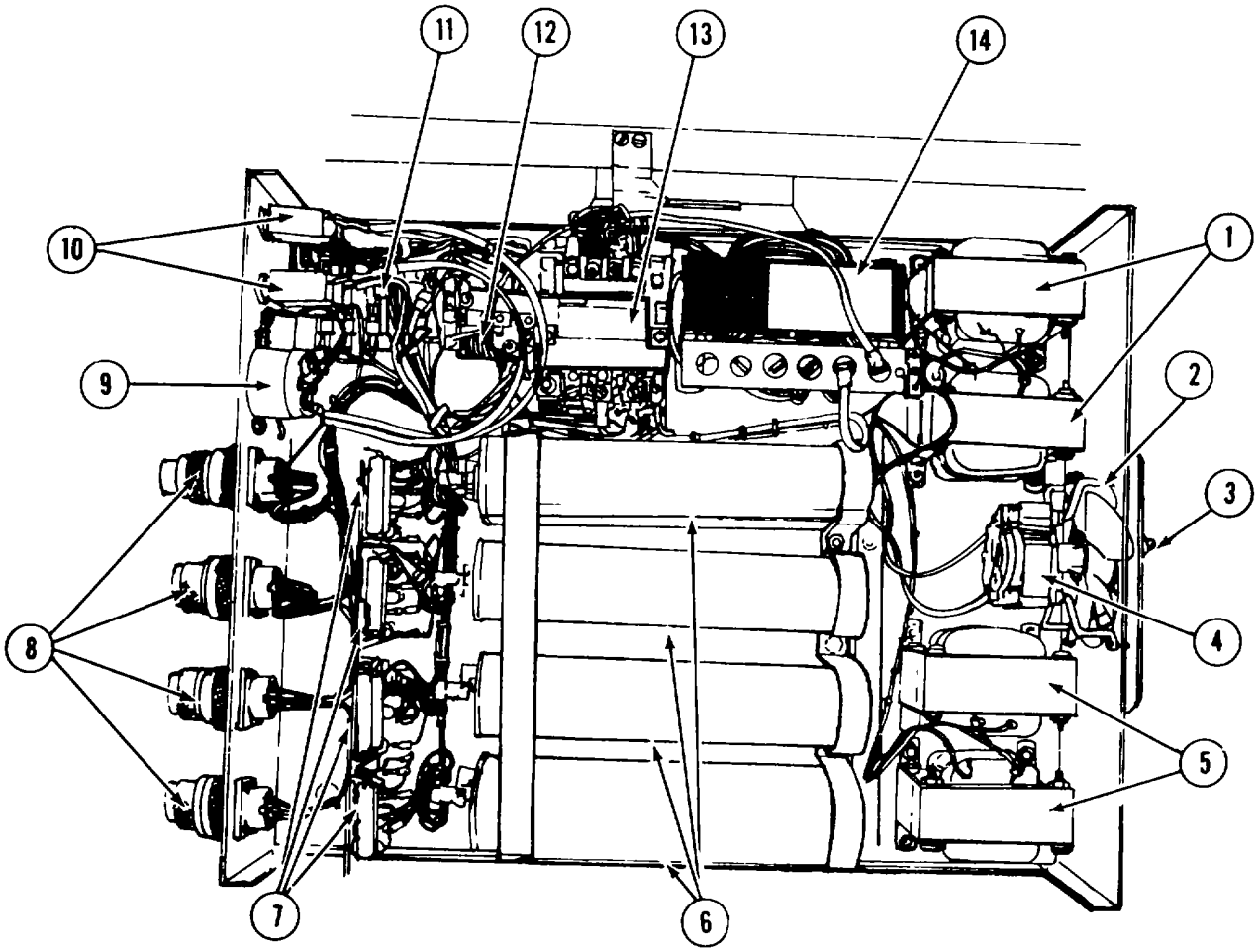
1. Reflector
2. Ceramic feedthru
3. Pulse transformer
4. Nut
5. Screw
6. Retainer clip
7. Nut
8. Screw
9. Capacitor
10. Screw
11. Rear mounting bracket
12. Screw
13 Fan motor
14. Housing
15 Front mounting bracket

Figure 4-8.1. Lighting unit disassembly (Model 1969M).



1 Screw
2 Washer
3. Lock washer
4. Nut
5. Hold down bracket
6. Power supply assembly cover
7. Power supply assembly mounting bracket

Figure 4-9.1. Power supply assembly mounting brackets (Model 1969M).



1. 7A chokes (2)
2 Fan mounting bracket
3 Fan guard
4. Fan motor
5. 7A chokes (2)
6. Capacitors (4)
7. Circuit boards (4)
8. Receptacles (4)
9 Timer receptacle
10 Circuit breakers (2)
11 Fuse block
12 115V relay
13. 230V relay
14 Autotransformer assembly

Figure 4-10.1. Power supply assembly (Model 1969M).

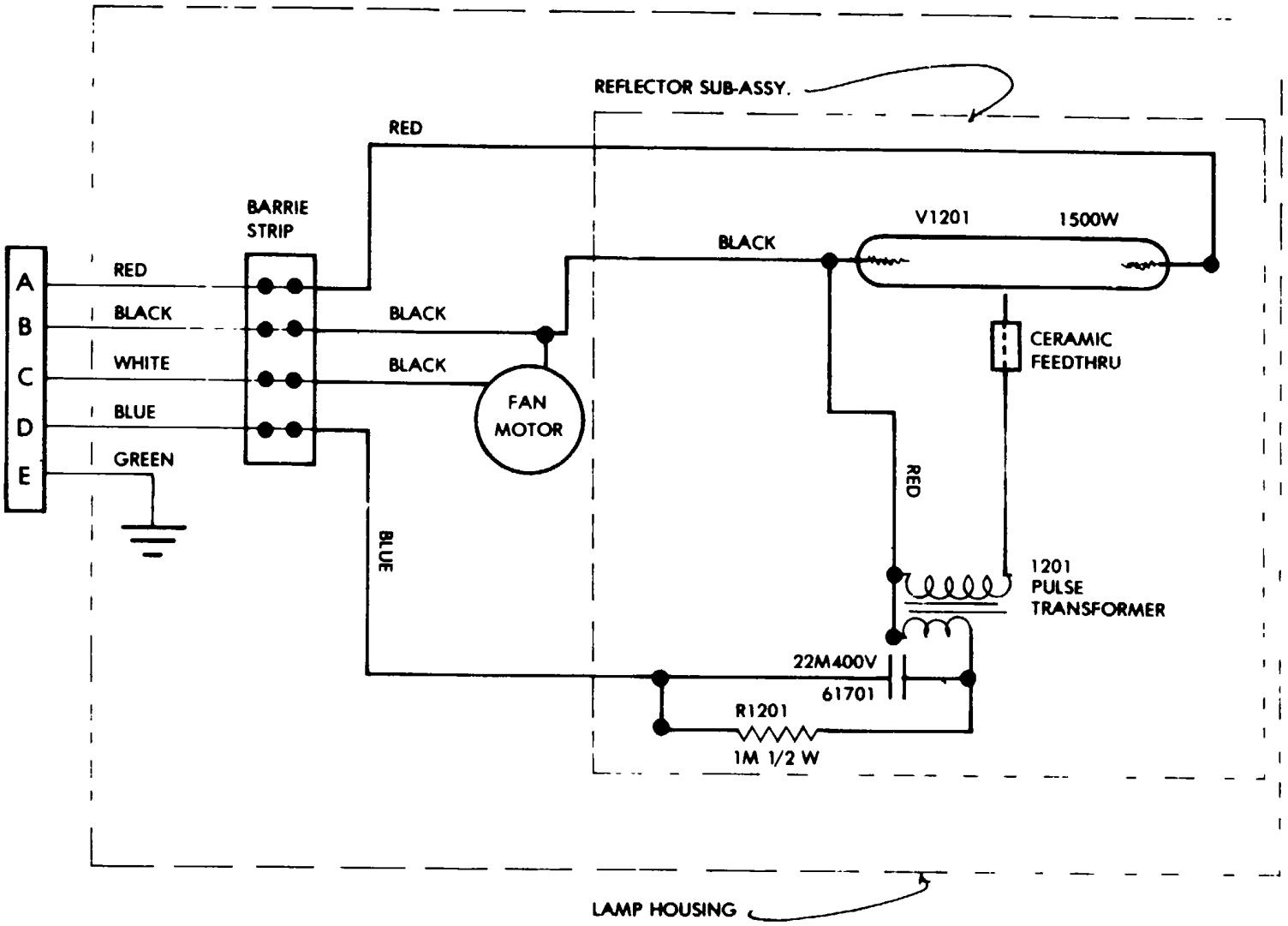
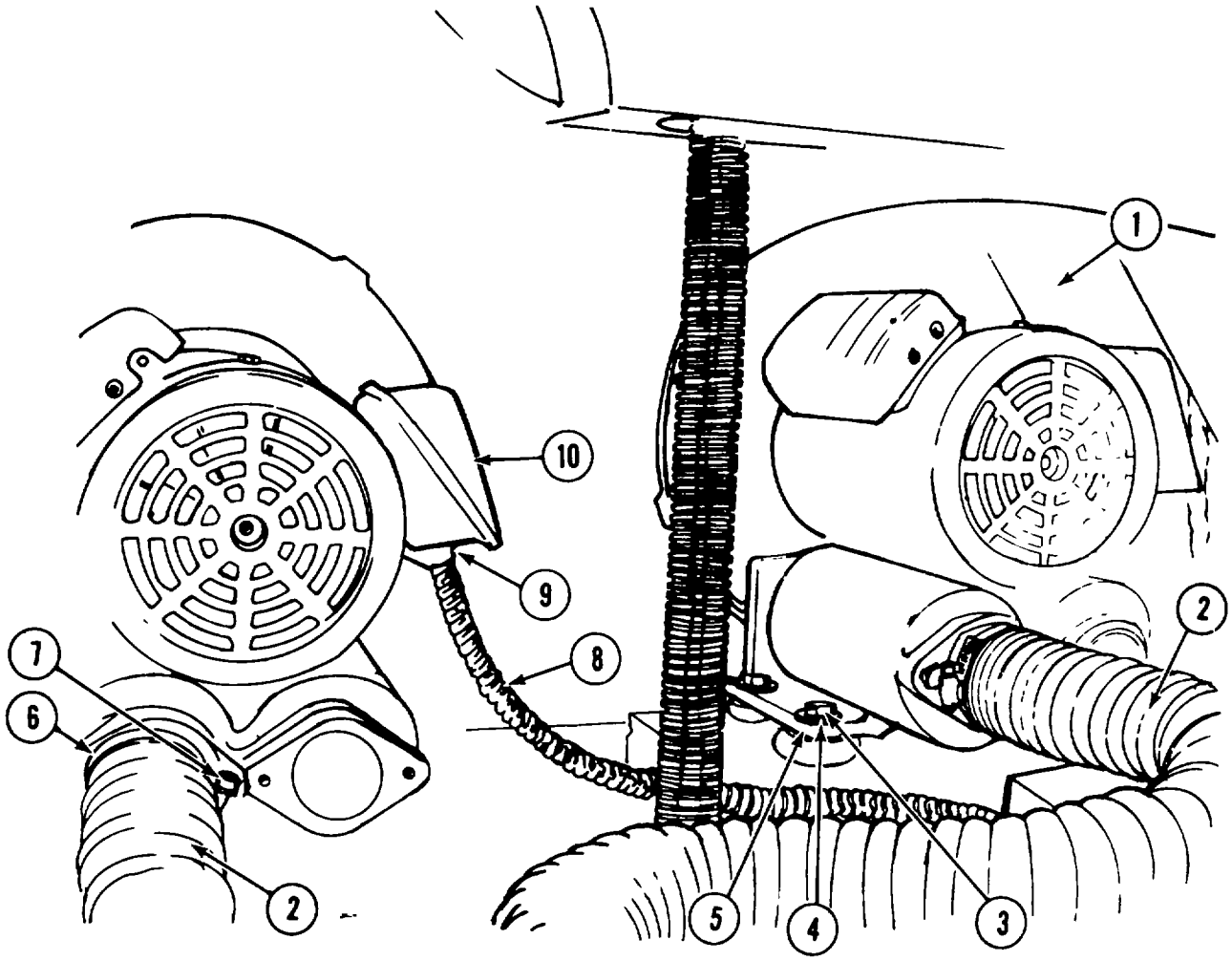


Figure 4-11.1 Pulsed Xenon lighting system wiring diagram (Model 1969M).



1. Mounting bolts
2. Flatwasher
3. Lock washer
4. Blower assembly
5. Power line
6. Screw
7. Junction box
8. Clamp screw
9. Clamp
10. Vacuum hose

Figure 6-2.1. Vacuum Blower Assembly and mounting brackets (Model 1969M).

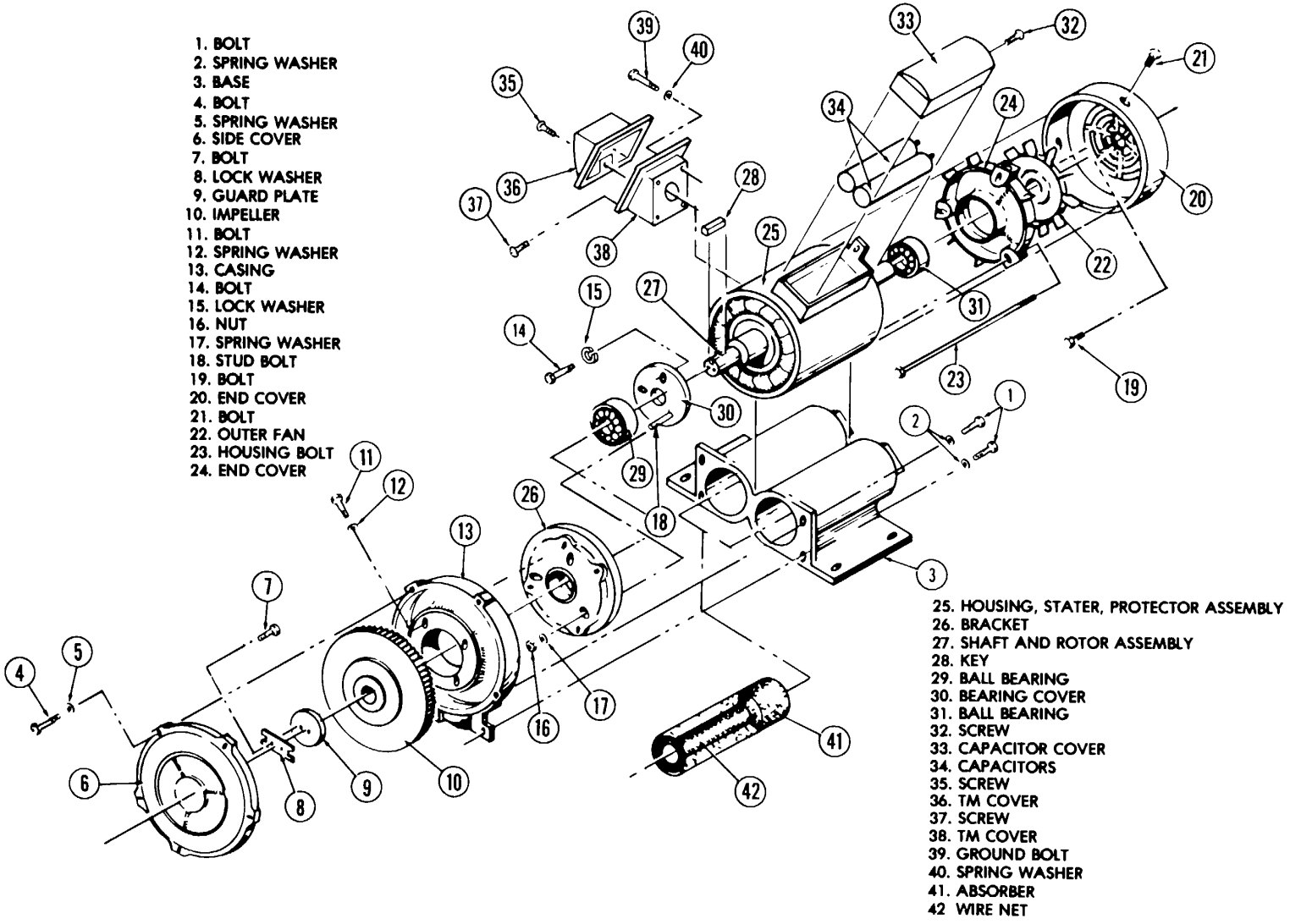


Figure 6-3.1.1. Vacuum Blower Assembly (Model 1969M).

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

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CHANGE

NO. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *12 January 1978*

Operator, Organizational,
Direct Support and
General Support Maintenance Manual

CAMERA, COPYING, MOBILE PROCESS 208 VOLT, 3 PHASE,
60 HERTZ, 24 X 30 INCH, CONSOLIDATED INTERNATIONAL
MODEL 1969, NSN 3610-00400-7588

TM 5-3610-220-14, 12 April 1971, is changed as follows:

The title page and table of contents page are changed as shown above

Page ii. The Appendixes are superseded as follows:

APPENDIX	A.	REFERENCES
	B	COMPONENTS OF END ITEM LIST
	C.	ADDITIONAL AUTHORIZATION LIST (Not Used)
	D.	MAINTENANCE ALLOCATION CHART
	E.	EXPENDABLE SUPPLIES AND MATERIALS LIST

Page 1-1. Paragraph 1-id is superseded as follows:

d. You can help to improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Troop Support and Aviation Materiel Readiness Command, ATTN. DRSTS-MTPS, 4300 Goodfellow Boulevard, St. Louis, MO 63120. A reply will be furnished to you.

Page A-1. Appendix A is superseded as follows:

APPENDIX A
REFERENCES

A-1. Lubrication

C9100IL	Identification List for Fuels, Lubricants, Oils and Waxes

A-2. Painting

TM 43-0139	Painting Instructions for Field Use

A-3. Maintenance

TM 38-750	The Army Maintenance Management Systems
TM 5-3610-220-24P	Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Camera, Copying, Consolidated International Model 1969.

*This change supersedes C1, 7 July 1972.

A-4. Shipment and Storage

TB 740-97-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage.
TM 740-93-3	Administrative Storage of Equipment.

A-5. Destruction to Prevent Enemy Use

TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use.

Page B-1. Change "APPENDIX B MAINTENANCE ALLOCATION CHART" to read "APPENDIX D MAINTENANCE ALLOCATION CHART".

Preceding Appendix D, add the new Appendix B as follows:

APPENDIX B
COMPONENTS OF END ITEMS LIST

Section I. INTRODUCTION

B-1. Scope

This Appendix lists integral components of and basic issue items for the Camera, to help you inventory items required, for safe and efficient operation.

B-2. General

The Components of End Item List is divided into the following sections:

a. Section II. Integral Components of the End Item. These items, when assembled, comprise the camera and must accompany it whenever it is transferred or turned in. These illustrations will help you identify these items.

b. Section III Basic Issue Items. These are minimum essential items required to place the camera in operation, to operate it, and to perform emergency repairs. Although shipped separately packed, they must accompany the camera during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard- to-identify items. This manual is your authority to requisition replacement BII, based on Table(s) of Organization and Equipment, (TOE)/Modification Table of Organization and Equipment (MTOE) authorization of the end item.

B-3. Explanation of Columns.

a. Illustration. This column is divided as follows

(1) Figure Number. Indicates the figure number of the illustration on which the item is shown (if applicable).

(2) Item Number. The number used to identify item called out in the illustration.

b. National Stock Number (NSN). Indicates the National Stock Number assigned to the end item which will be used for requisitioning.

c. Part Number (P/N). Indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

d. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

e. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of major item before moving on to an adjacent area.

f. Usable on Code. "USABLE ON" codes are included to help you identify which component items are used on the different models (if applicable).

g. Quantity. This column is left blank for use during inventory. Under the Rcv'd column, list the quantity you actually receive on your major item. The Date columns are for use when you inventory the major item at a later date; such as for shipment to another site.

Section II. INTEGRAL COMPONENTS OF END ITEM

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure No.	(b) Item No.	National Stock Number	Part No.	Description	Location	Usable On Code	Qty Reqd	Rev'd	Date	Date	Date
2-10		6760-00-734-7128	19 (51261)	Lens Process, 19 Inch			1				
2-10	2	6760-00-138-8672	13200E5216 (97403)	Case, Lens			1				
2-12		6760-00-734-7129	24 (51261)	Lens, Process, 24 inch			1				
2-12	2	6760-00-472-4504	13200E5276 (97403)	Case, Photographic			1				
1-1	7	3610-00-937-3821	13200E5207 (97403)	Crank, Hand			1				
2-8	6	3610-00-418-4699	13200E5117 -1(97403)	Frame, Channel, Right			1				
2-8	6	3610-0-418 4700	13200E5117-2	Frame, Channel, Left			1				
2-8	2	3610-00-495-5813	3051-01 (83113)	Roller and Curtain			2				
2-8	1	3610-00-418-4693	13200E5118 (97403)	Support Channel, Top							
1-6	1	3610-01-038-6738	2001-36-1 (83113)	Bracket, Aerial Film, R. H.			1				
1-6	1	3610-01-038-6739	2001-36-2 (83113)	Bracket, Aerial Film, L. H.			1				
1-6	1	3610-01-038-6743	2001-37-1 (83113)	Bracket, Aerial Film, R. H.			1				
1-6	1	3610-01-038-6744	2001-37-2 (83113)	Bracket, Aerial Film, L. H.			1				
2-15		3610-1-038-6742	4022-03 (83113)	Frame, Cover, Film			1				
1-1		3610-0-418-4685	X8110 (32537)	Cable Assembly, Main Power			1				
		3610-01-038-6741	4000-100 (83113)	Tie Bar Assembly, Arc Lamp, Lower			1				
		3610-01-038-6740	2010-24 (83113)	Tie Bar, Assembly, Arc Lamp, Upper			1				
		6760-00-138-8673	13200E5228 (97403)	Case, Filter			1				

Section III. BASIC ISSUE ITEMS

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure No.	(b) Item No.	National Stock Number	Part No.	Description	Location	Usable On Code	Qty Reqd	Rev'd	Date	Date	Date
		3610-00-419-8590	13200E5220 (97403)	Chest Assembly, Accessories			1				
		5120-00-28-7803		Screwdriver, flat tip, plain blade, wood handle, size 3/16" dia, x 1 1/2" lg., Fed Spec GGG 121, Class 1, Style 2			1				
		5120-0-227-7356		Screwdriver, flat tip, plain blade, plastic handle, size 3/16" dia., x 6" lg., Fed Spec GGGS121, Class 1, Style 2			1				
		5120{)0 227-7362		Screwdriver flat tip, heavy duty, plastic handle, size 3/8" shank x 12" lg., Fed Spec GGCG-S-121, Shape B			1				
		493(0 -537-8977		Oiler, Hand, leak-proof, design, push button type, 7 inch, flexible spout, size 1/2 pmt, Fed Spec GG 591			1				
		4930-00-253-2478		Grease Gun, Hand, Lever operated, high pressure gun loader fitting, cartridge or bulk grease, size 14 oz ca-pacity, Mlyr G-3859C, Type I, Size 1			1				

Section III. BASIC ISSUE ITEMS (CONT)

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure No.	(b) Item No.	National Stock Number	Part No.	Description	Location	Usable On Code	Qty Reqd	Rev'd	Date	Date	Date
		5120-00-595 9244		Key Set, Socket head, short series, sizes 0 050, 1/16, 5/64, 3/32 1/8, 5/32, 3/16, 7/32, 1/4, 5/16 and 3/8 inch, w/case GGG- K-266, Type I, Class 1			1				
		5120-00-148-7918		Wrench Set, Open End, Fixed, c/o 7 wrenches, sizes 1/4 to 1 inch w/case							
		5210-01-044 0937	2010-114 (83113)	Dial Indicator and Trammel Assembly			1				
		3610-00-257-1427	BIC070A (37405)	Carbon Holder Key U-60			2				

Page C-1. Appendix C is superseded by Appendix E as follows:

APPENDIX E
EXPENDABLE SUPPLIES AND MATERIALS LIST
Section I. INTRODUCTION

E-1. Scope

This index lists expendable, supplies and materials you will need to operate and maintain the camera. These items are authorized to you by CTA50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

E-2. Explanation of Columns

a. Column i-Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, Item 5, Appendix D").

b. Column 2-Level. This column identifies the lowest level of maintenance that requires the listed item.

C-Operator/Crew

c. Column 3-National Stock Number. This is the National Stock Number assigned to the end item; use it to request or requisition the item.

d. Column 4-Descriptown. Indicates the Federal item name and, if required, a description to identify the item The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parenthesis, is applicable

e. Column 5--Unit of Measure (UM). Indicates the measure used in performing the actual maintenance function This measure is expressed by a two-character alphabetical abbreviation (e g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National stock number	(4) Description	(5) U/M
1	C	6850-00-227-1887	Cleaning Compound, Optical Lens Liquid 1 qt Fed Spec P. D-438	QT
2	C	6640-00-597-6745	Paper, Lens Tissue, substance, 8Y2 per 100 sheets of 24 x 36 inch basic size, 6 inch long x 4 inch wide, 50 sheets per book, Fed Spec NN-P-40, Type II	BK
3	C	9330-00-286-1231	Plastic Sheet: Cellulose acetate, transparent, glossy finish both sides, colorless, 0 0075 inch thick, 40 inch wide x 50 ft roll, Fed Spec L-P-504, Type I	RO
4	C	5977-00-501-3963	Carbon Electrode, Upper 100 per box	BX
5	C	5977-00-501-3964	Carbon Electrode, Lower 100 per box	BX
6	C	9150-00-190-0904	Grease, Automotive and Artillery, GAA lb can	CN
7	C	9150-00-231-6689	Oil, Lubricating, General Purpose, PL-S, 1 qt can	CN

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CHANGE

No. 2.

HEADQUARTERS
DEPARTMENT OF THE ARMY
W D.C., 15 *March 1973*

Operator: Organizational, Direct Support and General Support Maintenance Manual

CAMERA, COPYING, MOBILE PROCESS 208-VOLT,

3 PHASE, 60 CYCLE, 24X30 INCH, CONSOLIDATED

INTERNATIONAL MODEL 1969, FSN 3610-400-7588

TM 5-3610-220-14, 12 April 1971, is changed as follows:

Page iii, figure 2-10 and 2-11. Change "Goerz 19 lens" to read "Nikon 19 lens".

Figure 2-12 and 2-13. Change "Goerz 24 lens" to read "Nikon 24 lens".

Page 1-2. Figure 1-1 is superseded as follows

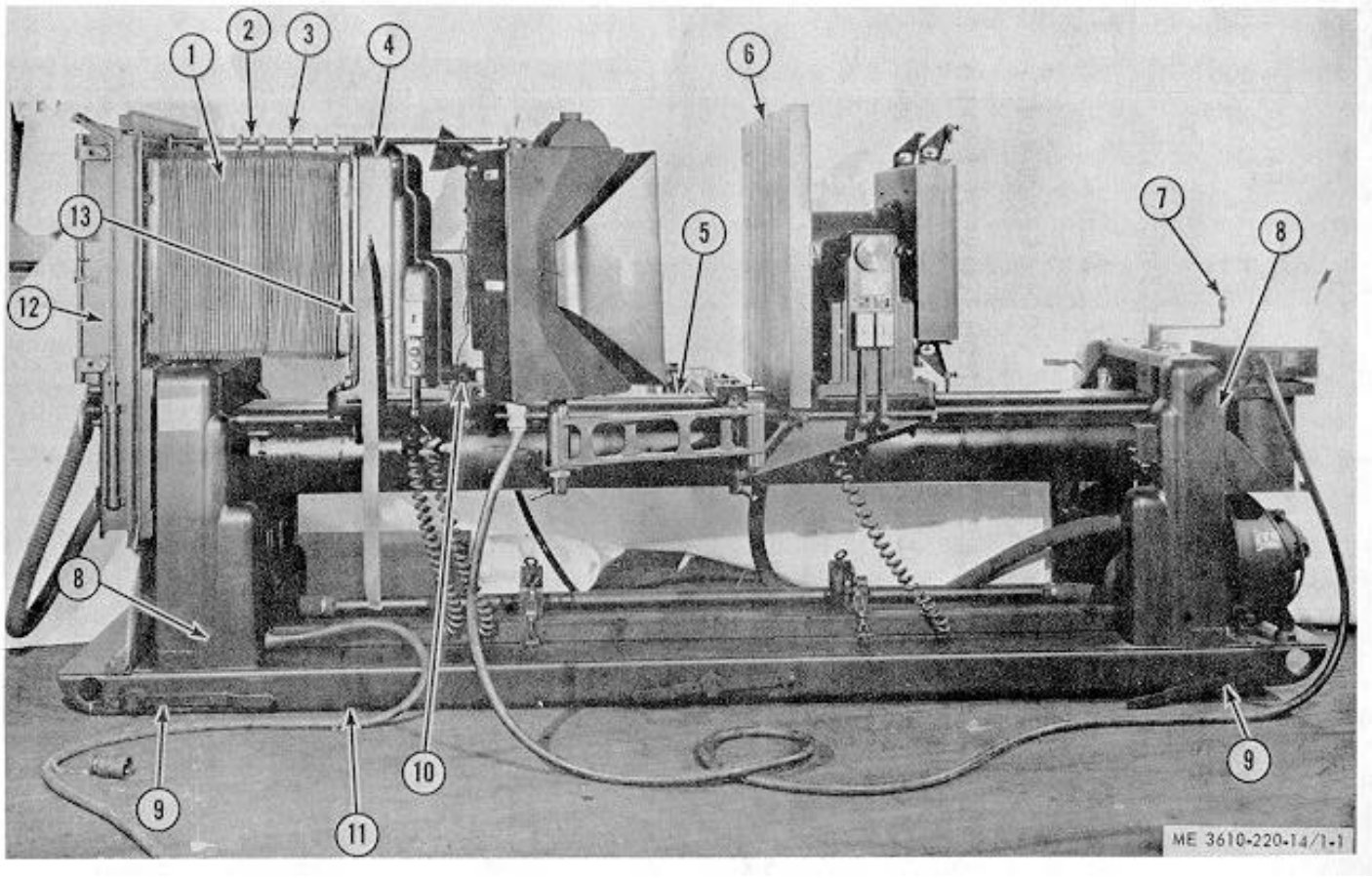
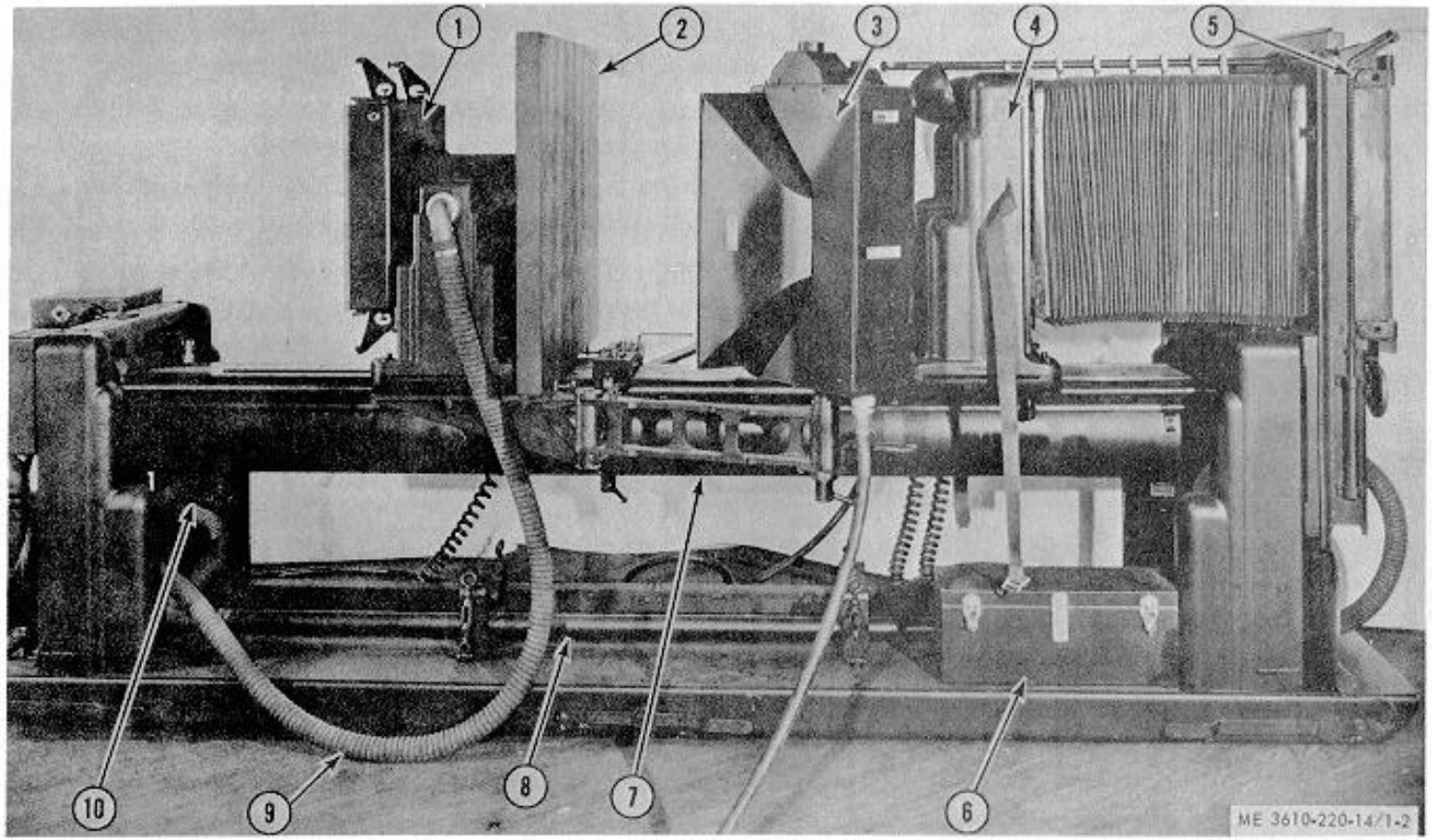


Figure 1-1. Copying camera, left side view.

1 Bellows assembly
2 Tube support assembly
3 Roller carries
4 Lensboard
5 Camera rail
6 Copyboard
7 Crank handle
8 Truss support assembly
9 Lift handle
10 Limit switches
11 Camera skid
12 Camera back
13 Bellows strap

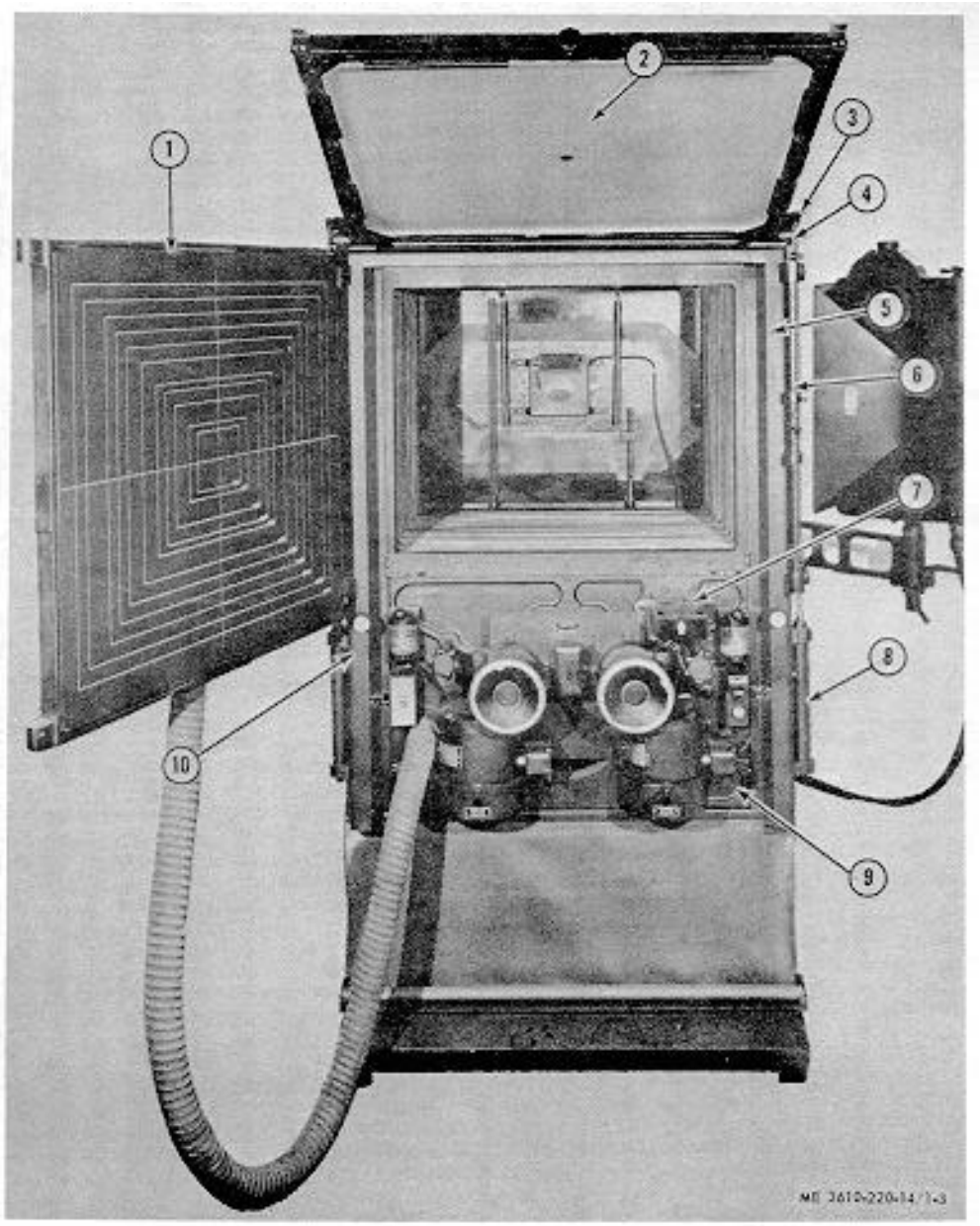
Figure 1-2 is superseded as follows.



1 Transparency holder
2 Copyboard
3 Arc lamp
4 Lensboard
5 Camera back
6 Tool box
7 Camera tube
8 Vacuum suction pipe
9 Copyboard flexible hose
10 Vacuum back flexible hose

Figure 1-2. Copying camera, right side view.

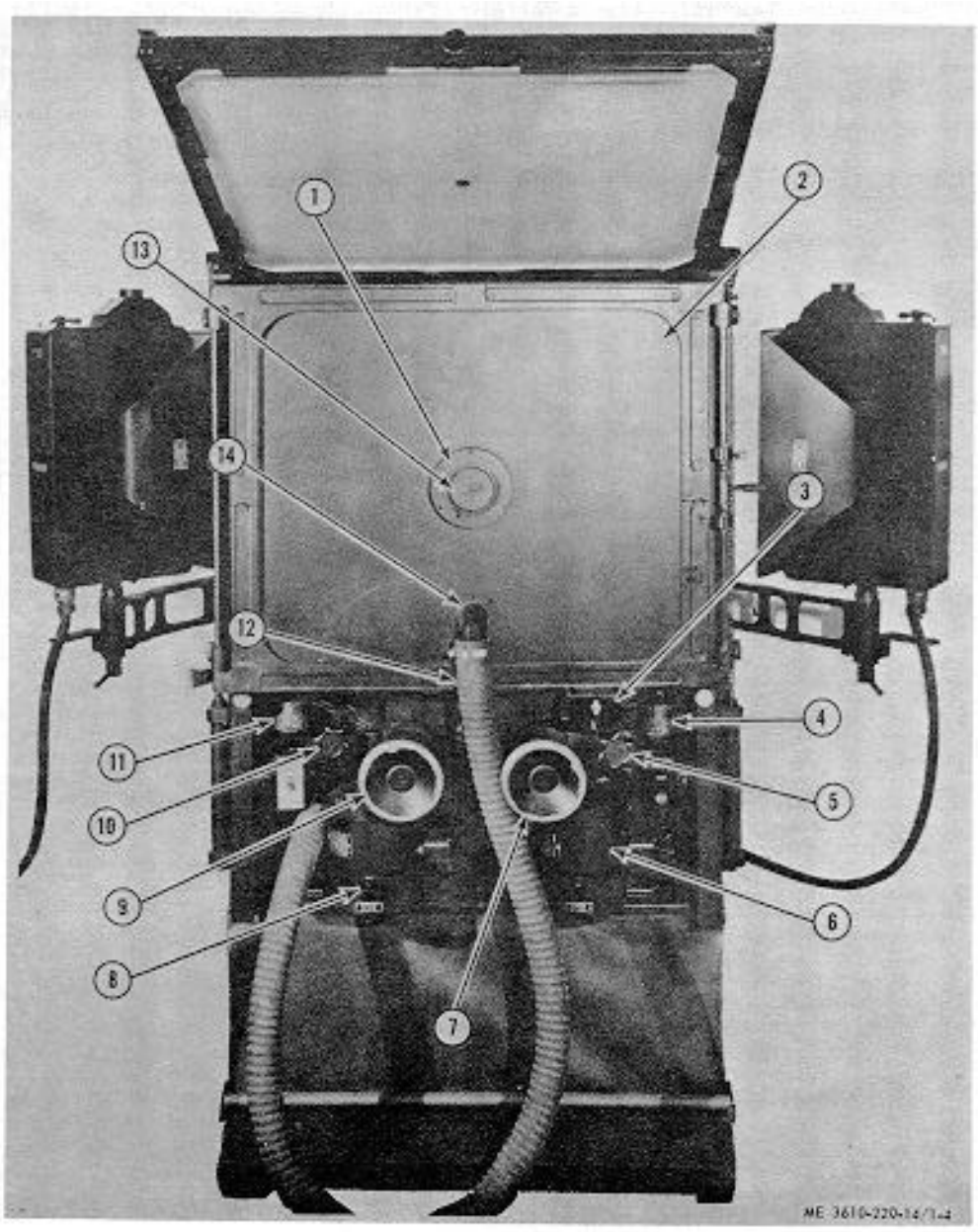
Page 1-3. Figure 1-3 is superseded as follows.



1 Vacuum back assembly
2 Focusing glass
3 Counterbalance arm
4 Hinge bracket
5 Camera back housing
6 Counterbalance chain
7 Counter safety light and switch
8 Spring counterbalance
9 Back support plate
10 Magnetic latch

Figure 1-3. Copy camera, darkroom view with vacuum back open

Figure 1-4 is superseded as follows.



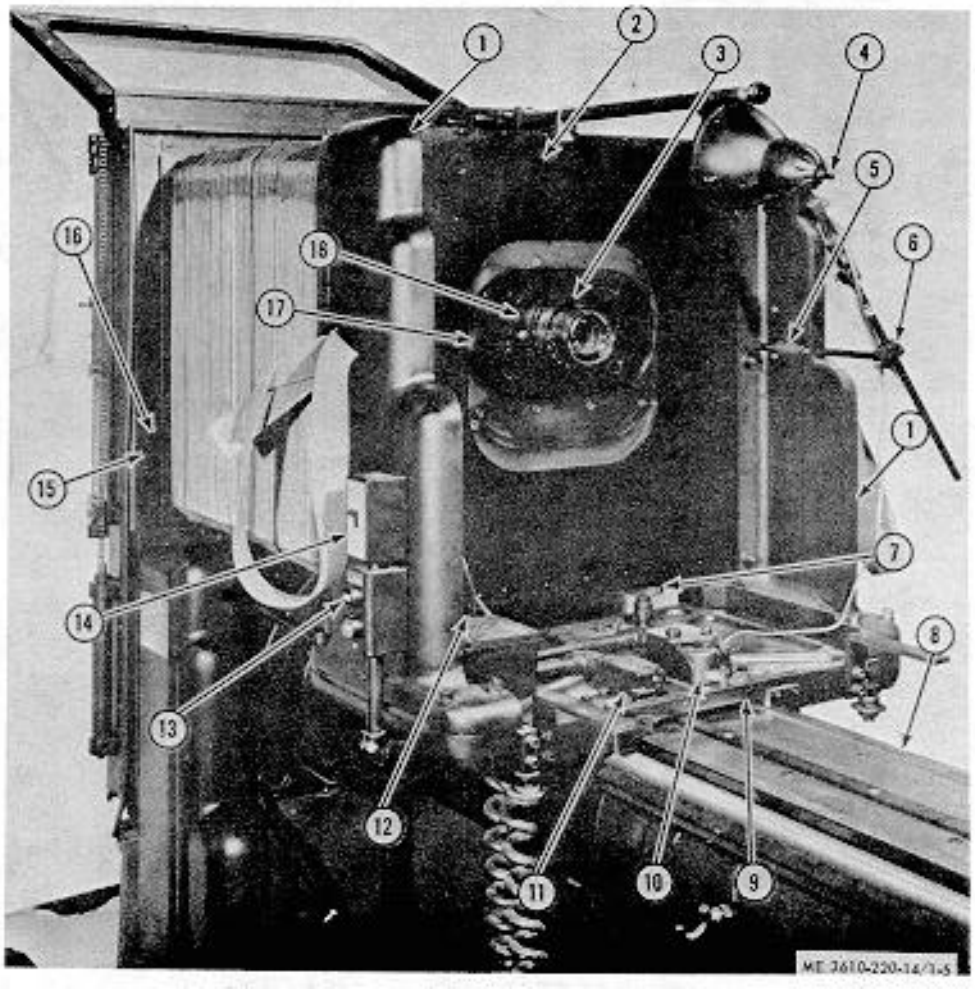
1 Vacuum back valve housing
2 Vacuum back assembly
3 Counters
4 Lensboard control switch
5 Lens vertical control knob
6 Lensboard drive motor
7 Lensboard fine adjustment handwheel
8 Copyboard drive motor
9 Copyvboard fine adjustment handwheel
10 Lens horizontal control knob
11 Copyboard control switch
12 Flexible rubber hose
13 salve control knob
14 Vacuum elbow

Figure 1-4. Copy camera, darkroom view with door closed.

Paragraph 1-3 c is changed to read:

c. Vacuum Back Assembly. This assembly (2, fig. 1-4) is hinged to and supported by the camera back housing, and consists of a door, with a suction plate on the inner side and a vacuum back plate on the other side. Attached to the vacuum plate is an aluminum vacuum back valve housing (1) with a valve control knob (13). A flexible rubber hose (12) extending through the back support plate is clamped to the vacuum elbow (14) which is fastened to the vacuum back plate".

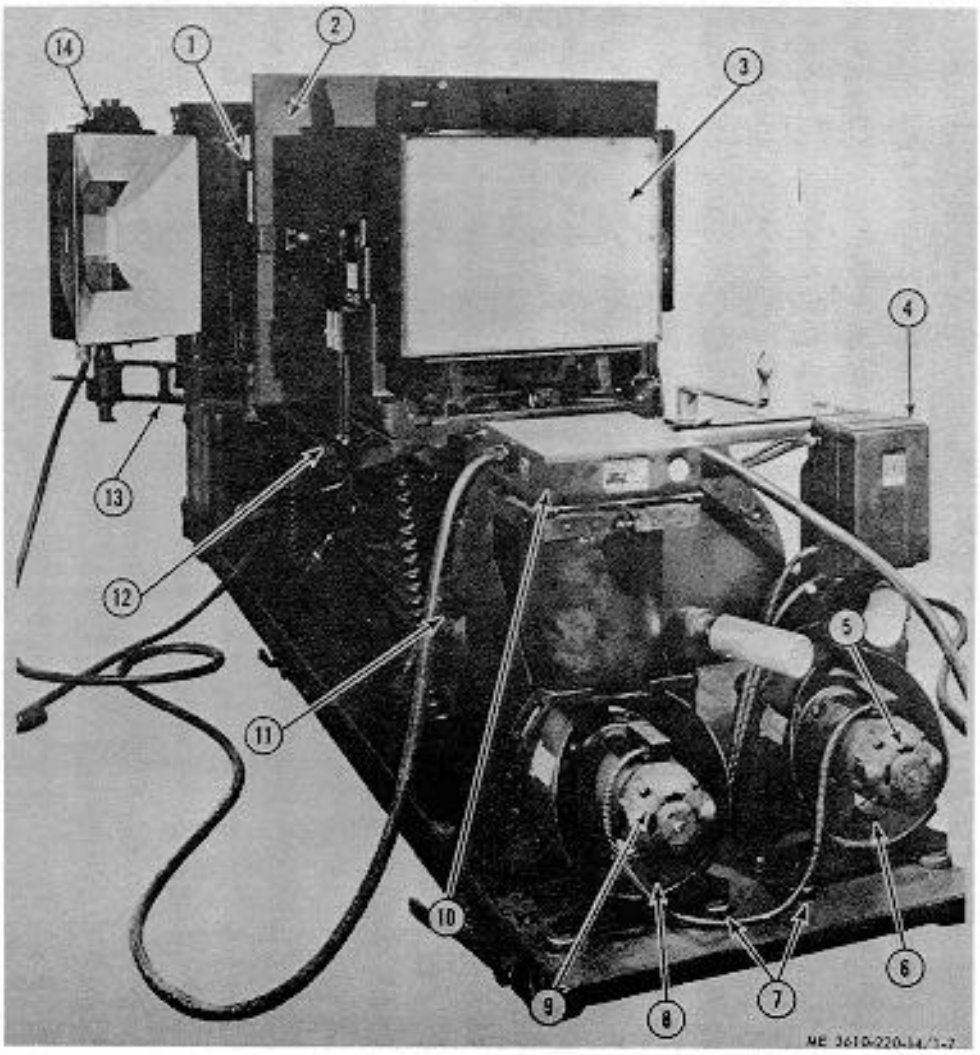
Page 1-4. Figure 1-5 is superseded as follows.



1 Lensboard side frame
2 Lensboard
3 Lens
4 Flash lamp switch
5 Flash lamp adjustment screw
6 Adjustment screw: thumb, 1/4 x 20 x 1
7 Lensboard horizontal adjustment hand-, heel
8 Camera rail
9 Lensboard carriage base plate
10 Limit switches
11 Holding stud and locknut
12 Lensboard vertical adjustment hand wheel
13 Lensboard arc lamp switch
14 Lensboard shutter switch
15 Clamp
16 Clamp screen
17 Inner lensboard frame
18 Lens mounting frame

Figure 1-5. Lensboard assembly.

Page 1-6. Figure 1-7 is superseded as follows.



1 Lenshboard
2 Copyboard
3 Transparency holder
4 Magnetic contactor
5 Vacuum back turbo-compressor motor
6 Vacuum back turbo-compressor assembly
7 Vibrator mount
8 Copyboard turbo-compressor assembly
9 Copyboard turbo-compressor motor
10 Transformer
11 Vacuum suction pipe
12 Center arm assemble
13 Free-end arm bracket
14 Arc lamp

Figure 1-7. Copying camera, three-quarter view from copyboard end.

Page 1-7. Figure 1-8 (sheet 1 of 2) is superseded as follows.

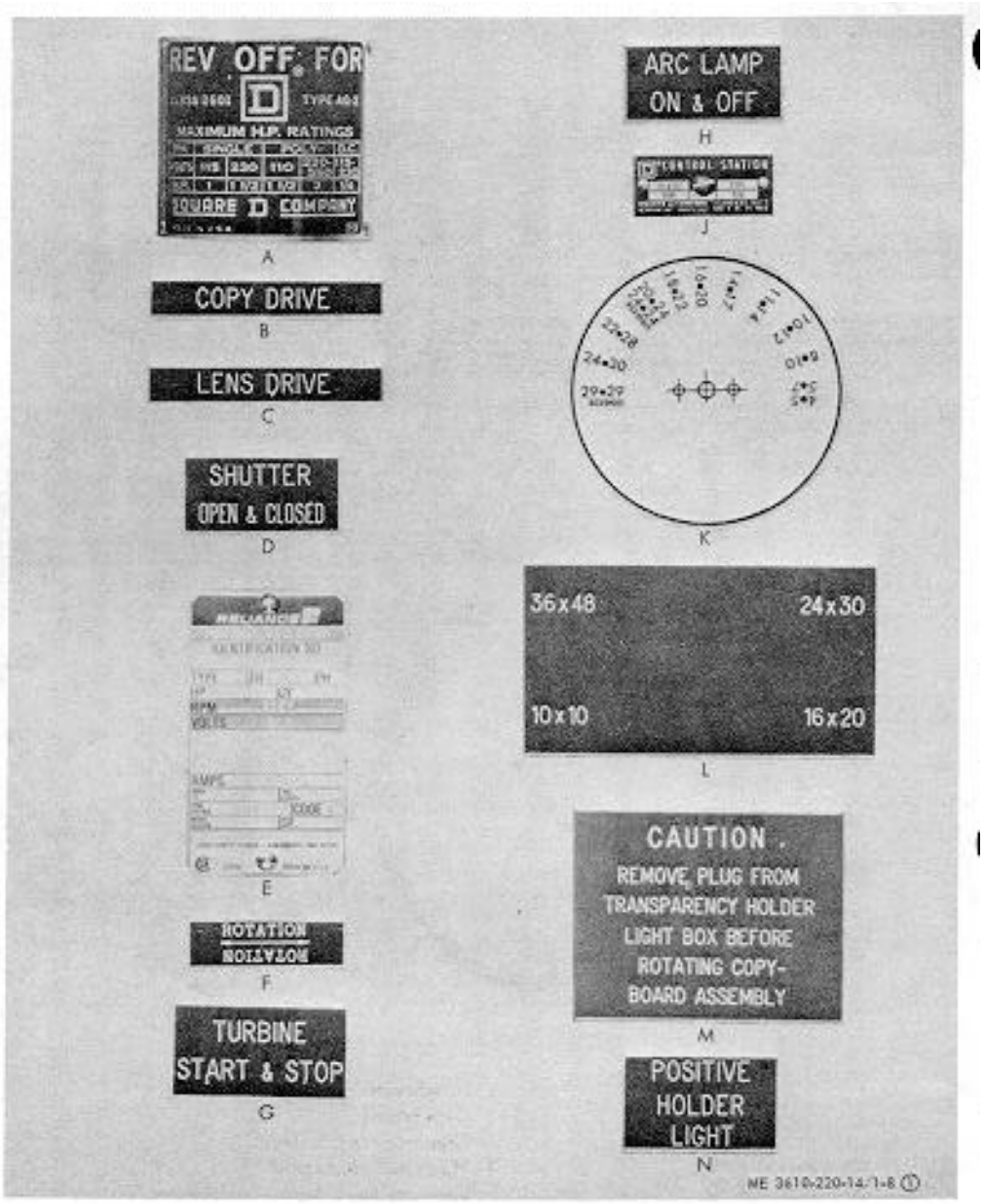
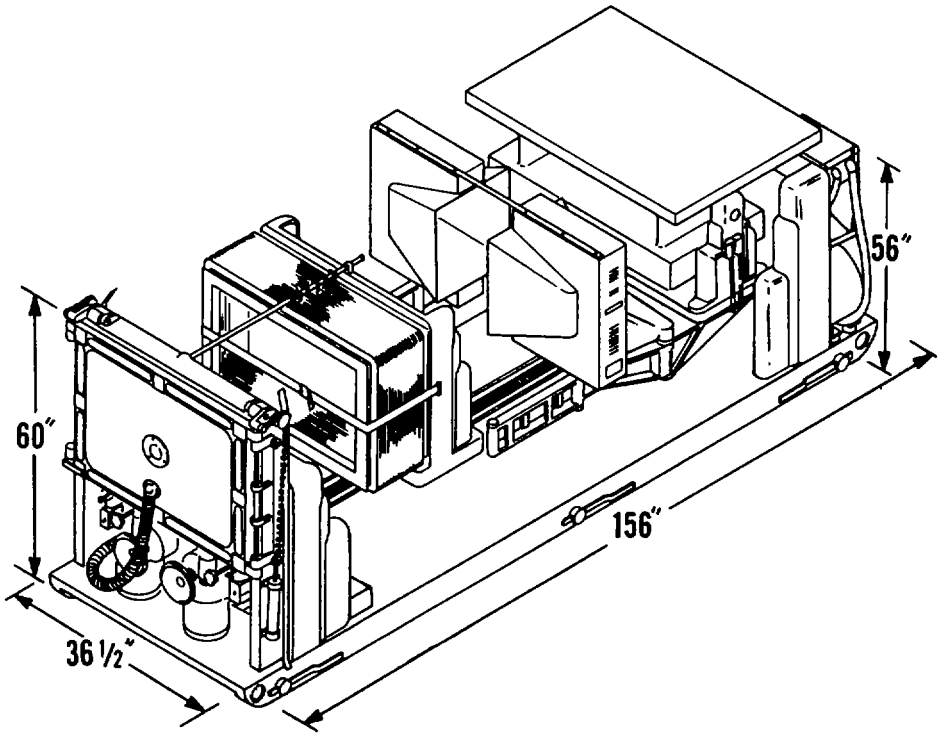


Figure 1-8. Identification plates (sheet 1 of 2)

Page 1-9. Figure 1-9 is superseded as follows.



ME 3610-220-14/1-9

Figure 1-9. Dimensions of copying camera ready for shipment.

Paragraph 1-6. Subparagraphs b, c, and d are superseded as follows.

b. Dimensions and Weight (Uncrated).

Overall length	1.6 inches
Overall width	38 ½ Inches
Overall height	77 inches
Gross weight	3,35(lbs.

c. Dimensions Under Shipping Conditions (fig. 1-9).

Overall length	19 inches
Overall width	40 inches
Overall height	72 inches
Gross weight	4,700 lbs

d. Lens.

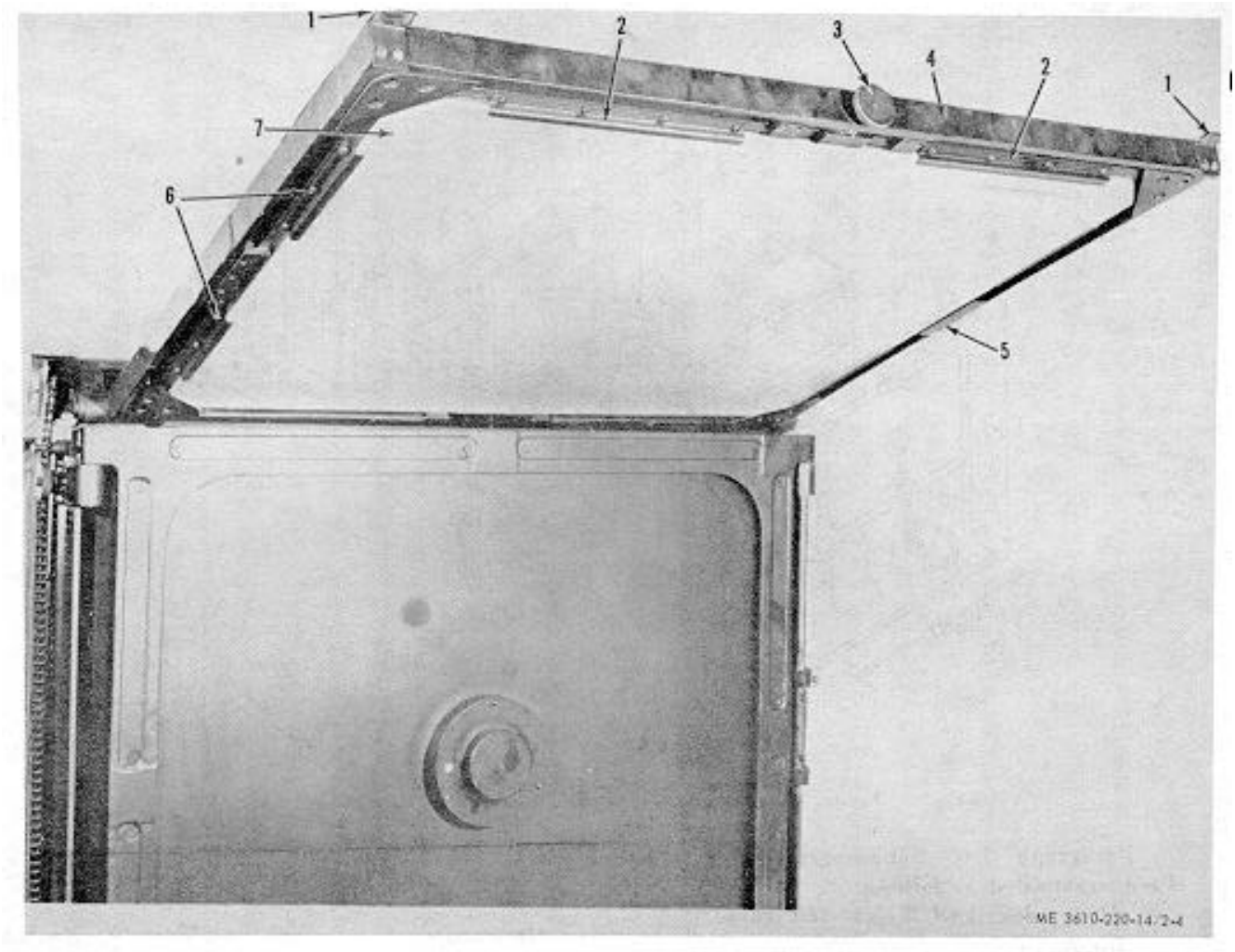
(1) 19 inch lens.

