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# TM 11-2352

WAR DEPARTMENT TECHNICAL MANUAL



U.S. Dept. of Army

# CAMERA EQUIPMENT PH-104

WAR DEPARTMENT • 26 FEBRUARY 1945

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CAMERA  
EQUIPMENT  
PH-104

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## DESTRUCTION NOTICE

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

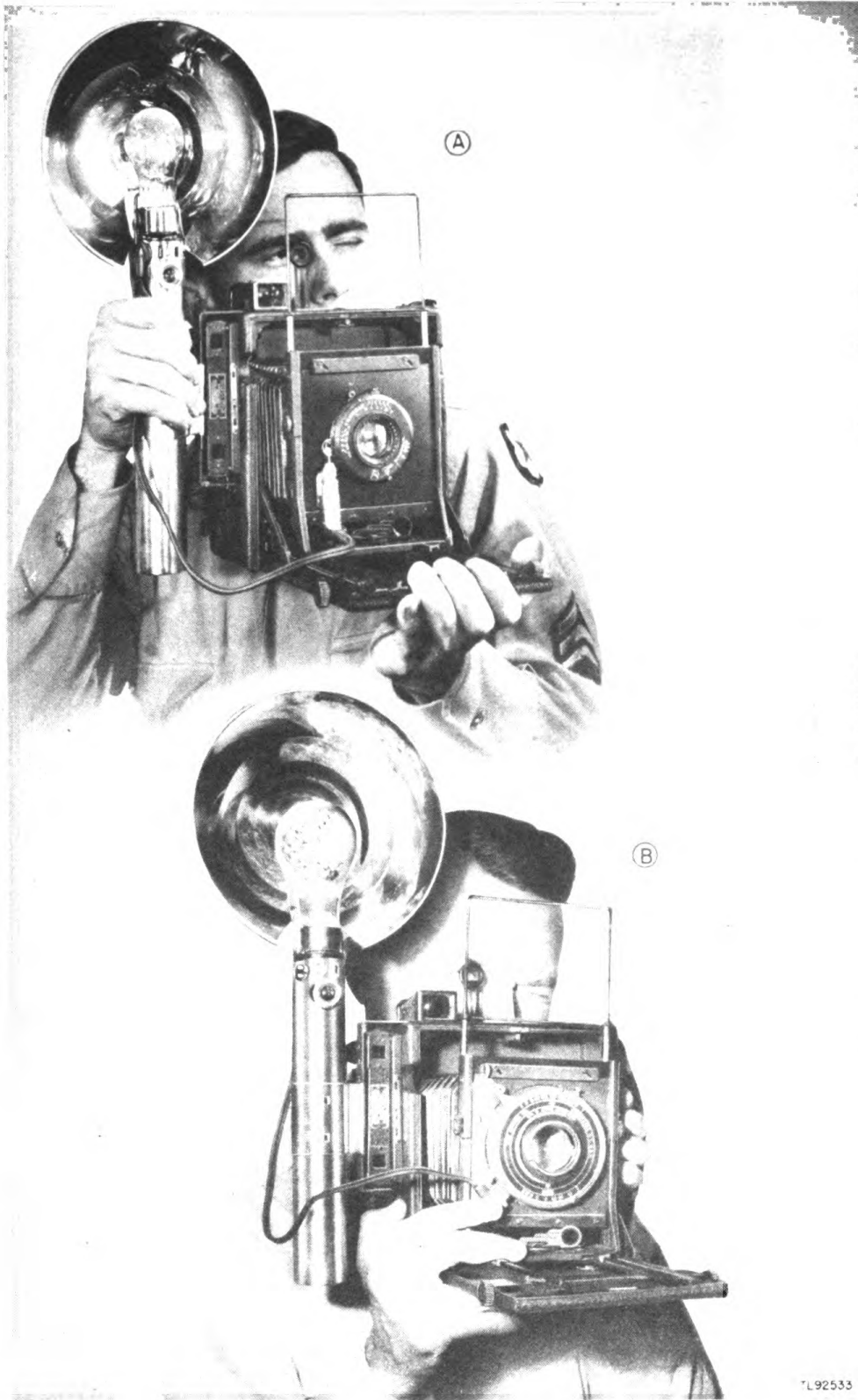
**WHEN**—When ordered by your commander.

- HOW** —1. Smash—Use sledges, axes, handaxes, pickaxes, hammers, crow-bars, 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, foxholes, other holes. Throw in streams. Scatter.

## USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT

- WHAT**—1. Smash—Camera, lens, shutter, solenoid release, flash synchronizer, side-lighting unit, reflectors, film pack adapter, lens hood, filters, filter holder, tripod, all lamps, carrying case.
2. Cut —Bellows, focusing cloth, all cables and connections.
  3. Burn —Film holders, all film, this manual, all wood and cloth parts.
  4. Bend —Remains of camera, reflectors, and solenoid release.
  5. Bury or scatter—All that remains.

## DESTROY EVERYTHING



(A) Camera PH-47-E

(B) Camera PH-47-F

Figure 1. Two models of camera supplied with Camera Equipment PH-104

X

# PART ONE INTRODUCTION

## SECTION I

### DESCRIPTION OF CAMERA EQUIPMENT PH-104

#### 1. GENERAL (fig. 2).

Camera Equipment PH-104 may be issued with either Camera PH-47-E or PH-47-F, both of which are press-type cameras designed for hand use or for mounting on a tripod. Each camera accepts a film holder and film pack adapter for 4- by 5-inch film, and is equipped with a focal plane shutter, a lens mounted in a between-the-lens shutter on a removable lens board, rising and shifting front, drop bed and double extension bellows, focusing scale, ground-glass focusing screen, wire and tubular viewfinders, and a rangefinder. Camera Equipment PH-104 also includes a flash synchronizer, side-lighting unit, reflectors, connecting cord, extension cord, cable release, lens hood, lens cover, filter holder with adapter ring, filters, film holders, film pack adapter, tripod, and focusing cloth. The equipment is contained in a fiber carrying case.

#### 2. COMPONENT PARTS OF CAMERA EQUIPMENT PH-104 (fig. 2).

Quantity	Component	Dimensions (in.)				Weight (lb.)
		Width	Depth	Length	Diam.	
1	Camera Equipment PH-004 complete					25.0
1	Adapter PH-110-A, film pack	5.0		4.0		0.625
1	Cable Release PH-308			7.5		
1	Camera PH-47-E (Ektar or Velostigmat 127-mm $f/4.7$ lens in No. 2 Supermatic shutter)					6.25
1	or Camera PH-47-F (Ilex Paragon anastigmat $5\frac{1}{2}$ -inch $f/4.5$ lens in No. 3 Acme synchronized shutter)					6.50

Quantity	Component	Dimensions (in.)				Weight (lb.)
		Width	Depth	Length	Diam.	
1	Case PH-83-D, fiber	11.25	9.25	19.50		9.125
1	Cloth PH-130-A, focusing	48.0		40.0		0.375
1	Cord, connecting (for Camera PH-47-E)			18.0		
	or					
1	Cord, connecting (for Camera PH-47-F)			21.0		
1	Cord, extension			180.0		
1	Filter (Wratten series VI, K2 yellow)				1.625	
1	Filter (Wratten series VI, X1 green)				1.625	
1	Filter (Wratten series VI, G orange)				1.625	
1	Filter (Wratten series VI, A red)				1.625	
6	Holder PH-81, cut film	5.0		4.0		0.5625
1	Holder PH-106-A, filter and lens hood					
1	Reflector				5.0	
1	Reflector				7.0	0.4375
1	Side-lighting unit					
1	Flash synchronizer (Graflex No. 37)					
1	Tripod PH-121					2.375

### 3. LENS AND SHUTTER ASSEMBLY (fig. 1).

a. Camera PH-47-E is fitted with a 127-mm  $f/4.7$  anastigmat, Ektar or Velostigmat lens. It covers an angular field of approximately  $53^\circ$  on the long side of the negative and is mounted in a No. 2 Supermatic shutter with an iris diaphragm that may be stopped down to  $f/32$ . The shutter consists essentially of five blades lying between the front and rear cells of the lens. It is a rim-set type, providing nine speeds ranging from 1 to  $1/400$  second, plus bulb and time. The shutter contains a press-focus button.

b. Camera PH-47-F is provided with a  $5\frac{1}{2}$ -inch  $f/4.5$  anastigmat Paragon series S lens. It covers an angular field of approximately  $49^\circ$  on the long side of the negative, and is mounted in a No. 3 Acme synchronized shutter with an iris diaphragm that may be stopped down to  $f/32$ . This shutter provides eight speeds from 1 to  $1/200$  second, plus time and bulb. It has a press-focus button, and includes a built-in mechanical synchronizer.

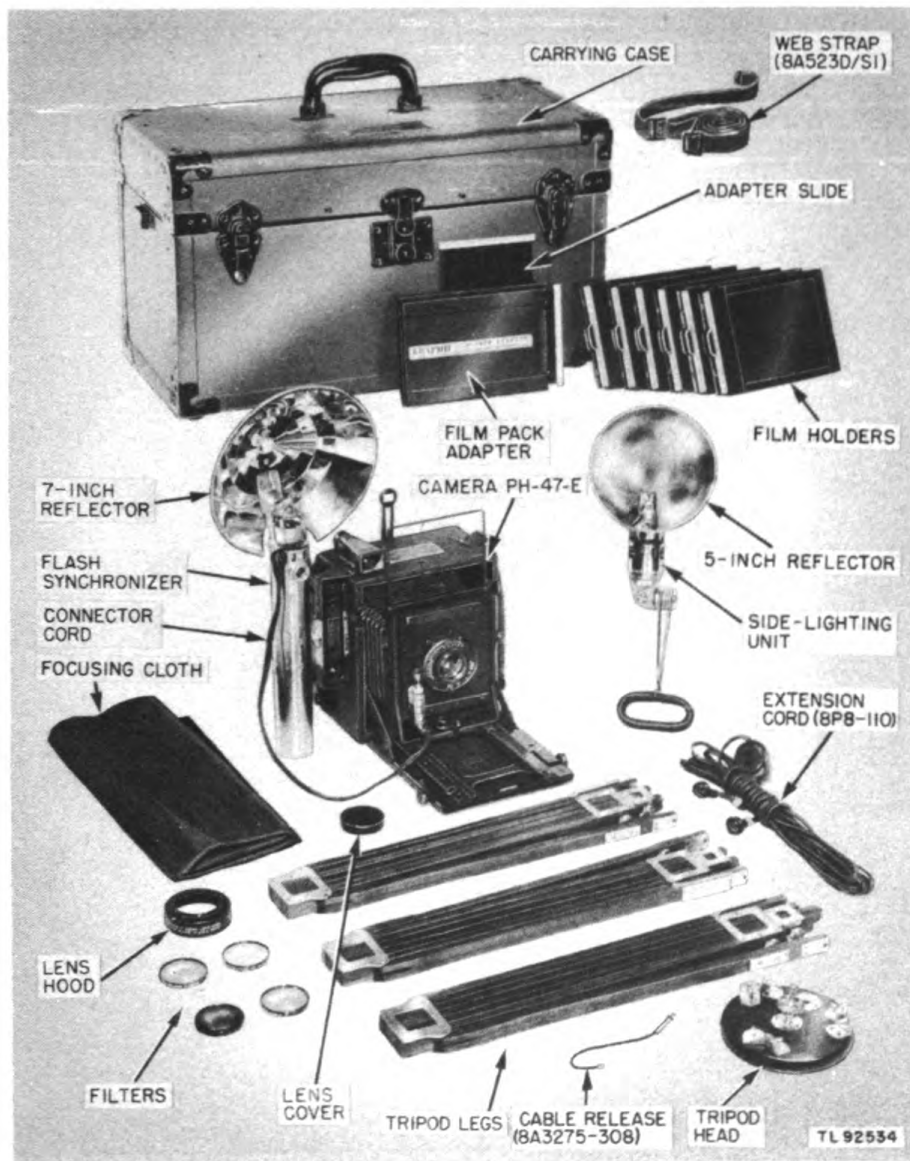


Figure 2. Camera Equipment PH-104

#### 4. FRONT ASSEMBLY (fig. 3).

The front assembly consists of a metal standard mounted on the two-piece movable tandem yoke and supports the lens board containing the lens and shutter assembly. On Camera PH-47-E, the lens board also contains a solenoid release. It is fastened to the lens board frame by means of a slide lock and a retaining strip. The wire finder (fig. 9 (5)) attached to the lens board frame, which is used in conjunction with the peepsight (4), permits a full-scene observation from eye level. It can be raised when needed and telescoped behind the standard when not in use. The two rising front locking nuts, used to hold the lens board frame in a raised position, are located on the vertical

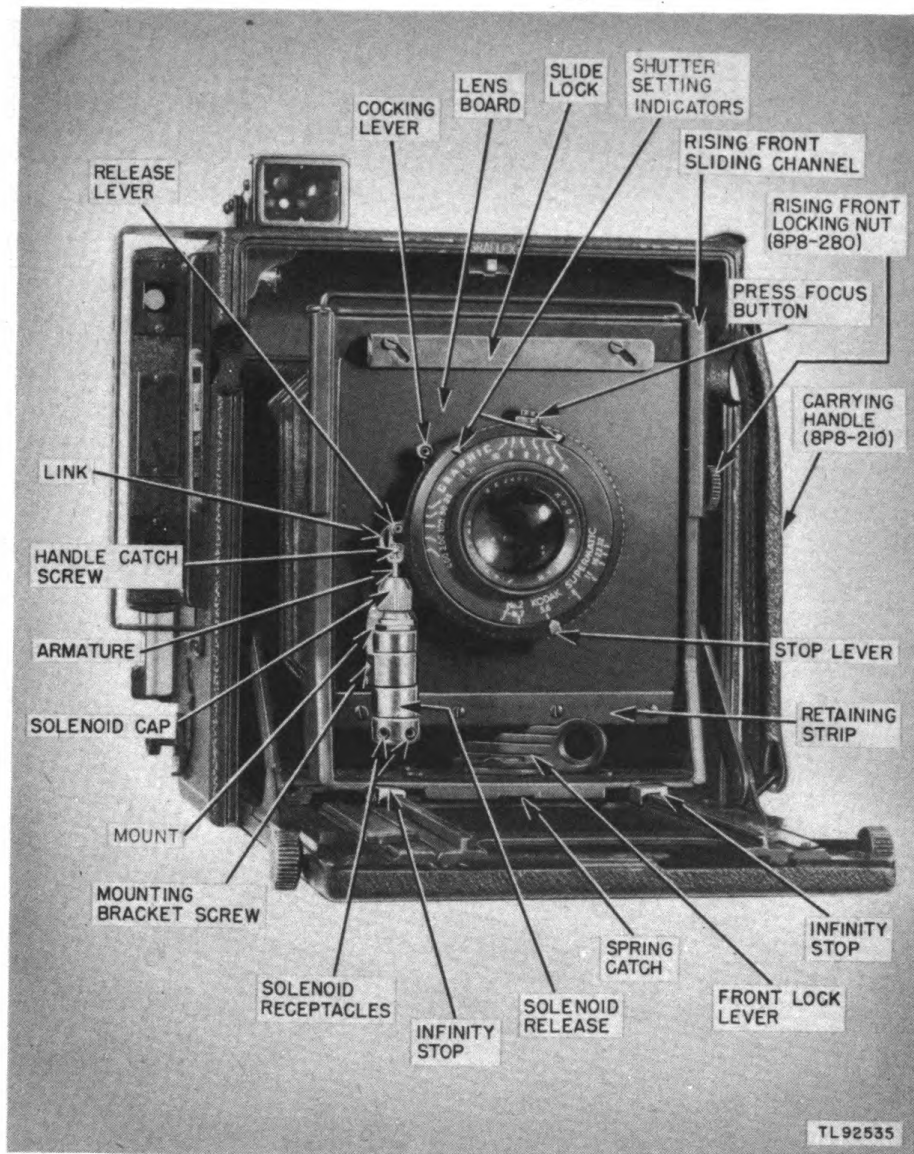
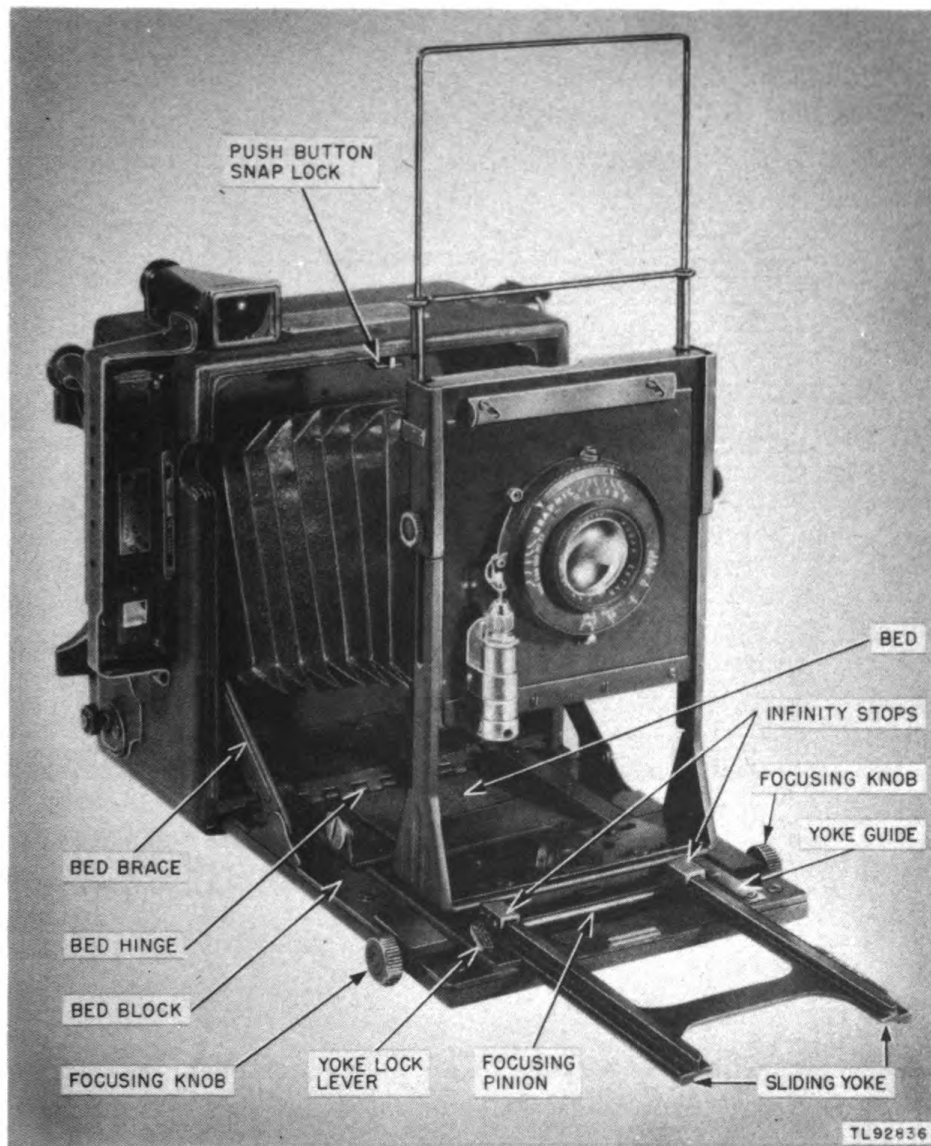


Figure 3. Camera front

sides of the standard. The lens is centered only when the lens board is flush with the top of the standard. The standard is locked into the camera body and also at the infinity stops by the front lock lever, mounted on its base. Also mounted on the standard, directly underneath the front lock lever, is the spring catch which when pressed down permits the standard to be shifted laterally.

##### 5. BED AND YOKE ASSEMBLY (fig. 4).

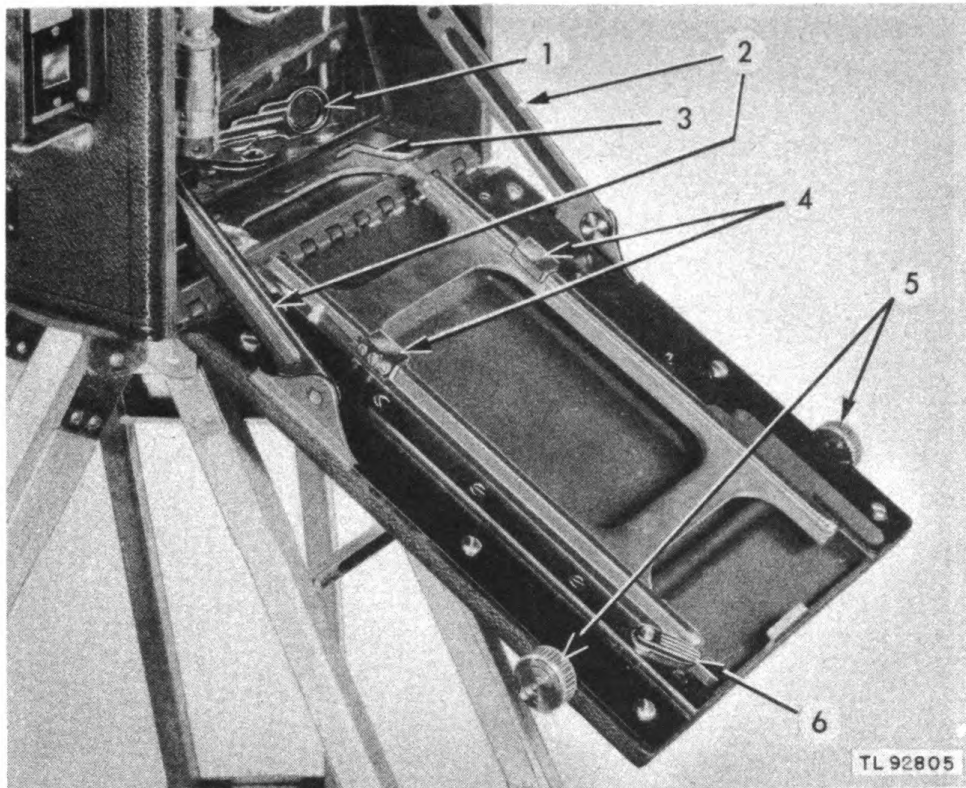
The bed, which is hinged to the camera body at the bottom, serves as the front door of the camera. When closed, it is held in position by the push-button snap lock and protects the interior from dirt and damage. When the



*Figure 4. Bed and yoke*

door is open, it is held rigidly in operating position by two bed braces. The sliding yoke is made up of two sections hinged together by links. One section is in the body yoke and the other is in the bed yoke. The tandem sliding yoke moves between two yoke guides, supported by two bed blocks that are attached to the bed. The forward and backward movements of the tandem sliding yoke, during focusing adjustments, are controlled by a helical focusing pinion assembly operating on a rack which is actuated by two focusing knobs, one on each end of the pinion shaft. The vernier-type focusing scale, calibrated in feet to indicate the distance from the subject to the focal plane, when the subject is in focus, consists of two parts. One part is mounted on the sliding yoke





- |                     |                              |
|---------------------|------------------------------|
| 1. Front lock lever | 4. Infinity stops            |
| 2. Bed braces       | 5. Focusing knobs            |
| 3. Body yoke        | 6. Yoke lock lever (8P8-260) |

Figure 5. Drop bed

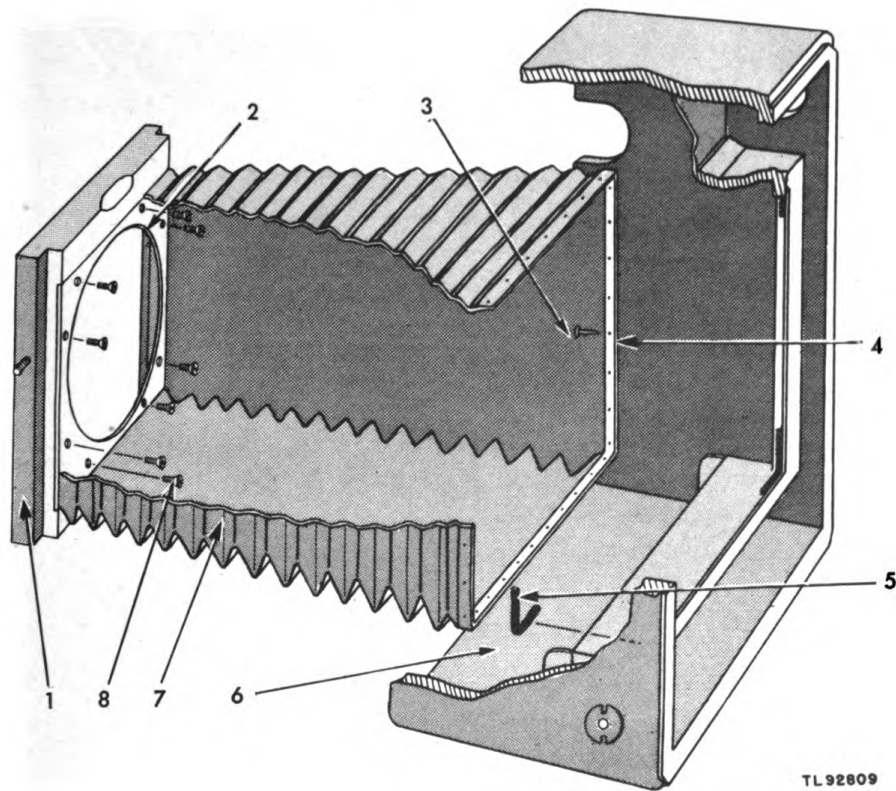
and the other on the bed yoke guide. Two infinity stops on the bed yoke hold the camera front at the correct position on the sliding yoke so that when the focusing scale is on infinity or any distance marked on the scale the lens corresponds. A yoke lock lever, when in its locked position, supplies sufficient friction to prevent the sliding yoke from slipping. The bed (fig. 5) may be dropped below its normal position when using a wide-angle lens. When dropped, the bed locks rigidly in position. This prevents it from accidentally changing position.

