TM 11-2312

WAR DEPARTMENT TECHNICAL MANUAL

CAMERA EQUIPMENT

PH-545/PF

(V-MAIL)

WAR DEPARTMENT • JUNE 1945

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TM 11–2312, War Department Technical Manual, Camera Equipment PH–545/PF (V-Mail) is published for the information and guidance of all concerned.

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DESTRUCTION NOTICE

WHY—To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN—When ordered by your commander.

HOW—1. Smash—Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut—Use axes, handaxes, machetes.

3. Burn—Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives—Use firearms, grenades, TNT.

5. Disposal—Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT

WHAT—1. Smash—Camera, power control unit, tripod, and easel.

2. Cut—Power cord, interconnecting cord, flood lamp cord, foot switch cord, and converter cord.

3. Burn—Carrying cases, all film, documents, and records.

4. Bend—Tripod assembly.

5. Bury or scatter—all remains.

DESTROY EVERYTHING

SAFETY NOTICE

The voltages used in this equipment are sufficiently high to endanger human life. Precautions must be taken to avoid contact with high voltages.

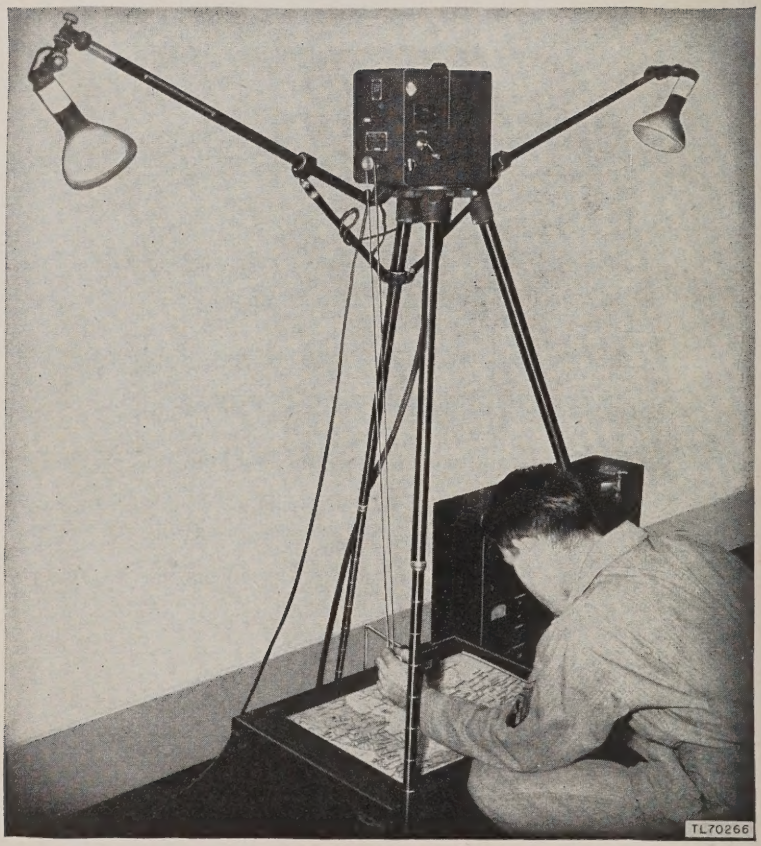


Figure 1. Camera Equipment PH-545/PF in operation.

PART ONE

INTRODUCTION

Section I. DESCRIPTION

1. General (fig. 1)

Camera Equipment PH–545/PF (V-Mail) is a semiautomatic, portable, document-copying set for recording documents on 35- or 16-mm perforated or unperforated photographic film. The unit operates on 115-volt alternating current or 115-volt direct current when used with a converter. The equipment consists of a camera (Recordak film unit model E), a tripod and easel assembly, reflector flood lamps, a light meter, a foot switch, and a power control unit. The automatic camera is electrically operated and photographs small documents placed horizontally on an easel attached to the tripod base, or larger documents mounted vertically on a wall support.

2. Application

Camera Equipment PH–545/PF is designed for copying documents on film. It can be used to copy any type of document, map, or chart which can be accommodated by the 22½- by 33½-inch easel. When using 35-mm unperforated film for horizontal operation, documents up to 37½ by 52½ inches can be recorded. When 16-mm unperforated film is used for vertical operation, the camera can copy any document up to 10½ by 27 inches. Documents up to 17 by 45 inches can be copied when the unit is used horizontally. In Photomail stations, the equipment is used to supplement recorders which record V-Mail letters. Recorders cannot be used for maps, charts, official documents and other materials which differ in size from the standard V-Mail letter. Kodacrome film can be used in the camera to photograph documents in full color. The portability of the equipment makes it possible to move it easily from one location to another. This is particularly useful in the event that the secret nature of documents to be copied prohibits their transfer. The entire unit can be set up for operation in 10 or 15 minutes.

3. Carrying Cases

The two carrying cases shown in figure 2 are made of wood and are covered with imitation leather.

a. Camera Carrying Case (fig. 3). The camera carrying case measures 8 by 20 by 27 inches and weighs approximately 75 pounds when

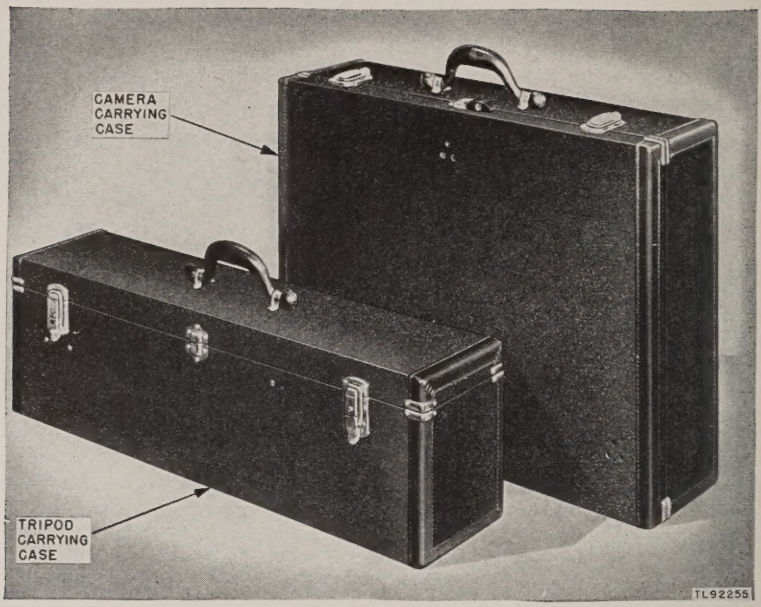


Figure 2. Carrying cases closed.

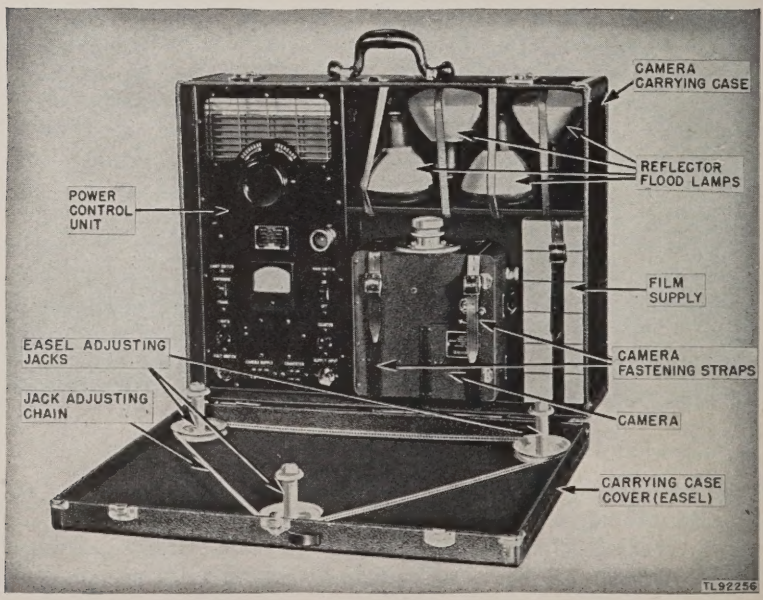


Figure 3. Camera carrying case open, showing contents packed.

packed. The case cover, when removed, forms the easel or copy holder for the equipment. The power control unit occupies about one-third of the case interior. The remainder of the space is divided into two compartments. The upper compartment provides carrying facilities for the four reflector flood lamps and the lower compartment accommodates the camera and a supply of film. Straps, fastened to the case, secure the camera in place.

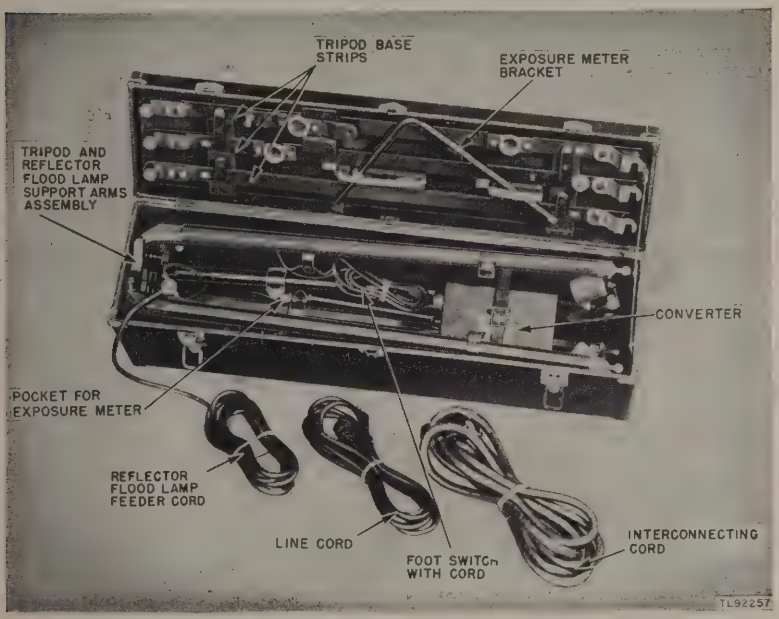


Figure 4. Tripod carrying case, packed.

b. Tripod Carrying Case (fig. 4). The tripod carrying case measures 8 by 10 by 32 inches and weighs approximately 50 pounds when packed. The three iron base strips which form the triangular tripod support are clamped to the underside of the case lid. The L-shaped exposure meter bracket also is attached to the lid. The tripod with attached reflector flood lamp support arms, is carried in the case. A converter for d-c operation, and various feeder cords also are packed in the tripod carrying case.

4. Camera (figs. 5 and 6)

The body of the camera consists of a block-shaped metal casting 9 inches high, 9½ inches wide, and 5½ inches deep. For descriptive purposes, the film compartment side of the camera will be referred to as the front. This is the side viewed by the operator when the equipment is set up for

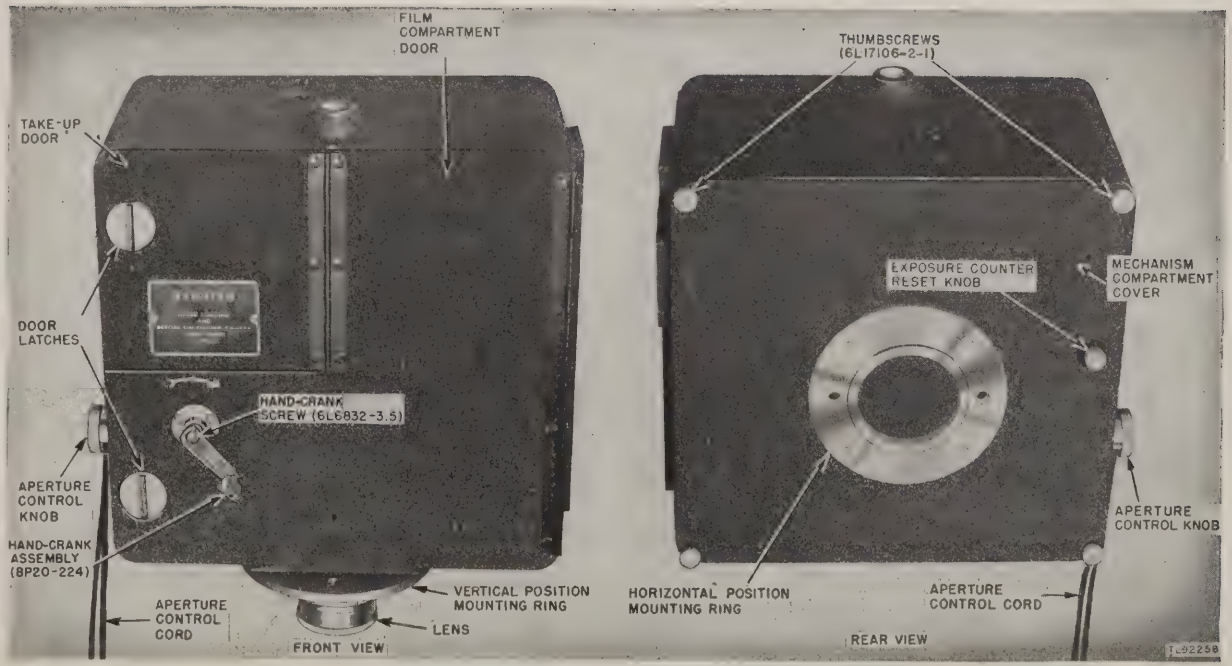


Figure 5. Recordak model E camera, front and rear views.

vertical operation as shown in figure 1. The bottom of the camera accommodates the lens. The back of the camera is fitted with a tripod head mounting ring used for horizontal operation. The right side holds the interconnecting cord and the left side is equipped with an aperture control knob, an exposure counter, and a footage indicator. A solid metal partition divides the camera into a front and rear compartment.

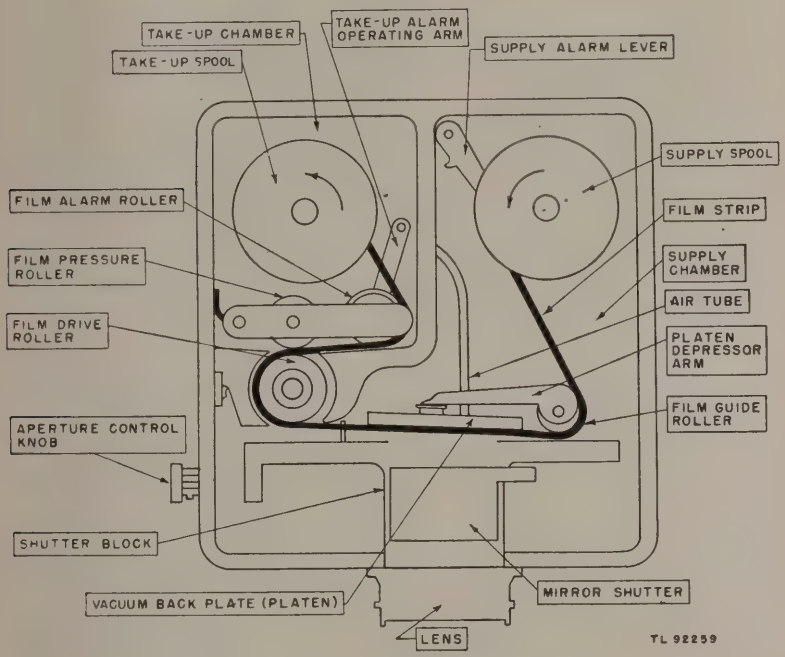


Figure 6. Diagram of camera film compartment.

a. Film Compartment (fig. 7). The film compartment is 2¼ inches deep and is divided into two chambers; the supply chamber and the take-up chamber. The supply chamber contains the supply spool and the vacuum platen. The take-up chamber houses the take-up spool and the film take-up rollers. The film unrolls from the supply spool in a counterclockwise direction to pass around a film guide roller and under the vacuum platen. The platen holds the film in the focal plane of the path of light coming from the lens. An intermittent alarm will sound on the buzzer if the film is not tracking properly under the platen. After passing under the vacuum platen, the film runs around a film drive roller. A pressure roller holds the film against the drive roller. The strip of film next passes around an alarm roller and winds on the take-up spool in a counterclockwise direction. The alarm roller rides on the loop of film

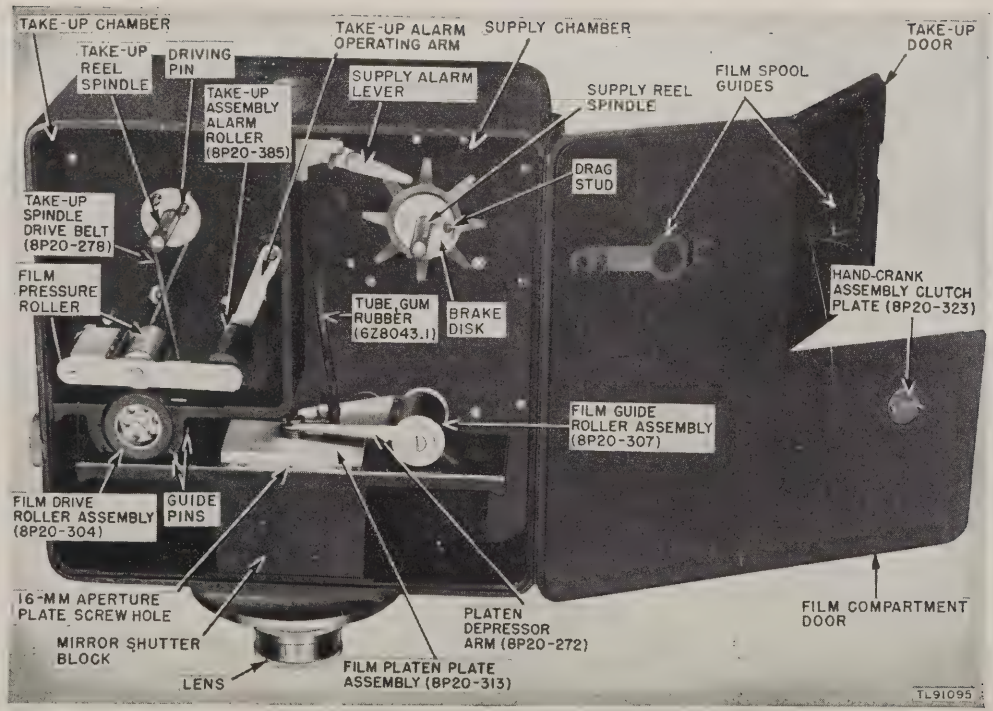


Figure 7. Camera, with film compartment doors open.

just before it is wound on the take-up spool. Should the film break, this roller will drop, closing a circuit and sound the alarm buzzer. Another alarm is incorporated in the film feed system, and is actuated by a lever riding on the film at the supply spool. This alarm lever sounds the buzzer when the supply of film is exhausted, and also operates a meter showing the amount of film on the supply spool. A cast hollow block, mounted in the camera housing, incloses the mirror shutter and forms a lighttight space between the film and the lens. The film compartment door is made

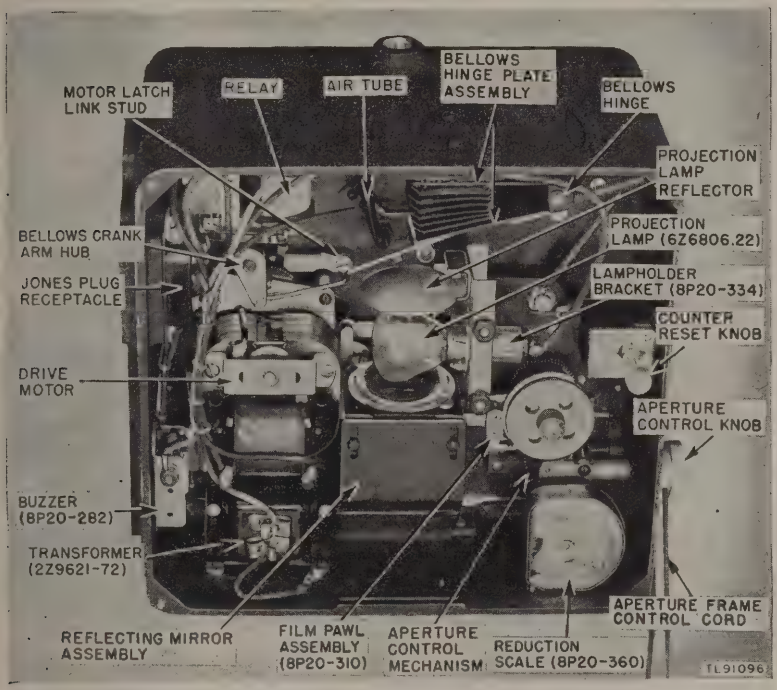


Figure 8. Recordak model E camera, showing interior of mechanism compartment.

in two sections. This makes it possible to open either the entire film compartment or just that part of the compartment housing the take-up spool. It is possible, in this way, to remove the exposed film without disturbing the remainder of the unexposed stock. If only the take-up door is open, the unexposed film stock will be safely protected from light. A hand crank (fig. 5) is mounted on the hinged cover to advance the film manually when space must be allowed between the end of one microfilming job and the beginning of the next. The winding crank also is used to take up the leader at the beginning of a fresh spool of film and to take up the trailer at the end of a completed spool.

b. Mechanism Compartment (fig. 8). This compartment is 3 inches deep and is covered by a metal plate fastened to the camera case by four knurled thumbscrews. (See fig. 5.) Centered on the cover is a tripod mounting ring, used when the camera is in a horizontal position. The exposure counter reset knob protrudes through this cover. When the camera is in its usual position with the lens pointed downward for vertical operation, the bellows which creates the vacuum for the platen is found in the upper right corner of the compartment. To the left of the bellows is the motor control relay which starts the camera drive motor. Left of the relay is the 6-wire Jones plug receptacle. Below the camera drive motor is the alarm buzzer transformer which supplies 8-volt alternating current for the alarm system. Beneath the motor control relay and in the lower left corner is a table motor or counter switch which controls an electric exposure counter. This counter switch is used only when the camera is in a permanent installation, and does not operate when the camera is used with Camera Equipment PH–545/PF. Mounted approximately in the center of the compartment is the projection or finder lamp, and the visual finder optical system which enables the operator to judge the camera field of view. The lamp projects a rectangular light beam on the easel which has markings to indicate the photographic field for the various films used in the camera. The levers and gears which operate the aperture control mechanism are in the lower section of the compartment. The aperture control knob extends outside the case. Directly above the shaft of this knob is the film pawl assembly. The alarm buzzer is located near the bottom of the compartment, on the left side. A flexible steel reduction scale, coiled in a housing, is located in the lower right corner. The tape is calibrated in reduction factors to correspond with similar markings on the camera lens.