Manufacture.....	Nippon Kogaku K.K. Nihobashi, Chuo-Ku Tokyo 103, Japan
Type.....	Apo-Nikkor Process

(2) 24 inch lens.

Manufacture.....	Nippon Kogaku K.K. Nihonbashi, Chuo-Ku Tokyo 1()3, Japan
Type.....	Apo-Nlkkor Process

Page 2-4. Figure 2-4 is superseded as follows.



1 Magnetic latch
2 Bottom holder clip
3 Oscillating knob
4 Focusing glass frame
5 Side holder clip
6 Screw, pan-hd. 10-32 x 1/2
7 Focusing glass

Figure 2-4. Focusing glass details.

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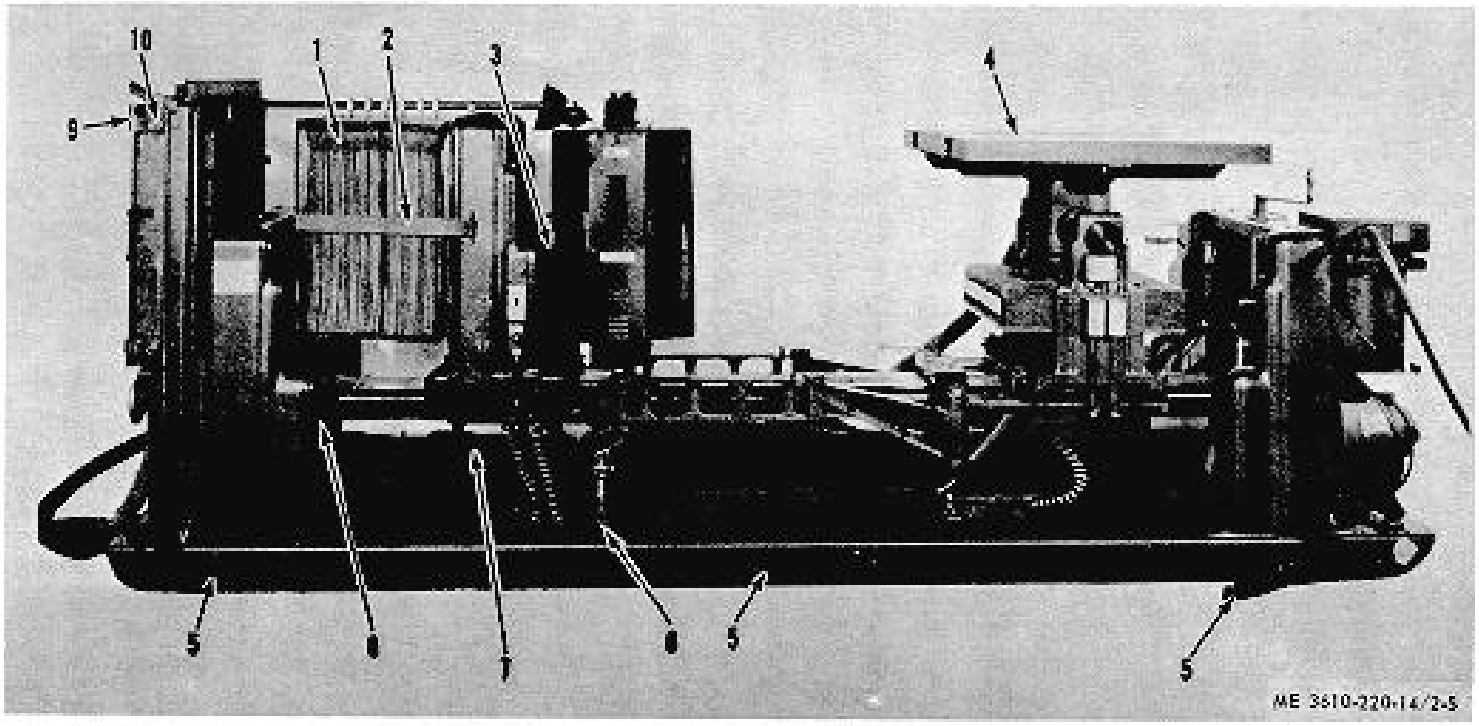
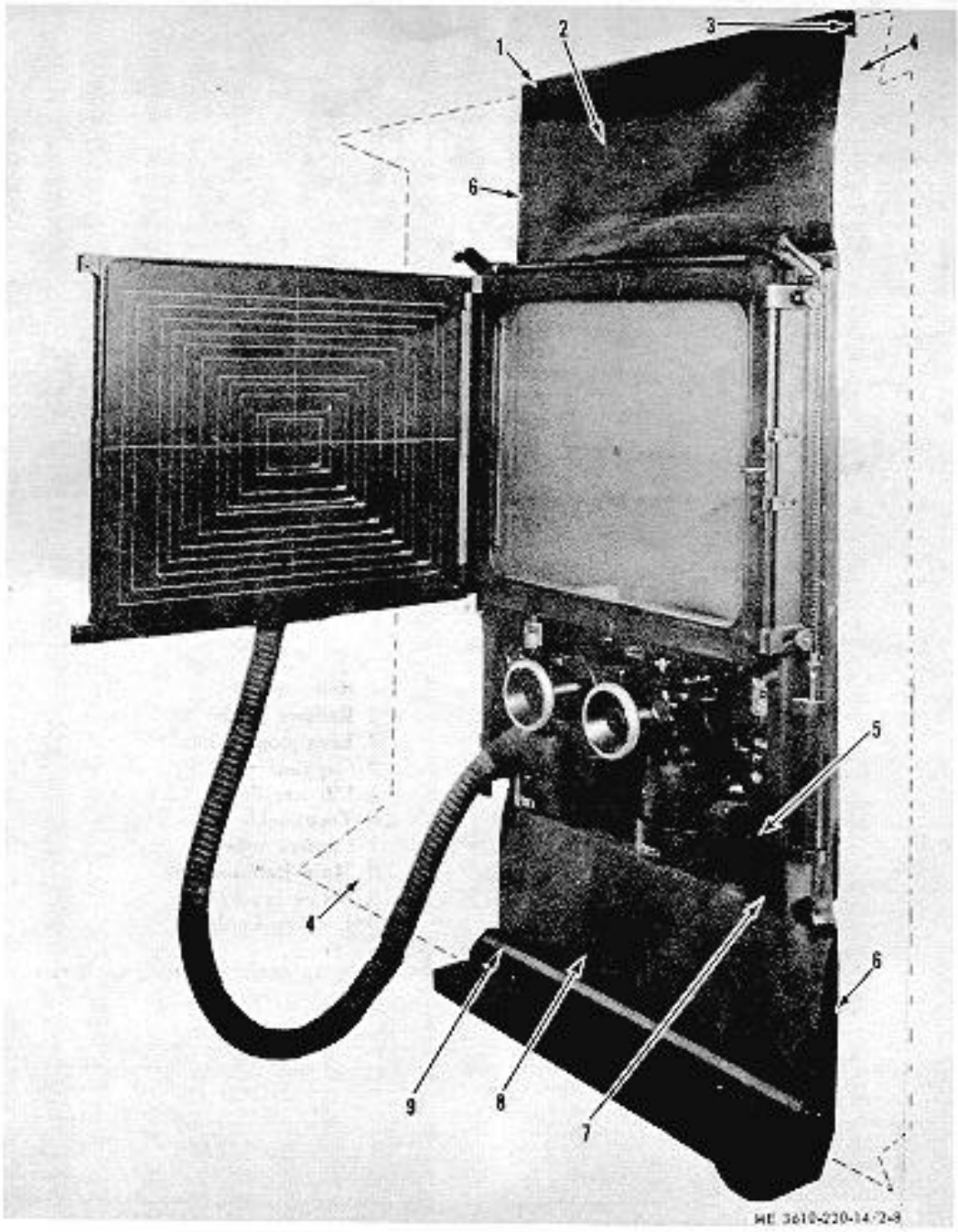
Page 2-5. Figure 2-5 is superseded as follows.



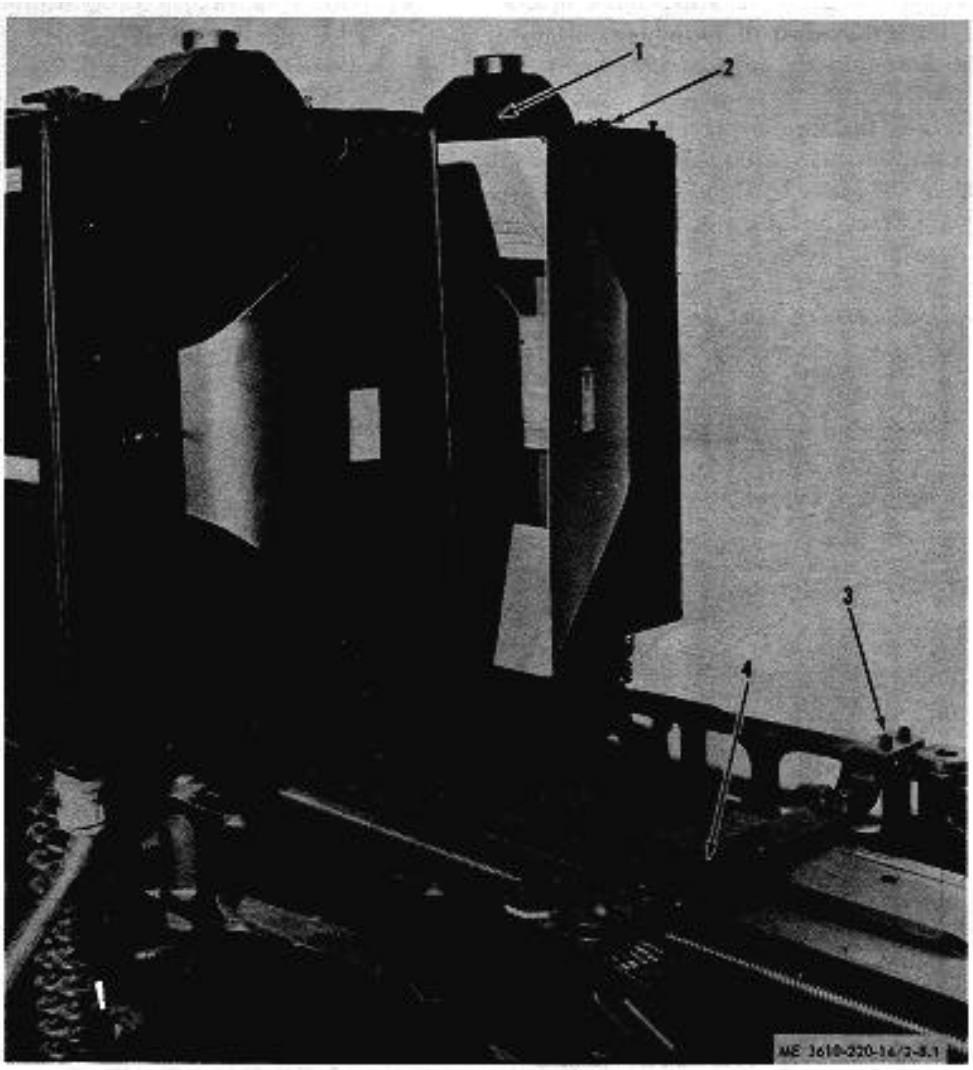
1 Bellows
2 Bellows strap
3 Lens storage box
4 Copyboard
5 Lift handle
6 Turnbuckle
7 Camera tube
8 Main junction box
9 Hinge bracket
10 Locking knob

Page 2-5. Figure 2-5 is superseded as follows.



1 Top curtain holder
2 Top curtain
3 Cotter pin. 1/8 x 1
4 Darkroom panels
5 Back support plate
6 Vertical connecting frame strip
7 Thumbscrews. 8-32 x 1/2
8 Bottom curtain
9 Bottom curtain holder

Figure 2-8. Darkroom connecting frame, installed.



1 Lamp tie bar assembly
2 Thumb screw
3 Socket head screw
4 Arm tie bar assembly

Figure 2-8.1. Tie bar assemblies.

Paragraph 2-3 *a*. Add the following subparagraph after subparagraph (3).

(3.1) Fasten the lamp tie bar assembly (1, fig. 2-8.1) to both lamps with the thumb screws (2) on the tie bar. Remove four socket head screws (3), two on each arm, and position the arm tie bar assembly. Fasten the arm tie bar assembly (4) with previously removed socket head screws." *Page 2-9*, paragraph 2-15 is superseded as follows:

2-15. Vacuum Back Valve Control Knob

a. Description. The vacuum back valve control knob (13, fig. 1-4), is an indicator knob, controlling the vacuum area of the vacuum back.

b. Location. It is mounted in the valve housing, covered by a plate with a window through which the indicator plate fastened to the control knob shows the different vacuum area positions.

c. Purpose. It regulates the air intake through the vacuum back controlling the area on the suction plate for various film sizes and screen sizes. *Page 2-11*. Paragraph 2-35 *c* is superseded as follows:

c. Install the 19 inch or 24 inch lens on the lensboard as detailed in the following procedures:

(1) *Nikkor 19 inch lens*.

(a) Remove the lens mounting plate (4, fig. 2-10) with the attached lens (1) from the lens box

(2). Unscrew lens from mounting plate and remove back lens cap (5). Refasten lens to mounting plate.

(b) Insert the lugs behind the lens mounting plate (1, fig. 2-11), in the slots of inner lensboard frame (2).

(c) Grasp the knobs (3) on the mounting plate, and rotate 15° in a clockwise direction to lock the lens in the inner lensboard frame. Positive indication of correct locking position is indicated when the filter slot (5) is facing the operators side of cam era.

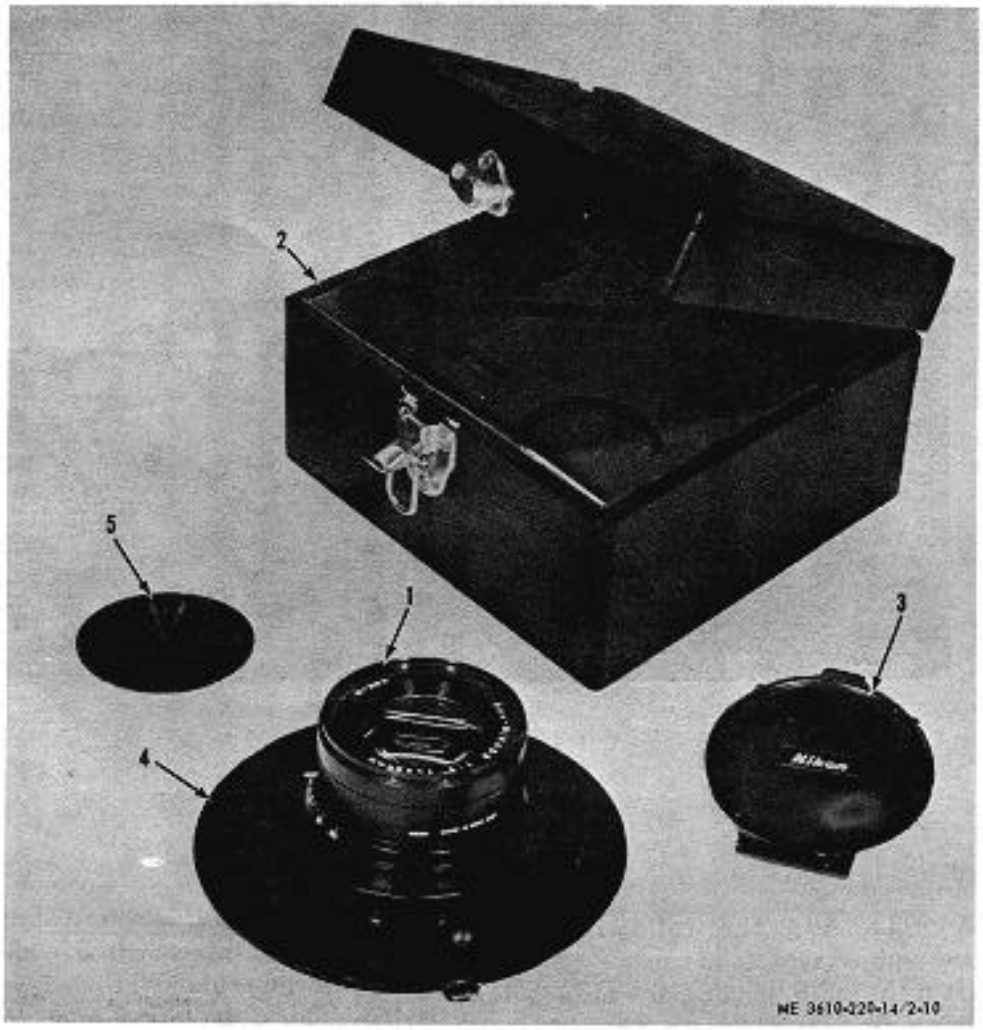
(2) *Nikkor 24 inch lens.*

(a) Remove the lens mounting plate (4, fig. 2-12) with the attached lens (1) from the lens box (2). Unscrew lens from mounting plate and remove back lens cap (5). Refasten lens to mounting plate.

(b) Insert the lugs behind the lens mounting plate (1, fig. 2-13), in the slots of inner lensboard frame (2).

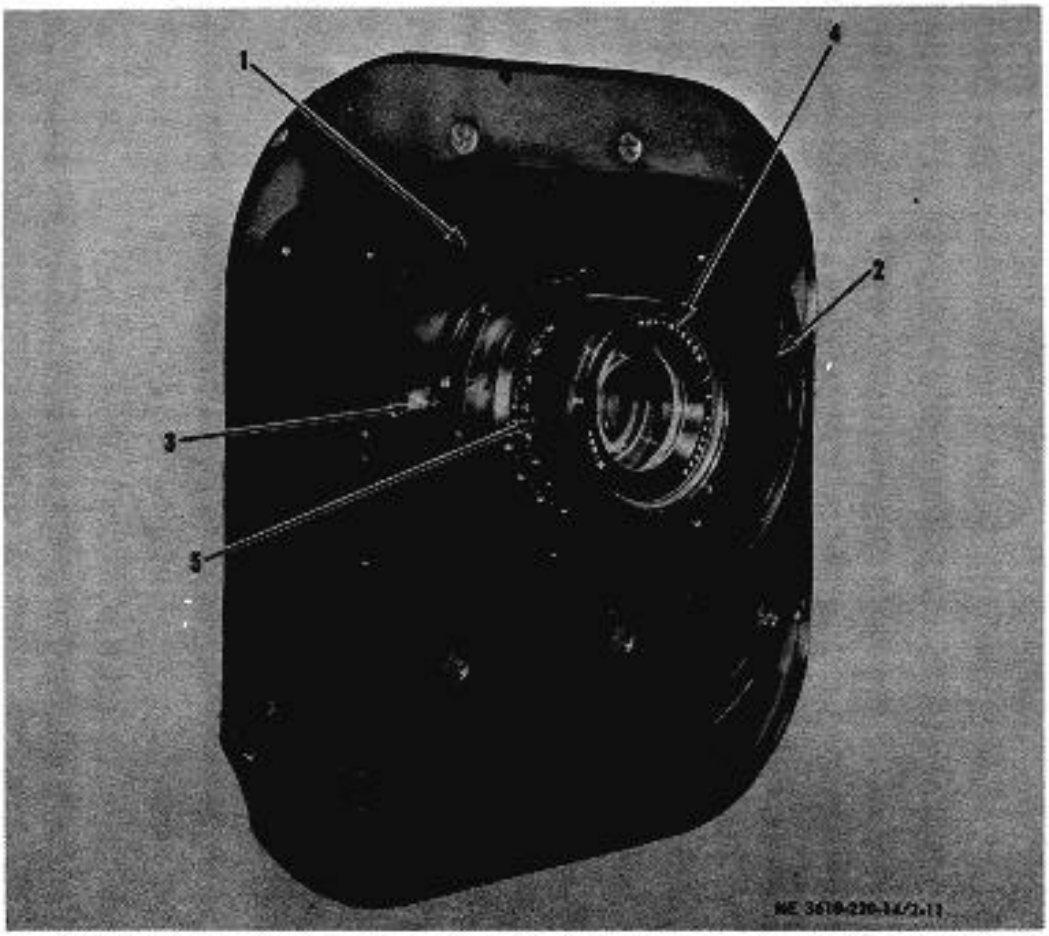
(c) Grasp the knobs (3) on the mounting plate, and rotate 15° in a clockwise direction to lock the lens in the inner lensboard frame. Positive indication of correct locking position is indicated when the filter slot (5) is facing the operators side of cam era.

Figure 2-10 is superseded as follow:



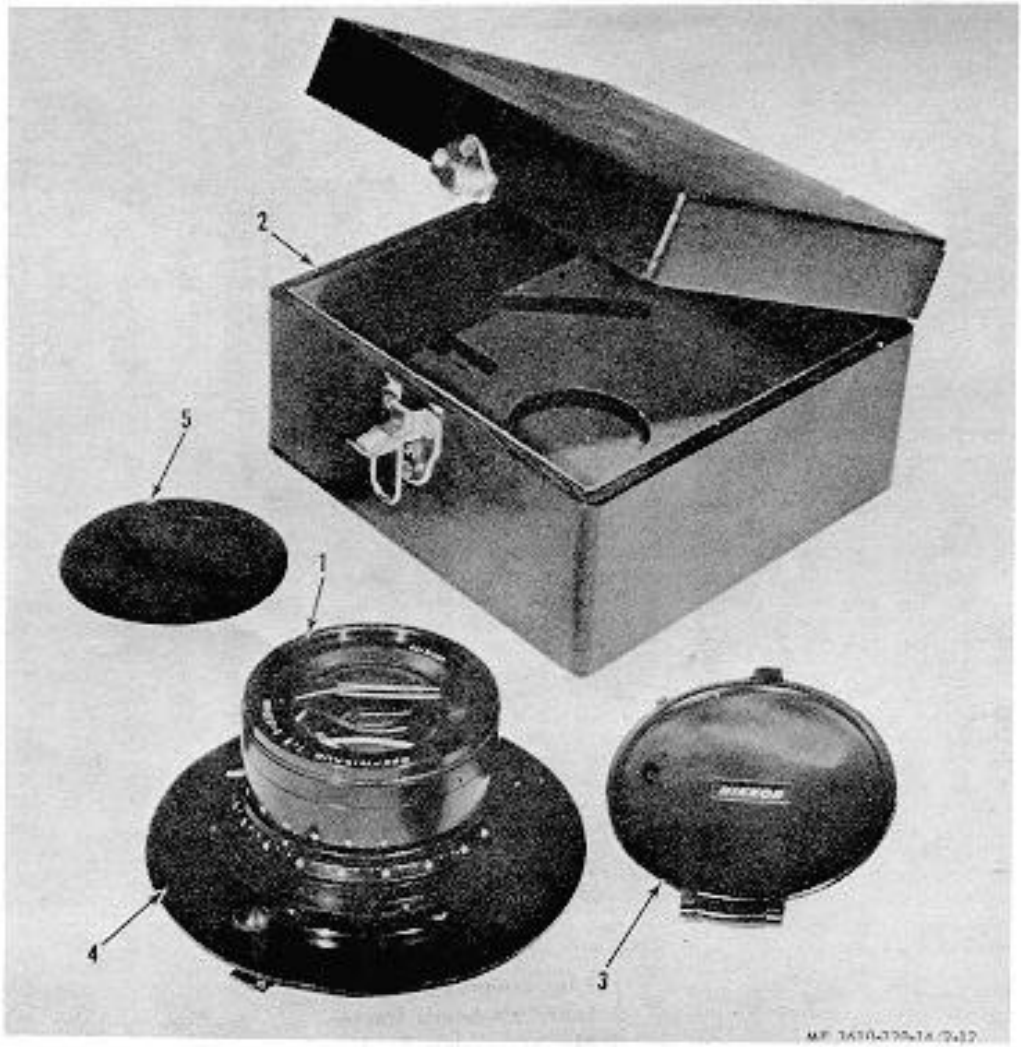
1 Lens
2 Lens box
3 Lens cap, front
4 Lens mounting plate
5 Lens cap, back

Figure 2-10. Nikon 19 inch lens.



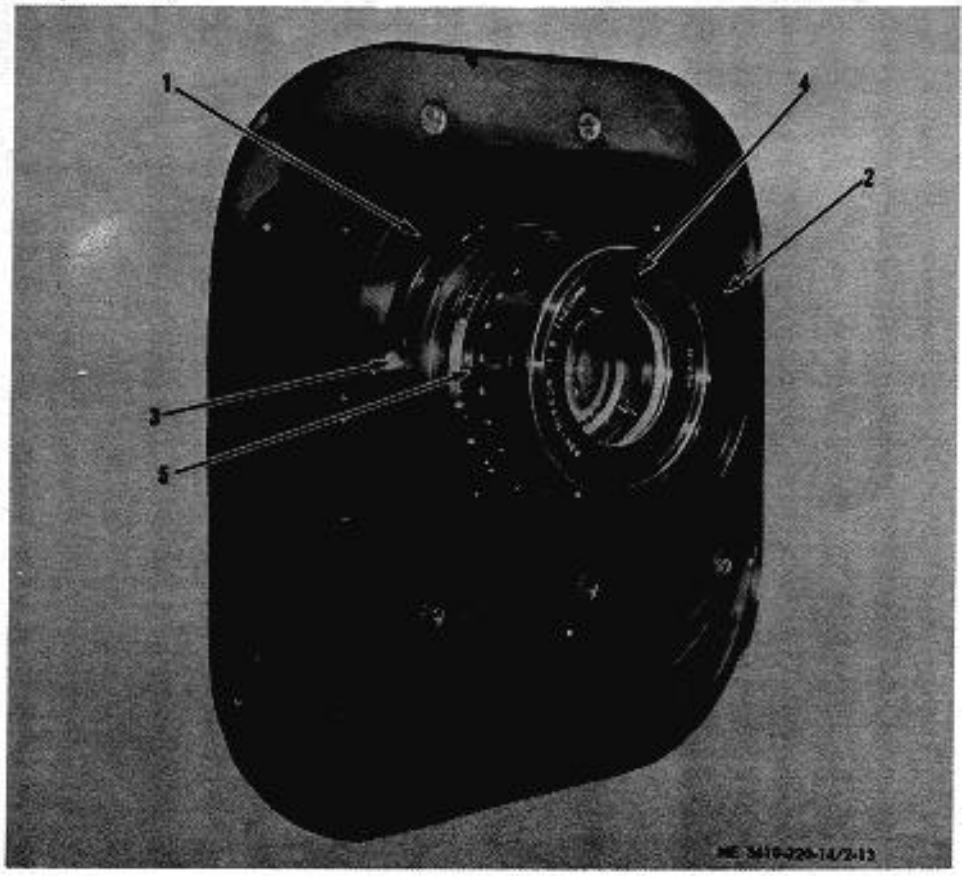
1 Lens mounting plate
2 Inner lensboard frame
3 Mounting plate knobs
4 Lens
5 Filter slot

Figure 2-11. Nikon 19 inch lens, installed.



1 Lens
2 Lens box
3 Lens cap, front
4 Lens mounting plate
5 Lens cap, back

Figure 2-12. Nikon 24 inch lens.



1 Lens mounting plate
2 Inner lensboard frame
3 Mounting knobs
4 Lens
5 Filter slot

Figure 2-13. Nikon 24 inch lens, installed.

Page 2-15. Figure 2-14 is superseded as follows.

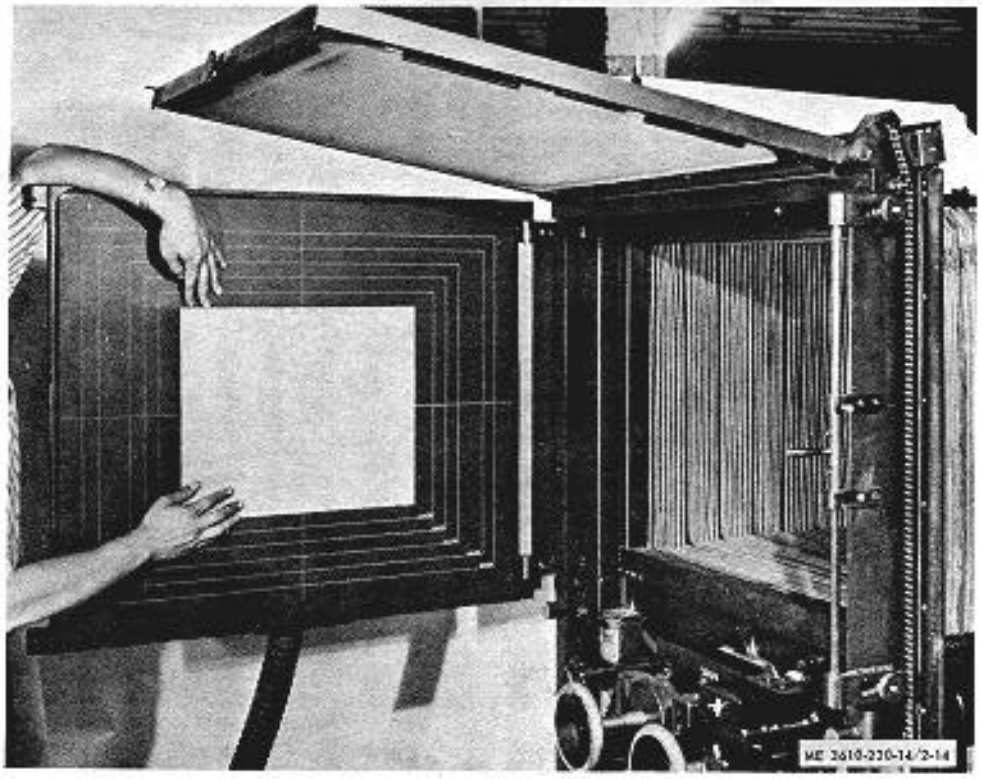


Figure 2-14. Placing film on vacuum back.

Pages 3-5. Paragraph 3-10 *a* and *b* (1) is changed to read:

3-10. Lens, 19 Inch

a. General. The 19 inch lens (1, fig. 2-10) is a Nikon Apo-Nikkor lens equipped with an attached mounting plate (4) and lens caps (3) and (5). A special lens box (21) is provided to store the lens when it is not mounted on the camera.

b. Removal.

(1) Grasp the knobs (3, fig. 2-11) on the lens mounting plate (1), and rotate 150 counterclockwise to unlock the lens (4) from the inner lensboard frame (2).

Page 3-6. Paragraph 3-11 *a* and *b* are changed to read:

3-11. Lens, 24 Inch

a. General. The 24 inch lens (1, fig. 2-12) is a Nikon Apo-Nikkor lens equipped with an attached mounting plate (4) and lens caps (3) and (5). A special lens box (2) is provided to store the lens when it is not mounted on the camera.

b. Removal. With knobs (3, fig. 2-13), turn the lens mounting plate (1, fig. 2-13), 15° in a counterclockwise direction to release it from the inner lensboard frame (2, fig. 2-13).

Page 4-5. Figure 4-1 callout "4" is changed to read:

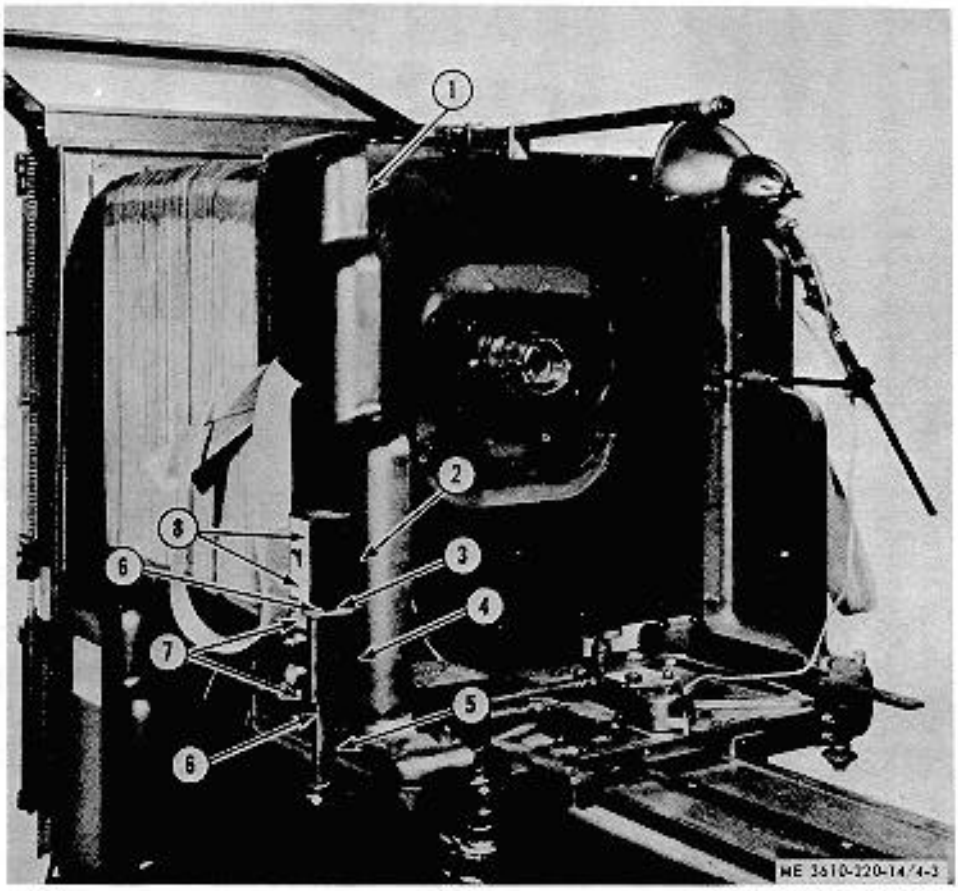
"4 Socket hd. mach. screw # 6-32 x 38 lg." *Page 4-7*. Paragraph 4-16 is superseded as follows:

4-16. Vacuum Back Valve Control Knob

a. Removal. Unscrew one #10-32 flat head screw in the center of the knob. Lift off the knob.

b. Installation. Replace the knob on the dowel pins and fasten with the # 10-32 flat head machine screw.

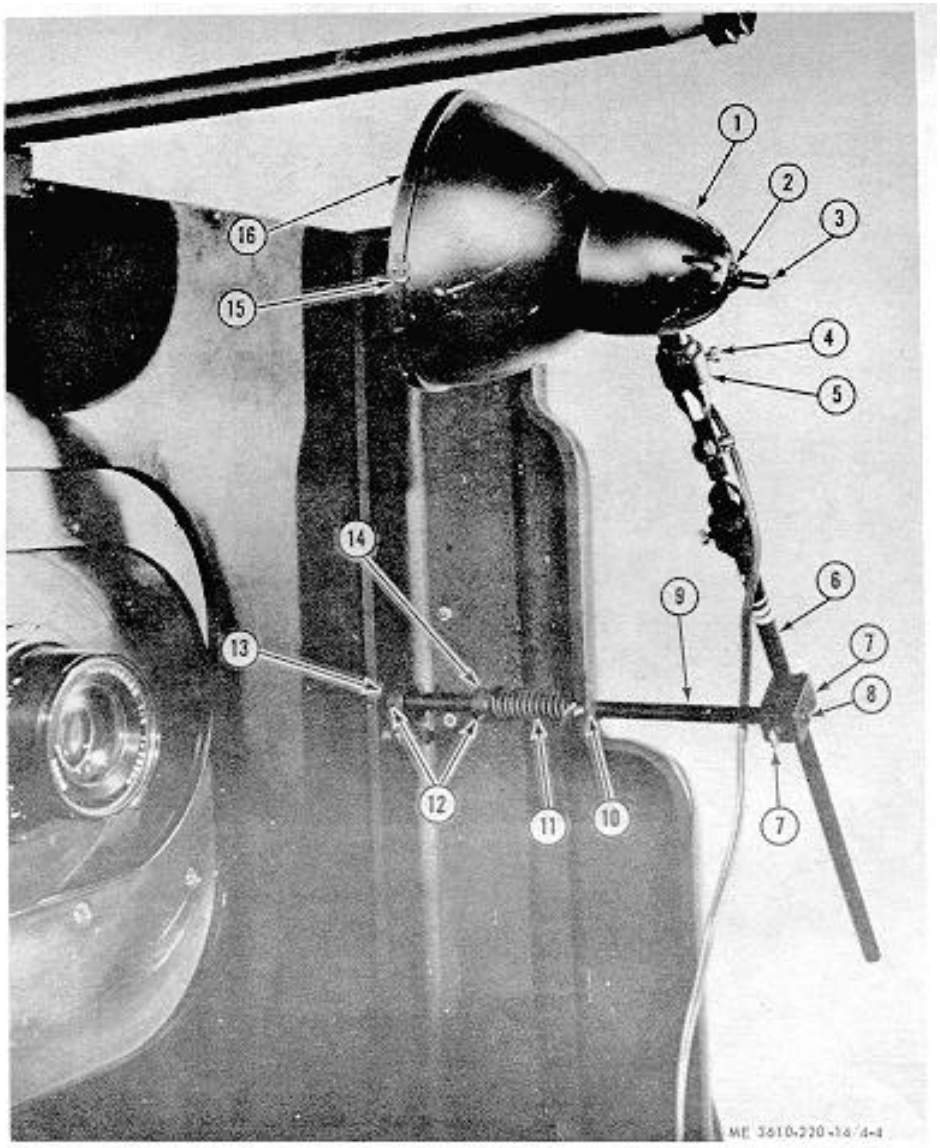
Figure 4-3 is superseded as follows.



1	Lensboard side frame
2	Lensboard shutter switch
3	Nipple
4	Lensboard arc lamp switch
5	Nipple
6	Locknut
7	Screw. rd hd. 8-32 x 1/2
8	Screw. rd hd. 8-32 x 3/8

Figure 4-3. Lensboard shutter switch and arc lamp switch. installed.

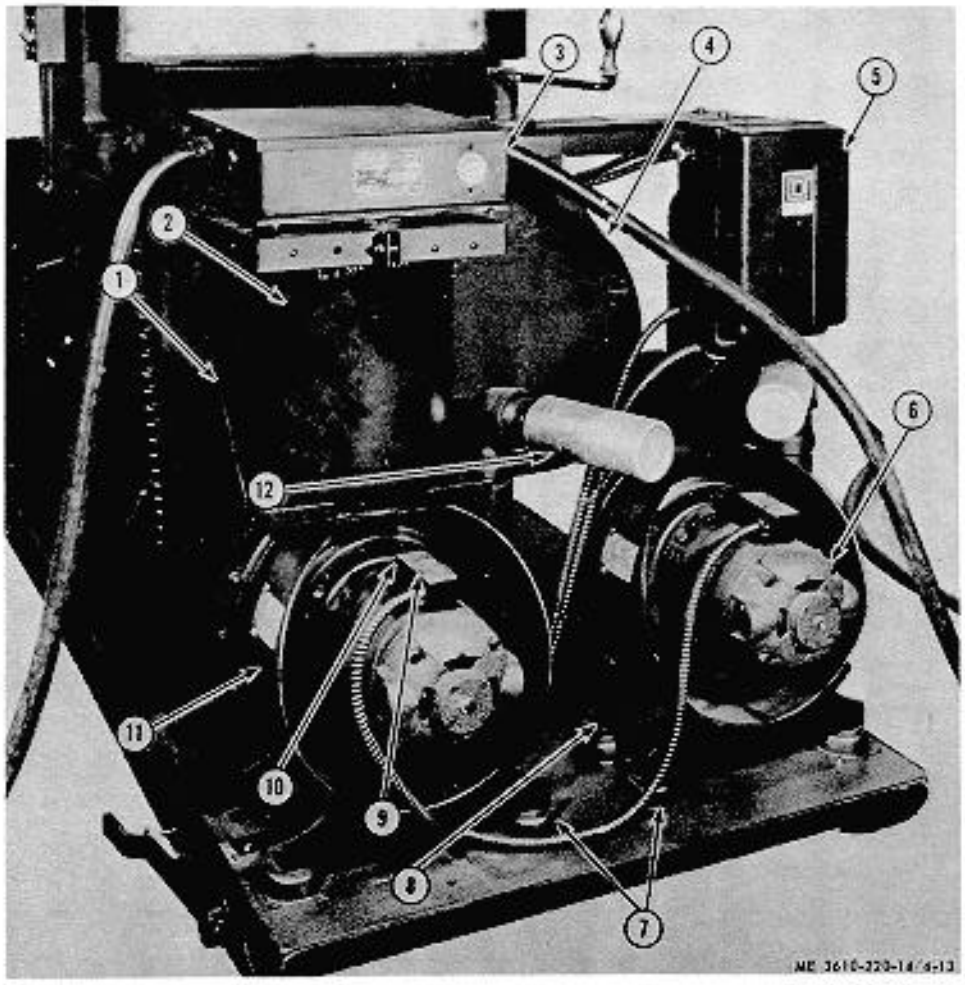
Page 4-8. Figure 4-4 is superseded as follows.



1	Lamp reflector
2	Locknut
3	Socket-switch assembly
4	Hex soc hd screw
5	Lamp bracket
6	Cross shaft
7	Adjustment screw 1/4-20 x 1
8	Joint block
9	Pivot shaft
10	Adjustment screw 1/4-20 x 1
11	Shaft spring
12	Drive pin
13	Collar
14	Pivoting collar
15	Screws
16	Retainer

Figure 4-4. Flash lamp assembly, installed.

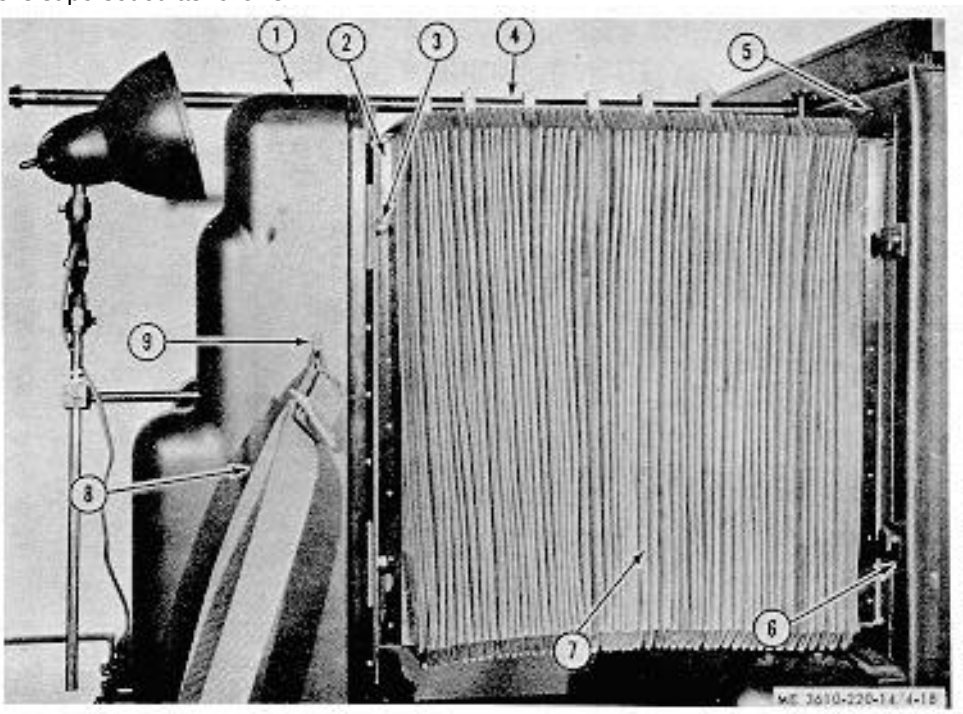
Page 4-17. Figure 4-13 is superseded as follows.



1	Support bracket
2	Transformer
3	Transformer cover
4	Rear support plate
5	Magnetic contactor
6	Vacuum back turbo-compressor assembly
7	Vibration mount
8	Vibration mount nut
9	Screw, rd hd, 10-32 x 3/4
10	Outlet box cover
11	Copyboard vacuum turbo-compressor assembly
12	Muffler

Figure 4-13. Camera components, copyboard end.

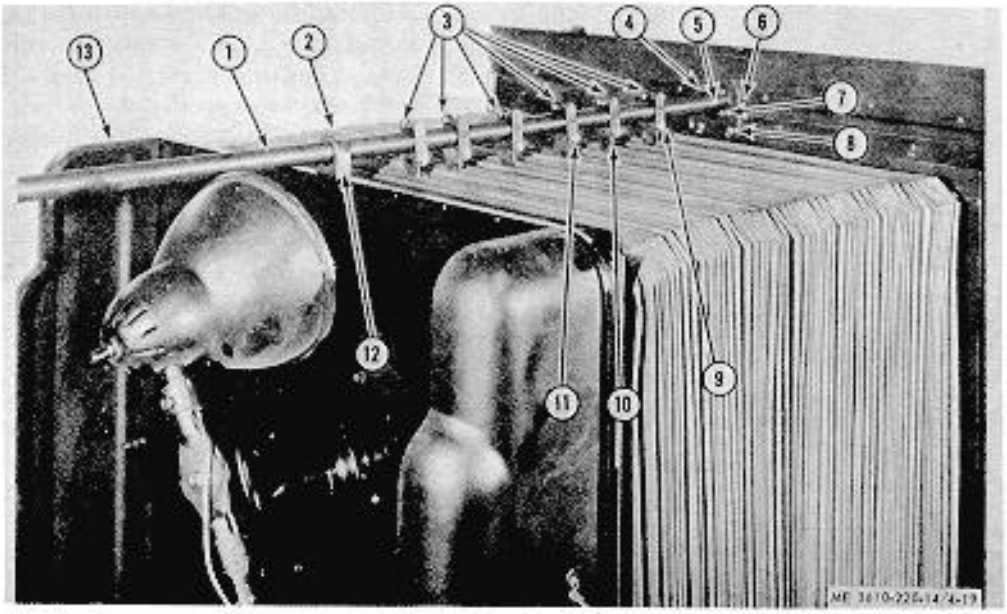
Page 4-21. Figure 4-18 is superseded as follows.



1	Lensboard
2	Bellows end frame
3	Screw, hex soc hd, 5/16-18 x 1 1/2
4	Tube support assembly
5	Bellows end frame
6	Clamp and screw assembly
7	Bellows
8	Bellows strap
9	Screw, hex soc hd, 3/16-16 x 3/4

Figure 4-18. Bellows assembly components.

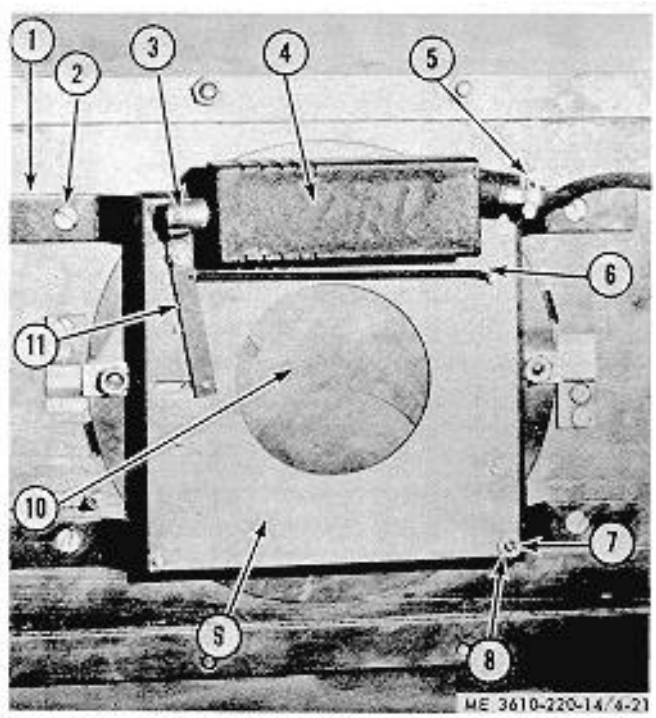
Figure 4-19 is superseded as follows.



1	Outer tube
2	Tube guide
3	Roller carrier
4	Screw, rd hd, 10-32 x 1 1/4
5	Tube flange
6	Flange plate
7	Screw, hex soc hd, 8-32 x 1/2
8	Screw, hex soc hd 10-32 x 1/2
9	Screw, hex soc hd 10-32 x 1 1/2
10	Connector plate
11	Hex nut
12	Screw, hex soc hd 1/4-20 x 3/4
13	Lensboard

Figure 4-19. Tube support assembly, installed.

Page 4-23. Figure 4-21 is superseded as follows.



1 Z-bracket
2 Screw, ft hd 10-32 x 1/4
3 Screw, rd hd 6-32 x 1/2
4 Shutter solenoid
5 Jack plug
6 Shutter return spring
7 Screw, rd hd 10-32 x 1/4
8 Washer
9 Shutter
10 Shutter blades
11 Shutter arm

Figure 4-21. Shutter assembly.

Paragraph 4-40. Subparagraph a is changed to, read:

a. Description. The 19 inch lens (1, fig. 2-10) is a Nikon Apo-Nikkor Process lens equipped with an attached mounting plate (4) and a front lens cap (3) and back lens cap (5). A special lens box (2) is provided to store the lens when it is not mounted on the camera.

Subparagraph b (1) is changed to read:

b. Removal.

(1) Grasp the knobs (3, fig. 2-11) on the lens mounting plate (4) and rotate 150 in a counterclockwise direction to unlock the lens (1) from the inner lensboard plate (2).

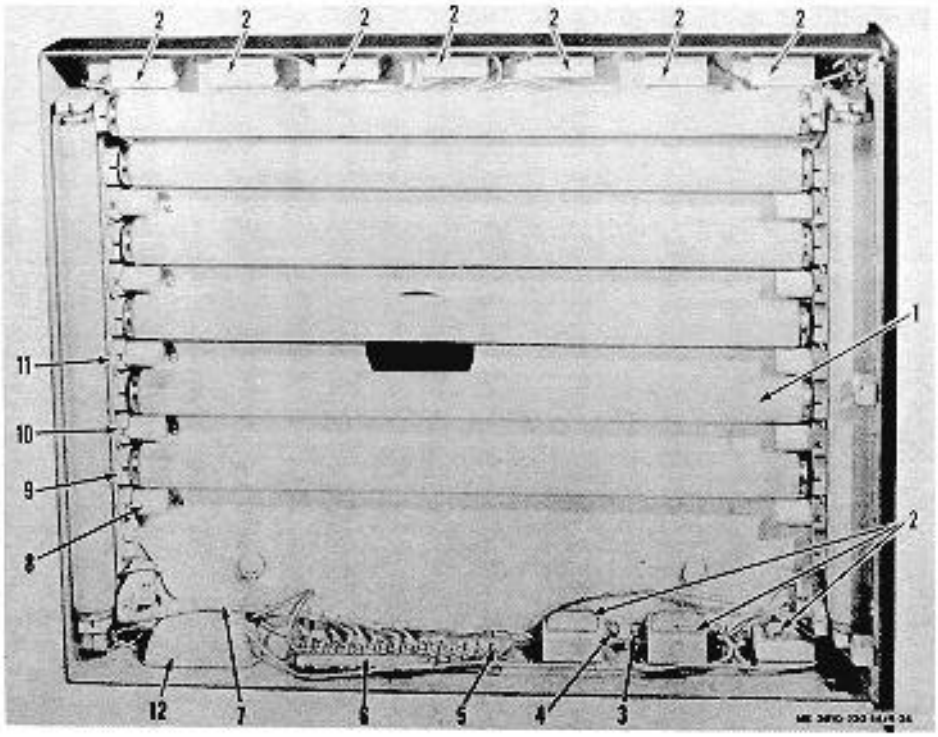
Page 4-24, paragraph 4-41. Subparagraph a is changed to read:

a. Description. The 24 inch Nikon Apo-Nikkor Process lens (1, fig. 2-12) is equipped with an attached mounting plate (4) and a front lens cap (3) and back lens cap (5). A special lens box (2) is provided to store the lens when it is not mounted on the camera.

Subparagraph "*b*" is changed to read:

b. Removal. With knobs (3, fig. 2-13) turn the lens mounting plate (4), 15° in a counterclockwise direction to release it from the inner lensboard plate (2).

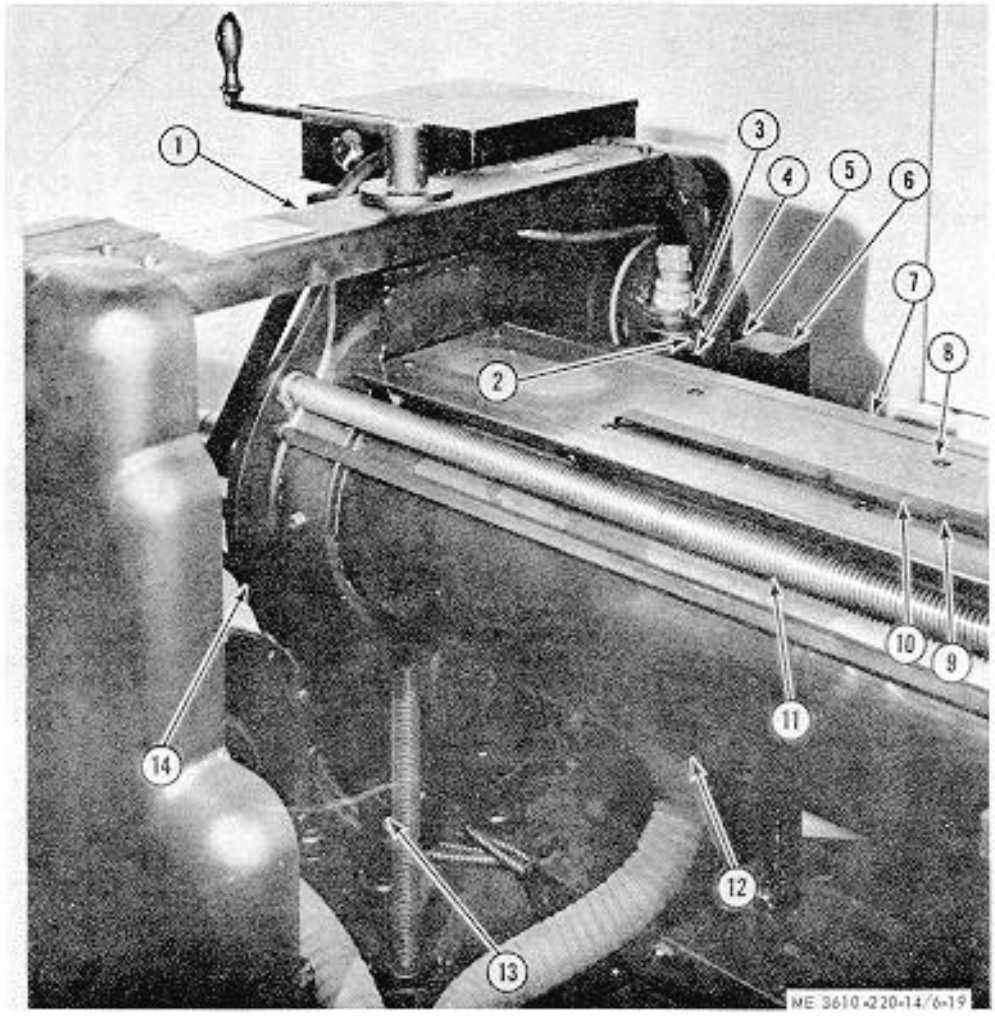
Page 4-27. Figure 4-24, is superseded as follows:



1	Fluorescent tube
2	Ballast
3	Screw, fil hd 10-32 x 1/2
4	Washer
5	Screw, rd hd 10-32 x 3/4
6	Terminal block
7	Wiring harness
8	Starter
9	Fluorescent tube socket
10	Screw, rd hd 6-32 x 1/2
11	Starter socket
12	Radio suppressor

Figure 4-24. Light box assembly.

Page 5-4. On the second line of the "Note" "(the Goerz 19 inch lens)" is changed to read "(the Nikon 24 inch lens)."
Page 6-17. Figure 6-19 is superseded as follow:



1	Support channel
2	Screw. 1/4-20 x 1/2
3	Bracket
4	Filter
5	Truss support
6	Interlock switch
7	Camera rail
8	Screw. hex soc hd. 3/8-16 x 3/4
9	Limit switch track
10	Screw. fl hd, 3/8-16 x 1
11	Drivescrew
12	Camera tube
13	Rear jack screw
14	Rear tube flange

Figure 6-19. Truss support assembly, copyboard end.

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:

VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25A (qty rqr block no. 802) Organizational Maintenance requirements for Equipment, Miscellaneous: Camera Copying.

TECHNICAL MANUAL
NO. 5-3810-220-14

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *12 April 1971*

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND

GENERAL SUPPORT MAINTENANCE MANUAL

CAMERA, COPYING, MOBILE PROCESS, 208-VOLT,

3 PHASE, 60 CYCLE 24X30 INCH CONSOLIDATED

INTERNATIONAL MODEL 1969 FSN 3610-400-7588

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

a. These instructions are published for the use of the personnel to whom this copying camera is issued. They contain information on operator, organizational, direct support and general support maintenance of the copying camera as well as a description of the major units and their functions in relation to other components of the materiel. They apply only to the Consolidated International Model 1969 copying camera.

b. Refer to TM 750-244-3 for instructions on the destruction of army material to prevent enemy use.

c. Refer to TM 740-90-1 for instructions on the Administrative Storage of Equipment.

d. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and forwarded direct to Commanding General; U. S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120.

1-2. Record and Report Forms

a. DA Form 2258 (Depreservation Guide of Engineer Equipment).

b. For other record and report forms applicable to the operator/ crew and organizational maintenance, refer to TM 38-750.

Section II. DESCRIPTION AND DATA

1-3. Description

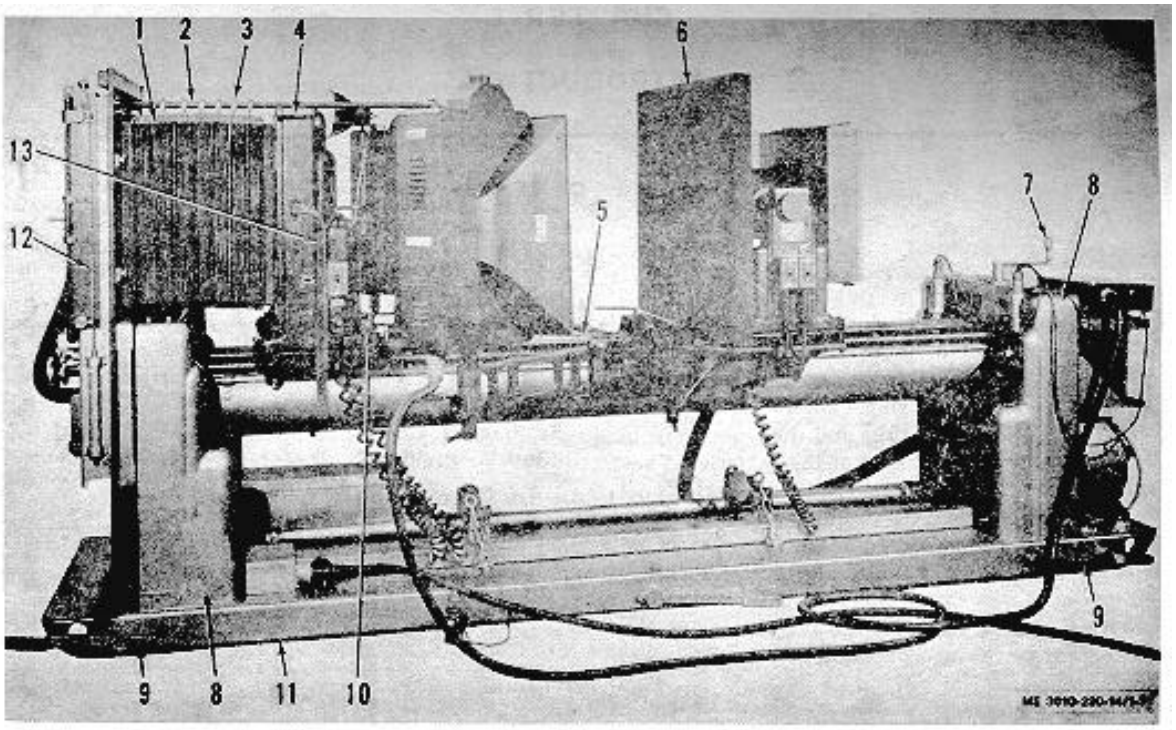
a. General Information.

(1) The lithographic copying camera (fig. 1-1) is designed for installation and operation in a mobile or fixed unit and can be readily positioned into a wall opening of the required size. The truss support assemblies (8) are the supporting structure of the camera and are mounted on a skid platform which is the base of the camera both in transport and in use. The three planes of photo reproduction, the focusing glass camera back (12, fig. 1-1), lensboard (4, fig. 1-1), and copyboard (6, fig. 1-1) are mounted on sturdy all-metal construction, providing a minimum of image distortion.

(2) The camera skid (11, fig. 1-1) is provided with six cast-iron casters, three on each side equally spaced, for rapid installation and adjustment in a mobile or fixed unit. Once the camera is installed in a mobile vehicle or a fixed unit darkroom, the casters can no longer be raised or lowered.