## 6. BELLOWS ASSEMBLY (fig. 6).

The bellows is made of accordion-pleated fabric and forms a collapsible, lighttight connection between the film and the lens. It extends and contracts as the camera front is moved in and out for focusing. The front frame of the bellows is screwed to the lens board frame. The tacking strip forms the rear end of the bellows and is attached to the body with nails. To insure a light-proof connection, a strip of yarn is placed between the corners of the bellows and the body.

## 7. BODY ASSEMBLY (fig. 7).

The mahogany body is reinforced with metal inserts and covered with black leather. The bed is hinged to the front of the body and protects the interior from dust and damage. The push-button snap lock holds the bed closed. The focal plane shutter mechanism is inside the body at the rear and the controls of the shutter are located on the outside right rear. The back assembly, which holds the film-holding accessories in place, is mounted on the rear. The carrying handle is attached to the left side by means of two handle catches. The brace plates, mounted inside the body at the front, serve as guides and supports for the bed braces. The tubular viewfinder is mounted at the top right, and the rangefinder at the front of the right side of the body. If the camera is supplied with a Hugo Meyer rangefinder, the steel bracket mounted around the rangefinder protects the mechanism and also serves to hold the battery case.



- |                           |                    |
|---------------------------|--------------------|
| 1. Lens board frame       | 5. Yarn            |
| 2. Front frame            | 6. Body            |
| 3. Bellows tack (8P8-635) | 7. Bellows         |
| 4. Tacking strip          | 8. Screw (8P8-415) |

Figure 6. Bellows (8P8-45)

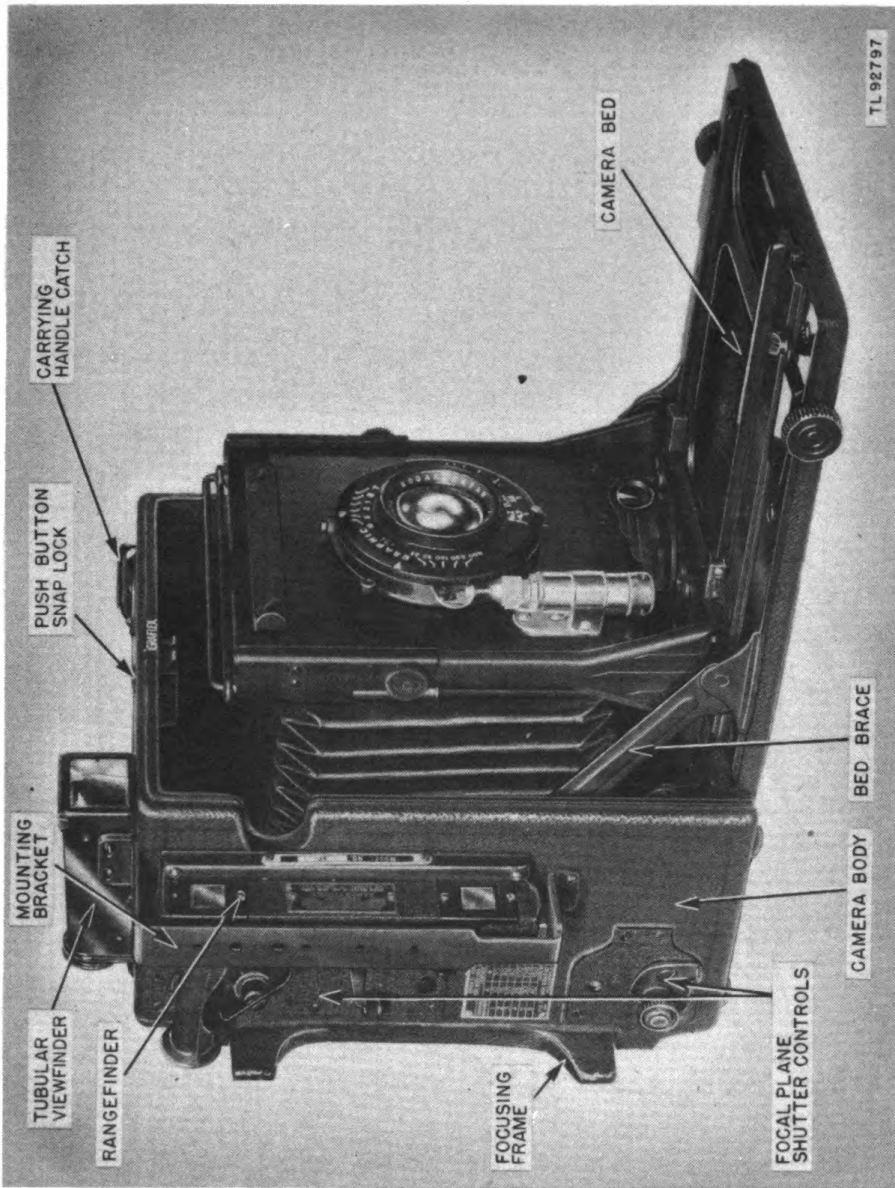


Figure 7. Camera body

## 8. FOCAL PLANE SHUTTER ASSEMBLY (fig. 8).

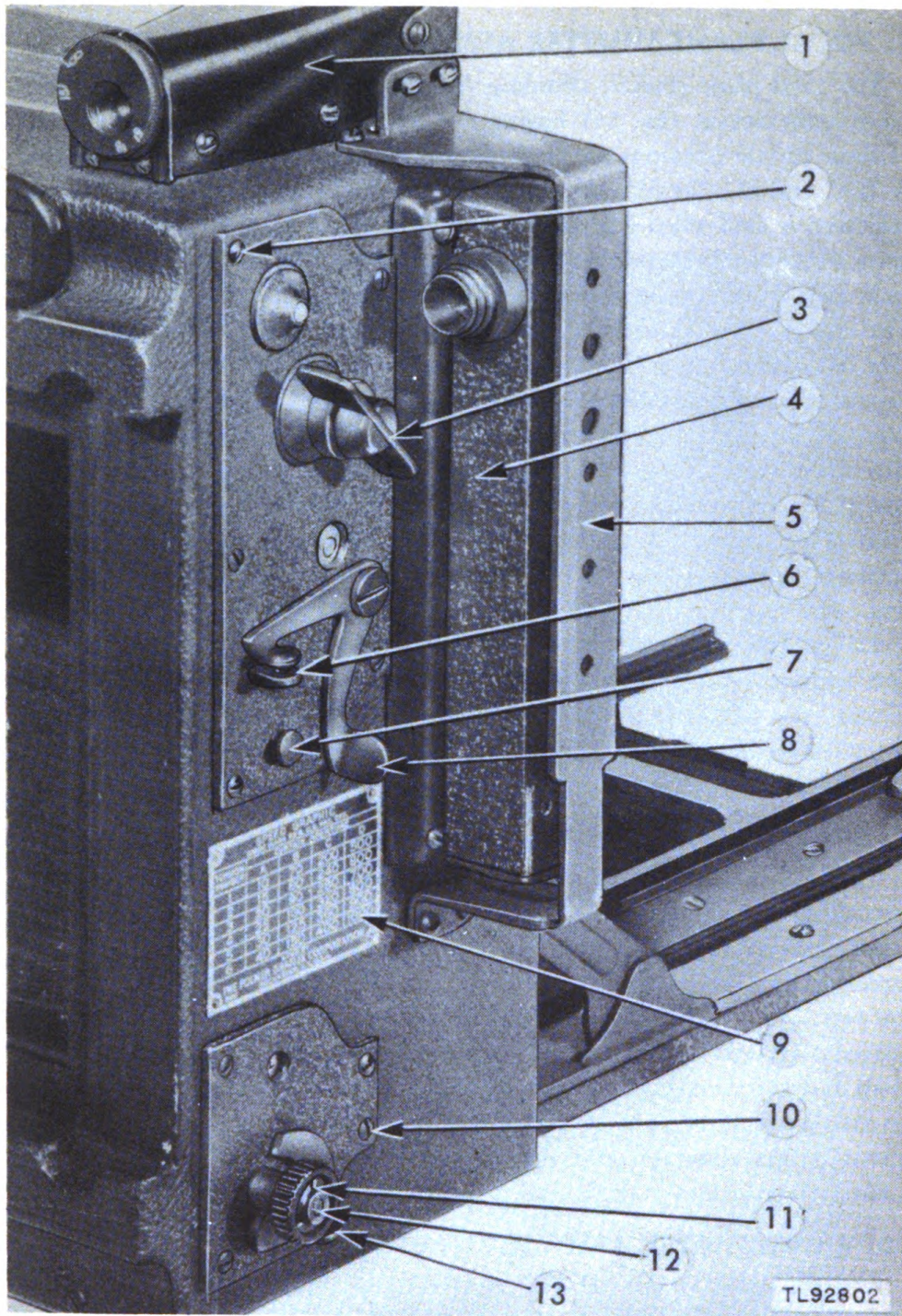
The focal plane shutter, affording fast shutter speeds, consists of a light-proof cloth curtain (fig. 54) having five rectangular openings or slits. Four of these curtain openings are marked on the shutter speed table (par. 49) as A, B, C, and D. The fifth slit, which is indicated by O in the curtain aperture indicator, is used when it is desired to have the focal plane shutter completely open. The approximate sizes of these openings are  $1\frac{1}{2}$  inches,  $\frac{3}{4}$  inch,  $\frac{3}{8}$  inch, and  $\frac{1}{8}$  inch, respectively. The fifth opening is used for time exposures. The shutter speed table indicates shutter speeds in fractions of seconds obtainable in combination with six degrees of shutter tension. By combining the various tensions with curtain opening sizes, it is possible to obtain 24 different exposure intervals, ranging from  $1/10$  second to  $1/1,000$  second, and time. Any one of the openings can be made to pass in front of the focal plane at any one of the six available tensions. The highest tension, No. 6, provides the greatest speed for any selected curtain opening. Selection of a larger or smaller opening produces a lower or higher shutter speed at any selected tension setting. The upper shutter roller (fig. 54) supports the upper end of the curtain. It does not contain a spring, and rotates freely until checked by the escapement. The bottom tension roller contains the tension spring. When the shutter release lever (fig. 55) is actuated, the curtain, with the selected opening, is pulled downward in front of the focal plane, exposing the film. Two idlers (fig. 59) guide the curtain during movement.

## 9. BACK ASSEMBLY (fig. 9).

The back assembly is composed of a metal panel, a wooden focusing frame, two screen springs, a ground-glass focusing screen, a hinged cover, and two fabric light-shields. The metal panel is screwed directly to the rear of the camera body. The focusing frame is attached to the metal plate by means of the two screen springs, and contains the ground-glass focusing screen. The hinged cover and the fabric shields on each side of the cover protect the screen from dust and damage, and prevent undesirable light from reaching the image on the ground glass. The cover is kept closed by a catch at the bottom. Two screen springs allow the focusing frame to be separated sufficiently to permit a film holder or film pack adapter to be inserted and held tightly in position.

## 10. RANGEFINDER ASSEMBLY (fig. 10).

Cameras PH-47-E and PH-47-F may be equipped with either a Kalart or a Hugo Meyer rangefinder. The two rangefinders differ in details of design and construction, but are basically similar. Their operation is identical. A rangefinder (fig. 20) is an optical device for quick, accurate focusing of the lens. It includes a pivoted mirror (lower mirror) coupled with the rangefinder arm which is influenced by the focusing movements of the camera front along the sliding yoke, and a fixed semi-mirror (upper mirror). Looking through the rubber extension eyepiece attached to the rangefinder, two images of the object at which the camera and the rangefinder are directed will be visible.



- |  |  |
|--|--|
| 1. Tubular viewfinder                    | 8. Shutter-release lever                 |
| 2. Curtain-setting plate mounting screws | 9. Shutter-speed table                   |
| 3. Shutter winding key                   | 10. Tension-setting plate mounting screw |
| 4. Rangefinder                           | 11. Tension locknut                      |
| 5. Bracket                               | 12. Tension-winding knob                 |
| 6. Cable-release lug                     | 13. Tension dog                          |
| 7. Shutter lock latch                    |  |

Figure 8. Focal plane shutter operation panels.

The primary image, viewed directly through the semi-mirror (upper mirror), fills the entire visible field. The secondary image, reflected by both mirrors, occupies a smaller, brighter, circular field in the center of the larger area. Focusing movements of the yoke cause the rangefinder arm to rotate the pivoted mirror so that its image (the secondary) moves vertically in the smaller, circular field. If the camera front is in position tightly against the infinity stops, and the primary and secondary images in the field of the rangefinder coincide and become one, the camera lens is in perfect focus.

### **11. TUBULAR VIEWFINDER ASSEMBLY (fig. 11).**

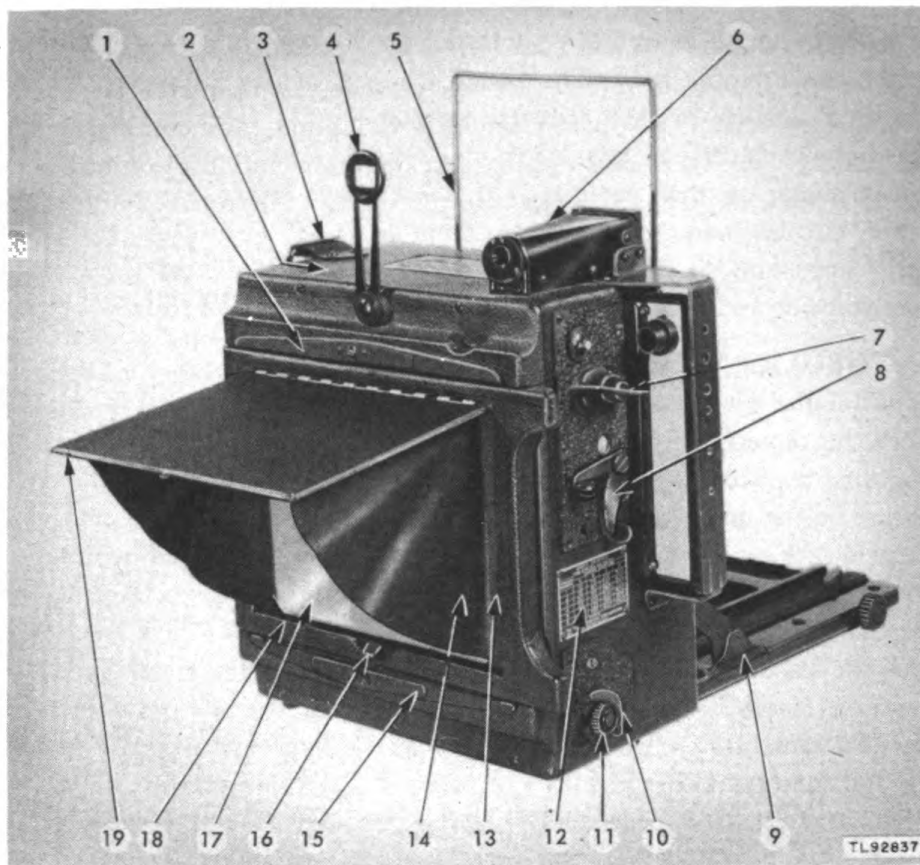
The tubular viewfinder is used to show what portion of the entire scene before the camera will appear on the negative. This provides a means for composing a picture without use of the ground glass. The size of the front aperture on the finder determines the maximum field of view seen through it. The field of view is established by a mask which may be changed by the insertion of a mask of another size to correspond with the angular field of the lens used. The masks supplied with Cameras PH-47-E and PH-47-F are chosen to match the lenses fitted to these cameras. The viewfinder has a scaled rotatable eccentric eyepiece for use in correcting parallax. The eyepiece has four adjustments for centering the subject in the finder at distances of 6 feet, 8 feet, 15 feet, and infinity. Other elements included in the viewfinder assembly are a base plate which is screwed directly to the camera body, a three-sided plastic housing to exclude light from the interior, a front reducing lens, a rear magnifying lens, a front cap, and a retaining clip for the eyepiece.

### **12. FLASH SYNCHRONIZER ASSEMBLY (figs. 24 and 27).**

Cameras PH-47-E and PH-47-F are provided with a flash synchronizer which can be mounted on the side of the camera. A flash synchronizer is an accessory device for firing flash lamps simultaneously with the operation of the front shutter. It consists of a battery case to hold the dry cells that supply the necessary electrical energy, a socket to hold the flash lamp, and a reflector to concentrate and direct the light from the lamp. Camera PH-47-E is fitted with a solenoid release tripping device that synchronizes the operation of the shutter with the flash lamp. The solenoid release causes the shutter to reach its maximum opening simultaneously with the peak of illumination of the lamp. Camera PH-47-F is provided with a shutter that has a built-in mechanical synchronizing device that completes an electric circuit and flashes the lamp when the shutter is at its maximum opening.

### **13. REFLECTOR ASSEMBLY (fig. 2).**

Two reflectors are supplied with Camera Equipment PH-104. The 7-inch, circular reflector of chromium-plated metal causes even illumination on the subject. It is adjustable vertically so that it can be centered for a standard-base lamp of any size. The 5-inch reflector is made of polished, chromium-plated metal and is parabolic in shape. The socket is pre-centered for bayonet-base lamps.



- |  |                                    |
|--|------------------------------------|
| 1. Upper screen spring (8P8-590A)                        | 10. Tension dog                    |
| 2. Body  | 11. Tension-setting knob           |
| 3. Carrying handle catch (8P8-320) with spring (8P8-585) | 12. Shutter-speed table            |
| 4. Peepsight (8P8-540A)                                  | 13. Screen mounting strip          |
| 5. Wire finder (8P8-165)                                 | 14. Light shield (8P8-537)         |
| 6. Tubular viewfinder                                    | 15. Lower screen spring (8P8-590)  |
| 7. Shutter winding key                                   | 16. Spring catch (8P8-75)          |
| 8. Shutter-release lever                                 | 17. Ground glass (8A1201)          |
| 9. Bed brace   | 18. Focusing frame (8P8-175)       |
|  | 19. Hinged cover on focusing frame |

Figure 9. Camera, rear view

#### 14. SIDE-LIGHTING UNIT ASSEMBLY (fig. 12).

The side-lighting unit is used as an auxiliary flash lamp accessory when operating with the flash synchronizer. It accepts miniature flash lamps, and the special head accepts both the 5-inch and 7-inch reflectors which are supplied with Camera Equipment PH-104. The spring clamp with rubber-covered jaws can be attached to convenient objects. The universal-joint neck permits lamp and reflector adjustments in all directions. The extension cord furnished with Camera Equipment PH-104 provides a means of using the side-lighting unit at a distance of 15 feet from the camera.

## **15. LENS HOOD AND FILTER HOLDER ASSEMBLY (fig. 18).**

Holder PH-106-A incorporates a threaded adapter-ring insert. The combination of filter holder and adapter ring provides means for mounting the lens hood which is used for shading the lens, or for mounting the filters when needed, or both. The holder can then be slipped over the front cell of the lens.

## **16. FILTERS (fig. 18).**

The filters are composed of thin sheets of colored photographic gelatin cemented between two disks of optical glass. The edges are sealed against moisture and are protected by metal rims on which the description of the filter is engraved. The action of a filter is to stop light of certain colors. Rays of some colors are allowed to pass through freely, while others are partially or completely absorbed (fig. 13). This is the fundamental concept of a filter and should be kept in mind whenever a filter is used.

## **17. FILM HOLDERS (fig. 17).**

Holder PH-81 is the Graphic type of holder for cut film. It is constructed of wood, with metal septums and hinged retaining strips to facilitate positioning of the film. The hard rubber slides are held in place by brass slide hooks. Each slide has a metal handle, one side of which is black, and the other light in tone. This serves to indicate whether or not the film has been exposed. A series of raised points serves to indicate the light side when loading film in the darkroom.

## **18. FILM PACK ADAPTER (fig. 16).**

Adapter PH-110-A is of all-metal construction, has a hinged cover, and is equipped with a self-locking spring catch. The slide is made of hard rubber and has a metal handle. The adapter accommodates a 4- by 5-inch film pack of 12 exposures.

## **19. TRIPOD (fig. 14).**

Tripod PH-121 is constructed of seasoned wood and has brass fittings. Disassembled, the tripod consists of a wooden head and three adjustable extension legs. The wooden head has two camera mounting holes to facilitate operation when photographing with the bed dropped.

## **20. FOCUSING CLOTH (fig. 2).**

Cloth PH-130-A is made of black cloth and is used for shielding the ground-glass screen from light when focusing.

## **21. CARRYING CASE (fig. 15).**

Case PH-83-D is constructed of heavy fiber, reinforced with riveted metal corners. The hinged lid has a leather carrying handle. The case is equipped with two snap-lock catches, a metal lock and two metal brackets, one on each side, that provide means for attaching or inserting a carrying strap. The compartments inside the case and the space inside the hinged lid provide ample storage space to accommodate all of Camera Equipment PH-104.



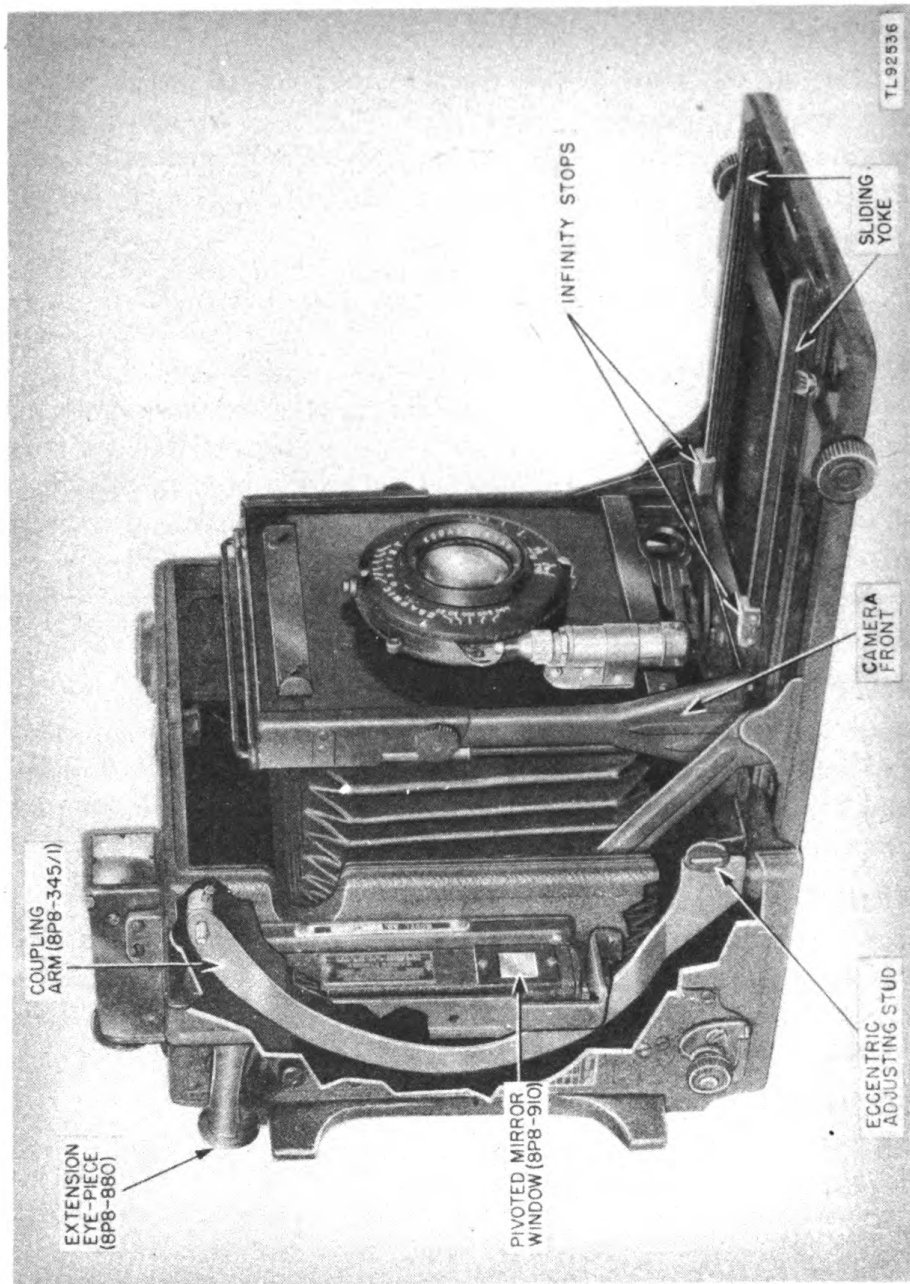


Figure 10. Rangefinder arm

## **22. CABLE RELEASE (fig. 2).**

Cable Release PH-308 consists of a spring cable encased in a flexible metal tube, covered with a webbed fabric. It is 7½ inches long. One end is equipped with a plunger; the other end has a threaded tip which screws into the cable release socket on the front shutter, or into the cable release lug for the focal plane shutter. The cable release permits the operation of the shutters without risk of camera movement when the camera is mounted on a tripod. It is especially useful for time and bulb exposures.