5. Tripod and Easel Assembly

The tripod and easel for Camera Equipment PH–545/PF are integral parts of the focusing system and are designed to form a rigid unit for the camera. A triangular-shaped base furnishes three secure footholds for the tripod legs and serves as a base for the easel.

a. Base (figs. 9 and 13). The base is made up of three metal strips with tripod sockets at the corners to support the legs of the tripod. Mounted on the base are three threaded jack sockets to accommodate the easel support jacks. The easel rests within the tripod legs when the unit is set up.

b. Tripod (figs. 10 and 11). The tripod is of tubular construction, each leg being made up of two telescoping members. Each of the tripod legs is calibrated in reduction factors so that the camera may be set at the height of any desired reduction, from 18 to 10 diameters. The lower extremeties of the tripod legs are shaped to fit in the sockets at

the corners of the base. The upper ends of the legs are set in the sockets of the cast metal tripod head assembly which is designed to accommodate either of the two camera tripod mounts. Hinged to the tripod head assembly are two reflector flood lamp supporting arms. Their degree of elevation is adjustable by means of a sliding clamp on the rear leg of the tripod. The extension cords which supply current to the reflector flood lamps are encased in the tubular lamp-supporting arms.

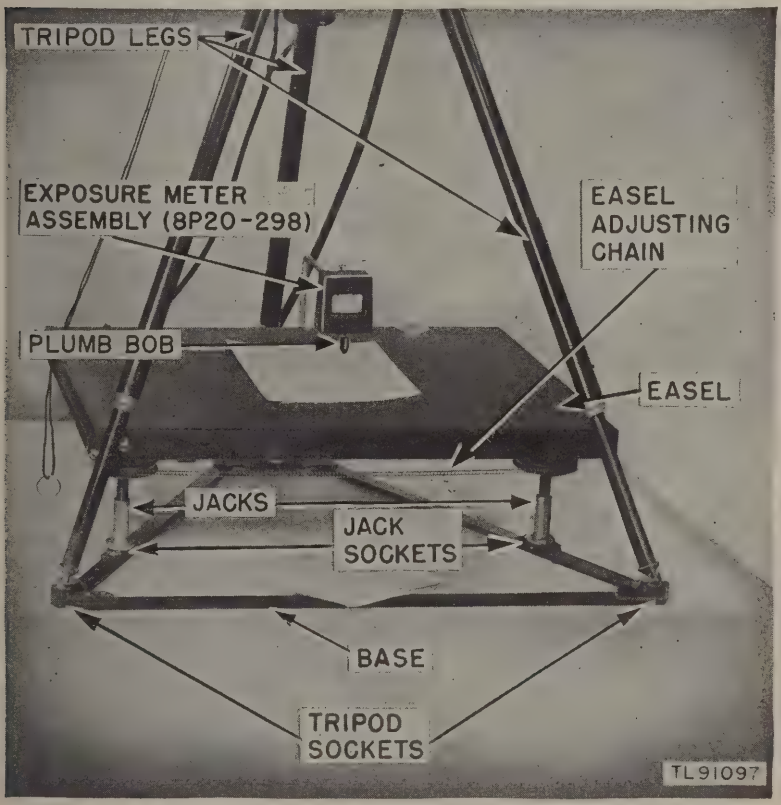


Figure 9. Tripod and easel assembly.

c. Easel (figs. 9 and 13). The cover of the camera carrying case, (fig. 3) forms the easel of the camera. Fastened to the inside of the cover with elevating screws are three supporting jacks, connected together with an easel adjusting chain. All three jacks are raised or lowered simultaneously by the movement of the chain. When the easel is set in position over the base, the jacks lock down over the threaded jack sockets. The light meter is mounted on a bracket which extends from the base of

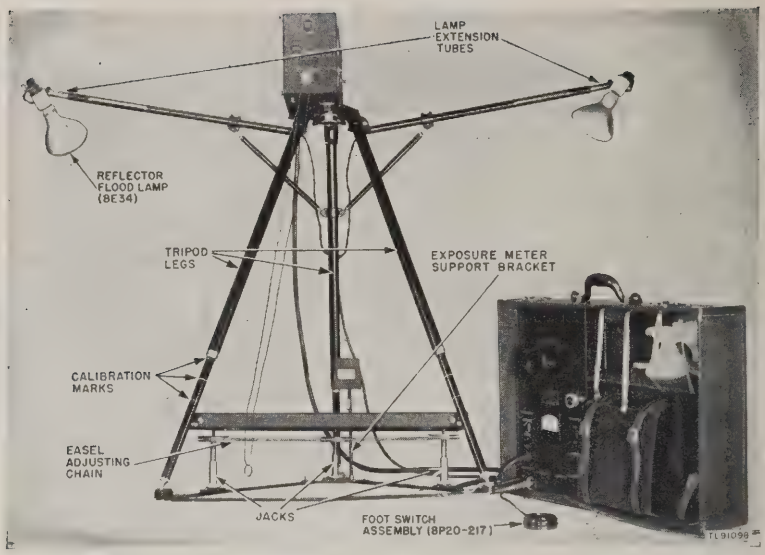


Figure 10. Tripod.

the tripod and swings into position directly over the easel when in use. A plumb bob suspended from this meter bracket is used to gauge the height of the easel.

6. Power Control Unit (fig. 12)

The power control unit of Camera Equipment PH–545/PF measures 10 by 19 inches and is built into the left section of the camera carrying case. (See fig. 3.) The top of the panel is fitted with a grill to provide ventilation for the flood lamp rheostat which is operated by a control knob.

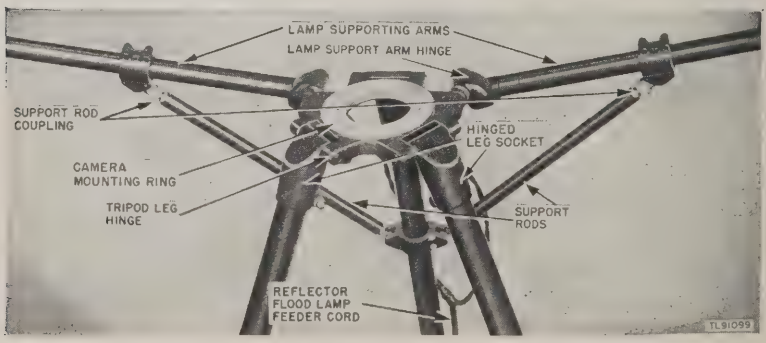


Figure 11. Detail of tripod head and lamp-supporting arms.

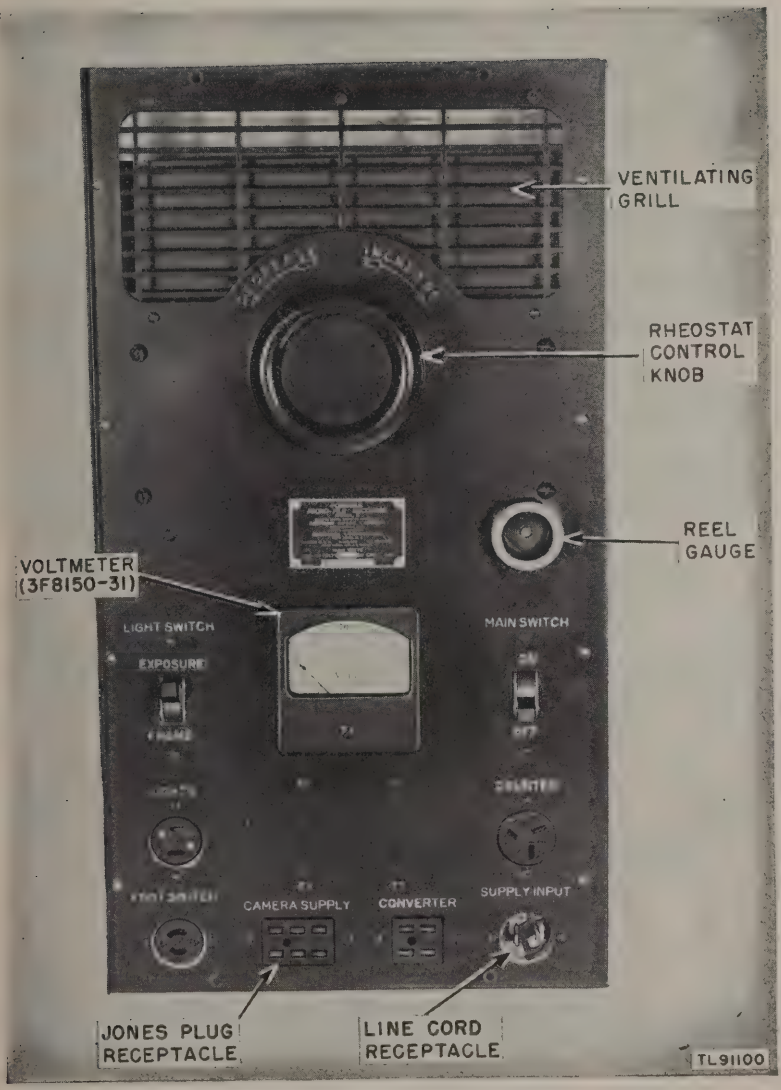


Figure 12. Panel of power control unit.

Directly beneath the rheostat control knob on the panel is the manufacturer's nameplate giving the power requirements for the equipment. To the right of the rheostat is a spool gauge used for testing film take-up spools before placing them in the camera. This gauge tests both 35- and 16-mm spools. Directly beneath the nameplate is the voltmeter which reads the line voltage of the reflector flood lamp circuit. To the left of the voltmeter is a double-throw toggle switch marked LIGHT SWITCH. When thrown to EXPOSURE, the switch lights the reflector flood lamps. When thrown to FRAME, the switch lights the finder lamp inside the camera. Below the toggle switch is a receptacle marked LIGHTS. The reflector flood lamp feeder cord is plugged into this receptacle. Below the reflector flood lamp outlet is another receptacle marked FOOT SWITCH into which the foot switch cord is plugged. To the right of the foot switch receptacle is a 6-pronged Jones plug receptacle marked CAMERA SUPPLY. This receptacle accepts the 6-wire interconnecting cord which connects the camera to the power unit. To the right of the Jones plug receptacle is a 4-prong receptacle marked CONVERTER. This plug is used when operating the unit on direct current. The converter, when plugged into this outlet, draws direct current out of two prongs and feeds alternating current to the power unit through the other two prongs. To the right of the converter outlet is the SUPPLY INPUT receptacle into which the main line cord of the equipment is plugged. Above the input receptacle is the COUNTER receptacle used for feeding an electric counter when the camera is used in a permanent installation. Since no electrical counter is included in the portable outfit, this receptacle is not used with Camera Equipment PH–545/PF. Above the electric counter receptacle is the MAIN SWITCH, controlling the entire power unit. All the components of the power control unit are fastened to the rear of the control panel. (See fig. 27.)

Section II. INSTALLATION AND ASSEMBLY

7. Uncrating and Unpacking

Camera Equipment PH–545/PF is packed in two wooden cases for oversea shipment. One shipping case measures 33 by 25 by 12 inches and weighs 110 pounds. It contains the camera carrying case. The second case measures 33 by 15 by 12 inches and weighs 78 pounds. It contains the tripod carrying case. Uncrate the equipment by first opening the sides of the cases marked OPEN, being careful not to damage the carrying cases. The carrying cases may be lifted easily from the packing crates.

a. Camera Carrying Case (fig. 3). To unpack camera carrying case, proceed as directed below.

(1) Unsnap the cover clasps, open the cover, and remove it from the camera case.

(2) Unbuckle the camera-retaining straps and remove the camera from the carrying case.

(3) Unsnap the lamp-retaining tapes and remove the lamps.

(4) Unbuckle the film retaining strap and remove the film cartons if the case is stocked with film.

b. Tripod Carrying Case (fig. 4). To unpack the tripod carrying case, proceed as directed below.

(1) Unsnap the cover clasps and open the cover.

(2) Turn the retaining bars and remove the tripod base strips and the exposure meter bracket from the case cover.

(3) Remove the cables from the case.

(4) Unbuckle the converter-retaining strap and remove the converter.

(5) Remove the tripod assembly.

(6) Remove other parts as required.

8. Checking (figs. 3 and 4)

Consult figures 3 and 4 for the proper placement of parts in the camera and tripod carrying cases.

a. Camera Carrying Case. Check the contents of the camera carrying case for the following components.

(1) One case cover (easel) detachable.

(2) One camera, Recordak film unit model E.

(3) Four reflector flood lamps.

(4) Supply of film (if stocked).

b. Tripod Carrying Case. Check the contents of the tripod carrying case for the following components.

(1) Three tripod base strips.

(2) One exposure meter bracket.

(3) One line cord.

(4) One foot switch cord with foot switch attached.

(5) One interconnnecting cord.

(6) One converter for d-c operation.

(7) One tripod and reflector flood lamp support arm assembly, complete with reflector flood lamp feeder cord.

(8) One exposure meter.

(9) One box containing 16-mm conversion parts (two spool spacers; two spring film spool guides; one 16-mm aperture plate and retaining screw; and one 16-mm platen plate assembly).

9. Installation

Camera Equipment PH–545/PF may be installed on the floor or on a sturdy table. Care must be taken, however, to see that the room lighting

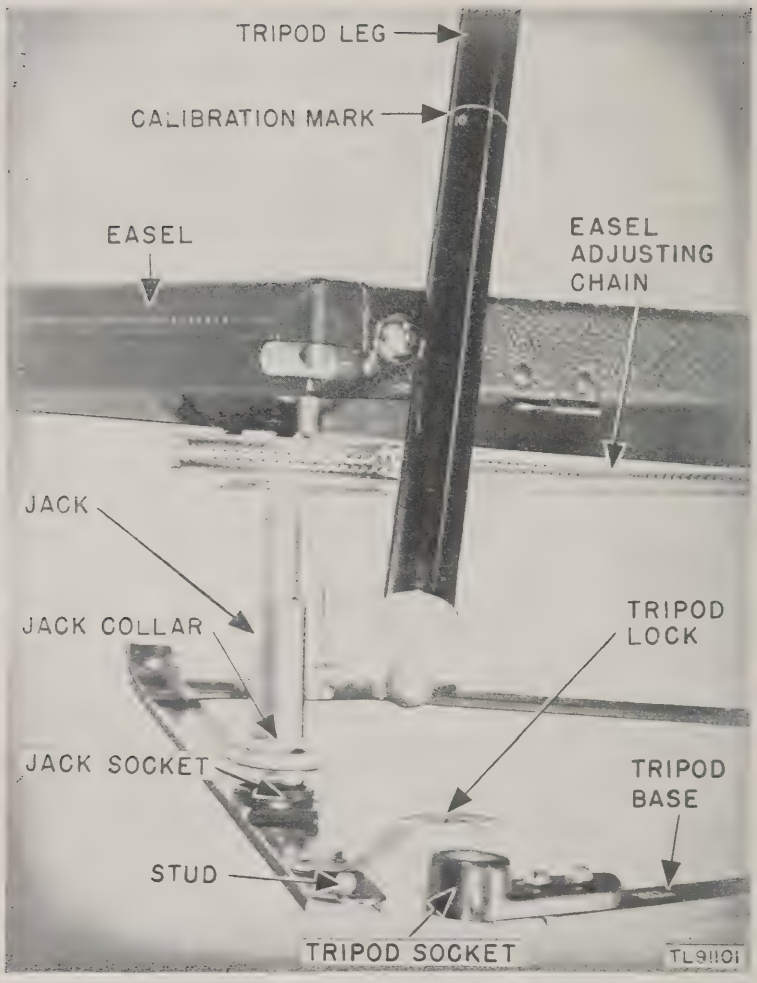


Figure 13. Detailed view of tripod base, easel, and easel jack.

does not throw bright spots or cast shadows on the copy being photographed.

10. Assembly of Equipment for Vertical Operation

a. Triangular Base (figs. 9 and 13). Lay out the tripod base strip marked FRONT RIGHT and FRONT LEFT. Fasten the other two strips according to the markings found on their ends, by fitting the tripod sockets over the studs found under the tripod locks. Swing the rear jack

socket on its movable arm until the arm can be held by a stud at the rear of the right strip. Snap the tripod locks into position to hold the tripod base together.

b. Easel (fig. 13). Place the cover of the large carrying case on the table with the hinged edge toward the front and three jacks projecting upward. Shorten the jack by turning the chain clockwise as far as it will go. Check each jack to see that it is as short as possible. Turn the previously assembled tripod base upside down and place it so that the three jack sockets are over the three jacks. Turn each jack slightly until it is seated in its socket. Screw the collars of each jack into the thread of its base socket. Turn the unit over so that the tripod base rests on the table and the case cover forms the copy holder, or easel, as shown in figure 9.

c. Tripod. Extend the tripod assembly legs by turning each leg counterclockwise. Set each leg at the same reduction figure, as indicated by the calibrations etched on the legs. Lock the legs in position by turning each leg clockwise. Place the tripod on the triangular base, being sure that the leg with the reflector flood lamp-supporting arms is at the rear. Set the tripod legs in position and swing the tripod locks into place. Extend the lamp-supporting arms to the position shown in figure 11. Attach the braces to the locking nuts, and screw the reflector flood lamps into their holders. Connect the reflector flood lamp feeder cord to the receptacle on the control panel marked LIGHTS.

d. Camera. Place the camera on the camera mounting ring of the tripod head with the lens projecting through the hole in the center of the camera mounting ring. (See fig. 11.) Do not remove the cover from the lens or jar the camera in any way. Turn the camera slightly on the tripod head until the knurled screws engage the two sockets on the underside of the camera. Tighten these screws. With the loading door to the front, the camera is now mounted in the normal operating position.

e. Exposure Meter. Slip the L-shaped exposure meter bracket through the hole found at the rear of the easel and insert the bottom of the bracket in the bearing of the tripod base. (See fig. 10.) Set the exposure meter into the bracket as far as it will go, and tighten the knurled screw to hold it in place.