However, before this is accomplished the camera can be maneuvered whenever required. Each caster is equipped with an eccentric housing and lift handle (9) to permit raising and lowering the camera skid for transit or operation. The central casters extend below the end casters to permit pivoting the entire camera in movement.

(3) The copying camera contains a camera tube (7, fig. 1-2), horizontal structural member extending from end to end and supporting the lensboard (4), copyboard (2), and transparency holder (1). The tube can be lowered to a shipping position, as shown in figure 2-5, by the use of a crank handle (7, fig. 1-1) at the copyboard end of the camera.



1. Bellows assembly
2. Tube support assembly
3. Roller carriers
4. Lensboard
5. Camera rail
6. Copyboard
7. Crank handle
8. Truss support assembly
9. Lift handle
10. Limit switches
11. Camera skid
12. Camera back
13. Bellows strap

Figure 1-1. Copying camera, left side view.

1. Transparency holder
2. Copyboard
3. Arc lamp
4. Lensboard
5. Camera back
6. Tool box
7. Camera tube
8. Vacuum suction pipe
9. Copyboard flexible hose
10. Vacuum back flexible hose

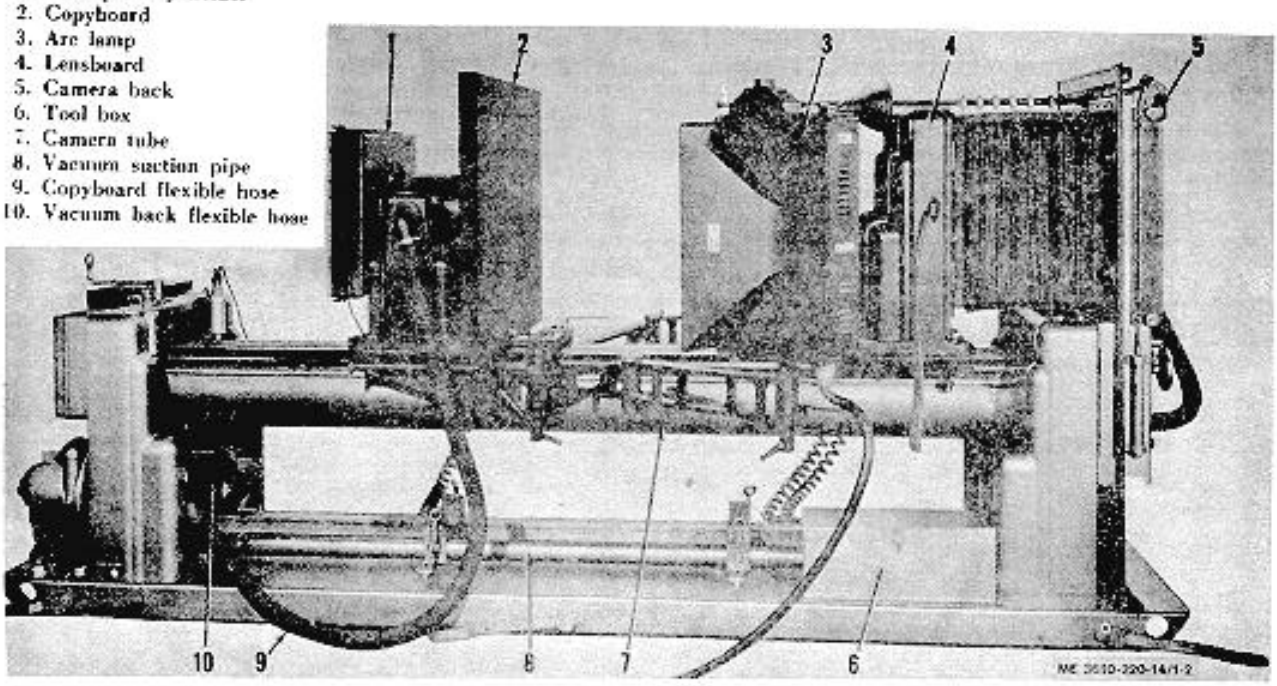
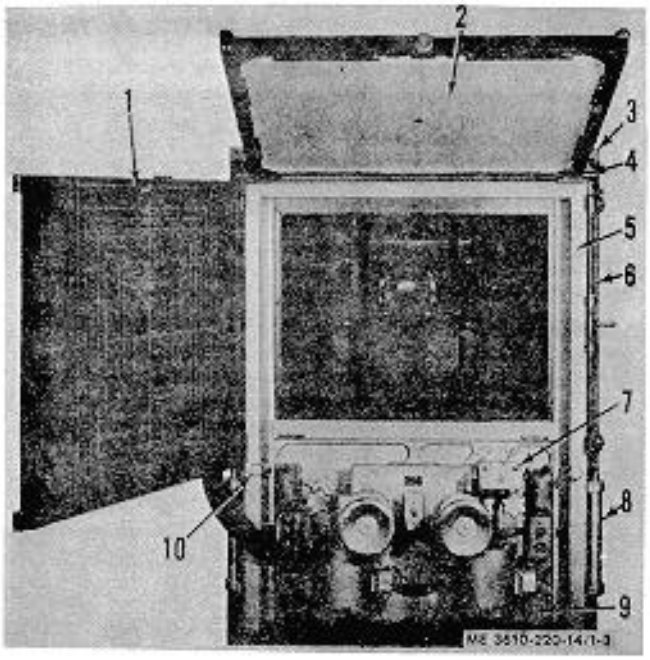


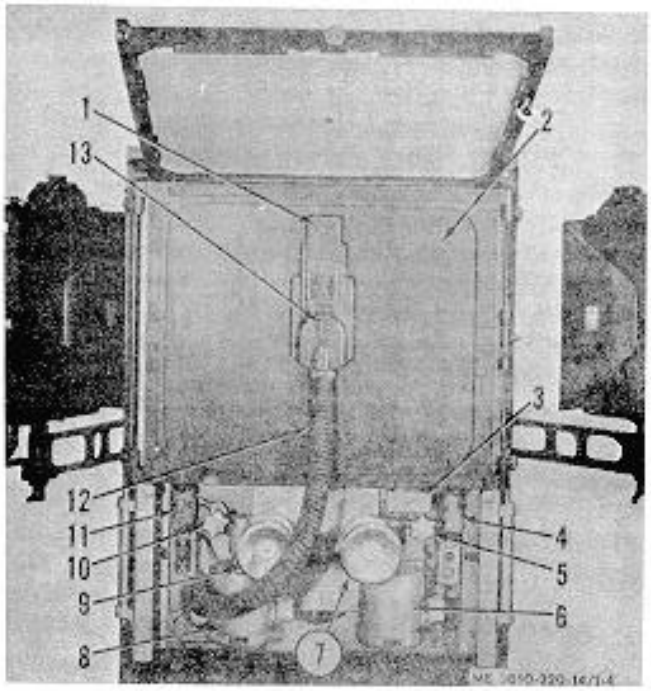
Figure 1-2. Copying camera, right side view.

b. Camera Back Assembly. The camera back assembly is part of the darkroom end of the copying camera, consisting of the camera back housing (5, fig. 1-3), the focusing glass (2, fig. 1-3) and its details. The main structure of the camera back assembly is the camera back housing, which supports the vacuum back assembly (1) and the back support plate (9). The back support plate is attached to the lower section of the housing, and bears the lensboard and copyboard drive motors (6 and 8, fig. 1-4), counters (3), and the darkroom end of the camera drive mechanism. The focusing glass (2, fig. 1-3) and its adjacent parts are connected to the housing by a hinge bracket (4) and a counterbalance arm (3), one at each upper corner of the housing frame. The side channels of the housing secure the spring counterbalances (8) and chains (6) of the focusing glass.



1. Vacuum back assembly
2. Focusing glass
3. Counterbalance arm
4. Hinge bracket
5. Camera back housing
6. Counterbalance chain
7. Counter safety light and switch
8. Spring counterbalance
9. Back support plate
10. Magnetic latch

Figure 1-3. Copy camera, darkroom view with vacuum back open.



1. Vacuum back valve housing
2. Vacuum back assembly
3. Counters
4. Lensboard control switch
5. Lens vertical control knob
6. Lensboard drive motor
7. Lensboard fine adjustment handwheel
8. Copyboard drive motor
9. Copyboard fine adjustment handwheel
10. Lens horizontal control knob
11. Copyboard control switch
12. Flexible rubber hose
13. Valve handle

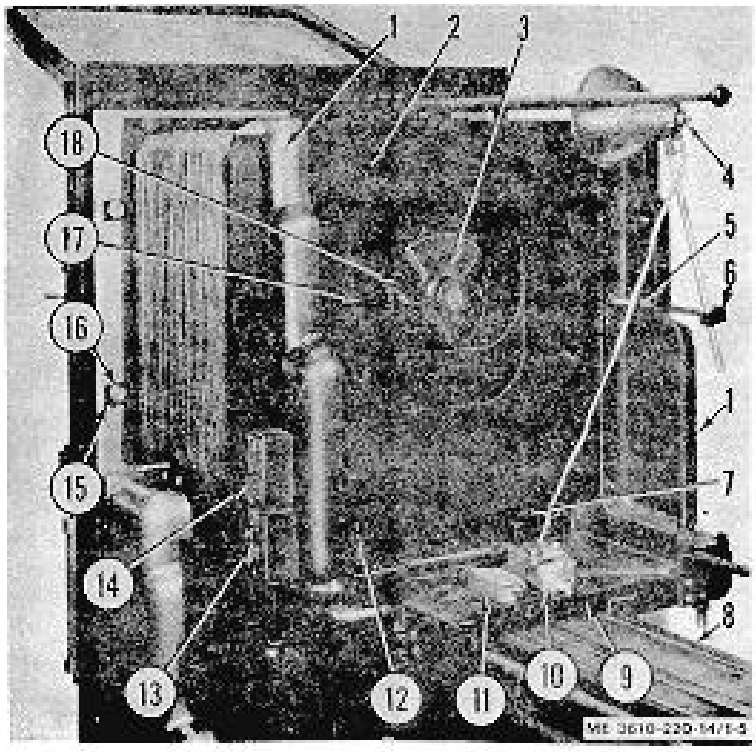
Figure 1-4. Copy camera, darkroom view with door closed.

c. Vacuum Back Assembly. This assembly (2, fig. 1-4) is hinged to and supported by the camera back housing, and consists of a door with a porous suction plate on the inner side and a vacuum back plate on the outer side, having attached to it an aluminum-cast vacuum back valve housing (1) with a valve handle (13). A flexible rubber hose (12) extending through the back support plate is clamped to the vacuum back valve housing.

d. Bellows Assembly. The bellows assembly (1, fig. 1-1) is the rubberized fabric connecting the lensboard (4) and the camera back (12). It is expandable and end-framed for mounting to the adjacent components. The tube support assembly

(2), attached to the camera back and supported by a tube guide on the lensboard, is extendible and in turn supports the bellows by six roller carriers (3). A webbed strap (3) secures the bellows assembly to the lensboard frame while the camera is in transit.

e. Lensboard Assembly. The lensboard (2, fig. 1-5) is one of the upright members of the camera, supported by the lensboard carriage base plate (9) by two side frames (1). The assembly is provided with an inner lensboard frame (17), receiving the lens mounting plate (18) equipped to hold the 19 or 24 inch lens (3). The inner lensboard frame is movable and can be adjusted horizontally and vertically by two manual control knobs (5 and 10, fig. 1-4) at the darkroom end of the camera. The lensboard carriage base plate (9, fig. 1-5) provides support for the lensboard assembly and travels horizontally on the camera rail (8) within a limited area. The base plate is driven by an induction-start, induction-run reversible motor controlled by a switch (14) on the back support plate. A handwheel (7) provides fine focusing adjustment for the lensboard assembly.



KEY to fig. 1-5:
1. Lensboard side frame
2. Lensboard
3. Lens
4. Flash lamp switch
5. Flash lamp adjustment screw
6. Adjustment screw: thumb. ¼ x 20 x 1
7. Lensboard horizontal adjustment handwheel
8. Camera rail
9. Lensboard carriage base plate
10. Limit switches
11. Holding stud and locknut
12. Lensboard vertical adjustment handwheel
13. Lensboard arc lamp switch
14. Lensboard shutter switch
15. Clamp
16. Clamp screw
17. Inner lensboard frame
18. Lens mounting frame

Figure 1-5. Lensboard assembly

f. Transparency Holder Assembly. The transparency holder (1, fig. 1-2) and its related parts are located at the end of the camera opposite the camera back (5) and the lensboard (4). Its main structure is the transparency holder housing (2, fig. 1-6) bolted to the axle and tube assembly (3), which permits a pivoting motion of both the copyboard (5) and the transparency holder. The face of the holder is a 5/ 16 inch polished plate glass diffuser (12, fig. 4-22) which covers an inner glass diffuser (13) of equal size. The top and bottom sections of the holder are identically equipped with a slide bar (14, fig. 1-6) to hold the aerial film brackets (1). The inside of the transparency holder consists of a light box assembly (12) which is in itself, an independent unit housed like a sliding door. The transparency holder has internal air passages, with corner openings in the glass diffusers, so that suction can be applied to the transparency by pulling out diverter knob (13).

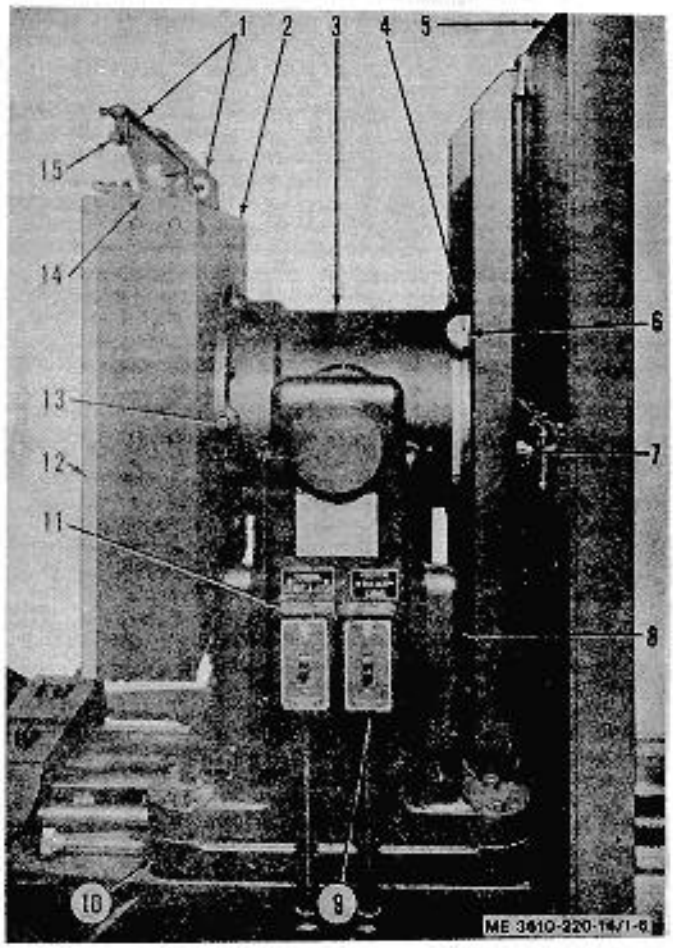


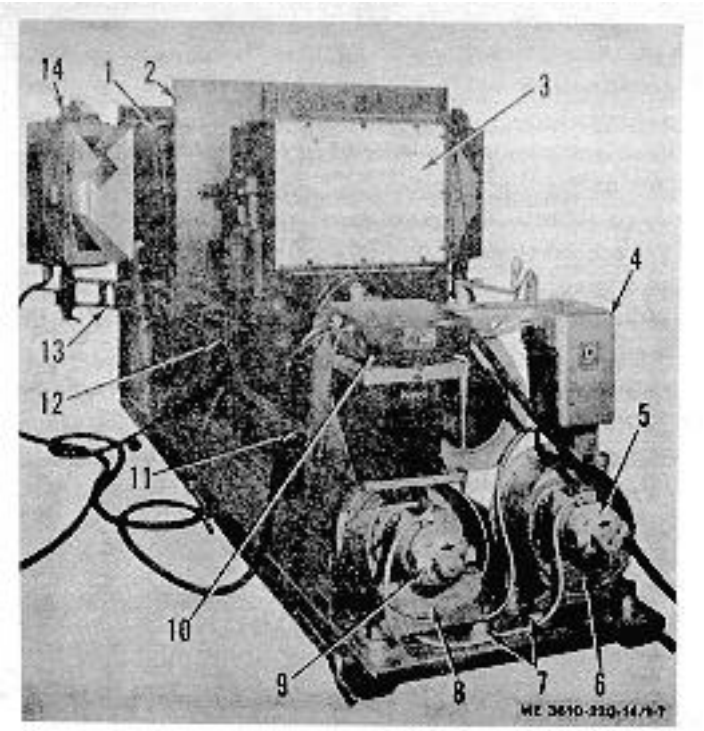
Figure 1-6. Transparency holder and copyboard connections.

g. Copyboard Assembly. Attached to the axle and tube assembly (3, fig. 1-6) and opposite the transparency holder is the copyboard (5), a rectangular member with a series of perforated holes on the front panel. The copyboard is fastened to the axle and tube assembly by two hand knobs (6), which fit into the grooves of the copyboard flange (4) to hold the copyboard secure. Since the faces of the transparency holder and copyboard are of equal distance from the center of the axle and tube assembly, either can be rotated into the same photographic plane. The axle and tube assembly is supported by, and pivots on, two copyboard frames (8) bolted and pinned to the carriage base plate (10). This assembly is similar in function to the lensboard assembly, having its own drive motor (8, fig. 1-4), control switch (11), and handwheel (9) for horizontal movement on the camera rail.

h. Vacuum Turbo-Compressor Assembly. The vacuum back and the copyboard have identical but separate vacuum sources. The basic unit for the vacuum sources is the turbo-compressor assemblies (6 and 8, fig. 1-7) located on the extreme copyboard end of the camera. The turbocompressor assemblies are mounted separately, each on four vibration mounts (7) bolted to the camera skid. Each assembly has a induction start, induction run motor (5 and 9) attached to its housing frame. The copyboard turbo-compressor is equipped with a flexible rubber hose (9, fig. 1-2) extending from its vacuum side to the transparency holder (1) and copyboard (2). Vacuum is supplied to the camera via a connecting pipe (8) on the camera skid which connects to the compressor and camera back with flexible rubber hoses (10, fig. 12).

KEY to fig. 1-6:

1. Aerial film brackets
2. Transparency holder housing
3. Axle and tube assembly
4. Copyboard flange
5. Copyboard
6. Hand knob
7. Copyboard vacuum operating knob
8. Copyboard frame
9. Transparency holder light switch
10. Copyboard carriage base plate
11. Copyboard vacuum control switch
12. Light box assembly
13. Diverter knob
14. Slide bar
15. Aerial film bracket crank



1. Lensboard
2. Copyboard
3. Transparency holder
4. Magnetic contactor
5. Vacuum back turbo-compressor motor
6. Vacuum back turbo-compressor assembly
7. Vibrator mount
8. Copyboard turbo-compressor assembly
9. Copyboard turbo-compressor motor
10. Transformer
11. Vacuum suction pipe
12. Center arm assembly
13. Free-end arm bracket
14. Arc lamp

Figure 1-7. Copying camera, three-quarter view from copyboard end.

i. Arc Lamp Arm Assembly. There are two arc lamp arm assemblies on the unit, each on opposite sides of the camera rail and each protruding from the carriage base plate of the copyboard. The camera arm assembly supports the arc lamp (14, fig. 1-7), and consists of two main structures, the center arm bracket (12) and the free-end arm bracket (13). These members are adjustable to permit extending the arc lamps to the required working distance and angle to the copyboard so as to uniformly illuminate the copy for exposure.

1-4. Identification

The copying camera has 23 different identification and instruction plates (fig. 1-8). The copyboard control switch and lensboard control switch identification plates (A), both on the darkroom end 1-6 of the camera, identifies the manufacturer's H. P. rating and component movement. The copyboard drive identification plate (B) and lensboard drive identification plate (C) identifies the control switches. Shutter switch plates (D), one on the darkroom end and one on the lensboard side frame, locate and identify the shutter switches. Copyboard and lensboard drive motor identification plates (E) riveted to the motor frame designates the manufacturer's name and other data. The rotation plates (F) riveted to the frame of the copyboard and lensboard drive motors, indicate direction of motor rotation. The turbine identification plate (G) on the darkroom end identifies the switch for the vacuum back turbo-compressor. Two arc lamp switches identification plates (H), one on the darkroom end of the camera and one on the side frame of the lensboard, identify the switches. The two arc lamp switches (J) identify the manufacturer and type. The vacuum back instruction plate (K) on the vacuum housing sets forth the valve openings for specified size negatives. The operating dial plate (L) on the back of the copyboard gives instructions as to the suction areas for specified size copy. The caution plate (M) mounted on the copyboard frames, specifies instructions for the transparency light box plug. The positive holder light identification plate (N) on the copyboard frame identifies the light switch of the light box assembly. Manufacturer's identification plates (P) attached to the lensboard side frame and to the camera skid, include the model and serial number of the camera. The caution plate (Q), mounted on top of the cross support channel of the rear truss support assembly, specifies instructions for the bellows and camera bed. The caution plate (R) mounted on the rear truss assembly specifies instructions for raising the camera. The two limit switch identification plates (S) on the lensboard and copyboard specifies the manufacturer's name and type. The limit switch identification plate (T) on the lensboard identifies the manufacturer and type. Arc lamp nameplates (U), on the rear panels of the arc lamps, identify the manufacturer and type. The transformer nameplate (V), located on the transformer side, provides the manufacturer's designation and electrical rating. The turbo-compressor motor nameplate (W) specifies the manufacturer's designation and rating. The turbo-compressor identification plates (X), on the compressor housing, identify the manufacturer and provide electrcial and pressure data. The compressor rotation plates (Y) on the compressor housing indicate rotation of motor.

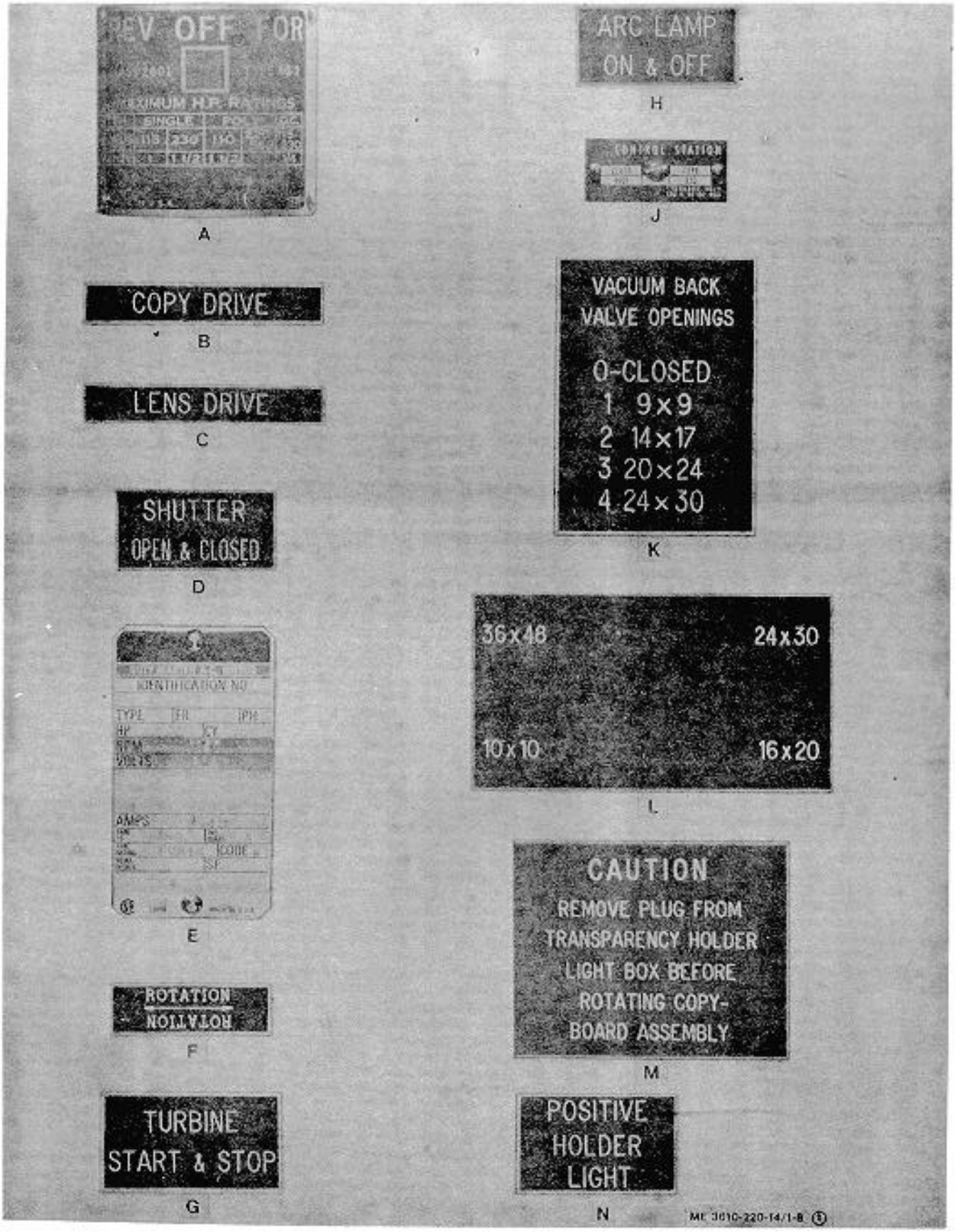


Figure 1-8. Identification plates (Sheet 1 of 2).

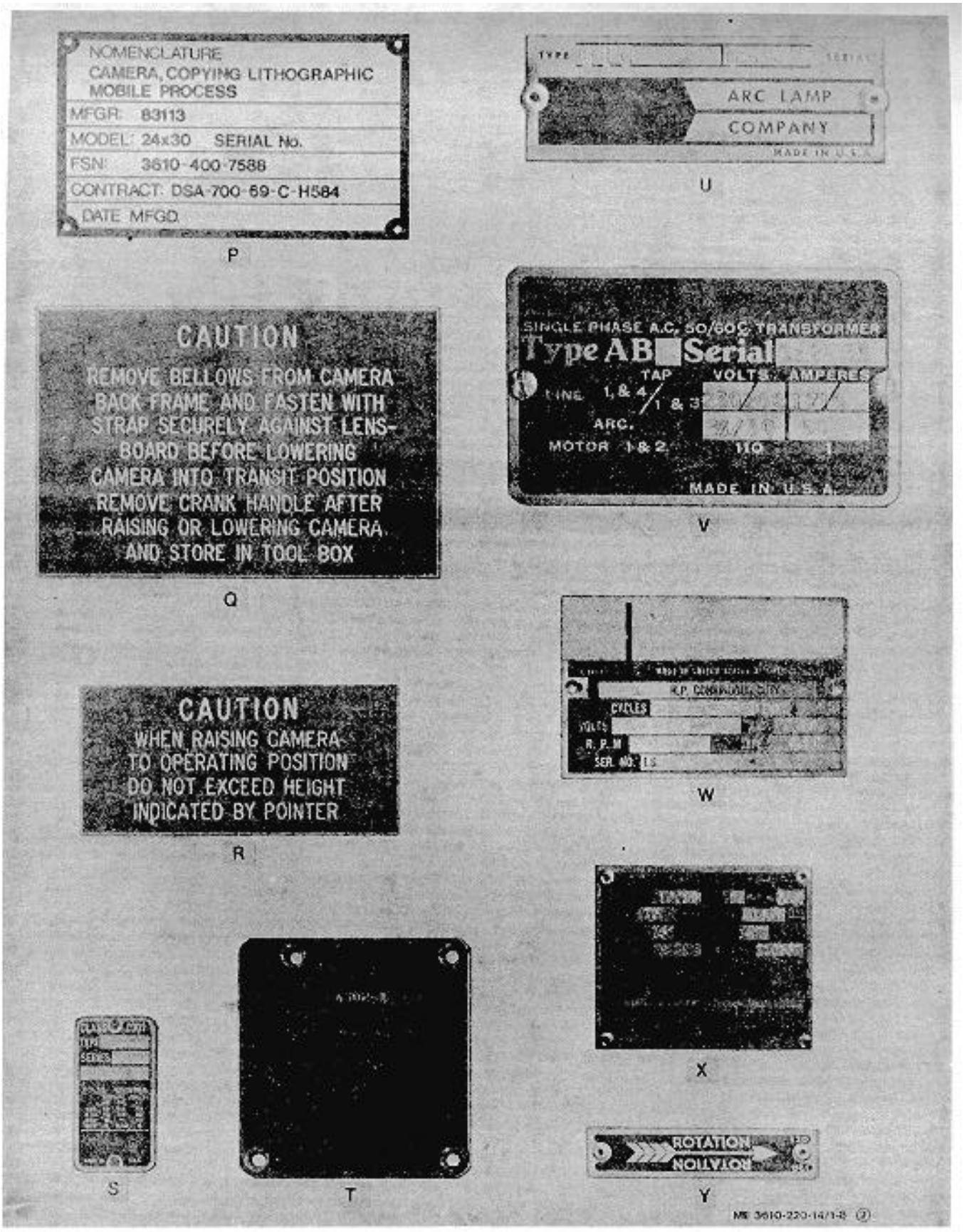


Figure 1-8. Identification plates (Sheet 2 of 2).

1-5. Differences in Model

This manual applies only to the Consolidated International Model 1969, 24 x 30 inch copying camera.

1-6. Tabulated Data

a. General.

Manufacturer ..... Consolidated International Corporation.
Model 1969.
Type ..... Copying camera, 24 x 30 in., lithographic.
Power requirements..... 208 volts, 3-phase, 60 cycle, 4-wire.

b. Dimensions and Weight. (Uncrated)

Overall length ..... 156 in
Overall width..... 84 in
Overall height ..... 82 in.
Gross weight..... 3,500 lb.

c. Dimensions Under Shipping Conditions (fig.1-9)

Overall length ..... .156 in.
Overall width..... 361½ in.
Overall height ..... 60 in.

d. Lens.

(1) 19 inch lens.

Manufacturer ..... C. P. Goerz American Optical Co
Type ..... Apochromat Artar, Process.

(2) 24 inch lens.

Manufacturer ..... C P. Goerz American Optical Co.
Type ..... Apochromat Artar. Process.

e. Shutter.

Manufacturer ..... Consolidated International Corp.
Type ..... Silent type Shutter A-21242

f. Lensboard and Copyboard Drive Motors.

Manufacturer ..... Reliance Electric Co.
Model 463222-LU
Type frame K56
Voltage..... 208/ 220V. 1.48 Amp. 50 /60 Cycle
Horsepower..... 1/4 H. P.
R.P.M. 1140
Temp. rise, degrees centigrade..... 400 C.

g. Copyboard and Vacuum Back Turbo-Compresso

Manufacture..... The Spencer Turbine Co.
Model Cat No..... 1001 U
Horsepower..... 1
Cubic feet per minute..... 75
Differential pressure..... 16 ounces.
Inlet temp degrees centigrade..... 70° C
Inlet pressure..... 14 7 P.S.I.A., (Per square inch Absolute)

h. Vacuum Back and Copyboard Turbo Compressor Motors.

Manufacturer ..... The Lamb Electric Co
Model 453
Type ..... C.S.C.
Voltage..... 115V. AC or DC, 10 Amps, 25-60 Cycle
Horsepower..... I
R.P.M. 6500
Temp. Rise, Degrees Centigrade..... 40° C.

i. Lamp Transformer.

Manufacturer ..... Macbeth Arc Lamp Co.
Type ..... A B
Voltage..... Primary: 230/208 V, I Phase, 50/60 Cycle. Secondary: 30/30V., 50 Amp.

j. Arc Lamps.

Manufacturer ..... Macbeth Arc Lamp Co.
Type ..... AB
Voltage..... 30/ 30 Volts 50 Amps

k. Flash Lamp.

Manufacturer ..... Fostoria Electric Co.
Type VCX
Voltage..... 110V.

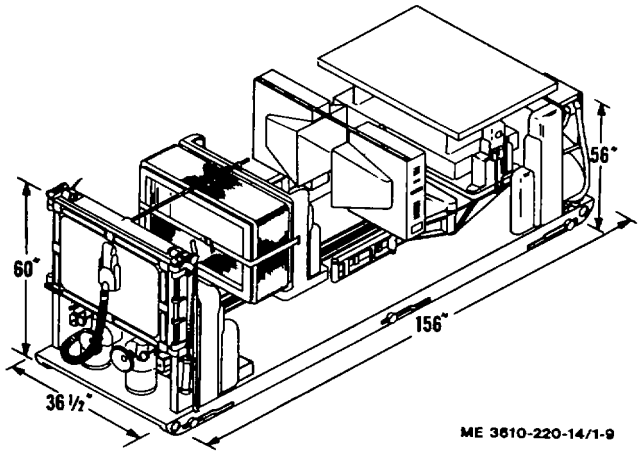


Figure 1-9. Dimensions of copying camera ready for shipment.

l. Base Plan.

(1) In mobile unit (fig. 1-10). The copying camera is mounted and made secure in the van by means of four fabricated camera clamps. Align the camera in the unit between the camera clamp holes. Retract the six casters of the camera to a non-operating

position, permitting the skid to rest flash on the floor. Insert the threaded rods extending from the L-shaped camera clamp through the steel frame floor. Fasten the camera clamps to the floor after inserting plywood pads between the camera skid and clamps.

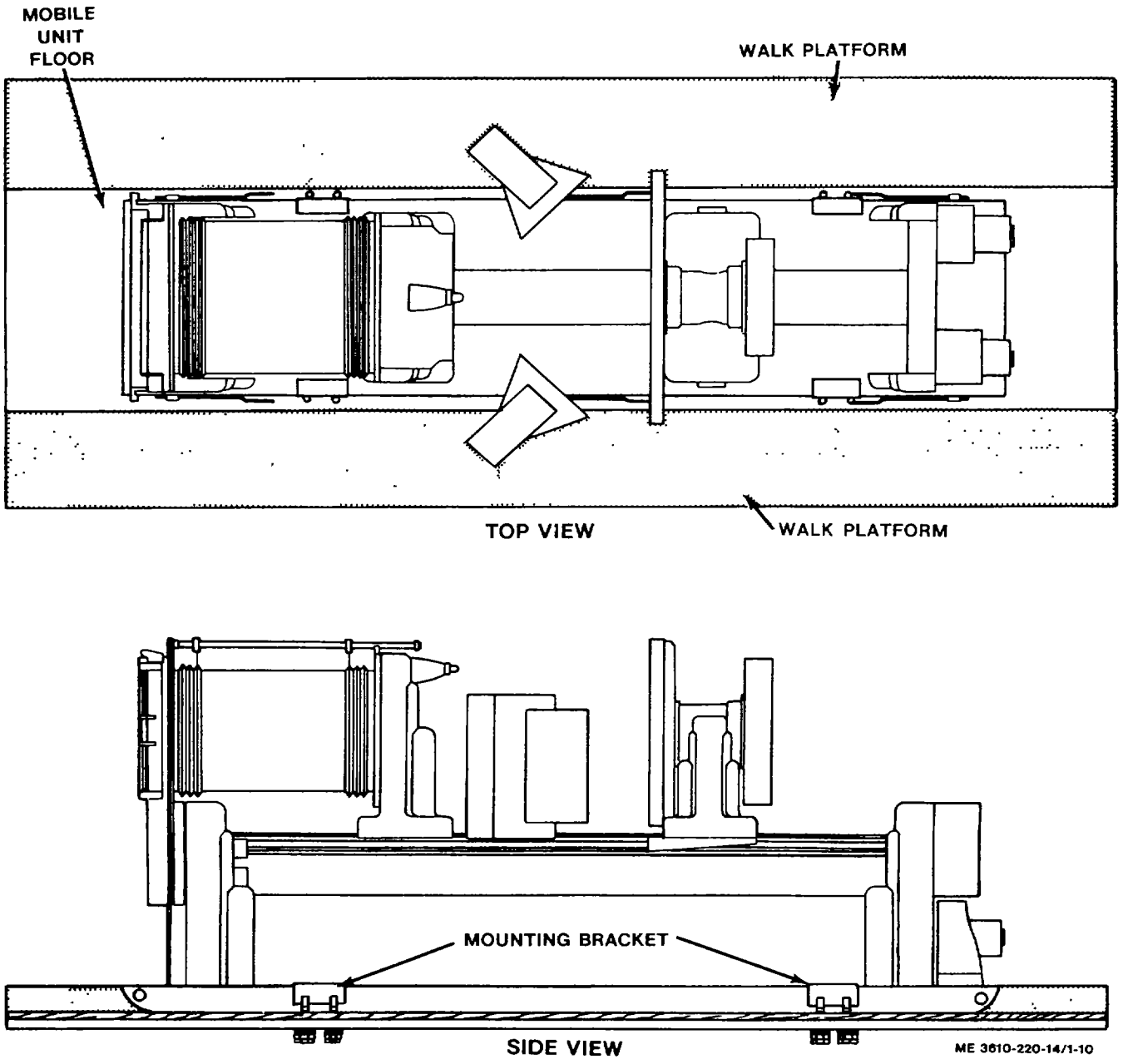


Figure 1-10. Base plan

(2) In installation. No special mounting equipment is needed for operation at an installation or in an inclosed shelter where the floor is level. It may be necessary to shim the camera skid to match the darkroom wall opening or to compensate for uneven flooring

m. Wiring Diagram. See figures 1-11 and 1-11A.

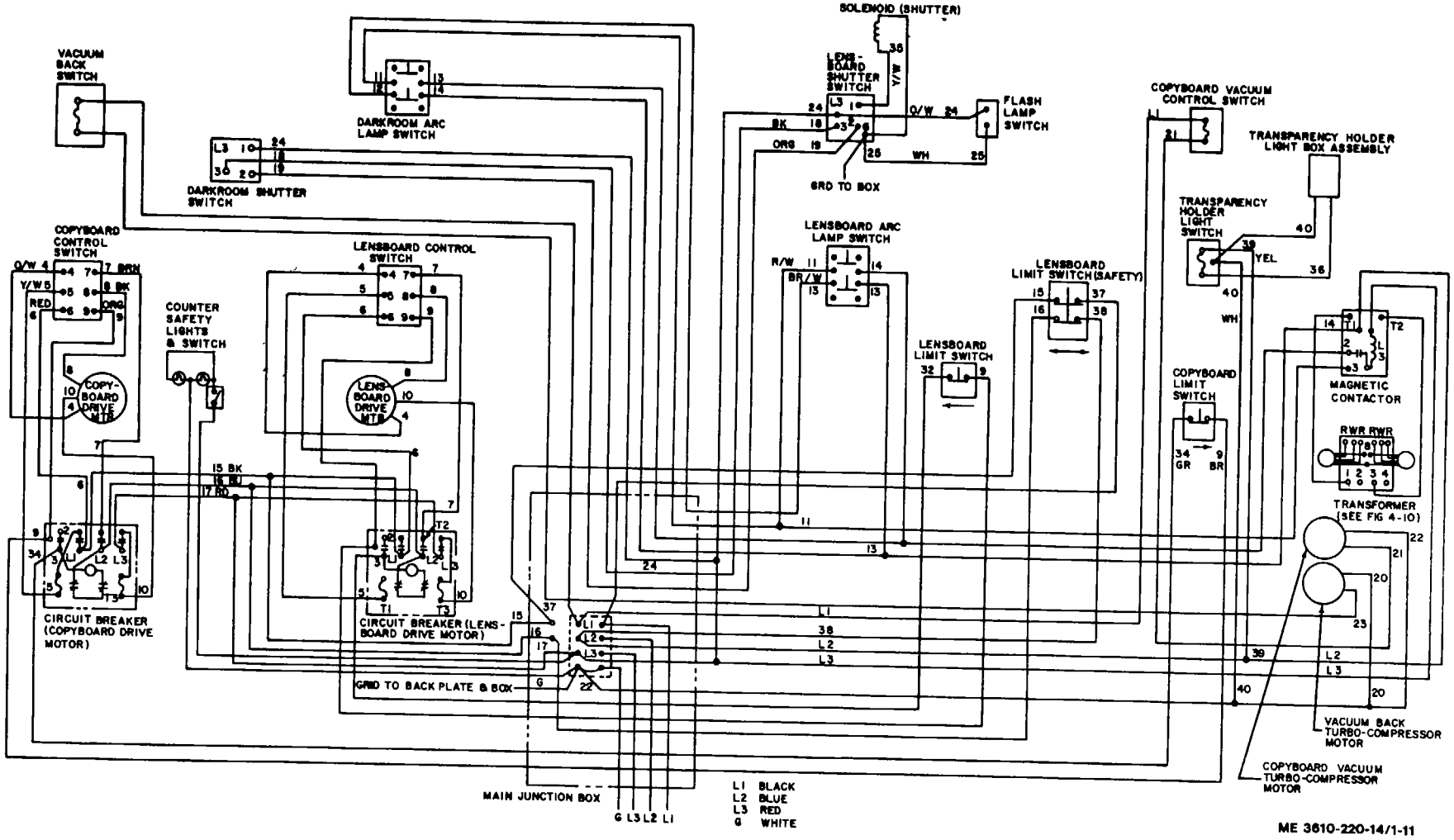


Figure 1-11. Copying camera schematic wiring diagram.

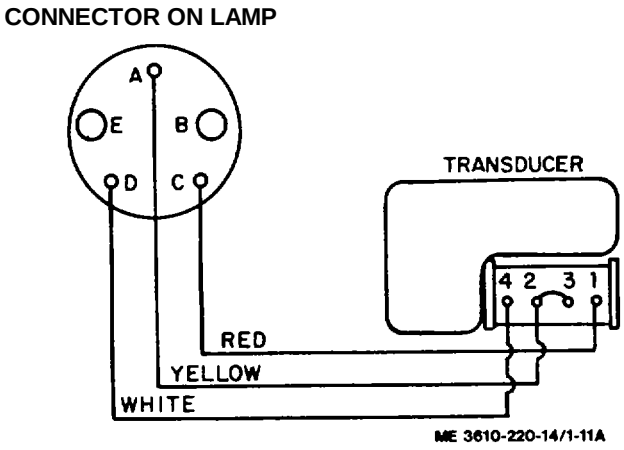


Figure 1-11A. Internal wiring of arc lamp.

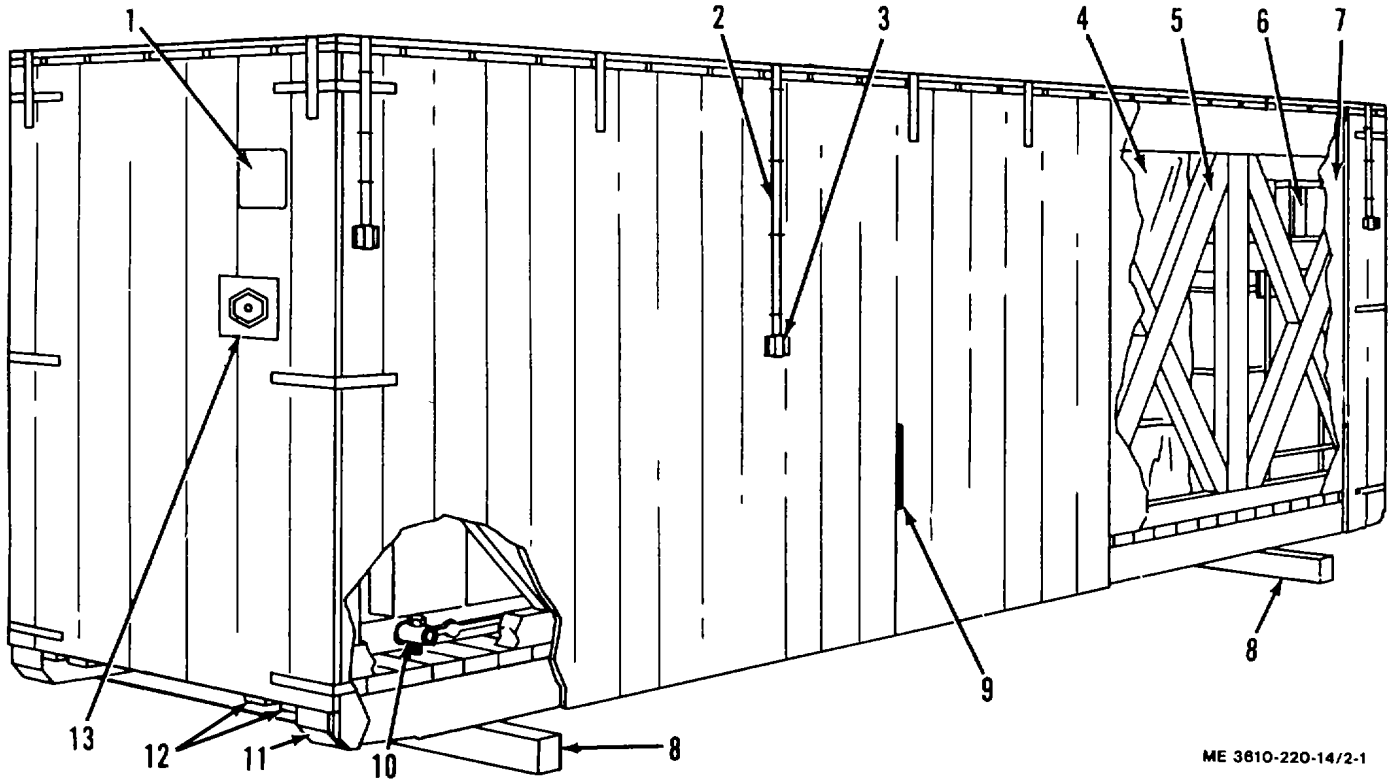
CHAPTER 2

OPERATING INSTRUCTIONS

Section I SERVICE UPON RECEIPT OF EQUIPMENT

2-1. New Equipment

a. General (fig. 2-1). For overseas shipment a new copying camera and its accessories are arranged on a wooden skid platform (11) which is completely framed and boxed. The inner frame (5) of the crate is covered with a waterproof barrier liner (7) of asphalt paper serving as a protection against moisture or water seeping through the exterior boards. The camera is wrapped entirely in a waterproof laminated paper bag (4), and sealed according to military standards. The accessories (6) are boxed in small cartons, and are placed and made secure at the end of the skid platform. For domestic shipment the copying camera is packed similarly, with the exception that it is not covered with a waterproof bag.

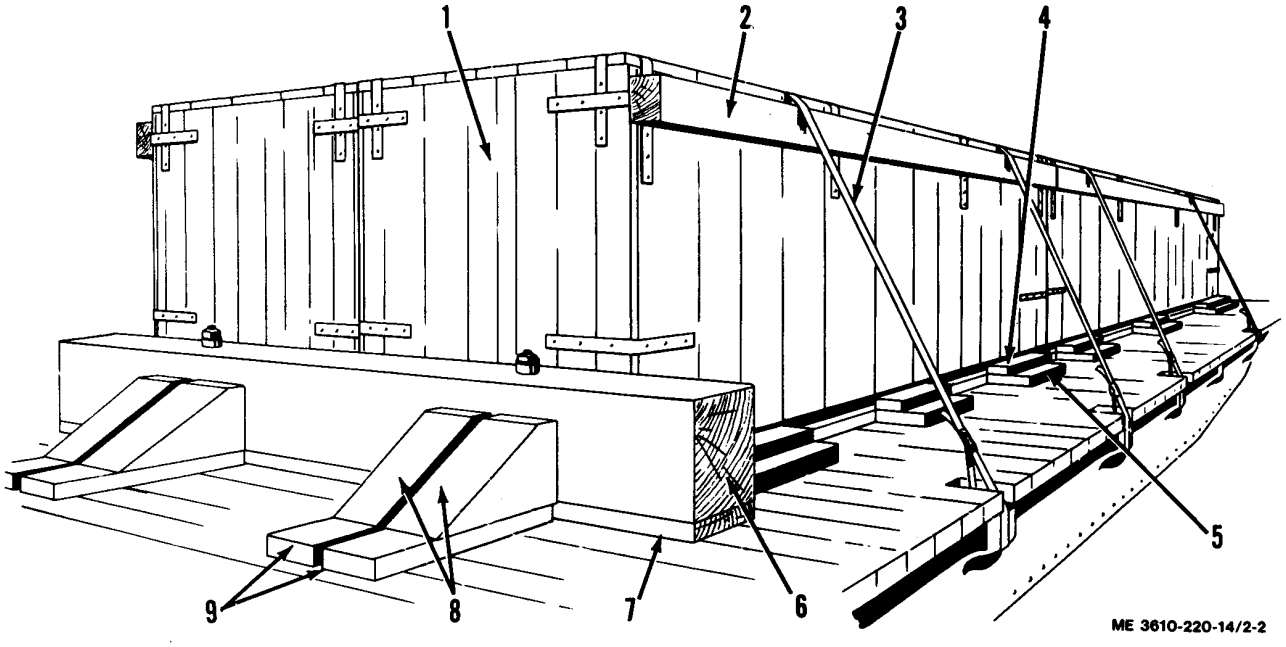


1. Packing list
2. Strapping
3 Strapping anchor plate
4 Waterproof laminated bag
5 Inner frame
6 Boxed accessories
7 Waterproof barrier liner
8. Timbers, 4 x 4
9. Center of balance mark
10 Lifting attachment
11 Skid platform
12 Sling notch
13 Hydrotector plug

Figure 2-1 Camera packing details.

b. Unloading. Four crated copying cameras may be shipped in a flatcar, blocked and strapped, as shown in figure 2-2. Before attempting to remove the wedge supports and blocks, cut the banding strap (3) and remove it from the tops of the crates and from the side frames of the flatcar. Remove the side members (2), wedge blocks (8) and supports (9), end blocks (6) and supports (7), and the side blocks (4) and (5) on the rail side of the crates. Attach two crane slings to the notches (12, fig. 2-1) provided at the bottom of the skid platform of the crate, and one crane sling around the sides at the

center of balance (9). Lift the crate from the flatcar with the crane, and place it on the nearby loading platform or on a level suitable for further transportation. If a fork truck is required for a short moving distance, the crates must be placed on two 4 x 4 timbers (8), so that the fork extensions may be placed on the under side at the center of balance.



1. Crate
2. Side member 6 x 6
3. Banding strap
4. Side block 4 x 8
5. Side block 4 x 10
6. End block 12 x 24
7. End block support, 4 x 12
8. Wedge block
9. Wedge block support

Figure 2-2 Unloading details of camera from flatcar.

c. Uncrating.

(1) Unpack the crate as close as possible to the point of installation.

(2) Cut the strapping (2, fig. 2-1) from the top and four sides of the crate. Remove the anchor plates (3) and straps.

(3) Detach the packing list (1) from the crate.

(4) Remove the nails holding the top of the inner frame (5) and remove the top boards. Do not drive a crowbar into the crate.

(5) Remove the four sides of the crate in a manner similar to removing the top.

(6) Cut the straps holding the accessory boxes (6) and remove them from the skid platform.

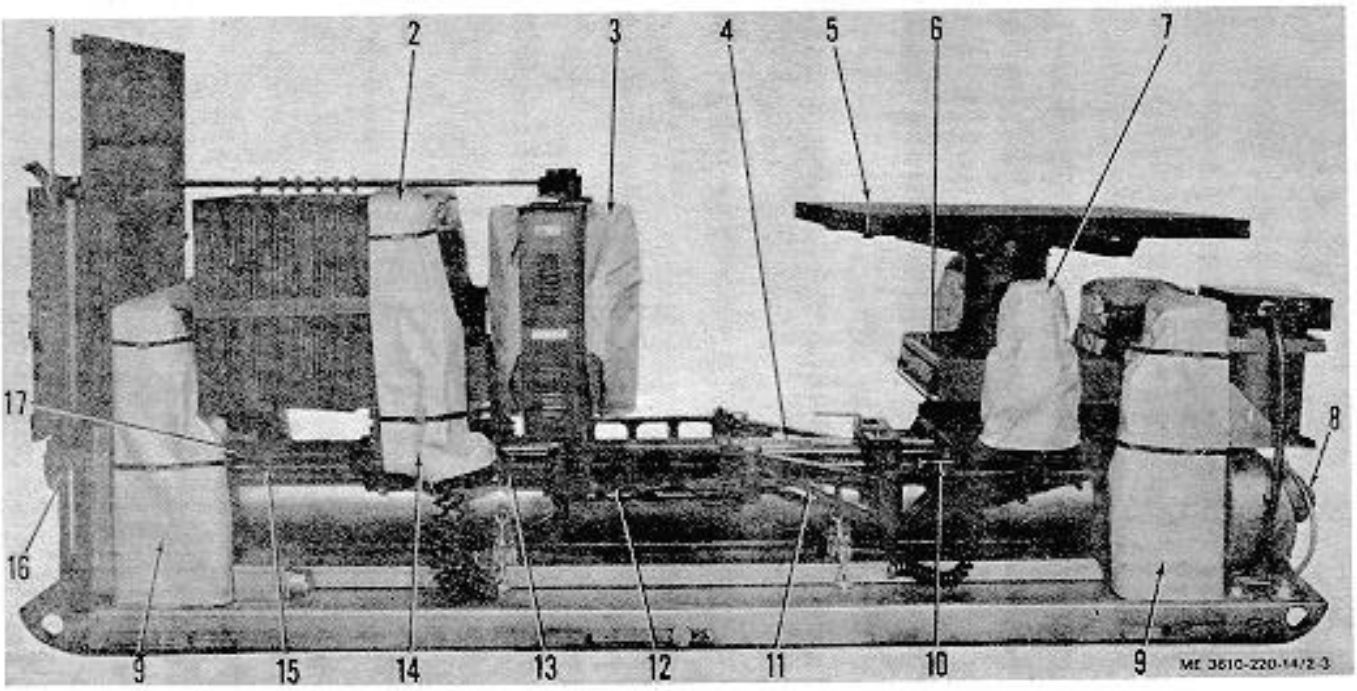
(7) Unwrap the waterproof laminated bag (4) from the camera and remove the desiccant.

(8) Withdraw the four packing bolts from the iron-pipe lifting attachments (10).

(9) Install the slings in the bolt holes of the lifting attachments and, by means of a crane, lift the camera clear of the skid platform.

d. Removal of Preservative Compounds and Lubricants.

(1) Remove the grease proof barrier and holding tape from the camera rail (4, fig. 2-3). Wipe the light oil preservative from the rail with a soft, clean cloth.



1. Vacuum back
2. Lensboard
3. Arc lamp
4. Camera rail
5. Copyboard
6. Transparency holder housing
7. Copyboard frame
8. Turbo-compressor motor
9. Truss support assembly
10. Copyboard drive bracket
11. Center arm bracket
12. Free-end arm bracket
13. Lensboard driven gear
14. Lensboard side frame
15. Lensboard control shaft
16. Drive motors
17. Camera driveserew

Figure 2-3. Location of preservatives.

(2) Unwrap the barrier from the truss support assemblies (9), lensboard side frames (14), and copyboard frames (7). Wipe off the thin coating of oil with a cloth.

(3) After removing the protective barrier from the copyboard drive bracket (10) and lensboard driven gears (13), remove the protective grease packing and wipe off the residue with cleaning solvent.

(4) Remove the barrier tape from the openings of the drive motors (16) and the turbocompressor motors (8).

(5) Wipe the thin coating of oil from the copyboard (5), transparency holder housing (6), and lensboard (2) with cleaning solvent, and dry with a clean cloth.

(6) Remove the greaseproof barrier from the lensboard control shaft (15) and the camera drivescrews (17).

(7) Wipe the light coating of protective oil from the exterior of the vacuum back (1) with cleaning solvent; wipe dry with a clean cloth.

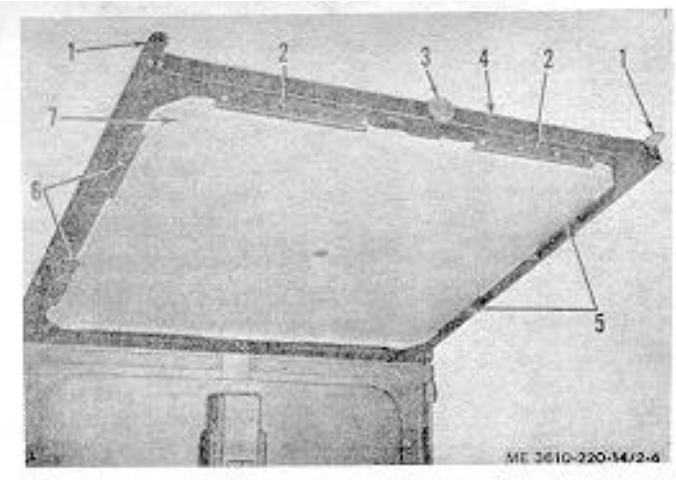
(8) Unwrap the protective barrier from the arc lamps (3), and clean the outer surfaces with cleaning solvent and clean cloth. Wipe the protective oil coating from the center arm bracket (11) and free-end arm brackets (12).

e. Assembling. The copying camera is shipped fully assembled except that the diffuser glasses and fluorescent lamps of the transparency holder and the focusing glass are packed separately.

(1) Fluorescent lamps. Remove the light box assembly from the transparency holder, and install the fluorescent lamps in their holders in the light box.

(2) Diffuser glasses. Insert the opal glass diffuser into the inner grooves of the transparency holder. Insert the plate glass diffuser (grain side iii into the outer grooves. Slide the light box assembly, into the transparency holder.

(3) Focusing glass (fig. 2-4). Open the vacuum back, and remove the holder clips (2 and 5) on bottom and one side of the focusing glass frame (4). Loosen screws in others slightly. Lower focusing glass frame approximately 45°. Insert glass with grained side toward the lensboard and with numbered dimensions reading right side up. Replace the holder clips and tighten screws.



1. Magnetic latch
2. Bottom holder clip
3. Oscillating knob
4. Focusing glass frame
5. Side holder clip
6. Screw, pan-hd, 10 — 32 x ½
7. Focusing glass

Figure 2-4. Focusing glass details.

f. Inspection.

(1) General. Make a complete inspection of the copying camera, identifying the equipment and visually checking for loss and damage which may have occurred in shipment.

(2) Lensboard assembly. Check the lensboard carriage assembly for loosened bolts. Rock carriage assembly on rail to determine if carriage shoes and gibs have loosened from snug fit with the rail. Inspect the inner lensboard frame and the shutter for damage affecting their operation.

(3) Copyboard assembly. Make a complete inspection of the copyboard for damages. Check the copyboard front and rear plates for warping. Inspect for missing or loosened screws. See that operating dial knob functions properly. Inspect the copyboard carriage assembly for loosened bolts. Rock carriage assembly on rail to determine if carriage shoes and gibs have loosened from a snug fit with the rail. Pivot the copyboard and transparency holder to determine if the axle and tube assembly binds or is difficult to move. Inspect with thin feeler (0.0015 in. or 0.002 in.) between cop! board back and adjustable pads on base of copyboard frames to ascertain if they contact uniformly in both positions of the copyboard facing and away from the lens).

(4) Bellows assembly. Thoroughly inspect the rubberized fabric for tears, cuts, or crack Check the end frames of the bellows for loose connections and missing screws and nuts. See that bellows are properly supported by the tube support assembly, and that internal reinforcement frames to which they are attached are not bent or separated.

(5) Transparency holder assembly. Check the transparency holder housing for dents and bends affecting the inner components. See that the diffuser glasses are properly seated in grooves. Check glasses closely for scratches or other flaws within their work area that will necessitate replacement. Examine the light box assembly for broken ballasts and wire connections. See that the light box slides smoothly into transparency holder housing. Check the bolts and nuts, securing the housing to the flange to assure that they are tight.

(6) Camera back assembly. Inspect the camera back housing and its interconnecting members for light-tight connections.

(7) Arc lamp assembly. Examine the reflectors and reflector doors of the arc lamps for bends and tears. Check the carbon holders for missing or damaged parts. Inspect the arm bracket castings supporting the arc lamps for cracks and splits. Check the wire connections of the transducer assembly located in the arc lamp.

(8) Flash lamp assembly. Inspect the lamp for broken outer glass. Check for burned-out bulb, Move the flash lamp in a horizontal position to check operation to lens. Check for loose wire connections and broken wire plug and receptacle.

(9) Truss support assembly. Check the truss supports for breaks in casting. See that the truss supports are securely bolted to the skid platform and the support channel. Examine the cross members between the truss supports for tight fit.

(10) Copyboard and lensboard drive mechanism. Check carefully for burred or damaged threads on the drivescrews. Inspect the drive gears for nicks and impacted dirt between the teeth. Examine the handwheels, gear guards, drive motors, and counters for looseness, breaks, and other damage.

(11) Vacuum system. Check the flexible hose to the vacuum back and copyboard for tears and improper connections. Examine the turbo-compressors for dents in the housing or blockage of the mufflers that might affect their function. Check the vacuum backhousing and the valve handle on the vacuum back for damage. Move the valve handle to several positions to see that it functions properly. Check the porous suction plate for damage or injuries that may affect its function.