## **23. EXTENSION CORD (fig. 2).**

The 15-foot extension cord, used for connecting the auxiliary side-lighting unit to the flash synchronizer, has molded peanut female right-angle connectors at both ends. It is equipped with a standard, female receptacle in the line.

## **24. CONNECTOR CORD (fig. 2).**

The connector cord is a double-conductor, rubber-covered cord made of copper-stranded wire. It is 18 inches long. One end is fitted with a peanut male plug and the other end has a peanut female plug. It is used to connect the flash synchronizer with the solenoid release on Camera PH-47-E. The connector cord used to connect the synchronizer with the shutter on Camera PH-47-F is 21 inches long, and has female plugs at both ends.

## **25. DIFFERENCES IN MODELS.**

Camera PH-47-E and Camera PH-47-F are identical, except for the lenses, shutters, and trippers described below:

a. Camera PH-47-E is equipped with either an Ektar or Velostigmat 127-mm *f*/4.7 anastigmat lens mounted in a No. 2 supermatic shutter with an iris diaphragm (fig. 1 (A)). The camera is equipped with a solenoid release.

b. Camera PH-47-F is equipped with a Paragon anastigmat 5½-inch *f*/4.5 series S lens mounted in a No. 3 Acme synchronized shutter with an iris diaphragm (fig. 1 (B)). This shutter has a built-in mechanical synchronizer.

## **SECTION II ASSEMBLY**

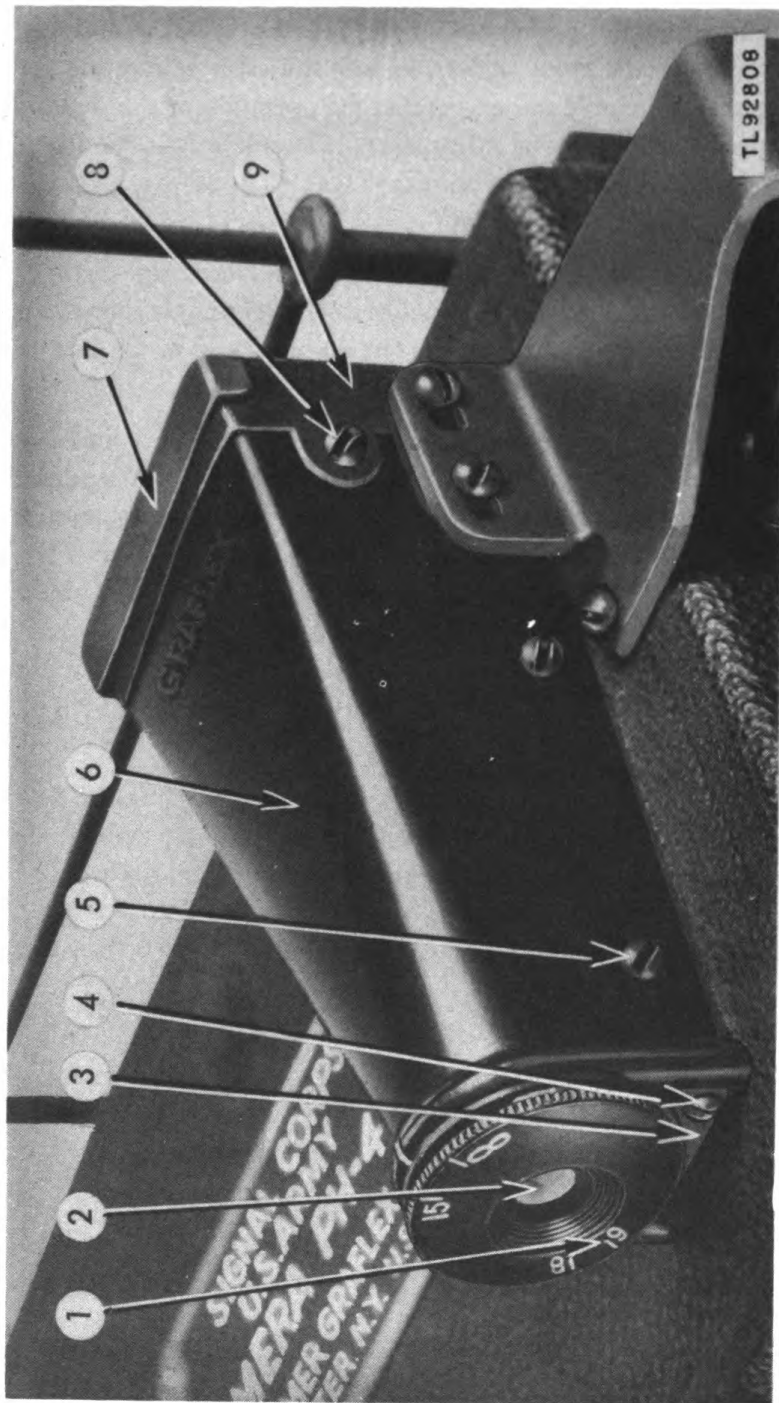
### **26. UNPACKING AND CHECKING.**

When unpacking, handle the equipment gently.

Check all parts against the table of component parts (par. 2). Any damaged or missing parts may be replaced if they are included in the maintenance parts lists (pars. 84 through 96).

### **27. ASSEMBLING TRIPOD (fig. 14).**

Attach each leg separately as follows: Fold back the two wings of the collapsed leg assembly, and then press the two free ends of the wing together so that the holes in their brass end-pieces can be slipped over the bracket pins, on the under side of the wooden head. Lock the leg assemblies to prevent accidental disconnections from the wooden head by pushing down the hinged



- 1. Scaled rotatable eyepiece
- 2. Rear lens
- 3. Eyepiece retaining clip
- 4. Eyepiece mounting screw
- 5. Housing screw (8P8-460)
- 6. Viewfinder housing (8P8-215)
- 7. Removable mask (8P8-270)
- 8. Cap mounting screw (6L6256-3.1)
- 9. Cap (8P8-72)

Figure 11. Tubular viewfinder

brass spreaders until they snap into position. Set the height of the tripod by adjusting both the extension and spread of the legs. Change the length of each leg by telescoping or extending it, after the tightening screws have been loosened. Adjust camera height by means of the lower sliding member which, being solid, may be tightened at any elevation. When attaching or removing the tripod legs from the tripod head, disengage the spreaders, grasp the upper leg members as near the tripod head as possible and press gently. This will minimize the danger of splitting the legs. Breakage of tripod legs will also be avoided by extending the upper sliding member to its lowest position, as far as it will go, so that the tightening screw will exert pressure against it.

## 28. MOUNTING CAMERA ON TRIPOD.

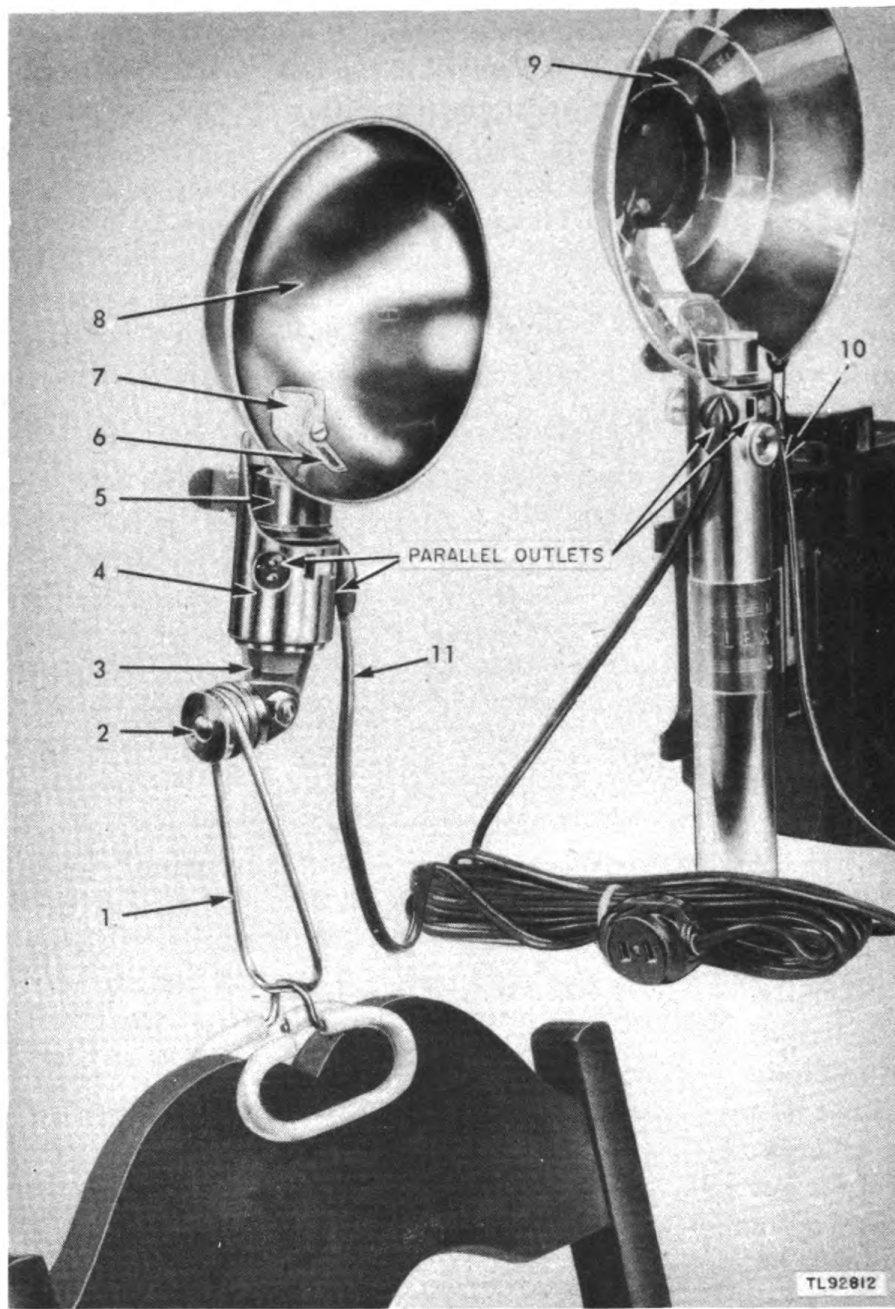
Long exposures necessitate the use of the tripod. Set the tripod firmly on a stationary surface. Avoid platforms that shake or vibrate. When working on soft ground, place the legs of the tripod on boards or stones large enough not to sink or slip. Place the camera on the tripod head, and secure it in position by tightening the locknut screw of the tripod head into the socket located on the under side of the camera body. Cameras PH-47-E and PH-47-F are provided with two tripod sockets mounted in the body of each, one at the bottom, the other on the handle side. In order to make accessible the socket for vertical pictures, unhook the top end of the carrying handle from its catch. The cameras are held firmly against the felt-covered head of the tripod by means of the long brass locknut assembly with an adjustable locknut. When photographing with the bed dropped, this screw is transferred to the hole nearer the rim of the tripod head; otherwise it is used in the center hole.

## 29. REPACKING IN CASE PH-83-D (fig. 15).

When repacking Camera Equipment PH-104 proceed as follows:

- a. **In Front (Long and Narrow Compartment).** The three tripod legs, one above the other on top of the tripod-lifting strap to facilitate removal.
- b. **In Left (L-shaped) Compartment.** The 7-inch reflector in the left end of the case; the 5-inch reflector in the left back corner; the synchronizer mounted opposite the 7-inch reflector and the side-lighting unit alongside the 5-inch reflector.
- c. **In Large Center Compartment.** The camera, with camera back toward the front of case.
- d. **In Right Front Compartment.** The flash lamps.
- e. **In Center Rear Compartment.** The film holders.
- f. **In Right Rear Compartment.** The film pack adapter, filters, and filter holder.
- g. **In Inside of Lid.** The tripod top screwed into socket with locknut screw; technical manual and focusing cloth under center strap; lens shade under straps at left.

**CAUTION:** If the articles do not fit properly in their assigned spaces, do not force them, but locate the cause of binding.



- |                            |                      |
|----------------------------|----------------------|
| 1. Body clamp              | 7. Shell socket      |
| 2. Body and clamp assembly | 8. Reflector, 5-inch |
| 3. Neck assembly           | 9. Reflector, 7-inch |
| 4. Bracket                 | 10. Connector cord   |
| 5. Lamp clamp              | 11. Extension cord   |
| 6. Lamp spring release     |                      |

Figure 12. Side-lighting unit (8P8-538)

# PART TWO

## OPERATING INSTRUCTIONS

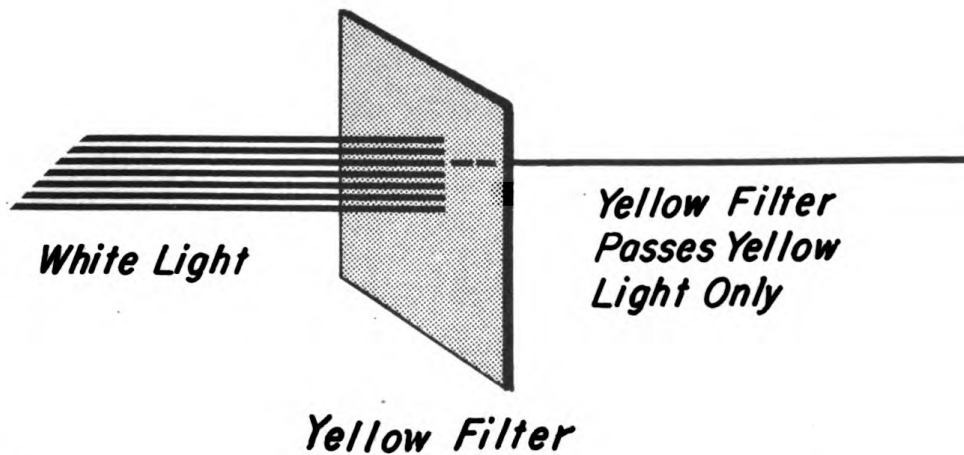
**NOTE:** For information on destroying this equipment to prevent enemy use, see destruction notice at the front of this manual.

### SECTION III

#### PREOPERATION PROCEDURES

#### 30. LOADING FILM PACK ADAPTER (fig. 16).

Open the hinged cover by depressing the two chromium-plated cover release studs. These studs are located at the edge from which the slide may be withdrawn. Insert the metal film pack so that its tabs protrude through the slot in the adapter when the hinged cover is closed. The aperture in the pack must face the film pack adapter slide so that, when the slide is withdrawn, the film will be exposed. Close the cover, making sure that it catches on both sides. The outside tab of the film pack (No. 0) must be withdrawn and torn from the pack before the first exposure can be made. After each exposure pull out and tear off the numbered tab, starting with No. 1 and continuing in sequence through No. 12. After the last tab has been pulled, the exposed film pack is protected by a black tab and may be removed from the adapter without fogging. Save the paper and metal foil in which the film pack was wrapped originally so that it may be rewrapped when it is removed from the adapter. The film pack adapter may be loaded in daylight but never in strong light or direct sunlight. Always hold the film pack by its side when unwrapping it.



TL91197

Figure 13. Filter action

1. Tightening screw
2. Tripod leg
3. Wing
4. Bracket
5. Locknut screw
6. Hinge spreader
7. Locknut assembly

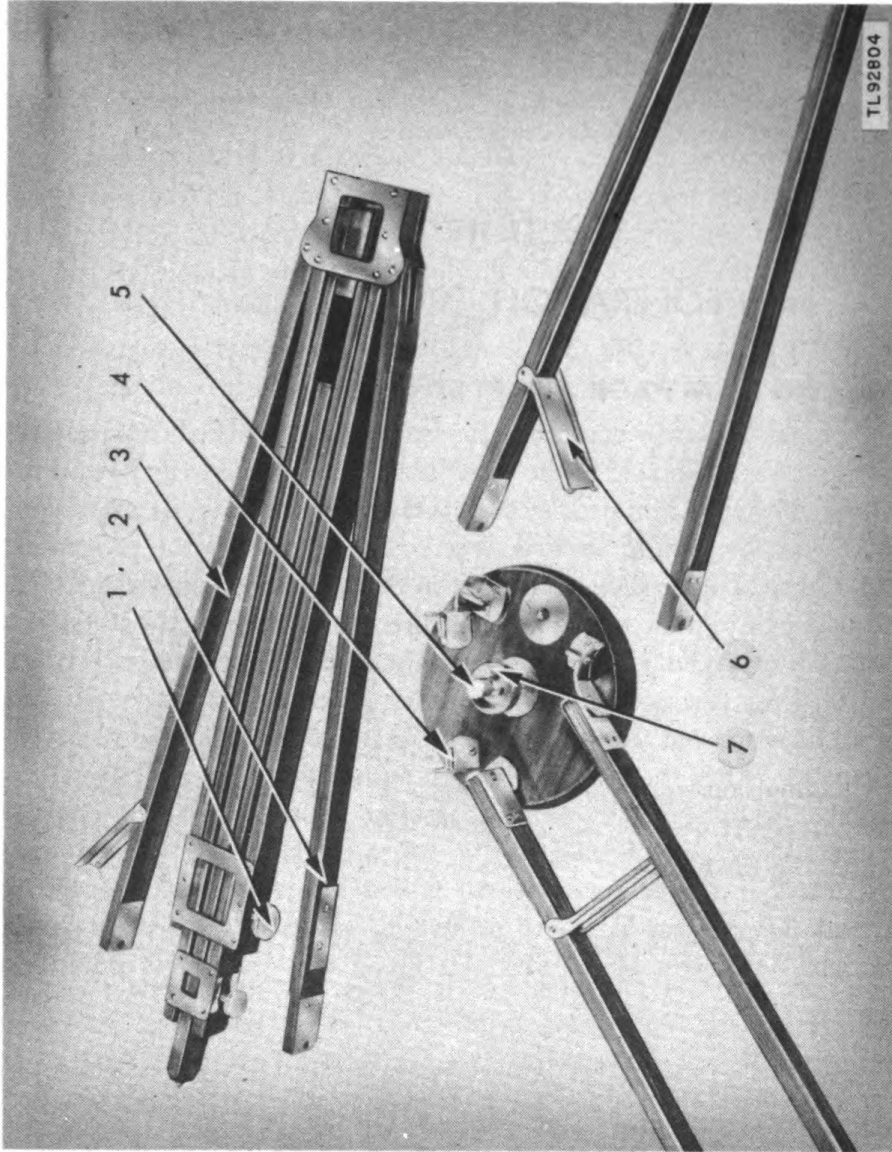


Figure 14. Tripod PH-121

The film will be fogged if the protective black paper appearing in the front opening of the film pack is depressed.

### **31. LOADING FILM HOLDER (fig. 17).**

Withdraw the dark slide about 2 inches, or remove it entirely. Then bend the bottom retaining strip of the holder out from the position which it occupied when the slide was in place. Slip the piece of sheet film under the crimped edges of the septum, so that the emulsion side will face the slide when reinserted. Be sure to slip the film underneath the channel. It may be necessary to depress the film with the fingernail to position it properly. After the film has been slid as far as it will go into the holder, return the retaining strip to its normal position and push the slide in. Make sure that it seats fully in the slot in the strip. Until the film in the holder has been exposed, the dark slide should have the light side of the handle facing outward. Rotate the slide hooks to prevent the unintentional withdrawal of the slide, and to indicate that the holder is loaded. Use the reverse sequence in unloading the holder.

**CAUTION:** Loading or unloading a sheet film holder must be done only in total darkness. In order to acquire the necessary skill to do this, practice in the light with a sheet of fogged or waste film.

**a.** To determine the emulsion side of a piece of sheet film in the dark, hold the film flat and feel the position of the notches cut along one of its shorter edges. The emulsion side will be facing up when the unnotched short edge of the film is nearer the operator and the notches in the other short edge are in the upper right-hand corner. Always handle the film by its edges and never touch the front surface.

**b.** A convenient way of loading is to take the holder open side up in the left hand. The retaining flap should be held away from the operator by the left forefinger. Insert the film with the right hand while holding the upper right-hand corner with the notches lying under the right forefinger. The choice of film should be made with regard to the subject to be photographed and the illumination available, whenever these factors are known. Reserve the extremely fast emulsions for occasions when moving subjects must be photographed in poor light. Photographs showing the greatest amount of detail and gradation usually are made on the slower films.

### **32. FITTING LENS HOOD AND FILTER HOLDER (fig. 18).**

The combination lens hood and filter holder slips on the front cell of the lens. The narrow collar of the adapter ring is slotted so that it may be spread or tightened easily by pushing on the collar sections, thus permitting a proper fit despite slight possible variations in the size of either the lens mount or the adapter ring. Use wooden tools to spread or close the adapter. Be careful to attach or remove the assembly by pushing or pulling it straight on or off in order not to damage the finish of the lens mount.



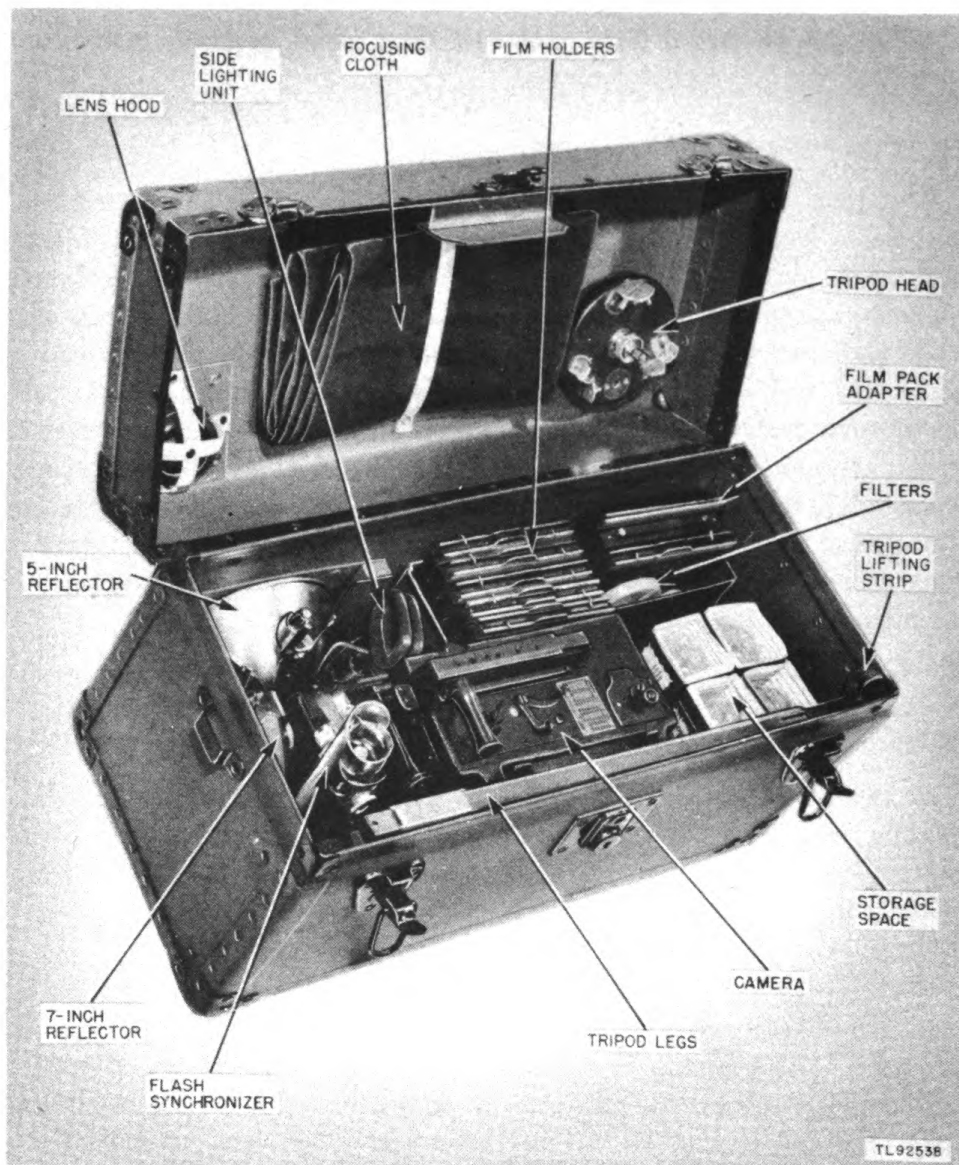


Figure 15. Carrying Case PH-83-D

**a. Use as Lens Hood.** Screw the lens hood directly into the adapter ring, and do not use the insert.

**b. Use as Combination Filter Holder and Lens Hood.** Retain the filter in position by the lens hood, and do not use the insert.