11. Interconnections for Vertical Operation

a. Alternating Current. Insert the Jones plug of the interconnecting cord into the receptacle provided on the right edge of the camera and connect the other end of the cord to the CAMERA SUPPLY receptacle on the control panel. Connect the foot switch cord to the receptacle marked FOOT SWITCH on the control panel and place the switch in a convenient position. This switch may be operated by either hand or foot pressure. Plug the line cord into a 115-volt, a-c power source and plug the other end of the cord into the SUPPLY INPUT receptacle. Plug

the reflector flood lamp feeder cord into the receptacle on the control panel marked LIGHTS. Check to see that all cords are properly connected, and then remove the lens cap and the equipment is ready for initial adjustments.

b. Direct Current. Make all the connections described in *a* above, with the exception of the line cord. Plug the line cord into a 115-volt, d-c power source and into the receptacle in the control panel marked SUPPLY INPUT. Place the converter near the equipment so that the converter connecting cord can reach the control panel. Plug the 4-contact Jones plug of the converter cord into the receptacle on the panel marked CONVERTER.

12. Remounting Camera for Horizontal Operation
(figs. 17 and 18)

The greatest reduction possible with the camera in a vertical position is 18 times. Reductions from 19 to 30 times must be made by placing the

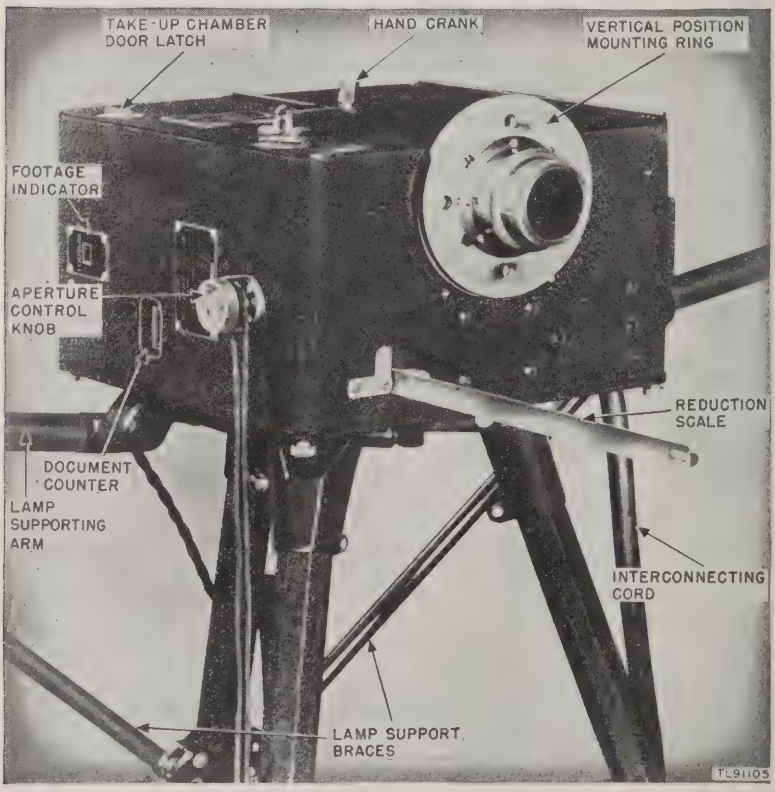


Figure 14. Camera mounted horizontally.

document on a wall and remounting the camera in a horizontal position, as shown in figure 17. To remount the camera for horizontal operation, proceed according to the directions given below.

a. Remove the Jones plug from the camera and remove the camera from the tripod.

b. Keeping the tripod in place, move the tripod base to a position about 7 feet from the wall on which the document is to be mounted.

c. Reinstall the camera on the tripod head in a horizontal position, using the horizontal position mounting ring on the camera rear.

d. Adjust the camera position so that the axis of the lens is perpendicular to the plane of the wall.

e. Insert the Jones plug into its receptacle on the camera.

f. Turn the LIGHT SWITCH to the FRAME position and project the rectangle of light on the wall.

g. Adjust the position of the tripod and camera so that the field of view for the film being used will accommodate the document to be copied. Be sure that the illuminated field is squared on the wall.

h. Fasten the document to the wall in the proper position as indicated by the projection light.

13. Repacking (Figs. 2, 3, and 4).

a. Dismantling Equipment. (1) Disconnect the line cord, interconnecting cord, and foot switch cord. Coil all cords for packing as shown in figure 4.

(2) Remove the exposure meter from the bracket. Remove the bracket.

(3) Install the lens cap on the camera lens and remove the camera from the tripod head.

(4) Disconnect the lamp feeder cord from the control panel, remove the reflector flood lamps, and lower the lamp support arms.

(5) Open the tripod base locks and lift the tripod clear of the base.

(6) Telescope the tripod legs.

(7) Turn the tripod base and easel upside down and unscrew the jack collars.

(8) Turn the chain clockwise to shorten the jacks.

(9) Install the cover on the camera carrying case.

(10) Disassemble the tripod base.

b. Repacking Tripod Carrying Case. (1) Place the exposure meter and foot switch in their tripod carrying case pockets.

(2) Set the tripod and reflector flood lamp support arms assembly in the tripod carrying case.

(3) If the converter has been used, place it in the tripod case, strapping it into place.

(4) Place the various coiled cords in the case, packing them in between the tripod legs.

(5) Fit the three strips of the tripod base into place in the cover of the tripod case and turn the clamp bars to hold the strips in place.

(6) Set the exposure meter support bracket in place across the strips in the cover. Fasten the bracket in place and close the tripod carrying case.

c. Repacking Camera Carrying Case. (1) Set the camera in place in the camera carrying case with the lens uppermost. Fasten the camera holding straps.

(2) Fit the two reflector flood lamps in place above the camera. Make sure that the fastening straps hold the lamps securely.

(3) Place the boxes of film in the compartment to the right of the camera. Fasten them with the strap provided.

(4) Make sure that the reel gauge is clipped into place on the control panel.

(5) Close the camera carrying case.

Note. For instructions to prevent use of this equipment by the enemy, see the destruction notice in the front of this manual.

Section III. STEP-BY-STEP OPERATING PROCEDURE

14. Checking Alarm Buzzer

Before loading the camera, make sure that the alarm system is in operating condition. To check the alarm system, proceed as follows:

a. Move the MAIN SWITCH to the ON position.

b. Move the LIGHT SWITCH to the EXPOSURE position. The alarm buzzer should sound.

15. Positioning Easel for Vertical Operation (fig. 9)

The easel must be positioned properly before any document is photographed. To do this, place the document on the easel so that it is centered under the camera lens. If the copy consists of a single sheet of paper, make sure that it is flat on the easel. If the pages of a book are being photographed, flatten them as much as possible and, if necessary, hold the edges down with weights or cellulose tape. With a document in position, swing the exposure meter bracket arm over the copy. The suspended plumb bob should just touch the copy when the easel is in the proper plane. If the bob does not reach the copy, or if the document is too close to the bob, reach under the base and move the easel adjusting chain until the bob just touches the copy. Swing the exposure meter bracket arm back until it reaches its stop. The camera now may be focused properly on the copy plane at any desired reduction.

16. Selecting Film Size

Before any document can be photographed, the operator must determine the amount of reduction necessary to fit the document to the film area. The amount of reduction will vary with the size of the film used. 35-mm film will give the greatest negative area and should be used when the amount of reduction is great or when the fine detail in the copy must be preserved. When the amount of reduction is not great, or when there are no fine details to be preserved, 16-mm film is recommended. The equipment is designed so that adequate results up to 30-diameter reductions may be obtained with either film size. The quality of the work, however, decreases as the reduction ratio increases. Documents copied at a reduction of 30 diameters will be of poorer quality than work copied at a

773346°—48——4

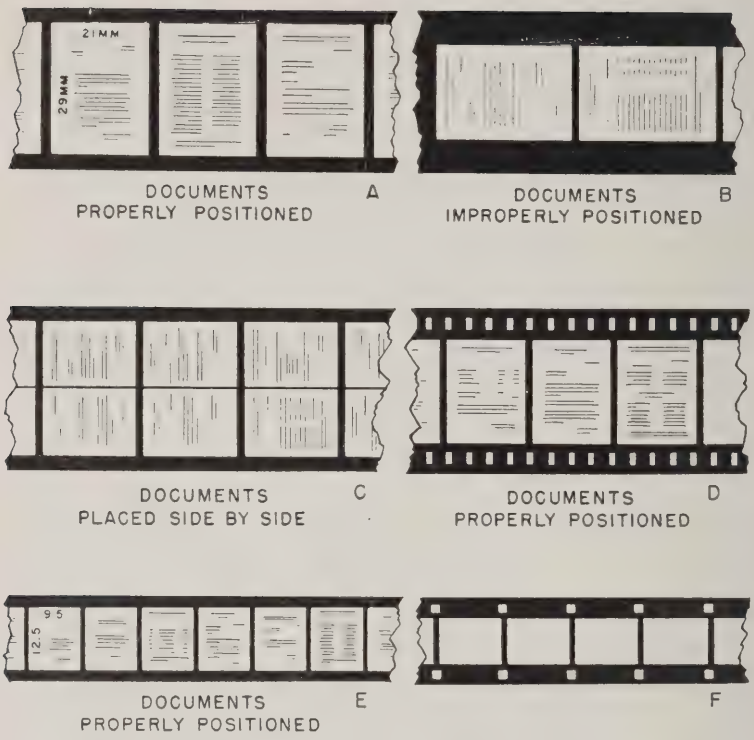


Figure 15. Various methods of document positioning.

reduction of 15 diameters. Therefore, the importance of the work involved will govern the choice of film.

17. Converting Camera To 16-MM (fig. 7)

To convert the camera for 16-mm use, proceed as directed below.

a. Open the take-up and film compartment doors of the camera and loosen the two screws on the left side of each of the two film spool guides. These guides are located on the inside of the door.

b. Swing both guides upward and remove them from the door. Place them in the accessory case.

c. Install the two 16-mm spool guides. These 16-mm spool guides project further than the 35-mm spool guides.

d. Remove the air tube from the platen.

e. Slide the platen to the left to disengage it from the platen depressor arm.

Caution: Care should be taken to protect the optically flat surface of the platen from damage. When not in use, the platen should be kept in the 16-mm conversion parts box in the tripod case.

f. Remove the 16-mm aperture plate from its box and set it in position in the camera directly over the mirror shutter block.

g. Insert the 16-mm aperture plate retaining screw through the small hole in the front of the plate and tighten the screw.

Note. The retaining screw is stored in the center of the conversion parts box in the tripod case.

h. Set the 16-mm platen into position by engaging the platen screw in the slot of the platen depressor arm.

i. Connect the air tube to the 16-mm platen.

j. Install the machined spacers on the supply and take-up spindles and rotate the spacers until they engage the driving-pins on the spindle assemblies.

k. Install a 16-mm take-up spool.

Caution: In adjusting the aperture to suit the size of the copy, the operator must use the 16-mm markings projected by the projection lamp.

18. Selecting Reduction Factor for Vertical Operation

There are two methods of determining the reduction factor.

a. Trial and Error. Trial and error is an accurate but rather slow method for determining the reduction factor. Move the LIGHT SWITCH of the power control unit to the FRAME position and then move the MAIN SWITCH to ON. The projection lamp inside the camera will light. Care must be taken, however, not to use the projection lamp unnecessarily. Excessive use will overheat the camera. If the camera is loaded with 35-mm unperforated film, the guide lines so marked enclose the area covered by the camera at any particular setting. If the copy extends beyond these largest guide lines, it will be necessary to raise the camera to get the document within the finder area limits. Raise the camera by unlocking the leg locks and extending the legs one at a time. To avoid tipping the unit, never extend a tripod leg more than two divisions at any one adjustment. Raise the camera until the width of the copy just fits within the projected finder markings. At this setting it may be discovered that the long dimension of the area being photographed is larger than the copy size. If this is the case, adjust the

aperture by manipulating the aperture frame control cord which is looped over the aperture control knob (see fig. 8.) Figure 15 shows various methods of document positioning.

b. Mathematical Calculation. (1) The reduction factor can be determined mathematically by dividing the dimensions of the copy by 32 millimeters, the usable width of unperforated 35-mm film. If 16-mm film is used, divide the copy dimensions by 12 millimeters, the usable width of unperforated 16-mm film. For example, if an 8—by 10½-inch document is to be copied on 35-mm unperforated film, and the document is

APPROXIMATE FIELD SIZE REDUCTION TABLE
FOR CAMERA EQUIPMENT PH-545/PF

16-mm.	Perforated Film		Unperforated Film		35-mm.	Perforated Film		Unperforated Film	
Aperture Size	Length 1.50"	Width .50"	Length 1.50"	Width .59"	Aperture Size	Length 1.75"	Width .94"	Length 1.75"	Width 1.25"
Reduction	FIELD SIZES IN INCHES				Reduction	FIELD SIZES IN INCHES			
8	12.00	4.00	12.00	4.72	8	14.00	7.52	14.00	10.00
9	13.50	4.50	13.50	5.31	9	15.75	8.46	15.75	11.25
10	15.00	5.00	15.00	5.90	10	17.50	9.40	17.50	12.50
11	16.50	5.50	16.50	6.49	11	19.25	10.34	19.25	13.75
12	18.00	6.00	18.00	7.08	12	21.00	11.28	21.00	15.00
13	19.50	6.50	19.50	7.67	13	22.75	12.22	22.75	16.25
14	21.00	7.00	21.00	8.26	14	24.50	13.16	24.50	17.50
15	22.50	7.50	22.50	8.85	15	26.25	14.10	26.25	18.75
16	24.00	8.00	24.00	9.44	16	28.00	15.04	28.00	20.00
17	25.50	8.50	25.50	10.03	17	29.75	15.98	29.75	21.25
18	27.00	9.00	27.00	10.62	18	31.50	16.92	31.50	22.50
19	28.50	9.50	28.50	11.21	19	33.25	17.86	33.25	23.75
20	30.00	10.00	30.00	11.80	20	35.00	18.80	35.00	25.00
21	31.50	10.50	31.50	12.39	21	36.75	19.74	36.75	26.25
22	33.00	11.00	33.00	12.98	22	38.50	20.68	38.50	27.50
23	34.50	11.50	34.50	13.57	23	40.25	21.62	40.25	28.75
24	36.00	12.00	36.00	14.16	24	42.00	22.56	42.00	30.00
25	37.50	12.50	37.50	14.75	25	43.75	23.50	43.75	31.25
26	39.00	13.00	39.00	15.34	26	45.50	24.44	45.50	32.50
27	40.50	13.50	40.50	15.93	27	47.25	25.38	47.25	33.75
28	42.00	14.00	42.00	16.52	28	49.00	26.32	49.00	35.00
29	43.50	14.50	43.50	17.11	29	50.75	27.26	50.75	36.25
30	45.00	15.00	45.00	17.70	30	52.50	28.20	52.50	37.50

Field size dimensions shown are nominal, and are subject to ±2% variation.

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Figure 16. Reduction factor table.

placed as shown in figure 15A, convert 10½ inches into millimeters (multiply by 25, there being approximately 25 millimeters in 1 inch). To obtain the reduction factor, divide the result, 262.5 millimeters, by 32, the usable width in millimeters. In this case, the reduction factor is 8.5. It is impractical to use fractions in reduction factors, so the operator should choose the next higher factor which, in this case, is 9. If the tripod legs and the camera lens are both set at 9, the document will fit on the film and be in proper focus. After these adjustments have been

made, turn on the projection lamp and center the document in the field of view. Adjust the aperture until the lighted rectangle accommodates the document.

(2) The reduction factor table (fig. 16) is compiled by mathematical calculation. All of the possible reduction factors are given so that the operator will not be required to make lengthy computations. For example, if an 8- by 10½-inch document is to be copied on 35-mm unperforated film, and the copy is placed as shown in figure 15A, the operator will find in the column marked width, the nearest number that will accommodate 10½-inch paper safely. In this case, it will be the second figure in the width column, or 11¼ inches. In line with this figure in the reduction column, the factor is given as 9. If a document to be copied is 11 by 14 inches in size, the same reduction factor could be used if the copy were placed with the 11-inch side running across the width of the film. The length column in the table shows that a reduction factor of 9 will accommodate a document 11¼ inches across and 15¾ inches along the film. An inspection of the projection light beam will show that the aperture should be reduced to the 14-inch length of the document in order to conserve film. A 22- by 28-inch document should be copied at a reduction ratio of 18. This aperture size will accommodate an area of 22⅕ by 31½ inches.

19. Selecting Reduction Factor for Horizontal Operation (fig. 17)

a. Pull out the steel reduction scale until it touches the positioned document on the wall.

b. Read the amount of reduction on the steel reduction scale at the point where it leaves the camera.

c. Set the camera lens to the reduction factor value read on the scale.

d. Push the reduction scale back into its case, being careful not to damage or kink the steel tape.

20. Adjusting Illumination for Vertical Operation (fig. 28)

The reflector flood lamps must be adjusted to give uniform illumination over the entire surface of the copy. Normal adjustment is obtained when the index marks on the swivel lamp socket are opposite the dots on the other half of the swivel. The lamps should be kept in pairs so that both lamps in use at any one time have seen the same amount of service. Unequal lighting will result in unequal density of the developed film. To check for even illumination, place a large piece of white paper on the easel. Remove the exposure meter from its support arm and place it in the center of the easel with the cell window down. Move the LIGHT SWITCH on the control panel to the EXPOSURE position and turn the MAIN SWITCH to ON. Adjust the reflector flood lamp rheostat

knob until the meter reads 10 scale units. Without changing the rheostat setting, move the exposure meter to each corner of the easel. Readings at the corners should be between 12 and 12½ units. If the lamps do not give these readings on the exposure meter, the lamp position should be readjusted.



Figure 17. Camera Equipment PH–545/PF set up for horizontal operation.

21. Adjusting Illumination for Horizontal Operation (fig. 17)

a. Adjust the reflector flood lamps so that they are horizontal and pointing toward the document to provide uniform illumination.

b. Remove the exposure meter from its support and hold it approximately 4 inches from the document with the cell window of the meter toward the wall.

c. Hold the meter in hand and adjust the reflector flood lamp illumination as described in paragraph 20.

d. Turn the rheostat knob until the proper exposure meter reading, as determined by previous exposure tests, is attained.

c. When the lights are properly adjusted, proceed to make the exposure in the usual manner.

22. Loading Film (figs. 6 and 7).

Caution: Film used with this camera is so sensitive to light that, from the time a film can is opened until the film is placed in the camera and the doors closed, it must be handled so that it does not unwind.