(12) Lubrication fittings. Check the six lubricationfittings on the camera skid for looseness, breaks, or other damage.

(13) Electrical system. Inspect all switches of the camera for dismantling, damaged boxes, and loose wire connections. Check the wires and arc lamp cables for frayed or torn insulation. Examine all receptacles and cutout boxes for secure mounting.

g. Service.

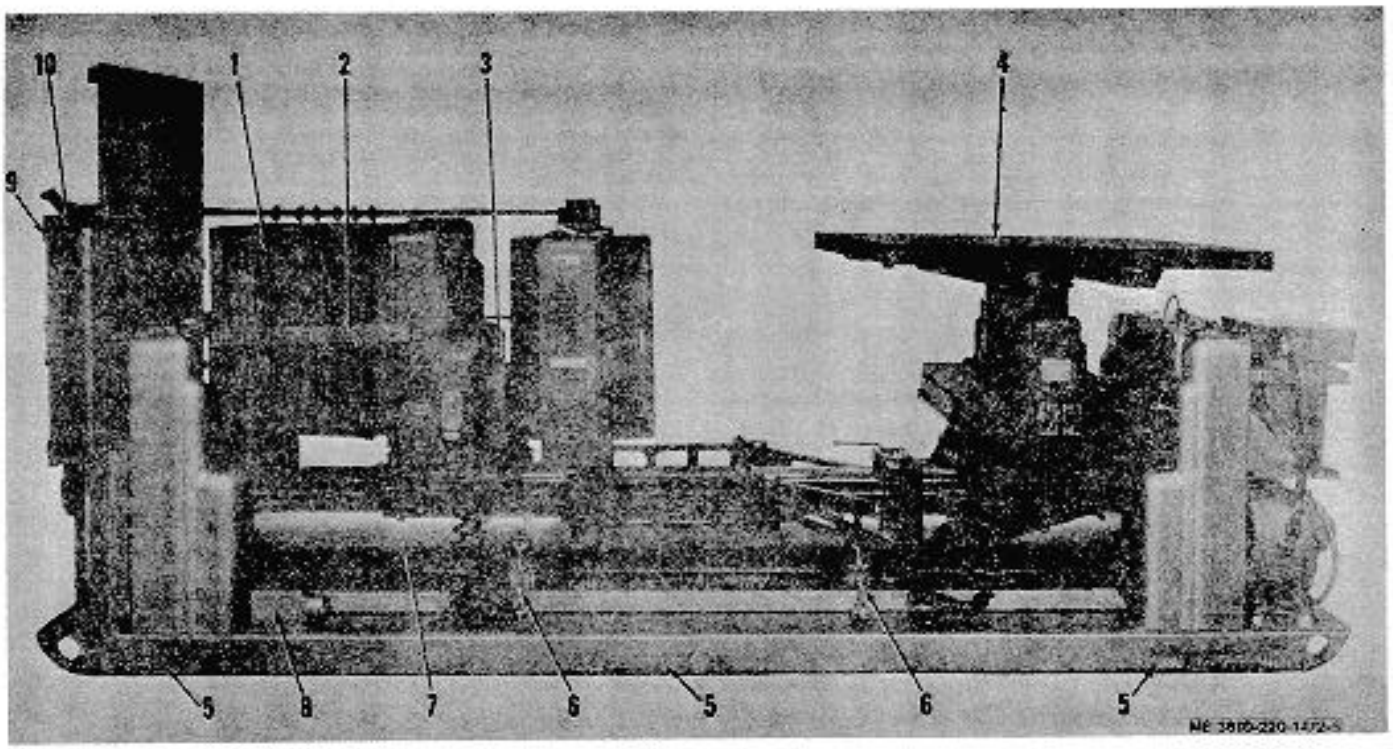
(1) Lubricate the camera in accordance with paragraphs 3-3 and 3-4.

(2) Perform the daily preventive maintenance services detailed in paragraph 3-6.

h. Camera Installation and Setting-Up Procedures.

(1) Location recommendation. The camera, when not installed in the mobile camera van, should be located in level dry area adjacent to the associated functions of map copy preparation, stripping, and platemaking. The area should be at least 10 feet wide by 1412 feet long, backed by a darkroom at least 10 feet wide by 8 feet deep. The camera room area should be in closed and suitably illuminated to prevent extraneous light from entering through the lens to the negative and from adding uneven illumination to the copyboard. Adequate air circulation should be provided through light-tight louvers or fans. The darkroom should be constructed to be light-tight in advance of the camera installation. The approximate center ofthe darkroom wall receiving the camera should have a framed camera back opening equal in dimensions and construction to that of the mobile camera unit. The entry between the camera and the darkroom should be through a light-trapped passageway. Sufficient clearance should be allowed behind the copyboard end of the camera to permit the operator's passage for trimming arc lamps and other servicing. Power, water, drain, illumination, and other utilities will correspond to those specified for mobile camera unit installation.

(2) Leveling. The floor on which the camera is installed should be level and solid to minimize structural distortion. If the floor is uneven, flat shims should be installed under the camera skid rails adjacent to the bolts, securing the skid to the floor. These shims should be accurately built up so that the camera skid platform rests solidly, flat, and level on the floor. Retract the six casters with lift handle (5, fig. 2-5) provided on the camera, as shown in figure 2-6.



1. Bellows
2. Bellows strap
3. Lens storage box
4. Copyboard
5. Lift handle
6. Turnbuckle
7. Camera tube
8. Main junction box
9. Hinge bracket
10. Locking knob

Figure 2-5. Copying camera, setting-up details.

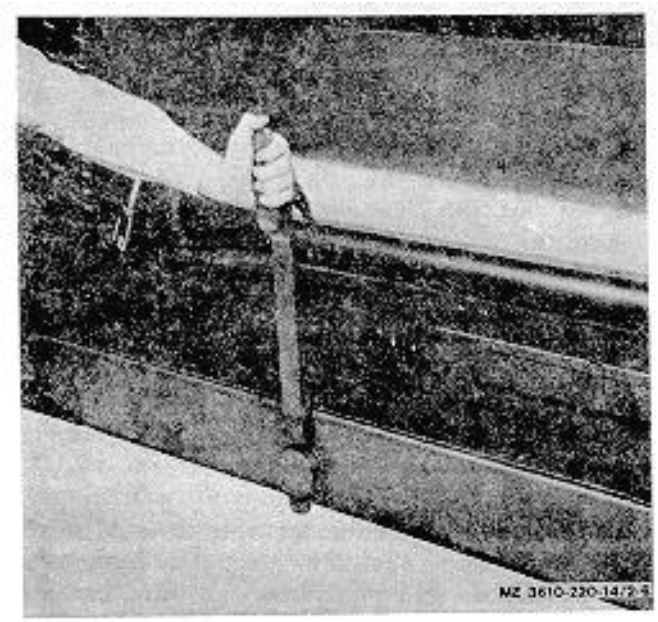


Figure 2-6. Retracting wheel of camera skid.

(3) Power source. The camera is electrically rated as 208 volt, 3 phase, 60 cycle, 4 wire equipment, and will operate off a similarly rated portable generator or power line supply. This fourwire system will also supply 120 volt output between any of the phase wires and the fourth or ground wire. As some of the camera equipment is rated for 110 or 115 volt operation, any installation involving other than the prescribed power source must be checked with an electrician before any connections are made.

(4) Setting-up procedures.

(a) Remove copyboard blocking, release both hand knobs, rotate copyboard 90° on its axle and tube assembly, tighten both hand knobs, and swing copyboard (4, fig. 2-5) to a vertical plane.

(b) Loosen the four turnbuckles (6), and unhook them from the camera tube (7).

(c) Raise the camera bed to operating height by turning the jackscrew with crank handle (7, fig.1-1). The operating height is indicated by a pointer at the copyboard end of the camera (fig. 2-7). When the mark on the camera bed coincides with the pointer, the bed is at operating height. Remove the crank handle and return to toolbox (6, fig. 1-2).

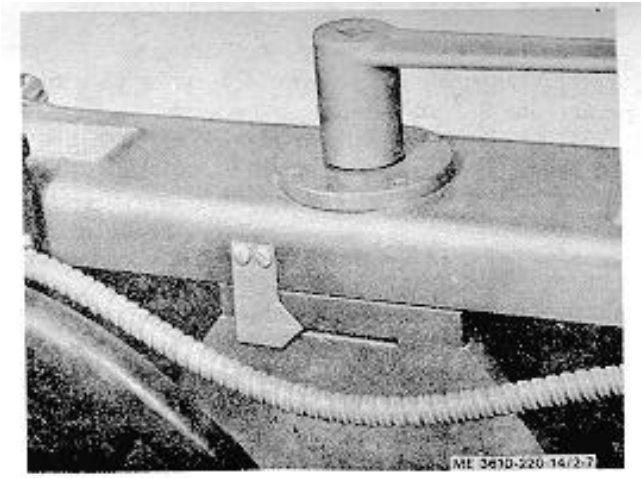


Figure 2-7. Camera at operating height.

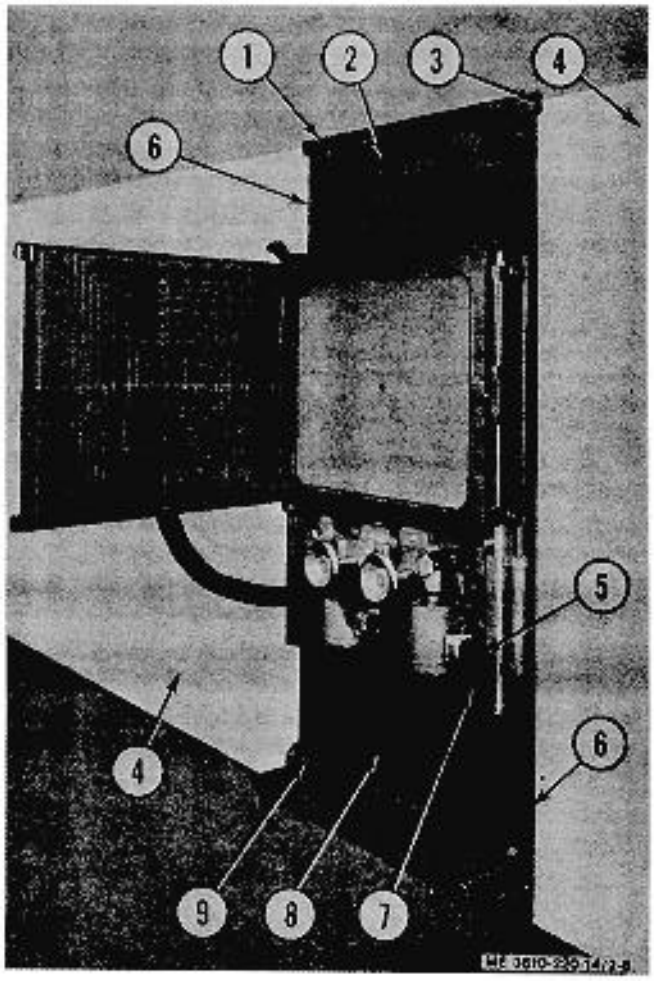
(d) Remove the lens storage box (3, fig. 2-5) from the lensboard carriage base plate.

(e) Open vacuum back and raise the focusing glass. Loosen the locking knobs (10, fig. 25), two on each side of the camera back. Move the hinge brackets 49) forward (toward the copyboard), and tighten the locking knobs.

(f) Unfasten the bellows strap (2, fig. 2-5), and slide the bellows (1) over to the camera back. Fasten with clamp and screw (15 and 16, fig. 1-5).

(g) Loosen the holding stud locknuts (11, fig. 1-5) locking the arc lamp arm brackets to the lensboard carriage. Move the lensboard away from the copyboard by turning handwheel (7, fig. 1-4) until the arm bracket disengages the holding stud. Tighten the locknuts to avoid losing them.

(h) Install the bottom curtain holder (9, fig.2-8) of the darkroom connecting frame to skid on darkroom end of camera. Fasten the bottom curtain (8) to bottom of back support plate with thumbscrews (7). Insert vertical connecting frame strip (6) so that flexible material fastened to the camera back lies in channel groove, and then assemble the strip to the bottom curtain holder with cotter pins (3). Place top curtain holder (I) on top of the vertical connecting frame strips, and assemble with cotter pins (3). Fasten the top curtain (2) to top of screen housing with thumbscrews (7). Insert darkroom panels (4) into grooves of strips to close balance of wall opening.



1. Top curtain holder
2. Top curtain
3. Cotter pin, ⅛ x 1
4. Darkroom panels
5. Back support plate
6. Vertical connecting frame strip
7. Thumbscrews, 8-32 x ½
8. Bottom curtain
9. Bottom curtain holder

Figure 2-8. Darkroom connecting frame, installed.

i. Calibration of Camera to Lens. The camera is received calibrated. It is calibrated to a predetermined focusing system for accurately positioning the lensboard and copyboard for any ratio of enlargement or reduction over the specified ranges for lenses furnished. Each lens is accompanied by focusing charts providing easily legible counter readings for each percentage of reduction and enlargement over the range of reproduction.

Note. Calibrating the camera to the lens is the responsibility of the field and depot maintenance. Under no circumstance should the operator attempt to calibrate, or adjust camera equipment affecting the initial focusing system.

2-2. Used Equipment

a. General. If a used camera is received in a crate, it should be unloaded, uncrated, inspected, assembled, and put in operational condition in accordance with instruction contained in paragraph 2-1.

b. Inspection. During inspection procedures, check carefully for missing, broken, bent or worn parts. Check the bellows assembly for cracks and tears in the rubberized fabric.

c. Service. Service the camera as detailed in paragraph 2-1 g.

Section II. MOVEMENT TO A NEW WORKSITE

2-3. Dismantling for Movement

a. Disconnecting and Shutting Down the Unit.

(1) Disconnect external power source cable from the camera and the plug from the transparency holder. Be certain that all switches are in neutral or OFF position.

(2) Remove lens from lensboard and place it in the lens box.

(3) Place lens boxes, ratio charts, and other loose items into the lens storage box (3, fig. 2-5), and fasten this box securely to lensboard carriage base plate.

(4) Set arc lamps in sockets in center of arm brackets as shown in figure 2-5. Insert a wooden dowel in place of the carbons, and lock the carbon holders together so that they will not be subject to shock in transit. Move arm brackets parallel with axis of camera. Move lensboard forward by turning the lensboard fine adjustment handwheel until the holding stud and locknut (11, fig. 1-5) engages the

slot of the free-end arm bracket. Tighten holding stud and locknut

Note: Lensboard must be at least 36 inches from camera back when In locked position to avoid damaging bellows while lowering camera

(5) Loosen bellows clamp and screw (15 and 16, fig. 1-5) on both sides of the camera back. Turn clamps 900 to release bellows from camera back. Tighten clamps and screws.

(6) Secure bellows to the lensboard with strap (2, fig. 2-5).

(7) Loosen four locking knobs (10) on the camera back, and move the hinge brackets (9) backward (away from camera back). Tighten locking knobs.

(8) Open vacuum back and lower the focusing glass. Close the vacuum back and lock in position.

(9) Lay the four turnbuckles (6) flat on camera skid. Check camera skid to be sure no obstructions are present.

(10) Lower the camera bed with crank handle (7, fig. 1-1) until the camera tube rests on skid.

(11) Connect the turnbuckles to the sides of camera tube. Tighten turnbuckles.

(12) Remove the crank handle and store in toolbox, (6, fig. 1-2).

CAUTION: Never operate the camera with crank handle in position, or damage may be done to the copyboard or transparency holder. Always store crank handle in toolbox.

(13) Remove darkroom connecting frame (fig. 2-81, and wrap protective covering on top and bottom curtain holders.

b. Loading the Unit Lower the six casters of the camera skid by means of the lift handles (9, fig. I1). Insert the iron-pipe lifting attachments through the holes provided at the ends of the skid. Attach crane slings to the lifting attachments, and with the use of a crane, lift the camera onto the mobile van floor. Detach the slings and lifting attachments from the camera skid, and roll the camera into position.

c. Loading on Flatcar, from Installation.

(1) For a long distance move, or when the camera may be subject to shock in transit, tilt the copyboard into horizontal position, release the two knobs (6, fig. 1-6), and rotate the copyboard so that its long dimension parallels the camera bed. Then lock the two knobs. Cover the copyboard surface with soft padding, topped with a plywood or other protective covering, and strap in place. Prepare a crate as shown in figure 2-1, and pack equipment as detailed in paragraph 2-1. a.

(2) Move the crate to the loading platform with a fork truck. Attach two crane slings to the notches (12, fig. 2-1) at the base of crate and one crane sling around the side at the center of balance (9). Lift the crate with a crane and place on flatcar. Block, strap, and tie down crates as illustrated in figure 2-2.

2-4. Reinstallation After Movement

Reinstall the copying camera according to details specified in paragraph 2-1 h.

Section III. CONTROLS AND INSTRUMENTS

2-5. General

This section describes, locates, illustrates and furnishes the operator sufficient information about the various controls and instruments for the proper operation of the material.

2-6. Copyboard and Lensboard Limit Switches

a. Description. The limit switches (10, fig. 1-1 and 10, fig. 1-5) for the copyboard and lensboard are microswitches used to cut the current to the drive motor when actuated. There are 3 limit switches, each containing a spring-loaded switch lever attached to the exterior of the limit switch box.

b. Location. On the camera copyboard and lensboard carriage.

c. Purpose. These switches limit the forward and reverse travel distance of these components to prevent injury to the bellows, interference between carriages, and jamming of drives at ends of travel.

2-7. Copyboard and Lensboard Positioning Counters

a. Description. The positioning counters (3, fig.1-4) of the copyboard and lensboard have a six digit face, providing the distance reading of the components to the focusing glass in increments of inches and one-hundredths of an inch.

b. Location. Positioned on a platform on the darkroom side of the camera back.

c. Purpose. Provide the lens and copyboard distance readings from plane of focusing glass for accurately positioning these components to provide the required reproduction ratio and focus.

2-8. Lensboard Control Switch

a. Description. The lensboard control switch (4, fig. 1-4) is a forward and reverse control, operating the lensboard through the lensboard drive motor. The switch is provided with a hand lever, spring loaded, which returns to a neutral position after being released.

b. Location. Mounted on the back support plate of the camera back.

c. Purpose. Controls the movement of the lensboard distance to and from the focusing glass. Control use for approximating distance only.

2-9. Lens Vertical Control Knob.

a. Description. The vertical movement of the lens is controlled by a finger-grooved knob (5, fig. 4), being pinned to a shaft extension with the lensboard control shaft operating through it.

b. Location On the back support plate of the camera back.

c. Purpose. Governs the vertical movement of the lens by raising or lowering the inner lensboard frame. This movement results in a vertical displacement of the photographic image on the focusing glass as may be required for centering, positioning, or measuring the vertical dimension of the image.

2-10. Lens Horizontal Control Knob.

a. Description. The lens horizontal control knob (10, fig. 1-4) is identical in physical appearance as the lens vertical control knob, having gripping qualities on its circumference.

b. Location. On the back support plate of the camera back.

c. Purpose. Governs the horizontal movement of the lens on the lensboard. This movement displaces the photographic image on the focusing glass horizontally as may be required for centering, measurement, or positioning the horizontal dimension of the image.

2-11. Lensboard Fine Adjustment Handwheel

a. Description. The lensboard fine adjustment control is a solid-metal handwheel (7, fig. 1-4) approximately 7 inches in diameter, pinned to an extension which connects it to the lensboard drivescrew.

b. Location. On the camera back on the same horizontal plane as the drivescrew.

c. Purpose. Provides the fine adjustment of the lensboard in moving it to and from the focusing glass after an approximation has been made with the lensboard control switch.

2-12. Copyboard Control Switch

a. Description. The copyboard control switch (I11, fig. 1-4) is a forward and reverse control operating the copyboard through the copyboard drive motor. The switch is provided with a hand lever, spring loaded, which returns to a neutral position after being released.

b. Location. On the back support plate of the camera back.

c. Purpose. Controls the movement of the copyboard distance to and from the focusing glass. This control is used for approximating distance only.

2-13. Copyboard Fine Adjustment Handwheel

a. Description. The copyboard fine adjustment control is a handwheel (9, fig. 1-4) approximately 7 inches in diameter, and is pinned to an extension which connects it to the copyboard drivescrew.

b. Location. On the camera back on the same horizontal plane as the drivescrew.

c. Purpose. Provides the fine adjustment of the copyboard in moving it to and from the focusing glass after an approximation has been made with the copyboard control switch.

2-14. Counter Safety Lights and Switch

a. Description. The copyboard and lensboard positioning counters are equipped with shielded safety lamps (9, fig. 4-1) on the darkroom side of the camera back. The counters are provided with one switch, controlling the lamps on the camera back.

b. Location. Mounted inside the counter platform.

c. Purpose. Provide illumination of the counters under darkroom conditions.

2-15. Vacuum Back Valve Handle

a. Description. The vacuum back valve handle (13, fig. 1-4) is an indicator lever, controlling the vacuum area of the vacuum back.

b. Location. Mounted on the vacuum back valve housing, centered about the indented digits.

c. Purpose. Regulates the air intake through the vacuum back, controlling the suction area of the porous plate for various negative sizes.

2-16. Camera Crank Handle

a. Description. The camera crank handle (7, fig. 1) is a steel hand crank broached with a square opening to engage the top end of the jack screw shaft on the copyboard end of the camera.

b. Location. A loose item, carried in the toolbox.

c. Purpose. To elevate the camera on its skid for installation and to lower it into compact form for transportation.

2-17. Magnetic Contactor

a. Description. The magnetic contactor (4, fig. 17) is a two-pole across-the-line type automatic starter used in the arc lamp circuit of the camera.

b. Location. Mounted on the rear support plate of the truss support assembly.

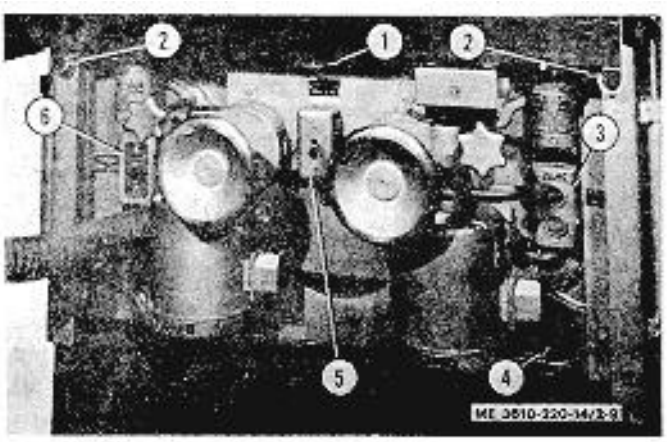
c. Purpose. To transmit the heavy current load required by the arc lamps without requiring this current to pass through the control switches.

2-18. Vacuum Back Pushbutton Switch

a. Description. This vacuum back switch (6, fig. 2-9) is a two-position toggle control for start and stop of the vacuum back turbo-compressor assembly.

b. Location. Mounted on the back support plate of the camera back.

c. Purpose. Starts and stops operation of the turbo-compressor providing vacuum to the camera back.



1. Oscillating knob
2. Magnetic latch
3. Darkroom arc lamp pushbutton switch
4. Back support plate
5. Darkroom shutter switch
6. Vacuum back switch

Figure 2-9. Darkroom controls of camera back.

2-19. Copyboard Vacuum Operating Knob

a. Description. The operating knob (7, fig. 1-6) is a plastic hand knob provided with a suction zone indicator.

b. Location. On the rear side of the copyboard.

c. Purpose. Operates internal valves to limit the suction area to that required by the copy size.

2-20. Aerial Film Bracket Crank

a. Description. A short arm hand crank (15, fig. 6) equipped with a stud and clutch to engage the aerial film spool.

b. Location. Revolves in the aerial film bracket (1) secured to the slide (14) mounted on the transparency holder.

c. Purpose. To wind the aerial film from spool to spool so as to present and center the required frame (aerial photograph) on the transparency holder.

2-21. Darkroom Shutter Switch

a. Description. The darkroom shutter control is a three-way toggle switch (5, fig. 2-9) with OFF-ON markings.

b. Location. Mounted on the back support plate of the camera back.

c. Purpose. Provides control of the shutter from the darkroom end of the camera.

2-22. Lensboard Shutter Switch

a. Description. This control is a three-way toggle switch (14, fig. 1-5) with OFF-ON markings on the toggle knob.

b. Location. Mounted on the side frame of the lensboard.

c. Purpose. Provides control of the shutter from light-room end of camera.

2-23. Darkroom Arc Lamp Switch

a. Description. The darkroom arc lamp switch (3, fig. 2-9) is a two-way push button control with START-STOP markings.

. Location Mounted on the back support plate of the camera back.

c. Purpose. Provides control of the arc lamps from the darkroom end of camera.

2-24. Lensboard Arc Lamp Switch

a. Description. The lensboard arc lamp switch is a two-element push button control (13, fig. 1-5) with OFF-ON markings.

b. Location. Mounted on the lensboard side frame.

c. Purpose. Controls the arc lamps from the light room end of the camera.

2-25. Flash Lamp Switch

a. Description. The flash lamp switch (4, fig. 15) is a two-position rotating knob which is part of the socket base of the lighting fixture.

b. Location. Wired directly in the flash lamp.

c. Purpose. Provides a simple off-and-on control of the flash lamp.

2-26. Flash Lamp Arm Adjustment Screw

a. Description and Purpose. The flash lamp arm adjustment screw (5, fig. 1-5) is a thumbscrew with a special tip equipped to hold the pivot shaft and flash lamp at a set position.

b. Location. Tapped into the lensboard side frame through to the pivot shaft.

2-27. Flash Lamp Block Adjustment Screws

a. Description and Purpose. The flash lamp block adjustment screws (6, fig. 1-5) are standard thumbscrews equipped with a dog point to hold the cross shaft of the lamp at a set position.

b. Location. On the joint block of the flash lamp assembly.

2-28. Focusing Glass Magnetic Latches

a. Description and Purpose. The focusing glass magnetic latches (1, fig. 2-4 and 2, fig. 2-9) are latches provided with the focusing glass assembly to hold it secure to the camera back during operating conditions.

b. Location. On the focusing glass frame, one at each lower corner.

2-29. Focusing Glass Oscillating Knob

a. Description. This control is a knurled knob (3, fig. 2-4) connecting the pinion shaft and oscillating gear to the focusing glass.

b. Location. On the base of the focusing glass frame.

c. Purpose. Oscillates the focusing glass for image alinement to the grid.

2-30. Lensboard Vertical Adjustment Handwheel

a. Description. The handwheel (12, fig. 1-5) is a knurled aluminum knob held secure to the vertical drive shaft by a setscrew.

b. Location. Under the lensboard outer frame.

c. Purpose. The handwheel is accessible from the front of the lensboard, permitting vertical adjustment of the lens from the lightroom section of the camera.

2-31. Lensboard Horizontal Adjustment Handwheel

a. Description. The handwheel (7, fig. 1-5) is a knurled aluminum knob held secure to the horizontal drive shaft by a setscrew.

b. Location. Under the lensboard outer frame.

c. Purpose. The handwheel is accessible from the front of the lensboard, permitting horizontal adjustment of the lens from the lightroom section of the camera.

2-32. Copyboard Vacuum Control Switch

a. Description. The switch (11, fig. 1-6) is a two-way toggle switch with OFF-ON markings.

b. Location. On the copyboard frame.

c. Purpose. Starts and stops operation of the turbo-compressor exhausting through the vacuum copyboard.

2-33. Transparency Holder Light Switch

a. Description. This control (9, fig. 1-6) is a thermal overload type of a manual starting switch with OFF-ON markings.

b. Location. Mounted on the copyboard frame.

c. Purpose. Controls electrical supply to fluorescent lamps illuminating the transparency holder.

Section IV. OPERATION UNDER USUAL CONDITIONS

2-34. General

a. The instructions in this section are published for the use of the personnel responsible for the operation of this camera.

b. It is essential that the operator know how to set up and adjust this equipment for every operation of which it is capable. This section gives instructions for arranging and adjusting the components of the equipment, instructions on the basic functions of these components, and instructions on how to coordinate the basic functions of the various components to perform the specific tasks for which the camera is designed. Since nearly every job presents a different problem, the operator may have to vary the given procedure to fit the individual job.

2-35. Setting Up Camera

a. Perform the before-operation services detailed in paragraph 3-6. *b*.

b. Rotate the axle and tube assembly of the copyboard carriage to bring the copyboard or transparency holder so that it faces the lens. Insert plug in light box assembly if needed.

c. Install the 19-inch or 24-inch lens on the lensboard as detailed in the following procedures:

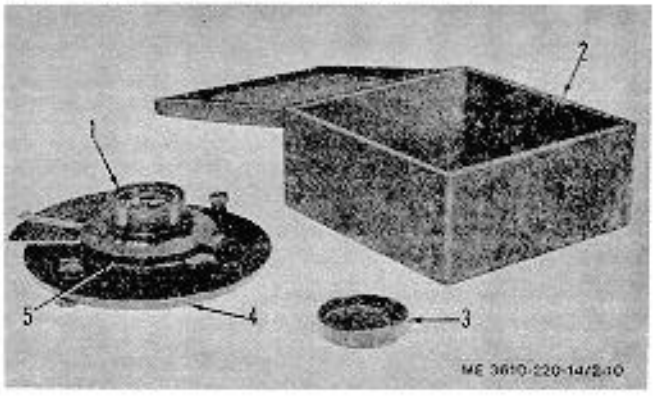
(1) *Goerz 19 inch lens.*

(a) Remove the lens mounting plate (4, fig. 2-10) with the attached lens (1) from the lens box (2).

(b) Insert the lugs behind the lens mounting plate (2, fig. 2-11), in the slots of inner lensboard frame (4).

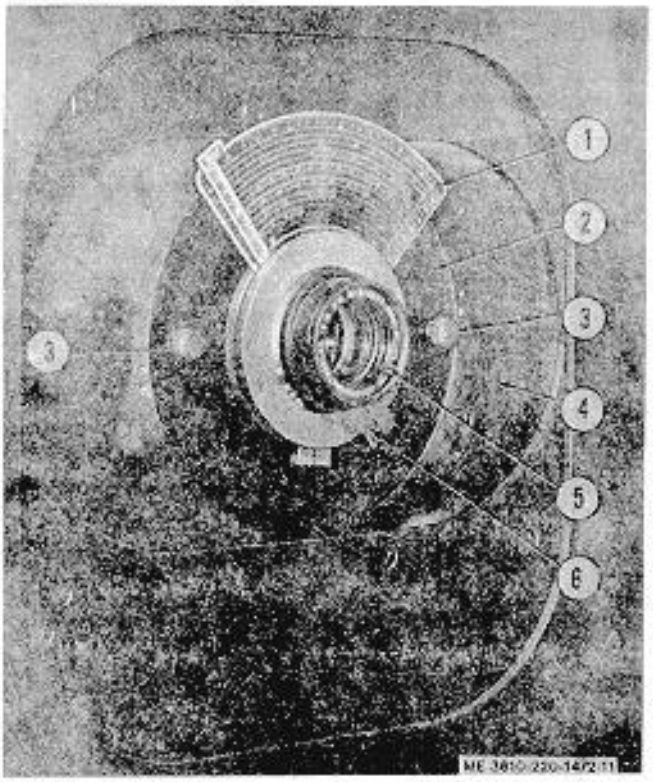
(c) Grasp the knobs on the mounting plate, and rotate 15° in a clockwise direction to lock the lens in the inner lensboard frame. Positive indication of correct locking position is indicated when the lens scale (1, fig. 2-11) attached to the mounting plate (2) is at top.

Note.
Avoid touching optical surface of lens at all times. Fingerprints may impair photographic definition and permanently mar the lens surface.



1. Lens
2. Lens box
3. Lens cap
4. Lens Mounting plate
5. Diaphragm opening control

Figure 2-10. Goerz 19 inch lens.



1. Lens scale
2. Lens mounting plate
3. Mounting plate knobs
4. Inner lensboard frame
5. Lens
6. Diaphragm opening control

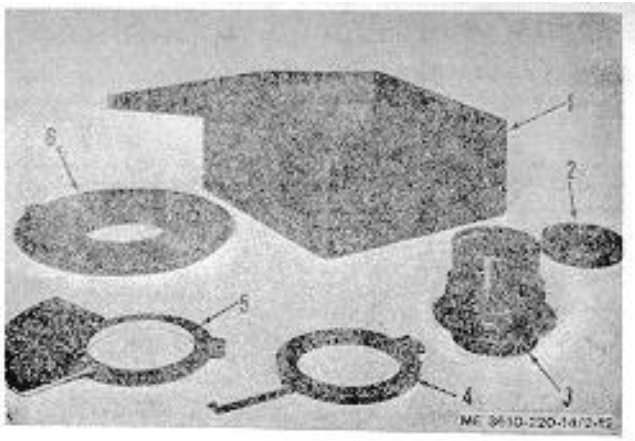
Figure 2-11. Goerz 19 inch lens, installed.

(2) *Goerz 24 inch lens.*

(a) Remove the lens mounting plate (6, fig. 2-12) from the lens box (1), and insert the lugs of the plate in slots of the inner lensboard frame (4, fig. 2-13).

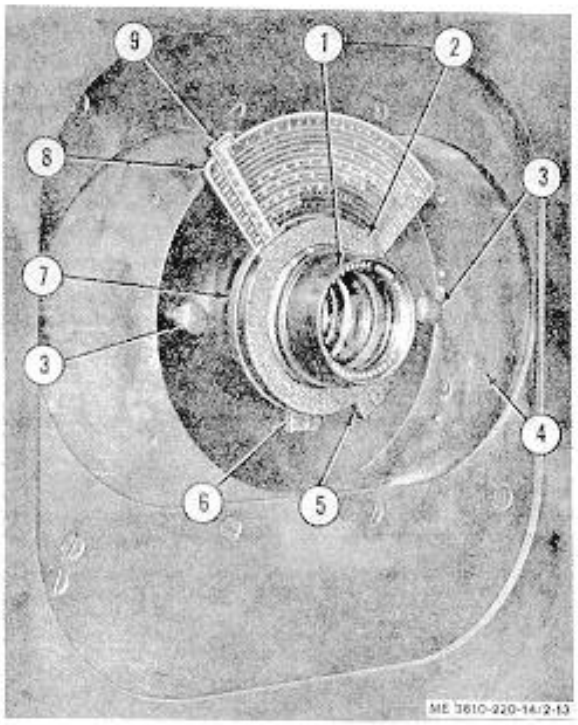
(b) Grasp the knobs (3, fig. 2-13) on the mounting plate, and rotate 150 in a clockwise direction to lock plate in the inner lensboard frame (4). Positive indication of correct locking position is when the lens scale (8), attached to the mounting plate, is at top.

(c) Remove the lens (3, fig. 2-12) from the lens box (1), and insert into the holding ring (5).



1. Lens box
2. Lens cap
3. Lens
4. Diaphragm opening control
5. Holding ring
6. Lens mounting plate

Figure 2-12. Goerz 24 inch lens.



1. Lens
2. Diaphragm opening control
3. Mounting plate knobs
4. Inner lensboard frame
5. Hex soc hd setscrew
6. Hex soc hd setscrew
7. Holding ring
8. Lens scale
9. Pointer

Figure 2-13. Goerz 24 inch lens, installed.

(d) Attach the holding ring (7, fig. 2-13) onto the rear of lens (1). Tighten screw (6) to lock holding ring to lens. Insert lens into lens mounting plate.

(e) Attach the diaphragm opening control (2, fig. 2-13) onto the barrel of the lens (1). Align pointer (9) and tighten screw (5).

2-36. Producing Line or Continuous-Tone Negatives

a. General. The reproduction of either line or continuous-tone copy requires identical camera settings, and differs only in the type of film used, the exposure time, and the subsequent film processing (development). The copying camera will enlarge, reduce, or reproduce copy at the same size, in accurate proportions. It is not; intended for rectifying or distorting map grids or other subject.

b. Copyboard Settings (Non-transparent (copy).

(1) Rotate the copyboard (5, fig. 1-6) to a vertical position facing the lensboard, if not previously so positioned.

(2) Set the copyboard vacuum operating knob (7) for the smallest area that will include the entire copy. The smallest setting is 10 x 10 inches. Copy smaller then this, or any copy smaller then the dimensions indicated on the vacuum operating knob must be surrounded with black paper to prevent vacuum leakage and provide adequate suction.

(3) Push the diverter knob (13) to a closed position, shutting off the vacuum suction to the transparency holder housing (2).

(4) Turn on the copyboard vacuum control switch (11).

(5) Place the copy in the approximate center of the copyboard; press out wrinkles in copy. If copy shape or size results in excessive vacuum leakage so that copy is not drawn flat against the copyboard, cover the surrounding leakage areas with strips of black paper.

c. Arc Lamps. Be sure the arc lamp arm brackets (12 and 13, fig. 1-7) are in their outer positions at an angle of 36° to the camera ways. If the arc lamps are out of position, loosen the cap nut and reposition the arm brackets. Check carbons for correct feed allowance and centering. Trim if necessary.

d. Lensboard Settings.

(1) Rotate diaphragm opening control to required stop corresponding to the ratio of reproduction necessary (see TM 5-245). Remove lens cap, placing it face down so that it will not gather dust.

(2) If lens is off center, center it by rotating handwheels (7 and 12, fig. 1-5).

(3) If color filter is required, open filter slot in lens and insert the filter in its holder.

e. Focusing Camera by Counters.

(1) Refer to ratio charts for counter readings required for the desired enlargement or reduction (for the lens used).

(2) Position the copyboard carriage to an approximate figure some number above the required reading by use of the copyboard control switch (11, fig. 1-4) located at the camera operating end. Then rotate the fine adjustment handwheel (9) counterclockwise until the required reading is reached. Always set the final reading by a counterclockwise rotation of the handwheel. This is consistent with the procedure used for calibration and trammeling the camera and minimizes any error due to possible play in the copyboard carriage drive.

(3) Position the lensboard carriage similarly by use of the corresponding lensboard controls (4 and 7, fig. 1-4).

(4) Lower focusing glass into viewing position, as shown in figure 2-8, first releasing vacuum back and swinging it out of position, if in the way.

(5) Turn on switch (5, fig. 2-9) to open shutter, and light arc lamps through switch (3).

(6) Examine image on focusing glass. If tilted, rotate image to level by turning oscillating knob (3, fig. 2-4) until center lines on copy (or grid lines) are parallel with grid on focusing glass. If image is off center, bring to center by rotating lens control knobs (5 and 10, fig. 1-4). Then switch off arc lamps and close shutter.

f. Focusing Camera Visually. Visual focusing may be required if a lens is used for which no focusing chart has been prepared (as may be temporarily necessary with a replacement lens), for emergency conditions when counters are inoperative, or where relief maps or three dimensional copy are to be photographed. For thick copy the total copy thickness in hundreds of an inch should be added to the copyboard counter chart reading to assure sharp focus.

(1) Position copyboard and lensboard carriages to a rough approximation of where they should be for the ratio of reproduction desired.

(2) Open diaphragm to largest stop (opening). Remove lens cap and place it face down on lens carriage.

(3) Switch open lens shutter, and switch on arc lamps.

(4) Examine image on focusing glass for sharpness.

(5) Operate lensboard control switch (4, fig. 1-4), moving the lensboard in one direction, and note if image is sharpening up or becoming more indistinct. If the image is sharpening, continue until a sharp image is obtained. If it is becoming more

indistinct, reverse switch direction and obtain a sharp image. (If a sharp image cannot be obtained by lensboard movement alone, this is usually due to the copyboard being too close the camera's back. Move the copyboard away (increasing counter numbers) a few in., and repeat the focusing movements with the lens until a sharp image is obtained.

(6) Check image size by scale or against the grid markings on the focusing glass. If smaller than required, move lensboard forward a short distance (away from focusing glass, counter numbers increasing), and adjust copyboard position until sharp focus is again obtained. Check size of image again. Then repeat operations until exact size and focus is obtained. During the final focusing, make certain that image is square and centered with the grid on the focusing glass (use the oscillating knob (3, fig. 2-4) if necessary to square, and control knobs (5 and 10, fig. 1-4) to center), and that image is critically sharp when viewed through the focusing magnifier. Record the carriage readings on the back or margin of the copy or on an improvised focusing chart to enable return to the same camera settings if necessary to re-make negatives. Switch off arc lamps and shutter.

(7) Close lens diaphragm down to the stop required for photography (see TM 5-245).

g. Vacuum Back Settings and Film Placement.

(1) Set the vacuum back valve handle (13, fig. 1-4) to size of film.

(2) Turn on the vacuum back toggle switch (6, fig. 2-9).

(3) Place film on the vacuum back, as shown in figure 2-14, being certain that film is held flat and is centered. In placing film, hold it by edges only. Align one edge with rectangle line on the porous plate, and roll the film slightly so that it gradually adheres across its length or width to avoid formation of wrinkles. If it is necessary to shift location,4to not attempt to slide film, but raise it almost entirely away; relocate and lower it again into contact. Be sure that the film's lighter colored emulsion side is facing the camera's lens. Film used should coincide with job requirements for continuous tone or line copy work. (For more detailed information on films and their characteristics see TM 5-245).

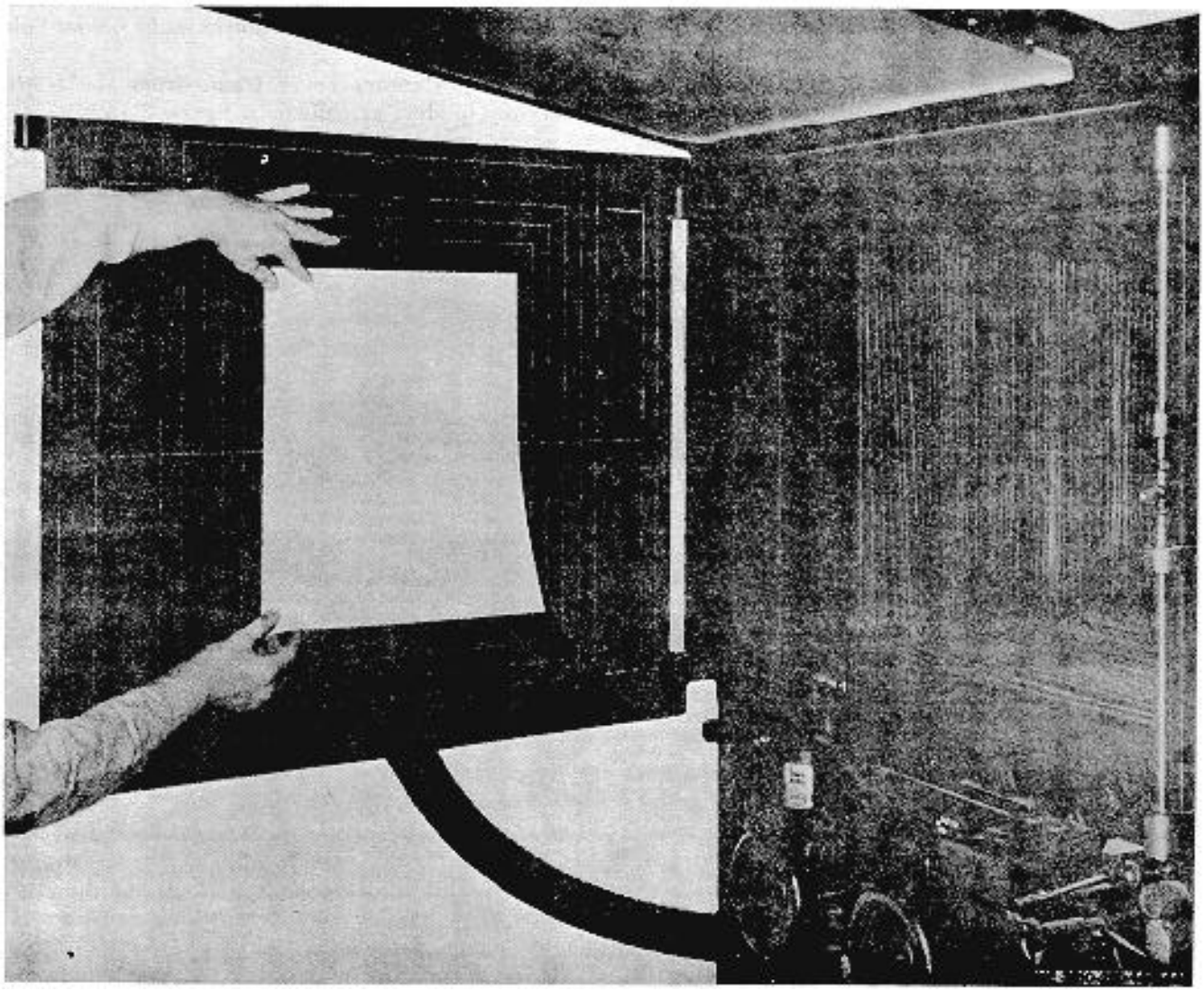


Figure 2-14. Placing film on vacuum back.

(4) Lock the vacuum back in photographic position.

h. Film Exposure.

(1) Turn on switch (3, fig. 2-9) to light arc lamps.

(2) Open shutter through switch (5) for full exposure time, and then close shutter.

(3) Turn off the arc lamps and open the vacuum back.

(4) Turn off the vacuum back toggle switch (6), and remove film from the vacuum back. The film is now ready for developing.

2-37. Producing Halftone Negative

a. General. When any continuous-tone subject is to be reproduced by printing on the offset map reproduction presses, it is necessary to photograph the subject so as to obtain a halftone negative. The preparation of a halftone negative requires the use of a high contrast film similar to that used for line negatives, the introduction of a contact halftone screen between the negative and lens, and a series of exposures designed to provide the desired contrast range.

b. Arc Lamps. Position the arc lamps at 36 degrees, as detailed in paragraph 2-36. *c.*

c. Vacuum Back Settings. Follow instructions as given in paragraph 2-36. *g*.

d. Halftone Negatives Using Contact Screen. To prepare halftone negatives through a contact screen instead of the glass screen, the contact screen must be larger than the film to be exposed so that it will seal the film against the vacuum back. The exposure control for contrast correction is also accomplished through a fixed stop opening (varying only for size ratio of reproduction as in "line" photography), either by proportioning exposures through a rose colored and a yellow filter inserted alternately in the filter slot of the lens, or by an improved method of exposing the subject without a

filter and then using a yellow flash exposure to complete the dot formation and provide the desired contrast. Detailed instructions covering evaluation of copy and determination of exposure times are provided with the contact screen by the manufacturer. The camera operations for preparing a contact screen negative will be as follows:

(1) Attach the magenta contact screen centrally on the porous plate of the vacuum back, screen side facing the back, by applying vacuum to hold the screen flat. Secure it to the back with a long strip of pressure-sensitive tape along the top edge, to serve as a hinge.

(2) Focus the camera normally as for line exposures (para. 2-36). (No compensations to counter readings are necessary for the screen insertion into the optical system as were required for the glass screen.)

(3) Refer to the exposure guide furnished with the contact screen for the "main" and "flash" exposure times required for the copy.

(4) Leave valve handle (13, fig. 1-4) open to cover full area of contact screen, regardless of film size to be exposed, and turn on vacuum through switch (6, fig. 2-9).

(5) Lift contact screen away from vacuum back by lower edge, and with the other hand, place the film centrally in position. Then carefully lower the contact screen, from its tape hinge downward, until it is drawn firmly against the vacuum back to seal the film within its margins. Examine the screen under safe-light to make certain that no air pockets (blisters) remain. If some exist, they will usually disappear within a half minute. If a wrinkle persists, raise the screen and lower again so that it can be drawn out. Do not touch the screen area of the contact screen with the fingers, and avoid attaching tape to the film or leaving pieces of tape on the vacuum back in the screen area as they may permanently damage the screen.

(6) Follow exposure and flash instructions provided with the screen, controlling the arc lamps and shutter in accordance with instructions provided for line exposures (para. 2-36).

(7) Upon completion of exposures, shut off the vacuum, and immediately raise the contact screen with one hand and remove the film with the other. The film is now ready for development. Remove the pressure-sensitive tape from the screen before returning it to the storage container.

2-38. Reproducing From Negative or Positive Transparencies

a. Flat film.

(1) *Transparency holder setting.*

(a) Rotate the transparency holder into the vertical position facing the lensboard.

(b) Insert plug into socket of light box assembly, and turn on the transparency holder light switch.

(c) Remove cover frame from the transparency holder, as shown in figure 2-15.

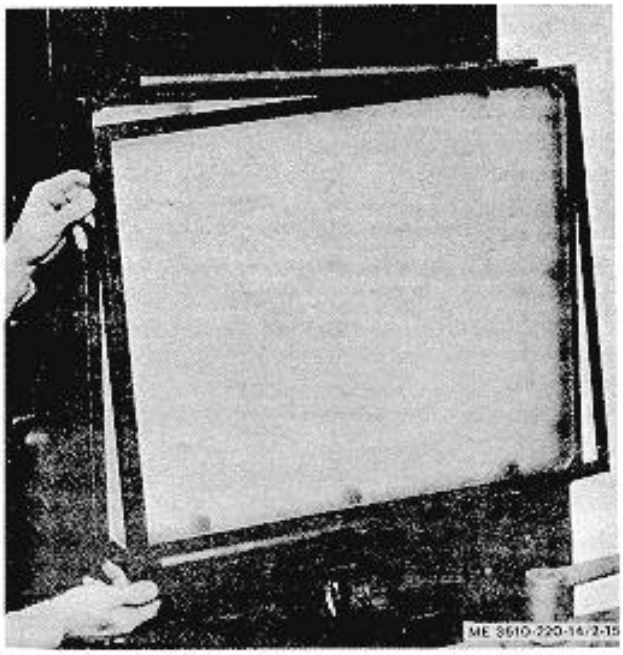


Figure 2-15. Removing cover frame from transparency holder.

(d) Pull out the diverter knob (13, fig. 1-6) to permit vacuum suction to the transparency holder.

(e) Set the copyboard vacuum operating knob (7) for smallest size copy.

(f) Turn on the copyboard vacuum control switch (11).

(2) Film placement.

(a) Place film in approximate center of transparency holder. If film is smaller than glass area of transparency holder so that the suction does not hold it, secure it to the glass with a tab of pressure-sensitive tape on its top central margin.

(b) Replace cover frame on the holder. Press the plastic sheet of the cover frame to be certain that film is flush with diffuser glass until the suction takes hold to flatten the clear plastic sheeting against the film and diffuser glass.

(3) Lensboard settings. Set the lensboard as detailed in paragraph 2-36.d.

(4) Vacuum back settings. Set the vacuum back according to instructions in paragraph 2-36. g.

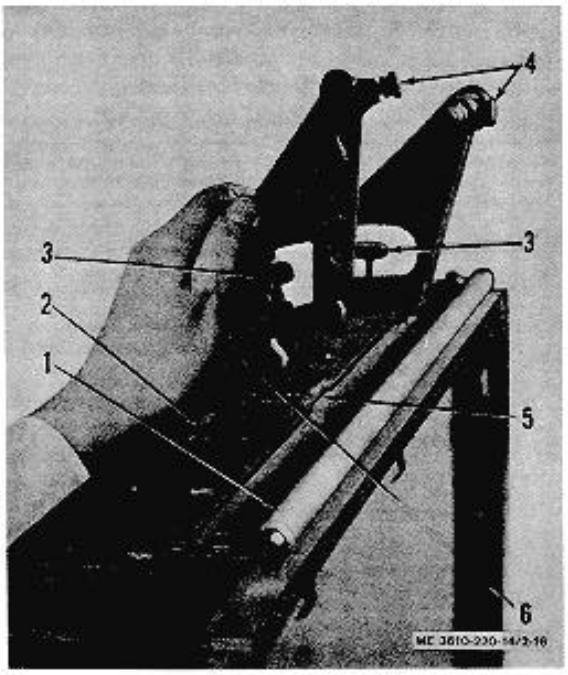
(5) Lens diaphragm settings and exposures. The exposure of transparencies to obtain line, continuous-tone, or halftone negatives (or positives) will follow identical procedure to that used for non-transparent copy (para. 2-36 and 2-37) except that

all exposure times (other than flash) will be proportionately greater in direct ratio to the relative light intensities received by the negative. If the transparency is small or does not cover most of the light area of the holder, the surrounding areas should be masked with black paper to prevent extraneous light from fogging the negative.

b. Aerial Roll Film.

(1) *Aerial film bracket placement*.

(a) Place the aerial film brackets in slot of slide bar, as shown in figure 2-16.



1. Roller
2. Slide bar
3. Bracket lockscrew
4. Crank lockscrew
5. Slide bar slot
6. Aerial film bracket

Figure 2-16. Attaching aerial film bracket.

(b) Slide the brackets just enough to accommodate length of film spool.

(c) Insert film spool on brackets, adjusting position of brackets to suit.

(d) Tighten bracket lockscrews (3).

(e) Place aerial film brackets on slide bar at base of transparency holder, as outlined in steps (a), (b), and (d) above.

(2) Film placement.

(a) Draw film from spool over roller (1), across diffuser glass, over other roller, and engage into slot in take-up spool. Release brackets and centralize spools so that film will feed true across the center of the transparency holder. Tighten brackets. Wind film until frame to be reproduced is centered on the transparency holder.

Note

It is recommended that the transparency holder glass be covered with a black paper mask, having an opening equal to the frame size plus marginal data to improve the quality of the reproduction. The mask can be attached with tabs of self-adhesive tape along the margins but should not block the suction openings at the corners.

(b) Tighten the crank lockscrews (4).

(c) Place plastic cover over transparency and switch on copyboard vacuum control switch (11, fig. 1-6) so that the vacuum will flatten the plastic cover and film against the glass of the transparency holder.

(3) *Diaphragm settings and exposures.* Refer to paragraph 2-38. *a*. (5).

Section V OPERATION UNDER UNUSUAL CONDITIONS

2-39. General

a. Special instructions for operating and servicing the copying camera under unusual conditions are contained in this section. When repeated failure of material results from subjection to extreme conditions, a report of the failure should be made to the proper authority. The information presented pertains to the equipment as installed in an enclosed shelter where it may be subjected to extreme climatic conditions.

b While the copying camera may be subjected to extremes in temperature during storage or transit, it will seldom be operated below 50° F. or above 125° F. as the associated photographic processing of the exposed film will not develop at low temperatures and will cause excessive fog at high temperatures.

As similar temperature extremes are determined to the subsequent plate-making and press operations, it is essential that some means of temperature control should always be available. The camera itself has been designed to withstand extreme climate changes in storage, but may lag in equalizing its ambient temperature with that of the mobile unit when that unit is heated or cooled. In most instances there should be no harmful temperature effects to the photo-chemistry or other supporting operations by the time camera operation preparations have been completed. Environmental factors which can contribute to possible difficulty in camera operation are detailed in paragraph 2-40 thru 2-44.

2-40. Operation in Extreme Cold (Below 0 °F.)

a. General. Extreme cold will cause thickening of lubricants, and make most materials brittle so that they will damage easily when subjected to bending or shock. If camera and equipment have been exposed to sub-zero temperatures, they should be permitted to warm up to room temperature before set-up and the problem of condensation on the camera and its optics by allowing any condensation present to evaporate. Condensation on a lens will prevent satisfactory photography (see para. 2-40. *e.).* Condensation on non-lubricated or otherwise unprotected metallic components will induce corrosion.

b. Electrical System. Inspect wires, cables, switches, and all electrical connections daily for cracked insulation, broken wires, or shorting.

c. Vacuum Turbo-Compressors. Check the flexible vacuum hose frequently for cracking. Make a daily check of hose connections at the vacuum back and copyboard for breaks.

d. Optical Components. When the lenses, focusing glass, and diffusers have been subjected to extreme cold and the surrounding area is being warmed up for operation, condensation may form on all surfaces as stated in a. above. This condensation will evaporate by itself as the equipment warms up. Do not attempt to wipe condensation off a cold lens or use anti-fog preparations as the coated surfaces of the lens are easily damaged. Cemented lenses subjected to extreme cold may also evidence crystallization of the bonding medium, but this, too, will revert to a plastic state as the temperature rises.

2-41. Operation in Salt Water Areas

a. General. During inspections, check the camera drivescrews and lensboard control shafts for pitting. Examine the counter drive chains and counterbalance chains for moisture. Clean these parts as often as necessary to prevent corrosion and insure satisfactory operation

b. Electrical System. Check the wires, cables, and interconnections for deterioration. Open the junction and outlet boxes, and examine connections for moisture and corrosion. Wipe connections dry, and wrap worn wires with electrical tape.

c. Care of Film and Copy. Store the film and copy in appropriate containers provided with airtight and waterproof covers. Keep the containers in a cool, dry area where the temperature remains constant.

d. Protective Finish. All exposed machined surfaces must be wiped daily. Painted surfaces must be carefully inspected to see that there is no rusting or pitting. Any corrosion should be removed and the affected area restored to its original finish..

2-42. Operation in High Humidity

a. General. Equipment used in hot, humid weather is subject to rapid deterioration and fungus growth. Make frequent inspections. Clean to prevent deterioration.

b. Electrical System. Inspect the wires throughout the camera for fungus. Clean affected wires thoroughly and wrap with electrical tape. Also refer to paragraph 2-41. *b*.

c. Care of Film and Copy. Refer to paragraph 2-41. *c*. for care of copy and film.

d. Lenses. Lenses are subject to deterioration in tropical humid areas principally from fungus attack. Refer to DA Pam 310-4 for manuals covering preventive practices. The lens boxes should be treated with fungicides to inhibit fungus growth.

2-43. Operation in Extreme Heat

a. Electrical System. Check the terminal boards in the electrical boxes for base solder connections and worn contact joints. Examine wires and insulation for moisture content. Clean parts thoroughly and resolder defective solder joints. Wrap electrical tape around wires having worn insulation.

b. Vacuum Turbo-Compressors. Examine the inner sections of the vacuum flexible hose for moisture and deterioration. Check the turbo compressor housings for corrosion and pitting. Clean parts thoroughly and remove scaling.

2-44. Operation in Dusty or Sandy Areas

If the copying camera is installed and operated in a dusty or sandy area, it must be in a closed shelter where it will be free of particles affecting its operation. The camera will not operate if grit, sand, or dust accumulates on the camera rail, copyboard, and lensboard, or in the turbo-compressors or drive motors. Grit or other abrasive materials adhering to lens or screen surfaces should be carefully dusted off with a clean camel's hair brush. Do not wipe off with a rag or tissue, as the grit will imbed itself in the material and scratch the glass surface.

CHAPTER 3
OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. BASIC ISSUE ITEMS

3-1. General
The operation detailed in this chapter may be performed with standard mechanic's handtools.

3-2. On-Equipment Tools
The on-equipment tools normally supplied with this equipment for the use of the operator are listed in appendix C.

Section II. LUBRICATION INSTRUCTIONS

3-3. General Lubrication Information

This manual prescribes first and second echelon lubrication maintenance for the camera copying, lithographic, 208 Volt, 3 Phase, 60 Cycle, 24 x 30 inch, Consolidated model 1969.

3-4. Detailed Lubrication Information

a. Care of Lubricants. Since lubricants are useless if contaminated by dust, or dirt, lubrication containers must be securely closed when not in use. Keep lubrication equipment where it will be safe from damage and from dust or dirt. Clean the equipment both before and after use.

b. Points of Application. Lubrication fittings, universal joints, drivescrews, gears, and other points of application are readily located by referring to the lubrication order.

c. Cleaning. Use cleaning solvent to clean or wash all parts. Dry parts thoroughly before applying lubricant. Apply a light grade of oil to all polished metal surfaces to prevent rusting.

d. Counter Drive Chains and Counterbalance Chains. Paint the chains with a light oil to make sure lubricant enters the inner crevices of the chains.

e. Skid Casters. The six casters of the camera skid are provided with lubrication fittings, and should be serviced with care to prevent overlubrication.

f. Camera Drivescrews. Lubricate entire drivescrew with an oil saturated cloth.

g. Operation Immediately After Lubrication. If possible, all parts should be operated immediately after lubrication so that lubricant can be distributed to the friction surfaces for which intended.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-5. General

To insure that the copying camera is ready for operation at all times, it must be inspected systematically, so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance services to be performed are listed and described in table 3-1. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit shall be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded, together with the corrective action taken, on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

3-6. Preventive Maintenance Checks and Services

a. General. Table 3-1 contains a tabulated listing of operator's periodic (daily and weekly) preventive checks and services. All inspections of assemblies, or parts must include any supporting members or connections, and must determine whether the unit is in good condition, correctly assembled, secure, or worn. Any condition which may result in damage to the unit, must be corrected before the unit is operated, or as soon as the condition is noted.

b. Before-Operation Services. These services and checks are performed to determine if the condition of the equipment has changed since it was

last operated and to make sure that the equipment is ready for operation. Any deficiencies must be corrected and reported to the proper authority, before the unit is put into operation.

c. During-Operation Services. The operator is responsible for correcting or reporting unusual sounds or odors, deficiencies in performance, or other signs of abnormal operation.

d. After-Operation Services. To insure that the equipment is ready to operate at any time, after operation services and checks should be performed immediately after any operating period. All deficiencies must be corrected or reported to the proper authority.

e. Weekly Checks and Services. These services and checks are performed at intervals of one week or 60 hours of operation, whichever comes first.