**c. Use as Filter Holder Only.** When used as a filter holder only without the lens hood, the filter is dropped into the adapter ring, and retained by the insert.

**NOTE:** Instructions for the selection and use of filters will be found in TM-1-219, Basic Photography, and in TM 11-2351, Exposure Meters.

## SECTION IV

### STEP-BY-STEP OPERATING PROCEDURES

#### **33. OPENING CAMERA (fig. 4).**

Press the push-button snap lock releasing the hinged camera bed. Swing the bed down. When the spring-actuated bed braces lock, the camera bed is in its normal open position. Grasp the front locking lever, pointing it toward the front of the bed, and pull it forward along the yoke until it meshes with the springs of the infinity stops. Turn the locking lever in either direction and lock. This holds the front standard in position.

#### **34. INSERTING FILM HOLDERS AND FILM PACK ADAPTERS.**

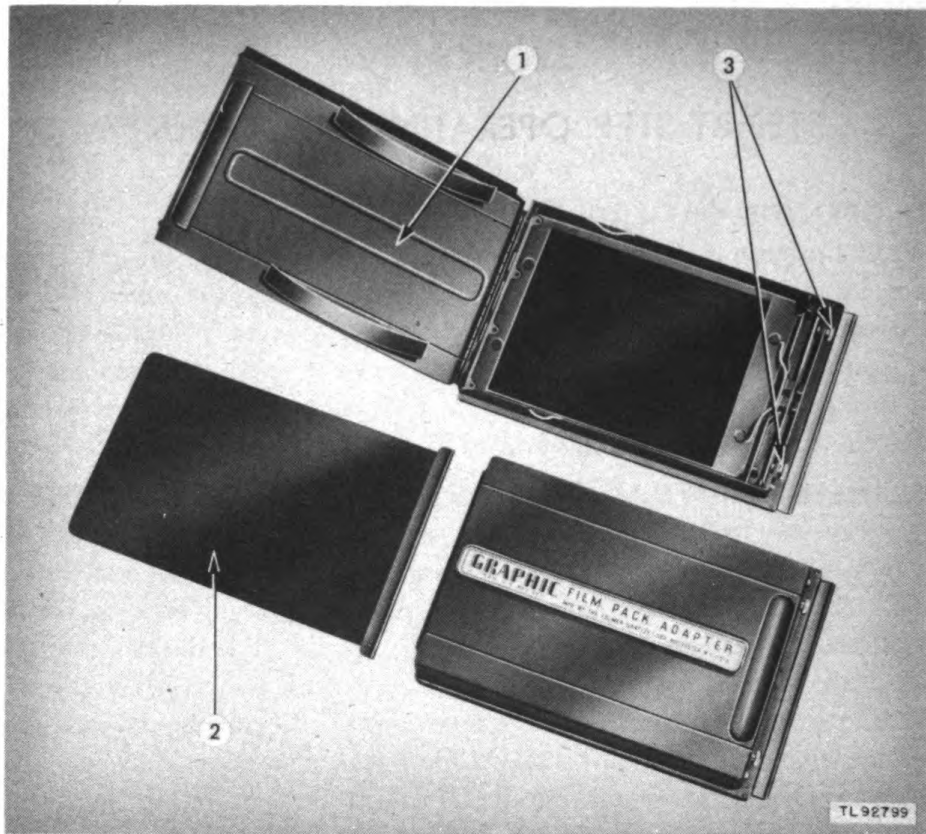
For exposure in the camera, insert the film holder or film pack adapter (with the film to be used toward the lens) between the focusing frame and the back panel. Separate the frame from the back panel by pushing back on the two ears at the right of the focusing frame (fig. 7), and slide the holder or film pack adapter all the way in. Make sure that the ridge on the metal cross strip (fig. 17) seats in the corresponding groove in the back of the camera so that the film will lie in the focal plane and there will be no leakage of light. The film pack adapter is inserted into the camera in the same way as the cut film holder. One side of the metal handles (fig. 17) of the film holder slides is smooth and painted black, while the other is natural metal and has several raised points near one edge. When the holder is loaded, the bright sides of the handles should face out. After exposure, the slides are replaced with the dark sides of the handles out to indicate which films have been exposed.

#### **35. DOUBLE BELLOWS EXTENSION.**

For focusing on very near objects, a double bellows extension is available, which may be extended without removing the infinity stops (fig. 5) from the yoke. Open the bed as instructed in paragraph 33, but do not draw out the front. Depress the bed braces farther and force the bed down into the dropped position shown in figure 5, making sure that the bed braces snap into the lower set of notches in the bed brace plates. Then, with the front lock lever in its released position, draw the front completely out of the camera and off the yoke. Supporting the front with the hand, allow the bed to return to its normal horizontal position by releasing (depressing) the braces. Finally, slip the standard over the front ends of the yoke, and lock it by moving the lock to either side. The rangefinder and focusing scales will not function with double extension, and the ground glass must be used for focusing.

#### **36. VERTICAL AND LATERAL SHIFT OF LENS (figs. 3 and 4).**

**a. Rising Front.** When a camera is tilted up or down so that the film is no longer vertical, lines that are vertical and parallel in the subject will not be rendered parallel in the negative. It is often possible to include the full height of a subject by raising the lens and keeping the camera horizontal with-



1. Hinged cover  
 2. Slide (8A101A/S1)  
 3. Cover release studs

Figure 16. Film pack Adapter PH-110-A

out changing the perspective of vertical lines. This adjustment is permitted by the rising front, controlled by the rising-front locking nuts, which provides for a vertical displacement of the lens of approximately  $1\frac{3}{4}$  inches. To raise or lower the lens, loosen the rising-front nuts, move the lens board to the proper position, and tighten the nuts. Lower to the normal position before closing the camera.

**b. Lateral Shift.** This can be accomplished only while the front lock lever is in its free position (pointing forward). Depress the spring catch directly below it, and move the standard to either side as required. Before final focusing and exposing, the lock must always be returned to its locked position. Before attempting to close the camera, the front standard must be returned to its central position.

### 37. SETTING LENS.

**a.** The only required adjustment of the lenses is to set the diaphragm aperture (lens stop). This is accomplished by moving the stop lever (fig. 3) to a position opposite the desired  $f/$  number on the diaphragm scale. When an object is focused sharply in the camera, a limited area before and beyond the

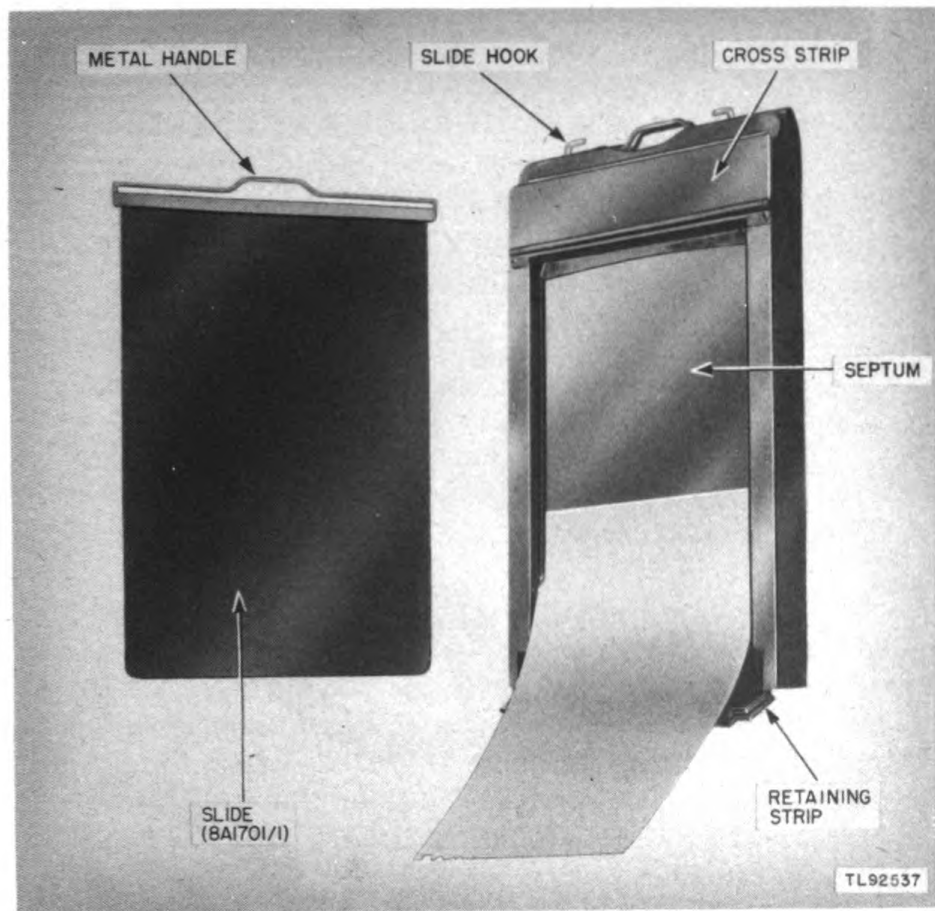


Figure 17. Film Holder PH-81

focused distance also appears acceptably in focus. This range of object distances is known as the depth of field of the lens. Hyperfocal distance is defined as the distance from the focal plane to the nearest object in acceptably sharp focus when the lens is focused on infinity. The hyperfocal distance varies with the aperture at which the lens is set. It differs for lenses of different focal lengths. At small diaphragm apertures the hyperfocal distance of a particular lens lies nearer the camera than at the large apertures. Similarly, a lens of shorter focal length will have a shorter hyperfocal distance than a lens of greater focal length set at the same diaphragm aperture.

b. The following is a table of hyperfocal distances for a 127-mm or 135-mm lens.

Aperture	$f/4.7$ or $f/4.5$	$f/5.6$	$f/8$	$f/11$	$f/16$	$f/22$	$f/32$
Hyperfocal distance (ft.)	95	78	55	40	27	20	14

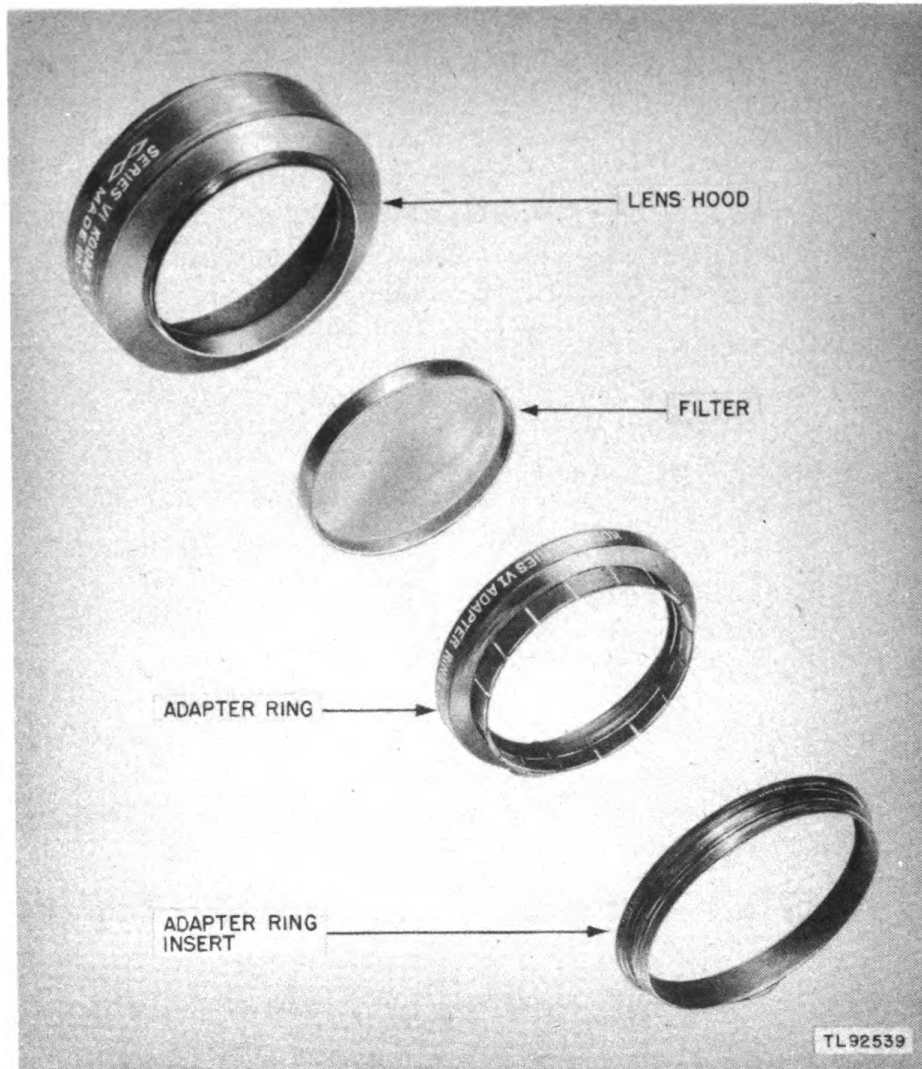


Figure 18. Lens hood and filter Holder PH-106-A

**EXAMPLE:** If the 127-mm lens is focused on infinity and the aperture set at  $f/16$ , everything more than 27 feet distant from the camera will be acceptably sharp in the negative.

c. A type of universal focus is possible on the basis of the hyperfocal distance. When a lens is set at the hyperfocal distance for the aperture in use, everything from infinity down to one-half the hyperfocal distance will be acceptably sharp on the negative.

**EXAMPLE:** If the 127-mm lens is focused on 27 feet with the aperture set at  $f/16$ , the depth of the acceptably sharp field will extend from 13 feet to infinity.

d. The practical application of the hyperfocal distance is that, when a picture must be made in a hurry, the lens can be set at infinity and the aperture

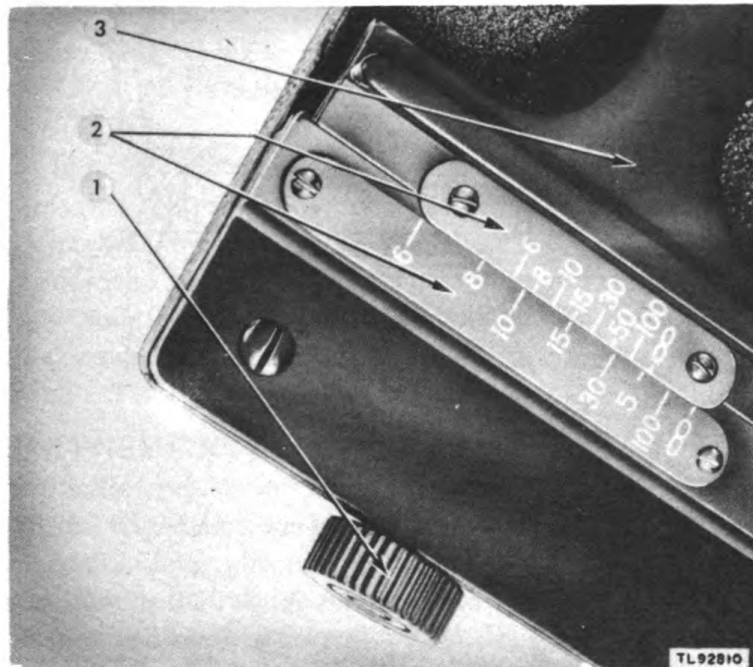
adjusted to bring the subject into focus. When the subject is closer to the camera than the closest hyperfocal distance permitted by prevailing conditions, the lens may be set at the hyperfocal distance for the particular aperture that must be used. When the background must be sharp, focusing on the hyperfocal distance offers the greatest possible utilization of available depth of field.

**CAUTION:** Bear in mind that variations in the aperture require corresponding adjustments in the exposure time (shutter-speeds setting).

### 38. GROUND-GLASS FOCUSING.

When focusing on the ground-glass screen, proceed as follows:

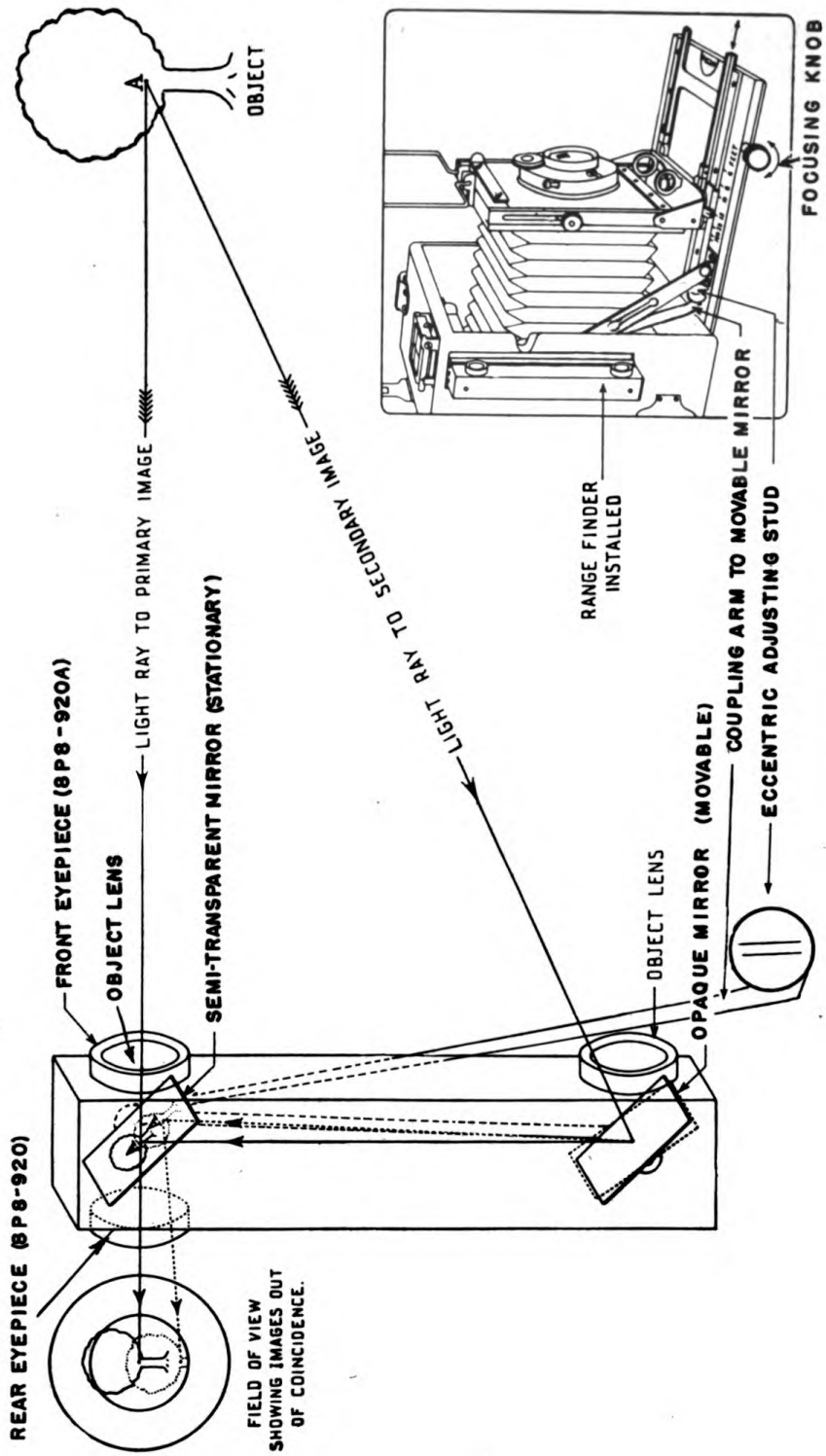
- a. Open the lens to its largest aperture. This will be  $f/4.7$  on Camera PH-47-E, and  $f/4.5$  on Camera PH-47-F.
- b. Set the between-the-lens shutter on time.
- c. Open the focal plane shutter by placing 0 in the curtain aperture indicator.
- d. Open the hinged cover on the focusing frame.
- e. Shield the ground glass from outside light by placing the focusing Cloth PH-130-A over the head and camera body, taking care not to cover the lens, so that the image will be distinct. Rack the lens in and out by turning either of the focusing knobs (fig. 4) until the object to be photographed is sharp. The yoke lock lever should be swung outward to secure the yoke against unintentional movement when critical focusing has been accomplished. Close the hinged cover (fig. 9). Close the shutter that is to be used for making the exposure.



1. Focusing knob  
2. Focusing scale

3. Sliding yoke

Figure 19. Vernier focusing scale



TL 92925

Figure 20. Rangefinder principle

**NOTE:** Return the yoke lock lever to its forward position before attempting to change the focus or close the camera.

f. Use the focusing scale (fig. 19), which is mounted on the camera bed, only when the front standard has been pulled out firmly against the infinity stops. The distances marked are from the focal plane (the ground glass or film) to the object in sharpest focus. The scales are of the vernier type, and the distance is read off as that for which the nearest correspondingly numbered lines on both scales coincide (15 feet in the illustration).

### **39. RANGEFINDER FOCUSING (figs. 20 and 21).**

To use the rangefinder, look through the eyepiece and locate the subject in the visible field. The entire field contains an image and in the center is a smaller, brighter, circular area containing a second (yellow) image. When the rangefinder and the lens are focused on the subject a single image will be visible in the central field. When they are out of focus, two images will be seen. Focusing the lens by means of the focusing knobs will cause a shift in the position of the central image; when it is brought into coincidence with the image in the larger field, the lens will be focused. It is helpful to focus on a portion of the subject containing sharp lines that have good contrast and run at right angles to the axis of the rangefinder, so that the exact coincidence of the images will be easier to detect. Use the rangefinder only when the front standard has been pulled out firmly against the infinity stops.

### **40. USING TUBULAR VIEWFINDER (fig. 11).**

The tubular, direct, optical viewfinder provides a means for determining the field of view, correcting parallax, and locating the center of the field at extremely close distances. The rotatable eyepiece on the back of the finder has four markings, which can be aligned with the white line at the top of the finder. Notches assist in locating the four points so that subjects at distances of 6 feet, 8 feet, 15 feet,  $\infty$  (infinity), respectively, will be centered on the negative when they are centered in the viewfinder, provided the photographer's eye is also centered. When using the finder, set the dial for the distance to the subject indicated by the focusing scales. Intermediate distances may be estimated with sufficient accuracy. The front of the tubular viewfinder is provided with a removable mask which indicates the approximate field of view covered by the 127-mm or 135-mm lens.

### **41. USING WIRE FINDER (fig. 30).**

The wire finder consists of the peepsight, mounted on the back of the camera, and the wire frame, which telescopes behind the front standard. It is best suited to making pictures of rapidly moving objects that would be difficult to follow in the tubular finder. To prepare the wire finder for use, raise the pivoted peepsight to a vertical position; grasp the upper bar of the wire frame at its center, and pull it straight up until the upper section is fully extended and the lower bar of the frame is about 1 inch above the top of the lens board frame. To use the wire finder, place the eye as close as possible to



the peepsight (fig. 1) and center the eye and peepsight in the wire frame. The area included by the frame corresponds approximately to the field of the 127-mm or 135-mm lens. To close the wire finder push the peepsight down to the right and push the wire frame straight down until it is completely telescoped.