Open both doors of the camera film compartment. Remove a can of unexposed film from its carton and remove the adhesive tape from the can. With all lights off, lift the film from the can and pull off the paper tape which binds the film. Remove all traces of tape from the film. Save the carton, can, and black paper to rewrap the film after it has been exposed. Move the supply alarm lever down to the left and place the supply spool on the supply spindle. Be sure that the hole near the spool center fits over the drag stud on the spindle brake disk. If the spool does not fit evenly on the disk, remove it and replace it on the spindle with the other side out. It will fit only one way. Allow the supply alarm lever to move back and rest on the film in the spool. Unwind about 18 inches of film and pass it around the flanged film guide roller and then, between the aperture plate and the film platen plate. Pass the film between the two guide pins, then raise the film pressure roller frame and place the film around the film drive roller and under the take-up alarm roller. The edge of the film should be lined up with the edge of the pressure roller. Close and lock the large door of the film compartment. Test the take-up spool with the reel gauge by placing the gauge between the flanges and moving it completely around the spool. Do not force it against the core of the spool. If, at any point, the gauge is held so tightly that it does not fall out of its own weight, use another spool which tests satisfactorily. Enter the film end into the slot of the take-up spool and revolve the spool several turns in a counterclockwise direction. Place the spool on the take-up spindle so that the two holes on one side of the spool flange engage the two driving pins. Turn the spool in a clockwise direction until the film is loose around the alarm roller. Close and lock the small door. If the doors do not close easily, check the supply and take-up spools. *Do not force the doors.* Move the LIGHT SWITCH on the control panel to the EXPOSURE position and turn the MAIN SWITCH to ON. Press the foot switch momentarily to make one exposure. During the exposure, the alarm bell should ring because the film is loose around the alarm roller. Push in the hand crank on the camera door and give it eight clockwise turns to wind up the leader. Actuate the foot switch again to make another exposure. During this exposure, the alarm bell should not ring because the film now has been pulled tightly around the alarm roller. If the alarm bell rings during the second exposure, see the trouble chart in paragraph 42.

23. Test Exposures

The camera has a fixed lens aperture and a fixed shutter speed. The only means of varying the exposure is to vary the light intensity. This is done by adjusting the rheostat on the control panel. For ordinary work with a white background, the background density of the film should be between 1.1 and 1.3. To determine the proper rheostat setting, it is necessary to make a series of tests. Place a large sheet of white paper on the easel and set the camera for a reduction factor of 14. Swing the exposure meter out over the center of the sheet of paper on the easel. Adjust the rheostat until the exposure meter reads 2. Then swing the meter back out of the way. With a soft black pencil, write the exposure meter reading on a 2-inch square of paper and lay the piece of paper in the center of the easel on the large sheet of paper. Actuate the foot switch to make one exposure. Mark another 2-inch square of paper with the figure 2½ and set it on the easel in place of the first square. Swing

EXPOSURE RECORD (MICROFILE E NO. 2)

DATE	SIZE OF DOCUMENT	COLOR OR TONE OF BACKGROUND	TYPE OF FILM	REDUCTION FACTOR	LIGHTMETER READING	BACKGROUND DENSITY	QUAL.
4 JAN	8 1 0 2	white	DB	9	2.	85	Thin
5 JAN	8 1 0 2	white	DB	9	2.75	1.16	OK
6	8 1 0	white	DB	8	3.	1.26	OK
6	20 x 26	yellow - white	DB	16	3 25	1.12	OK
7	11 1 6	white	DB	13	2. 75	1.22	OK
7	8 1 0 2	grey white	DB	9	3.50	1 10	OK
7	8 1 6	white	DB		2.75	1.08	OK

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Figure 18. Example of exposure record.

the exposure meter over the easel and readjust the rheostat until the meter reads 2½. Make a second exposure. Continue this process until exposures have been made at each half unit on the scale from 2 through 10, as indicated on the exposure meter. When all of these exposures have been made, remove the film from the camera, as directed in paragraph 26b, and have it developed under standard conditions. When the processed film is dry, read the background density on a densitometer. If graybase film has been used, those frames showing a density range of from 1.3 to 1.4 have been properly exposed and the light readings, as indicated on the frames, may be used as a guide for subsequent copying. If dyeback film has been used, those frames showing a density range of from 1.1 to 1.2 have been exposed properly and the light values indicated on the frames may be used as a guide in constructing an illumination exposure chart. An exposure record should be made for each type of copying done on the machine, showing the date, size of document, color, reduction factor, and

exposure meter reading. This information will increase in value with time and will be a definite aid in future tests and in trouble shooting. An example of this record is shown in figure 18.

Note. Compensation for line voltage fluctuations should be made by the operator by adjusting the lamp rheostat to provide the proper lamp voltage to maintain the required light intensity.

24. Setting Equipment in Operation

a. Set the exposure counter to zero.

b. Remove the lens cap.

c. Turn the LIGHT SWITCH to FRAME.

d. Place the document on the easel, making sure that it is flat and free from folds.

Note. Arrange torn or damaged documents to appear as natural as possible, and insert a sheet of dark paper beneath the document to show the outline of the original document. Documents with holes or missing portions should be backed with white paper before being copied. Repair torn documents with transparent tape whenever necessary.

e. Center the copy in the rectangle of light so that it falls within the guide lines which denote the field of view for the type of film being used. If a number of documents of the same size are to be photographed, mark the position of the first document with adhesive tape as an aid to positioning the succeeding documents.

f. Check the lens focus to coincide with the tripod leg calibration.

g. Actuate the foot switch to make a single exposure.

Note. The foot switch should be depressed just long enough to start the camera cycle of operation. In operation, the camera is distinctly audible. The operator should release the foot switch as soon as the drive motor in the camera is heard to start. If the foot switch is held too long, the camera automatically will take a second picture of the same document.

h. After the exposure has been made and the drive motor has advanced the film automatically, remove the document from the easel and place the second document in position.

i. Continue this procedure until all of the documents have been photographed, or until the warning buzzer indicates that the film supply has been exhausted.

j. If the supply of film has been exhausted, remove the take-up spool from the camera, as described in *26a* below.

k. If the work is completed before the film supply is exhausted and another series of documents is to be photographed on the same roll of film, turn the winding crank one complete revolution. This will advance the film approximately 4 inches and leave a blank space to separate the two job lots.

25. Indications of Normal Operation

a. Control Panel and Light System. When the reflector flood lamps, foot switch, line cord, and camera have been properly connected

to the control panel, the voltmeter should register when the MAIN SWITCH is turned to ON. When the LIGHT SWITCH is turned to FRAME, the projection lamp within the camera should light. When the LIGHT SWITCH is turned to EXPOSURE, the reflector flood lamps should light. When the rheostat control knob is turned clockwise, the voltage, indicated by the voltmeter, should increase and the reflector flood lamps brighten.

b. Camera. When the foot switch is actuated, the operator will hear first a slight hum, and then the sound of the shutter opening and closing. The hum will continue until the film is advanced. At this point, the camera becomes completely silent and remains silent until the foot switch is actuated to start another cycle. During normal operation with film in the camera, the buzzer should not sound. If the buzzer does sound, check the footage indicator on the camera. If the indicator registers empty, turn the MAIN SWITCH to OFF and reload the camera as described in paragraph 22.

26. Unloading Camera

a. Film Supply Completely Exhausted. (1) When the warning buzzer sounds and the footage indicator registers empty, turn the winding crank at least eight times to make sure that all of the film is wound on the take-up spool.

(2) Release the latches and open both film compartment doors.

(3) Remove the take-up spool, being sure to keep the film wound tightly on the spool.

(4) Wrap the film in black paper. Place it in the film can and place the can in its original carton.

(5) Mark the necessary identification on the outside of the carton and send it to the processing laboratory for developing.

b. Unexposed Film Remaining on Supply Spool. (1) Turn the film winding crank eight times to provide a film leader for the spool.

(2) Open the small or take-up door of the film compartment. Do not open the large door.

(3) Cut the film between the film alarm roller and the take-up spool. Be sure to keep the film on the spool from unwinding.

(4) Remove the take-up spool and wrap as described in *a* above.

(5) Place an empty take-up spool on the take-up spindle. Attach the film to the spool by inserting it in the slot and turning the spool approximately two revolutions counterclockwise.

(6) Close the small door to the film take-up chamber and turn the film winding crank three complete revolutions. The camera now is ready for further operation.

27. Shutting Down Equipment (figs. 3 and 4)

a. When the equipment is to be shut down for long periods of time, the equipment should be disassembled and repacked as directed below.

(1) Remove the exposed film from the camera as described in paragraph 26*a*.

(2) In subdued light, remove the unexposed film from the camera. Be careful to hold the film tightly on the spool to avoid fogging. Wrap the film in black paper, place it in the film can and place the can in its carton. Note on the outside of the carton the approximate number of feet on the spool, as indicated by the footage indicator before the film was removed from the camera. Allow approximately 3 feet for the film leader.

(3) Disassemble the equipment and repack as described in paragraph 13.

b. When the equipment is to be shut down for a few hours or for overnight, it need not be disassembled.

(1) Remove the exposed film from the camera as described in paragraph 26*a*.

(2) Disconnect the line cord from the control panel and from the power supply receptacle. Disconnect the foot switch from the power supply. Disconnect the lamp feeder cord from the power supply, and disconnect the interconnecting cord from the camera and from the power supply.

(3) Coil all cords and place them on the easel.

(4) Move the camera carrying case near the tripod and cover the camera, tripod, and camera carrying case with a cloth or paper to protect the components from dust.

Note. The unexposed film need not be removed from the camera if the equipment is to be shut down for a very short period of time.

PART THREE

PREVENTIVE MAINTENANCE

Section IV. PREVENTIVE MAINTENANCE TECHNIQUES

28. Meaning of Preventive Maintenance

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment, to eliminate major break-downs and unwanted interruptions in service, and to keep the equipment operating at top efficiency. To understand what is meant by preventive maintenance, it is necessary to distinguish between preventive maintenance, trouble shooting, and repair. The prime function of preventive maintenance is to prevent break-downs and, therefore, the need for repair. On the other hand, the prime function of trouble shooting and repair is to locate and correct existing defects. The importance of preventive maintenance cannot be overemphasized.

Note. The operations in sections IV, V, and VI are first and second echelon (organization operators and repairmen) maintenance.

29. General Inspection

In order to insure long life and trouble-free operation, the equipment should be inspected for cleanliness and serviceability at regular intervals.

a. Weekly Inspection. Set up the equipment and make the necessary connections as described in paragraphs 10 and 11. Check for indications of normal operation as described in paragraph 25, and inspect the various items listed below.

(1) Open the doors to the film compartment and check the interior for cleanliness and indications of rust. Check to see that the levers and rollers move freely.

(2) Check for proper tension on the supply alarm lever, the take-up alarm lever, and the pressure roller arm.

(3) Inspect the air hose for a proper connection to the platen.

(4) See that the platen is properly attached to the platen depressor arm.

(5) Inspect the spring belt of the take-up spindle to see that it is not worn or stretched.

(6) Check the film spool guides to see that they have not become flattened.

(7) Remove the camera from the tripod, set it to one side, and inspect the tripod head for indications of rust or corrosion.

(8) Inspect the surface of the camera mounting ring and inspect the threads of the camera mounting bolts on the underside of the ring.

(9) Check to see that the screws of the lamp-supporting arm braces

are tight and that the clamping screw in each tripod head leg socket is tight enough to hold the leg securely.

(10) Check the swivel adjustments of the reflector flood lamp holders to see that the swivel turns easily and can be locked securely in place. Check to see that the extensions of the lamp-supporting arms operate easily.

(11) Check the leg adjustment to see that each leg will release and lock properly, maintaining its setting.

(12) Check the tripod locks and jack collar to see that they are in good operating condition. Examine the threads for evidences of rust or corrosion.

(13) Check the condition of the control panel to see that the panel is securely fastened to the camera carrying case. If the panel or the carrying case show any evidence of corrosion or fungus growth, remove the control panel from the case as described in paragraph 45. Examine the electrical parts inside the case.

(14) Examine all cords for evidence of fraying or broken wire. Check to see that the plug terminals are not corroded.

b. Lubrication. In addition to the weekly inspection procedure outlined in *a* above, the equipment should be lubricated as prescribed by the War Department Lubrication Order. (See figs. 31 and 32.)

Section V. ITEMIZED PREVENTIVE MAINTENANCE

30. Common Materials Needed

The following materials must be on hand before performing preventive maintenance: supply of lintless cloth, crocus cloth strips, lens tissues, Oil, Lubricating, Preservative, Special (PS), Solvent, Dry-Cleaning (SD), and Compound, Moisture and Fungus-resistant, Leather Treating.

31. Detailed Instructions for Performing Preventive Maintenance (figs. 3, 4, 7, and 8)

a. Carrying Cases. The carrying cases are integral parts of the equipment and must be cared for as thoroughly as the mechanical and optical parts of the set.

(1) The exterior of the cases should be kept clean, and handled carefully to keep the covering from being cut or torn. Wash the exteriors occasionally with mild soap and water and, after drying well, apply the leather-treating moisture- and fungus-resistant compound. This will prevent the cover from cracking. To prevent the latches and hinges from rusting and corroding, clean them with a cloth lightly dampened in preservative lubricating oil (PS). Wipe off all excess oil.

(2) The interiors of the cases are divided into felt-lined compartments

to accommodate the various parts of the equipment. Dust the felt frequently. Wash the leather retaining straps occasionally with saddle soap to keep them soft and pliable. To insure the security of the equipment during transit, tighten the screws that hold the equipment-retaining latches. Should the lining of the cases become torn, repair the tear immediately.

b. Camera. The camera is a precision instrument and must be handled with care to avoid damaging the lens, film advance mechanism, or any of its component parts.

(1) *Film compartment.* The film compartment must be kept free of dust and accumulated emulsion shreds which may collect gradually at points where the film is drawn over the stationary surface. Carefully dust the entire interior of the film compartment with a camel's hair brush, blow the loosened material from the compartments with an air syringe. The supply alarm lever rides on the emulsion side of the film and may collect a deposit of emulsion which eventually will harden and scratch the film. Clean the end of the supply alarm lever at frequent intervals to remove accumulated emulsion. Use a soft, lintless cloth lightly dampened with water, and dry the arm thoroughly. Using a water-dampened cloth, clean the film guide roller, the film drive roller, the film alarm roller, and the film pressure roller. Dry well. When the interior has been cleaned, remove the air tube from the platen and remove the platen from the platen depressor arm. Clean the grooved surface of the platen with a damp cloth to remove any particles of emulsion or gelatin adhering to the surface. Hardened accumulations of emulsion that have lodged in the grooves may be removed with an orange stick or a sliver of soft wood. While the platen is removed, clean the upper surface of the lens with a camel's hair brush and an air syringe. The lens must not be removed from the camera but the lower surface of the lens should be cleaned with lens tissue. The lens should be capped whenever the camera is not in use.

(2) *Mechanism compartment.* Inspect the interior of the mechanism compartment every 6 months for evidences of corrosion and dust. The dirt and dust should be loosened with a camel's hair brush, and blown out with an air syringe. Dry-cleaning solvent will aid in removing any oily deposits. Remove the projection lamp, and clean the upper surface of the condenser lens with lens cleaning tissue. Replace the lamp and remove all fingerprints with lens tissue. Check the other mechanism components for unusual conditions, but do not disturb any parts that operate properly and appear normal. Clean the cover carefully before reinstalling it on the mechanism compartment. The reduction scale should be inspected readily for damage, kinks, and cleanliness.

c. Tripod and Easel Assembly. The tripod and easel must be kept clean and dry.

d. Connecting Cords and Plugs. The various cords should not be coiled tightly enough to crack the insulation or kink the cords. Keep

the cords away from oil and water, and clean them with a damp cloth. Do not remove a plug from a receptacle by pulling on the cord itself. Examine the contact blades of the plugs to be sure that they are not corroded. Remove any traces of corrosion by polishing with crocus cloth, and cleaning thoroughly with a dry cloth.

32. Preventive Maintenance Check List

Item	Par. ref.	Operation	Agent	Weekly	Each 6 mos.
Carrying cases	31a	Clean.	Cloth, moisture and fungus - resistant compound for leather	X	..
Camera film compartment	31b (1)	Clean.	Camel's hair brush and air syringe	X	..
Film Rollers	31b (1)	Clean.	Water-dampened, lintless cloth	X	..
Supply alarm lever	31b (1)	Clean.	Water-dampened, lintless cloth	X	..
Platen	31b (1)	Clean.	Water-dampened, lintless cloth, and orange stick	X	..
Lens (external surface only)	31b (1)	Clean.	Lens tissue	X	..
Camera mechanism	31b (2)	Clean.	Camel's hair brush, air syringe, lintless cloth, dry-cleaning solvent (SD)	..	X
Projection lamp	31b (2)	Clean.	Lens tissue	..	X
Reduction scale	31b (2)	Clean.	Dry cloth	X	..
Tripod and easel	31c	Clean.	Cloth	X	..
Connecting cords	31d	Clean.	Damp cloth	X	..
Cord plugs	31d	Clean.	Crocus cloth	..	X

33. Necessary Precautions During Preventive Maintenance

The camera is a complex precision instrument and care must be taken during cleaning to avoid bending any of the connecting levers in the mechanism compartment. The cover of the mechanism compartment should never be removed unless the room is reasonably free from dust. When cleaning the upper surface of the camera lens, the finder aperture must be opened to its widest dimension so that the aperture plates are out of the way and safe from damage.

Section VI. LUBRICATION

34. War Department Lubrication Orders

War Department Lubrication Orders are illustrated, numbered, and dated cards or decalcomania labels which prescribe approved first and second echelon lubrication instructions for mechanical equipment which requires lubrication by using organizations. Current War Department Lubrication Orders which are available are listed in the latest edition of FM 21–6. Lubrication orders should be requisitioned in conformance with instructions and lists in FM 21–6, which is published monthly by The Adjutant General.

35. Compliance with War Department Lubrication Orders

Instructions contained in War Department Lubrication Orders are mandatory and supersede all conflicting lubrication instructions of an earlier date. Applicable War Department Lubrication Orders which are available will be obtained, carried with the equipment at all times, and fully complied with. Difficulties experienced in obtaining and complying with such orders will be reported through technical channels to the Commanding General, Army Service Forces, Attention: Maintenance Division.

36. Location of War Department Lubrication Order for Camera Equipment PH–545/PF (figs. 31 and 32)

a. The War Department Lubrication Order for Camera Equipment PH–545/PF will remain with the equipment at all times.

b. Figures 31 and 32 and facsimiles of the War Department Lubrication Order for Camera Equipment PH–545/PF.

Note. The official nomenclature of the equipment was changed after the War Department Lubrication Order was prepared.

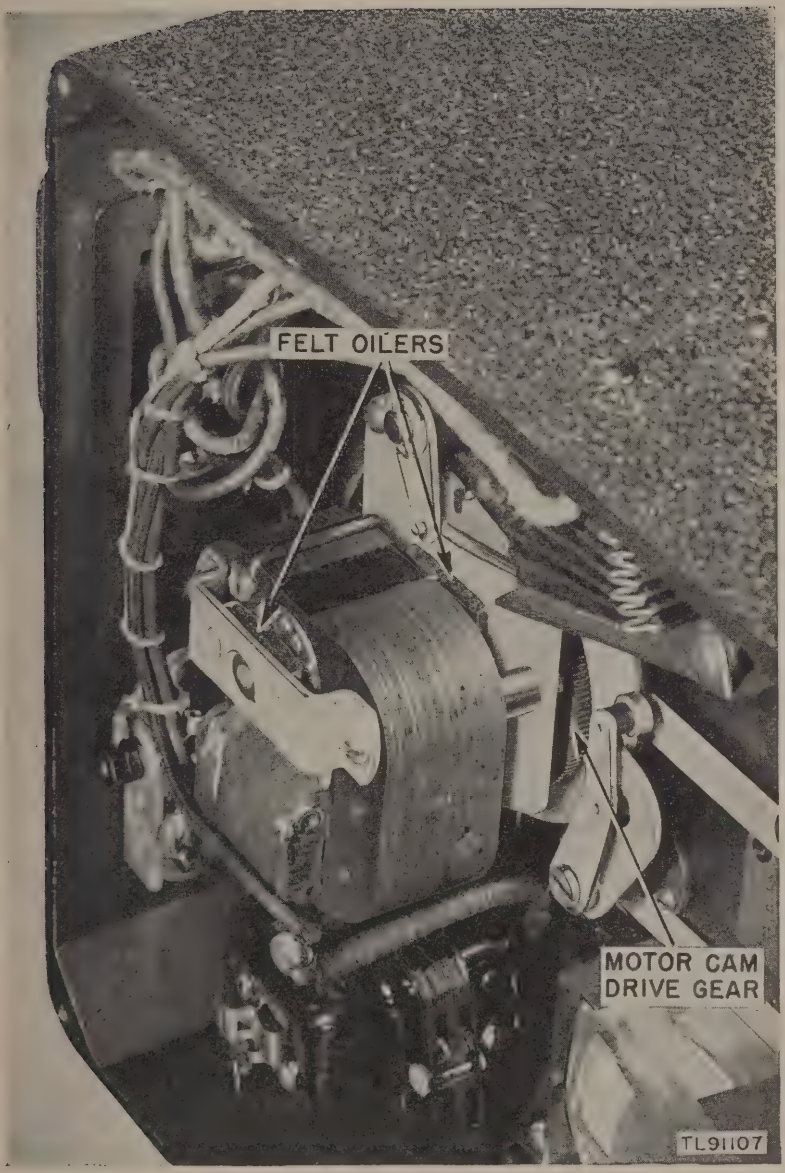


Figure 19. Detailed view of motor showing felt oilers.