Table 3-1. Preventative Maintenance Checks and Services

Operator Maintenance Category ***Daily Schedule (or weekly)***

Interval and Sequence No.			Item to be inspected	Procedure	Paragraph reference
Before operation	**During operation**	**After operation**			
1			Controls	Check to see that the controls are in the OFF or neutral position before connecting the external power supply.	2-5
2			Camera rail	See that the camera rail is free of objects that could obstruct movement of the copyboard and lensboard.	6-42
3			Vacuum back	Check for operating position. See that the flexible rubber hose is connected. See that the vacuum back is properly positioned on the hinge assembly.	1-3. *c*.
4			Copyboard and lensboard	Check limit switches by moving the copyboard and lensboard forward and backward to insure proper operation. Check copyboard and lensboard distances.	2-6
5			Darkroom connecting frame	Check to see that the vertical connecting frame strips, curtain holders, and darkroom panels are properly connected and secure. Check to see that the top and bottom curtains are properly drawn to prevent light leakage.	2-1. *h*. (4) (h)
6			Arc lamps and flash lamp	Check the arc lamps for correct operating position and correct or irregular size carbons. Check that the arc lamp cables are firmly connected to the arc lamps. Check the flash lamp for broken face glass and bent or damaged reflector. See that the flash lamp is in a vertical non-operating position, and that all connecting points are tight.	4-22, 4-26 thru 4-29
	7		Vacuum controls	Check to see that the valve handle on the vacuum back is properly positioned to correspond with size of negative. Check to see that the vacuum diverter knob is properly positioned.	1-3. *c*.
	8		Arc lamps	Check arc lamp arm brackets to be sure that they are in their outer position approximately a 36 degree angle to the camera ways. Observe light of arc lamp for flickering, and if erratic lighting exists regap carbons or replace them.	4-30
	9		Unusual operation or noises	Check for any unusual noises from the turbo-compressors or from the vacuum back and copyboard. If any irregularity exists, stop operation and report the condition to the proper authority.	3-6
		10	Shutdown precautions	Check that all controls are in the OFF or neutral position before disconnecting the external power supply. Disconnect plug from transparency holder.	2-3
		11	Lens	Remove lens from lensboard. Wipe with an approved lens tissue only if finger prints or grime are noted. Use a camel's hair brush to remove dust or other particles. Avoid excessive cleaning of the lens, as the coating is relatively soft and easily damaged.	2-35

Interval and Sequence No.			Item to be inspected	Procedure	Paragraph reference
Before operation	**During operation**	**After operation**			
		12	Clean equipment	Remove all dirt, oil and grease from the camera ways and skid. The ways should not be left dry for any length of time. To prevent corrosion, relubricate the ways. Wipe the focusing glass with a soft cloth and solvent.	1-3. *a*. (2) 6-42
		13	Visual inspection	See that the external power cable is disconnected from the camera and that plug to transparency holder is removed. Check that the focusing glass is in an open position and that the vacuum back is properly closed.	4-25 2-1. *h*. (4)
* 14			Lubrication	Inspect the camera for missing or damaged lubrication fittings and for indication of insufficient lubrication.	3-4. *e*.
* 15			Tools and equipment	See that all tools and equipment assigned to the camera are clean, serviceable, and properly stowed in tool box.	App. C
* 16			Appearance	Inspect the general appearance of the camera. Pay special attention to cleanliness, legibility of identification markings and condition of paint.	2-41. *d*. 5-4.
* 17			Publications	See that a copy of this technical manual, and all other publications associated with the camera are in serviceable condition.	

( ) be accomplished weekly.

Section IV. TROUBLESHOOTING

3-7. Use of Troubleshooting Section

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the copying camera or any of its components. Each trouble sympton stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause.

Table 3-2. Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. Vacuum back fails to hold film properly.	a. Improper selection of vacuum back valve ports.	a. Measure size of film and move valve handle to a position best suited to hold film of vacuum back.
	b. Opening in vacuum flexible hose.	b. If opening is small make temporary repair with electrical tape. Notify proper authority for permanent repair.
2. Copyboard fails to hold copy properly.	Copyboard suction not directed properly.	Measure size of copy and turn operating knob to correct position.
3. Arc lamps flicker.	a. Drafty conditions around operating location.	a. Eliminate all drafts around working area.
	b. Gap between carbons too great to provide constant lighting.	b. Adjust carbons. (para 4-27)
4. Image distortion.	a. Thick copy.	a. If copy has appreciable thickness, its thickness must be added to the copy-board counter readings in units of 1 / 100 inch.
	b. Copy not placed on copyboard properly.	b. Remove copy and remount on copyboard, smoothing out wrinkles and folds.
	c. Lens not positioned.	c. Check the lensboard counter readings. Determine if the lens is screwed in the lens plate.

Section V. MAINTENANCE OF VACUUM TURBO-COMPRESSOR ASSEMBLY

3-8. General

The vacuum for the operation of the vacuum back and the copyboard is provided by two separate but identical vacuum turbo-compressors. The compressors are located at the extreme copyboard end of the camera, and are mounted separately. Each turbo-compressor is mounted on four vibration mounts bolted to the camera skid (para 1-3 *h*).

3-9. Maintenance and Adjustment

The mountings of the turbo-compressor should be inspected for loose or worn fittings, and the turbo-compressor inspected for suction. If there are any discrepancies, they should be reported to the proper authority.

Section VI. MAINTENANCE OF LENS ASSEMBLY

3-10. Lens, 19 Inch

a. General. The 19 inch lens (1, fig. 2-10) is a Goerz apochromat Artar lens equipped with an attached mounting plate (4) and a lens cap (3). The diaphragm opening control (5), integral with the lens is mounted on the lens barrel. A special lens box (2) is provided to store the lens when it is not mounted on the camera.

b. Removal

(1) Grasp the knobs (3, fig. 2-11) on the lens mounting plate (2), and rotate 15 degrees in a counterclockwise direction to unlock the lens (5) from the inner lensboard frame (4).

(2) Release the lens mounting plate and the lens from the slots of the inner lensboard frame.

c. Cleaning and Inspection. Always keep lens covered when not in use. Avoid touching lens surfaces. Clean only if accumulated dust or accidental fingerprints necessitate it. To clean, first dust with a clean camel's hair brush. If markings

presist, breathe lightly on the lens and wipe lightly with a clean lens tissue. Discard tissue after each use. Inspect the lens thoroughly for scratches, broken or bent diaphragm opening control, and damaged barrel. If lens is defective, regardless of how slight the damage, report the condition to the proper authority. If internal lens surfaces are stained or dirty, or inner elements are loose, also report condition to the proper authority to obtain qualified servicing. Do not attempt to disassemble lens, as the components are critically spaced and
aligned, and the lens elements may distort under excessive pressure.

***CAUTION*: Never use any solution on the lens and never oil the diaphragm or other lens mechanism.**

d. Installation. Install the lens as detailed in paragraph 2-35. c. (1).

3-11. Lens, 24 Inch

a. General. The 24 inch Goerz apothromat Artar process lens is equipped with a lens cap (2, fig. 2-12), a detachable lens mounting plate (6), and a lens box (1). A holding ring within the lens mounting plate is used to lock the lens firmly in operating position. The diaphragm opening control (4) is a ring attached on the barrel of the lens.

b. Removal. With knobs (3, fig. 2-13), turn the lens mounting plate (6, fig. 2-12) 15 degrees in a counterclockwise direction to release it from the inner lensboard frame (4, fig. 2-13).

c. Cleaning and Inspection. Refer to paragraph 3-10. c.

d. Installation. Install the lens as detailed in paragraph 2-35. c. (2).

Section VII. MAINTENANCE OF COUNTER SAFETY LIGHTS

3-12. General

The copyboard and lensboard positioning counters are equipped with shielded safety lamps (7, fig. 1-3) on the darkroom side of the camera back. These lamps are mounted on the counter platform over the counters to provide illumination under darkroom conditions. Upon failure of these lamps the operator should notify the proper authority for their immediate replacement.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIAL

4-1. General
Complete instructions for the servicing, inspection and installation of the camera are given in chapter 2, paragraphs 2-1 and 2-2.

Section II. MOVEMENT TO A NEW WORKSITE

4-2. General
Complete instructions for dismantling the equipment and preparation for transportation to a new worksite are given in section II of chapter 2.

4-3. Reinstallation After Movement
Reinstallation instructions are identical to the initial servicing, inspection and installation instructions given in chapter 2, paragraph 2-1. *h*.

Section III. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

4-4. Tools and equipment
Tools, equipment, and repair parts issued with or authorized for the Consolidated model 1969, camera copying, lithographic, are listed in the basic issue items list, appendix C.

4-5. Special Tools and Equipment
The operations detailed in this chapter may be performed with standard mechanics handtools.

4-6. Maintenance Repair Parts
Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering organizational maintenance in TM 5-3610-220-20P.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-7. General
Preventive maintenance checks and services should be performed regularly by the organizational maintenance personnel to insure good operation and lessen the chances of mechanical failure.

4-8. Organizational Maintenance
Organizational preventive maintenance is performed by organizational maintenance personnel, with the aid of an operator at monthly intervals. The monthly interval will be equivalent to 4 weeks, or 240 hours of use, whichever occurs first. Table 4-1 contains a tabulated listing of organizational preventive maintenance checks and services.

Table 4-1. Preventive Maintenance Checks and Services

Organizational Maintenance Category ***Monthly Schedule***

Sequence number	Item to be inspected	Procedure	Paragraph reference
1.	Lubrication	Lubricate if necessary.	3-3, 3-4
2.	Tools and equipment	See that all tools and equipment assigned to the camera are clean, serviceable, and properly stowed in toolbox. See that tool box is in good condition and that it closes and fastens properly.	App. C
3.	Wiring, switches	Inspect wiring for oil-soaked, cracked, or frayed insulation, broken wires and cables, and loose or corroded connections. Check operation of switches. Replace defective switches and wires. See that all wiring is clean and that connections are clean and tight.	2-1. *f.* (13)
4.	Magnetic contactor	Check the magnetic contactor for secure mounting and tight wire connections. See that contact points make contact and are flush. Check wires for shorting. Tighten or replace all loose or missing screws. Replace defective wires.	6-33
5.	Arc lamps	Replace defective or short carbons. Adjust gap between carbon ends for correct spacing, if necessary. Clean ash from bottom of arc lamp. Repair or report any breaks or cracks in arc lamp exterior.	4-27, 4-29
6.	Copyboard and lensboard transmission	Inspect drive gears for proper setting and mesh. Check for any unusual gear noise during operation. Check gears for wear. If gears are worn or unusual noises are present, report condition to the proper authority.	6-29
7.	Counter sprockets and chains	Check the counter sprockets for wear and damage. Check the chains for wear, loose or missing links, and proper tension. Repair or replace worn or damaged chains.	6-29
8.	Universal joints	Check universal joints for wear and damage. Check for loose or missing pins, holding joints to shafts. Replace worn or damaged universal joints and loose or missing pins.	6-42 thru 6-45
9.	Copyboard and lensboard drivescrews	Check the drivescrews for damaged threads. Inspect the drivescrews for end play at the end supports of the camera. See that worn or damaged drivescrews are repaired or replaced. Adjust drivescrews if end play is beyond limitations (para 6-32. *b.*).	6-29 thru 6-32
10.	Turbo-compressors	Check the mounting of the turbo-compressors on the vibration mounts and against the frame of the camera. Check for suction. Tighten or replace loose or missing mounting bolts and nuts; replace worn vibration mounts. Report condition to proper authority if poor suction exists.	6-1
11.	Turbo-compressor	Tighten or replace loose or missing mounting bolts and nuts. If unusual noises exist due to friction of parts, report condition to the proper authority. Replace brushes that are worn beyond limits or brushes with weak springs. Tighten wire connections securely. Be sure that brushes are free in the holders for proper contact with commutator.	6-2
12.	Lensboard assembly	Tighten all loose connections and replace missing bolts and nuts. Replace worn wipers on the carriage with new, oiled wipers; tighten the wiper guards. If carriage gibs are worn, causing faulty reproduction, report condition to the proper authority. Faulty or damaged vertical and horizontal drive shafts, preventing proper movement of inner lensboard frame, must be reported to the proper authority. Replace weak or damaged inner lensboard frame spring. Report unsatisfactory operation of shutter.	6-21

Table 4-1. Preventive Maintenance Checks and Services-Continued

Organizational Maintenance Category ***Monthly Schedule***

Sequence number	Item to be inspected	Procedure	Paragraph reference
13.	Copyboard	Check that all mounting bolts, nuts, and lockwashers of the copyboard are secure. Inspect the operating knob for proper function during operation. Check the vacuum conditions of the copyboard with sample copy for proper suction. Tighten all loose connections. If operating knob does not control vacuum to hold copy of specified sizes, report condition to the proper authority.	4-51
14.	Transparency holder	Check that all mounting bolts, nuts, and lockwashers of the transparency holder are secure to the tube and axle assembly. Inspect the diverter knob during operation to determine if the valve plate is functioning properly to permit suction through transparency holder. the light box assembly for burned-out fluorescent tubes and starters, and defective ballasts. Tighten all loose connections. Defective valve plate must be reported to the proper authority.	4-45 Check
15.	Copyboard Carriage	Check that all bolts, lockwashers, and nuts are firm and secure. Inspect for worn wipers and loose wiper guards. Check that bolts, holding the carriage gibs, are tight to prevent misalignment of copyboard, lens-board, and focusing glass. Tighten all loose con-nections. Replace worn wipers with new, oiled wipers; tighten the wiper guards. Worn carriage gibs causing faulty reproduction must be reported to the proper authority.	2-1. *f*. (3) 6-17
16.	Vacuum back hinge assembly	See that locking knobs are tight against the bearing thrust hinges to hold the vacuum back in operating position. Operate the valve handle to check if the vacuum valve is working properly. Tighten loose locking knobs and check for proper position of vacuum back. If the handle valve does not operate properly to hold negatives on surface, report condition to the proper authority.	1-3.*c*.
17.	Focusing glass	Check the focusing glass clips for secure mounting. Inspect and operate the oscillating knob for proper function of pivoting motion. Check that focusing glass remains in open position without slack. Check for damaged or broken glass or cleanness. Tighten screws of focusing glass clips if loose; replace missing screws. Repair and replace the oscillating knob if not operating properly. Clean the focusing glass. If focusing glass does not remain in open position, report condition to the proper authority.	4-34
18.	Bellows	Check the bellows end frames for loose or missing bolts, and secure mounting to the lensboard and camera back. Inspect the bellows for cracking, tears, and dry rot. Check the tube support assembly supporting the bellows for satisfactory operation and proper con-nection. Tighten all loose connections and replace missing bolts and nuts. Replace the bellows if cracking, tears, and dry rot are evident. Repair all minor damages to the rubberized fabric. Replace damaged pins, tube, or roller carriers of the tube support assembly.	4-35 4-36 4-37

Section V. TROUBLESHOOTING

4-9. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the copying camera or its components.

Each trouble symptom stated is followed by probable causes of the trouble. The possible remedy recommended is described opposite the probable cause.

Table 4-2. Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. Vacuum back fails to hold film properly	a. Improper selection of vacuum back valve ports	a. Measure size of film and move valve handle to a position best suited to hold film on vacuum back.
	b. Opening in vacuum flexible hose	b. Remove hose clamps at the vacuum back valve housing and suction pipe on camera skid, and remove flexible hose. If opening in hose is comparatively small, make a temporary repair with electrical tape.
2. Copyboard fails to hold copy properly	a. Copyboard suction not directed properly.	a. Measure size of copy and turn operating knob to the correct position.
	b. Diverter valve plate not in closed position.	b. Diverter valve plate is in open position, permitting suction to the transparency holder and thereby lessening the vacuum to the copyboard. Push the diverter knob completely in.
3. Arc lamps flicker	a. Gap between carbons too great to provide consistant lighting.	a. Adjust carbons (par. 4-27. d.).
	b. Drafty conditions around operating location.	b. Eliminate all drafts around working area of camera.
4. Image distortion	a. Copyboard Not aligned with focusing glass	a. Trammel four corners of copyboard with focusing glass for correct alignment of components. Check that focusing glass frame is firmly contacting at magnetic latches on both sides of frame.
	b. Lens not positioned correctly.	b. Check the lensboard counter readings. Determine if lens is screwed in the lens plate.
	c. Copy not placed on copyboard properly.	c. Remove copy and remount on copyboard, smoothing out wrinkles and folds.
	d. Distance of lensboard not related to same reduction ratio.	d. Recheck the focusing chart for correct lensboard and copyboard distance.
	e. Thick copy.	e. If copy has appreciable thickness, its thickness must be added to the copyboard counter readings in units of 1/ 100 inch.
5. Vibration or excessive noise during operation	a. Dry oil felt wipers causing lensboard or copyboard to vibrate while under power.	a. Apply oil to wipers. Let the oil penetrate thoroughly before resuming operation.
	b. Loose mounting hardware.	b. Locate loose hardware and tighten.

Section VI. MAINTENANCE OF CONTROLS AND INSTRUMENTS

4-10. General

The various controls and instruments of the camera become defective because of constant handling during operation, atmospheric conditions causing corrosion and deterioration, and general breakage of parts. New or reconditioned replacement parts must be exact in physical appearance and function to maintain maximum performance of the equipment. Under no circumstance should substitutions of components be made unless authority comes from the proper source. Replacement of controls and instruments involving wiring must be handled with care to avoid strain on wire and insulation.

4-11. Lensboard and Copyboard Positioning Counters

a. Darkroom Side.

(1) *Removal*.

(a) Record the distance reading of counters.

Note. Prior to any removal procedures, the distance of the lensboard and copyboard, as shown on the counters, must be recorded so that new counters may be calibrated to identical reading. Failure to record the distances will affect calibration of the camera.

(b) Remove four screws to release the cover plate (3, fig. 4-1) from the counters (6 and 7). Disconnect counter safety light wires from terminals to free cover plate.

(c) Loosen two setscrews (4) to release the counter from the counter drive.

(d) Remove four mounting screws (5), and remove the counter from its base.

(2) *Installation*.

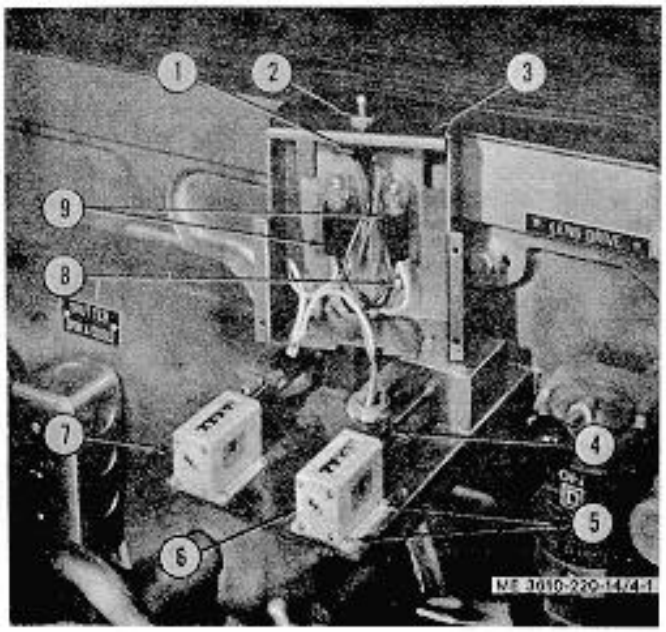
(a) Set the new counter to the distance reading.

(b) Install counter on the base, being careful not to disturb digits, and tighten the two setscrews (4).

(c) Fasten counter securely with four mounting screws (5).

(d) Attach loose wire leads to terminals.

(e) Replace cover plate (3) with four screws.



1. Counter safety light switch
2. Locknut
3. Cover plate
4. Setscrew, hex hd, 4-40 x 3/16
5. Screw, fil hd, 8-32 x 3/8
6. Lensboard positioning counter
7. Copyboard positioning counter
8. Screw, rd hd, 10-32 x 3/8
9. Counter safety light receptacles

Figure 4-1. Positioning counters, installed, darkroom side.

4-12. Lensboard and Copyboard Fine Adjustment Handwheels

a. Removal. Turn handwheel (3 and 6, fig. 4-2), if necessary, to make pin accessible. Tap pin through shaft extension and handwheel. Slide the handwheel off the extension.

b. Installation. Install the handwheel on the extension, aligning pin holes. Insert pin into hole and tap into place.

4-13. Lens Horizontal and Vertical Control Knobs

a. Removal. Turn the horizontal control knob (2, fig. 4-2) or vertical control knob (8), if necessary, to make small end of pin accessible. Tap out pin from control knob to release.

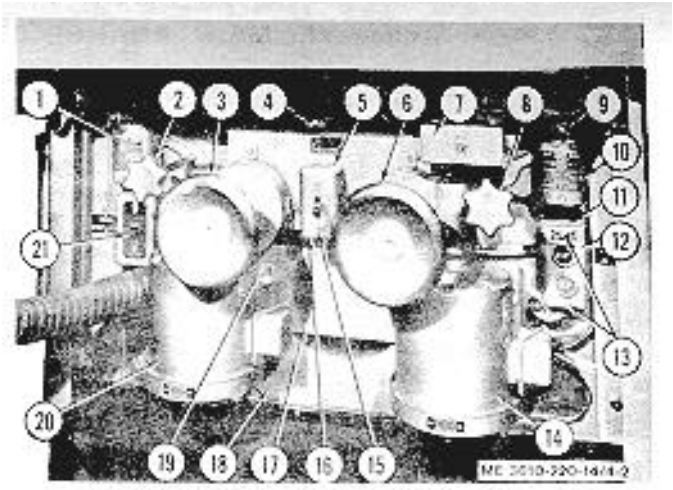
b. Installation. Place control knob on drill rod extension, aligning pin holes. Insert pin into hole and tap into place.

4-14. Lensboard Control Switch and Copyboard Control Switch

a. Description. The lensboard and copyboard control switches (9 and 1, fig. 4-2), although separately located, are identical switches mounted similarly and attached on opposite sides on the back support plate.

b. Removal. Remove the screw on the front of control switch (9), and slide switch cover (10) from switch. Remove four mounting screws to detach control switch. Disconnect wire leads from terminals.

c. Installation. Connect wire leads to terminals of control switch (9). Mount switch with four mounting screws. Replace switch cover (10) and attach with screw on front.



1. Copyboard control switch
2. Lens horizontal control knob
3. Copyboard fine adjustment handwheel
4. Oscillating knob
5. Darkroom shutter switch
6. Lensboard fine adjustment handwheel
7. Counters
8. Lens vertical control knob
9. Lensboard control switch
10. Lensboard control switch cover
11. Darkroom arc lamp switch
12. Darkroom arc lamp switch cover
13. Screw, rd hd, 8-32 x ¼
14. Lensboard drive motor
15. Screw, rd hd, 8-32 x ¾
16. Darkroom shutter switch cover
17. Motor support bracket
18. Back support plate
19. Nut, hex, ⅜-16
20. Copyboard drive motor
21. Vacuum back switch

Figure 4-2. Camera controls, installed darkroom end.

4-15. Counter Safety Lights

a. Counter Safety Light Receptacle, Darkroom Side.

(1) *Removal*. Remove the cover plate (3, fig. 4-1) as detailed in paragraph 4-11.*a*. (1) (b). Remove two screws (8) to release the counter safety light receptacle (9).

(2) *Installation*. Attach the counter safety light receptacle (9) with two screws (8). Attach loose wires to terminals, and install cover plate.

b. Counter Safety Light Switch, Darkroom Side.

(1) *Removal*. Remove the cover plate (3, fig. 4-1), (para 4-11. *a*. (1) (b). Disconnect switch wire leads from terminals. Loosen locknut (2) and remove counter safety light switch (1) from cover plate (3).

(2) *Installation*. Position switch (1) on cover plate (3), and secure with locknut (2). Connect wire leads to terminals. Install the cover plate.

4-16. Vacuum back Valve Handle

a. Removal. Tap taper pin from valve handle (13, fig. 1-4), and remove from the vacuum back valve housing (1).

b. Installation. Place valve handle (13) on vacuum back housing (1), and retain with taper pin.

4-17. Darkroom Arc Lamp Switch and Lensboard Arc Lamp Switch

a. Description. The darkroom arc lamp switch (1ii 1, fig. 4-2) and the lensboard arc lamp switch (4, fig. 4-3) are identical switches and serve the same function. Both switches are similarly installed.

b. Removal. Remove screws (13, fig. 4-2) to release switch cover (12) from darkroom arc lamp switch (11). Disconnect wires from switch terminals. Remove four mounting screws to release switch (11).

c. Installation. Connect loose wire leads to switch, and install with four mounting screws. Place switch cover (12) on switch and retain with screws (13).

4-18. Copyboard Vacuum Operating Knob

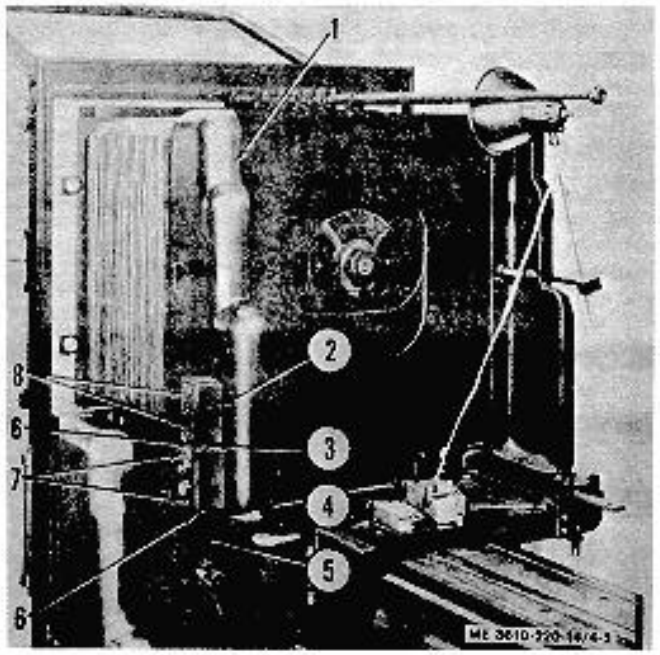
a. Removal. Insert Allen wrench in hole of operating knob (7, fig. 1-6), and loosen setscrew. Remove operating knob from copyboard.

b. Installation. Place the operating knob (7) on shaft protruding from copyboard, ascertaining that indicator corresponds to correct vacuum zone size. Tighten setscrew inside the operating knob.

4-19. Lensboard shutter switch

a. Removal. Remove two screws (8, fig. 4-3) to release cover plate from lensboard shutter switch (2). Loosen locknut (6) to disconnect switch from nipple (3) attached to the adjacent arc lamp switch (4). Remove two screws inside the shutter switch to release it from the lensboard side frame (1). Disconnect wires from terminals of shutter switch. Remove shutter switch, being careful not to break wire leads.

b. Installation. Connect loose wires to shutter switch (2). Attach shutter switch to nipple (3) with locknut (6). Connect the shutter switch with two screws. Position the cover plate on shutter switch, and retain with two screws (8).



1. Lensboard side frame
2. Lensboard shutter switch
3. Nipple
4. Lensboard arc lamp switch
5. Nipple
6. Locknut
7. Screw, rd hd, 8-32 x ½
8. Screw, rd hd, 8-32 x ⅜

Figure 4-3. Lensboard shutter switch and arc lamp switch, installed.

4-20. Darkroom Shutter Switch

a. Removal. Loosen screws (15, fig. 4-2) to release outlet box cover (16). Remove two mounting screws to release the shutter switch from the outlet box. Disconnect two wire leads to free shutter switch from outlet box.

b. Installation. Replace the shutter switch with two screws. Connect two loose wire leads of outlet box to shutter switch. Replace cover on outlet box with screws (15).

4-21. Lensboard Arc Lamp Switch

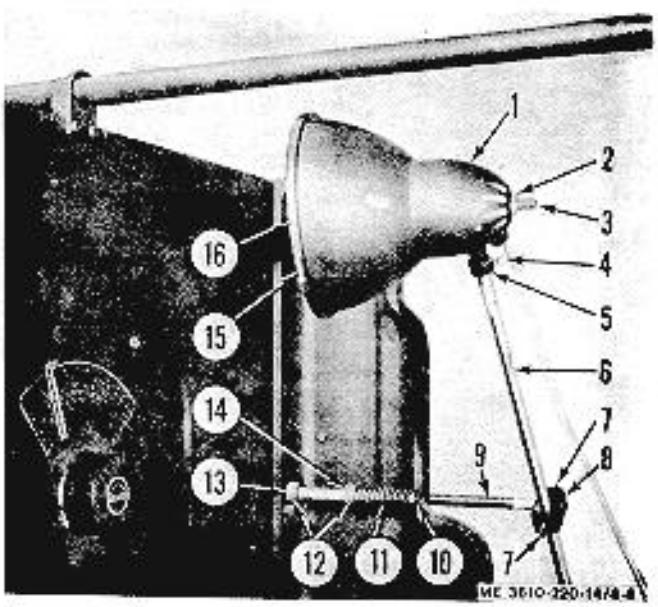
a. Removal. Remove screws (7, fig. 4-3) to release cover plate from arc lamp switch (4). Disconnect two wire leads from switch terminals. Remove two screws on inside of switch to release it from board side frame (1). Loosen locknut (6) on the nipple (5) and remove switch.

b. Installation. Connect loose wires protruding from nipple (5) to terminals of arc lamp switch (4). Attach the switch to the nipple (5) with locknut (6). Mount switch with two screws. Slide cover plate over switch and return with screw (7).

4-22. Flash Lamp Switch

a. Removal. Loosen adjustment screw (7, fig. 4-4) and slide flash lamp assembly from pivot shaft (9). Remove screw (4), on side of lamp bracket (5), to release the flash lamp. Detach the socket-switch assembly (3) by removing nut (2). Remove socket from the lamp reflector (1).

b. Installation. Mount the socket into lamp reflector (1) with nut (2). Position the flash lamp assembly on the pivot shaft (9), and tighten adjustment screw (7) to pivot shaft (9).



1. Lamp reflector
2. Locknut
3. Socket-switch assembly
4. Hex soc hd screw
5. Lamp bracket
6. Cross shaft
7. Adjustment screw ¼-20 x 1
8. Joint block
9. Pivot shaft
10. Adjustment screw ¼-20 x 1
11. Shaft spring
12. Drive pin
13. Collar
14. Pivoting collar
15. Screw
16. Retainer

Figure 4-4. Flash lamp assembly, installed.

4-23. Focusing Glass Oscillating Knob

a. Removal. Lower focusing glass to an operating position, and tap out pin holding the oscillating knob (4, fig. 4-2), to the pinion shaft. Release the knob.

b. Installation. Position the oscillating knob (4) on the pinion shaft, aligning the pin holes. Insert pin and tap in place.

4-24. Copyboard Vacuum Control Switch and Vacuum Back Control Switch

a. Description. The copyboard control switch (1, fig. 4-5) and the vacuum back control switch (21, fig. 4-2) are identical. Both switches are similarly installed, one for each function.

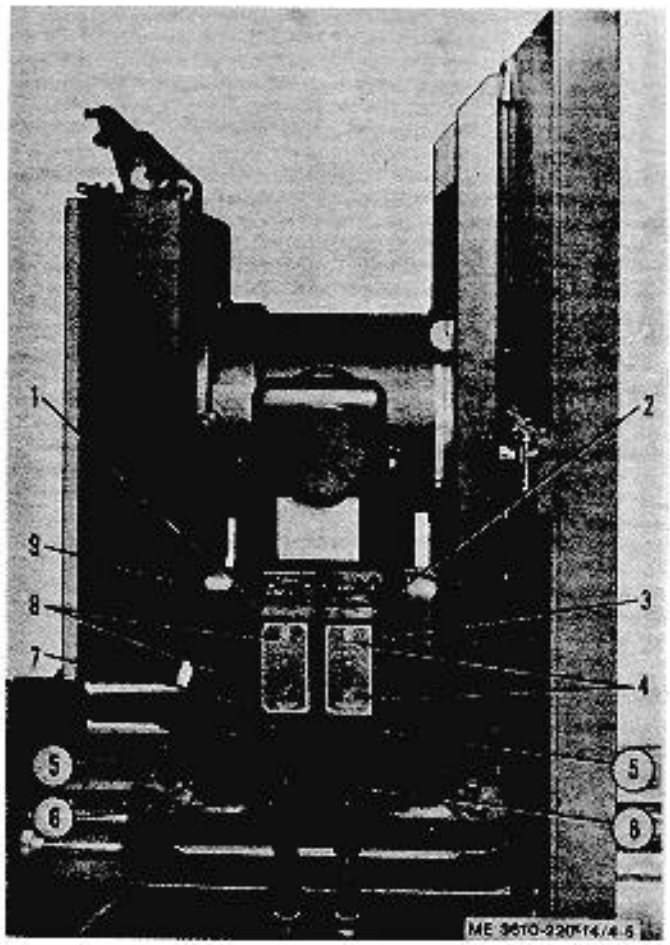
b. Removal. Remove cover plate screws (8, fig. 4-5) from the copyboard vacuum control switch (1). Slide cover plate (7}) from switch. Remove two screws on inside of switch to release it from the copyboard frame (9). Disconnect wire leads from switch. Loosen the locknut (5) to release the vacuum control switch from nipple (6).

c. Installation. Attach the vacuum control switch (1) with locknut (5). Mount the vacuum control switch to the copyboard frame (9) with two screws. Connect loose leads to switch terminals. Slide cover plate (7) over switch and retain with screws (8).

4-25. Transparency Holder Light Switch

a. Removal. Remove screws (4, fig. 4-5) to release cover (3) from transparency holder light switch (2). Loosen two screws holding switch to copyboard frame (9). Disconnect wires from switch terminals. Loosen locknut (5) to release the switch from the nipple (6). Disconnect wire leads from switch.

b. Installation. Attach the switch to nipple (6) with locknut (5). Connect loose wire leads to switch terminals. Mount the switch to the copyboard frame (9) with two screws. Attach cover (3) with screws (4).



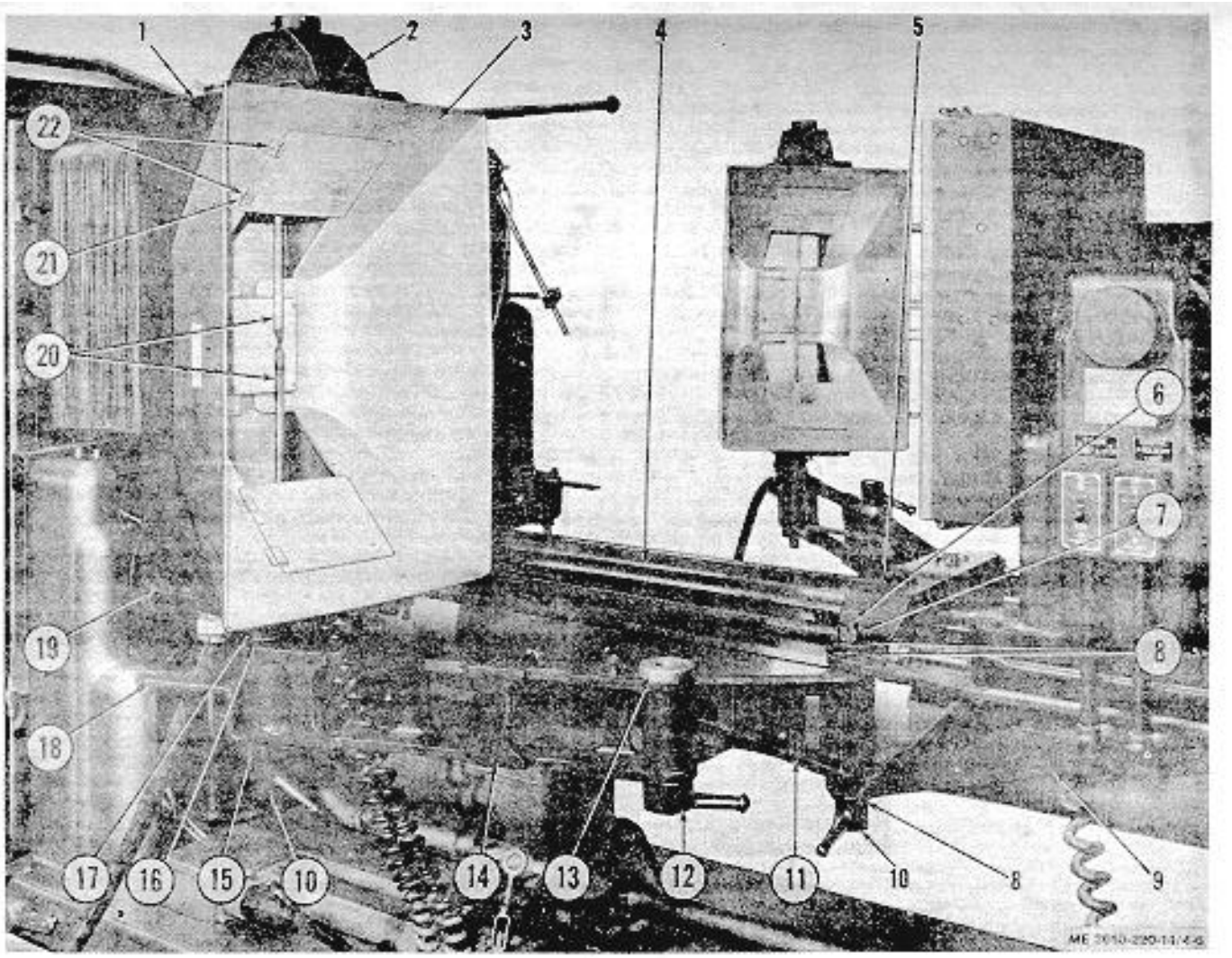
1. Vacuum control switch
2. Transparency holder light switch
3. Transparency holder light switch cover
4. Screw, 8-32 x ½
5. Locknut
6. Nipple
7. Vacuum control switch cover plate
8. Screw, 8-32 x ½
9. Copyboard frame

Figure 4-5. Copyboard vacuum control switch and transparency holder light switch, installed.

Section VII. MAINTENANCE OF ARC LAMP ASSEMBLY

4-26. Description

The copyboard is illuminated by two constant intensity carbon arc lamps which provide a uniform intensity of light over the entire area of the image. The arc lamps are mounted on arm brackets (11 and 14, fig. 4-6) which are coupled to the copyboard to maintain a uniform intensity of illumination regardless of their position along the camera ways. The arc lamps are equipped with reflectors (3) which are integral with the assembly, having high reflecting surfaces. Housed within the reflectors are two carbon electrodes (20) which are mounted on adjustable arms and are electronically controlled by electronic sensing devices. The arc lamps operate from a 110-volt AC source in conjunction with a single-phase transformer switched by a magnetic contactor. The arc lamp wiring diagram and exploded view are shown in figures 4-10 and 4-11 respectively.



1. Side panel
2. Top casting
3. Arc lamp reflector
4. Camera rail
5. Cross brace assembly
6. Hinge pin shaft
7. Hinge pin nut
8. Washers
9. Secured-end arm bracket
10. Cap nut
11. Center arm bracket
12. Cap nut
13. Hinge pin
14. Free-end arm bracket
15. Hex nut
16. Bushing
17. Collar
18. Locking bracket
19. Bottom casting
20. Carbon electrodes
21. Screw, rd hd, 8-32 x ¼
22. Reflector door hinge

Figure 4-6. Arc lamp assembly, installed.

4-27. Carbon Electrodes

a. Description. The electrodes used in the arc lamp are. 10 mm by 12 inches long, 50-ampere, copper-coated carbons. The upper carbon (5, fig. 47) is rated as high intensity and the lower carbon (8) as a white flame type; therefore, care must be taken in replacing the proper electrode. The carbons are held secure in the arc lamp by vise type insulated carbon holders (and 10) which are fastened to the arms (4 and 9) by thumbscrews. The upper and lower arms are adjustable so that they can be moved up or down to facilitate the removal or replacement of the carbons. The wires to the carbons are covered with an asbestos wrapping which acts as insulator from the intense heat thrown by the arc lamps during operation.

b. Removal.

(1) Open the reflector doors (12, fig. 4-7) and grasp the upper arm, as shown in figure 4-8. Move the upper arm up to separate upper and lower carbon ends.

(2) Loosen thumbscrew (3, fig. 4-7) to release upper carbon (5) from upper carbon holder (2) and upper arm (4).

(3) Loosen thumbscrew (3) of lower carbon holder (10) and lower arm (9), and remove lower carbon (8).

c. Installation.

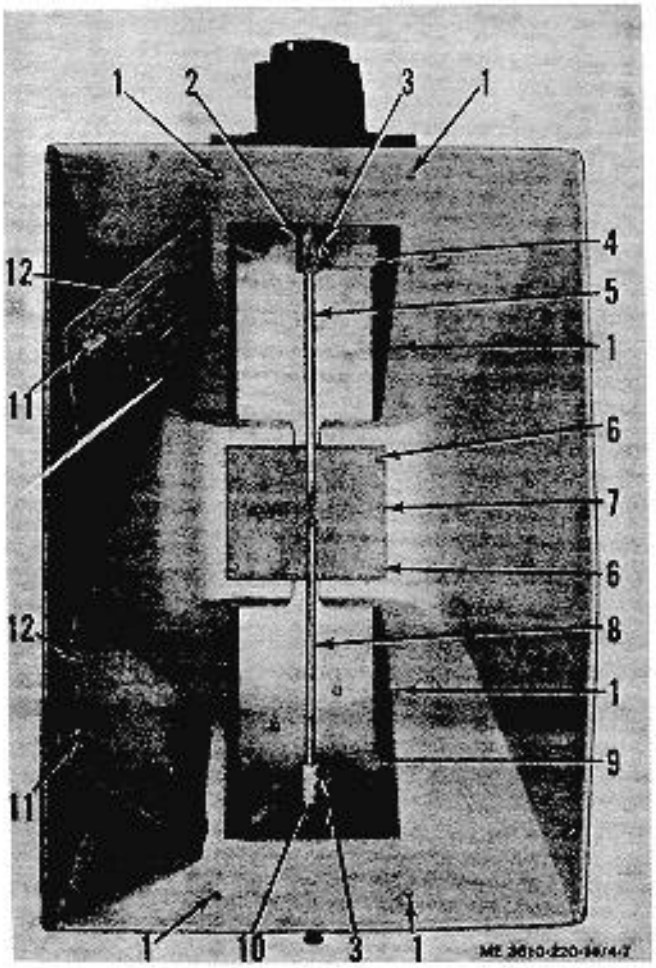
(1) Replace upper carbon (5) between upper carbon holder (2) and upper arm (4), positioning the carbon so that approximately 8 inches exist from carbon end to holder.

(2) Tighten thumbscrew(3), being absolutely sure the carbon is securely clamped and not cocked.

(3) Replace lower carbon (8, fig. 4-7) between lower carbon holder (10) and lower arm (9), positioning the carbon so that its length from end to holder matches length of upper carbon.

d. Adjusting. Move the upper arm (4) down so that upper carbon (5) and lower carbon ends meet at the center of the reflector. Reclamp carbons on holders if carbons ends are not flush and centered, or if unequal carbon lengths are apparent.

Note. When installing burned-off carbons, make certain they are approximately the same length, and that they are adjusted in the holders to meet at the center of the reflector. Avoid removal of carbons from arc lamps when hot or warm, as serious burns will result. Wait until carbons cool.



1. Screw, rd hd, 10-32 x ¾
2. Upper carbon holder
3. Carbon holder thumbscrew
4. Upper arm
5. Upper carbon
6. Screw, rd hd, 10-32 x ½
7. Center support plate
8. Lower carbon
9. Lower arm
10. Lower carbon holder
11. Reflector door latch
12. Reflector door

Figure 4-7. Inside view of arc lamp.

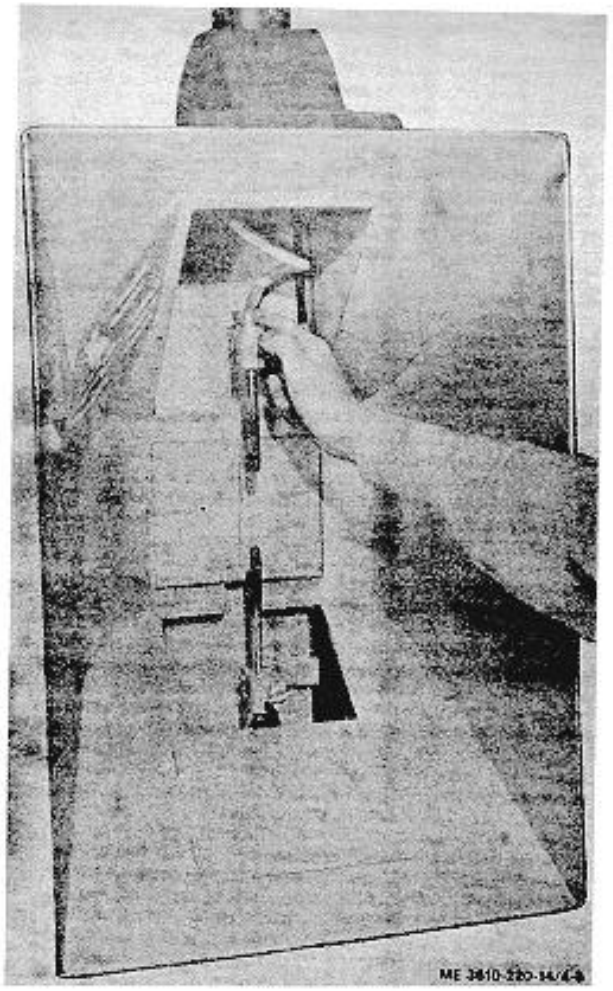


Figure 4-8. Adjusting carbon holders.

4-28. Arc Lamp Reflector

a. Description. The reflector (3, fig. 4-6) is a funnel-shaped panel containing a highly glazed surface to provide maximum lighting reflection. The top and lower sections of the reflector are equipped with hinged doors (12, fig. 4-7), making the upper and lower chambers of the arc lamp accessible. The reflector is supported primarily by the top casting (2, fig. 4-6) and bottom casting (19) and two side panels (1) which serve as a frame for the arc lamp.

b. Removal.

(1) Remove the carbon electrodes as detailed in paragraph 4-27. b.

(2) Close the reflector doors (12, fig. 4-7).

(3) Release the reflector from the side panels by removing eight mounting screws (1, fig. 4-7).

c. Disassembly.

(1) Remove four screws (6, fig. 4-7) to release the center support plate (7) from the reflector.

(2) Disconnect reflector door by removing hinge screws (21, fig. 4-6) from the two hinges (22), supporting the door. Remove the other reflector door in similar manner.

(3) Remove the reflector door latches (1, fig. 4-7) by removing two screws and nuts.

d. Cleaning, Inspection, and Repair. Clean the surfaces of the reflector (3, fig. 4-6), center support plate (7, fig. 4-7), and the reflector doors (12) with cleaning solvent and a clean, soft cloth. Clean the reflector door latches (11) with cleaning solvent. Wipe all surfaces dry with a clean cloth; use air hose to dry inner surfaces of the latches. Inspect the parts of dented, cracked and bent surfaces. Observe closely for crinkling, peeling, or other signs of finish deformation of the surfaces. Inspect the reflector door latches (11) for satisfactory operation. Replace defective latch if necessary. Straighten and level dented or bent surfaces of the reflector (3, fig. 4-6) and center support plate (7, fig. 4-7) with a

wooden mallet or soft-faced hammer, using a lead or wooden block for support. Remove all signs of peeling and scaling around the repaired area, and refinish with the proper finishing lacquer. Replace parts showing holes, cracks, and openings in the surface.

e. Reassembly.

(1) Position the latches (11, fig. 4-7) on the reflector door (12) and attach with two screws and nuts.

(2} Install the reflector doors (12) on the reflector with hinge screws (21, fig. 4-6).

(3) Install the center support plate (7, fig. 4-7) with four screws (6).

f. Installation.

(1) Position the arc lamp reflector (3, fig. 4-6) on the side panels (1) and install with eight screws (1, fig. 4-7).

(2) Install the carbon electrodes (para. 4-27. c.).

(3) Adjust the carbon electrodes (para. 427. d.).

4-29. Arc Lamp Ash Door

a. Description. The ash door is located on the bottom casting (19, fig. 4-6) of the arc lamp and is used to clean out fallen carbon ash aid stubs from the lower chamber of the fixture. The ash door (fig. 4-9) is spring-loaded operating from two spring type hinges (2) which are directly fastened to the bottom casting.

b. Removal.

(1) Remove two screws (11 on the ash door hinge (2) to release it from the bottom casting (5). Release the other hinge (2, fig. 4-9) in a similar manner and remove the ash door from the arc: lam p.

(2) Detach the ash door hinges from the door by removing two screws on each hinge.

(3) Unscrew the ash door knob (3) to release it from the door panel (4).

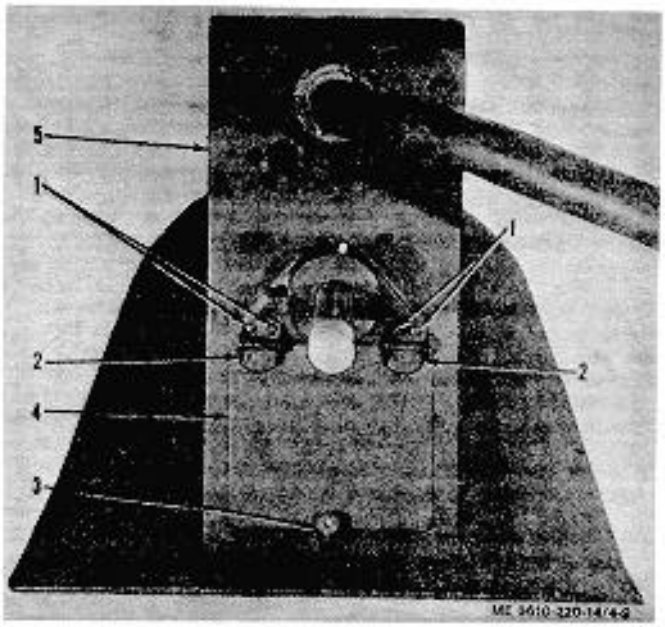
c. Cleaning, Inspection and Repair. Clean the ash door panel (4) with a cleaning solvent and a clean, soft cloth. Wash the ash door hinges (2) and the ash door knob (3) with cleaning solvent. Wipe the door panel (4) and door knob (3) with a soft cloth; dry the hinges (2). Inspect the parts thoroughly for damages showing cracks, bends or dents, and breaks. Observe the door panel (4) for crinkling or scaling in finish. Straighten and level dented or bent surfaces of door with a wooden mallet or a soft faced hammer, using a lead or wooden block for support. Scrape off any loose paint and refinish with the proper finishing lacquer. Replace defective door knob (3) and hinges (2).

d. Installation.

(1) Attach the ash door hinges (2) to the door panel with screws.

(2) Secure the door knob (3) by inserting it into the threaded hole of the door panel (4).

(3) Attach the door to the bottom casting with screws (1).



1. Screw, 8-32 x ½h
2. Ash door hinge
3. Ash door knob
4. Ash door panel
5. Bottom casting

Figure 4-9. Bottom view of arc lamp showing ash door.

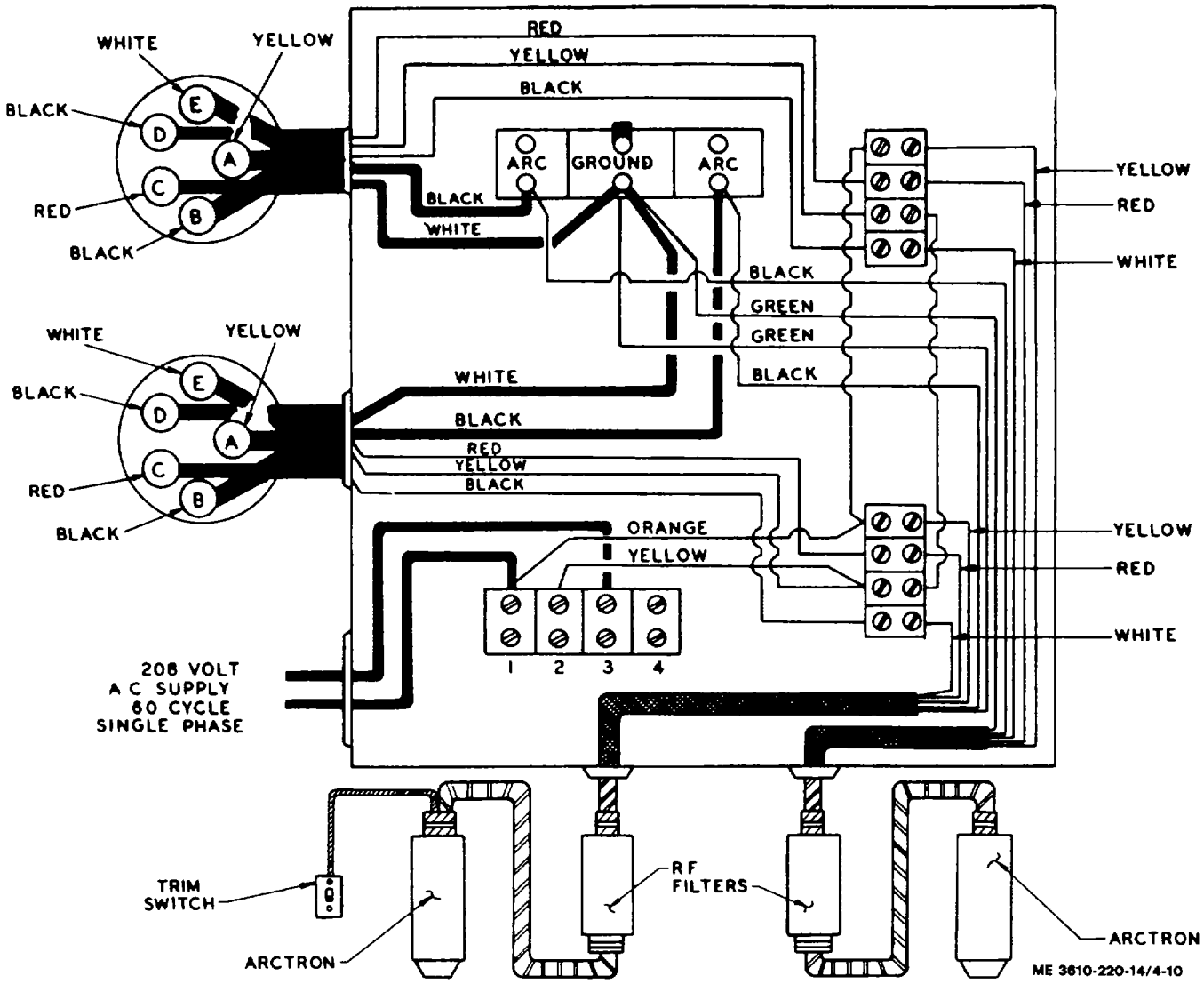
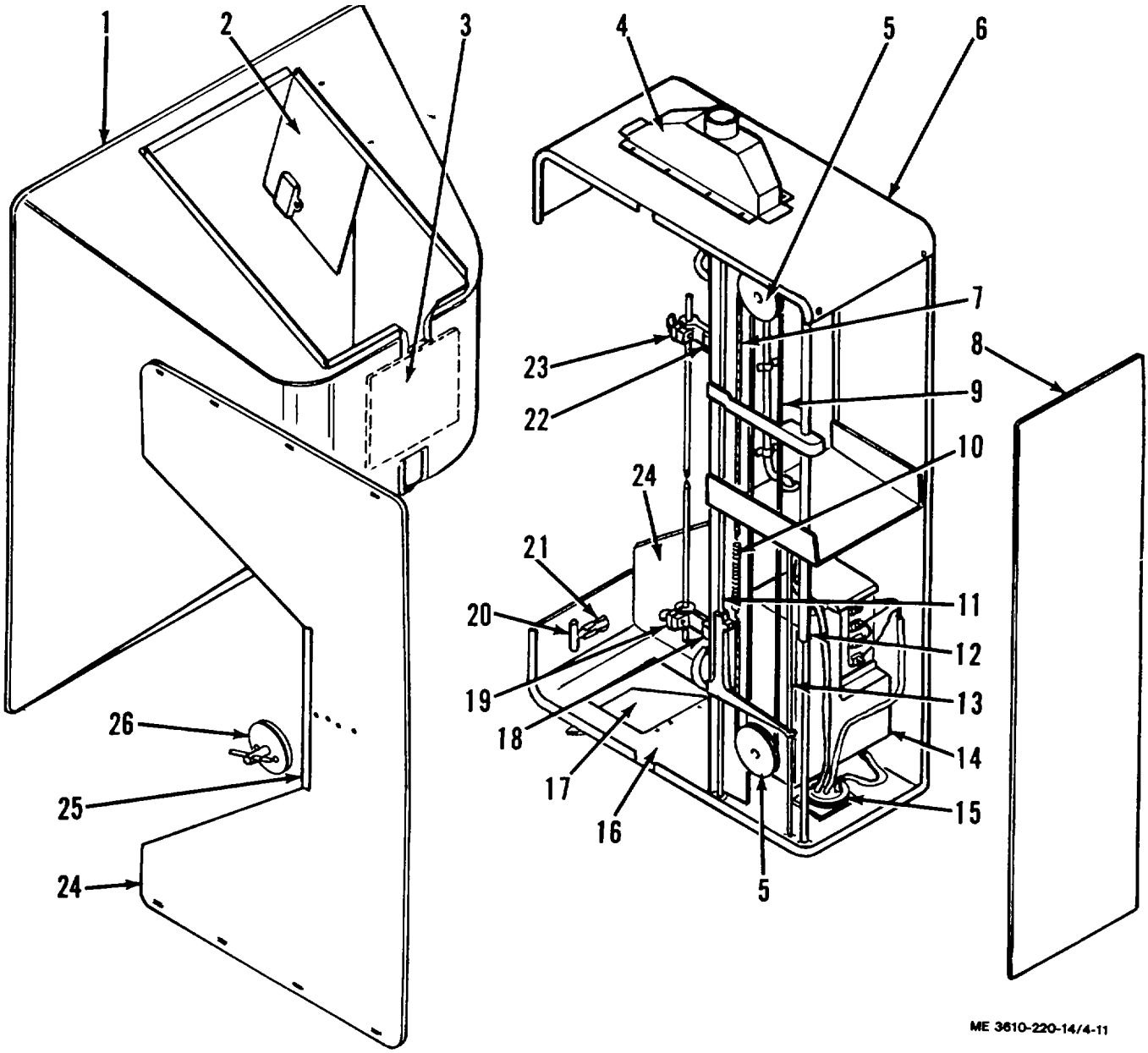


Figure 4-10. Arc lamp transformer wiring diagram.



1. Reflector assembly
2. Reflector door
3. Monobestos plate
4. Vertical vent cover
5. Pulley
6. Top casting
7. Flexible drive cable 15½6" x 1/ 16"
8. Rear cover plate
9. Flexible drive cable 32" x 1/ 16"
10. Drive cable tension spring
11. Guide rod, 5/16"
12. Guide rod, 1"
13. Guide rod, 1/4"
14. Transducer assembly
15. Lamp connector
16. Base casting
17. Ash door assembly
18. Lower arm
19. Lower carbon holder
20. Carbon holder key
21. Carbon holder key clamp
22. Upper arm
23. Upper carbon holder
24. Side assembly
25. Side filler
26. Hand screw trunnion assembly

Figure 4-11. Arc lamp, partial exploded view.

4-30. Arc Lamp Arm Assembly

a. Description. The arc lamp arm assembly is the carrier of the arc lamp, mainly consisting of the center arm bracket (11, fig. 4-6) and the free-end arm bracket (14), which are coupled by a hinge pin (13) and cap nut (12). The collar (17) supports the arc lamp and is pinned to the pivot pin in the free-end bracket by a taper pin. The locking bracket (18) on the base of this arm bracket is used to couple the arc lamp arm assembly to the lensboard carriage for shipping purposes. The hinge pin shaft (6), is the main pivoting axle of the arm assembly.

b. Removal.

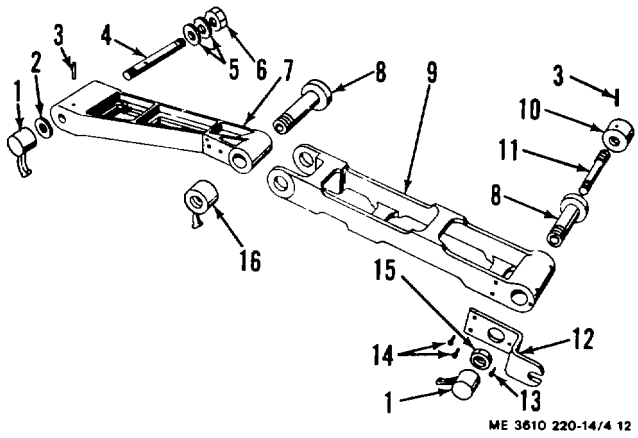
(1) Remove the hinge pin nuts (7, fig. 4-6) and washers (8) from the cross brace assembly (5), and lift the assembly from the camera rail (4), exposing the ends of the hinge pins (6).