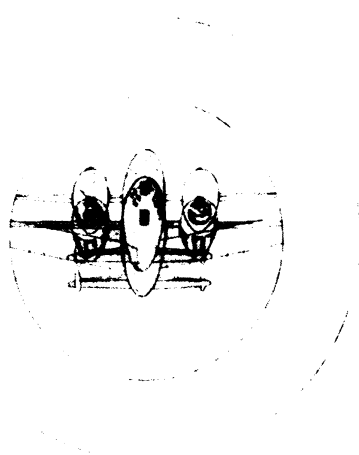
**NOTE:** Viewfinders should not be relied upon for a very accurate indication of the exact limits of the scene. The amount of scene visible through a finder depends upon the position at which the observer holds his eye. This condition differs between individuals and varies when the user wears glasses. For accurate composition, place the camera on a tripod and use ground glass.

#### **42. USING SUPERMATIC SHUTTER ON CAMERA PH-47-E (fig. 3).**

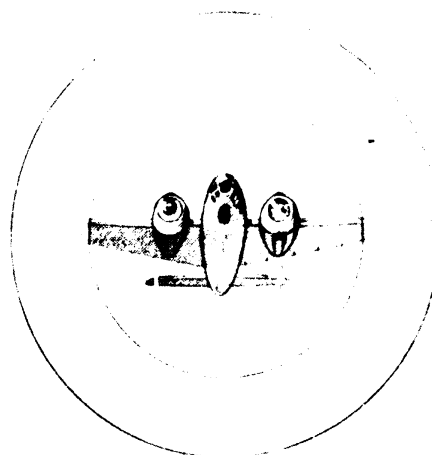
To set the supermatic shutter, rotate the speed indicator ring, on which are the two shutter setting indicators, until the selected indicator is immediately adjacent to the desired speed on the shutter speed scale. The slower speeds (below 1/25) require that the camera be on a tripod or other firm support and that the cable release be used. The cable release socket is located in the edge of the shutter housing below the release lever and behind the solenoid cap. The speeds (1/25 through 1/400) are generally for hand-held exposures. When necessary, the shutter speed may be altered after cocking. To cock the supermatic shutter, move the cocking lever upward until it catches. This is required for all exposures, including time and bulb. To release the supermatic shutter, depress the release lever gently, or press a cable release inserted in the socket, or trip the shutter by means of the flash synchronizer. To make a time or bulb exposure, set the shutter indicator ring at either T or B and cock the shutter. Pressure on the release lever allows the shutter to open at both settings. When set for bulb, the shutter closes as soon as the pressure on the release lever is removed, but when set for time, a second pressure on the release lever is required to close the shutter. For ground-glass focusing without opening the shutter on time or bulb, use the press-focus button (blade-arrestor). Set the shutter at any desired speed, and cock. Depress the press-focus button and hold it down; then depress the shutter release lever. The shutter blades are caught and held open. When focusing is complete, re-cock the shutter. The blade-arresting mechanism disengages itself so that the exposure may then be made in the normal way. To remove the shutter from the camera, take out the entire lens board to which the lens, shutter, and solenoid release are attached. Move the slide lock, which is the long plate near the top of the lens board frame, up and to the left by pressing on the turned-out extension at its left end. Lift out the lens board at the top, and then up until it is free. Reverse the operation to replace the lens board.

#### **43. USING ILEX No. 3 ACME SYNCHRONIZED SHUTTER ON CAMERA PH-47-F (fig. 22).**

To set this shutter, rotate the outer knurled speed indicator ring, on which a single shutter setting indicator is engraved, to either the left or the right



OUT OF FOCUS



IN FOCUS

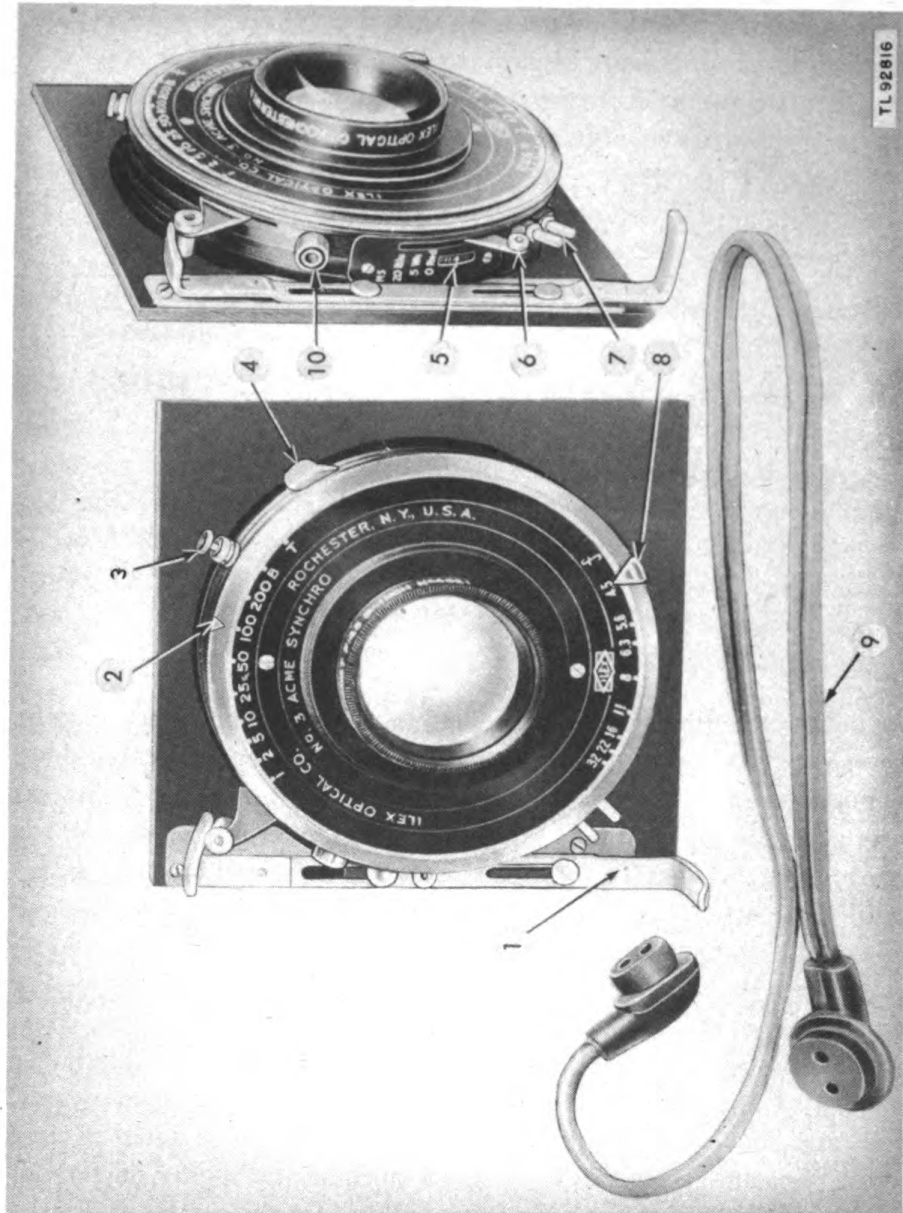
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Figure 21. Rangefinder images

until the indicator is directly over the desired speed on the shutter speed scale. The slower speeds below  $1/25$  require that the camera be on a tripod or other firm support and that the cable release be used. The speeds  $1/25$  through  $1/200$  are generally for hand-held exposures. This shutter may be set over the entire range after cocking. To cock the shutter, move the cocking lever downward until it catches. This is required for all exposures, including time and bulb. To release the shutter, pull the auxiliary shutter release lever downward, or press a cable release inserted in the socket. Time and bulb exposures require the pointer to be set at T or B respectively, and the shutter to be cocked. Pressure on either the auxiliary release lever or the cable release allows the shutter to open both settings. When set for bulb, the shutter closes as soon as pressure is released, but when set for time, a second pressure is required to close the shutter. Ground-glass focusing, without opening the shutter on time or bulb, is obtained by use of the press-focus button. Set the shutter at any desired speed and cock it. Then press the press-focus button, which opens the shutter. When focusing is complete, recock the shutter. The exposure may then be made in the normal manner.

#### 44. USING FOCAL PLANE SHUTTER (fig. 23).

a. The shutter speed table (par. 49) gives approximate exposure times, in fractional parts of a second, obtained with the curtain openings A, B, C, and D in various combinations with the tension numbers 1 through 6. The letters are changed progressively on the curtain aperture indicator by turning the shutter winding key counterclockwise. The tension numbers are changed from 1 to 6 on the lower tension indicator by turning the tension setting knob counterclockwise. In so doing, progressively smaller openings and higher



1. Auxiliary shutter release lever
2. Shutter-setting indicator
3. Press-focus button
4. Cocking lever
5. Synchronizing disk
6. Shutter-release lever
7. Shutter-contact points
8. Stop lever
9. Connector cord

Figure 22. Ilex No. 3 Acme synchronized shutter

tensions, producing shorter exposures, are made available. To reverse either operation and return to a wider opening or lower tension (longer exposure) than indicated, move the shutter release lever and the tension release dog respectively to allow the mechanism to unwind, one notch at a time. It will be found easier to set to a higher tension before winding to a narrower opening.

**CAUTION:** Because one of the curtain openings passes in front of the picture aperture every time the curtain is moved either by winding the key, or by allowing it to unwind by actuating the shutter release lever, it is necessary to protect any film in the camera while the focal plane shutter is being set; otherwise injurious fogging of the film will result. When using the focal plane shutter always keep the slide in the film holder or film pack adapter, except when an exposure actually is being made.

**b.** When the shutter has been set in accordance with the directions above, make the exposure by carefully pressing the shutter release lever or the plunger of a cable release screwed into the cable release lug. To make a time exposure with the focal plane shutter, wind or release the curtain until T (time) appears in the upper window. Set the tension at 1; rest the camera upon a rigid support; open the shutter with one pressure upon the shutter release lever and terminate the exposure by a second pressure.

**CAUTION:** When using the focal plane shutter, be sure that the between-the-lens shutter is set at time and is open. Conversely, be sure that the focal plane shutter is set at 0 (full opening) and locked when using the between-the-lens shutter.

**c.** The focal plane shutter can be locked open (0 in the upper window) or closed (T in the upper window) by moving the shutter lock latch toward the back of the camera. It may be unlocked again either by pushing it forward, or by turning the shutter winding key.

**d.** The cable release may be inserted in the cable release lug for the focal plane shutter for making time exposures.

**e.** When the focal plane shutter is not in use, set the tension indicator at 1 or low tension, to avoid weakening the tension spring.

#### **45. USING SYNCHRONIZER WITH CAMERA PH-47-E (fig. 24).**

Attach the battery case to the mounting plate on the rangefinder housing or to the rangefinder mounting bracket; connect the solenoid release to a parallel outlet on the battery case; attach the proper reflector to the battery case, and insert a lamp in the socket. Detailed instructions follow.

**a. Attaching Synchronizer to Camera.** Open the clamp lever on the battery case, slide the clamp on the mounting plate or bracket from the bottom to the desired location; lock the battery case on the plate by closing the clamp lever. Push the male plug of the connector cord firmly into the receptacle in

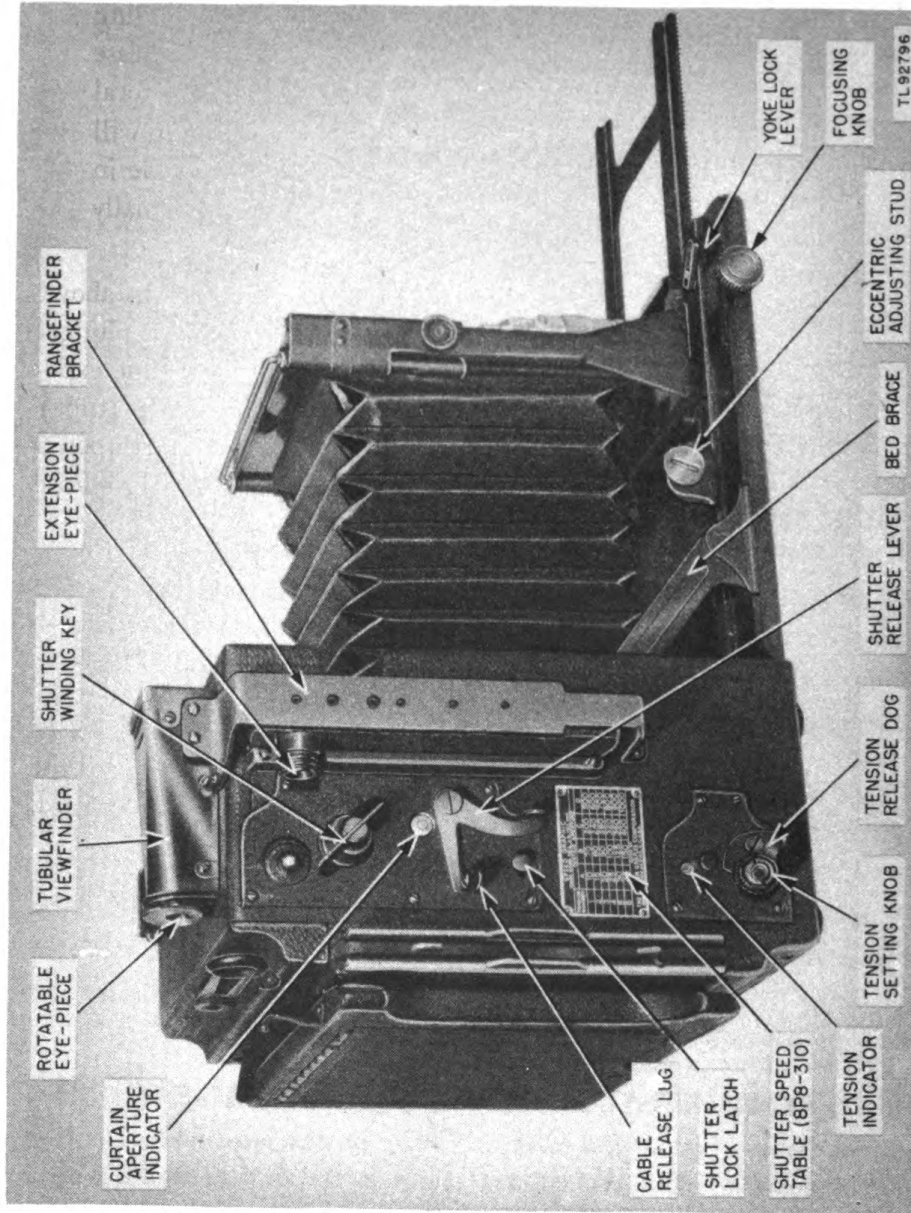


Figure 23. Focal plane shutter controls

the solenoid release. Push the female plug on the other end of the cord on to one of the parallel outlets at either side of the top front of the battery case.

**b. Attaching Reflectors.** The reflector to be used will depend upon the type of lamp selected for the picture. For pictures at close and medium distances the light output of the bayonet-base lamps and 5-inch reflector is adequate. For pictures at long distances the high output of the larger standard-base lamps and 7-inch reflector is required.

(1) If a standard-base lamp is to be used, the 7-inch reflector will be required. Insert the two prongs of the reflector support in the openings at the upper rear of the battery case head and press down firmly with the thumb on the flat portion of the support until the small lug at the back of the support can engage the corresponding hole in the back of the battery case; push the support back so that this lug engages in the hole to lock the support and reflector in position.

(2) If a miniature bayonet-base lamp is to be used, the 5-inch reflector is required. It is inserted in substantially the same way as is the 7-inch reflector. In pressing the reflector down into position, the thumb should rest on the socket that is a part of the reflector assembly.

**CAUTION:** Under no circumstances should a reflector be inserted by pressing on the reflector itself; always press on the reflector support or socket, lest the reflector be deformed or bent out of its proper shape.

**c. Inserting Lamps.** Both standard-base and bayonet-base lamps can be used with the synchronizer.

(1) Standard-base lamps are inserted in the 7-inch reflector merely by pressing the base down into the socket. They are released by pressure on the two wings of the clamp protruding from the top rear of the battery case. The height of the reflector should be adjusted so that its center is opposite the center of the lamp; to make this adjustment loosen the thumbscrew at the back of the reflector.

(2) Bayonet-base lamps are inserted in the socket of the 5-inch reflector by engaging the prongs of the base in the slots at the front and rear of the socket and pressing the lamp down until the front prong is below the lug of the clamp that retains it. Lamps are released by downward pressure on the portion of the clamp that protrudes forward.

**d. Operating Synchronizer.** The synchronizer is operated by pressure on the push-button switch at the back of the battery case. To make a flash exposure it is necessary only to cock the shutter; place a film holder in the camera and remove the slide; insert a lamp in the synchronizer socket; focus the lens; compose the picture in a viewfinder; and, lastly, press the main switch on the synchronizer. After exposure has been made, release the lamp as instructed above; replace the slide in the holder, and remove the holder.

**e. Using Side-lighting Unit (fig. 38).** Use this equipment when it is desirable to throw additional lighting on the subject. Clamp the side-lighting

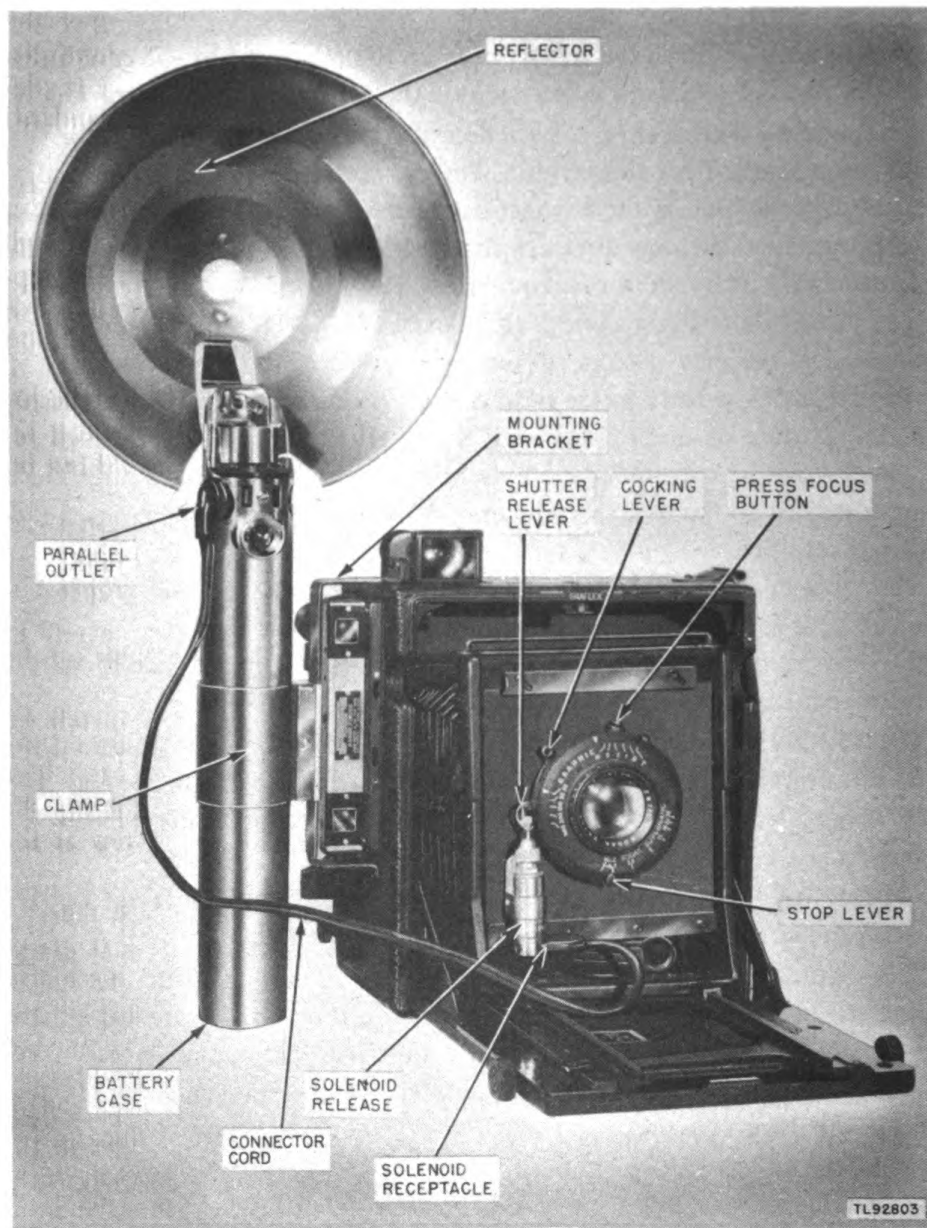
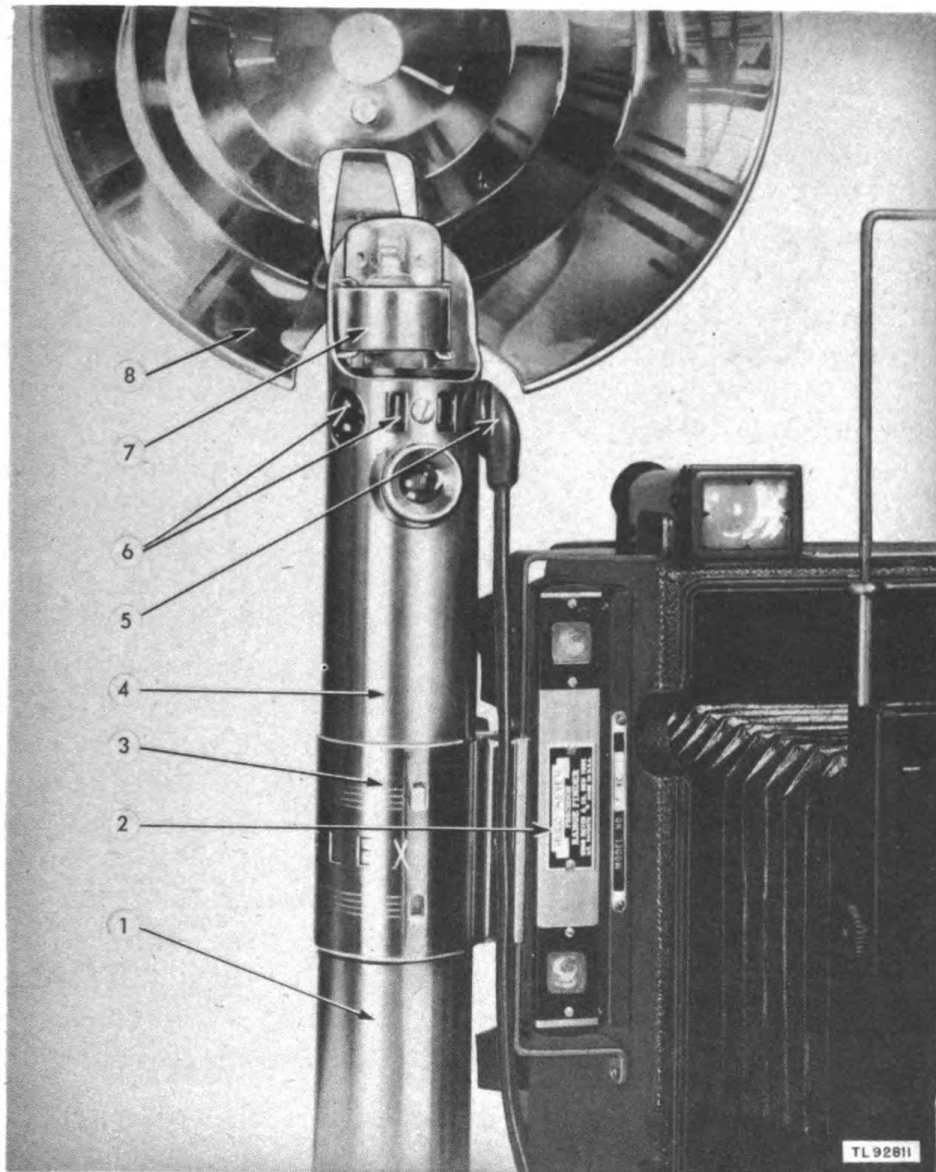


Figure 24. Camera PH-47-E, with flash synchronizer (8A3698.3)

unit to a convenient support, attach the 5-inch reflector, and plug one end of the long extension cord into the side-lighting unit and the other end to one of the parallel outlets in the front of the synchronizer battery case. When the synchronizer is operated by pressure on its main switch, both lamps (in the synchronizer itself and in the side-lighting unit) will ignite simultaneously with the maximum opening of the shutter. If desirable, insert another flash-extension unit equipped with a standard household male plug into the receptacle in the long extension cord of the first side-lighting unit or in the standard female outlet between the two parallel outlets on the battery case.