PART FOUR

AUXILIARY EQUIPMENT

(Not used)

PART FIVE

REPAIR INSTRUCTIONS

Note. Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on WD AGO Form 468 (Unsatisfactory Equipment Report); by Army Air Forces, on Army Air Forces Form 54 (Unsatisfactory Report). If either form is not available, prepare the data according to the sample form reproduced in figure 30.

Section VII. THEORY OF EQUIPMENT

37. Electrical, Optical, and Mechanical Design of Camera Equipment PH–545/PF

a. Electrical System (fig. 20). The electrical system of Camera Equipment PH–545/PF was designed for rapid installation and simple operation, and contains protective devices to guard against improper usage. The control panel mounts all of the necessary electrical controls, thus permitting easy voltage adjustments on quick switches from FRAME to EXPOSURE. To simplify maintenance or repair work, the electrical equipment can be removed from the camera carrying case by merely removing the panel. All of the equipment is mounted on the back of the panel, and is entirely free of any connections with the case itself. The various cords terminate in plugs designed so that it is impossible to insert a plug in the wrong receptacle. The mechanism in the camera will operate on alternating current only, but a power converter is supplied for us with direct current. A blocking capacitor, connected in series with the input circuit, protects the electrical equipment in case it should be inadvertently attached to direct current. This capacitor prevents the passage of direct current to the control relay, but permits it to pass directly to the reflector flood lamps which operate on either alternating or direct current. The relay shunts the direct current to the 4-prong converter receptacle where the direct current enters the converter through two contacts. It leaves the converter as alternating current through the second pair of contacts. This alternating current then returns to the relay to feed the drive motor and the transformers of the equipment. Incorporated in the camera is an alarm system consisting of an 8-volt buzzer and a small transformer which supplies the buzzer with current. The three alarm contacts are connected in parallel so that actuation of any one of them will sound the buzzer.

b. Optical System (fig. 21). The optical system of the camera has been designed so that the camera lens is used not only for photographing

the document, but also for projecting a rectangle of light which indicates the exact field of view of the camera at any distance from the easel. To accomplish this, a projection lamp is incorporated in the camera. Light beams from the lamp pass through a condenser lens, strike a 45° angle mirror, and pass through a sheet of glass. The sheet of glass is etched with lines to represent the film areas of the four film sizes which can be

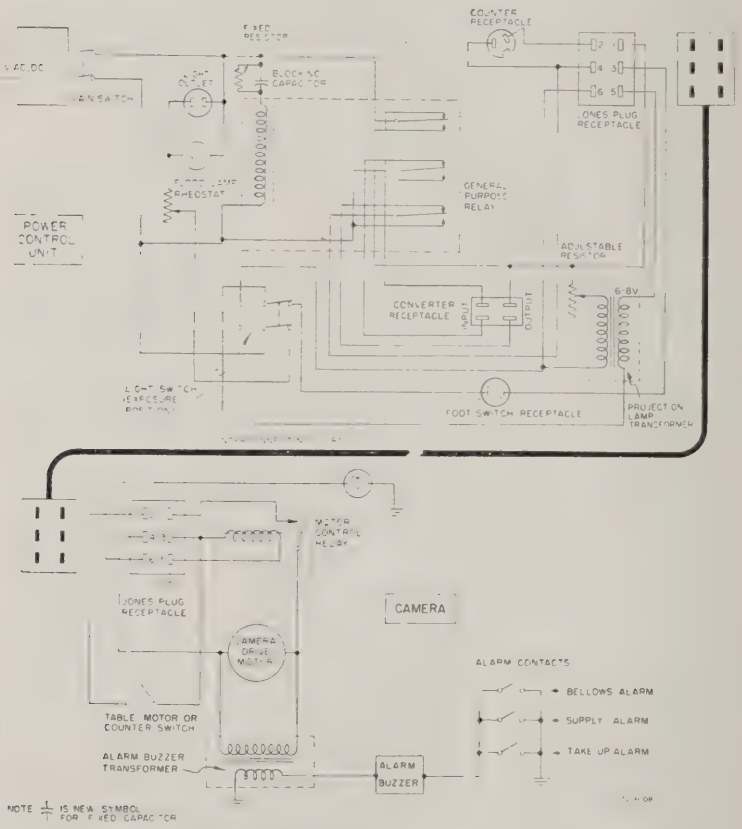


Figure 20. Wiring diagram of Camera Equipment PH–545/PF.

used with the camera. The light beams pass through the etched glass and strike a second 45° angle mirror which reflects the light down through the camera lens to the easel. The second 45° mirror also serves as the shutter of the camera. When the cycle of operation starts, the mirror moves to permit the light from the document to reach the film strip which is directly above the lens. After approximately 4/10 second, when the exposure has been completed, the mirror shutter moves back

to block the patn of light to the film. At the same time, tne shutter positions itself to reflect the projection lamp light down on the easel when the finder lamp is lighted by the LIGHT SWITCH on the control panel.

c. Mechanical Design. The general mechanical design of Camera Equipment PH–545/PF is to provide a lightweight, portable, microfilming equipment that packs into two carrying cases. The equipment, when set up for operation, is rigidly assembled to make precision negatives of

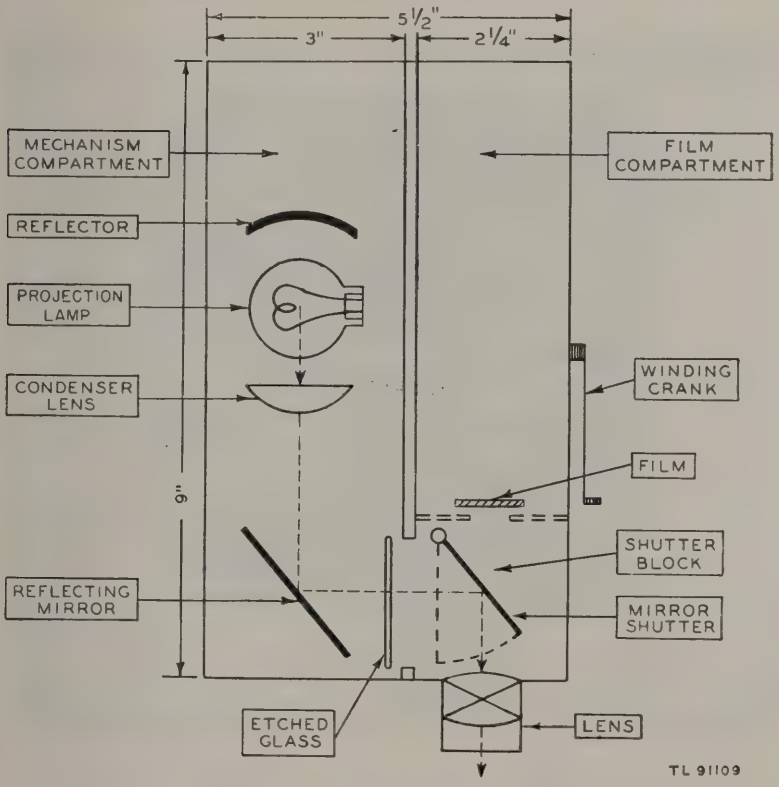


Figure 21. Optical system of camera.

maps and other documents up to 37½ by 52½ inches when operating horizontally. The simplicity and ease of operation permits high-speed copying of documents of similar size, and rapid conversion for copying documents of different sizes, and at different reduction ratios. The entire equipment is readily transportable, and may be moved to a new location and set up for operation within a few minutes. The carrying cases provide space for spare reflector flood lamps, and for a supply of film capable of photographing several thousand documents.

38. Cycle of Operation

It is necessary to possess a knowledge of the cycle of events which occurs within the camera and in the power control unit, before the operator and the maintenance man can determine the operating condition of the equipment. When operating on alternating current, with the MAIN SWITCH turned ON, the general purpose relay in the power control unit becomes energized to close certain electrical circuits. With the light switch turned to FRAME, the reflector flood lamps shut off and the finder lamp becomes

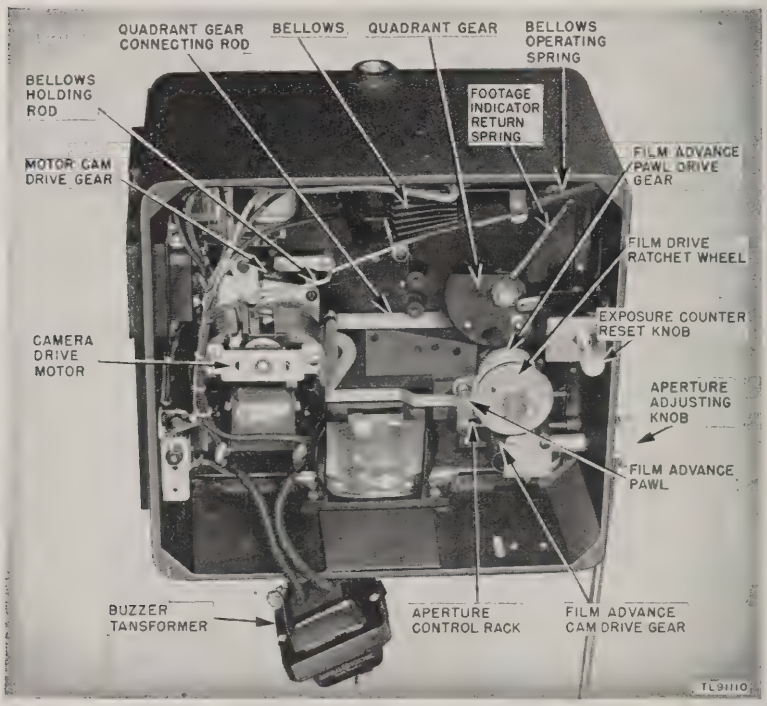


Figure 22. Mechanism compartment of camera, partially dismantled.

lighted for document-positioning purposes. With the LIGHT SWITCH turned to EXPOSURE, the reflector flood lamps are lighted and, when the foot switch is actuated, the motor control relay becomes energized to start the camera drive motor. As the camera drive motor operates, a slow-running cam operates a latch which holds the motor relay contacts closed. This keeps the motor running throughout the cycle without further need of the foot switch. During one revolution of the cam, the camera drive motor provides motive power to perform the various functions in the following order:

a. Forces the vacuum back plate assembly down on the film over the film aperture.

b. Releases the spring-loaded bellows which extend and create a vacuum, drawing the film against the vacuum back plate in the focal plane.

c. Opens and closes the mirror shutter to expose the film.

d. Forces the spring-loaded bellows to close and break the vacuum.

e. Permits the vacuum back plate to raise.

f. Turns the film drive roller, advancing the film a predetermined amount.

g. Actuates the cam-operated latch which opens the motor control relay contacts to stop the motor.

Note. If the foot switch is held down, the entire cycle will be repeated, resulting in another exposure of the same document.

39. Functioning of Parts

a. Aperture Control and Film Advance Mechanism (figs. 22 and 23). The camera provided with Camera Equipment PH–545/PF has a controlling mechanism by which the amount of film advanced is related to the area of film required to photograph a document. The film advance control mechanism is correlated with the aperture adjustment so that adjusting the aperture to accommodate a document automatically stops the film advance when enough film has been moved forward to photograph that document. This is accomplished in the manner described below.

(1) The film drive motor is coupled by a connecting rod to a quadrant gear. The teeth of the quadrant gear engage a film advance gear which supports and actuates a film advance pawl. This pawl engages teeth on the perimeter of a film drive ratchet wheel which is fastened to the film drive roller shaft.

(2) A roller on the side of the film advance pawl rides on a film advance cam. This cam controls the amount of film advanced, by lifting the pawl away from the teeth of the ratchet wheel, thus disconnecting the film drive.

(3) The position of the film advance cam is shifted by operating the aperture adjusting knob on the outside of the camera. The mechanism is designed so that when, for example, the aperture is set at 1 inch, the film advance pawl will be lifted off the ratchet wheel when 1 inch of film, plus a slight surplus for image separation, has been advanced.

(4) The aperture plates are connected to two racks which engage the opposite sides of a pinion. When the pinion is turned, the racks move in opposite directions. Turning the aperture control knob on the outside of the camera drives the pinion. This pinion drives the racks which move the aperture plates either away from, or toward each other to increase or decrease the aperture width.

(5) A hold-back pawl is provided to prevent a backward movement of the film drive ratchet wheel as the film advance pawl returns to its starting position.

(6) An auxiliary film advance system is provided to prevent the pos-

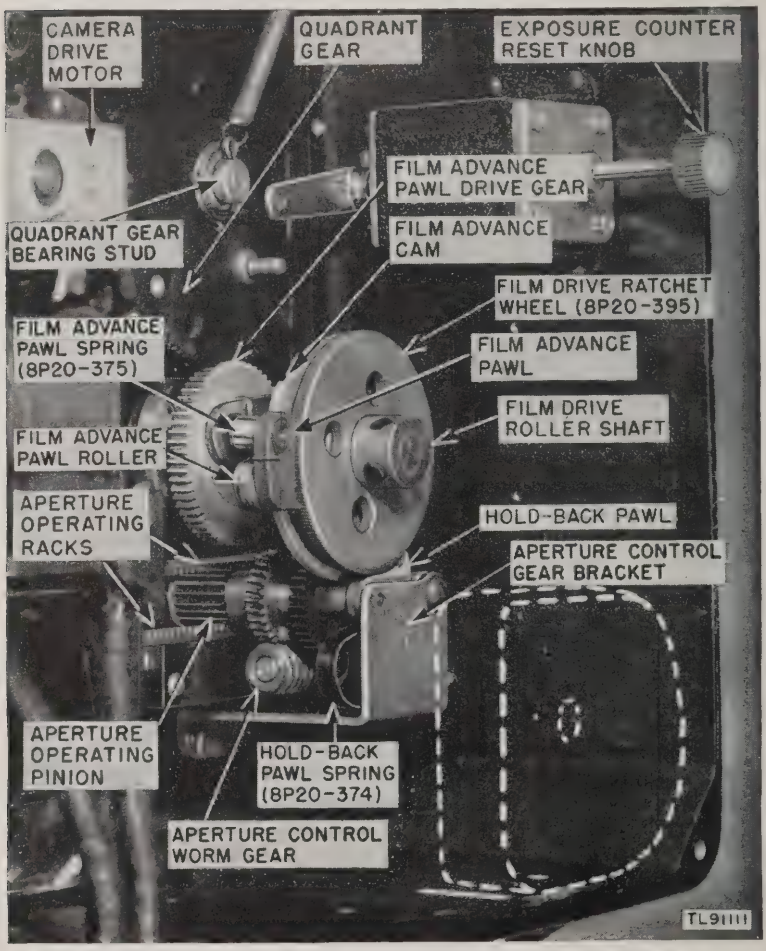


Figure 23. Detailed view of film advance mechanism.

sibility of an overlapping exposure. Without this auxiliary film advancement, an overlapping would result whenever the aperture plates were opened to accommodate a document larger than the one previously photographed. If, for example, the aperture plates are set to an aperture width of 1 inch, the film will be advanced 1 inch following the exposure.

If the next document to be photographed requires a wider aperture, a part of the previously exposed image will be uncovered when the plates are further separated, unless the film is advanced to compensate for this

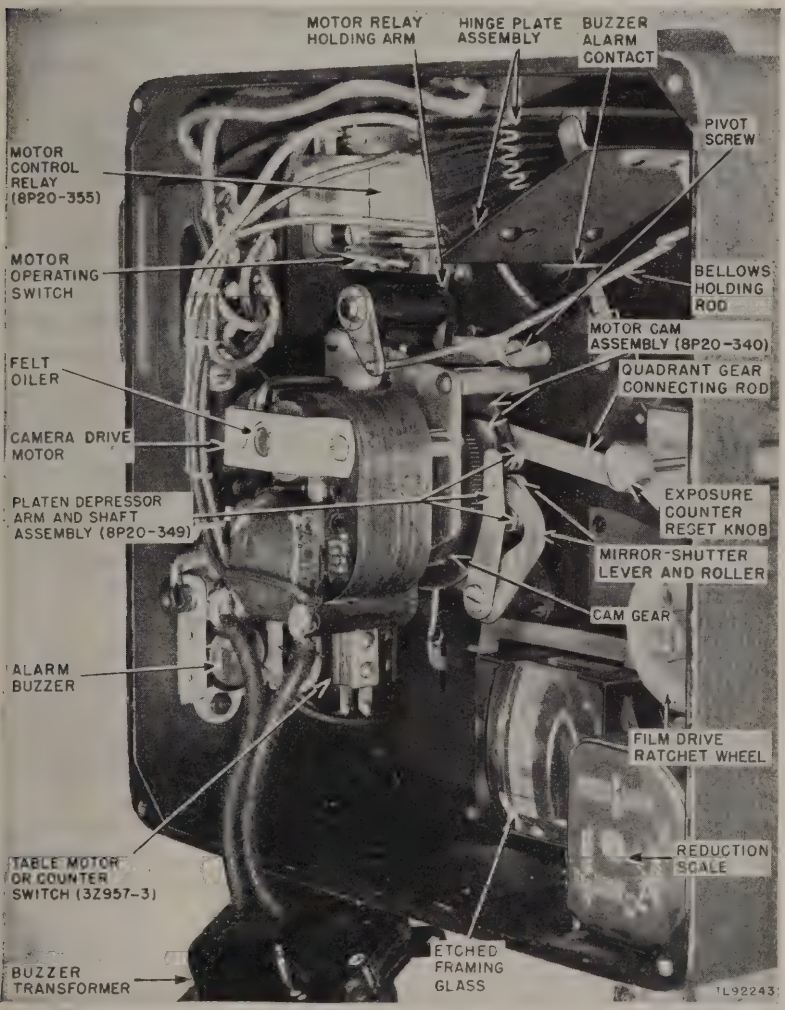


Figure 24. Detailed view of motor cam assembly and motor control relay.

additional aperture width. To operate this supplementary film advance, a pawl is attached to the film advance cam. This pawl engages the teeth on the inner side of the film drive ratchet wheel. Whenever the aperture control knob is turned to increase the aperture width, the pawl moves

the film drive ratchet wheel. This advances a length of film equal to the increase in aperture width.

b. Motor Cam Assembly (fig. 24). The motor cam assembly consists of a double cam plate driven through reduction gears by the camera drive motor.

(1) The inner plate operates the motor control relay armature, holding the relay contacts closed to keep the motor running through one revolution of the cam after the foot switch has been released. Connected by a stud to this inner cam plate is a connecting rod which operates the quadrant gear. The quadrant gear drives the film advance mechanism and trips the exposure counter. The fellows holding rod closes the bellows to break the vacuum and release the film from the platen.