(2) Remove cap nut (10), and washer (8). Tap out taper pin that pins the hinge pin shaft (6) to the center arm bracket (11). Lift the hinge pin (6) to release the center arm bracket (11) from the secured-end arm bracket (9).

c. Disassembly.

(1) Remove cap nut (18, fig. 4-12) from hinge pin (8).

(2) Remove cap nut (15) and lock nut (17). Tap out taper pin (10) from collar (11) and pivot pin (12). Lift out hinge pin (8). Remove screws (14 and 16) from securing locking bracket (13) to free-end arm bracket (9).



1. Cap nut
2. Washer
3. Taper pin
4. Hinge pin shaft
5. Washers
0. Hex nut
7. Center arm bracket
8. Hinge pin
9. Free-end arm bracket
10. Drive pin
11. Collar
12. Pivot pin
13. Locking bracket
14. Screw, hex soc hd 10-32 x ¾:¼
15. Cap nut
16. Screw, hex soc hd 10-32 x 1
17. Hex nut
18. Cap nut

Figure 4-12. Arc lamp arm assembly, exploded view.

d. Cleaning and Inspection. Clean all parts thoroughly with a cleaning solvent and clean cloth. Dry the parts thoroughly with a soft cloth. Inspect hinge pins (4 and 8, fig. 4-12) and pivot pin (12) for scoring or excessive wear. Inspect for burrs around edge of bore. Inspect threads on hingepin shafts (4 and 8), pivot pin (12), and all screws for stripped or damaged condition. Inspect locking bracket (13) for cracks and breaks. Replace defective parts if necessary.

e. Reassembly.

(1) Drive pivot pin (12, fig. 4-12) into free end arm bracket (9). Position locking bracket (13) and secure with two screws (16). Insert remaining screw (14).

(2) Position center arm bracket (7) and hinge it to free-end arm bracket (9) with hinge pin (8). Secure hinge pin in position with cap nut (18) onto threaded end of hingepin (8).

f. Installation. Position center arm bracket (7) to secured-end arm bracket (9, fig. 4-6). Insert hinge pin (4, fig. 4-12). Line up and drive in taper pin (3). Position cross brace assembly (5, fig. 4-6) with washers (8) and secure with lock nut (7). Replace washer (8) and cap nut (10) on underside of hinge pin (6).

4-31. Transformer

a. Description. The transformer used to supply the arc lamps has a contactor-controlled primary input of 17 amperes at 220 volts and a secondary output of 50 amperes at 30 to 50 volts to each lamp. The transformer (2, fig. 4-13) is located on the copyboard end of the camera and is mounted on a bracket (4) secured to the rear support plate (1). The transformer is equipped with a cover (3) which, when removed, exposes the terminal board connections and the wiring (fig. 4-14) connecting the arc lamps and the external source cable.

b. Removal

(1) Remove the cover (3, fig. 4-13) from the transformer (2) to make wire connections accessible.(2) Tab all wires coming from the cables using fig. i-11A for identification of wires and mating terminals.

(3) Disconnect cable wires from terminals.

(4) Remove locknuts (2, fig. 4-14) from connector nipples (3). Dress wires to facilitate removing nipples.

(5) Remove cables from transformer, being extremely careful not to snare wire insulation while pulling wires through transformer panel.

(6) Loosen screws (4) on the support bracket (1) to release the transformer. Lift the transformer from the support bracket.

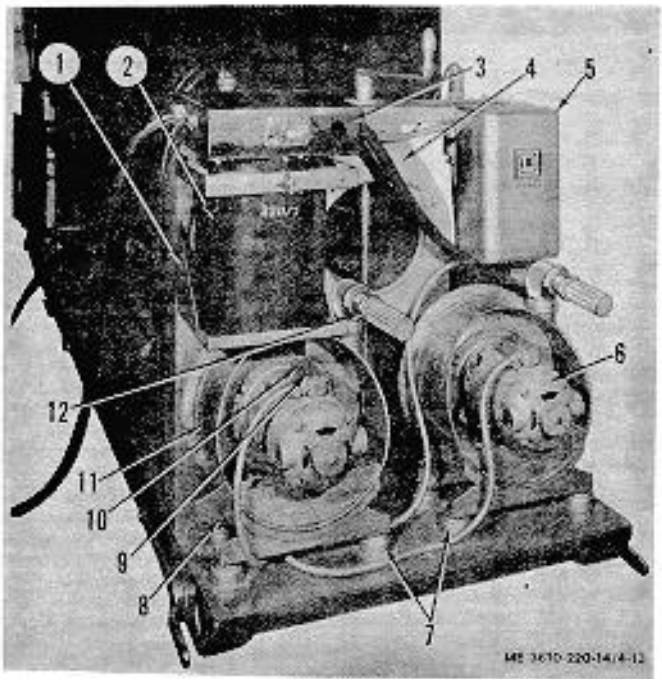
c. Installation.

(1) Replace transformer on the support bracket (1, fig. 4-13) of the rear support plate (4).

(2) Be sure the transformer (2) is firmly seated, and then tighten screws (4, fig. 4-14).

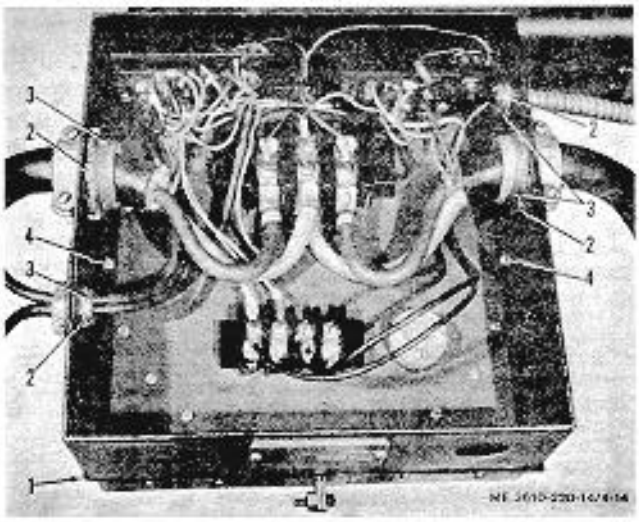
(3) Insert cable wires through transformer panel and attach the locknuts (2) to connector nipples (3).

(4) Attach loose wires to mating terminals, and replace the transformer cover (3, fig. 4-13).



1. Support bracket
2. Transformer
3. Transformer cover
4. Rear support plate
5. Magnetic contactor
6. Vacuum back turbo-compressor assembly
7. Vibration mount
8. Vibration mount nut
9. Screw, rd hd, 10-32 x 3/4
10. Outlet box cover
11. Copyboard vacuum turbo-compressor assembly
12. Muffler

Figure 4-13. Camera components, copyboard end.



1. Support bracket
2. Locknut
3. Connector nipple
4. Screw, pan hd, ¼/4-18 x /2

Figure 4-14. Transformer with cover removed.

Section VIII. MAINTENANCE OF WIRING SYSTEM

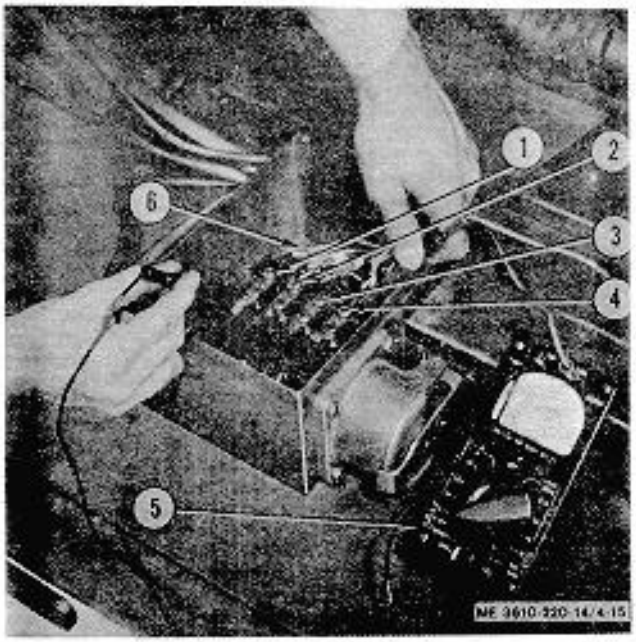
4-32. Description

The four-wire electrical supply from the portable! generator is designed to deliver a 208 volt, 60 cycle, 3 phase source from which a 120 volt supply can be obtained between any phase line and the fourth ground wire. Accordingly, some of the equipment such as the carriage drive motors, operates from the 3 phase 208 volt supply, whereas others, such as the arc lamps and the turbo-compressor motors, are balanced on the 120 volt supply legs. All wires are numbered to facilitate tracing lines and servicing the electrical equipment.

4-33. Wire Testing and Repair

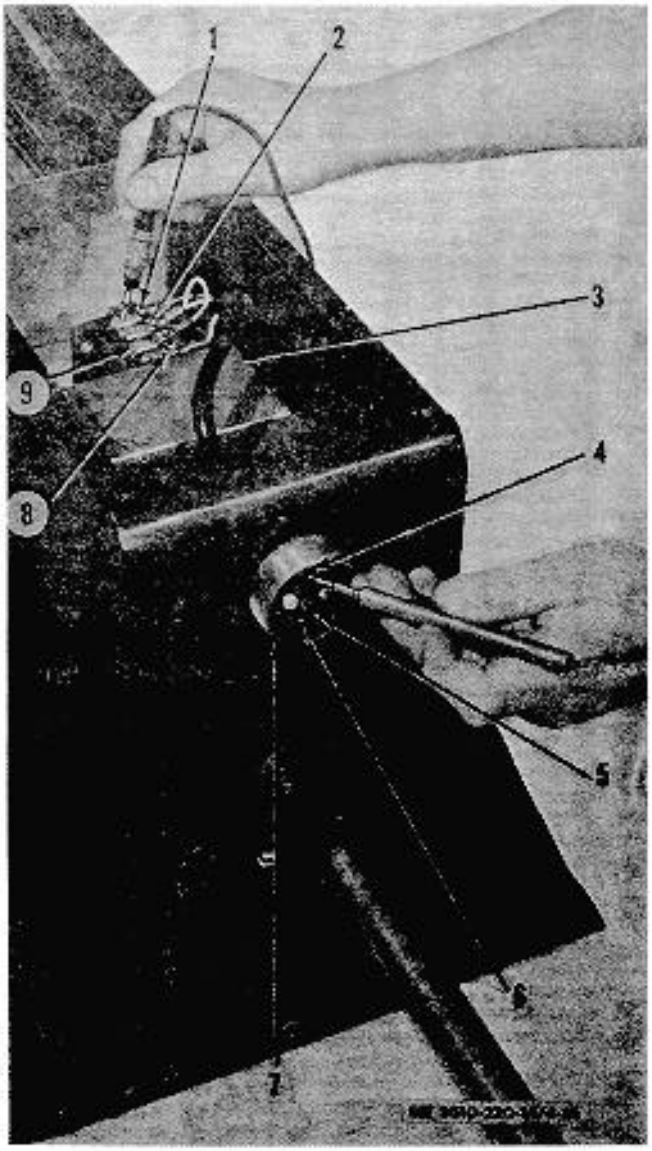
a. Test for Open Circuit in Camera Network (fig. 4-15 and fig. 1-11). Disconnect power source at the main junction box (fig. 4-15 and fig. 1-11). Set all switches of the end item in the "OFF" position. Remove cover from the main junction box to expose terminal connections. Set the volt-ohmmeter in the XI mode. Apply test lead across terminal No. I in the main junction box (1, fig. 415 and LI, fig. 1-11) and place the other test lead across terminal No. 4 (4, fig. 4-15 and G, fig. 1-11). If the needle of the volt-ohmmeter does not deflect, the circuit is open. Repeat test for terminals No. 2 and No. 3 (2 and 3, fig. 4-15 and L2 and L3, fig. 111) maintaining second test lead across terminal No. 4 (4, fig. 4-15 and G, fig. 1-11).

b. Test for Open Circuit in Arc Lamp Network (fig. 4-16 and fig. 4-7). Disconnect power source from arc lamp at the connector cable socket (7, fig. 4-16 and fig. 4-7). Remove the rear cover plate (8, fig. 4-11) from the arc lamp to expose the transducer assembly (3 fig. 4-16 and fig. 4-7). Set the volt-ohmmeter in the XI mode. Apply one test lead to transducer terminal No. 2 or No. 3 (2 or 9, fig. 416 and fig. 4-7) and the other test lead across socket contact No. 2 and No. 3 (4, fig. 4-16 and A, fig. 47). If the needle of the volt-ohmmeter does not deflect the circuit is open. Similarly, test transducer terminal No. 1 (1, fig. 4-16 and fig. 4-7) with socket contact No. 1 (5, fig. 4-16 and C, fig. 4-7) and transducer terminal No. 4 (8, fig. 4-16 and fig. 4-7) with socket contact No. 4 (6, fig. 4-16 and D, fig. 4-7).



1. Terminal No. 1
2. Terminal No. 2
3. Terminal No. 3
4. Terminal No. 4
5. Volt-ohmmeter
6. Screw, pan hd, 10-32 x 3/8

Figure 4-15. Testing for open circuit at main junction box.



1. Transducer terminal No. 1
2. Transducer terminal No. 2
3. Transducer assembly
4. Socket contact No. 2 and No. 3
5. Socket contact No. 1
6. Socket contact No. 4
7. Cable socket
8. Transducer terminal No. 4
9. Transducer terminal No. 3

Figure 4-16. Testing for open circuit at arc lamps.

c. Testing of Short Circuit. Expose the terminal board in outlet box of component in which shorting is occurring. Set the switch control of the component to an ON position, theoretically closing the circuit. Apply the test lead of test lamp to wire in outlet box and the other test lead to the frame of component. If shorting is present, the test lamp will not light. Figure 4-17 illustrates testing for short at turbo-compressor motor.

d. Repair and Replacement. Repair wire and cable with electrical tape, wrapping neatly to avoid hum ping. Replace conductors that have badly worn insulation or bare wire. Since wires within the flexible cable are harnessed, the entire cable must be replaced when defective conductors are present. The wires housed inside the rigid cable are not harnessed and can be individually replaced. In removing short-circuited conductors, attach new wire to defective wire on one end of rigid cable and pull out defective wire from other end, replacing it with a new wire. To replace broken wire in rigid cable, remove broken segments. Wrap two new wires to end of good wire in rigid cable. Pull this wire out from other end, replacing the attached new wire in cable.

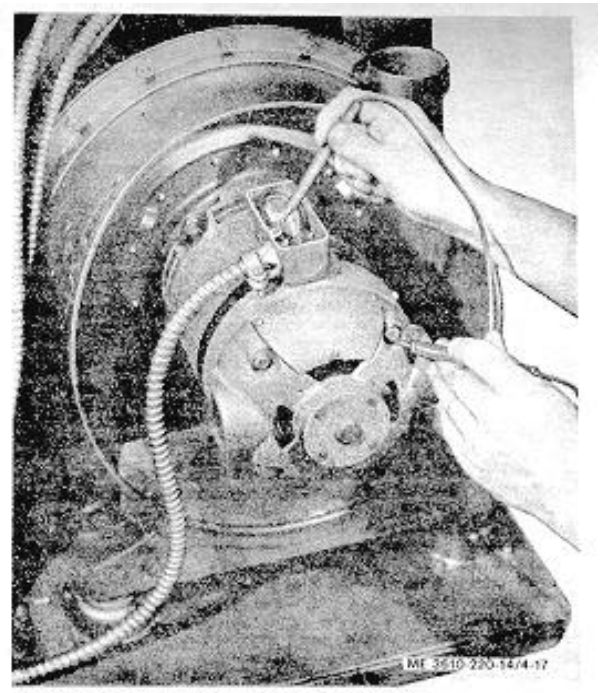


Figure 4-17. Testing for short circuit at turbo-compressor motor.

Section IX. MAINTENANCE OF FOCUSING GLASS FRAME ASSEMBLY

4-34. Focusing Glass

a. Description. The focusing glass (7, fig. 2-4) is contained in the focusing glass frame by six holder clips (2 and 5) located on the sides and bottom structures of the frame (4). The focusing glass is finished with a fine, uniformly grained surface which contains a grid of photographically exposed, permanently fused lines spaced at intervals of 0.100 inch and covering the 24by 30-inch rated area. A clear transparent circle 1 inch in diameter is provided in the center of the grid area on the focusing glass and conforms with the optical axis of the camera.

b. Removal

(1) Remove one of the bottom holder clips (2) on right side of focusing glass frame (4) by releasing four screws (6).

(2) Remove two side holder clips (5) on right side of focusing glass frame by removing three screws (6) on each.

(3) Supporting the focusing glass (7), loosen screws on the remaining holder clips.

(4) Lift the focusing glass from its frame (4).

(5) Release the remaining bottom holder clip and the two side holder clips by removing screws.

c. Cleaning and Inspection. Clean the focusing glass with a soft, clean cloth dampened in acetone. Wipe all surfaces thoroughly to keep focusing glass at maximum transparency. Dry the focusing glass with a soft, dry cloth. Clean the holder clips with cleaning solvent and wipe parts dry with cloth. Inspect the holder clips for' bends and worn inner felt strip. Check clips with straight-edge forwarding. Replace defective holder clip if necessary. Inspect the focusing glass for chipped edges affecting its alignment. Examine the glass for cracks and breaks. Replace defective focusing glass.

d. Installation.

(1) Install two side holder clips (5) on left side of focusing glass frame (4) with six screws (6).

(2) Install one bottom holder clip (2), retaining with four screws (6). Do not tighten screw s.

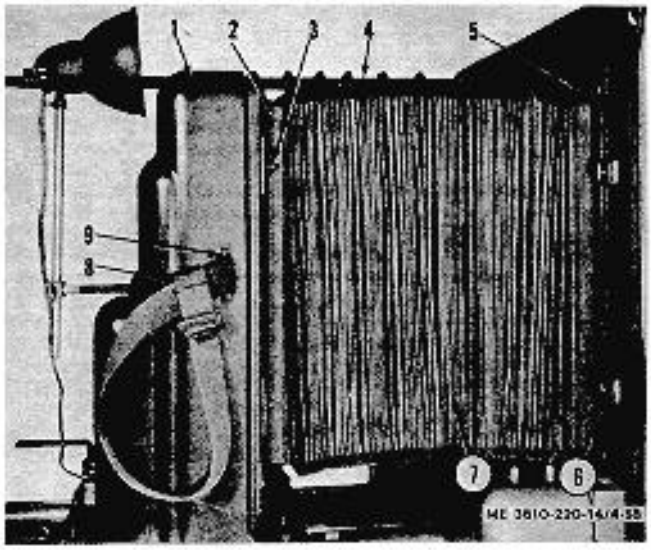
(3) Position the focusing glass (7) on the focusing glass frame under the holder clips.

(4) Install the remaining two side holder clips (5) and the bottom holder clip (2) on the right side of focusing glass frame. Retain with screws (6). Tighten screws on holder clips previously installed.

Section X. MAINTENANCE OF BELLOWS ASSEMBLY

4-35. Description

The bellows assembly is an expandable component of the camera, connecting the camera back to the lensboard and supported at its ends by two metal end frames (2 and 5, fig. 4-18) which are integral with the bellows (7). The tube support assembly (4) and its roller carriers reinforce the bellows, and are supported by the lensboard and camera back.



1. Lensboard
2. Bellows end frame
3. Screw, hex soc hd, 5/16-18 x 1/2
4. Tube support assembly
5. Bellows end frame
6. Clamp and screw assembly
7. Bellows
8. Bellows strap
9. Screw, hex soc hd, 3/16-16 x 3/4

Figure 4-18. Bellows assembly components.

4-36. Tube Support Assembly

a. Description. The tube support assembly (fig. 4-19) consists of a pair of internally spring loaded telescoping tubes (3 and 5, fig. 4-20) and six roller carriers (3, fig. 4-19), and is supported on the lensboard by a tube guide (2) on one end and on the camera back by the tube flange (5) and flange plate (6) on the other end. The roller carriers (3) are attached to the internal reinforcing frames by the adjacent plates pinned to the carriers.

b. Removal.

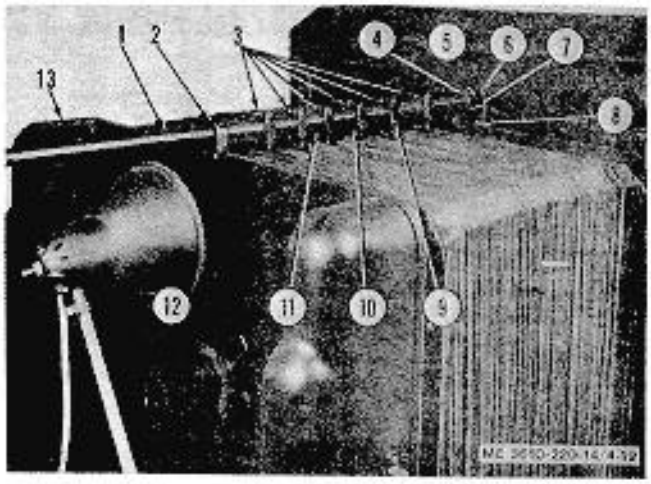
(1) Remove screws (12, fig. 4-19) to release tube guide (2).

(2) Release the tube flange (5) from flange -plate (6) by removing four screws (8). Release the flange plate (6) with two screws (7).

(3) Bend one end of a length of wire (about 1 / 16-in. dia.) into a hook, and hook onto loop of internal spring (6, fig. 4-20) inside of tube flange (4). Then holding tension on spring with wire, remove screw (1) and ease spring into tubing. Remove screw (1) to release inner tube cap (2) at front end of telescoping inner tube (5). Then pull out spring with wire. Push out inner tube from the outer tube (3) from end that was attached to the flange (4).

(4) Disconnect the roller carrier (3, fig. 4-19) from connector plate (10) by removing screw (9) and hex nut (11). Remove the other five roller carriers in the same manner.

c. Cleaning and Inspection. Wash the parts thoroughly with cleaning solvent and clean cloth. Clean inner surfaces and threaded areas and dry parts thoroughly with a clean cloth. Inspect components for bends, cracks, and breaks. Examine the tube for distortion and corrosion on outer surface. Check the roller carriers for burrs or pitted spots. Replace all defective parts.



1. Outer tube 2. Tube guide
3. Roller carrier
4. Screw, rd hd, 10-32 x 11/4
5. Tube flange
6. Flange plate
7. Screw, hex soc hd, 8-32 x l/2
8. Screw, hex soc hd 10-32 x 1/2
9. Screw, hex soc hd 10-32 x 1½/2
10. Connector plate
11. Hex nut
12. Screw, hex soc hd l/4-20 x 3/4
13. Lensboard

Figure 4-19. Tube support assembly, installed.

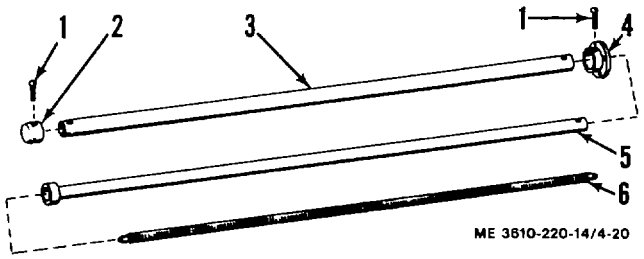
d. Installation.

(1) Insert the inner tube (5, fig. 4-20) in outer tube (3) so that it protrudes beyond bevel end of outer tube. Attach hooked wire to end of internal spring (6), and pull spring through inner tube (5) until one looped end of 'spring extends just outside of end to be capped. Rotate spring slightly until its loop is at right angle to the screw securing the cap. Press on cap (2), insert screw (1) (through cap, tube, and spring loop), and turn screw in tight.

(2) Insert telescoping tubing through tube guide (2, fig. 4-19) and roller carriers (3). Then place tube flange (4, fig. 4-20) over end of outer tube (3), aligning screw hole with that in the tube. Grasp the wire still hooked to the loop of internal spring (6), and draw the spring until it extends a foot or so out of the tube (3). Apply a little grease to the spring, then ease the wire gradually until the spring loop is in line with the screw hole. Insert screw (1) through tube flange (4), outer tube (3), and spring (6) and tighten screw.

(3) Attach flange plate (6, fig. 4-19) with two screws (7). Then place telescoping tube assembly over bellows, and screw on tube guide (2) with screws (12), and flange (5) to flange plate (6) with screws (8).

(4) Line up roller carriers (3) with connector plate (10), and install screw (9) and nut (11) to support bellows.



1. Screw, rd hd, 10-32 x 1¼/4
2. Inner tube cap
3. Outer tube
4. Tube flange
5. Inner tube
6. Internal spring

Figure 4-20. Telescoping tubes, exploded view.

4-37. Bellows

a. Description. The bellows (7, fig. 4-18) is made of heavy rubberized duck material to form a single accordion bellows unit capable of expanding and contracting within the full range of reproduction ratios. Two clamp and screw assemblies (6), one on each side of the bellows end frame (5), attach the bellows to the camera back. On the opposite end the bellows is attached to the lensboard (1) by four screws equally spaced on the bellows end frame (2).

b. Removal.

(1) Operate lensboard to extend bellows (7). Then remove hex nuts (11, fig. 4-19) and screws (9), supporting bellows.

(2) Detach the bellows (7, fig. 4-18) from the camera back by loosening clamp and screw assembly (6) on each side of bellows end frame (5).

(3) Remove four screws (3, fig. 4-18), two on each side of the bellows end frame (2), to release bellows from the lensboard (1).

(4) Release the bellows strap (8) by removing 2 screws from the footman loop.

c. Cleaning, Inspection, and Repair. Clean the bellows with a damp cloth. If necessary, use a little soap, and follow with a damp cloth again. Be sure to clean the inner crevices. Clean the bellows end frames thoroughly, being certain to clean threaded holes. Inspect the bellows for cracks, tears, and holes. Examine for overall wearing of fabric. Repair small holes and cracks with patches of rubberized duck material and the appropriate rubber adhesive cement. Expand the bellows to its fullest extent and apply a light coat of neoprene compound to the fabric to prevent cracking and dry rot. Replace bellows if beyond repair.

d. Installation.

(1) Install the bellows (7, fig. 4-18) on the lensboard (1) with four screws (3).

(2) Connect the bellows to the camera back by connecting the clamp and screw (6) to the bellows end frame (5).

(3) Install the bellows strap (8) by connecting the footman loop with 2 screws (9) to the bellows end frame (2).

(4) Support bellows on roller carriers (3, fig. 4-19) by inserting screws (9) through carriers and connector plates (10), and then attach hex nuts (11).

Section XI. MAINTENANCE OF FLASH LAMP ASSEMBLY, SHUTTER ASSEMBLY AND LENS

4-38. Description

The flash lamp assembly, shutter assembly, and the lens listed in this section are parts of the lensboard assembly which can be removed and installed without affecting the calibration of the camera. The flash lamp is located on the lensboard side frame and is mechanically and manually operated from a pivoting position 900 to the lens. The shutter assembly and lens are mounted on opposite sides of the innerlensboard frame and are optically centered with the focusing glass and copyboard. The lens is a detachable part of the frame with its own mounting facilities. The shutter assembly is a fixed member attached to the frame by screws. The lens and shutter are simultaneously adjusted through the inner lensboard frame by the lens vertical and horizontal control knobs.

4-39. Shutter Assembly

a. Description. The shutter assembly (fig. 4-21) is an electrically controlled standard silent shutter operating under 95 to 125 DC volts. The shutter is equipped with a power rectifier unit for converting alternating current to direct current, and a solenoid for controlling the shutter.

b. Removal.

(1) Remove four screws (3, fig. 4-18) to detach the bellows (7) from the lensboard (1). Roll the bellows back to make the shutter accessible.

(2) Disconnect the jack plug (5, fig. 4-21) to release the shutter (9) from the power source.

(3) Remove four screws (7) and washers (8) to release the shutter from the two brackets (1).

c. Cleaning and Inspection. Clean the parts of the shutter with a clean cloth. Clean the solenoid with acetone and a separate clean cloth. Dry all parts thoroughly with tissue. Inspect the shutter for bends and tears. Check operation of the shutter blades by moving shutter arm. See that blades are aligned properly. Examine the solenoid for broken insulation and loose wire leads. Replace defective parts if necessary.

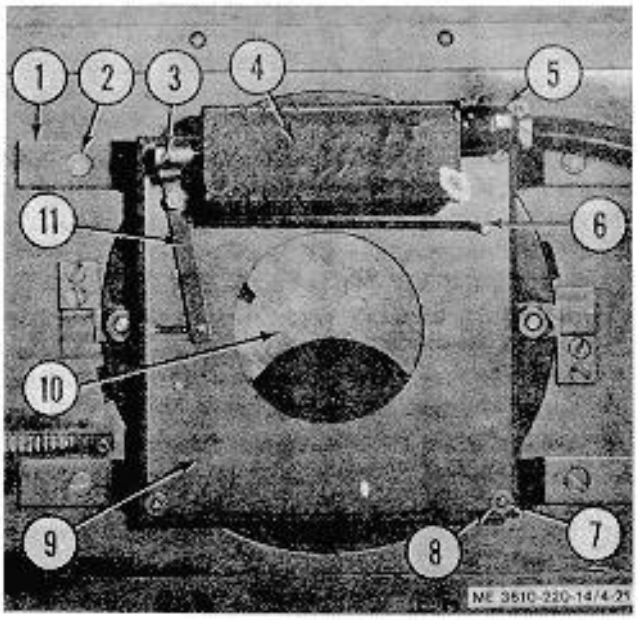
d. Installation.

(1) Position the shutter (9) on the brackets and retain with four screws and washers (7 and 8).

(2) Retain the solenoid cable to the shutter.

(3 Attach sections of jack plug (5) to connect power source.

(4) Install the bellows (7, fig. 4-18) to the lensboard (l) with four screws (3).



1. Z-bracket
2. Screw, ft hd 10-32 x ¼
3. Screw, rd hd 6-32 x ½
4. Shutter solenoid
5. Jack plug
6. Shutter return spring
7. Screw, rd hd 10-32 x ¼
8. Washer
9. Shutter
10. Shutter blades
11. Shutter arm

Figure 4-21. Shutter assembly.

4-40. Lens 19 Inch

a. Description. The 19 inch lens (1, fig. 2-10) is a Goerz apochromat Artar lens equipped with an attached mounting plate (4) and a lens cap (3). The diaphragm opening control (5), with the lens, is mounted on the lens barrel. A special lens box (2) is provided to store the lens when it is not installed on the camera.

b. Removal.

(1) Grasp the knobs (3, fig. 2-11) on the lens mounting plate (2), and rotate 15° in a counterclockwise direction to unlock the lens (5) from the inner lensboard frame (4).

(2) Release the lens mounting plate and the lens from the slots of the inner lensboard frame.

c. Cleaning and Inspection. Always keep lens covered when not in use. Avoid touching lens surfaces. Clean only if accumulated dust or accidental fingerprints necessitate it. To clean, first dust with a clean camel's hair brush. If markings persist, breathe lightly on the lens and wipe lightly with a clean lens tissue. Discard tissue after each use. Inspect the lens thoroughly for scratches, broken or bent diaphragm opening control, and damaged barrel. If lens is defective, regardless of how slight the damage, report the condition to the proper authority. If internal lens surfaces are stained or dirty, or inner elements are loose, also report condition to the proper authority to obtain qualified servicing. Do not attempt to disassemble lens, as the components are critically spaced and aligned, and the lens elements may distort under excessive pressure.

CAUTION

Never use any solution on the lens and never oil the diaphragm or other lens mechanism.

d. Installation. Install the lens as detailed in paragraph 2-35. c. (1).

4-41. Lens, 24 Inch

a. Description. The 24 inch Goerz apochromat Artar process lens is equipped with a lens cap (2, fig. 2-12), a detachable lens mounting plate (6), and a lens box (1). A holding ring (5) with the lens mounting plate is used to lock the lens firmly in operating position. The diaphragm opening control (4) is a ring attached on the barrel of the lens.

b. Removal. With knobs (3, fig. 2-13), turn the lens mounting plate 15° in a counterclockwise direction to release it from the inner lensboard frame (4).

c. Cleaning and Inspection. Refer to paragraph 4-40. c.

d. Installation. Install the lens as detailed in paragraph 2-35. c. (2).

4-42. Flash Lamp Assembly

a. Description. The flash lamp assembly (fig. 44) consists of a flash lamp fixture mounted on a spring-loaded pivot shaft (9) which operates from and is supported by the lensboard side frame. The lamp reflector (1) houses a standard medium screw base bulb which is protected by an opal-colored face glass contained in the retainer (16) of the reflector. The pivot shaft controls the motion of the flash lamp through a spring (11), pivoting collar (14), and adjustment screw (10). The pivot shaftand cross shaft (6) are jointed by a block (8) and two adjustment screws (7) serving as locks.

b. Removal

(1) Remove the flash lamp switch (para. 4-22. a.).

(2) Loosen screw (15, fig. 4-4), remove glass retainer and face glass from the lamp reflector (1). Unscrew the lamp bulb.

(3) Loosen adjustment screw (7), holding cross shaft (6) to joint block (8), and remove shaft.

(4) Unscrew cross shaft from lamp bracket (5).

(5) Remove drive pin (12) to release tension on spring (11). Remove drive pin (12) in collar (13) and remove collar, pivot collar (14), and spring (11) from pivot shaft (9).

(6) Remove pivot shaft from lensboard side frame.

c. Cleaning and Inspection. Clean parts with a cleaning solvent, using a soft, clean cloth, and dry parts thoroughly with a soft, dry cloth. Dry spring and inner surfaces of the collars and joint block. Inspect parts for bends, cracks, and corroded surfaces. Examine the flash lamp socket for broken contacts and wiring. Check reflector, face glass, and retainer for damages. Replace all defective parts.

d. Installation.

(1) Insert the pivot shaft (9, fig. 4-4) into the lensboard side frame. Install the spring (11), pivoting collar (14), and collar (13).

(2) Replace drive pin (12) in collar (13) to lock position of pivot shaft.

(3) Insert end of spring (11) in pivoting collar (12), and move collar to center of shaft. Hold pressure of spring, align holes and replace drive screw (12).

(4) Install the lamp bulb in reflector (1). Seat the face glass in retainer (16), and position glass and retainer on rim of reflector. Screw on reflector to lock face glass in place.

(5) Thread the cross shaft (6) into the detached lamp bracket (5). Insert cross shaft into the joint block (8) and lock with adjustment screw (7).

(6) Assemble and install the flash lamp switch as detailed in paragraph 4-22. b.

Section XII. MAINTENANCE OF CAMERA DRIVE SYSTEM

4-43. Description

The camera drive system consists of the lensboard drove motor (6, fig. 1-4) and the copyboard drive motor (8), both identical in physical appearance and electrical rating. The motors are reversible and can move the lensboard or copyboard forward and backward on the camera rail. The units are vertically mounted on separate motor support bracket (17, fig. 4-2) bolted to the back support plate 18) of the camera back.

4-44. Drive Motors

a. Description. The lensboard drive motor (14, fig. 4-2) and copyboard drive motor (20) have an electrical rating of 208 volt, 3 phase, 60 cycle frequency. The motors contain permanently sealed bearings requiring no lubrication.

b. Removal.

(1) Disconnect wire cable from terminal outlet box.

(2) Remove four nuts (19) to release drive motor (14 and 20).

(3) Lift the motor from the motor support bracket (17) being careful not to damage motor gear.

c. Cleaning and Inspection. Clean the outside casing of the drive motor with a cloth dampened with cleaning solvent. Inspect the motor for damaged casing and bent shaft. Apply a 208 volt external source to motor wires and check operation. Replace defective drive motor if necessary.

d. Installation.

(1) Position drive motor (14 or 20) on motor support bracket (17), aligning motor gear with driven gear on drivescrew.

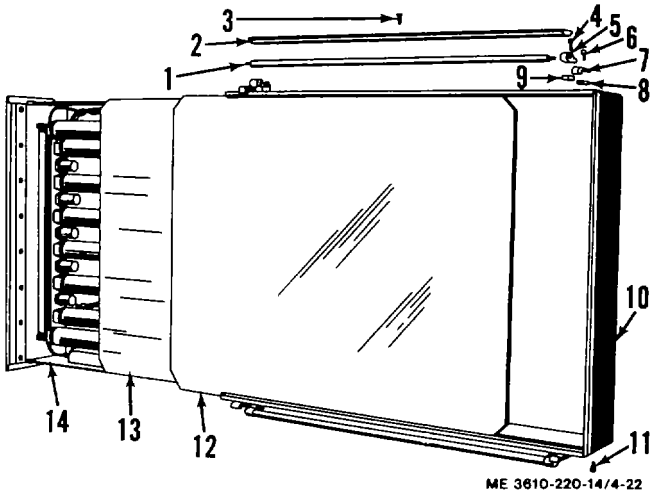
(2) Retain drive motor on motor support bracket with four nuts (19).

(3) Attach wires to terminal outlet box.

Section XIII. MAINTENANCE OF TRANSPARENCY HOLDER ASSEMBLY AND DIVERTER VALVE PLATE ASSEMBLY

4-45. Description

The transparency holder assembly consists of a housing light box assembly (14, fig. 4-22), opal glass diffuser (13), and a polished plate glass diffuser (12). The transparency holder housing, the main structure of the assembly, is rigidly bolted to the axle and tube assembly (3, fig. 1-6) to assure that its front surface is of equal distance from the axis of rotation and parallel to that of the copyboard. A diverter valve plate assembly, secured to the transparency holder housing, controls the suction flow through the assembly. The light box assembly, mounted in the housing, contains fluorescent tubes to supply the necessary illumination for copying transparencies. Mounted on slide bars (14, fig. 1-6) on the top and bottom of the housing are aerial film brackets (1) used to roll aerial film over the diffuser.



1 Roller
2 Slide bar
3 Screw, fl hd 10-24 x 5/8
4 Screw, hex soc hd 10-24 x 7/8
5 Bearing
6 Screw, hex soc hd 8-32 x 5/8
7 Cover frame clip
8 Clip spacer
9 Roller spacer
10. Transparency holder housing
11 Screw, hex soc hd 1/4-20 x 3/4
12. Diffuser, polished plate glass
13 Diffuser, opal glass
14 Light box assembly

Figure 4-22. Transparency holder assembly, exploded view.

4-46. Aerial Film Brackets

a. Description. Two sets of aerial film brackets (1, fig. 1-6) are installed on the transparency holder for aerial film copying. One of the brackets in each set contains a crank to roll film on the aerial film spool.

b. Removal. Loosen bracket lockscrew (3, fig. 2-16), and move aerial film bracket (6) to slot (5) of slide bar (2) and remove.

c. Cleaning and Inspection. Clean the aerial film bracket with a cleaning solvent and clean cloth. Dry bracket thoroughly with a clean cloth. Inspect the bracket for breaks in casting, crank for freedom of movement, and lockscrews. Replace aerial film bracket if defective.

d. Installation. Place the aerial film bracket (6, fig. 2-16) in slot (5) of slide bar (2), and move the bracket to accommodate the film spool. Tighten the bracket lockscrew (3).

4-47. Diffusers

a. Description. The transparency holder assembly contains two glass diffusers to provide a distribution of light for copying transparencies. The inner diffuser (13, fig. 4-22), a 5/16 inch plate opal glass adjacent to the light box assembly (14), diffuses the light to eliminate hot spots. The 5/16 inch polished plate diffuser (12), forming the face of the transparency holder, also diffuses the light, providing an even distribution of light over the entire area.

b. Removal.

(1) Remove two screws (11, fig. 4-22) and slide the light box assembly from the transparency holder housing (10), as shown in figure 4-23.

(2) Slide the polished plate glass (12, fig. 422) and opal glass diffuser (13) from the transparency holder housing (10).

c. Cleaning and Inspection. Clean the diffuser glass with a cloth saturated in acetone. Wipe dry with a clean, soft cloth. Inspect the glass for cracks and chipping on edges. Replace gasket if cracked or chipped.

d. Installation.

(1) Slide the opal glass diffuser (13, fig. 4-22) in the groove on the transparency holder housing (10). Similarly position the polished plate glass (12) in the housing.

(2) Slide the light box assembly (14) in the housing and retain with two screws (11).

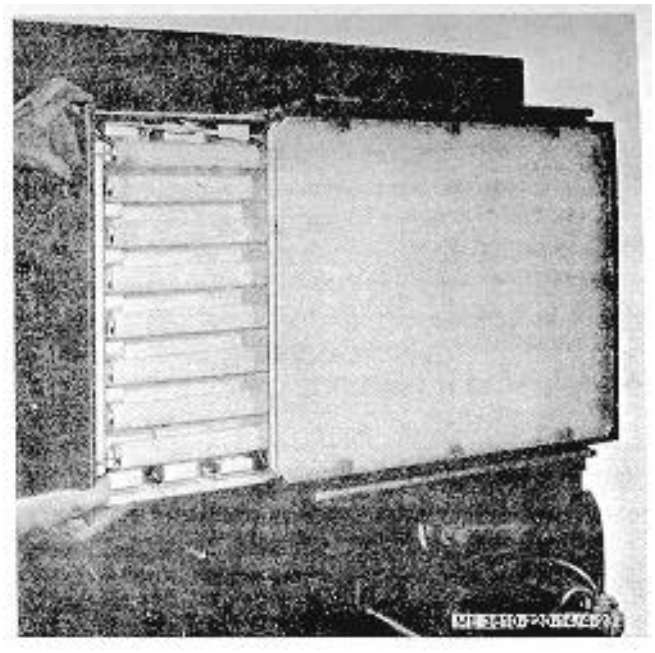


Figure 4-23. Removing light box assembly from transparency holder.

4-48. Light Box Assembly

a. Description. The light box assembly (fig. 424) is the light source for positive transparency and aerial film reproduction. Ten fluorescent tubes in the light box are wired in a parallel circuit. Ten ballasts, internally mounted, stabilize the flow of electricity to the fluorescent tubes. The starter for each tube is adjacent to the tube it controls. A terminal block is provided to facilitate wiring and connections.

b. Removal. Remove the light box assembly (14, fig. 4-22). Refer to paragraph 4-47. b. (1).

c. Disassembly.

(1) Remove the fluorescent tube (1, fig. 4-24) from light box by rotating it in its sockets (9).

(2) Remove the starter by depressing, turning counterclockwise, and then pulling out. Trace wires of starter socket (11}) to the terminal block (6) and detach wires. Release two screws (10) and nuts to remove starter socket.

(3) Trace wires of fluorescent tube socket (9) to the terminal block and detach them. Remove tube socket by releasing two screws (10).

(4) Disconnect wires of ballast (2) from terminal block and remove ballast by releasing two lockwashers (4), and screws (3).

(5) Remove the terminal block (6) by releasing two screws (5).

d. Reassembly.

(1) Install the terminal block (6) with two screws (5).

(2) Install the fluorescent tube socket (9) with two screws (10). Dress wires to terminal block and attach to terminals.

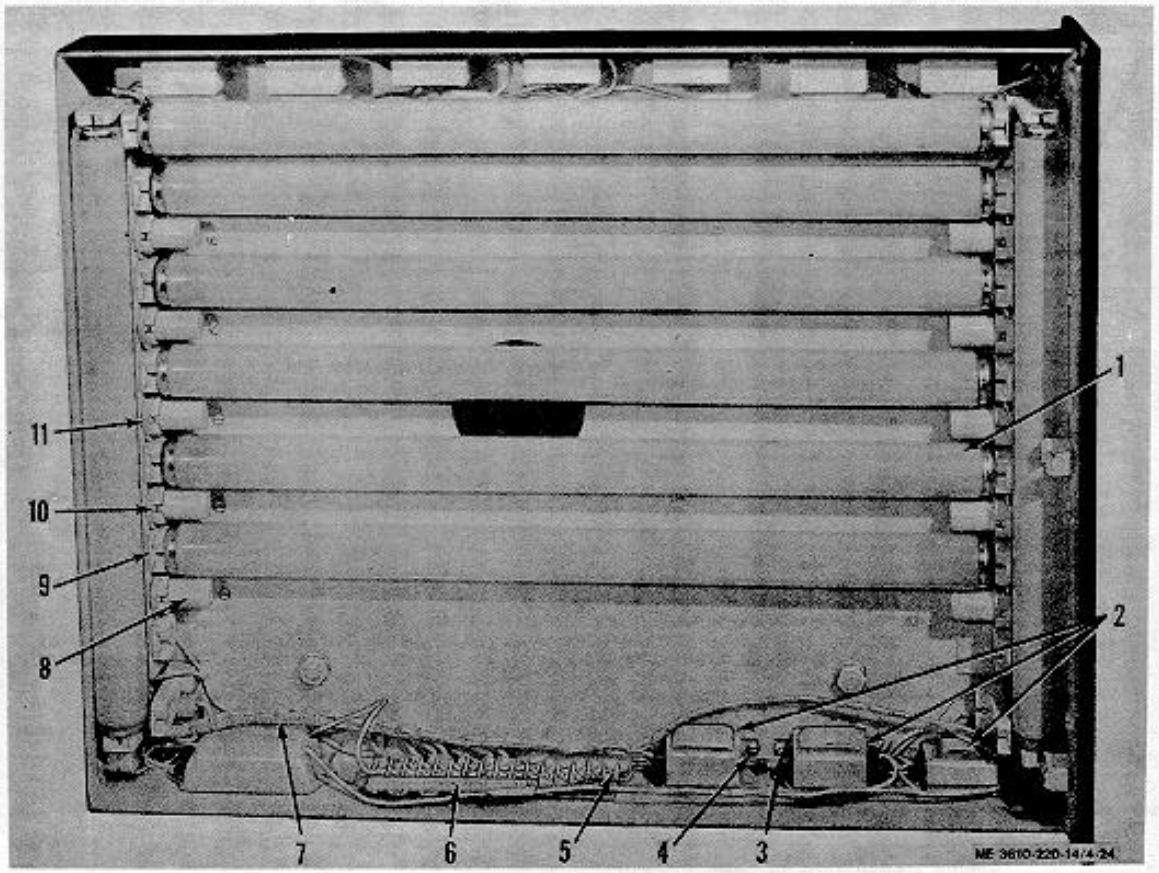
(3) Position starter socket (11) on light box and retain with two screws (10) and nuts. Dress wires to terminal block and attach to terminals.

(4) Install the ballast (2) and retain with two screws (3) and lockwashers (4). Connect wires of ballast to terminal block.

(5) Dress and group wires and tape them into a harness.

(6) Insert starter (8) in socket (11). Insert fluorescent tube (1) in socket (9) and rotate to lock.

e. Installation. Install the light box assembly. Refer to paragraph 4-47. d. (2).



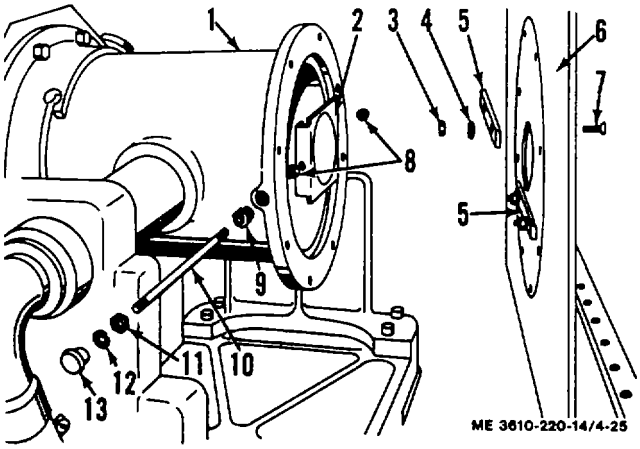
1. Fluorescent tube
2. Ballast
3. Screw, fil hd 10-32 x ½
4. Washer
5. Screw, rd hd 10-32 x ¾
6. Terminal block
7. Wiring harness
8. Starter
9. Fluorescent tube socket
10. Screw, rd hd 6-32 x ½
11. Starter socket

Figure 4-24. Light box assembly.

4-49. Transparency Holder Housing and Diverter Valve Plate Assembly

a. Description. The transparency holder housing (2, fig. 1-6) is supported by the axle and tube assembly (3) and is interconnected to the diverter valve plate assembly through two valve guides (5, fig. 4-25) secured to the back of the housing. The diverter valve plate (2) riding on the valve guides,

controls the flow of suction to the transparency holder housing by opening and closing the housing port by a manually operated diverter knob (13).



1. Axle and tube assembly
2. Diverter valve plate
3. Hex nut
4. Lockwasher
5. Valve guide
6. Transparency holder housing
7. Screw, fl hd, ¼-20 x ¾
8. Stop nut
9. Bushing ¼ ID
10. Stud
11. Hex nut
12. Lockwasher
13. Diverter knob

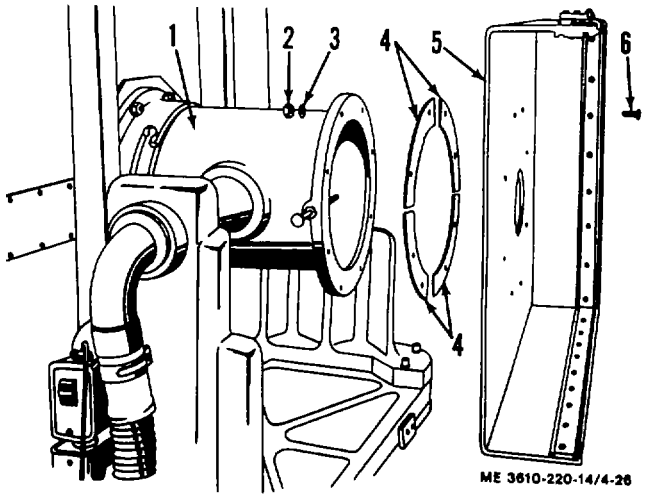
Figure 4-25. Diverter valve plate assembly, exploded view.

b. Removal and Disassembly.

(1) Remove the light box assembly and diffusers from the transparency holder housing (para. 4-47. b.).

(2) Pull diverter knob (13, fig. 4-25) as far out as it will come. Working through port of transparency holder housing (6), reach behind diverter valve plate (2) and unscrew stop nut (8) which secures diverter valve plate to stud (10).

(3) Remove eight nuts (2, fig. 4-26) and lockwashers (3) securing transparency holder housing (5, fig. 4-26) to axle and tube assembly (1). Remove housing and lift off four shims (4). Remove eight screws (6). Mark shim position to facilitate assembly.



1. Axle and tube assembly
2. Hex nut
3. Lockwasher
4. Shims
5. Transparency holder housing
6. Screw, fl hd, ⅜-16 x 2

Figure 4-26. Transparency holder housing, exploded view.

(4) Slide diverter valve plate (2, fig. 4-25) out of valve guides (5). Remove four nuts (3), lockwashers (4), and screws (7), securing two valve guides to transparency holder housing (6). Lift off valve guides.

(5) Remove stop nut (8, fig. 4-25) from stud (10) and slide out stud. Loosen nut (11) and unscrew knob (13), lock washer (12), and nut (11) from stud. Unscrew bushing (9) from flange of axle and tube assembly (1).

c. Cleaning and Inspection. Clean the transparency holder housing and diverter valve parts with a cleaning solvent, being certain to reach threaded areas. Dry parts thoroughly with a clean cloth. Inspect threaded parts for stripped or damaged condition. Inspect valve plate for cracks and distortion. Examine valve guides for worn and corroded surfaces. Replace all defective parts.

d. Reassembly and Installation.

(1) Screw nut (11, fig. 4-25) on stud (10) and slide on lockwasher (12). Screw diverter knob (13) on same end of stud, and tighten nut and lockwasher against diverter knob. Screw bushing (9)

into flange of axle and tube assembly (1). Insert stud into bushing and screw stop nut (8) on stud.

(2) Position two valve guides (5, fig. 4-25) on transparency holder housing (6), and secure each valve guide with two screws (7), lockwashers (4), and nuts (3). Slide diverter valve plate (2) into tracks of valve guides.

(3) Position four shims (4, fig. 4-26) as marked during disassembly, and secure transparency holder housing (5) to axle and tube assembly (1) with eight screws (6), lockwashers (3), and nuts (2).

(4) Working through port of transparency holder housing, slide diverter valve plate (2, fig. 425) to +he left and secure diverter plate to stud (10) with stop nut (8).

(5) Install the diffusers and light box assembly (para 4-47. d.).

4-50. Aerial Film Mounting Attachments

a. Description. Two groups of aerial film mounting attachments are provided on the transparency holder housing, each group having identical parts. The attachments consist of the slide bar (2, fig. 4-22) roller (1) and bearings (5). The slide bars support the aerial film brackets; the rollers guide the film over the polished glass diffuser; the cover frame clips hold the cover frame secure to the housing.

b. Removal.

(1) Remove the aerial film brackets from the slide bar (para 4-46. b.).

(2) Remove four screws (4, fig. 4-22), securing two bearings (5) to transparency holder housing (10), one at each end of roller (1). Remove roller, bearings, and roller spacers (9).

(3) Remove two screws (6) from each of two cover frame clips (7). Remove clips and clip spacers (8).

(4) Remove 14 screws (3), securing slide bar (2) to transparency holder housing (10). Lift off bar.

Section XIV. MAINTENANCE OF COPYBOARD ASSEMBLY AND COPYBOARD LOCKING DEVICE

4-51. Description

The copyboard (5, fig. 1-6) is mounted on the axle and tube assembly (3) by two hand knobs (6) which are part of the copyboard locking devices. The locking devices fit into the slots of the copyboard flange (4, fig. 1-6), holding the copyboard secure. The flange is bolted to the copyboard, providing a rigid interconnection of the assemblies.

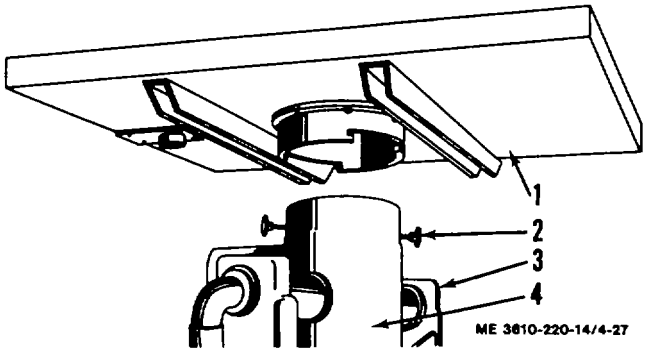
4-52. Copyboard Assembly

a. Description. The front surface of the copyboard assembly contains a series of inlet holes systematically arranged to hold copy of specified sizes. The operating knob (7) on the back of the copyboard controls the suction area of the assembly.

b. Removal.

(1) Loosen the two hand knobs (6, fig. 1-6) on the axle and tube assembly (3).

(2) Turn the copyboard (1, fig. 4-27) clockwise to free the locking devices (2) from the slots of the copyboard flange. Lift the copyboard from the axle and tube assembly (4), oscillating it slightly to assist its release. Be extremely careful not to damage copyboard.



1. Copyboard assembly
2. Copyboard locking device
3. Copyboard frame
4. Axle and tube assembly

Figure 4-27. Copyboard assembly, exploded view.

c. Cleaning and Inspection. Clean the surfaces of the copyboard with a clean cloth dampened with cleaning solvent. Clean clogged inlet holes on the front plate of the copyboard. Dry surfaces thoroughly with a clean cloth. Inspect the front plate for damaged surface, cracking, and corrosion.

Check the assembly for overall warping. Examine the operating knob for satisfactory operation. If any part of the copyboard assembly is defective, report the condition to the proper authority.

d. Installation.

(1) Install the copyboard (1, fig. 4-27) on the axle and tube assembly (4), being sure that it sits flush.

(2) Turn the copyboard counterclockwise so that the locking devices (2) are inserted in the slots of the copyboard flange. Tighten the hand knobs.

4-53. Copyboard locking Device

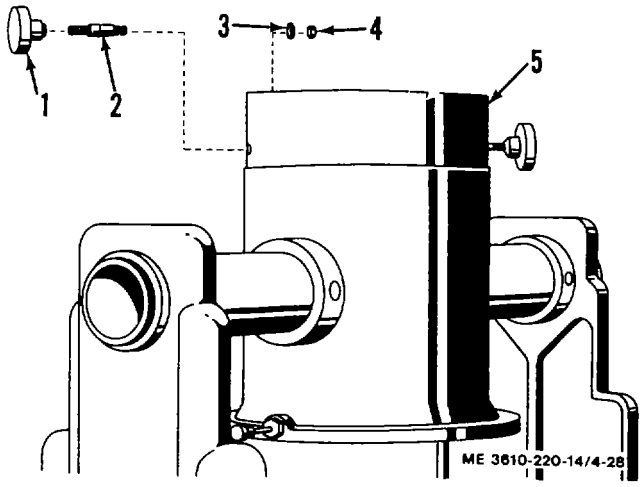
a. Description. The copyboard locking device (2, fig. 4-27) is mounted on the axle and tube assembly (4). It consists of a positioning stud with a hand knob threaded on the exterior end and a lockwasher and nut on the inner end holding it to the tube.

b. Removal.

(1) Remove the copyboard assembly (para 4-52. b.).

(2) Unscrew knob (1, fig.4-28) from positioning stud (2).

(3) From the inside of axle and tube assembly (5), remove nut (4) and lockwasher (3) from stud (2). Tap out the stud.



1 Hand knob
2 Positioning stud
3. Lockwasher
4. Hex nut
5. Axle and tube assembly

Figure 4-28. Copyboard locking device, exploded view.

c. Cleaning and Inspection. Clean the parts with cleaning solvent and dry with a clean, soft cloth. Inspect the hand knob and positioning stud for worn threads, bends, and breaks. Replace defective parts if necessary.

d. Installation.

(1) Place stud (2, fig. 4-28) in axle and tube assembly (5). From the inside of axle and tube assembly (5), install nut (4) and lockwasher (3) on stud (2).

(2) Screw knob (1) on stud (2).

(3) Install the copyboard assembly (para 4-52. d.).

CHAPTER 5
DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

5-1. General

Instructions in this section and in succeeding sections of this chapter are published for the use of maintenance personnel responsible for general support and higher levels of maintenance of the copying camera. They contain information on maintenance which is beyond the scope of the tools, equipment, or supplies normally available to using organizations.

5-2. Tools and Equipment

a. The operations detailed in this chapter may be performed with standard mechanic's hand tools.

b. Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering direct and general support maintenance in TM 5-3610-220-35P.

Section II. TROUBLESHOOTING

5-3. Use of This Section

This section provides information useful in the diagnosing and correction of unsatisfactory operation or failure of the copying camera or any of its components. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause.

Table 5-1. Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. Vacuum back fails to hold film properly	a. Improper selection of vacuum back valve ports.	a. Measure size of film and move valve handle to a position best suited to hold film on vacuum back.
	b. Opening in vacuum flexible hose.	b. Remove hose clamps at the vacuum back valve housing and suction pipe on camera skid, and remove flexible hose. If opening in hose is comparatively small, make a temporary repair with electrical tape.
	c. Vacuum turbo-compressor defective.	c. Replace defective parts of vacuum turbo-compressor assembly (para 6-2) or vacuum turbo-compressor motor (para 6-6). Replace entire unit if necessary.
2. Copyboard fails to hold copy properly	a. Copyboard suction not directed properly.	a. Measure size of copy and turn operating knob to the correct position.
	b. Operating gate out of line.	b. Align operating gate on operating shaft (para 6-16. a.).
	c. Diverter valve plate not in closed position.	c. Diverter valve plate is in open position, permitting suction to the transparency holder and thereby lessening the vacuum to the copyboard. Push the diverter knob completely in.
	d. Clogged suction holes in copyboard.	d. Foreign matter in holes of copyboard causes and unequal distribution of suction. Remove copyboard front plate and clean (para 6-14.b.)