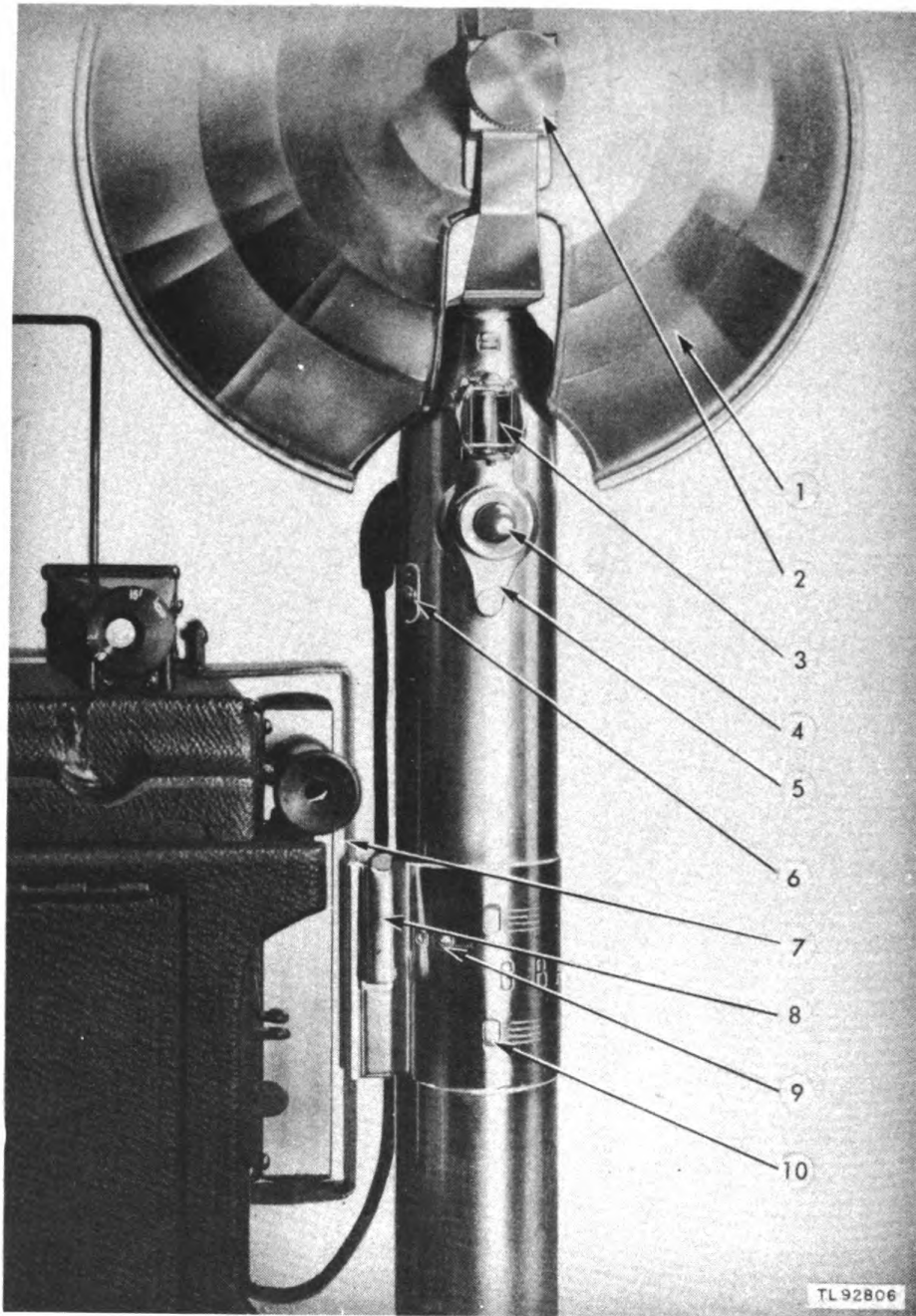
- |                       |                              |
|-----------------------|------------------------------|
| 1. Lower tube         | 5. Female plug               |
| 2. Rangefinder        | 6. Parallel outlets          |
| 3. Battery case clamp | 7. Clamp and spring assembly |
| 4. Battery case       | 8. Reflector                 |

Figure 25. Flash synchronizer, front view

**NOTE:** The side-lighting unit may be adjusted either by lateral rotation of the entire neck and head in the clamp spring or by pivoting the head at right angles to the other adjustment. By suitable combinations of these two adjustments, the reflector may be turned in any direction.

**f. Using Spotlight.** At the top of the battery case is a spotlight which may be turned on an object as an aid in focusing under bad lighting conditions. It is operated by a switch on the back of the battery case.





- |                              |                        |
|------------------------------|------------------------|
| 1. Reflector                 | 6. Slide switch        |
| 2. Reflector adjusting screw | 7. Mounting bracket    |
| 3. Clamp and spring assembly | 8. Clamp lever         |
| 4. Push-button switch        | 9. Locking screw       |
| 5. Series outlet             | 10. Battery case clamp |

*Figure 26. Flash synchronizer, rear view*

## 46. USING SYNCHRONIZER WITH CAMERA PH-47-F (fig. 27).

**a. Connecting and Operating Synchronizer.** Attach the battery case to the mounting plate on the rangefinder housing or to the rangefinder-mounting bracket. Connect the shutter with the battery case. Attach the proper reflector to the battery case. Insert a lamp in the socket. Check to see that the lamp and reflector are centered and that the synchronizing disk is set for the type of lamp being used. Detailed instructions follow.

(1) Open the clamp lever on the battery case; slide the clamp on the mounting plate or bracket from the bottom to the desired location; lock the battery case on the plate or bracket by closing the clamp lever.

(2) Unscrew the knurled cap on the push-button switch (fig. 26), allowing the button assembly to swing down, revealing the series outlet located underneath.

(3) Connect the oblong end of the connector cord to the shutter outlet and the round end to the series outlet described in subparagraph (2) above.

(4) Attach the reflector (par. 45 b).

(5) Insert the lamp (par. 45 c).

(6) Revolve the synchronizing disk (fig. 22) until the colored dot coincides with the indicating mark, which represents the desired time delay; for example, the red dot for 0 millisecond's delay (Kodatrøn Speedlamp); the white dot for 5 milliseconds' delay (SM or SF lamp); the blue dot for 20 milliseconds' delay (regular flash bulbs).

(7) Depress the master synchronizing lever to the limit of its motion.

(8) Revolve the ring until the arrow point is over the desired time exposure.

(9) Push in the cocking lever.

(10) Focus, using rangefinder, or ground-glass and press-focus button (par. 43).

(11) Set the stop lever to the desired diaphragm opening.

(12) Make the exposure by depressing the auxiliary shutter release lever or by pushing the cable release button.

**NOTE:** The built-in synchronizing unit will work with all instantaneous and retarded exposures. If, by mistake, the ring has been set at T or B, the synchronizing unit will allow an automatic exposure of approximately 1/25 second. Flash bulbs can be set in the reflector in advance, to be ready for quick flash exposure. They will not be ignited when regular pictures are taken unless the master synchronizing lever has been pulled down.

**b. Using Side-lighting Unit.** See paragraph 25 e.

**c. Using Spotlight.** See paragraph 45 f.

## 47. HOLDING CAMERA.

Figures 30 through 34 show conventional methods of holding the camera. Variations of these methods may be used. The sole idea in holding the camera is to keep it in a rigid position when the exposure is made. Try the

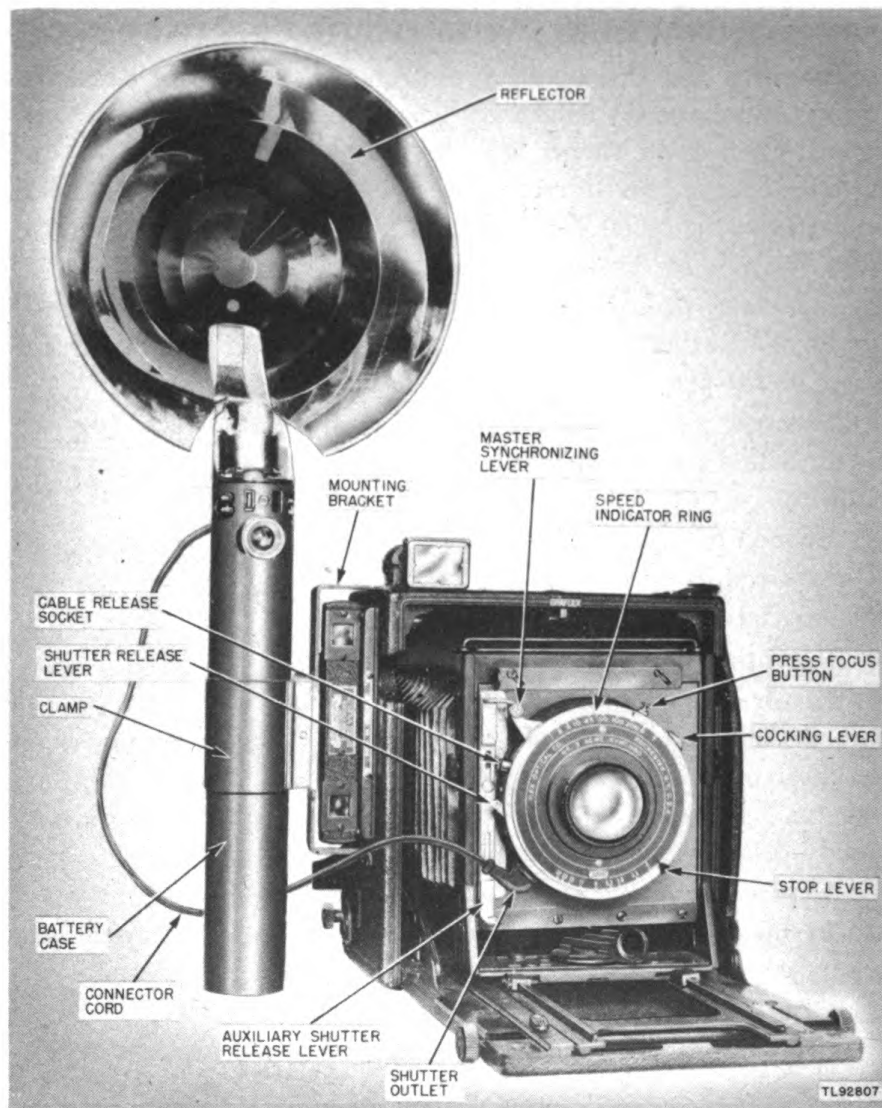


Figure 27. Camera PH-47-F, with flash synchronizer

positions illustrated. These can be varied until a comfortable position is found and until the camera is most easily operated in a rigid position.

**a. Operating Focal Plane Shutter, Position No. 1 (Cameras PH-47-E and PH-47-F) (fig. 30).** The operator holds the camera firmly against his left shoulder, his left hand bent and his elbow against the hipbone. The position of the left hand is very similar to that used in holding a rifle in the off-hand position. The right hand does not help to steady the camera at all but is used solely to release the focal plane shutter. Holding the camera in this position enables the operator to sight with either eye. It is necessary that the wire finder be used when holding the camera in this position because the optical finder is so low as to cause discomfort to the operator.

**b. Operating Focal Plane Shutter, Position No. 2 (Cameras PH-47-E and PH-47-F) (fig. 31).** The camera is operated with one hand. The entire weight of the camera rests upon the little finger. However, this weight is decreased as pressure from the third and fourth fingers forces the camera back into the palm of the hand. With proper leverage the wrist absorbs the strain. The index finger releases the focal plane shutter. In the one-hand position, it is impossible to use the front shutter. This position is used in an emergency.

**c. Operating Front Shutter with Flash, Position No. 3.**

(1) Figures 1 (A) and 32 show the most common position for holding Camera PH-47-E. The battery case of the synchronizer affords a good grip to the operator and this makes the handling of the camera easier. The solenoid is used to trip the shutter whether or not flash is being used. The left hand holds the camera in a rigid position.

(2) Figure 1 (B) shows the corresponding position for Camera PH-47-F.

**d. Operating Front Shutter with Flash, Position No. 4.**

(1) Figure 33 shows the manner of holding Camera PH-47-E in a horizontal position with the synchronizer attached. Notice that the camera rests on the left hand. The right hand does not support the camera. This position is especially helpful for vertical framing or when shooting angles, and is effective in photographing oncoming vehicles.

(2) The corresponding position for Camera PH-47-F is not shown but can be deduced readily from figure 1 (B).

**e. Operating Front Shutter with Flash, Position No. 5.**

(1) Figure 34 shows the synchronizer detached from the body of Camera PH-47-E and held in a position away from the lens for better lighting.

(2) Camera PH-47-F cannot be used in this manner.

**48. CHECK LIST FOR OPERATING PROCEDURE.**

**a. Instantaneous Exposure, Camera Hand-held without Flash.**

Using the equipment listed, follow the procedure below.

Camera PH-47-E or Camera PH-47-F.

Loaded film pack adapter or sheet-film holders.

Lens hood and filter holder combination.

(1) Open the carrying case.

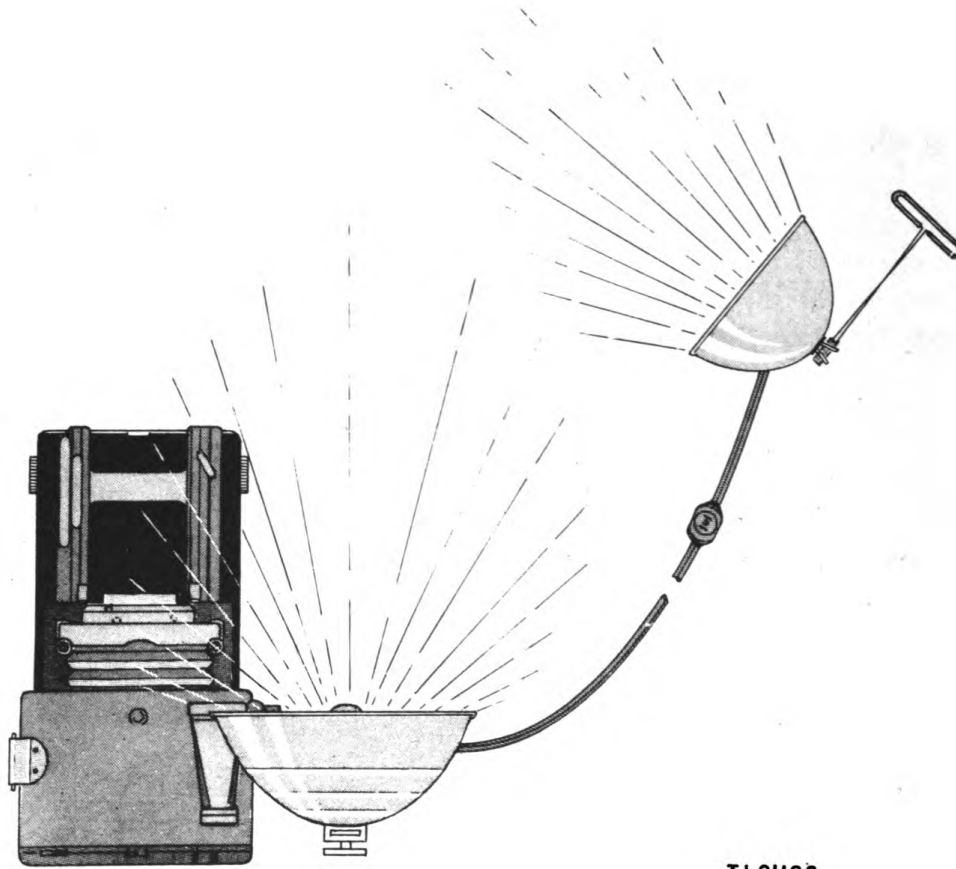
(2) Lift out the camera and open the bed, making sure that the braces snap into position.

(3) Draw out the front until it snaps into the spring on the infinity stops and locks it.

(4) Make sure that the shutter not being used is open, and that the focal plane shutter, if open on 0, is locked.

(5) Attach the lens shade with or without a filter, as required.

(6) Focus on the principal element of the subject with the rangefinder or ground-glass or estimate the distance and focus by scale. Lock the yoke in position.



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*Figure 28. Multi-flash book-up*

(7) Set the shutter speed indicator and stop lever according to film in use; the rate of movement of the subject; the intensity of illumination; the type of subject, and depth of field required.

(8) Insert a film holder or film pack adapter in the camera and remove the slide from the forward side of the holder.

(9) Set the parallax adjustment of the tubular viewfinder to correspond with the object distance, and frame the subject in the viewfinder.

(10) Hold the camera as illustrated in figure 30.

(11) Trip the shutter, exerting steady pressure on the release lever or the cable release, and taking care not to jar the camera.

(12) Replace the slide in the holder with the dark side of the handle facing out, and remove the holder from the camera.

(13) If another exposure is to be made immediately, turn the holder

around and replace it with the unexposed film toward the lens, and then proceed as outlined in steps (5) through (9) above. If film pack is used, pull the next higher numbered tab. Replace the safety slide before resetting the focal plane shutter. If no further exposure is to be made for some time, place the holder in the carrying case and close the camera as follows:

(14) Remove the lens shade and make sure that the front shutter is not cocked, open, or set at its highest speed. Release the tension of the focal plane shutter curtain.

(15) Unlock and rack the yoke back until the focusing scales are on  $\infty$  (infinity).

(16) Unlock the front standard and move it back into the body at the rear of the track.

(17) Depress the bed braces and close the front; replace the camera in the carrying case.

**b. Instantaneous Exposure, Camera Hand-held, with Flash.** Using the equipment listed, follow the procedure below.

Camera PH-47-E or Camera PH-47-F.

Loaded film pack adapter or sheet-film holders.

Flash synchronizer.

Supply of suitable flash lamps.

(1) Open the carrying case.

(2) Lift out the camera and open the bed, making sure that the braces snap into position.

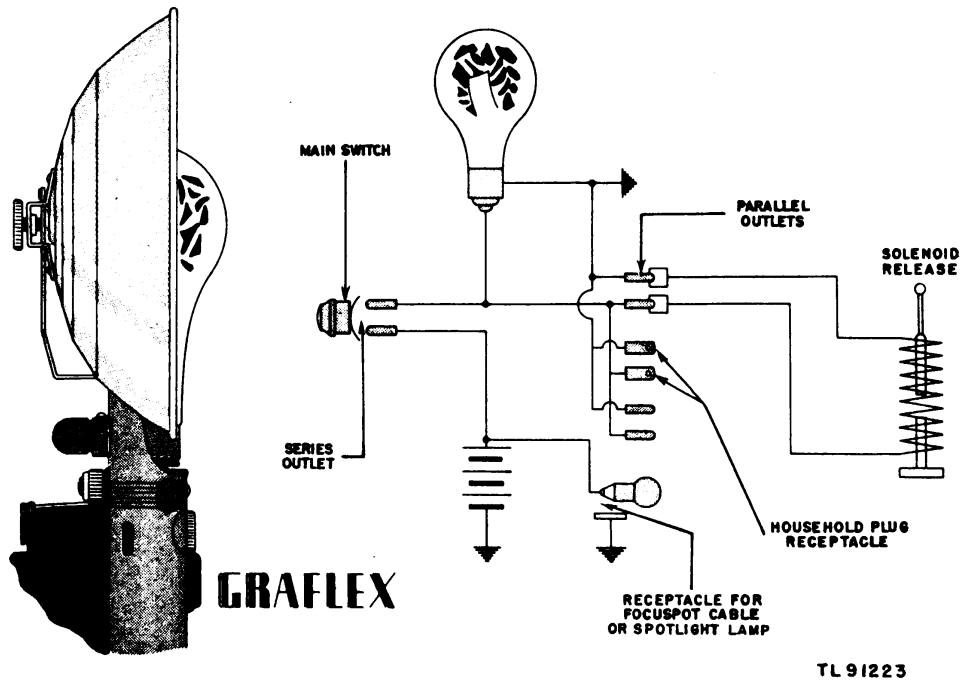


Figure 29. Flash synchronizer, wiring diagram



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*Figure 30. Holding camera, position No. 1*

(3) Draw out the front standard until it snaps in the infinity stops, and lock the front standard.

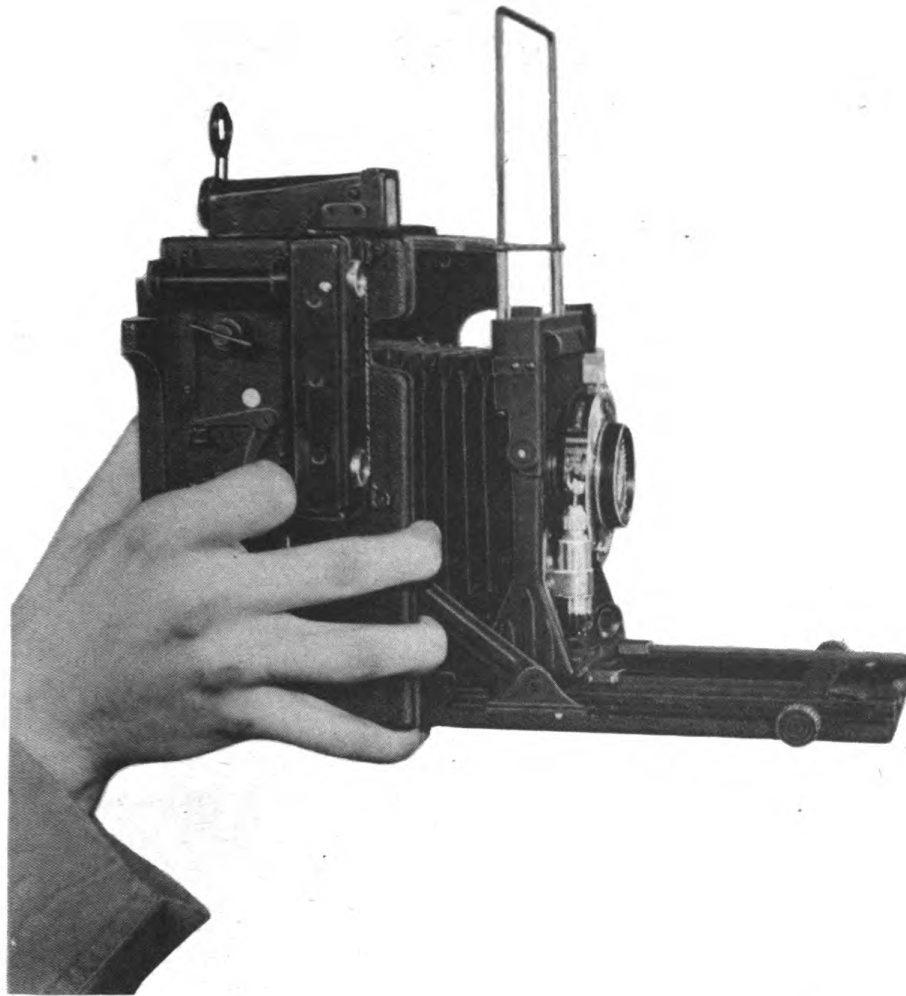
(4) Attach the battery case to the mounting plate.

(5) Attach the reflector to the battery case, and insert the lamp.

(6) To use Camera PH-47-E, insert the male plug of the connector cord in the receptacle at the base of the solenoid release and the female plug on one of the parallel outlets at the top front of the battery case. Make sure that the solenoid release link is attached to the shutter-release lever.

(7) To use Camera PH-47-F, attach the oval end of the connector cord to the outlet on the shutter and attach the round end to the series outlet, exposed by unscrewing the button on the back of the battery case.

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*Figure 31. Holding camera, position No. 2*

(8) Make sure the focal plane shutter is open and locked on 0.

(9) Focus on the principal element of the subject; if using the ground glass, hold the shutter open with the press-focus button. Be sure to lock the yoke.

(10) Set the parallax correction on the tubular viewfinder according to the reading of the focusing scales.

(11) Set and cock the shutter. Set the shutter speed indicator at the desired speed, usually 1/200 second. Set the aperture according to type of subject and surroundings, the sensitivity of the film, the brightness of the flash lamp, and the distance from the lamp to the subject (par. 50). In using Camera PH-47-F, revolve the disk until the colored dot coincides with the indicating mark, which represents the desired time delay; for example, the red dot for 0 millisecond's delay (Kodatron Speedlamp); the white dot for

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*Figure 32. Holding camera, position No. 3*

5 millisecond's delay (SM or SF lamp) ; the blue dot for 20 millisecond's delay (regular flash bulbs).

(12) Insert a holder or film pack adapter in the camera and remove the slide from the forward side of the holder.

(13) Hold Camera PH-47-E as shown in figure 32. Hold Camera PH-47-F as shown in figure 1 (B).

(14) Check the focus and frame the subject.

(15) Without jarring the camera, depress the switch on the back of the battery case of Camera PH-47-E, or, if using Camera PH-47-F, depress the auxiliary shutter release or press the cable release.