(2) The outer cam plate is used to perform two functions: to depress the vacuum back plate assembly (platen) and to actuate the mirror shutter. The platen depressor operating lever is fitted with two rollers. One depresses the platen before the shutter is opened, and the other keeps the platen depressed until the shutter is closed. The mirror shutter operating lever is fitted with a single cam roller.

c. Relays (figs. 24 and 27). (1) The general purpose relay (fig. 27), located in the power control unit, operates on alternating current through a blocking capacitor which prevents the passage of direct current to the relay. The relay is fitted with three, single-pole, double-throw contacts positioned for d-c operation of the equipment when the relay is not energized. When alternating current is applied to the relay, the switches are thrown and the alternating current is fed to the various parts of the equipment. When direct current is applied, the relay is not energized and the power flows directly to the converter. From the converter, the power flows as alternating current to the various parts of the equipment.

(2) When the foot switch is actuated, the 6-volt coil of the motor control relay (fig. 24) is energized by the projection lamp transformer. A cam-operated locking device holds the motor circuit closed throughout the motor-operating cycle.

d. Buzzer Alarm System (fig. 24). The buzzer alarm system consists of a buzzer connected to a power source through three alarm switches. The switches are connected in parallel so that any one may complete the circuit and sound the alarm.

(1) *Film supply alarm* (fig. 6). The film supply alarm consists of an arm which rides on the film in the supply spool. As the film is drawn off the spool, the arm drops lower into the spool. When only a few feet of film remain on the supply spool, the arm touches a copper contact located within the mechanism compartment of the camera, thus completing an electrical circuit to the buzzer.

(2) *Take-up alarm* (fig. 6). The take-up alarm consists of a roller mounted on an arm in the film take-up compartment. As the film moves off the drive roller, it is looped over the alarm roller before being wound

on the take-up spool. As long as the film is taut, the alarm arm is held up. If the tension on the film is relaxed because of a film break or because of a bent receiving spool, the arm will drop and touch the copper contact to complete the electrical circuit to the buzzer.

(3) *Platen alarm* (fig. 24). The bellows and hinge plate assembly acts as the platen alarm. In normal operation, the bellows will open only partially because the vacuum created when the film is drawn against the platen prevents the bellows from distending fully. If the film is improperly seated beneath the platen, no vacuum will be formed, and the bellows will fill completely, touching the copper stop to complete the electrical circuit to the buzzer.

Section VIII. TROUBLE SHOOTING

40. Trouble Shooting Technique

Troubles are rarely encountered with Camera Equipment PH–545/PF unless the equipment has been subjected to rough handling or unsual conditions during operation. Eventually, however, normal wear will cause trouble and necessitate the replacement of worn parts. The following subparagraphs will serve as a guide and offer a procedure for locating trouble.

a. Electrical Troubles (fig. 20). (1) *General.* Continuity test equipment such as a battery with bell, buzzer, light, or voltmeter, will be found useful in tracing electrical circuits. Reference to the wiring diagram (fig. 20) should be made whenever electrical troubles are encountered.

(2) *Connecting cords.* Whenever electrical failure occurs in the entire equipment, the electrical cords should be inspected for breaks, bad connections, or short circuits. When electrical trouble occurs in the camera, the interconnecting cord should be tested, and the defective circuit traced from the power control unit to the questionable parts of the camera. If the trouble lies in a defective connection or a broken connecting wire, repairs may be made by soldering the connection or replacing the wire. If the trouble lies in a defective part such as a transformer, relay, motor, etc., the part must be replaced.

b. Optical Troubles (fig. 21). The optical system performs two functions. It transmits light from the document to the film, and transmits light from the projection lamp to the easel. Troubles that occur in the finder system are confined to the projection lamp, the condensers, the reflecting mirror, the etched glass, the mirror shutter, and the camera lens. Troubles that occur in the exposure system are confined to the camera, projection lens, or the mirror shutter. No difficulty should be encountered in isolating optical troubles. Correction usually will require replacement of the defective parts.

Caution: Critical setting of the camera lens is absolutely essential for proper operation. Under no condition should the camera lens be removed for repairs in the field.

c. Mechanical Troubles. Mechanical troubles may be remedied by either repairing or replacing the defective part. Troubles occuring in the tripod or easel will be obvious to the maintenance man, and should be corrected easily. The correction of mechanical troubles which may occur inside the camera, particularly within the mechanism compartment, requires a thorough understanding of the theory of operation as covered in paragraphs 37 and 38. By opening the camera compartments and loading the camera with leader, the maintenance man can observe the camera in operation. If the functions of the various parts are understood, it is not difficult for the maintenance man to isolate and replace the defective parts, as described in paragraphs 43 and 44.

41. Trouble Chart

a. Electrical System (fig. 20).

Trouble	Probable cause	Remedy
Equipment fails to operate (a-c or d-c operation)	Defective power supply.	Check power supply.
	Defective power cord.	Repair or replace cord.
	Defective main switch.	Replace main switch.
Camera fails to operate but reflector flood lamps light (d-c operation).	Converter not connected.	Connect converter (par. 11b).
	Shorted blocking capacitor.	Replace capacitor.
	Defective converter.	Replace converter.
	Defective wiring.	Trace wiring and repair as necessary.
Camera fails to operate but reflector flood lamps light (a-c operation).	Open blocking capacitor.	Replace blocking capacitor.
	Defective general purpose relay.	Replace relay.
Camera operates but reflector flood lamps do not light (a-c or d-c operation).	Defective lamps.	Replace lamps.
	Defective rheostat.	Replace rheostat.
	Defective light switch.	Replace light switch.
	Defective wiring.	Trace wiring and repair as necessary.
Projection (finder) lamp does not light.	Defective lamp.	Replace lamp.
	Defective light switch.	Replace light switch.
	Defective adjustable resistor.	Replace adjustable resistor.

Trouble	Probable cause	Remedy
	Defective projection lamp transformer.	Replace transformer.
	Defective connections in Jones plugs or receptacles.	Repair or replace plugs or receptacles.
	Defective wiring.	Trace wiring and repair as necessary.
Camera fails to operate when foot switch is actuated.	Defective foot switch.	Replace foot switch.
	Defective adjustable resistor.	Replace adjustable resistor.
	Defective projection lamp transformer.	Replace transformer.
	Defective connections in Jones plugs or receptacles.	Repair or replace plugs or receptacles.
	Defective motor control relay.	Replace motor control relay.
	Defective camera drive motor.	Replace motor.
	Defective wiring.	Trace wiring and repair as necessary.
Alarm buzzer does not sound.	Defective buzzer.	Replace buzzer.
	Defective buzzer transformer.	Replace transformer.
	Defective wiring in alarm system.	Trace wiring and repair as necessary.
	Defective alarm contacts.	Clean alarm contacts.

b. Optical and Mechanical System.

Trouble	Probable cause	Remedy
Alarm buzzer sound (Camera loaded with film).	Film not fastened to take-up spool.	Fasten film to take-up spool.
	Bent take-up spool.	Straighten or replace spool.
	Film broken.	Remove exposed film and install empty take-up spool. Rephotograph documents as required.
	Failure of bellows hinge plate assembly.	Replace bellows if leak is found.
		Replace bellows actuating spring if broken.
	Hose disconnected from bellows or platen plate.	Reconnect hose.

Trouble	Probable cause	Remedy
Images not sharply focused. (Noted from processed film, retake required.)	Camera lens dirty.	Clean camera lens.
	Vacuum back plate not depressed.	Check motor cam assembly and vacuum plate linkage.
	Vacuum not extended to plate.	Check bellows hinge plate assembly, and operating spring.
		Check rubber tubing for leak. Replace if necessary.
		Check bellows for leaks.
Documents not completely covered. (Noted from processed film, retake required.)	Improper aperture adjustment.	Reset aperture with light switch set to FRAME.
Images overlap at irregular intervals.	Film slipping on film drive roller.	Clean surface of roller.
		Replace roller assembly.
	Hold-back pawl worn or spring broken.	Replace defective part.
	Film advance pawl worn or spring worn.	Replace defective part.
	Film drive ratchet wheel worn.	Replace.
Images overlap at regular intervals.	Quadrant gear out of time, or film advance cam improperly adjusted.	Adjust quadrant gear or film advance cam (par. 43p).
Too much space between images.	Film advance cam improperly adjusted, or locking screws loose.	Adjust film advance cam (par. 43p).
Images overlap on first exposure after aperture is widened.	Auxiliary film advance spring pawl defective.	Replace auxiliary spring pawl.
	Film drive ratchet wheel defective.	Replace wheel.
Images on film spaced too far apart.	Film advance cam improperly adjusted, or setscrews loose.	Remove film drive ratchet wheel. Readjust and tighten setscrews.
Projection lamp does not project beam of light on easel.	Mirror shutter open continually.	Mirror shutter spring broken, or mirror shutter jammed in open position.
	Light beam reflecting mirror broken.	Mirror shutter spring broken. Replace light beam reflecting mirror.
Film found to be fogged when processed.	Mirror shutter open continually.	en, or mirror shutter jammed in open position.
Easel difficult to raise and lower.	Easel jacks not properly aligned.	Remove camera from tripod. Remove easel and reassemble (par. 10c).
Tripod leg extension drops when leg is unlocked.	Broken steel clip spring for leg adjustment nut in tripod leg.	Replace spring (par. 45b).

Section IX. REPAIR AND ADJUSTMENT

42. Adjusting Film Advance Mechanism

To adjust the film advance mechanism for proper spacing of domuments, proceed as directed below.

a. Note the average space between documents on a length of film covering several images.

b. Note the position of the film-advance cam with respect to a pencil mark placed on the perimeter of the film drive rachet wheel.

c. Loosen the two screws holding the film advance cam. The screws are accessible through holes in the film drive rachet wheel.

d. Move the film advance cam in a counterclockwise direction to increase the space between images and in a clockwise direction to decrease the space. The cam should be moved a distance on the perimeter of the film drive rachet wheel equal to approximately 1½ times the increase or decrease required. To increase the space between documents ⅛ inch for example, mark the cam position, loosen the cam screws, and shift the cam 3/16 inch in a counterclockwise direction.

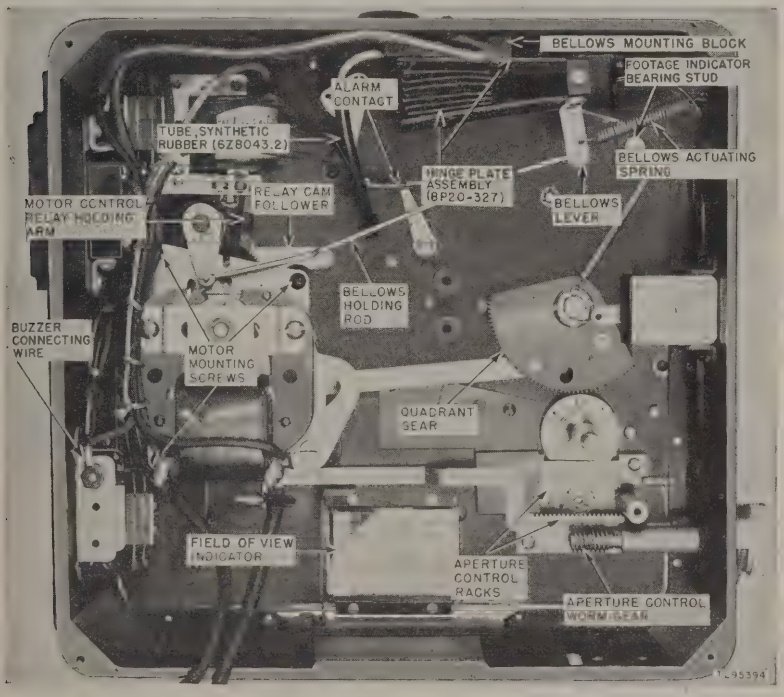


Figure 25. Detailed view of mechanism compartment showing aperture control gear assembly.

e. When the adjustment has been made, tighten the cam screws.

f. Test for proper document-spacing by actual copying operation, and readjust the cam if necessary.

43. Replacement of Camera Parts

To replace parts in the mechanism compartment of the camera, remove the compartment cover by removing the four knurled-head, cover retaining screws.

a. Alarm Buzzer (figs. 24 and 25). (1) Remove the two screws and nuts that fasten the buzzer to the camera housing.

(2) Remove the single connecting wire and connect it to the new buzzer.

(3) Install a new buzzer, and fasten it to the camera housing with the two retaining screws.

b. Alarm Buzzer Transformer (figs. 8 and 22). (1) Disconnect the lead wires from the secondary winding terminal clips.

(2) Remove the three transformer mounting screws and nuts from the bottom of the camera.

(3) Unsolder the primary winding leads from the camera drive motor.

(4) Solder the primary winding leads from the new transformer to the drive motor terminals.

(5) Mount the new transformer on the bottom of the camera case, being certain to install the terminal lug of the short ground wire under one of the transformer mounting screws.

(6) Attach the free end of the ground wire and the buzzer lead to the secondary clips of the transformer.

c. Bellows Hinge Plate Assembly (fig. 25). (1) Remove the rubber tube from the bellows.

(2) Remove the bellows holding rod and actuating spring from the bellows lever.

(3) Remove the two bellows retaining screws from the top of the camera and remove the entire bellows assembly. Remove the bellows from the mounting block.

(4) Install a new bellows assembly on the block, being certain that the gasket is between the bellows hinge plate and the mounting block. Cement the gasket in place.

(5) Install the complete bellows assembly in the camera case and tighten the retaining screws from the top of the camera.

(6) Connect the holding rod and actuating spring to the bellows lever.

(7) Connect the rubber tube to the elbow nipple of the mounting block.

d. Motor Control Relay (figs. 24 and 25). (1) Remove the two relay retaining screws from the film supply chamber.

(2) Remove the pivot screw from the relay cam follower.

(3) Lift the relay from the case and unsolder the lead wires from the terminals.

(4) Solder the lead wires to the new relay.

(5) Set the relay in place, and reinstall the pivot screw in the relay cam follower.

(6) Install the relay retaining screws from the film supply chamber, and tighten.

e. Projection Lamp (fig. 8). (1) Grasp the lamp firmly. While pushing the socket up from the bottom, press down slightly on the lamp and turn it in a counter clockwise direction to disengage the three positioning lugs.

(2) Fit the lamp flange holes over the projecting lugs, depress slightly, push up on the bottom of the socket, and turn clockwise until the lamp locks into position.

f. Reduction Scale (fig. 8). (1) Remove from the bottom of the camera the two screws that hold the reduction scale latch.

(2) Remove the reduction scale from the mechanism compartment of the camera.

(3) Install the new reduction scale assembly, and reinstall the latch and the latch-retaining screws.

g. Hand Crank Assembly, Including Spring and Clutch (figs. 5 and 7). (1) Press in on the crank and turn in a counter clockwise direction while preventing the clutch inside the compartment door from turning. This will unscrew the clutch from the shaft.

(2) Remove the handle, shaft, and spring from the outside of the compartment door. The handle may be removed from the shaft by removing the mounting screw.

(3) Install new parts as necessary. Insert the shaft through the hole in the door, grasp the two pins of the clutch, and turn the handle clockwise until it is fairly tight.

h. Reflecting Mirror (fig. 8). (1) Remove the four countersunk screws from the bottom of the camera beside the camera lens. When these screws are removed, the mirror and single condenser lens mount will come out as a unit.

(2) Slide the mirror out of its retaining grooves.

(3) Insert a new mirror, and push it into its grooves as far as it will go.

(4) Reinstall the entire assembly and tighten the four retaining screws.

i. Film Drive Roller Assembly (fig. 7). (1) Remove the film drive roller stripping tongue by removing the two screws that fasten the tongue to the camera case. This tongue fits into a groove cut in the surface of the rubber roller.

(2) Remove the screw in the center of the film drive roller and remove the roller from the shaft.

(3) Install a new roller on the shaft and tighten the center retaining screw.

(4) Reinstall the stripping tongue by installing the two screws.

j. Take-up Belt (fig. 7). (1) Remove the film drive roller as described in *i* above.

(2) Remove the pressure roller assembly by removing the pivot screw and pulling the pressure roller assembly out of the take-up chamber.

(3) Remove the coil spring belt from the pulleys on the film drive roller shaft and take-up spindle shaft.

(4) Install a new belt, and put a twist in the belt in order to cause the take-up spindle to revolve in a direction opposite that of the film drive roller.

(5) Replace the pressure roller assembly, making sure that the spring holds the pressure roller against the film drive roller.

(6) Replace the film drive roller as described in *i* above.

k. Take-up Alarm Roller Assembly (fig. 7). (1) Remove the pressure roller assembly by removing the pivot screw.

(2) Remove the alarm roller retaining screw from the center of the roller, and remove the roller from the shaft.

(3) Install a new roller and roller retaining screw. Reinstall the pressure roller assembly, being sure that the spring holds the pressure roller against the film drive roller.

l. Film Guide Roller, Platen Arm, and Spring (fig. 7). (1) Remove the platen from its slot in the end of the platen arm, as directed in paragraph 13*d* and *e*.

(2) Remove the one screw in the center of the rubber roller, and remove the roller and platen arm from the shaft.

(3) Remove the spring from the shaft.

(4) Install a new spring, and then install the new platen arm and roller as a unit.

Note. Be sure that the spring is installed so that it lifts the platen arm.

(5) Install the single retaining screw in the center of the roller.

(6) Install the platen in the slot at the end of the platen arm, and reconnect the air hose.

m. Supply Spool Brake Disk (fig. 7). (1) Unscrew the supply spindle by turning it in a clockwise direction.

(2) When the spindle is removed, remove the spool flange.

(3) Directly beneath the flange is the cork disk. Remove the disk and install a new one.

(4) Replace the spool flange, and reinstall the supply spindle by turning it counter clockwise.

n. Platen Depressor Arm and Shaft Assembly (figs. 7 and 24). (1) Remove the film guide roller, platen arm, and spring, from the supply compartment of the camera as described in *l* above.

(2) When the platen arm is removed, the platen arm depressor lever

is accessible. Remove the retaining screw and remove the depressor lever from the shaft.

(3) Working from the mechanism side of the camera, remove the reflecting mirror as described in *h* above. The platen depressor cam follower and the mirror shutter cam follower then are accessible.

(4) Swing the platen depressor cam follower away from the cam and pull the follower and shaft out of the camera.

(5) Insert the new platen depressor cam follower and shaft through the bearing of the mirror shutter cam follower, and work the shaft through the hole in the case until the platen depressor cam follower can be swung back to rest on the cam.

(6) Working from the film compartment side of the camera, install the platen depressor lever and tighten the retaining screw.

(7) Reinstall the film guide roller, platen arm, and spring, as described in *l* above.

(8) Reinstall the reflecting mirror in the mechanism compartment as described in *h* above.

o. Aperture Control Shaft and Gear Assembly (figs. 23, 25, and 26). (1) Open the aperture to its widest opening, and remove the reduction scale as described in *f* above.

(2) Loosen the Allen setscrew in the aperture control knob on the outside of the camera, and remove the knob.

(3) Remove the three mounting screws of the aperture control shaft bearing, turn the shaft counter clockwise to disengage the worm gear, and remove the bearing and shaft.

(4) Remove the film drive rachet wheel by loosening the Allen setscrews.

(5) With the aperture still opened to its maximum width, draw a pencil mark in a horizontal direction across the face of the film advance cam toward the camera case. Project this line with a straight edge to a point on the camera case, and mark the case. This line will act as a guide for repositioning the cam when installing the new gear assembly.

(6) Remove the aperture control gear bracket by removing the three screws, one at the top, and two at the bottom of the bracket.

(7) Remove the hold-back pawl.

(8) Remove the film advance cam and attached gear.

Caution: Do not loosen the screws that attach the film advance cam to its drive gear.

(9) Remove the aperture control gear assembly by withdrawing the pinion from between the aperture operating racks.