Table 5-1. Troubleshooting-Continued

Malfunction	Probable Cause	Corrective Action
	e. Vacuum turbo-compressor defective.	e. Replace defective parts of vacuum turbo-compressor assembly para 6-2) or vacuum turbo-compressor motor (para 6-6). Replace entire unit if necessary.
3. Arc lamp flickers	a. Gap between carbons too great to provide consistent lighting.	a. Adjust carbons (para 4-27. d.).
	b. Drafty conditions around operating location.	b. Eliminate all drafts around working area of cameras.
	c. Carbons of different lengths in holders.	c. Substitute carbons of same length or replace with new carbons (para 4-27. a.).
	d. Contacts in magnetic contactor not making proper contact.	d. Smooth badly pitted or burned contacts with a fine file (para 6-36). Replace defective parts (para 6-36) if necessary.
	e. Defective sensing device.	e. If one lamp does not flicker, switch the cables from the operating lamp sensing device to suspected sensing device. If the lamp which did not flicker now does, replace the defective sensing device. (para 6-37)
4. Image distortion	a. Copyboard not aligned with focusing glass.	a. Trammel four corners of copyboard with focusing glass for correct alignment of components. Check that focusing glass frame is firmly contacting at magnetic latches on both sides of frame
	b. Lens not positioned correctly.	b. Check the lensboard counter readings. Determine if lens is screwed in the lens plate.
	c. Copy not placed on copyboard properly.	c. Remove copy and remount on copyboard, smoothing out wrinkles and folds.
	d. Lensboard or copyboard positioning counters not calibrated to lens.	d. Recalibrate camera to lens (para 5-5).
	e. Distance of lensboard not related to same reduction ratio.	e. Recheck the focusing Chart for correct lensboard and copyboard distance.
	f. Thick copy.	f. If copy has appreciable thickness, its thickness must be added to the copyboard counter readings in units of 1/100 inch.
5. Vibration or excessive noise during operation	a. Impeller plates in vacuum turbo compressor not positioned properly.	a. Remove the vacuum turbo-compressor assembly (para 6-2.a.), disassemble (para 6-2. a.), and reset the impeller plates.
	b. Dry oil felt wipers causing lensboard or copyboard to vibrate while under power.	b. Apply oil to wipers. Let the oil penetrate thoroughly before resuming operation.
	c. Compressor fan in turbo-compressor motor rubbing against rear end frame.	c. Align compressor fan on motor shaft (para 6-8. a.)
	d. Dry or burned-out bearings in turbo- compressor motors or drive motors.	d. Replace defective bearings with new ones (para 6-8. a. and 6-12. a.).
	e. Loose mounting hardware.	e. Locate loose hardware and tighten.
	f. Gear meshing.	f. Vibration or noise will result if drive gears are not fully meshed. If gears are dry, apply sufficient grease, or if foreign matter is impacted between the teeth, clean thoroughly, or if a tooth is damaged, dress off or replace gear (para 6-32. a.)

Section III. GENERAL MAINTENANCE

5-4. Painting

a. General. All painted surfaces must be repainted whenever the existing paint is crinkled, cracked, or otherwise worn to the extent that rust is evident. When the equipment has spots from which the protecting paint has disappeared, although the rest of the painted surface is in satisfactory condition, a touchup rather than a complete painting job will often suffice.

b. Cleaning. The metal surface to be painted must be free of rust, dirt, grease, kerosene, and alkali. Paints will not adhere properly to rusty, greasy, or damp surfaces. All surfaces must be dry. Remove rust and loose scaling, if any, by wire brush, steel wool, abrasive cloth, or other suitable means. Clean the surface with cleaning solvent and dry thoroughly.

c. Masking. Mask all identification and instruction plates, as well as all the machined surfaces of the structure frames. Be certain to mask the machined edge of the camera rail, the inner lensboard frame, and the shutter. Provide masking covers for all gears, drivescrews, and control shafts. Tape the counter drive chains and counterbalance chains. Cover openings of the drive motors and vacuum turbo-compressors to insure that no paint is applied to these surfaces. Mask the electrical wiring throughout the equipment. For additional information on paint, refer to TM 9-213 and TB 740-97-2.

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS AND AUXILIARIES

5-5. Calibration of Camera to Lens

a. The camera has been previously calibrated to the 19 inch and 24 inch lenses and is provided with a set of focusing charts for each lens, giving the distances of the lensboard and copyboard for each reduction rate desired within the range of the camera. The removal and disassembly of components affecting the counter reading of the lensboard and copyboard necessitates recalibrating the camera to the lens.

b. The equivalent focal length, back focal length, and the centering point separation are commonly known as the lens characteristics which are required to calibrate the camera to the lens. No two lenses have the same characteristics. The lens constant pertains to the optical center of the lens which consists of two centering points, one a center for entering rays and the other for the same exiting rays. The distance between the two nodes is called the nodal separation or the internodal distance of the lens. The equivalent focal length is defined as the distance from the back node to the principal focus. The back focal length is known as the distance from the principal focus to the vertex of the back surface of the lens.

5-6. Calibrating Procedures

Before beginning calibration of the camera to a new or reconditioned lens, check the copyboard and lensboard carriage to ascertain that they move snugly along the rail without rock or play. Then trammel through from focusing glass to lensboard back face, and from lensboard front face to copyboard face to make certain that all three planes are parallel to within 0.005 inch. When camera is square, proceed with camera calibrations. (Refer to squaring procedure before beginning calibration.)

a. Squaring Camera.

(1) Squaring the camera consists of paralleling the copyboard, lensboard, and vacuum back in the horizontal and vertical planes. Squareness can be checked by using the master grid supplied with each camera. This grid is an exact replica of the ground focusing glass grid. To check squareness, mount the grid on the vacuum back, set the lensboard at 1 to 1, and observe the image on the ground glass. If the surfaces are not square, the grid image will not be in focus across the entire focusing glass. When the camera is out-of-square, lack of focus is greatest at an edge or corner; some part of the image will be in focus to some point. This out-of-focus differs from when the camera is out of calibration; when the calibration is incorrect, the entire image will not be in focus; when the camera is not in square, at least one part of the image will be in focus.

(2) To determine which plane (the copyboard, lensboard, or vacuum back) is not parallel, trammel the lensboard, to copyboard distance at the four farthest corners of the lensboard. If all four readings are correct, the copyboard is parallel. If a discrepancy exists, the lensboard to copyboard distance must be measured. This is done to determine if the discrepancy is in the lensboard to vacuum back distance, or the lensboard to copyboard distance. Once it has been determined which plane is not parallel, minor adjustments can be made to the vertical and horizontal mounts while observing the ground glass image until it is focused

across the entire surface, or trammeling the surface until all four corner measurements are equal.

b. Lensboard Settings. To position the counter so that it will provide correct lensboard positions in following the readings on the focusing chart, it is only necessary to determine accurately the exact distance between the vertex of the back surface of the lens and the adjacent surface of the focusing glass. The counter reading will then be this distance plus the difference between the equivalent and the back focal lengths of the lens. To measure this distance accurately, use a trammel rod of known length (such as 48.000 in.) or one with a length which can be measured with a precision caliper or micrometer. Place a sheet of lens tissue over the back of the lens, attaching it to the lens plate with a tab of self-adhesive tape. Then detach the bellows (7, fig. 4-18) by loosening clamp and screw (6) on the camera back, and strap them to the lensboard (1) with strap (8) so as to provide access for the measurement. Move the lensboard away from the focusing glass to a distance of one-half of an inch or so greater than the trammel rod length. Then very gently place the trammel rod against the lens tissue and in contact with the vertex of the lens, holding the end of the rod lightly against the lens (fig. 5-1). With the other end of the trammel rod supported by the other hand, have an assistant turn the lensboard fine adjustment handwheel (7, fig. 1-4) slowly to bring the lens toward the focusing glass. As the trammel rod approaches the focusing glass, move its end in small circles until it lightly touches the glass, when the assistant immediately stops the drive. Measure the trammel rod length, and add to it the difference between the equivalent and back focal lengths of the lens. Then set the lens counter (3, fig. 1-4) to read this distance in one one hundredth of an inch. (see para 4-11).

Note

The lensboard counter is set to agree with the principal lens used (the Goerz 19 inch lens). The focusing chart prepared for the second lens is first computed and then has a lens constant added or subtracted from each lens reading. This constant is a measurement of the difference in location of the back nodal points between the principal and secondary lens. Accordingly, if the camera must be calibrated to the secondary lens, it will be necessary to add or subtract the lens constant (depending on whether it is plus or minus, that is, whether the rear nodal point is a greater or lesser distance from the mounting surface on the lensboard) as can be determined from the lens data appearing on the focusing charts. As the lens tissue normally used is approximately 0.001 inch thick, it is not necessary to allow for this in setting the counters.

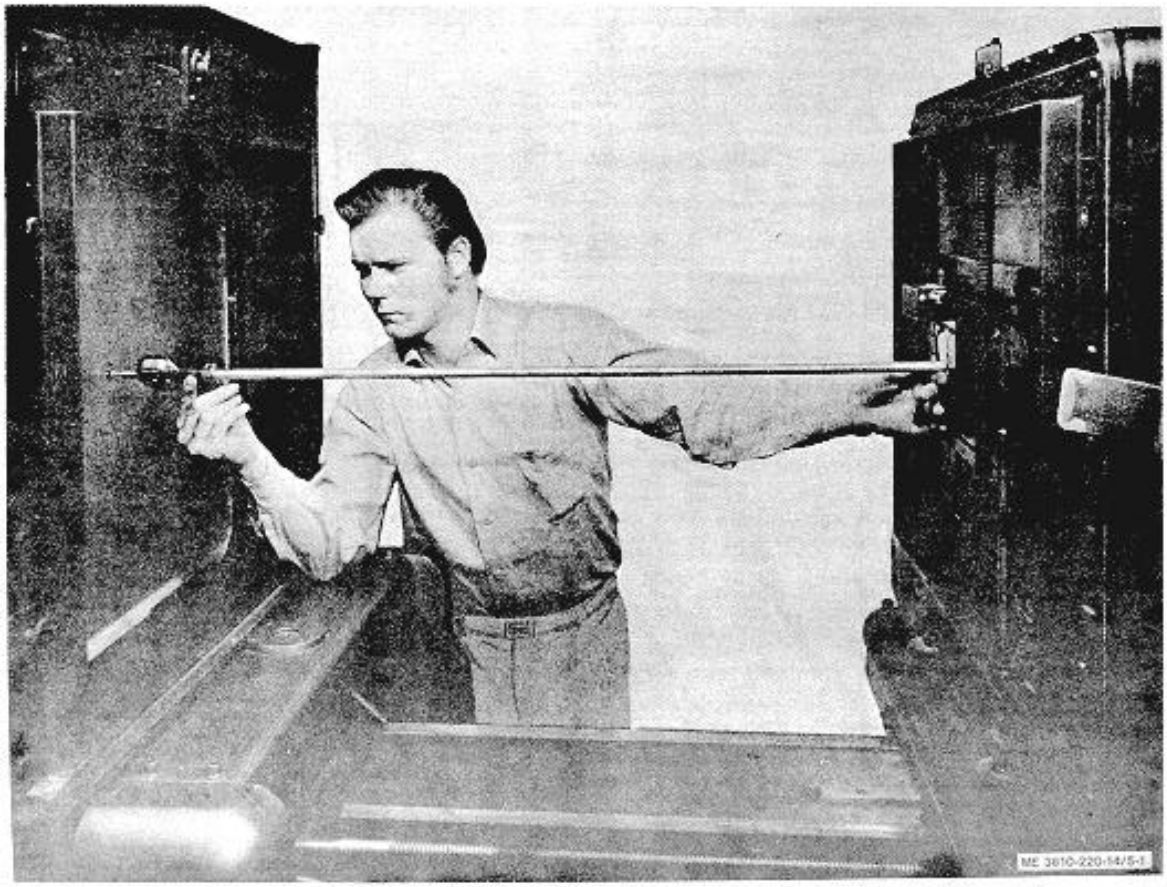


Figure 5-1. Tramelling focusing glass and lens.

c. Copyboard Setting. The copyboard, like the lensboard, is positioned to counter readings calculated to the principal lens, and requires a corrective constant for the secondary lens. This constant has been added or subtracted to all copyboard readings on the focusing chart of the secondary lens. The constant is a difference of the nodal separations between the two lenses and can be positive or negative depending on whether that of a secondary lens is a greater or lesser distance than that of the principal one. The copyboard readings for the principal lens on the focusing chart (to which the counters are to agree) represent the overall optical distance from the inside surface of the focusing glass to the surface of thecopyboard.

In setting the copyboard counters to the principal lens, it is only necessary to determine accurately the distance between the focusing glass. and the copyboard, as shown in figure 5-2, and then set the counters to agree with this distance plus the nodal correction for the lens. This nodal correction is approximately 3 / 2 the nodal separation, and can be used to add to the measured distance to set the counters. If a long trammel rod is not available, double trammeling with a shorter rod can be used to determine the overall distance, by adding the focusing glass-to-lens-board distance (plus the nodal correction) to obtain the copyboard counter readings for the principal lens.

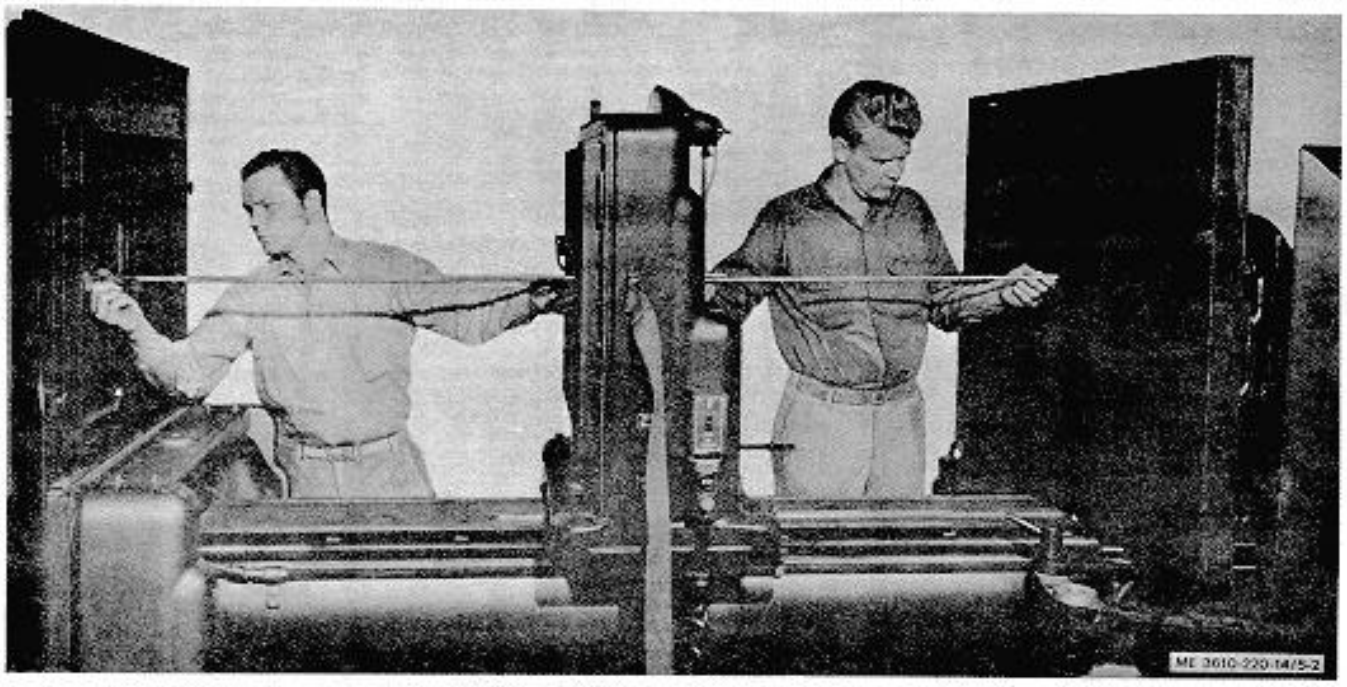


Figure 5-2. Trammeling focusing glass and copyboard.

d. Optical Check of Accuracy of Counter. After adjusting the counters to agree with lensboard and copyboard readings on the focusing chart (for the principal lens), the camera must be checked optically to ascertain that the use of the chart will provide exact reproduction size and focus. For this purpose a test chart is furnished with the camera, and consists of a grid of lines printed onto a white lacquered metal plate, this grid being identical to that on the focusing glass. By choosing appropriate rectangles on this grid, such as the 10,000 inch square and 20,000 inch square, and projecting their image on to the focusing glass, a means for accurately determining the correctness of ratio counter readings, as well as sharpness of focus and parallelism between the copyboard and focusing glass throughout its range of movement, is available. To perform the optical tests, put camera into operating condition, making electrical connections, trim carbons and position arc lamps, switch on copyboard turbo-compressor, and obtain the test chart, a drop cloth (to block out extraneous light if the camera is to be tested in the open instead of the darkroom), and a focusing magnifier provided with material and supplies accompanying the camera issue. The camera is checked as follows:

(1) Measure overall thickness of copy. Then mount copy on copyboard, centrally and square.

(2) Position copyboard to same-size counter reading on chart plus copy thickness in hundreds of an inch.

(3) Mount lens, open diaphragm up to f:16, and position lensboard to same-size (focusing chart) counter reading.

(4) Lower focusing glass in position, open shutter, and switch on arc lamps.

(5) Examine image of grid or square on focusing glass. It should be sharply defined when viewed without or with the focusing magnifier. (If not, see d. below.) Next square up and center the image on the grid of the focusing glass by use of oscillating knob (4, fig. 4-2) and lens control knobs (5 and 10, fig. 1-4). The image should exactly match the corresponding square on focusing glass within 0.005 inch tolerance (that is, the thickness of the grid lines) and the lines should overlap or touch. If not, see d. below.

(6) Repeat for several other ratios such as one half size (0.50), and twice size (2.00). If images are sharp and in size agreement with corresponding grid square, the camera is accurately focused to accord with the chart.

(7) Repeat checks with secondary lens to determine agreement with its focusing chart.

e. Out-of-Focus Conditions.

(1) If sharp focus is not obtained, note if image is slightly out-of-focus (can be seen but not distinctly) or completely out-of-focus (no resemblance of an image visible).

(2) If slightly out-of-focus, this may be due to the following (see also para 4-11, Note).

(a) Incorrect counter settings, or by not taking up play. Counters must always be set with decreasing readings down to number desired.

(b) Allowance not made for copy thickness. Copy thickness must be added to copyboard reading.

(c) Disturbance of optical planes. Check that copyboard rests solidly against its stops, that lens is screwed in firmly and seats on its ring in the lensboard, and that focusing glass rests solidly against the magnetic latches.

(d) If the above inspection does not reveal the cause of the out-of-focus condition, the trammeling measurements may have been in error, as any lens deviations would have been compensated for in the original calibration of the focusing chart. Sharpen up focus by moving the copyboard to or away from the lens and then check size (para 2-36.f.). When both exact size and focus are obtained visually, note the difference between the actual counter readings and those on the chart. Repeat this test for other ratios such as one-half size and twice size, and again compare readings. If all show approximately the same difference, the counters have not been set right, and should be reset by accurate measurement if possible, or by averaging the differences obtained and then changing the counter readings to bring them in agreement with image size and focus. (Differences should agree with each other within three or four hundredths of an inch. If more, it is likely that sharp focus and size are not being simultaneously obtained.)

Note

If counter readings are in close agreement at same size, and increase in variance for increasing ratios of enlargement or reduction, it is possible that the focal length of the lens differs from that given in the chart. This may be due to loosened lens elements (for which condition lens must be sent back to an optical technician for adjustment), or to a curvature of the main camera rail, that can be checked with a long precision straightedge or calibrated precision level. If rail is curved or otherwise distorted, it must be returned to true before accurate camera reproduction can be achieved. The camera specifications require that the camera copyboard maintain its alignment and parallelism throughout its movement to within 0.005 inch.

(3) If image is completely out-of-focus, this condition may be due to:

(a) Wrong counter readings.

(b) Wrong lens focusing chart. Check against lens number.

(c) Counters incorrectly set. Errors in trammeling distances, or adding distances, or allowances for nodal corrections, or for lens constant.

(d) Camera calibrated to secondary instead of principal lens.

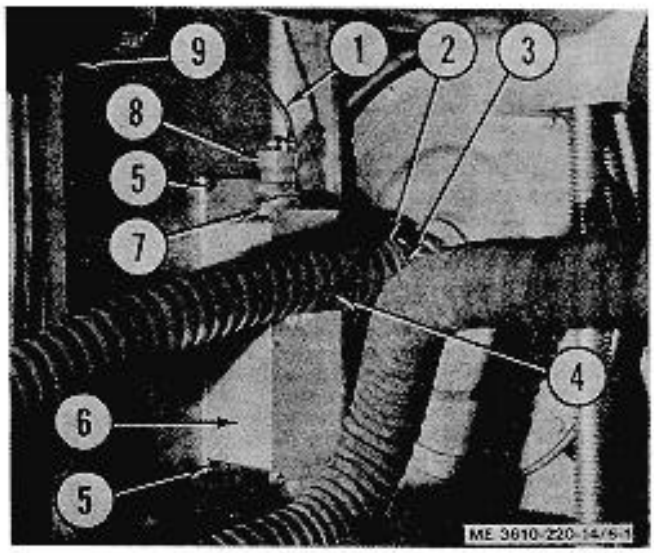
(e) Lens elements loose, or lens characteristics altered during lens repairs (to remove scratches or other defects) by manufacturer.

(4) Check all physical conditions listed above, other than internal lens inspection, to ascertain and correct existing cause. If this cannot be determined, focus camera visually (para 2-36.f.) and note differences of counter and chart readings for several ratios of reproduction (d. (2) (d) above) to determine if counter readings are displaced. If sharp focus cannot be obtained at all, or if some obvious lens defect is evident such as loose elements on shaking lens, or injuries that mar lens surface (chips, etching due to chemicals or fungus, or frosting due to improper cleaning of the lens), the lens must be sent to an optical technician for inspection and subsequent correction or replacement.

Section I. VACUUM TURBO-COMPRESSOR ASSEMBLIES

6-1. Description

Two identical vacuum turbo-compressor assemblies are mounted side by side at the copyboard end of the camera. One vacuum turbo-compressor assembly (11, fig. 4-13) provides suction at the copyboard and the other vacuum turbo-compressor assembly (6) provides suction at the vacuum back. The inlet of the turbo-compressor (11) is connected to the copyboard by a flexible hose (4, fig. 6-1) thus forcing all the intaken air to be drawn through the copyboard. A muffler (12, fig. 4-13) is mounted to the outlet to suppress the discharge of air. The other assembly is similarly connected to the vacuum back of the camera. Each vacuum turbo-compressor is capable of drawing 75 C.F.M. of air at 16 oz P.S.I., and is driven by a 1 hp, 25 to 60 cycle AC / DC motor. Two impeller plates (20 and 22, fig. 6-2) are bolted to the motor shaft and are separated by a stationary disk (7). The impeller plates are spaced at least one-eighth of an inch from the stationary disk; for this reason there are no wearing parts, except for the motor parts. The compressor body is sealed by a heavy cover plate (4, fig. 6-2) and cover plate ring (3), limiting the entry of air to the inlet connection.



1. Wiring cable
2. Hose clamp
3. Screw, rd hd, ⅜-16
4. Vacuum flexible hose
5. Screw, rd, 10-32 x ¼
6. Electronic sensing device
7. Connector nut
8. Cable connector socket
9. Rear truss support

Figure 6-1. Electronic sensing device, installed.

6-2. Vacuum Turbo-Compressor Disassembly

a. Removal.

(1) Remove four nuts (8, fig. 4-13) securing the vacuum turbo-compressor assembly to the vibration mount (7) and camera skid.

(2) Disconnect wire cable from the motor outlet box at main junction box.

(3) At the rear of the assembly, loosen screw (3, fig. 6-1) to release clamp (2). Work off the flexible hose (4).

(4) Lift off the vacuum turbo-compressor assembly.

b. Disassembly.

(1) Unscrew compressor extension (1, fig. 62) and remove four screws (24) securing cover plate flange (2) to cover plate (4). Remove cover plate flange.

(2) Remove 16 nuts (16) and bolts (23), securing cover plate (4) to turbo-compressor housing (15). Lift off cover plate and discard gasket (5). Separate cover plate ring (3) and cover plate.

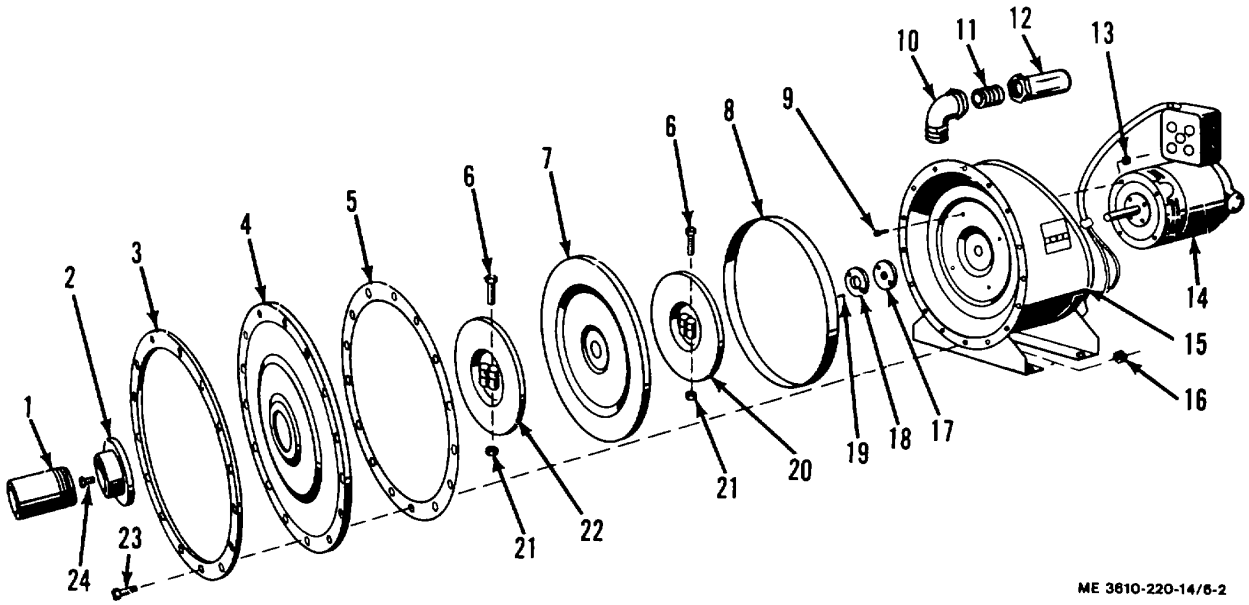
(3) Remove two screws (6) and nuts (21), clamping outer impeller plate (22) to motor shaft. Slide off outer impeller plate.

(4) Remove disk ring (8, fig. 6-2) and stationary disk (7). Remove two screws (6) and nuts (21) clamping inner impeller plate (20) to motor shaft. Slide off inner impeller plate.

(5) Remove four screws (9) and nuts (13), securing turbo-compressor motor (14) to turbocompressor housing (15). Slide out motor.

(6) Remove two screws (19), securing filler plate (18) to turbo-compressor housing (15). Lift off filler plate and gasket (17).

(7) Unscrew muffler (12) from nipple (11), nipple from elbow (10) and elbow from housing (15)



1 Compressor extension
2 Cover plate flange
3 Cover plate ring
4. Cover plate
5. Cover plate gasket
6 Screw, hex hd, ⅜-16 x 1½
7 Stationary disk
8. Disk ring
9 Screw, rd hd, ¼-20 x ¾
10. Elbow
11 Nipple
12 Muffler
13. Hex nut
14. Turbo-compressor motor
15. Turbo-compressor housing
16 Hex nut
17 Filler plate gasket
18 Filler plate
19. Screw, fl hd, 10-32 x ½
20 Inner impeller plate
21 Hex nut
22 Outer impeller plate
23 Bolt, hex hd, ⅜-16 x 1¼
24 Screw, rd hd, 10-32 x ¼

Figure 6-2. Vacuum turbo-compressor assembly, exploded view.

6-3. Vacuum Turbo-Compressor Cleaning and Inspection

Wash the parts of the turbo-compressor with a cleaning solvent and a clean cloth, being certain to reach threaded areas. Dry parts thoroughly with a clean cloth. Inspect the impeller plates, disks, and rings for bends and distortion. Check the housing for dents and holes. Examine the muffler for clogged filter suppression. Replace all defective parts.

6-4. Vacuum Turbo-Compressor Reassembly

a. Reassembly.

(1) Screw elbow (10, fig. 6-2) and nipple (11) into outlet of turbo-compressor housing (15) and install muffler (12).

(2) Position filler plate gasket (17) and secure filler plate (18) to turbo-compressor housing (15) with two screws (19).

(3) Position turbo-compressor motor (14) on turbo-compressor housing (15) and secure with four screws (9) and nuts (13).

(4) Slide inner impeller plate (20) on protruding motor shaft and space it 0.127 plus or minus 0.002 inch from the filler plate (18) on the turbo-compressor housing. Clamp impeller plate to shaft with two screws (6) and nuts (21).

(5) Insert stationary disk (7, fig. 6-2) and disk ring (8) into position in turbo-compressor housing (15). Slide outer impeller plate (22) on turbo-compressor motor shaft, spacing it 0.127 plus or minus 0.002 inch from the stationary disk (7). Clamp impeller plate to shaft with two screws (6) and nuts (21).

(6) Start motor with external power source and check impeller plate settings. Plates must rotate freely with no binding or rubbing. Adjust impeller plate to eliminate rubbing or binding.

(7) Position new cover plate gasket (5, fig. 62) on turbo-compressor housing (15), and secure cover plate (4) and cover plate ring (3) to housing with 16 bolts (23) and nuts (16).

(8) Secure cover plate flange (2) to cover plate

(4) with four screws (241. Screw compressor extension (1) into cover plate flange.

b. Installation.

(1) Position the vacuum turbo-compressor assembly on the vibration mounts (7, fig. 4-13), and secure with four nuts (8).

(2) Connect flexible hose (4, fig. 6-11 to rear of the turbo-compressor assembly with clamp (2), screw (3).

(3) Connect wire cable from the motor outlet box to the main junction box.

Section II. VACUUM TURBO COMPRESSOR MOTORS

6-5. Description

The driving motors (5 and 9 , fig. 1-7) for the copyboard turbo-compressor and the lensboard turbo-compressor are identical, each being a universal a-c-d-c type which operates on 115 volt, 25 to 60 cycle current frequency, drawing 10 amperes at a speed of 6,500 rpm. The motors are cooled by an internal fan arrangement. An internally connected capacitor provides filtering for radio interference elimination. The field rings and poles are intergral with the field frame assembly, being sealed and aligned to the frame.

6-6. Vacuum Turbo-Compressor Motor Disassembly

a. Removal. Refer to paragraph 6-2.

b. Dumbly.

(1) Remove four screws (9, fig. 4-13), securing cover (10) to the outlet box. Remove cover and remove leads to motor. Remove two screws, securing box to motor and lift off box.

(2) Remove two screws (21, fig. 6-3), securing brush cover plate (22) to front end frame (10). Slide out brush (23) and brush holder (24). ID similar manner, remove brush on opposite side of front end frame.

(3) Remove two screws (13), securing wire cover plate (12) to front end frame (10). Lift off wire cover plate.

(4) Remove end nut (17) and gasket (16). Remove four screws (1), securing end plate (15) to front end frame (10). Lift off front end plate.

(5) Remove bearing lock-crew (18, fig. 6-3), lockwasher (19),and bearing washer (201, securing front bearing (25) to shaft of armature (8). Remove front bearing by hand.

(6) Remove four screws (1), securing end plate (2) to rear end frame (5). Remove end plate, gasket (3), and locking ring (4).

(7) Remove four bolts (14) and lockwashers (11). Lift off front end frame (10) and rear end frame (5). Remove condenser (capacitor) (26) from front end frame.

(8) Remove armature (8) with rear bearing (6) and fan (7) attached. Place assembly in an arbor press and, with the bearing blocked up, press bearing off shaft. In similar manner, press off fan.

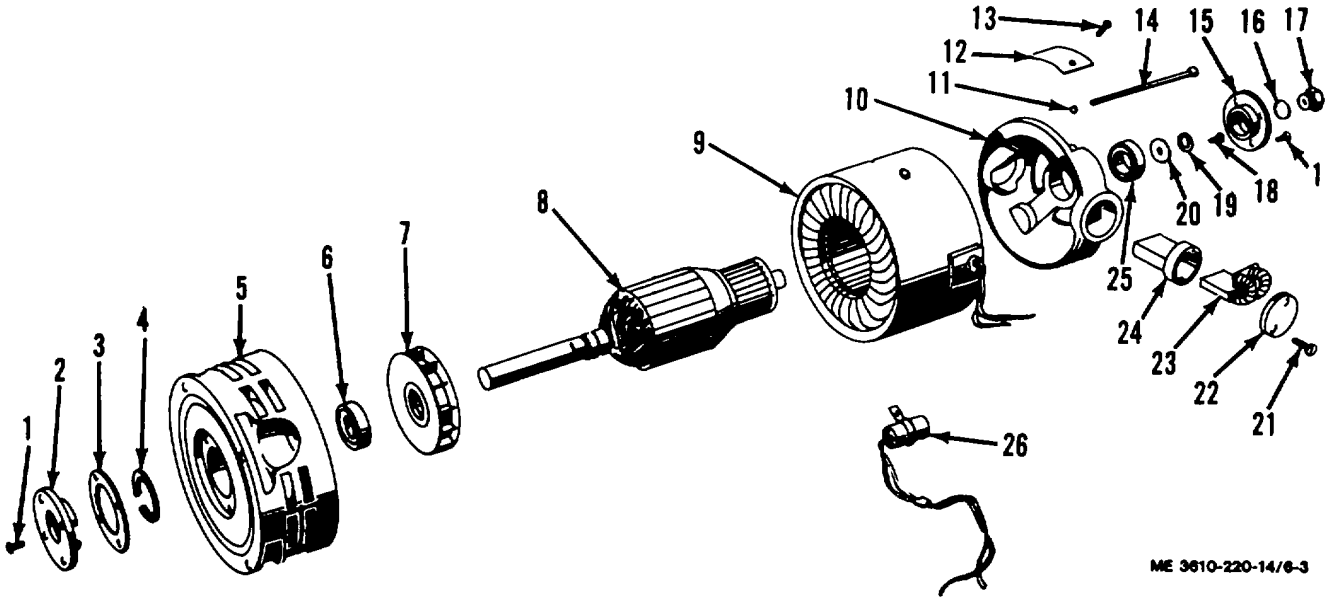


Figure 6-3. Vacuum turbo-compressor motor, exploded view.

KEY to fig. 6-3:

1. Screw, fl kid, 10-32 x ¾
2. End plate, rear end frame
3. End plate gasket
4. Locking ring
5. Rear end frame
6. Rear bearing
7. Fan
8. Armature
9. Field frame housing
10. Front end frame
11. Lockwasher
12. Wire cover plate
13. Screw, rd kid, 10-32 x ½
14. Motor assembly bolt
15. End plate, front end frame
16. End nut gasket
17. End nut
18. Bearing lockscrew
19. Lockwasher
20. Bearing washer
21. Screw, fl kid, 10-32 x I
22. Brush cover plate
23. Brush
24. Brush holder
25. Front bearing
26. Condensor

6-7. Vacuum Turbo-Compressor Motor Cleaning and Inspection

Wipe off all parts of the motor except the bearings with a cloth dampened with cleaning solvent. The bearings are life-sealed; to clean, wipe off their exterior surfaces with an oil-damp cloth. Examine all parts for damage and wear, checking end plates, end frames, and field frame casing for cracks and breaks. Check the commutators of armature for discoloration, pits, and roughness. If commutators are rough, smooth them down, using a fine sand-paper. Pitted or damaged commutators may be turned down in a lathe. Keep eccentricity of the commutator within 0. 001 inch. Undercut the mica between commutators to one thirty-second of an inch. Cut mica square and remove all burrs. Check to make certain that all conductors are firmly soldered into the commutator rises. Check the brushes and their springs for overall damages; inspect brushes for proper length and wearing edge. If brushes are worn to less than 11/4 inches, or worn to half their original length, replace brushes. In-spect the armature for damaged or missing in-sulation. Test for grounded coils by using a test probe. Ground one probe on the armature shaft and touch each commutator segment in turn. If the lamp lights, the commutator touched is grounded and the armature should be replaced. Test the capacitor with a multimeter on a low ohms scale. Place the multimeter leads across the capacitor leads; if the capacitor is good, the meter needle will rise and slowly fall. If the needle of the meter rises, and does not fall, the capacitor should be replaced. Test for shorted coils with a growler and a hacksaw blade. A shorted armature will cause the hacksaw blade to vibrate. Inspect the bearings for signs of wear and for loose inner and outer races. Replace bearing if races are loose or if signs of wear are present.

6-8. Vacuum Turbo-Compressor Motor Reassembly

a. Reassembly.

(1) Press fan (7, fig. 6-3) and rear bearing (6) on shaft of armature (8). Insert armature assembly into field frame assembly (91. Install condenser (capacitor) (26) in front end frame (10). Position front end frame and rear end frame (5) on field frame assembly, and secure in place with four bolts 14 and lockwashers (11)

(2) Position front bearing (25), and secure to shaft of armature (8) with bearing washer (20), lockwasher (19), and lockscrew (18).

(3) Insert brush holder (24) on side of front end frame (10-. Slide the brush (23) into holder. Position brush cover plate (22) and secure with two screws (21); install other brush to front end frame.

(4) Tap end plate (15, fig. 6-3) into position and secure with four screws (11. Position end nut gasket (16) and install end nut (171. Position wire cover plate (12) and secure with two screws (13)

(5) Insert locking ring (41 in rear end frame (51. Position end plate gasket (3) and tap end plate (2) into place. Secure end plate with four screws (1).

(6) Position outlet box and secure with two screws. Attach motor leads and secure cover (10, fig. 4-13) on box, and secure with four screws (9)

b. Installation. Refer to paragraph 6-4. b.

Section III. LENSBOARD AND COPYBOARD DRIVE MOTORS

6-9. Description

The copyboard drive motor (8, fig. 1-4) and the lensboard drive motor (6) are identical motors used to move the copyboard and lensboard by individual drivescrews. A gear pinned to the motor shaft engages a gear keyed to the drivescrew. The motors operate on 208 volt, 3 phase, 60 cycle, alternating current only, drawing 1. 3 amperes at a speed of 1,140 rpm. The motor is self-cooled by an internal fan arrangement. Each motor is rated at one-fourth hp and 60-minute 50° -C. temperature rise. The rotor is a squirrel cage type and is supported by shielded ball bearings at each end.

6-10. Drive Motor Disassembly

a. Removal. Refer to paragraph 4-44. b.

b. Disassembly.

(1) Drive out tapered pin (12, fig. 6-4), securing motor shaft gear (13) (to rotor (7) and remove gear.

(2) Remove two screws (1), securing wire cover plate (18) to end frame (3). Lift off plate.

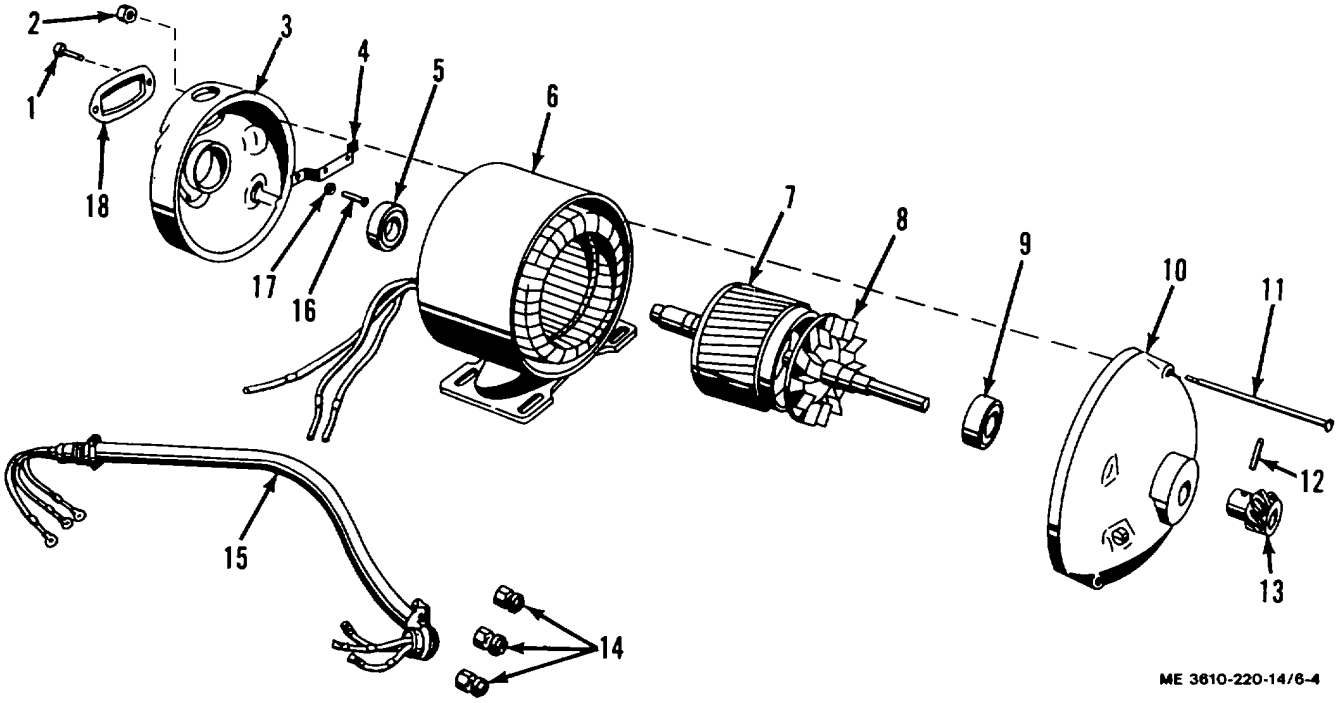
(3) Disconnect motor cable (15) from the leads of stator assembly (6) by removing three contact insulators (14). Remove cable from end frame (3).

(4) Remove four motor assembly bolts (11) an d nuts (2 I; separate end frame (3) and end frame (101 from stator assembly -6).

(5) Remove two screws (16) and lockwashers (17 I, securing wire support bracket (4) to end frame (3). Remove bracket.

(6) Slide out rotor assembly and, using a gear puller, remove gear-end bearing (9, fig. 6-4) from rotor (7). In similar manner, remove bearing (5).

(7) Do not remove motor fan (8) from rotor (-1) unless it must be replaced, for it will be damaged in removal. Press off fan (8) if necessary.



1 Screw, rd hd, 10-32 x ⅝
2 Hex nut
3. End frame, cable-end
4. Wire support bracket
5. Bearing
6. Stator assembly
7 Rotor
8 Fan
9 Bearing
10 End frame, gear-end
11 Motor assembly bolt
12 Taper pin No 3 x ¾
13 Motor shaft gear
14 Contact insulator
15 Motor cable
16. Screw, rd hd, 10-32 x ½
17. Lockwasher
18. Wire cover plate

Figure 6-4. Drive motor, exploded view.

6-11. Drive Motor Cleaning and Inspection

Wipe all parts of the motor except the bearings with a cloth dampened with cleaning solvent. The bearings are life-sealed; to clean wipe exterior surfaces with an oil-damp cloth. Check all metal parts such as end frames, cover plate, and stator assembly casing for cracks and breaks. Examine the motor fan for distortion and for bent or broken blades. Bent fan blades may be straightened by the fingers, as fan is made of thin metal. Do not remove fan from rotor shaft uless it is to be replaced. Inspect the bearings for loose inner and outer races and for overall wear. Replace defective bearings. Check the motor shaft gear for worn and broken teeth and replace if necessary. Use a test probe for grounded coils of stator assembly. To test, place one probe on frame of stator and touch the other probe to the coil terminals. If lamp lights, the coil is grounded. Check the rotor for broken or worn insulation covering and for damaged shaft. Inspect for loose rotor bars, using a growler and a hacksaw blade. Vibration of hacksaw blade should be felt at

every bar; otherwise an open bar is indicated. Replace defective stator assembly or rotor.

6-12. Drive Motor Reassembly

a. Reassembly.

(1) Carefully press new fan (8, fig. 6-4) on shaft of rotor (7) if previously removed. Press Bear. end bearing (9) and bearing (5) on rotor shaft.

(2) Position wire support bracket (4) and secure to end frame (3) with two screws (16) and lockwashers (17).

(3) Place rotor in stator assembly (6) and position end frame (3) and end frame (101. Secure to stator assembly with four bolts (11) and nuts (2-.

(4) Connect motor leads and motor cable (15, fig. 6-4), using three contact insulators (14).

(5) Position wire cover plate (18) and secure to end frame (3) with two screws (1).

(6) Tap motor shaft gear (13) on shaft and lock in position by driving in tapered pin (12).

b. Installation. Refer to paragraph 4-44. d.

Section IV. COPYBOARD ASSEMBLY

6-13. Description

The camera copyboard assembly (2, fig. 1-2) is made of a magnesium aluminum alloy to minimize warping and to facilitate its movability. The area of suction on the copyboard is controlled by a single operating knob (7, fig. 1-6) on the back of the copyboard. The knob operates an internal rack and pinion arrangement which opens or closes operating gates. These gates, when closed, divide the back of the copyboard into four sealed compartments. The inner compartment receives suction at all times. As the gate between the inner compartment and the next compartment is opened, the sue lion area is increased to include this compartment. The suction pressure from the vacuum turbo-compressor is constant so that as the suction area is increased, the suction pressure per square inch on the copyboard is decreased. As each successive gate is opened, the previously opened gate is held in an open position. There are three operating gates.

6-14. Copyboard Disassembly

a. Removal. Refer to paragraph 4-52. b.

b. Disassembly.

(1) Remove 88 screws (7, fig. 6-51, securing copyboard front plate (6) to copyboard back plate assembly (1). Lift off front plate.

(2) Remove six screws (13, fig. 6-6), securing copyboard cross brace (16). Remove other cross brace. Remove twelve nuts (14), six studs (12) and six jam mute (11) from each cross brace.

(3) Remove eight screws (2, fig. 6-5), lock-washers (10, fig. 6-6) and nuts (15), securing copyboard flange (9) to copyboard back plate assembly (1). Lift off flange (9) and spacer (20).

(4) Remove setscrew (8, fig. 6-6), securing operating knob (17) to operating gear and shaft (19). Slide off knob. Remove four screws (7), securing operating dial plate (18) to cover plate (5) and remove dial plate. Remove eight screws (6) securing cover plate (5) to copyboard back plate assembly (11. Lift off cover plate and pull out operating gear and shaft (19) and operating rod assembly (31. Remove operating rod assembly stop screw (2).

(5) Remove setscrew (8,fig. 6-6) from each of three operating gears (41. Slide three operating gears off gate operating shafts. Remove operating gate (3, fig. 6-5). Remove pivot screw (4). In a similar manner, remove remaining operating gates.

(6) Remove seven screws (7, fig. 6-5) and two screws (9), securing copyboard form rib (8) to copyboard back plate (1) and remove form rib. In similar manner, remove 18 remaining ribs.

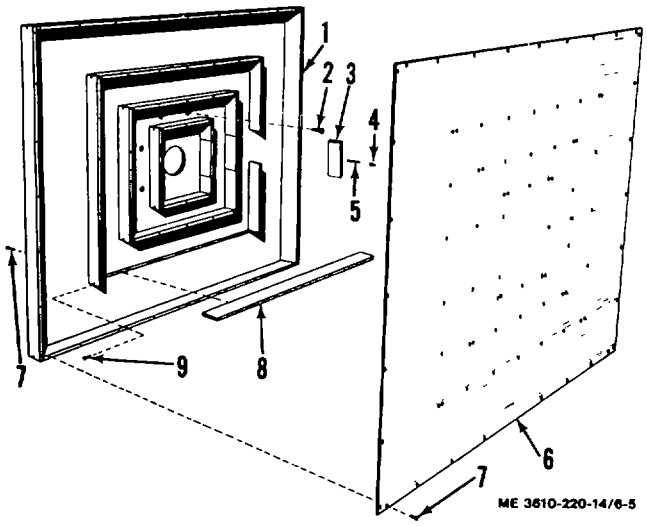
(7) Disassemble the operating rod assembly in the following manner:

(a) Remove three hex socket head screws (10, fig. 6-71, securing operating rod rack (1) to operating rod all. Lift off rack.

(b) Remove hex socket head screw (9), securing operating rod tooth (2) to operating rod all. Lift out tooth and repeat this operation on the remaining two teeth.

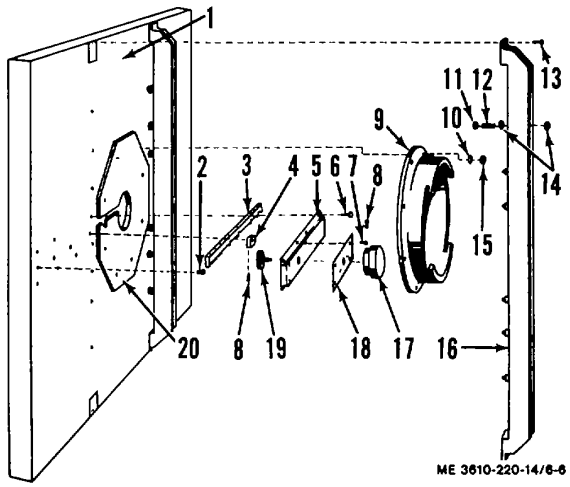
(c) Remove two screws (3l, securing block (4) to operating rod. Lift off block.

(d) Turn rod over and remove screws (8), securing block (5 (to rod. Pry block (5) from operating rod and remove dowel (6)



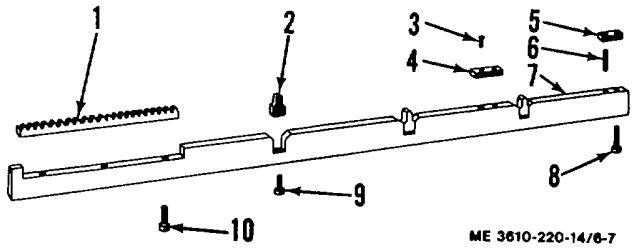
1. Copyboard back plate assembly
2. Screw, fl hd, ⅜-16 x 1½
3. Operating gate
4. Screw, 10-32 x ¼
5. Operating shaft
6. Copyboard front plate
7. Screw, fl hd, 10-32 x ⅝
8. Copyboard form rib
9. Screw, hex soc hd, 10-32 x ¾

Figure 6-5. Copyboard, front exploded view.



1. Copyboard back plate assembly'
2. Screw, 10-32 x ¼
3. Operating rod assembly
4. Operating gear
5. Cover plate
6. Screw, rd hd, 10-32 x ½
7. Screw, rd hd 8-32 x ⅛
8. Setscrew, 10-32 x ⅛
9. Copyboard flange
10. Lockwasher
11. Hex nut, jam
12. Stud
13. Screw, hex soc hd, 10-32 x ¼
14. Hex nut
15. Hex nut
16. Copyboard cross frame
17. Operating knob
18. Operating dial plate
19. Operating gear and shaft
20. Copyboard flange spacer

Figure 6-6. Copyboard, rear exploded view.



1. Operating rod rack
2. Operating rod tooth
3. Screw, fl hd, 3-48 x 5/16
4. Block
5. Block
6. Dowel, ⅛ x 7/8
7. Operating rod
8. Screw, hex soc hd, 6-32 x ¾
9. Screw, hex soc hd, 6-32 x 5/16
10. Screw, hex soc hd, 6-32 x ½

Figure 6-7. Operating rod assembly, exploded view.

6-15. Copyboard Cleaning and Inspection

Clean all parts thoroughly with a cleaning solvent and dry with compressed air, being careful to remove all dirt or cleaning solvent from Copyboard front plate perforations. Inspect all threaded parts and tapped holes for stripped or damaged threads. Replace any damaged parts. Inspect Copyboard front plate and replace if warped. Inspect operating gates and shaft for worn or damaged condition. Inspect operating gears and spacers for signs of excessive wear or damage. Inspect cross braces for warping or distortion. Inspect Copyboard flange for cracked or broken condition. Check the operating rod rack and its related parts for wear. Replace all defective parts.

6-16. Copyboard Reassembly

a. Reassembly.

(1) Position the Copyboard form rib (8, fig. 6-5) and secure with screws (9 and 71.

(2) Install screw (4). Insert operating shaft (5) in operating gate (3) and insert onto screw (4-. Insert shaft through hole in Copyboard back plate assembly (1) and swing gate to closed position. In a similar manner, install remaining two operating gates .

(3) Slide an operating gear (19, fig. 6-6) shaft and retain each with setscrew (8). Do not tighten setscrews at this time. Install screw (2).

(4) Reassemble the operating rod assembly (2) in the following manner:

(a) Tap dowel (6, fig. 6-7) into operating rod (7) and position block (5) on dowel. Turn operating rod over and insert hex socket head screw /8 (to secure block.

(b) Position block (4) on operating rod and secure with two screws (31.

(c) Position tooth (2, fig. 6-7) in operating rod recesses and insert hex socket head screw (9) through bottom of rod. Tighten hex socket head screw until step in tooth is flush with edge of beveled recess. Install the remaining two teeth in the same manner.

(d) Position operating rod rack (1) in operating rod recess and secure with three hex socket head screws (10).

(5) Position operating rod assembly (3, fig. 6-6) in its extreme right-hand position. Engage innermost operating gear so that it meshes with the first tooth on the operating rod assembly. With tooth and rod in this position, pivot operating gate until it is 45° from the closed position. Tighten the previously installed operating gear setscrew (8). In similar manner, set the remaining two operating gears and gates. Install operating rod stop screw (2).

(6) Push operating rod (3, fig. 6-6 (to the extreme right-hand position. This will close all operating gates. Insert operating gear and shaft (19-. Position cover plate (5) and secure with eight screws (6). Position operating dial plate (18) and secure with four screws (7-. Slide operating knob (17) on operating gear and shaft (19) with indicator on operating knob pointing to the smallest setting on operating dial plate. Secure operating knob to shaft dial plate. Secure operating knob to shaft with setscrew (8).

(7) Position copyboard flange (9, fig. 6-6) and secure to copyboard back plate assembly (1) with eight screws (2, fig. 6-5), lockwashers (10, fig. 6-6), and nuts (15). Position copyboard front plate (6, fig. 6-5) and secure with 88 screws (7).

(8) Position two copyboard cross braces (16, fig. 6-6) and secure each with six screws (13). Insert jam nut (11) onto stud (l 2) and screw into copyboard. Turn nut (14) onto protruding stud and seat stud on back of cross braces (16). While holding one nut (14) tighten second nut (14) to lock stud in seated position. In similar manner, install remaining It studs (12) in cross braces.

b. Installation. Refer to paragraph 4-52. d.

Section V. COPYBOARD CARRIAGE ASSEMBLY

6-17. Description

The copyboard carriage assembly consists primarily of the axle and tube assembly (2, fig. 6-8), copyboard frames (12), and the carriage base plate (3-. The copyboard assembly is secured to the axle and tube assembly which is able to swing through a 180° arc. A drivescrew moves the entire copyboard carriage assembly backward or forward on the camera rail. The axle and tube assembly is supported by the two frames (12) and rotates freely between them on its axle. The frames in turn are each bolted and pinned to the carriage base plate for rigidity. Two brackets (8) for mounting the arc lamp arm brackets are secured to the carriage base plate. A cross brace assembly (5) with internal rollers rides on the camera rail and offsets the weight of the arm brackets and arc lamps. A limit switch bracket (4) is mounted on top to limit travel of the assembly.

KEY to fig. 6-8:
1. Copyboard assembly
2. Axle and tube assembly
3. Copyboard carriage base plate
4. Limit switch bracket
5. Cross brace assembly
6. Hinge pin nut
7. Washer
8. Secured-end arm bracket
9. Wiper guard
10. Screw, hex soc kid, 10-32 x 3/4
11. Oil felt wiper
12. Copyboard frame

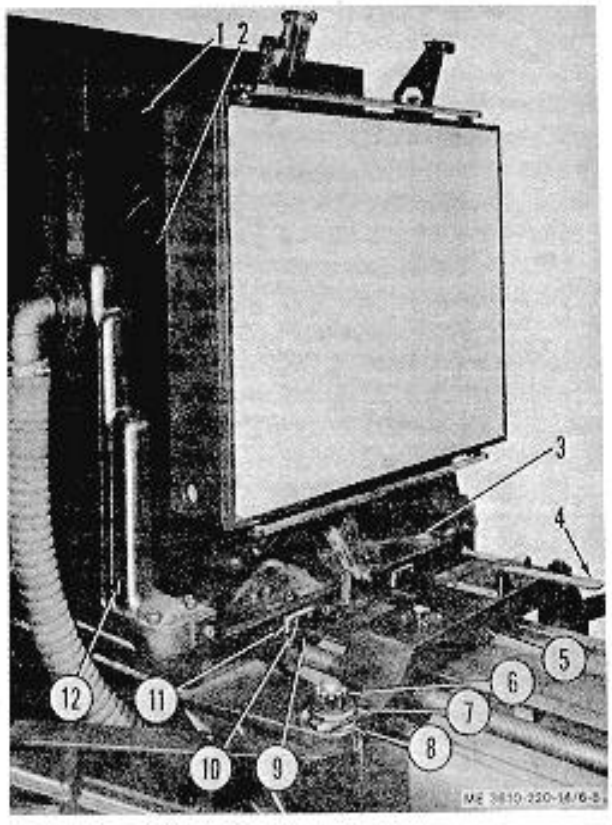


Figure 6-8. Copyboard carriage assembly, installed.

6-18. Copyboard Carriage Disassembly

a. Removal.

(1) Remove the copyboard assembly (para 4-52. by.

(2) Remove the transparancy holder assembly para 4-49. b.).

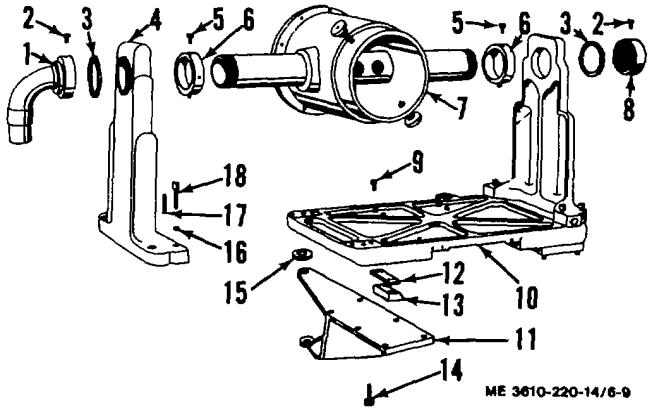
(3) Remove thecopyboard locking device para 4-53. b.).

(4) Lift off arc lamps from free-end brackets (14, fig. 4-6) and remove arc lamp arm assembly (para 4-30. b.).

(5) Release the cross brace assembly (5, fig. 6-8) by removing two hinge pin nuts (6) and washers (7).

(6) Remove two screws (10) from each of the four wiper guards (9). Lift off the four guards and oil felt wipers (11).

(7) Remove two screws (9, fig. 6-9), securing carriage base plate (10) to each of the four side bearing block gibe (13). Lift off copyboard carriage assembly. Remove gibe (13) and shims (12) from copyboard drive brackets 15, fig. 6-13).



1. Vacuum elbow assembly
2. Screw, hex soc, hd, ¼-20 x ¼
3. Ring
4. Copyboard frame
5. Screw, hex soc hd, ¼-20 x ¼
6. Axle collar
7. Axle and tube assembly
8. Cap
9. Screw, hex soc hd, ⅜-16 x 1½
10. Copyboard carriage base plate
11. Secured-end arm bracket
12. Shim
13 Side bearing block gib
14. Screw, hex soc hd, ⅛-16 x 1⅜
15. Washer
16. Lockwasher
17. Dowel pin, ⅛ x 2
18. Screw, hex soc hd, ½-13 x 2

Figure 6-9. Copyboard carriage assembly, exploded view.

b. Disassembly.

(1) Remove screw (2, fig. 6-9) and unscrew vacuum elbow assembly (1) from thread axle of the axle and tube assembly (7). Lift off ring (3).

(2) Remove six screws (14), securing secured-end arm bracket (1 1) to the carriage base plate (10). Lift off the bracket (11). Remove other bracket in similar manner.

(3) Drive out from the bottom two dowel pins (17, fig. 6-9), and remove four hex socket head screws (18) and lockwashers (16). Slide off copyboard frame (4) while supporting weight of axle and tube assembly (-1). Unscrew cap (8), and remove ring (3) and axle and tube assembly.

(4) Loosen four screws (5) and slide two axle collars (6) from axle.

(5) Remove four screws, securing remaining copyboard frame to carriage base plate (10); drive dowel pins out from the bottom and lift off frame.

(6) Disassemble the cross brace assembly (5. fig. 6-8) as follows:

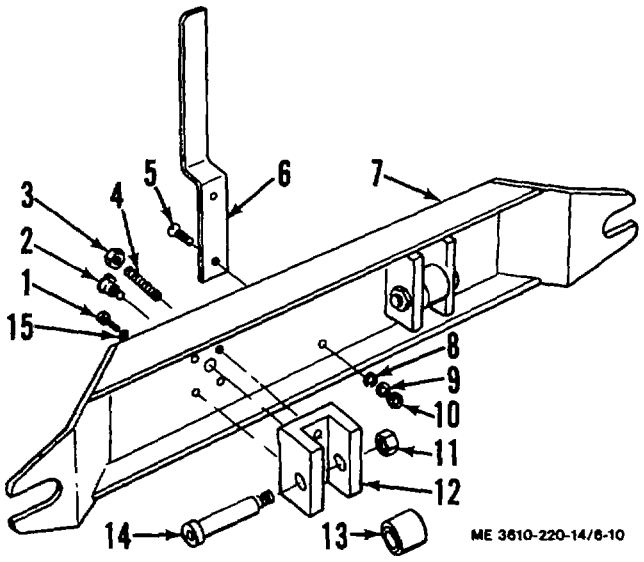
(a) Remove two screws (1, fig. 6-10), two flatwashers (15), two setscrews (4), and nuts (3), securing roller bracket (12) to cross brace channel (7). Lift out roller assembly.