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*Figure 33. Holding camera, position No. 4*

(16) Replace the slide with the dark side of the handle out and remove the plate holder from the camera. If film pack is used, pull the next tab.

(17) Eject the lamp.

(18) If another exposure is to be made immediately, repeat steps (9) through (16) above, replacing the lamp.

(19) If no further exposures are to be made, proceed as in subparagraph a (14) through (17).

**c. Tripod Exposure.** The same equipment is needed for a tripod exposure as for hand-held instantaneous exposure without flash, plus a tripod and a cable release. Proceed as follows:

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*Figure 34. Holding camera, position No. 5*

- (1) Open the carrying case.
- (2) Lift out the camera.
- (3) Lift out the tripod.
- (4) Assemble the tripod.
- (5) Adjust the length and spread of the legs according to the character of the ground.
- (6) Attach the camera to the tripod.
- (7) Proceed as in subparagraph a above.
- (8) If no further exposures are to be made, remove the camera from the tripod; close the camera and place it in the carrying case; disassemble the

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tripod, and return it to the case. If more exposures are to be made, repeat the steps given above.

#### 49. SHUTTER SPEED TABLE.

If the subject is moving during the exposure, the image on the film will move. If the picture is to be sharp, the exposure must be short enough to prevent appreciable blurring of the image. Therefore, the permissible length of exposure depends on the speed of the subject and also on the direction of its motion. A much higher shutter speed is necessary to stop motion at right angles to the camera axis than motion toward or away from the camera, or at a 45° angle. When the subject moves at right angles to the camera, the image of the subject on the film moves across the film. When the subject moves toward the camera, the image obviously does not move across the film, but simply changes in size, and this does not require so high a shutter speed. The distance from moving subject to camera also affects the shutter speed needed to stop motion. The nearer the subject the faster the shutter speed required. The following table is given as a guide to shutter speeds necessary for different subjects in motion, grouped according to approximate speed and direction of the motion in relation to the camera.

TABLE OF SHUTTER SPEEDS TO RECORD SUBJECTS IN MOTION					
Subjects in motion	Approximate speed of subject (mph)	Distance of subject from camera (ft.)	Motion toward or away from camera (sec.)	Motion at about 45° angle to camera (sec.)	Motion right angles to camera (sec.)
Landscapes, including slowly moving water		Beyond 25	1/50 to 1/100		
Parades, construction work, slowly moving vehicles, unloading of supplies	5 to 10	25 50 100	1/100 1/50 1/25	1/200 1/100 1/50	1/400 1/200 1/100
Track events, baseball, slowly moving boats, landing barges, slow tanks, parachutists, surf, views from trains	20 to 30	25 50 100	1/200 1/100 1/50	1/400 1/200 1/100	1/1000 1/400 1/200
Fast autos, motorcycles, fast tanks, PT boats, airplanes, fast trains	60 and up	25 50 100	1/400 1/200 1/100	1/1000 1/400 1/200	— 1/1000 1/400

## 50. FLASH EXPOSURE TABLE.

The following flash exposure table, containing approximate focal plane shutter settings, is to be used only as a guide. Dividing the flash factor by the distance in feet from lamp to subject establishes the approximate *f* stop; for example, flash number 110 divided by 10 feet equals *f*/11, and flash number 225 divided by 10 feet equals *f*/22.

FLASH EXPOSURES (Approximate)								
Based on 1/200 second, Weston 64 (Tungsten).								
For Weston speed of 32 (Tungsten) use next larger aperture.								
For time, bulb, 1/25 second, use next smaller lens opening.								
Conditions	Lumens in thousands	Distance (ft.)						Flash factor
		5	7	10	14	20	28	
At night out of doors	18-35	<i>f</i> /16	<i>f</i> /11	<i>f</i> /8	<i>f</i> /5.6	<i>f</i> /4.5		80
	35-50	<i>f</i> /16 to <i>f</i> /22	<i>f</i> /11 to <i>f</i> /16	<i>f</i> /8 to <i>f</i> /11	<i>f</i> /5.6 to <i>f</i> /8	<i>f</i> /4.5		95
	50-70	<i>f</i> /22	<i>f</i> /16	<i>f</i> /11	<i>f</i> /8	<i>f</i> /5.6	<i>f</i> /4.5	110
Large or dark interiors	18-35	<i>f</i> /22	<i>f</i> /16	<i>f</i> /11	<i>f</i> /8	<i>f</i> /5.6	<i>f</i> /4.5	110
	35-50	<i>f</i> /22 to <i>f</i> /32	<i>f</i> /16 to <i>f</i> /22	<i>f</i> /11 to <i>f</i> /16	<i>f</i> /8 to <i>f</i> /11	<i>f</i> /5.6 to <i>f</i> /8	<i>f</i> /4.5	135
	50-70	<i>f</i> /32	<i>f</i> /22	<i>f</i> /16	<i>f</i> /11	<i>f</i> /8	<i>f</i> /5.6	160
Small or light colored interiors	18-35	<i>f</i> /32	<i>f</i> /22	<i>f</i> /16	<i>f</i> /11	<i>f</i> /8	<i>f</i> /5.6	160
	35-50		<i>f</i> /22 to <i>f</i> /32	<i>f</i> /16 to <i>f</i> /22	<i>f</i> /11 to <i>f</i> /16	<i>f</i> /8 to <i>f</i> /11	<i>f</i> /5.6 to <i>f</i> /8	195
	50-70		<i>f</i> /32	<i>f</i> /22	<i>f</i> /16	<i>f</i> /11	<i>f</i> /8	225
TYPES OF BULBS								
Bulb size		Light output lumen seconds		Bulb size		Light output lumen seconds		
G. E. Synchro Press No. 5		18,000		Wabash Press No. 40		40,000		
Wabash No. 0		25,000		Wabash Press No. 50		50,000		
G. E. No. 11		30,000		G. E. No. 21		50,000		
G. E. No. 16 A		40,000		G. E. No. 22		60,000		

## 51. DAYLIGHT EXPOSURE TABLE.

The following table indicates approximate settings of the shutter and diaphragm for exposures under several general types of conditions and may be followed safely, but should not be considered to be exact.

Aperture		DAYLIGHT EXPOSURE TABLE (Approximate)						
		(Always use exposure meter when available.)						
		<i>f/4.5</i> <i>f/4.7</i>	<i>f/5.6</i>	<i>f/8</i>	<i>f/11</i>	<i>f/16</i>	<i>f/22</i>	<i>f/32</i>
Clear Bright	Pan A	1/300	1/200	1/100	1/50	1/25	1/10	1/5
	Pan B	1/600	1/400	1/200	1/100	1/50	1/25	1/10
	Pan C	1/1000	1/800	1/400	1/200	1/100	1/50	1/25
Hazy Overcast	Pan A	1/150	1/100	1/50	1/25	1/10	1/5	1/2
	Pan B	1/300	1/200	1/100	1/50	1/25	1/10	1/5
	Pan C	1/600	1/400	1/200	1/100	1/50	1/25	1/10
Cloudy Bright	Pan A	1/75	1/50	1/25	1/10	1/5	1/2	1
	Pan B	1/150	1/100	1/50	1/25	1/10	1/5	1/2
	Pan C	1/300	1/200	1/100	1/50	1/25	1/10	1/5
Cloudy Dull	Pan A	1/40	1/25	1/10	1/5	1/2	1	2
	Pan B	1/75	1/50	1/25	1/10	1/5	1/2	1
	Pan C	1/150	1/100	1/50	1/25	1/10	1/5	1/2

Pan A: Portrait Pan, X-F Pan, Isopan, Plus-X, Super-Sensitive Pan (Weston 32-50).  
 Pan B: Super-Pan Press, Super-Panchro-Press, Super-XX, Arrow Pan (Weston 64-100).  
 Pan C: Triple-S Pan, Tri-X Pan (Weston 125-200).  
 Use one-half recommended exposure time:  
 For snow or beach scenes.  
 For distant or aerial scenes.  
 Use double recommended exposure time:  
 For extreme close-ups.  
 For shadow detail.  
 In shaded areas.  
 For back lighting.  
 For early morning or late afternoon.  
 Filters: When using yellow filter, double the exposure time or increase diaphragm opening one stop.  
 When using orange filter, treble exposure time or increase diaphragm opening 1½ stops.  
 When using red filter, quadruple exposure time or increase diaphragm opening 2 stops.

**NOTE:** Filter factor tables will be found in TM 1-219, Basic Photography, and TM 11-2351, Exposure Meters.

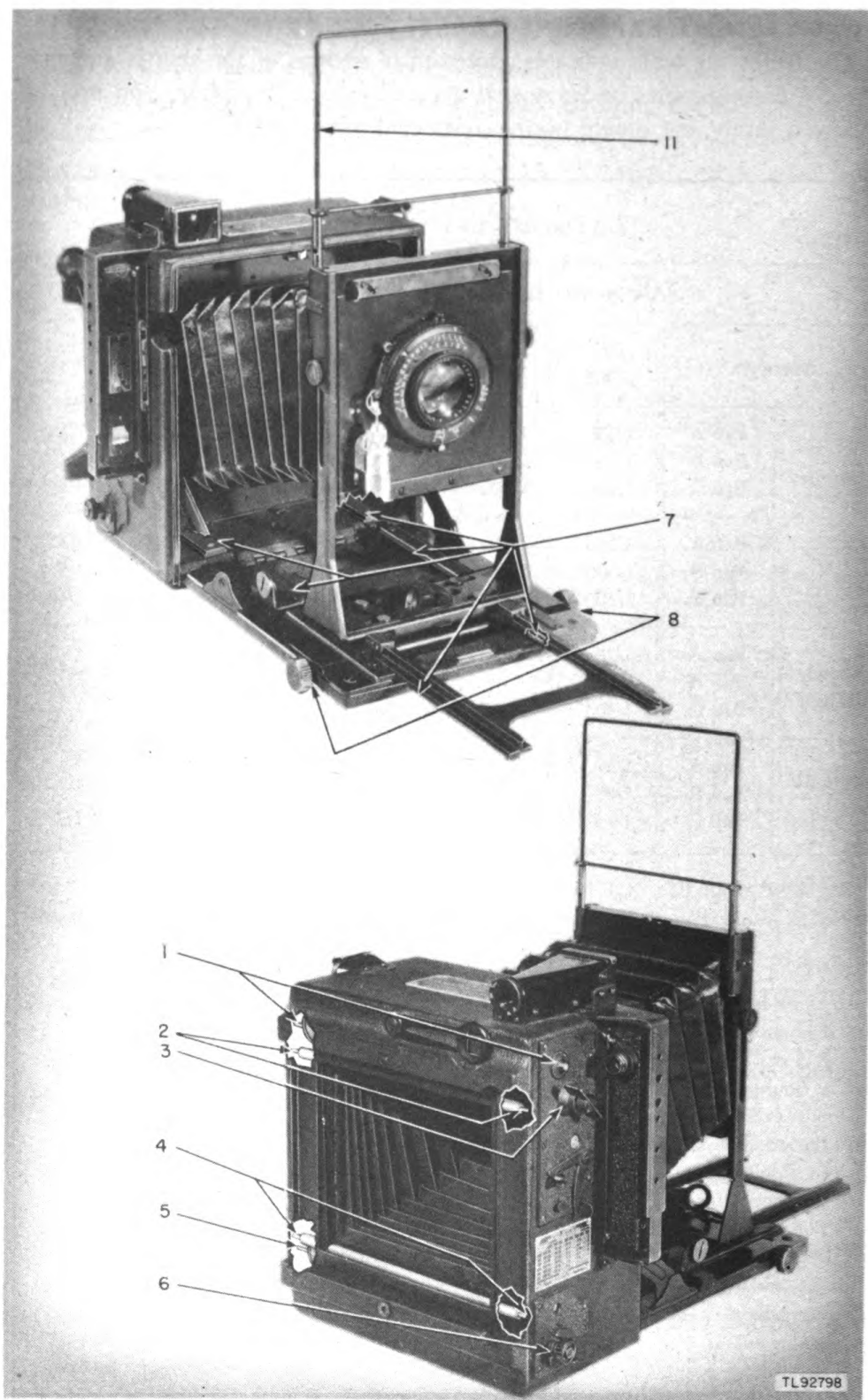


Figure 35. Lubrication points

# PART THREE

## PREVENTIVE MAINTENANCE

### SECTION V

#### PREVENTIVE MAINTENANCE TECHNIQUE

##### 52. MEANING OF PREVENTIVE MAINTENANCE.

Preventive maintenance may be defined as a series of operations performed on equipment to minimize interruptions in service and to eliminate major breakdowns. The function of trouble shooting and repair, on the other hand, is to locate and correct existing defects. This section of the manual contains specific instructions and serves as a guide which may be used by personnel assigned to perform the basic preventive maintenance operations on Camera Equipment PH-104.

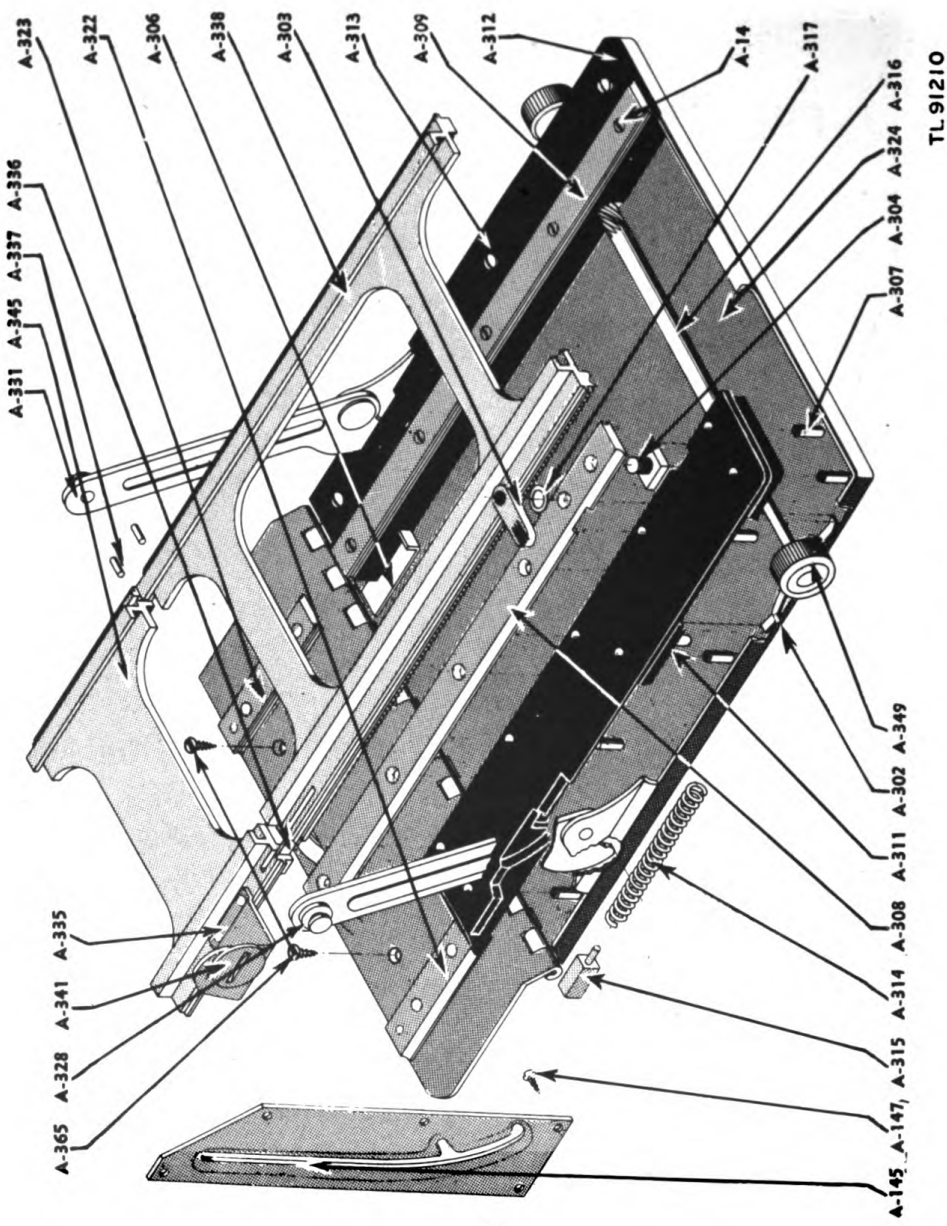
##### 53. DETAILED INSTRUCTIONS ON PERFORMANCE OF PREVENTIVE MAINTENANCE.

Cameras PH-47-E and PH-47-F are constructed carefully and with proper treatment will give efficient and continuous performance. Although they are strong enough to withstand normal shocks incident to shipping and actual use, these cameras are precision instruments and should be handled with care to avoid injuries to the more sensitive parts, such as lens, shutter, or range-finder.

###### a. Lens.

- (1) Keep the lens clean at all times.
- (2) Never touch the glass of a lens with the finger, for fingerprints corrode the highly polished surfaces and ruin the lens surface.
- (3) A soft camel's hair brush is usually sufficient for removing dirt and lint from the lenses and a small rubber air syringe is handy for blowing off dust. These articles are part of Repair Set PH-189.
- (4) If additional cleaning is necessary, use lens tissue made for that purpose.
- (5) Breathing on the lens after dusting and before wiping with tissue is accepted as good practice, but the use of water or household cleaning fluids should be definitely avoided.
- (6) Unless necessary to clean the shutter, never unscrew the lens elements from the shutter, for under normal conditions cleaning of the inside surfaces will be unnecessary. If removed, replace by tightening firmly, but do not use force.





- A- 14. Yoke guide screw (8P8-530)
- A-145. Bed-brace plate
- A-147. Screw
- A-302. Focusing shaft spring
- A-303. Yoke lock lever
- A-304. Screw
- A-306. Infinity stop
- A-307. Yoke guide screw bushing
- A-308. Right yoke guide (8P8-205)
- A-309. Left yoke guide (8P8-200)
- A-311. Right bed block (8P8-55A)
- A-312. Left bed block (8P8-55)
- A-313. Machine screw
- A-314. Bed-brace spring
- A-315. Plunger
- A-316. Focusing pinion rod (8P8-295)
- A-317. Washer
- A-322. Body yoke guide
- A-323. Body yoke guide
- A-324. Bed and binge assembly
- A-328. Bed brace (8P8-60A)
- A-331. Bed brace (8P8-60)
- A-335. Rangesfinder arm bracket rivet
- A-336. Yoke link
- A-337. Yoke link pin
- A-338. Bed yoke
- A-341. Bracket assembly
- A-345. Body yoke
- A-349. Focusing knob
- A-365. Wood screw

Figure 36. Bed (8P8-40) and yoke (8P8-685) mechanism

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## **b. Shutters.**

(1) Shutters contain springs that regulate their speed and should not be left over long periods in their stressed (cocked) position. Always release the front shutter before putting the camera away. Return the spring tension of the focal plane shutter to 1 and the curtain slit to 0. This will maintain maximum efficiency in the operation of these shutters.

(2) Front shutters usually may be cleaned by removing both the front and rear cells of the lens and blowing clean air not too forcibly into its interior. Blow on both sides with the diaphragm fully open and the shutter leaves closed, and then with the shutter leaves open; also, with the shutter leaves open and the diaphragm closed. If the shutter cannot be cleaned satisfactorily in this way, it must be disassembled.

**CAUTION:** Do not separate the elements of the lens cells unless their interior surfaces require cleaning. If this must be done, be sure to reassemble them hand-tight without forcing. Be sure not to screw the cells too tightly into the mount. *Do not oil any part of the Supermatic shutter or the Ilex No. 3 Acme synchronized shutter.*

(3) The focal plane shutter requires at least partial disassembly for any cleaning (par. 71).

**c. Filters.** Filters require the same care as lenses. Check the mount to see that it does not exert undue pressure on the filter. Be sure that the filter is attached accurately to the lens.

**d. Holders.** Dust the holders thoroughly inside and out before loading, with a reasonably stiff point brush having unused bristles which will not shed. Remove dust from the inaccessible edges with the air syringe.

## SECTION VI

### LUBRICATION

#### **54. WAR DEPARTMENT LUBRICATION ORDERS.**

War Department Lubrication Orders are waterproofed, 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 and monthly changes thereto.

#### **55. REQUISITION OF WAR DEPARTMENT LUBRICATION ORDERS.**

Posts, camps, stations, and ports of embarkation should requisition their requirements of the War Department Lubrication Orders for Signal Corps equipment in conformance with the requisitioning instructions which appear

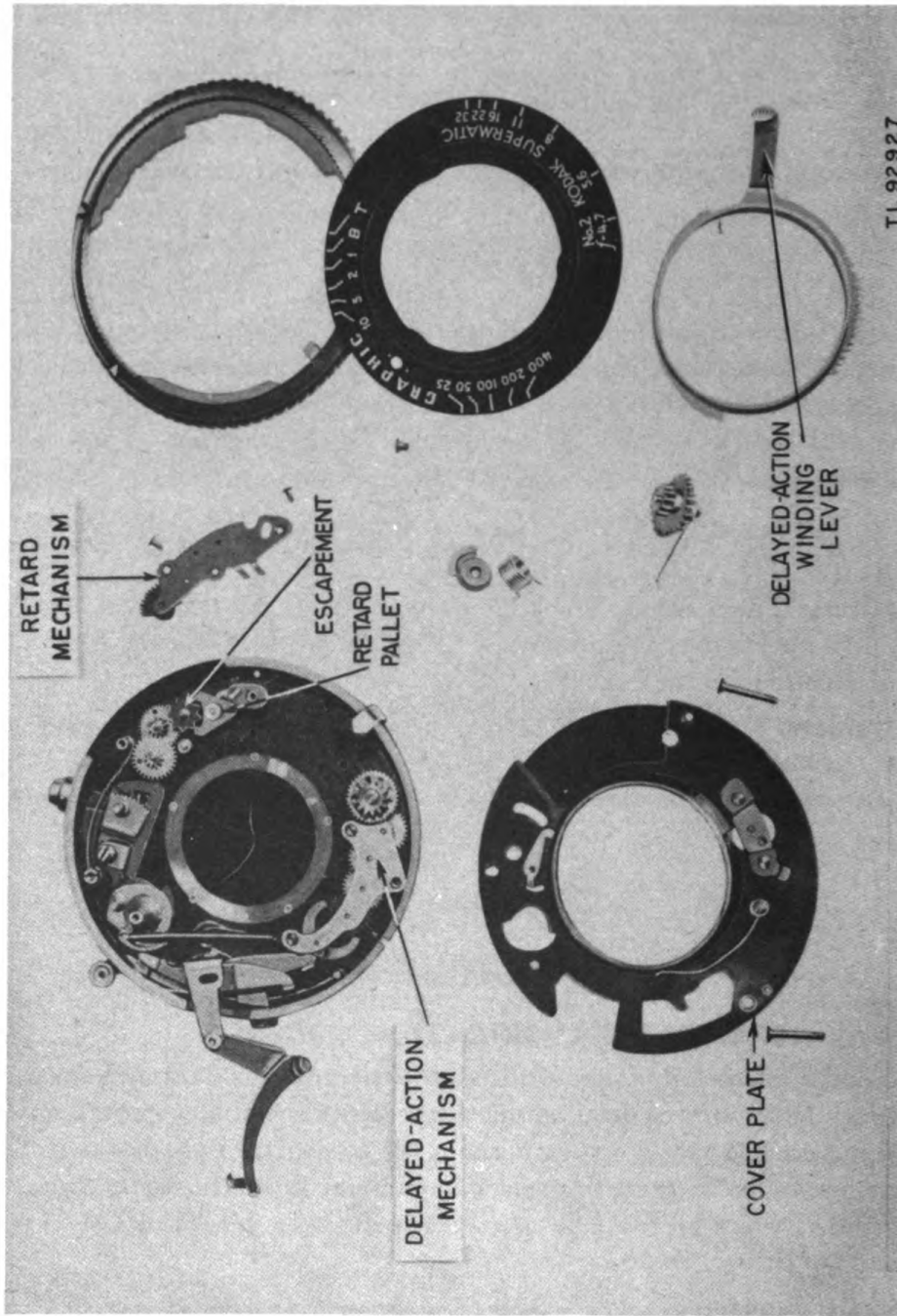


Figure 37. No. 2 Supermatic shutter disassembly, step 1

on each War Department Lubrication Order. A serial number between 3001 and 4000 inclusive indicates that the War Department Lubrication Order pertains to Signal Corps equipment. In the absence of specific requisitioning instructions, requisitions for War Department Lubrication Orders having a serial number between 3001 and 4000 inclusive should be forwarded to Commanding Officer, Philadelphia Signal Depot, Philadelphia, Pennsylvania. In no instance will requisitions for War Department Lubrication Orders be addressed to The Adjutant General.