(10) Install the new aperture control gear assembly, fitting the pinion between the racks without moving the racks.

(11) Install the hold-back pawl on the aperture control gear assembly shaft.

(12) Install the aperture control gear bracket with the three retaining screws.

(13) Install the film advance cam with gear attached, pointing the pencil line directly at the mark on the camera case.

Caution: If the new aperture control gear assembly does not permit the film advance cam to line up properly with the mark on the camera case, do not attempt to line up the cam by turning the aperture control gear assembly. Moving the gear assembly will shift the aperture plates, but to get perfect alignment, the plates must be left at their widest opening. If properly installed, the cam will never be more than one tooth off its proper position. If this should be the case, adjust the cam position as directed in (14) below.

(14) While the cam is in position, loosen the two screws that fasten the cam plate to the gear. Shift the cam plate until the line on the plate is pointing directly at the mark on the camera case, and then tighten the screws.

(15) Install the film advance rachet wheel with the two Allen setscrews.

(16) Install the new worm gear and shaft in the aperture control shaft bearing, and install the bearing in the camera case, tightening the three mounting screws.

(17) Install the aperture control knob, and test it for free operation. Check to see that the film drive roller turns as the aperture is widened.

(18) Reinstall the reduction scale.

p. Motor Cam Assembly (figs. 22 and 24). (1) Remove the reflecting mirror assembly, as described in *h* above.

(2) Remove the projection lamp as described in *e* above.

(3) Remove the lamp holder bracket as describe in *u* below.

(4) Remove the alarm buzzer transformer as described in *b* above.

(5) Remove the retaining screw, and remove the platen depressor cam follower from its shaft.

(6) Remove the mirror shutter cam follower and bearing from the shaft as a unit.

(7) Mark the teeth-engaging position on the quadrant gear and the film advance pawl drive gear.

Caution: The film advance mechanism will operate properly only if these gears are reinstalled in the exact positions they occupied before dismantling.

(8) Disconnect the footage indicator return spring, remove the quadrant gear retaining cotter pin and washer, and remove the quadrant gear.

(9) Remove the three motor mounting screws (fig. 25) from the rear of the rear bearing plate.

Caution: Do not loosen the two screws which hold the front bearing plate to the laminated motor magnet.

(10) Lift the motor and cam assembly from the case, shifting it slightly downward to clear the bellows holding rod.

(11) Turn the motor aand cam assembly upside down, and remove the cam assembly retaining nut.

Caution: Do not loosen the screw in the center of the cam retaining shaft.

(12) Remove the clutch spring washer and the clutch spring.

(13) Remove the motor cam assembly from the motor and remove the cork friction clutch washer.

(14) Clean the clutch friction surface, and install a new cork friction clutch washer.

(15) Install the new motor cam assembly.

(16) Install the clutch spring and the clutch spring washer.

(17) Install the cam assembly retaining nut, and tighten it until it is flush with the shaft.

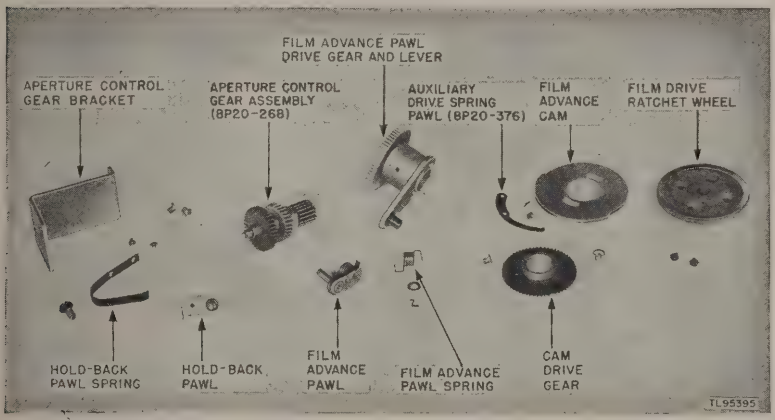


Figure 26. Parts of film advance and aperture control mechanism.

(18) Install the quadrant gear connecting rod on the motor cam assembly stud with the bellows lever actuating pin away from the motor cam assembly.

(19) Invert the motor and cam assembly so that the rear bearing plate enters the camera first. Turn the cam so that the connecting rod is extended toward the quadrant gear as far as possible.

(20) Hold the connecting rod firmly to keep it from falling off the stud. and set the motor into position in the camera case. Install the three motor retaining screws.

(21) Engage the quadrant gear stud into the connecting rod hole, and install the gear, meshing the teeth as previously marked.

(22) Install the quadrant gear retaining washer and cotter pin.

(23) Connect the footage indicator return spring to the cotter pin.

(24) Slip the shutter cam follower over its bearing shaft.

(25) Install the platen cam follower over the square end of the shaft, and install the retaining screw.

(26) Reinstall the buzzer transformer, the lamp holder bracket, the lamp, and the reflecting mirror.

q. Film Drive Ratchet Wheel (figs. 23 and 26). (1) Loosen the two Allen head setscrews which fasten the wheel to the shaft.

(2) Lift the wheel off the shaft.

(3) Install the new ratchet wheel and tighten the setscrews.

r. Film Advance Pawl Assembly and Spring (figs. 23 and 26).

(1) Remove the cotter pin from the underside of the pawl pivot shaft.

Note. The pawl pivot shaft mounts the pawl on the pawl advance lever. A mirror will aid in removing the cotter pin.

(2) Remove the pawl and pivot shaft, being careful not to allow the spring to fly off the pivot shaft.

(3) Slip the new spring over the pivot shaft of the new pawl, and engage the pivot shaft in the hole in the advance lever, being sure that the spring is attached so that the pawl is kept in contact with the ratchet wheel.

(4) Insert the cotter pin through the hole in the pawl pivot shaft.

s. Hold-back Pawl Spring (figs. 23 and 26). (1) Remove the reduction scale as described in *f* above.

(2) Remove the aperture control gear bracket by removing the one screw at the top and the two screws at the base of the bracket.

(3) The hold-back pawl spring is on the inside of this bracket assembly and is fastened by two screws. Remove the two screws and remove the defective spring.

(4) Install the new spring on the bracket.

(5) Reinstall the bracket assembly, making sure that the spring holds the hold-back pawl against the ratchet wheel.

(6) Reinstall the reduction scale as described in subparagraph *f* above.

t. Auxiliary Drive Spring Pawl (fig. 26). (1) Remove the two Allen-head setscrews from the ratchet wheel, and lift the wheel off the shaft.

(2) Two screws mount the auxiliary steel drive spring pawl on the outer face of the cam plate. The pawl is accessible when the film drive ratchet wheel has been removed. Remove the two screws and remove the defective steel spring pawl.

Caution: Do not disturb the setting of the cam plate.

(3) Install the new pawl and tighten the two retaining screws.

(4) Reinstall the film drive ratchet wheel and tighten the two Allen-head setscrews.

u. Lampholder Bracket (fig. 8). (1) Remove the projection lamp as described in *e* above.

(2) Remove the two machine screws that fasten the bracket to the

camera, and lift the bracket, together with the lampholder and mirror, out of the camera as far as the slack in the wire will allow.

(3) Disconnect the single connecting wire at the holder, and reconnect the wire to the new lampholder bracket.

(4) Install the new bracket and tighten the two retaining screws.

(5) Reinstall the projection lamp as described in *e* above.

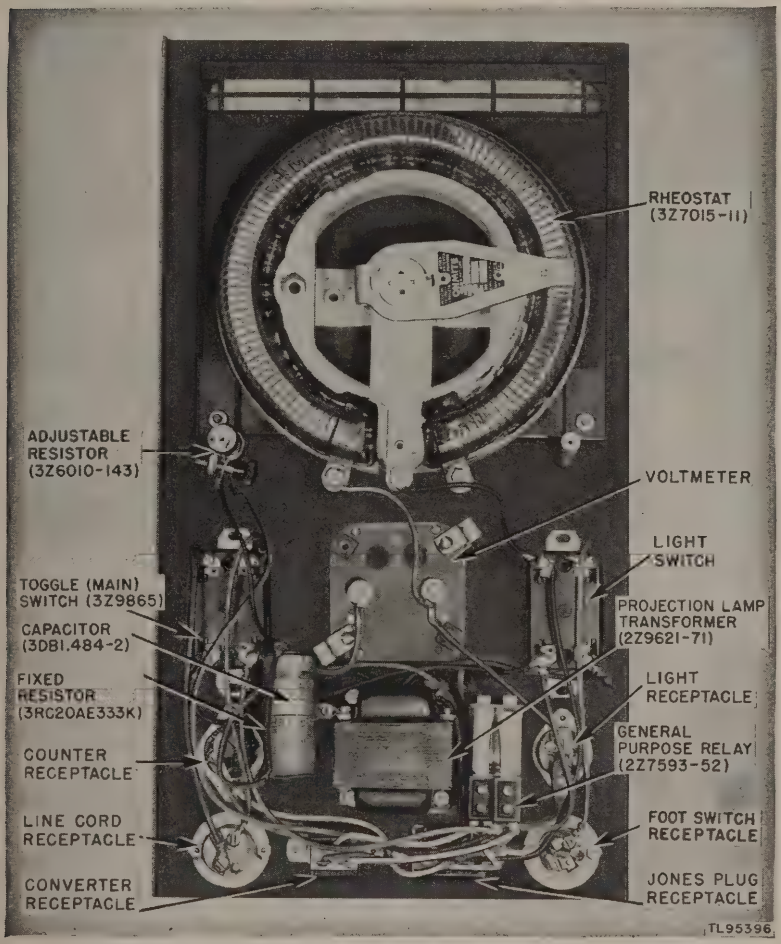


Figure 27. Power control unit panel, rear view with plate removed.

44. Replacement of Power Control Unit Parts (figs. 12 and 27)

All parts of the power control unit are located on the back side of the panel. Before any parts can be replaced, the panel must be removed from

the camera carrying case by removing the 12 screws that hold the panel in the case.

a. Capacitor or Fixed Resistor. To replace either the capacitor or the fixed resistor, remove the capacitor clamp from the transformer, lift the capacitor and resistor out as far as the slack in the wires will allow, and unsolder the connecting lead wires. The resistor, in a fabric covering, is connected across the capacitor terminals. Install a new resistor and solder the connections to the capacitor. Reinstall the capacitor and tighten the capacitor clamp to the transformer.

b. Adjustable Resistor. (1) Remove the protective metal plate from behind the rheostat.

(2) Slip the tubular resistor from the plate mounting stud.

(3) Unsolder the lead wires, and connect them to the new resistor.

(4) Slide the new resistor over the stud. Adjust the sliding contact to the same approximate position on the resistor.

(5) Reinstall the protective metal plate.

c. Projection Lamp Transformer. (1) Remove the capacitor clamp from the transformer.

(2) Remove the four screws and nuts that fasten the transformer to the panel.

(3) Disconnect the primary leads and solder them to the new transformer.

(4) Disconnect the secondary leads and solder them to the new transformer.

(5) Install the new transformer on the control panel.

(6) Install a capacitor clamp on the new transformer.

d. General Purpose Relay. (1) Remove the relay mounting screws from the front of the panel.

(2) Lift the relay clear and unsolder the leads, one at a time. Resolder them to the proper terminals of the new relay.

(3) Mount the new relay on the panel.

e. Main Switch. (1) Remove the two switch mounting screws from the front of the panel.

(2) Remove the leads from the defective switch, and install them on the new switch.

(3) Mount the new switch on the panel.

f. Rheostat. (1) Remove the rheostat protective metal plate from behind the rheostat.

(2) Remove the rheostat control knob.

(3) Remove the two wires from the terminals of the defective rheostat.

(4) Remove the four rheostat mounting screws and remove the rheostat.

(5) Install the new rheostat on the panel, and connect the lead wires to the center and left terminal (as viewed from the rear).

(6) Reinstall the protective metal plate and the rheostat control knob.

g. Voltmeter. (1) Disconnect the lead wires from the defective voltmeter.

(2) Remove the two voltmeter mounting clamps, and remove the voltmeter.

(3) Install the new voltmeter and the mounting clamps.

(4) Reconnect the lead wires to the new voltmeter.

45. Replacement of Tripod Parts

a. Reflector Flood Lampholder (fig. 28). (1) Remove the reflector flood lamp from the lamp holder.

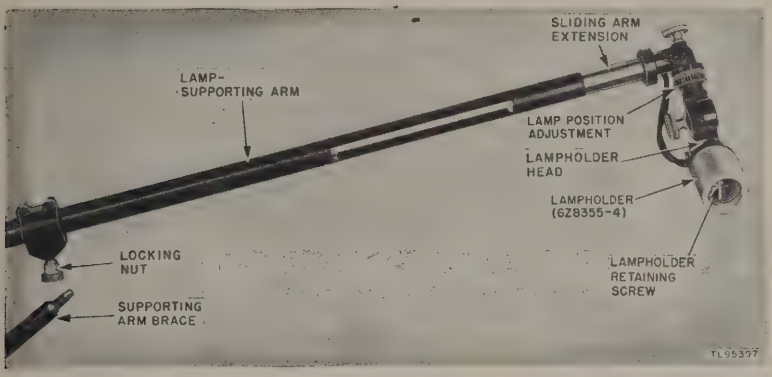


Figure 28. Detailed view of lamp supporting arm and lampholder.

(2) Remove the screw in the center of the porcelain holder, and remove the porcelain body from the metal head.

(3) Install the new porcelain body and replace the center retaining screw.

b. Tripod Leg Nut Adjustment Spring (fig. 29). With the camera removed, and the tripod knocked down, proceed as directed below.

(1) Remove the defective leg from its socket in the tripod head by loosening the clamp screw.

(2) Unscrew the metal ferrule from the lower end of the top section of the leg.

(3) Unlock the lower section of the leg by turning it counter clockwise, and withdraw it slowly from the upper section until the four bakelite wedges appear.

(4) Grasp the wedges firmly and withdraw the lower section of the leg from the upper section.

(5) Remove the four wedges and the defective spring.

(6) Install the new spring by inserting it in its retaining notch.

(7) Set the four wedges in position over the spring, and compress them by hand so that they can be inserted into the upper section of the leg.

(8) Push the lower leg section part way up, and lock it by turning in a clockwise direction.

(9) Install the aluminum ferrule.

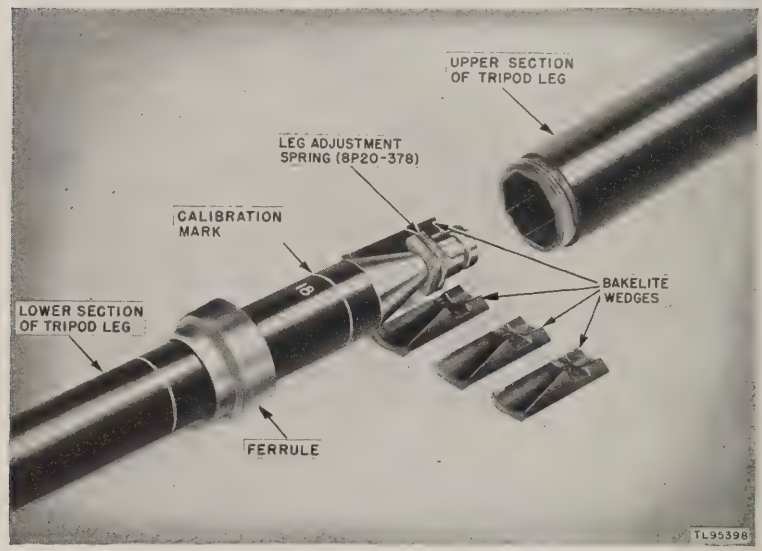


Figure 29. Detailed view of tripod leg adjusting mechanism.

46. Minimum Test Requirements

Minimum test requirements on Camera Equipment PH-545/PF will depend upon the repair work accomplished, or the parts that were replaced. If, for example, a projection lamp must be replaced, it is necessary to test only the lamp and the finder system. If a major repair operation such as replacing the motor cam assembly, must be performed, the equipment should be set up and operated, and the resultant negatives checked for quality, space between the images, etc. The operator should see paragraph 25 when checking the equipment after repairs, adjustments, or replacements have been made.

47. Unsatisfactory Equipment Report (fig. 30)

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, War Department Unsatisfactory Equipment Report, WD, AGO Form

468 should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form No. 54 should be filled out and forwarded through channels.

c. If either form is not available, prepare the data according to the sample form reproduced in figure 30.

WAR DEPARTMENT

UNSATISFACTORY EQUIPMENT REPORT

FOR (Technical service) SIGNAL CORPS — MATÉRIEL — DATE 15 JUN 1944

FROM (Organization) DETACHMENT 00, 000TH SIGNAL PHOTOMAIL CO. (Station) APO 000 NEW YORK, N.Y.

TO (Next superior headquarters) THEATRE SIGNAL OFFICER (THROUGH CHANNELS) (Technical service)

COMPLETE MAJOR ITEM

NOMENCLATURE: PRINTER PH-000 — TYPE:

MODEL: C-1 — MANUFACTURER: X.Y.Z. CO.

U. S. A. REG. NO: — SERIAL NO: B-219 — DATE RECEIVED: 1 JUN 1944

EQUIPMENT WITH WHICH USED (IF APPLICABLE):

NOMENCLATURE OF DEFECTIVE COMPONENT

PART NO: S.C. STOCK No. 7A000/A0 — TYPE: PLATEN SWITCH

MANUFACTURER: A.B.C. CORP. — DATE INSTALLED: 1 JUN 1944

LENGTH OF SERVICE

DATE OF INITIAL TROUBLE: 14 JUN 1944

TOTAL TIME INSTALLED: YEARS —, MONTHS —, DAYS 15

TOTAL PERIOD OF OPERATION BEFORE FAILURE (FILL IN WHERE APPLICABLE)

YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
—	—	—	7.5	—	—

DESCRIPTION OF TROUBLE AND PROBABLE CAUSE

GIVE TYPE OF FAILURE, MECHANICAL, ELECTRICAL, WORKMANSHIP, MATERIAL, DESIGN

ELECTRICAL CONTACTS BURNED AND PITTED, CAUSING POOR CONTACT AND ERRATIC EXPOSURE.

UNUSUAL SERVICE CONDITIONS

GIVE BRIEF DESCRIPTION: PRINTER OPERATED APPROXIMATELY 4 HOURS EACH DAY AT 80 EXPOSURES PER HOUR. CONDITIONS NORMAL.

TRAINING OR SKILL OF USING PERSONNEL (CHECK ONE): POOR — FAIR — GOOD ✓

DESCRIPTION OF ANY REMEDIAL ACTION TAKEN: BURNISHED THE CONTACTS AT 6-HOUR INTERVALS. INSTALLED CAPACITOR ACROSS CONTACTS, 250,000 MMF.

RECOMMENDATIONS: NEW TYPE OF MATERIAL FOR CONTACTS, AND A CAPACITOR ACROSS CONTACTS

1ST IND.

OFFICE — STATION — DATE

TO CHIEF (Technical service) SIGNAL OFFICER, WASHINGTON 25, D.C.

NAME — STATION — RANK

ORIGINATING OFFICER

SIGNATURE: John J. Smith

NAME: JOHN J. SMITH

RANK AND TITLE: 1ST LT. SIGNAL CORPS

ORGANIZATION: DETACHMENT O, 000TH SIGNAL PHOTOMAIL CO.

INSTRUCTIONS

1 It is imperative that the Chief of Technical Service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in material. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.

2 This form will be used for reporting manufacturing, design or operational defects in material with a view to improving and correcting such defects, and for use in recommending modifications of material.

3 This form will not be used for reporting failures, isolated material defects or malfunctions of material resulting from fair wear-and-tear or accidental damage nor for the replacement, repair, or the issue of parts and equipment. It does not replace currently authorized operational or performance records.

4 Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in AR 750-10 (Change No. 3).