(b) Remove and discard stop nut (11) and carefully tap out shoulder screw (14). Lift out roller (13).

(c) Remove remaining roller assembly in the same manner.

(d) Remove oiler (2) .

(e) Remove two screws (5), lockwashers (8), flat washers (9 (and nuts (10 (securing switch bracket (6).



1. Screw, hex soc hd
2. Oil cap
3. Hex nut
4. Setscrew, fl point
5. Screw, fl hd, 10-32 x 1
6. Limit switch bracket
7. Channel
8. Lockwasher
9. Flat washer
10. Hex nut
11. Stop nut
12. Roller bracket
13. Roller
14. Shoulder screw
15 Flat washer

Figure 6-10. Cross brace assembly, exploded view.

6-19. Copyboard Carriage Cleaning and Inspection

Clean all parts thoroughly with a cleaning solvent and a clean cloth, being certain to reach threaded areas. Examine threaded areas for stripped and damaged condition. Inspect all parts for cracked or broken condition. Check rollers, gibe, and shims for wear and burred working surface, and the axle and tube assembly for warping. Replace defective parts.

6-20. Copyboard Carriage Reassembly

a. Reassembly.

(1) Position copyboard frame (4, fig. 6-9) on carriage base plate (10) and attach with four hex socket head screws (18). Drive in two dowel pins (17).

(2) Slide an axle collar (6) on each end of axle but do not tighten screws (5). Insert one end of axle into installed frame and, while supporting weight of axle and tube assembly, slide remaining frame into position and secure frame to carriage base plate (10) with four hex socket head screws (181. Drive in two dowel pins (171.

(3) Center axle and tube assembly (((and slide both axle collars (6) against frames (4). Secure collars into position by tightening two screws (5 (in each collar.

(4) Position ring (3, fig. 6-9) on axle and screw on cap (8). Place ring (3) and elbow assembly (1) on other end of axle; secure elbow assembly with screw (2).

(5) Position two secured-end arm brackets (1 1) and secure each with six screws (14).

(6) Reassemble the cross brace assembly (5, fig. 6-8) as follows:

(a) Position roller (13, fig. 6-10) in roller bracket (12 (and tap in shoulder screw (14). Secure screw with a new stop nut (11) to prevent the possibility of the old stop nut from working free from the shoulder screw and causing damage to the base plate and camera bed.

(b) Position roller assembly in cross brace channel (hi and secure with two set screws (4l, two nuts (3l, two screws (1) and two flatwashers (15-. Assemble and install remaining roller in the same manner.

(c) Install oiler (2).

(d) Position limit switch bracket (6) and secure with screws (5l, lockwashers (8l, flat-washers (9) and nuts (10).

b. Installation.

(1) Position copyboard carriage assembly on camera rail and secure to four side bearing block gibe (13, fig. 6-9) and shims (12) with eight screws (9). Make certain that gibe draw carriage snugly to rail to provide a sliding fit without shake or play. Use shims if necessary to take up wear and play. If wear is pronounced, also check rail for wear as setting the gibe properly in the center of movement of the copyboard carriage may result in binding at the extremes. Check for wear by placing a precision straight edge on the rail. Low spots will be visible below the straight edge, or can be determined with shims. If rail is worn, it should be scraped into a uniform and true sliding with the carriage.

(2) Install the cross brace assembly (5, fig. 6-8) with two hinge pin nuts (6) and washers (7).

(3) Install the copyboard locking device (para 4-53. d.1

(4) Install the transparancy holder assembly (para 4-49. d. (and the copyboard assembly (para 4-52. d.).

(5) Replace new oil felt wiper (11, fig. 6-8) on copyboard carriage base plate (3) and install with wiper guards (9) and screws (101. Lubricate all four wipers.

(6) Install the arc lamp arm assembly (para 4-30.1) and position arc lamps on free-end arm bracket (14, fig. 4-6).

c. Calibratin. Calibrate the copyboard to the lens as detailed in paragraph 5-6. b.

Section VI. LENS BOARD ASSEMBLY

6-21. Description

The lensboard assembly is mounted on the lens-board carriage assembly by two side frames. The lensboard provides horizontal and vertical movement for the lens, and is controlled from the darkroom end of camera and from the lensboard location. The darkroom control knobs control the lens by the action of the driven gears (12, fig. 6-11) which operate from the lensboard control shafts (16). The lensboard control shafts move the horizontal drive shaft (22) and vertical drive shaft (6) which, in turn, move the inner lensboard frame (4). The lens and shutter assembly are mounted on opposite sides of the frame.

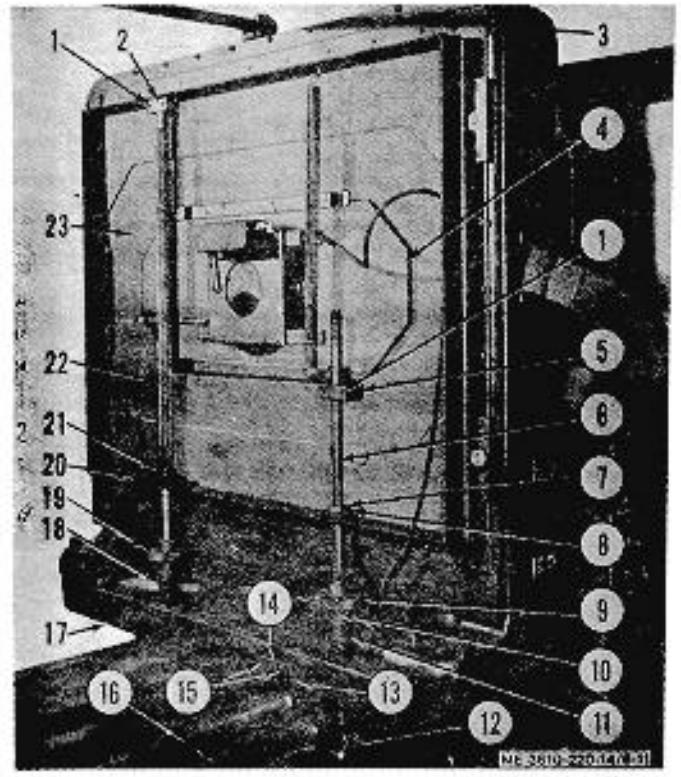


Figure 6-11. Lensboard assembly, installed.

6-22. Lensboard Disassembly

The lensboard is partially disassembled as it is removed from the lensboard carriage assembly.

a Remove the bellows (para 4-37. b.).

b Remove the shutter assembly (para 4-39. b.).

c Remove the lens (para 4-40. b.or para 4-41. b.).

d Remove two screws (1, fig. 6-11), securing lensboard vertical drive nut (5) to lensboard (231. Loosen setscrew

) on vertical drive shaft collar (7)

e. Drive out tapered pin (10) from universal joint (111. While backing off vertical adjustment handwheel (9l, elide out vertical drive shaft assembly.

f. Remove four screws (1, fig. 6 l 1), securing upper and lower bearing blocks (2) and (20) to lensboard. Loosen setscrew (1) on collar (21) of horizontal drive shaft (22). Drive out tapered pin (10) from universal joint (18), and elide out horizontal drive shaft assembly after backing off horizontal adjustment handwheel (19).

g. Remove four screws (3), securing lensboard assembly to carriage frames. Lift off lensboard.

6-23. Lensboard Cleaning and Inspection

Clean the lensboard with a cleaning solvent and a clean cloth. Clean the shafts and collars with a em all brush. Dry the lensboard with a soft, clean cloth. Use air hose to dry recessed surfaces and threaded parse. Inspect the lensboard and shafts for distortion and bends. Check parts for stripped threads and wear. Replace all defective parse.

6-24. Lensboard Reassembly

a Reassembly and Installation.

(1) Position lensboard (23, fig. 6-11) on carriage frames and secure with four screws (3).

(2) Insert vertical drive shaft (6) in position an d turn on vertical adjustment handwheel (9 J. Position drive nut (5) on lensboard and secure with

two screws (1). Slide collar (7) into position and secure with setscrew (1-. Attach vertical drive shaft (6) to universal joins with tapered pin (10-.

(3) Insert horizontal drive shaft (22, fig. 6-11) (into position on lensboard (23) and turn on horizontal adjustment handwheel (19). Position the two bearing blocks (2) and (20) and secure each to lensboard with two screws (1). Slide collar (21) into position and tighten setscrew (1). Attach horizontal drive shaft (22) to universal joint (18) with tapered pin (10).

(4) Install the shutter assembly (para 4-39. d.).

(5) Install the bellows (para 4-37. d.).

(6) Install the lens (para 2-35. c. (1) or para 2-35. c. (211.

b. Calibrating. Calibrate the lensboard to the lens. Refer to paragraph 5-6. b.

Section VII. LENSBOARD CARRIAGE ASSEMBLY

6-25. Description

The lensboard carriage assembly (fig. 6-12) consists of two vertical side frames of heavy ribbed casting bolted and pinned to the carriage base plate. The carriage base plate is equipped with side bearing block gibe and shims. It is securely mounted with provisions to take up wear and to insure an accurate sliding fit on the camera rail. The assembly is propelled along the camera rail by the lensboard drivescrew. Four oil felt wipers are installed on the carriage base plate to clear and lubricate the rail in both directions of travel. Two travel limit switches are mounted on the lens side.

6-26. Lensboard Carriage Disassembly

a Remove flashlamp assembly (para 4-42. b.).

b Remove thelensboard (para 6-22).

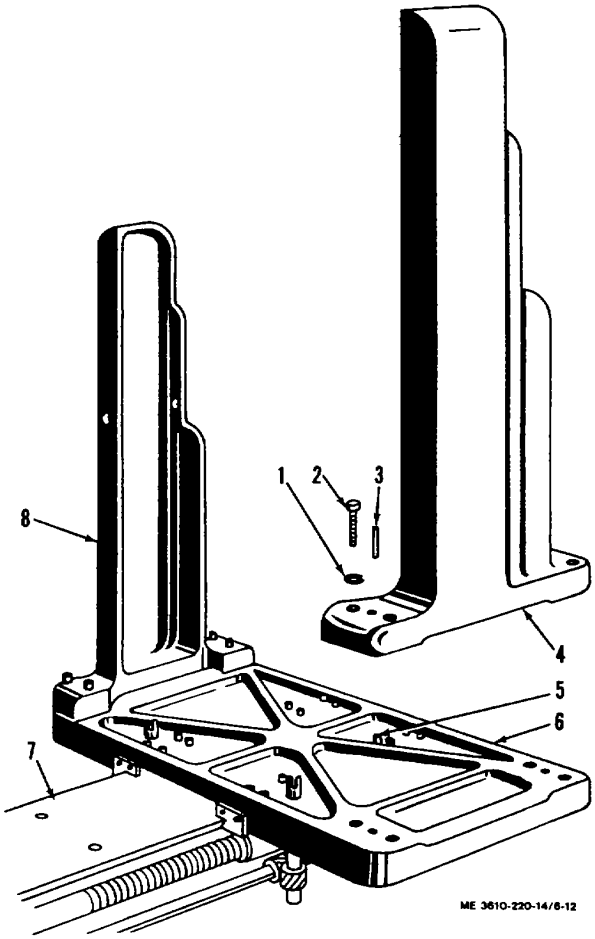
c. Remove two screws (15, fig. 6-11) to release the oil felt wiper (13) and wiper guard (14) from the carriage base plate (17). Remove the remaining three wipers in the same manner. Remove the limit switches (10, fig. 1-5).

d. Tap out two dowel pins (3, fig. 6-12) from under carriage base plate (6). Remove two hex socket head screws (2) and lockwashers (1) and lift off lensboard side frame (4). Remove the remaining side frame (a) in the same manner.

e. Remove eight screws (9, fig. 6-13), securing carriage base plate to four side bearing lock gibs (8). Remove four screws (2), securing the drive bracket (5) to carriage base plate (1).

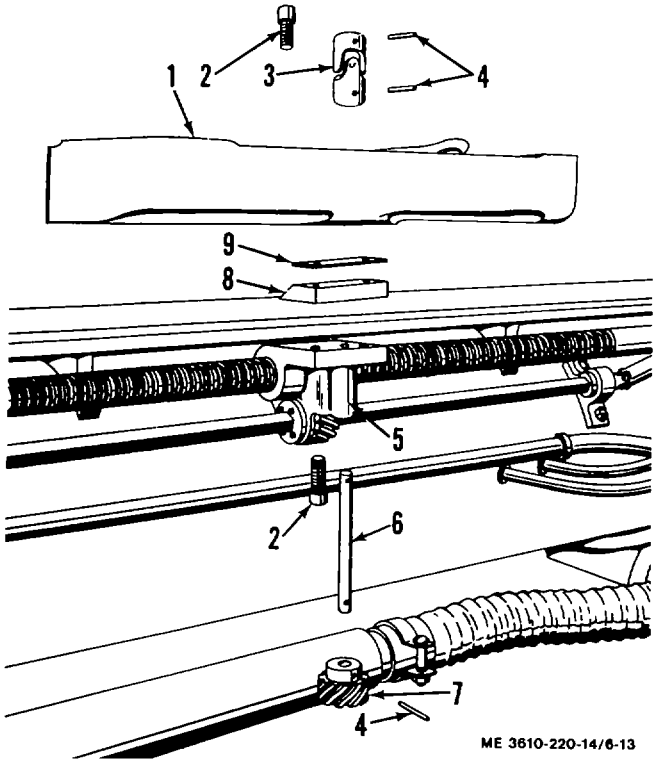
f. Tap out tapered pins (4) from driven gear (7) and shaft extension (6). Then remove extension and universal joint (3) through top of carriage base plate (1). Tap out pin (4) to disconnect extension and universal joint.

g. Remove carriage base plate from camera.



1 Lockwasher
2 Screw, hex soc hd, ½-13 x 2
3 Dowel pin, ⅛ x 2
4 Lensboard side frame
5 Screw, hex soc hd, ⅛-16 x 1⅛
6 Lensboard carriage base plate
7 Camera rail
8 Lensboard side frames

Figure 6-12. Lensboard carriage assembly, partially exploded.



1. Lensboard carriage base plate
2 Screw, hex soc hd, ⅛-16 x 1½
3 Universal joint
4 Taper pin, No. 2 x 1¼
5. Drive bracket
6 Horizontal drive shaft extension
7 Horizontal lensboard driven gear
8. Side bearing block gib
9 Shim

Figure 6-13. Lensboard carriage base plate, exploded view.

6-27. Lensboard Carriage Cleaning and Inspection

Clean all parts thoroughly with a cleaning solvent, using a small brush to clean threaded areas. Inspect frames for splits, cracks, and distortion. Replace if defective. Inspect carriage base plate for cracks and splits. Inspect all threaded areas for stripped or dam aged condition. Inspect gibe and shims for scoring or wear and gears for damaged teeth. Replace all defective parts.

6-28. Lensboard Carriage Reassembly

a. Position lensboard carriage base plate (1, fig. 6-13) on camera rail, and line up four side bearing gibe (8) and shims (9). Secure each gib to carriage base plate with eight screws (5, fig. 6-12). Take up play between gibe and rail, as with copyboard carriage (para 6-20. b. (1))-. Position carriage base plate and drive bracket (5, fig. 6-13), and secure bracket to base plate with two screws (2).

b. Tap driven gear (7, fig. 6-13) on horizontal drive shaft extension (6), and lock on extension with tapered pin (4). Slide extension assembly through drive bracket (5) and base plate (1), and attach universal joint (3) to extension with tapered pin (4). Install vertical drive shaft extension and driven gear on other side of base plate in the same manner.

c. Position the four new oil felt wipers (13 , fig. 6-11) and wiper guards (14), and secure each to carriage base plate (17) with two screws (15). Install two limit switches (10, fig. 1-5).

d. Position lensboard side frame (4, fig. 6-12) on the carriage base plate (6). Insert pins (3) and align holes. Insert two lockwashers (1) and hex socket head screws (2), and tap pin (3) into place. Install the side frame (a) in the same manner.

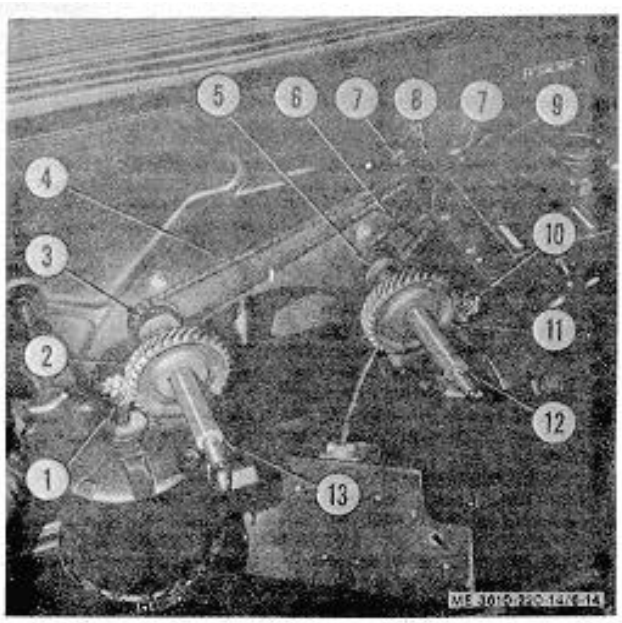
e. Install the flash lamp assembly (para 4-42. d.).

f. Install the lensboard (para 6-24).

Section VIII. CAMERA DRIVE MECHANISM

6-29. Description

The copyboard drive mechanism and the lensboard drive mechanism are identical systems. The data in this section are applicable to either unit. A gear (1 and 10, fig. 6-14) mounted on the drive motor shaft is meshed with a gear keyed and pinned to the drive-screw (12 and 13). A handwheel (7 and 9, fig. 1-4) is also keyed and pinned to the drivescrew. The counter drive sprocket is connected to the positioning counter by a counter drive chain (4 and 6, fig. 6-14). The drive mechanism is disassembled on its removal.



1. Copyboard drive motor gear
2. Copyboard driven gear
3. Copyboard counter drive sprocket
4. Copyboard counter drive chain
5. Lensboard counter drive sprocket
6. Lensboard counter drive chain
7. Tensioner
8. Copyboard sprocket
9. Lensboard sprocket
10. Lensboard drive motor gear
11. Lensboard driven gear
12. Lensboard drivescrew
13. Copyboard drivescrew

Figure 6-14. Camera drivescrews.

6-30. Drive Mechanism Removal and Disassembly

a Remove setscrew (15, fig. 6-15). Drive tapered pin (21 and slide off handwheel (1).

b Remove two screws (3), securing motor gear guard (4) to shield plate (8) and lift off guard.

c Drive out tapered pin t2). securing handwheel extension (5) to drive screw (9).

d Drive out tapered pin (6l, securing driven gear (14) to drivescrew and tap off gear.

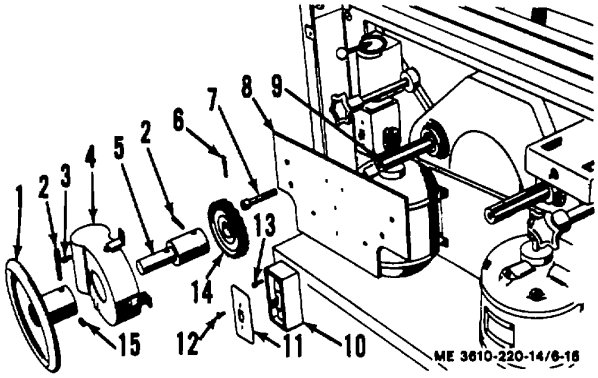
e Repeat the above operations on the remaining drive mechanism.

f. Remove two screws (7, fig. 6-15), securing shield plate (8) to back support plate and lift out plate. Remove two screws (12) to detach cover (1 1) from shutter switch (101. Remove two screws (13) to detach shutter switch from shield plate (8 I. Detach wires from switch. Remove counter drive chain (4, fig. 6-14) from counter drive sprocket (31.

g. Remove setscrew (2, fig. 6-16) and drive out 6-14 tapered pin (7l, securing counter drive sprocket (8) to drivescrew (6\. Tap off sprocket; pry out key (1l, and slide off washer (31.

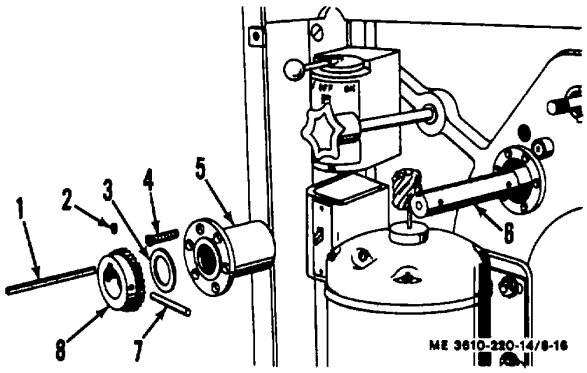
h. Remove six screws (4l, securing drivescrew bushing (S) to camera and slide off bushing.

i. Repeat g and h above for remaining drive mechanism.



1. Handwheel
2. Taper pin, No. 5 x 2¼
3. Screw, hex soc hd, 5/16-18 x ¾
4. Motor gear guard
5. Handwheel extension
6. Taper pin, No. 4 x 2
7. Screw, hex soc hd, ⅜-16 x 2½
8. Shield plate
9. Drivescrew
10. Darkroom shutter switch
11. Shutter switch cover
12. Screw, rd hd, 8-32 x ¾
13. Screw, hex soc hd, 10-32 x ¾
14. Driven gear
15. Set screw, ¼-20 x ⅛

Figure 6-15. Drive mechanism, exploded view, handwheel, extension, drive screw gear.



1. Key
2. Setscrew, ¼-20 x ¼
3. Washer
4. Screw, hex soc hd, 5/16-18 x 1½
5. Drivescrew bushing
6. Drivescrew
7. Taper pin No. 4 x 2
8. Counter drive sprocket

Figure 6-16. Drive mechanism, exploded view, counter drive sprocket, drive-crew bushing.

6-31. Drive Mechanism Cleaning and Inspection

Clean all parts thoroughly with a cleaning solvent, using a small brush to remove dirt from threaded areas. Dry parts with compressed air. Inspect all threads for stripped or damaged condition. Inspect gear and sprocket for chipped or broken teeth. Inspect drivescrew bushing for scoring or wear. Replace all defective parts.

6-32. Drive Mechanism Reassembly and Installation

a. Reassembly and Installation.

(1) Position drive screw bushing (5, fig. 6-16) and secure with six screws (4). Slide washer (3) on drivescrew (6). Tap key (1) into position in drivescrew (6).

(2) Position counter drive sprocket (8, fig. 6-16) on drivescrew (6) and pin to screw with tapered pin (-11. Insert and tighten setscrew (2). Engage counter drive chain (4, fig. 6-4) with sprocket (31.

(3) Repeat the above operations on remaining drive mechanism before proceeding further.

(4) Position shield plate (8, fig. 6-15) and secure with two screws (hi. Position shutter switch (l O) on shield plate and secure with two screws (13).

(5) Attach wires to shutter switch. Position cover (11) and attach with two screws (121.

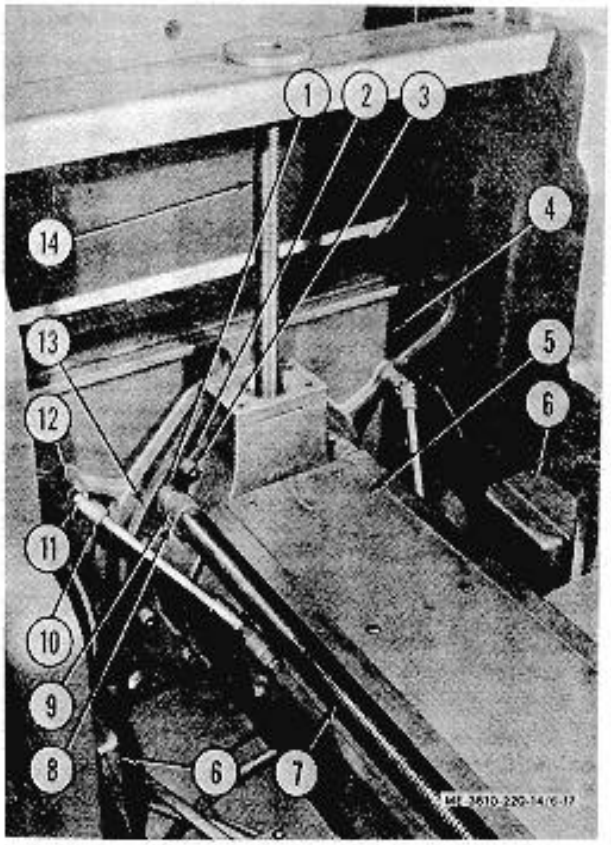
(6) Slide driven gear (14) on drivescrew (9) and lock in place with tapered pin (6). Position hand-vheel extension (5) on drivescrew and secure with tapered pin (2 I.

(7) Position motor gear guard (4, fig. 6-15) on shield plate (8) and secure with two screws (3). Slide handwheel (l) on handwheel extension (5) and lock with tapered pin (2). Insert and tighten setscrew (15 }.

(8) Repeat (6) and (1) above on remaining drive mechanism .

b. Adjustment. Check the end play of drivescrew at the copyboard end of camera. See that the end of drivescrew is resting flush in rear tube flange. To adjust, turn handwheel (7 or 9, fig. l -4 (clockwise, so as to draw carriages back and firmly seat and take up play between sprocket (8, fig. 6-16) washer (3), and bushing (51. Then turn take-up bushing collar (9, fig. 6-17) until snug against spacer bushing and lock collar with set-screw (81. Test for snug running fit by turning handwheels (7 and 9, fig. 1-4) in one direction, and then in the opposite direction. If too tight, ease up slightly on collar (9, fig. 6-17); if too loose, repeat adjustment operation above.

c. Calibrating. Calibrate the camera to the lens. Refer to paragraph 5-5.



1. Male takeup bushing collar
2. Washer
3. Screw, hex soc hd, ½-13 x 7/8
4. Back support plate
5. Camera rail
6. Circuit breaker box
7. Drivescrew
8. Setscrew, ¼-20 x ¼
9. Female takeup bushing collar
10. Lensboard extension shaft
11. Taper pin No. 2 x 1½
12. Universal Joint
13. Tube flange
14. Front jack screw

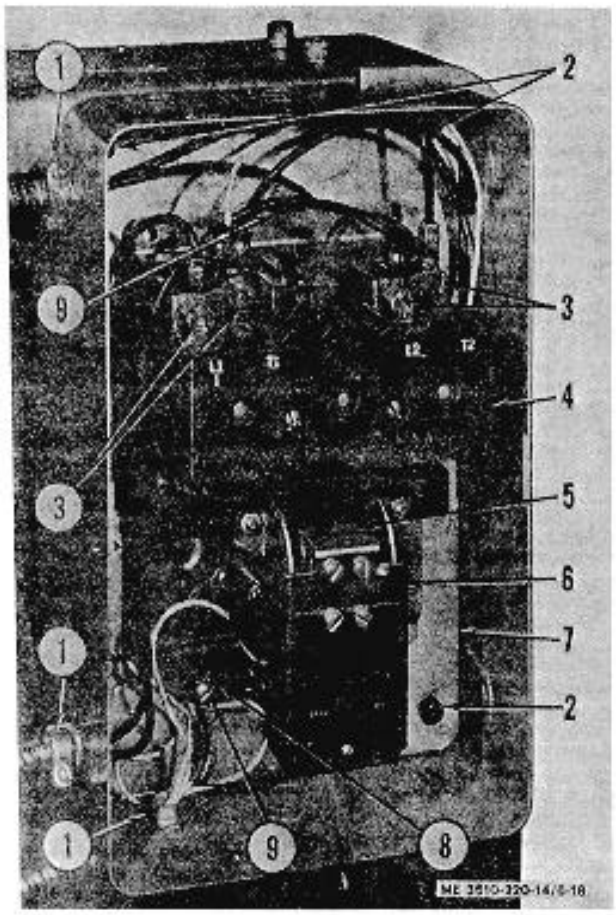
Figure 6-17. Camera drivescrew, showing takeup bushing collar,.

Section IX. MAGNETIC CONTACTOR AND ELECTRONIC SENSING DEVICES

6-33. Description

The magnetic contactor (fig. 6-18) is of the integral horsepower, electrically-held type. A pivoting cod! arm (5) provides positive equalized contact pressure. The magnetic coil (6) is of a solid, 100 percent filled, vacuum-impregnated, moistureproof type. The magnetic contactor works on 115 volt alternating current, 60 cycles. The movable

contacts are clamped to a contact shaft rotated by the movement of the coil arm. As contact is made, an auxiliary contact is also closed by a roller on the coil arm. This auxiliary contact provides power to the coil after the starting button is released, and thus holds the main contacts in a closed position.



1. Locknut and connector assembly
2. Screw, hex soc hd, 5/16-18 x 1½
3. Terminal locks
4. Terminal block
5. Coil arm
6. Magnetic coil
7. Support plate
8. External tooth lockwasher
9. Screw, rd hd, 10-32 x 7/8

Figure 6-18. Magnetic contactor, installed.

6-34. Magnetic Contactor Disassembly

a. Removal.

(1) Remove cover and disconnect all leads from terminal block (4, fig. 6-18) and coil (6). Tag all wire leads.

(2) Remove three locknut and connector assemblies (1) and remove wire cables.

(3) Remove four screws (2) to release magnetic contactor.

6-35. Magnetic Contactor Cleaning, In spection and Test

Clean all parts thoroughly, using a small brush, if necessary, to clean threaded areas. Burnish contact point with fine file, being careful to blow away all metallic particles removed. Inspect contact points for pitting. Remove pits with a fine abrasive cloth If deeply pitted, replace. Inspect insulator for cracks. If cracked or broken, replace the insulator Inspect nuts and studs on terminal plate for stripped or damaged threads. Replace defective parse. Remove any carbon deposits from insulator with a small brush and cleaning solvent Using an ohmmeter, check magnetic contactor coil for continuity. Replace if defective.

6-36. Magnetic Contactor Installation

a. Installation.

(1) Position magnetic contactor assembly on camera rear support plate and secure with four screws (2, fig. 6-18).

(2) Insert three cable assemblies and secure each in place with a locknut and connector assembly (1)

(3) Connect all leads to terminal block (4) and coil (6-. Remove tags from leads. Replace cover.

6-37. Electronic Sensing Devices

a. Description. The electronic sensing device (6, fig. 6-1) is an instrument used to produce a stabilized arc light from the carbon electrodes (20, fig. 4-6), providing a constant intensity of light over the copy. The device (6, fig. 6-1) electronically maintains the gap between the carbon ends at a set distance which remains constant during operation, thereby eliminating any variances in light intensity. The electronic sensing devices are mounted ver-tically on the inner side of the rear truss support (9) located on the copyboard end of the camera. The wiring cable (1) housing the arc lamp circuit wires, is connected to the device (6) by a cable connector socket (8). The sensing device cannot be checked externally or repaired, it must be replaced. Since there are separate sensing devices for each lamp, a trouble effecting both lamps cannot be caused by the sensing devices (except in the unlikely event both should fail simultaneously. If one lamp flickers or does not operate, while the other does, switch the lamp cables to the sensing devices. If the lamp which had operated normally then fails, replace the sensing device

b. Removal.

(1) Release the connector nut (7, fig. 6-1 (from the sensing device (6 I, and pull the cable connector socket (8) from its mating plug on the device.

(2) Remove the four mounting screws (5), two on each side of the device. Release the device from rear truss support (9).

c Installation

(1) Replace electronic sensing device (6) on rear truss support (9 (and attach with the four mounting screw s (5) .

(2) Plug in the cable connector socket 18), being certain that it is firmly seated in the device.

(3) Tighten the connector nut (a) to the plug on the device.

Section X. TRUSS SUPPORT ASSEMBLY

6-38. Description

The truss support assemblies are the legs of the camera. The trues supports (8, fig. 1-1) on the copyboard end of the camera skid (11) support the transformer (2, fig. 4-13) and magnetic contactor (5) by a rear support plate (4), which serves as a mounting base connecting the two truss supports. The truss supports are rigidly bolted to the camera skid and are crossmembered at the top by a support channel. The truss support (8, fig. 1-1) on the darkroom end is similarly mounted, with the exception that it is not equipped with a support plate and the circuit breaker boxes (6, fig. 6-17) are mounted on each side of the truss support.

6-39. Truss Support Removal and Disassembly

a. Remove the transformer (para 4-31. b.) and magnetic contactor (para 6-34. a. I. Set wire cables aside and away from working area.

b. Remove the vacuum turbo-compressor assemblies (para 6-2. a.), and remove eight vibration mounts (7, fig. 4-13) by releasing their m o u n tin g screw 8.

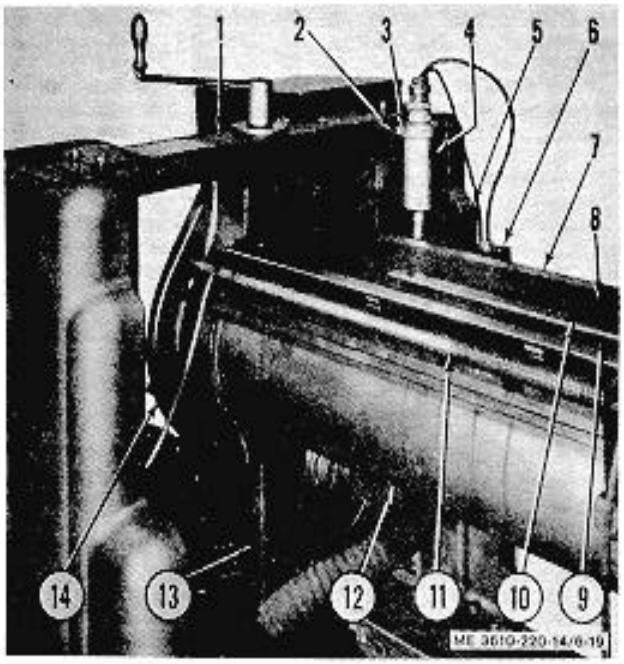
c. Remove the electronic sensing devices (para 6-37. b.).

d. Remove cover from main junction box (8, fig. 2-53 and disconnect wires from terminals. Remove four screws (6, fig. 4-15) to release box from terminals. Remove four screws (6, fig. 4-15) to release box from skid. Unclamp the filter (4, fig. 6-19) by removing screw (21. Lift out the filter. Disconnect the filter bracket (3) with two screws (2). Release the circuit breaker (6, fig. 6-17) by removing four screws inside of circuit breaker box. Remove in-terlock switch (6, fig. 6-19) by releasing two screws on the inside of truss support (S l.

e. Remove the rear support plate (11, fig. 6-20) from the truss supports (10 and 14) by removing four screws (12).

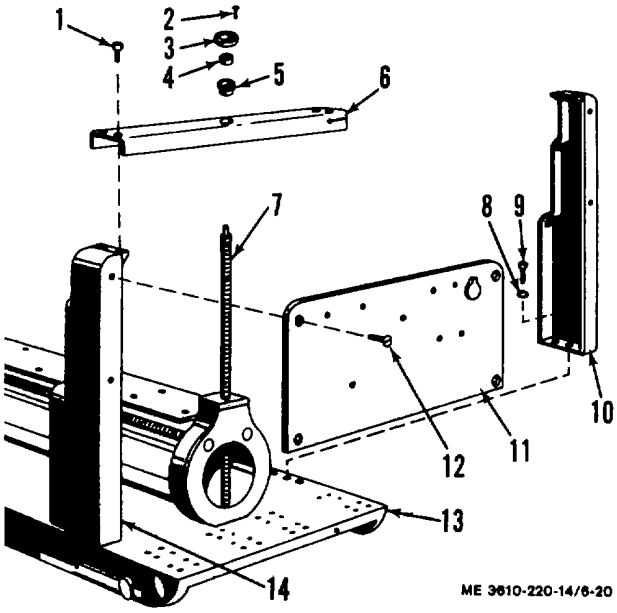
f. Release two screws (2, fig. 6-20), securing cover guard (3) to support channel (6). Lift off guard and remove bearing (4) and bearing retainer (5) from the rear jack screw (7) and channel (6).

g. Remove the channel by releasing four screws (1, fig. 6-20). Remove three screws (9) and lock-washer (8) to release truce support (10) from the camera skid (13). Remove trues support (14) in similar manner. The truss supports mounted on the darkroom end of camera are similar to this group of trues supports. Use same procedure.



1. Support channel
2. Screw, ¼-20 x ½
3. Bracket
4. Filter
5. Truss support
6. Interlock switch
7. Camera rail
8. Screw, hex soc hd, ⅜-16 x ¾
9. Limit switch track
10. Screw, fl hd, ⅜-16 x 1
11. Drivescrew
12. Camera tube
13. Rear jack screw
14. Rear tube flange

Figure 6-19. Truss support assembly, copyboard end.



1 Screw, hex hd, ⅜-16 x 1¾
2. Screw, hex soc hd, ¼-20 x ¾
3 Cover guard
4. Bearing
5. Bearing retainer
6. Support channel
7. Rear jack screw
8. Lockwasher
9. Screw, hex soc hd, 5/16-11 x 2
10. Truss support
11. Rear support plate
12. Screw, fl hd 5/16-18 x ¾
13. Camera skid
14. Truss support

Figure 6-20. Truss support assembly, exploded view.

6-40. Truss Support Cleaning and Inspection

Clean the truss supports plate and channel with a cleaning solvent and a small brush. Wipe the bearing, bearing retainer, and cover guard with a cloth dampened with cleaning solvent. Wipe parts thoroughly with a dry, clean cloth. Inspect the truss supports and channel for cracks, breaks, and corrosion. Check the rear support plate for bends and distortion. Examine the bearing retainer, and outer race of bearing for scoring. Repack bearing. Replace all defective parts.

6-41. Truss Support Reassembly and Installation

a. Position the truss supports (10 and 14, fig. 6-20) on the camera skid (13) and retain each with three lockwashers (8) and screws (91. Install the support channel (6) on truss supports with four screws (1). Place bearing retainer (5) and bearing (4) in channel over rear jack screw (71. Retain with cover guard (3) and four screws (2). Install the rear support plate (ll) with four screws (12).

b. Install the circuit breaker (6, fig. 6-17) on the truss support (5, fig. 6-19) with four screws placed inside of breaker. Position the interlock switch (6) on rim of truss support and retain with two screws.

c. Place the filter bracket (3, fig. 6-19) on the rear support channel (1 l and install with two screws (2). Position and clamp filter (4) on filter bracket (3) and retain with screw (2).

d. Install the electronic sensing devices (para 6-36. c. -.

e. Position eight vibration mounts (1, fig. 4-13) on camera skid and secure with mounting screws. Install the vacuum turbo-compressor assemblies (para 6-4. b.).

f. Install the transformer (para 4-31. c.) and magnetic contactor (para 6-36. a.). Dress all wire leads.

g. Connect wire leads to main junction box (8, fig. 2-5) and install box with four screws (6, fig. 4-15).

Section XI. CAMERA RAIL, TUBE AND DRIVESCREWS

6-42. Description

The camera tube (7, fig. 1-2) is the bed of the camera, supporting the copyboard (2), lensboard (4l, and the camera rail (5. fig. 1-1). The tube flanges welded to the ends of the camera tube support and aline it with the related supporting structures of the unit. The camera rail (7, fig. 6-19) is continuously fastened to the tube (12) and is dependent upon it for its rigidity and alignment. The camera rail is machined with beveled guides to provide for accurate support of the movable lens-board and copyboard carriages over their entire range of travel.

6-43. Camera Rail, Tube, and Drivescrew Removal

a. Remove the bellows (para 4-37. b.) and the tube support assembly (para 4-36. b.).

b. Remove the lensboard carriage assembly (para 6-26).

c. Remove the arc lamp arm assembly (para 4-30) and the copyboard carriage assembly (para 6-18).

d. Remove the camera drive mechanism (para 6-30).

e. Remove the drive motors (para 4-44.b.); remove focusing glass (para 4-34

f. Remove the truss support assemblies (para 6-39) at both ends of camera.

g. Remove six screws (10, fig. 6-19) securing limit switch track (9) to rail (7). Remove 26 screws (8) and washers, securing camera rail Hi) to tube (12 I. Lift off the rail; disconnect all accessible wiring .

h. Place handwheel on drivescrew (12 and 13, fig. 6-14). Turn counterclockwise to work out drivescrew unit until it is dislodged from rear tube flange (14, fig. 6-19). From the copyboard end of camera, remove the drivescrew from the front tube flange. Screw off the len-board and copyboard drive brackets from drivescrew. Remove remaining drivescrew in the same manner.

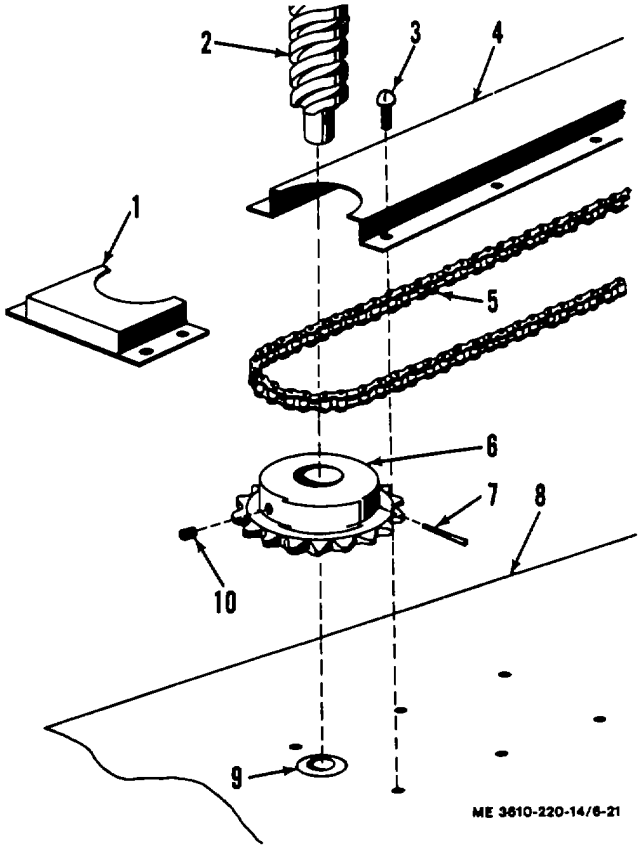
i. Remove tapered pin (11, fig. 6-17) of universal joint (12) to disconnect the lensboard extension shaft (10) from the back support plate 14-. In similar manner, disconnect universal joint on other side of camera rail (5 I.

j. Unclamp flexible rubber hose (12, fig. 1-4J from vacuum back valve housing (1). Then remove eight hex socket head screws (3, fig. 6-17 (and lockwasher (2) to release back support plate (4) and camera back from tube Mange.

k. Remove four screws (3, fig. 6-21) to release chain end cover (1) from camera skid (8). Remove other end of cover at opposite end of skid in similar manner. Remove 16 screws (3), securing chain cover i 4) and lift off cover exposing drive chain (5) and drive sprockets (6 I.

I. Remove setscrew (10, fig. 6-21) from drive sprocket and tap out tapered pin (I) to release jack screw (2). In (similar manner, remove jack screw at other end of camera. Remove drive chain and sprockets from camera skid.

m. Unscrew rear jack screw (13, fig. 6-19) from tube Range (14) and front jack screw (14, fig. 6-17) from tube flange (13). Lift off camera tube and disconnect all wiring.



1. Chain end cover
2. Jack screw
3. Screw, rd hd, 8-32 x ⅜
4. Chain cover
5. Drive chain
6. Drive sprocket
7. Taper pin No. 5 x 2½
8. Camera skid
9. Bearing
10. Setscrew, ¼-20 x ½

Figure 6-21. Drive sprocket and chain, exploded view.

6-44. Camera Rail, Tube, and Drivescrew Cleaning and Inspection

Clean the tube and its front and rear flanges with a brush and cleaning solvent. Clean the camera rail and drivescrews and jack screws with a cloth dampened with cleaning solvent. Clean out dirt impacted in teeth of drive sprocket and between links of drive chain. Brush off dirt on camera skid, and then clean with a brush and cleaning solvent. Inspect the tube for dents and damages, affecting its alinement. Check the tube flanges for cracks and splits in casting. Inspect the rail's bevel edges for wear and corrosion. Examine drivescrews and jack screws for slipped or worn threads and for general wear, affecting their alignment. Check the drive sprockets for broken or worn teeth, and the drive chain for damaged links. Replace defective parts if necessary. Lubricate the drivescrews and jack screw s.

6-45. Camera Rail, Tube, and Drivescrew Installation

a. Installation.

(1) Place and align the tube on the camera skid. Screw the front jack screw (14, fig. 6-17) into the front tube flange (131, and the rear jack screw (13, fig. 6-19) into tube flange (14). Block up or hoist the camera tube to allow for installation of drive chain and sprockets.

(2) With the camera tube suitably raised, lower the jack screw (2, fig. 6-21) until it protrudes through bottom of tube flange. Place the drive sprocket (6) on jack screw and secure with tapered pin (7) and setscrew (10-. Lower the jack screw until its end rests in bearing (9) on camera skid. In the same manner, install other jack screw at opposite end of camera.

(3) Adjust the jack screws so as to provide a uniform lift with each other. Turn jack screws individually, counterclockwise or clockwise, to obtain correct adjustment. Install chain (5, fig. 6-21) on drive sprockets (6l, being careful not to turn jack screws.

(4) Install the camera back by connecting back support plate (4, fig. 6-17) to tube flange by inserting eight hex socket head screws (3) and lock-washers (21. Clamp flexible rubber hose (12, fig. 1-4) onto vacuum back valve housing (1).

(5) Install the truss support assemblies (para 6-41) at both ends of camera.

(6) Screw on copyboard and lensboard drive brackets on the drivescrew. Insert shaft end of drivescrew into front tube flange (13, fig. 6-17); insert other end into flange (14, fig. 6-191. Install other drivescrew on camera, using same procedure.

(7) Connect lensboard extension shaft (10, fig. 6-17) to the back support plate (4) with pin (ll) inserted into universal joint (12). In similar manner, connect extension shaft on other side of rail (5).

(8) Install the camera rail (7, fig. 6-19) on the tube (12) with 26 screws (8). Install limit switch track (9) with six screws (10).

(9) Install the camera drive mechanism (para 6-32).

(10) Install the drive motors (para 4-44. d.).

(11) Install the copyboard carriage assembly (para 6-20. b.) and lenboard carriage assembly (para 6-281. Install the arc lamp arm assembly on the copyboard carriage (para 4-30. f. -.

(12) Attach the bellows to the camera (para 4-37. d. (and install the tube support assembly (para 4-36. d.).

(13 Install thefocusing glass (para 4-34. d.).

b. Calibrating. Calibrate the camera to the lens as detailed in paragraph 5-5.

APPENDIX A

REFERENCES

A-1. Lubrication

C 9100IL	Identification List for Fuels, Lubricants, Oils and Waxes

A-2. Painting

TM 9-213	Painting Instructions for Field Use

A-3. Maintenance

TM 38-750	The Army Maintenance Management Systems
TM 5-3610-220-20P	Organizational Maintenance Repair Parts & Special Tools List for Consolidated Model 1969, Copying Camera, Lithographic
TM 5-3610-220-35P	Direct, General Support (Depot Maintenance Repair Parts (Special Tools List for Consolidated Model 1969, Copying Camera, Lithographic

A-4. Shipment and Storage

TB 740-97-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage
TM 740-93-3	Administrative Storage of Equipment

A-5. Destruction To Prevent Enemy Use

TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance function.

c. Section III lists the special tool. and test equipment required for each maintenance function as referenced from Section II. (Not applicable)

d. Section IV contains supplemental instructions, explanatory notes and / or illustrations required for a particular maintenance function. (Not applicable)

B 2. Explanation of Columns in Section II

a. Group Number, Column (1). The assembly group is a numerical group assigned to each assembly in a top down breakdown sequence. The applicable assembly groups are listed on the MAC in disassembly sequence beginning with the first assembly removed in a top down disassembly sequence.

b. Assembly Group, Column (2). This column contain. a brief description of the components of each assembly group.

c. Maintenance Function`, Column (3). This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

C-Operator or crew
O-Organizational maintenance
F-Direct support maintenance
H-General support maintenance
D-Depot maintenance

The maintenance functions are defined as follows:

A - Inspect. To determine serviceability of an item by comparing it. physical, mechanical, and electrical characteristics with established standards.
B - Test. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.
C - Service. To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.
D - Adjust. To rectify to the extent necessary to bang into proper operating range.
E - Align. To adjust specified variable elements of an item to bring to optimum performance.
F - Calibrate. To determine the correction. to be made in the readings of in-trmnents or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and Adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.
G - Install. To set up for use in an operational environment such a. an emplacement, site, or vehicle.
H - Replace. To replace unserviceable item. with serviceable like items.
I - Repair. Those maintenance operation necessary to restore an item to serviceable condition through correction of material damage or a specific failure. Repair may be accomplished with each category of maintenance.
J - Overhaul. Normally, the highest degree of maintenance preformed by the Army in order to minimize time work in process is consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition e' prescribed by maintenance standards in technical publication. for each item of equipment. Overhaul normally doe. not return an item to like new, zero mileage, or zero hour condition.
K - Rebuild. The highest degree of materiel maintenance. It consists of restoring equipment a. nearly as possible to new condition in accordance with original manufacturing standards. Rebuild i. performed only when required by operational considerations or other paramount factors and then only at the depot maintenance category. Rebuild reduce. to zero the hours or miles the equipment' or component thereof, has been in use.

d. Tool' and Equipment. Column (4). This column is provided for referencing by code the special tools and test equipment, (sec. III) required to perform the maintenance functions (sec. II).

e. Remarks. Column (5). This column is provided for referencing by code the remarks (sec. IV) pertinent to the maintenance functions.

Section II. MAINTENANCE ALLOCATION CHART

(1) Group No	(2) Functional group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild		
01	Vacuum Back Assy								H	F				
	Back Assy Vacuum								H	F				
	Hinge Assy, Back								H	F				
	Lock Assy, Back								H	F				
02	Focusing Glass Frame Assy								H	F				
	Frame Assy	O							H					
	Glass, Focusing	O							O					
	Oscillating Assy, Focusing								F	F				
	Hinge Assy, Frame								F					
	Magnetic Lock Assy	O							O					
	Counter Balance Assy								F	F				
03	Dark Room Frame Assy	O							H					
	Curtain Roller Assys								O	O				
04	Bellows Assy								O	O				
	Bellows,								O	O				
	Carrier Roller Assy	O							O					
	Tube Support Assy								O	O				
05	Arc Lamp Assys								O	F				
	Arc Lamp								O	F				
	Cable, Power								O	O				
	Tie Bar Assy	O							O					
06	Arc Lamp Arm Support Assys								F	O				
	Arm Tie Bar Assy	O							O					
	Arm Assys								F	O				
07	Flash Lamp Assy								O	O				
	Lamp, Flash	O							O					
	Cable, Power	O							O					
08	Lens Board Assy								H	O				
	Lens Assys			C					C	D				
	Shutter Assy								O	O				
	Back Plate Assy								H	F				
	Rack Assy								H	F				
	Mounting Plate Drive Mechanism								H	F				
	Carriage Assy								H	H				
	Switch, Arc Lamp	O							O					
	Switch, Shutter	O							O					
09	Copyboard Assy								H	O				
	Cross Brace Assy	O							F					
	Copyboard Box Assy								F	F				
	Operating Rod Assy								F	F				
	Diverter Valve Plate Assy								F	F				
	Carriage Assy								H	H				
	Switch Vacuum Control	O							O					
10	Transparency Holder Assy								H	O				
	Lamps, Fluorescent	O							O					
	Ballasts, Lamp		F						F					
	Starters, Lamp	O							O					
	Diffusers, Light	O							O					
	Roller Assys, Film	O							O					
	Film Bracket Assys	O							O					
	Switch, Light	O							O					
11	Lensboard and Copyboard Drive Mechanisms	O							H					
	Motors, Drive								F	F				
	Screws, Drive	O							H					
	Shafts, Control	O							H					
	Chains, Counter, Drive	O							H					

Section II. MAINTENANCE ALLOCATION CHART

Group No	(2) Functional group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild		
11	Continued													
	Gears, Drive	O							F					
	Bushings, Screw & Shaft	H							H					
	Switches, Control	O							O					
	Switches, Arc Lamp	O							O					
12	Lensboard and Copyboard													
	Counter Assembly	O							F					
	Counters, Positioning	O							F					
	Switch, Lamp	O							O					
	Lamp, Safe	C							O					
	Receptacle, Lamp	O							O					
13	Transformer Assy		F						F					
	Transformer, Arc Lamp		F						F					
	Bracket Support Assy	O							O					
14	Electronic Sensing Device													
	Assys		F						F					
	Sensing Devices		F						F					
	Cable, Power	F							F					
15	Electronic Filter Assys		F						F					
	Filters		F						F					
	Brackets, Filter	O							F					
	Cable, Power	F							F					
16	Arc Lamp Circuit Breaker													
	Assy		F						F					
17	Main Magnetic Contactor Assy		F						F					
18	Vacuum Turbo-Compressor													
	Assys			C					F	F				
	Compressors, Turbo								F	F				
	Motors, Turbo Drive		F						F	F				
	Mufflers, Compressor	O							O					
	Mounts, Shock	O							F					
19	Camera Rail Assy	O							H	H				
20	Truss Support Assys	O							H	H				
	Jack Screws, Rear & Front	O							H					
	Bearings, Jack Screw	O							F					
21	Camera Tube Assy	O							H					
	Switches, Limit	O							F					
22	Camera, Base Assy									H				
	Chain Drive Screw	O							O					
	Casters, Retracting	O							H	H				
	Turnbuckles, Tiedown	O							O					
	Handle Assys, Lift	O							H					
	Fittings, Lube	O							O					

APPENDIX C

BASIC ISSUE ITEMS

Section I. INTRODUCTION

C-1. Scope

This appendix lists item e which accompany the copy camera or are required for installation, operation or operator's maintenance.

C-2. General

This Basic Issue Items List is divided into the following sections:

a. Basic Issue Items-Section II. A list of items which accompany the copy camera and are required by the operator / crew for installation, operation, or maintenance.

b. Maintenance and Operating Supplies-Section III. A listing of maintenance and operating supplies required for initial operation.

C-3. Explanation of Columns

The following provides an explantion of columns in the tabular list of Basic Issue Items, Section II.

a. Source, Maintenance, and Recoverability Codes (SMR):

(1) Source code indicates the source for the listed item. Source codes are:

Code	*Explanation*
P	Repair parts which are stocked in or supplies from the GSA/ DSA, or Army supply system and authorized for use at indicated maintenance categories.
P2	Repair parts which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
M	Repair parts which are not procured or stocked, but are to be manufactured in indicated maintenance levels.
A	Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies which are not procured or stocked and the mortality of which normally is below that of the applicable end item or component. The failure of such part or assembly should result in retirement of the end item from the supply system.
X1	Repair parts which are not procured or stocked. The requirement for such items will be filled by use of the next higher assembly or component.
X2	Repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain them through cannibalization. Where such repair parts are not obtainable through cannibalization, requirements will be requisitioned, with accompanying justification, through normal supply channels.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above GS and DS level or returned to depot supply level.

(2) Maintenance code indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	*Explanation*
C	Operator / crew

(3) Recoverability code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	*Explanation*
R	Repair parts (assemblies and components) which are considered economically repairable at direct and general support maintenance levels. When the maintenance capability to repair these items does not exist, they are noramlly disposed of at the GS level. When supply considerations dictate, some of these repair parts may be listed for automatic return to supply for depot level repair as set forth in AR ` 10-50. When so listed, they will be replaced by supply on an exchange basis.
S	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically repairable they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts normally are repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, fir high dollar value reusable casings or castings.

Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required. The abbreviation "w / e", when used as a part of the nomenclature, indicates the Federal stock number, includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufactures in parenthesis. Repair parts quantities included in kits, sets, and assemblies are shown in front of the repair part name.

d. Unit of Measure (U/M). A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e. g., ft. ea. pr, etc.

e. Quantity Incorporated in Unit. This column indicates the quantity of the item used in the assembly group. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated (e.g. shims, spacers, etc.).

f. Quantity Furnished With Equipment. This column indicates the quantity of an item furnished with the equipment.

g. Illustration. This column is divided as follows:

(1) *Figure number*. Indicates the figure number of the illustration in which the item is shown.

(2) *Item number*. Indicates the callous number used to reference the item in the illustration.

C-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies-Section III.

a. Component Application. This column identifies the component application of each maintenance or operating supply item.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the item name and brief description.

d. Quantity Required for Initial Operation. This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

e. Quantity Required for 8 Hours Operation. This column indicates the estimated quantities required for an average 8 hours of operation.

f. Notes. This column indicates informative notes keyed to data appearing in a preceding column.

C-5. Supply Code for Manufacturers

Code	*Manufacturer*
28118.....	Helwig Cabbon Products Inc.
83113.....	Consolidated International Corp.
97403.....	Army Engineer Research and Development Laboratories

Section II. BASIC ISSUE ITEMS

(1) SMR code	(2) Federal stock number	(3) Description Ref no & mfr code / Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) Qty furn with equip	(7) Illustration (A) fig no	(7) Illustration (B) Item no
PC	7550-559-9618	Case, Cotton Duck	ea		1		
PC	5120-498-9091	Wrench, Set, open end fixed, C/O 7 wrenches w/roll	ea		1		
PC	4930-253-2478	Grease Gun, hand	ea		1		
PC	5120-322-6010	Screwdriver, 12½" plastic handle	ea		1		
PC	5120-237-7356	Screwdriver, 9-7/8" plastic handle	ea		1		
PC	5120-227-7362	Screwdriver, 1¼" wood handle	ea		1		
PC	5120-595-9244	Key Set, Socket Head Screw, hex drive c/o " wrenches w/roll	ea		1		
PC	4930-266-9182	Can, Oil	ea		1		
PC	7510-889-3494	Book Binder, Log	ea		1		
PC	3610-937-3821	Handle, Crank, Camera bed lift	ea		1		
PC		Dial Indicator and Trammel Assy 2010-114 (83113)	ea		1		
PC	5977-501-3963	Carbon Electrodes, Upper	bx		1		
PC	5977-501-3964	Carbon Electrode, Lower	bx		1		
PC		TM 5-3610-220-14 DA Maintenance Manual	ea		1		

Section III. MAINTENANCE AND OPERATING SUPPLIES

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required F initial operation	(5) Quantity required F/8 hrs operation	(6) Notes
DRIVE SPROCKETS		OIL, LUBRICATING (2) PL-S	AS Req	2 Oz (4)	
FRONT JACK SCREWS		OIL, LUBRICATING (2) PL-S	AS Req	2 Oz (4)	
GEARS, MOTOR TO DRIVE SCREWS		GREASE, AUTOMOTIVE AND ARTILLERY: (3) GAA	AS Req	¼ Lb	
LENS BOARD CARRIAGE WIPERS FRONT AND REAR		OIL, LUBRICATING (2) PL-S	AS Req	2 Oz (4)	
LENS BOARD AND COPY BOARD DRIVE SCREWS		OIL, LUBRICATING (2) PL-S	AS Req	2 Oz (4)	
LENS BOARD HORIZONTAL DRIVE SHAFT		OIL, LUBRICATING (2) PL-S	AS Req	4 Oz (4)	
CAMERA SKID FITTINGS	9150-190-0904(1)	GREASE, AUTOMOTIVE AND ARTILLERY: 1 lb can as Follows. GAA	1 lb		(1) See C9100:1L for additional data and *requisitioning procedure*
COUNTER BALANCED CHAIN	9150-231-6689(1)	OIL, LUBRICATING: GENERAL PURPOSE: 1 qt can as follows PL-S	AS Req	2 Oz (4)	(2) Use oil as prescribed for *counter balance* chain (3) Use Grease as prescribed for camera skid fittings.
COUNTER DRIVE CHAINS AND SPROCKETS		OIL, LUBRICATING (2) PL-S	AS Req	2 Oz (4)	(4) Lubricate with cloth saturated with oil
COPY BOARD FRAME PIVOT		OIL, LUBRICATING (2) PL-S	AS Req	2 Oz (4)	
COPY BOARD CARRIAGE WIPERS		OIL, LUBRICATING (2) PL-S	AS Req	2 Oz (4)	
CROSS BRACE ROLLERS		OIL LUBRICATING (2) PL-S	AS Req	2 Oz (4)	
LENS BOARD VERTICAL DRIVE SHAFT		OIL, LUBRICATING (2) PL-S	AS Req	2 Oz (4)	
LENS BOARD DRIVEN GEARS		GREASE, AUTOMOTIVE AND ARTILLERY (3) GAA	AS Req	¼ Lb	
REAR JACK		OIL, LUBRICATING (2) PL-S	AS Req	2 Oz (4)	
UNIVERSAL JOINTS		OIL, LUBRICATING (2) PL-S	AS Req	2 Oz (4)	

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INDEX- Continued

By Order of the Secretary of the Army:

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