W. D., A. G. O. Form No. 468
1 December 1941

5 It will not be practicable or desirable in all cases to fill all blank spaces of the report. However, the report should be as complete as possible in order to expedite necessary corrective action. Additional pertinent information not provided for in the blank spaces should be submitted as inclosures to the form. Photographs, sketches or other illustrative material are highly desirable.

6 When cases arise where it is necessary to communicate with a chief of service in order to assure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.

7 This form will be made out by using or service organizations and forwarded in duplicate through command channels to the chief of technical service. The office of the chief of technical service receiving the report will forward an information copy to the Commanding General Army Ground Forces or Army Air Forces, whichever is applicable, and to the Commanding General, Army Service Forces.

8. Necessity for using this form will be determined by the using or service troops.

16—37785-1 U. S. GOVERNMENT PRINTING OFFICE

TL91061

Figure 30. Example of unsatisfactory equipment report.

APPENDIX I

MAINTENANCE PARTS

The following information was compiled on 25 May 1945. The appropriate sections of the ASF Signal Supply Catalog for Camera Equipment PH–545/PF are:

Organizational Spare Parts
SIG 7–PH–545/PF

Higher Echelon Spare Parts
SIG 8–PH–545/PF

For the index of available catalog sections, see the latest section of ASF Signal Supply Catalog SIG 2.

Note. This list covers first, second, and third echelon maintenance parts.

Ref. symbol (fig. No.)	Signal Corps stock No.	Name
26	8P20–268	APERTURE CONTROL SHAFT AND GEAR ASSEMBLY
7	8P20–272	ARM
25	8P20–327	BELLOWS HINGE-PLATE ASSEMBLY
7	8P20–278	BELT
8	8P20–282	BUZZER
27	3DB1.484–2	CAPACITOR
	8P20–290	DISK, supply reel brake
9	8P20–298	EXPOSURE METER ASSEMBLY
7	8P20–304	FILM DRIVE ROLLER ASSEMBLY
7	8P20–307	FILM GUIDE ROLLER ASSEMBLY
8	8P20–310	FILM PAWL ASSEMBLY
7	8P20–313	FILM PLATEN PLATE ASSEMBLY (35-mm)
	8P20–390	FILM PLATEN PLATE ASSEMBLY (16-mm)
10	8P20–317	FOOT SWITCH ASSEMBLY
5	8P20–224	HAND CRANK ASSEMBLY
7	8P20–323	HAND CRANK ASEMBLY
10	8E34	LAMP, flood reflector
8	6Z6806.22	LAMP, projection
28	6Z8355–4	LAMPHOLDER
8	8P20–334	LAMPHOLDER BRACKET
	8P20–337	MIRROR, reflecting
24	8P20–340	MOTOR CAM ASSEMBLY
	8P20–343	NUT, leg adjusting
	6L3604–401	NUT, holds buzzer
	6L974–4–32P	PIN, cotter, holds quadrant gear
	6L974–2–24	PIN, cotter, holds bellows arm crank
	8P20–346	PLATE, 16-mm aperture
24	8P20–349	PLATEN DEPESSOR ARM AND SHAFT ASSEMBLY
27	2Z7593–52	RELAY
24	8P20–355	RELAY WITH MOTOR STOP LATCH ASSEMBLY

Ref. symbol (fig. No.)	Signal Corps stock No.	Name
27	3RC20AE333K	RESISTOR, fixed
27	3Z6010–143	RESISTOR, adjustable
27	3Z7015–11	RHEOSTAT
8	8P20–360	SCALE
	6L6440–4.3S	SCREW, holds film drive roller assembly
	8P20–364	SCREW, machine, holds pawl spring
	6L18508–1.39F	SCREW, set, holds rachet wheel
	6L6256–1–1S	SCREW, machine, holds mask control spring
	6L6632–4.5S	SCREW, machine, holds mask control frame
	6L6440–6.2S	SCREW, machine, holds buzzer
5	6L17106–2–1	SCREW, thumb
5	616832–3.1S	SCREW, machine holds crank to shaft
	6L6440–4.3S	SCREW, machine holds depressor arm to plate
	6L6440–8.1S	SCREW, machine holds aperture plate
	8P20–370	SPACER FILM SPOOL ASSEMBLY, used to space 16-mm spool
23	8P20–375	SPRING, pawl
23	8P20–374	SPRING, acts as hold-back pawl
26	8P20–376	SPRING, pawl
29	8P20–378	SPRING
	8P20–377	SPRING, holds platen arm
	8P20–373	SPRING, hand-crank release
24	3Z9579–3	SWITCH
27	3Z9865	SWITCH
7	8P20–385	TAKE-UP ASSEMBLY
27	2Z9621–71	TRANSFORMER
8	2Z9621–72	TRANSFORMER
25	6Z8043.2	TUBE, synthetic rubber
7	6Z8043.1	TUBE, gum rubber
12	3F8150–31	VOLTMETER
	6L58022–1	WASHER, steel, used to position pawl
23	8P20–395	WHEEL, ratchet
	1B814.72	WIRE, insulated No. 14 AWG
	1B818.93	WIRE, insulated No. 18 AWG

APPENDIX II

REFERENCES

Additional data which will aid in the efficient operation of Camera Equipment PH–545/PF will be found in the publications listed below.

AR 380–5, Safeguarding Military Information

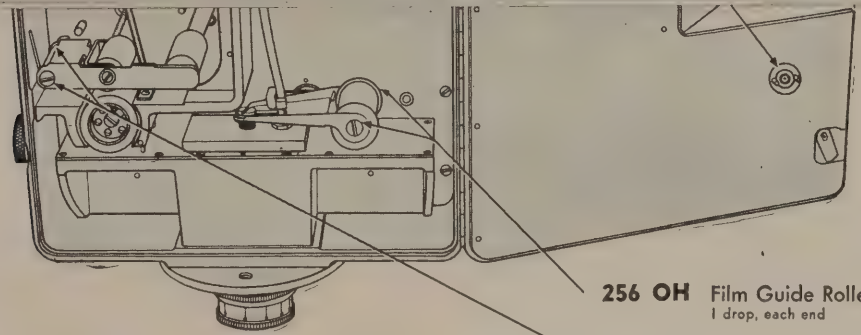
TM 1–219, Basic Photography

TM 11–2301, Densitometer PH–326

— U. S. GOVERNMENT PRINTING OFFICE: 1948

WAR DEPARTMENT LUBRICATION ORDER No. 3891

WAR DEPARTMENT, WASHINGTON 25, D.C., 26 SEPTEMBER 1944



CAMERA
(Right Side)

OIL CAN POINTS — Every 256 hours, lubricate Tripod Leg Hinges and Lamp Support Extension Arm Hinges with OH.

No. 3891

DO NOT LUBRICATE — Lamp Support Hinges, Lamp Bracket Swivel Hinges, Chain and Sprockets, Jack Locking Rings, Tripod Leg Locks, Leg Sockets, Ferrule Nuts and Door Hinges.
LUBRICATED BY MAINTENANCE PERSONNEL — Take-Up Pulley Assembly, Film Drive Roller and Supply Spindle Assembly.

TL96351

Figure 31. Facsimile of War Department Lubrication Order for Camera Equipment PH–545/PF (front view)

WAR DEPARTMENT LUBRICATION ORDER No. 3891

WAR DEPARTMENT, WASHINGTON 25, D.C., 26 SEPTEMBER 1944

CAMERA, MICRO-FILE PH-545/PF

(E. K. Co., Recordak, Model E)

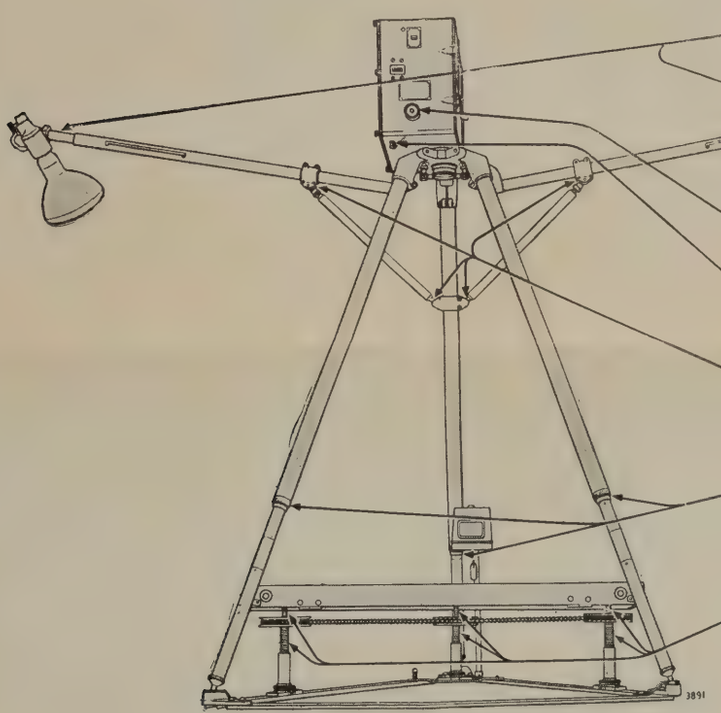
Reference—TM 11-2312.

Clean parts with a soft, clean brush or a clean, lint-free cloth lightly dampened with SOLVENT, dry cleaning. Thoroughly dry all parts before lubricating. Do not allow cleaning fluid to get on lens.

Requisition replacement Lubrication Order from Holabird Signal Depot, Baltimore, Maryland, by Signal Corps Stock No. 6D10121-91. See lists in FM 21-6.

CAUTION: To prevent over-lubrication, apply lubricant with a toothpick or some other similar device, unless otherwise instructed. After lubricating, operate mechanism to distribute lubricant on moving parts. Remove excess lubricant to prevent dripping or spreading onto Film, Lens, Copyboard, Rollers, Film Suction Platen, Finder Light and Mirror.

Operating Hours • Lubricant



256 OH Lamp Support Extension Tubes
Clean and wipe sparingly with a lint-free cloth lightly dampened with OH.

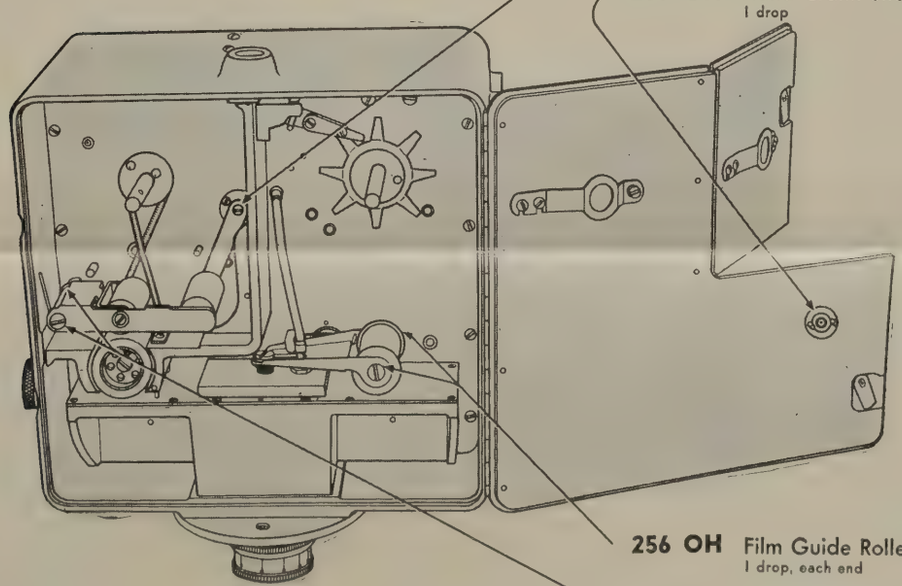
256 OH Mask Control Knob Shaft
1 drop

1024 OH Reduction Scale Tape
Clean and wipe sparingly with a lint-free cloth lightly dampened with OH.

256 OH Support Rod Coupling and Swivels
Clean and wipe threaded ends with a lint-free cloth lightly dampened with OH.
Lubricate swivels with 1 drop, each

1024 GL Tripod Legs
Clean and coat lightly 4 bakelite wedges and the splitnut. (Unscrew ferrule nut and withdraw the lower section of tripod leg from upper section carefully.
Lubricate 3 tripod legs)

256 OH Jacks
Clean and wipe threads with a lint-free cloth lightly dampened with OH.



256 OH Take-Up Alarm Arm Bearing
1 drop

256 OH Hand Crank Shaft Bearing
1 drop

256 OH Film Guide Roller Shaft
1 drop, each end

256 OH Contact Roller Frame Bearings
1 drop, each

CAMERA
(Right Side)

OIL CAN POINTS— Every 256 hours, lubricate Tripod Leg Hinges and Lamp Support Extension Arm Hinges with OH.

DO NOT LUBRICATE— Lamp Support Hinges, Lamp Bracket Swivel Hinges, Chain and Sprockets, Jack Locking Rings, Tripod Leg Locks, Leg Sockets, Ferrule Nuts and Door Hinges.
LUBRICATED BY MAINTENANCE PERSONNEL— Take-Up Pulley Assembly, Film Drive Roller and Supply Spindle Assembly.

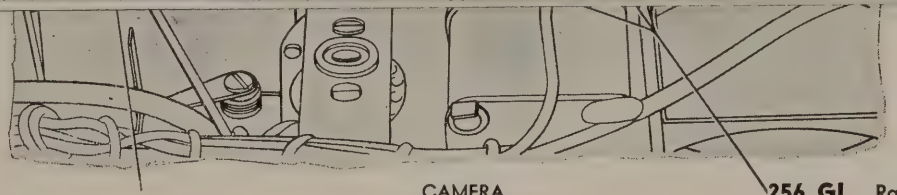
No. 3891

TL96351

Figure 31. Facsimile of War Department Lubrication Order for Camera Equipment PH-545/PF (front view)

WAR DEPARTMENT LUBRICATION ORDER No. 3891

WAR DEPARTMENT, WASHINGTON 25, D.C., 26 SEPTEMBER 1944



Footage Dial Stud **OH 256**
1 drop.

CAMERA
(Front View of Left Side)

256 GL Rack, Gears and Cam Assembly Clean and coat gear teeth and cam sliding surfaces lightly

—KEY—

OH— OIL, hydraulic	All working temperatures
GL— GREASE, lubricating, special	

DO NOT LUBRICATE— Footage Counter.

No. 3891

Copy of this Lubrication Order will remain with the equipment at all times. Instructions contained therein are mandatory and supersede all conflicting lubrication instructions dated prior to 26 September 1944.

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
J. A. ULIO,
Major General,
The Adjutant General.

TL96352

Figure 32. Facsimile of War Department Lubrication Order for Camera Equipment, PH–545/PF (rear view).

WAR DEPARTMENT LUBRICATION ORDER No. 3891

WAR DEPARTMENT, WASHINGTON 25, D.C., 26 SEPTEMBER 1944

CAMERA, MICRO-FILE PH-545/PF

(E. K. Co., Recordak, Model E)

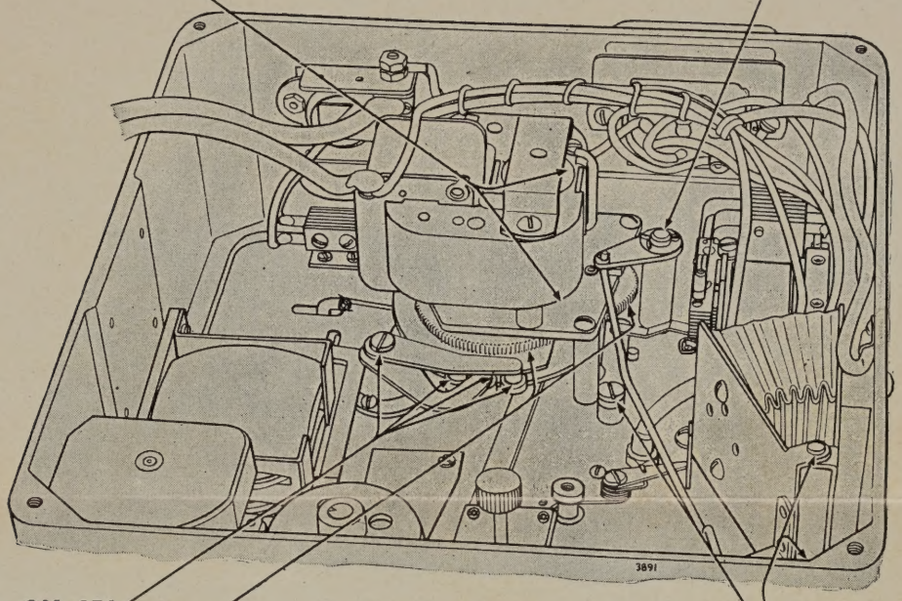
Reference—TM 11-2312.

Lubricant • Operating Hours

Camera Motor **OH 256**
2 or 3 drops, on each felt pad

Operating Hours • Lubricant

256 OH **Bellows Crank Arm Hub** 1 drop



Platen Cam Follower Arm Roller Assembly **OH 256**
1 drop, each

Cam Gears **GL 256**
Clean and coat lightly

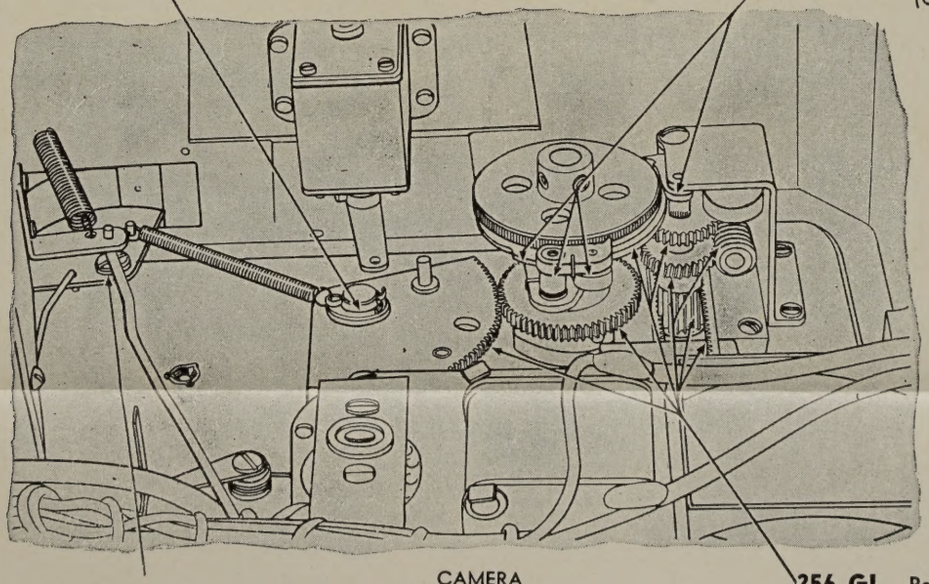
CAMERA (Transformer Removed)
(Rear View of Left Side)

256 OH **Bellows Hinge**
1 drop, each end

256 OH **Motor Latch Link Stud**
1 drop

Swing Gear Stud Shaft 1 drop **OH 256**

256 OH **Cam Roller, Pawl Arm and Gear Shaft Brgs.**
1 drop, each
(Oil hole in spur gear hub)



Footage Dial Stud **OH 256**
1 drop.

CAMERA
(Front View of Left Side)

256 GL **Rack, Gears and Cam Assembly** Clean and coat gear teeth and cam sliding surfaces lightly

—KEY—

OH— OIL, hydraulic	All working temperatures
GL— GREASE, lubricating, special	

DO NOT LUBRICATE— Footage Counter.

No. 3891

Copy of this Lubrication Order will remain with the equipment at all times. Instructions contained therein are mandatory and supersede all conflicting lubrication instructions dated prior to 26 September 1944.

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J. A. ULIO,
Major General,
The Adjutant General.

TL96352

Figure 32. Facsimile of War Department Lubrication Order for Camera Equipment, PH-545/PF (rear view).

THE HUGHES-KEENAN CO

Part No. C-1439

JAN 26 1956

JUN 15 1956

TM11-2312-3