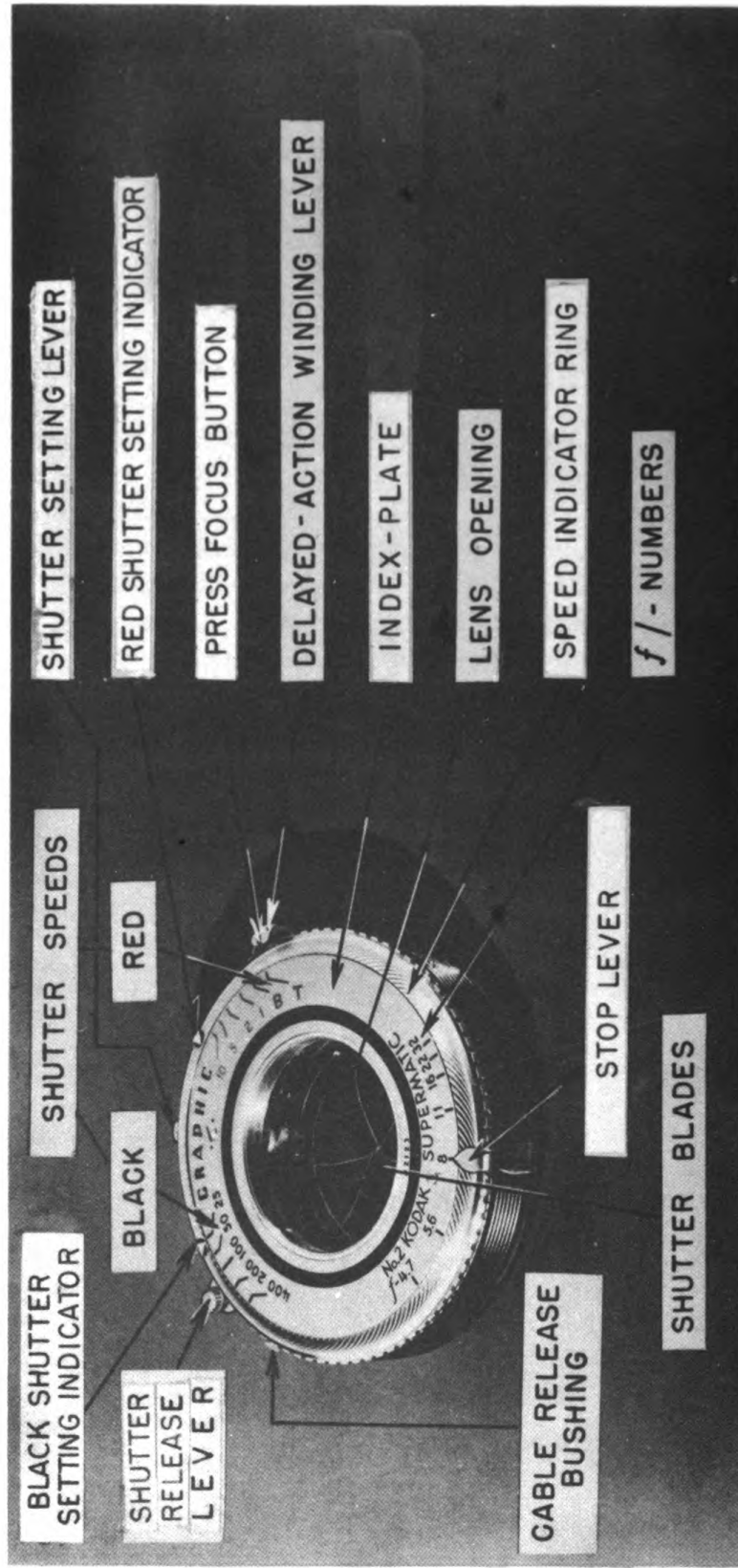
## 56. COMPLIANCE WITH WAR DEPARTMENT LUBRICATION ORDERS.

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 lubrication orders will be reported through technical channels to the Commanding General, Army Service Forces, Attention: Maintenance Division.

## 57. TABLE OF LUBRICANTS RECOMMENDED FOR USE WITH CAMERA EQUIPMENT PH-104.

The following table shows the lubricants recommended for the care of Camera Equipment PH-104 and explains the symbols and abbreviations used in the complete and detailed instructions for lubrication, which are given in paragraph 58.

Lubricants	Lowest expected air temperature			
	Above +60° F	+60° F to +20° F	+20° F to -30° F	Below -30° F
Oil, Lubricating, for aircraft instruments and machine guns (MO)	MO	MO or PS	PS	See note (par. 59 b)
Wax, Paraffin, Type 0, Grade A (PF)	PF	PF	PF	
Oil, Lubricating, Preservative, Special (PS)	PS	PS	PS	
Solvent, Dry Cleaning (SD)	SD	SD	SD	
Grease, Graphite (GG)	GG	GG	GG	
INTERVALS: 6M—Every 6 months. WN—When necessary.				



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Figure 38. No. 2 Supermatic shutter disassembly, step 2

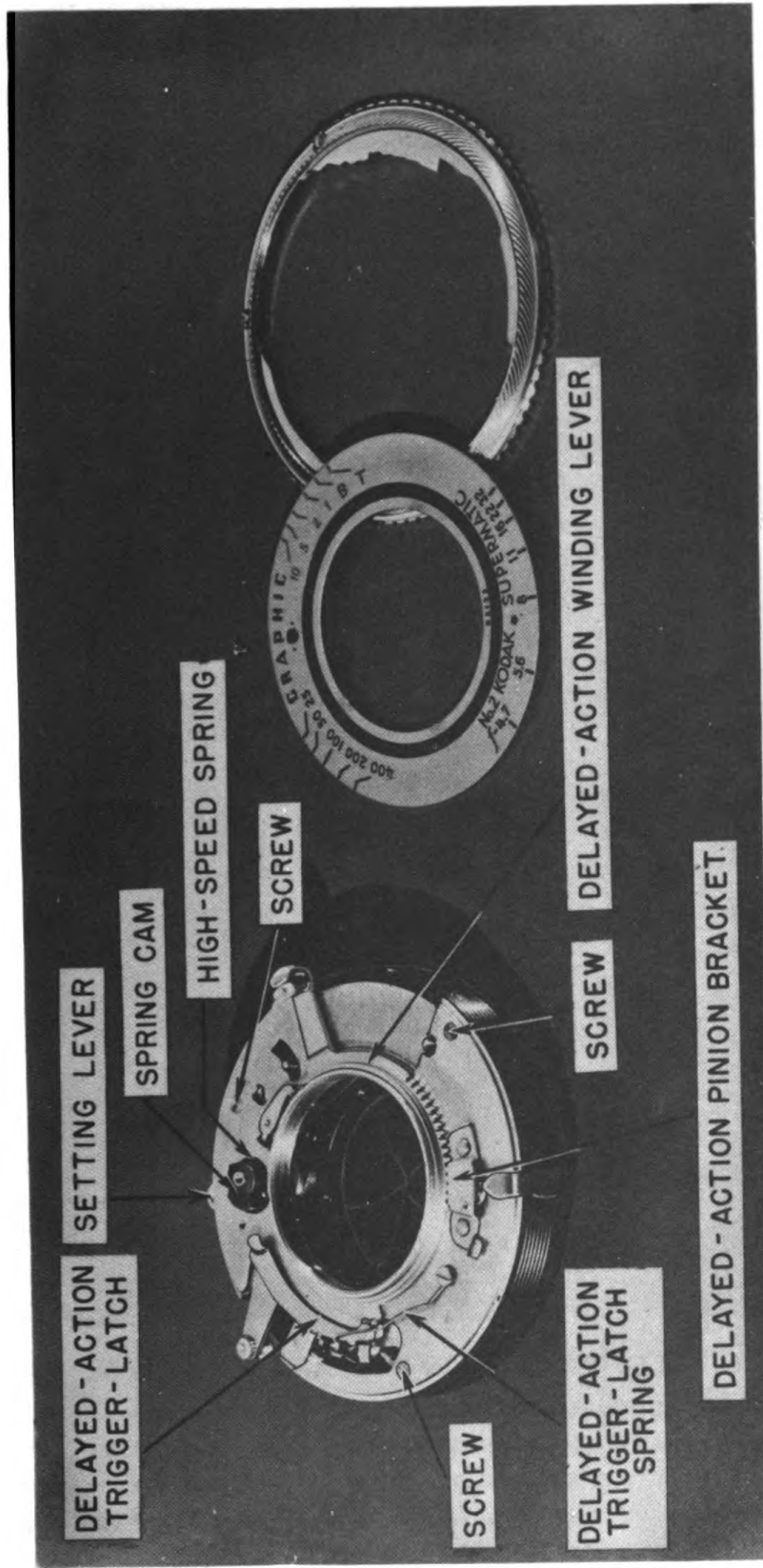


Figure 39. No. 2 Supermatic shutter disassembly, step 3

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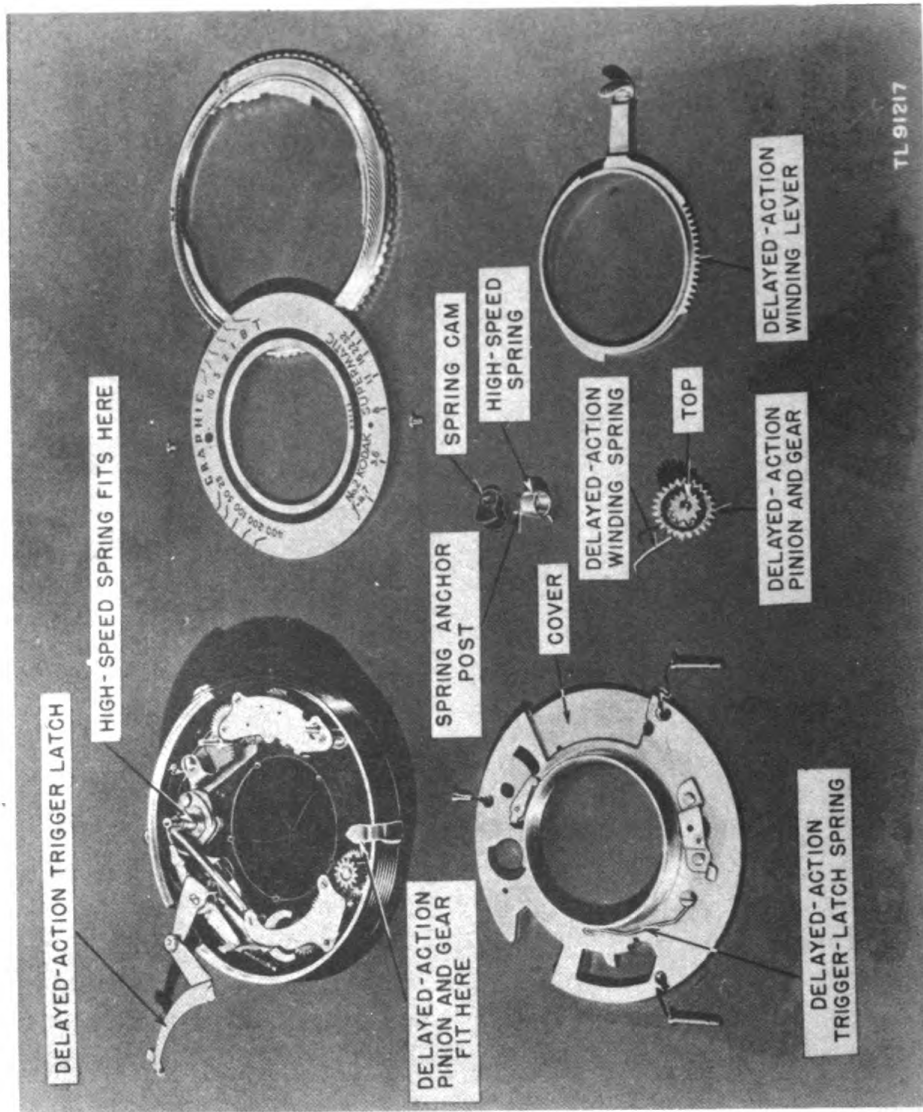


Figure 40. No. 2 Supermatic shutter disassembly, step 4

## 58. COMPLETE AND DETAILED INSTRUCTIONS FOR LUBRICATION (fig. 35).

### a. Lubrication Chart.

<i>Point No.</i>	<i>Description</i>	<i>Interval</i>	<i>Lubricant</i>
1	Focal plane shutter curtain roller shaft bearings, 1 drop each .....	6M	MO
2	Focal plane shutter curtain idler shaft bearings, 1 drop each. May require application of GG between periodic oilings, especially during overhaul by maintenance personnel .....	6M	MO
3	Focal plane shutter curtain winding key shaft bearing, 1 drop .....	6M	MO
4	Focal plane shutter curtain idler shaft bearings, 1 drop each .....	6M	MO
5	Focal plane shutter curtain roller shaft bearing, 1 drop. May require application of GG between periodic oilings, especially during overhaul by maintenance personnel .....	6M	MO
6	Tensions snail and shutter curtain roller shaft bearing, 1 drop .....	6M	MO
7	Yoke assembly. Rack the yoke assembly out onto the bed as far as it will go. Lubricate by rubbing a small piece of PF along the outside edges of the yoke and on the gear teeth of the focusing adjusting racks and along the grooves in the right and left yoke guides.....	6M	PF
8	Focusing shaft spring bearings, 1 drop each.....	6M	MO
9	Tripod, 1 drop to each hinge. Rub legs lightly.....	6M	PF
10	Carrying case, 1 drop to each catch, 1 drop to tumbler (inside lock) .....	6M	MO or PF
11	Wire finder. If finder sticks, especially after operation in rain, apply 1 drop each to outer and inner section, working up and down until free.....	WN	MO

**b. Intervals.** Every 6 months or after every 1,000 exposures, whichever occurs first, lubricate all points. If the camera has not been used for a month or more, inspect and lubricate all points before using, if required.

**c. Cleaning.** Clean parts with a soft, clean brush or cloth lightly dampened with dry cleaning solvent (SD). Thoroughly dry all parts. Do not allow cleaning fluid to get on lens. Periodically check curtain action. Slowed-up or noisy curtain action indicates need for removing old lubricants, cleaning parts, and applying fresh lubricants (par. 71).

## 59. SPECIAL INFORMATION ON CLIMATIC CONDITIONS.

**a. Maritime, High Altitude, Low Temperature, and Rain.** To prevent corrosion from salt-laden air or salt-water spray, and rusting from condensation or moisture, wipe all exposed metal parts with a soft cloth impregnated with lubricating oil (PS). To avoid condensation do not bring equipment into warm air after exposure to low temperature. Equipment in use should be kept in low temperature storage (usually on a protected outdoor



shelf). After the camera has been used in the rain, relubrication may be necessary. If parts indicated above, or others, stick, clean and adjust them, and relubricate. After the camera has been used under rainy, dusty, or dirty conditions relubrication may be required. Check status after each mission, relubricating if necessary.

**CAUTION:** Do not oil the between-the-lens shutter.

**b. Below -30° F.** Remove and clean all traces of former lubrication and operate dry.

**c. Tropical.** Inspect the camera, carrying case, and tripod daily for traces of fungus, mold, mites, moisture, and metallic corrosion. Remove fouling immediately by cleaning all parts thoroughly. Lubricate after cleaning.

**d. Desert.** To prevent sand and dust from collecting on the camera and tripod, clean and wipe dry all exposed metal parts. Equipment should be kept in proper carrying case when not in use. Reduce intervals to daily under extreme conditions of heat, sand, and dust.

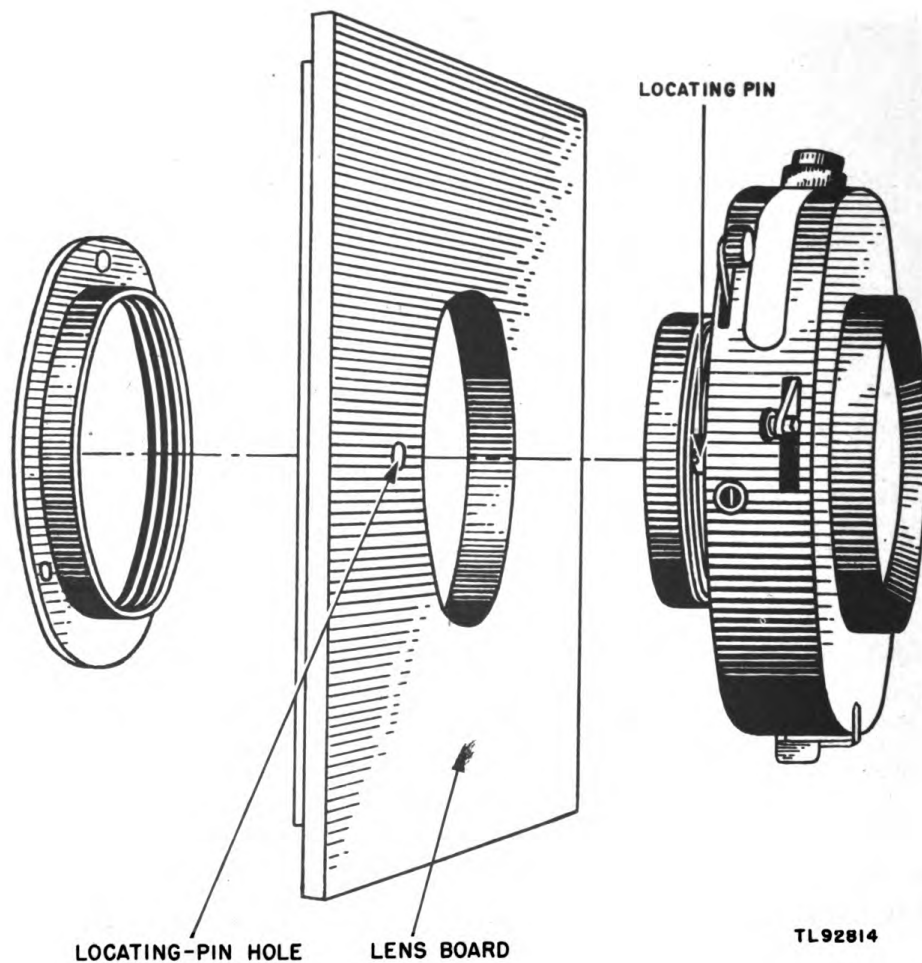


Figure 41. Shutter and lens board assembly

# PART FOUR

## AUXILIARY EQUIPMENT

### SECTION VII

#### AUXILIARY EQUIPMENT AND REFERENCES

##### **60. EXPOSURE METERS.**

An exposure meter is generally used to determine the intensity of light and the correct exposure. An exposure meter is not supplied, however, with Camera Equipment PH-104. Instructions for the use of exposure meters will be found in TM 11-2351.

##### **61. REFERENCES TO TECHNICAL PUBLICATIONS.**

Basic photographic principles and the technique of military photography, covering elementary photography, chemistry, sensitized materials, optics, filters, photographic sensitometry, ground camera photography, negative making, printing, copying lantern slides, color photography, and laboratory operations, will be found in TM 1-219, Basic Photography. A gravity-type synchronizer tester, Timer PH-191-A, when available, may be used for checking the accuracy of the adjustment of electromagnetic photoflash synchronizers. Instructions for its use will be found in TM 11-2378, Timer PH-191-A.

# PART FIVE

## REPAIR INSTRUCTIONS

**NOTE:** Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on W. D., A. G. O. Form No. 468 (Unsatisfactory Equipment Report). For particulars see paragraph 79. If Form No. 468 is not available, see TM 38-250. Failure or unsatisfactory performance of equipment used by Army Air Forces will be reported on Army Air Forces Form No. 54 (unsatisfactory report).

### SECTION VIII

#### THEORY OF EQUIPMENT

##### 62. FUNCTION AND THEORETICAL OPERATION.

Camera PH-47-E and Camera PH-47-F are designed for general utility and will accommodate cut film and film packs. The focal plane and between-the-lens shutters provide greater latitude of operation. The lens-coupled rangefinder and synchronous photoflash are useful for news, sport, and informal group photography. The synchronized flash is often used as a supplement to daylight to illuminate shadows, in weak daylight, or at night when there is insufficient light for exposures. Two viewfinders, the tubular, adjustable viewfinder for parallax and the wire finder, provide greater flexibility when making action photographs. The function and theoretical operation of each component comprising Camera Equipment PH-104 are covered in section I, Description, and section IV, Operating Instructions.

### SECTION IX

#### TROUBLE SHOOTING

##### 63. TROUBLE, CAUSE, AND REMEDY CHART.

The following table of potential troubles, causes, and the nature of required repairs is supplied so that the most common difficulties in the operation of Camera Equipment PH-104 may be recognized promptly and proper steps taken to correct them.

TROUBLE	CAUSE	REMEDY
Focusing yoke and pinion rough.	Normal wear or accidental damage.	Overhaul or replace.
Out-of-focus negatives.	Inaccurate focusing.	Greater care in focusing.

TROUBLE	CAUSE	REMEDY
	Lens elements loose.	Remove lens and hand-tighten lens elements.
	Front out of square (caused by shock or dropping of camera; shown by bad focus on only one side of the negative).	Overhaul front.
	Rangefinder out of adjustment.	Adjust rangefinder.
	Rangefinder broken.	Replace rangefinder.
Blurred image.	Tripod vibrating.	Use cable release. Place tripod on support that does not vibrate.
	Camera moved during exposure.	Hold camera steadily; use tripod for long exposure.
	Subject moved during exposure.	Use faster shutter speed.
Focal plane shutter not operating correctly or fails to operate.	Lack of lubrication.	Lubricate in accordance with instructions (par. 57).
	Foreign matter in shutter bearings.	Overhaul and clean shutter assembly.
	Curtain-setting plate damaged.	Overhaul.
	Tension plate damaged.	Overhaul.
	Shutter curtain damaged, stretched, or broken.	Replace shutter curtain and overhaul shutter.
	Tension spring worn or broken.	Overhaul.
Fogged or light-struck negatives (black streak across negative).	Film holder badly inserted.	Position film holder properly.
	Focusing frame loose.	Tighten focusing frame.
	Film holder slide loose.	Position slide properly.
	Film holder leaks through slide opening or hole in slide.	Use a perfect holder or replace slide.
Crescent shaped black spot near center.	Loose flange on lens board.	Tighten flange at rear of lens board. CAUTION: Do not tighten by turning shutter. A locating pin in the rear of the shutter engages a hole in the lens board.
Black streak at bottom of negative.	Focal plane shutter curtain rebounding.	Reset curtain.
Corners fogged.	Loose bellows attachments.	Refit bellows.

TROUBLE	CAUSE	REMEDY
Small light bursts.	Pinholes in focal plane shutter curtain.	Patch or replace curtain.
Spots of various sizes.	Holes in bellows.	Patch or replace bellows.
Over-all grayness, black splotches, or total blackening.	Loose lens board.	Refit or replace with new lens board or tighten lens board clip.
	Loading or unloading in improper light.	Load in proper safelight.
Bottom of negative blackened.	Curtain not closing fully.	Overhaul focal plane shutter.
Black streak along the narrow side, parallel with the edge.	Bent back panel.	Straighten back panel.
Black streaks at various angles.	Holes in lens board.	Patch or replace lens board.
Star-shaped fog at center.	Front shutter rebounding.	Use focal plane shutter. Return for repair when convenient.
Thin negatives from flash exposures.	Run-down batteries.	Replace batteries.
	Wrong type of flash lamps used.	Check flash lamps.
	Camera PH-47-E solenoid release not synchronized with shutter.	Resynchronize the solenoid release for the shutter and bulb with which it is to be used.
Solenoid release does not operate shutter when switch is closed.	Wrong setting of synchronized disk in Camera PH-47-F.	Reset synchronized disk.
	Underexposure.	Obvious.
	Exhausted batteries.	Replace batteries.
Sluggish solenoid release action.	Solenoid release not adjusted.	Adjust.
	Improper connection.	Check connections.
	Moisture in the solenoid release.	Remove the solenoid release from the lens board. Remove cap D-411 (fig. 60), and armature D-424. Remove armature spring D-407. Wipe all parts dry, including inside of solenoid, with a lint-free cloth. Connect to standard No. 6 dry-cell battery, allowing current to pass through for 2 hours. Reassemble solenoid release and replace on lens board.
	Exhausted batteries.	Check batteries.

## SECTION X

### REPAIR

**NOTE:** Replacement parts carried in organizational stocks are designated by Signal Corps stock numbers in the illustrations.

#### 64. GENERAL.

The following paragraphs outline the procedures for repairing damage most likely to occur to Camera Equipment PH-104. Tools required to make these repairs are supplied with Repair Set PH-189, as follows:

Screwdrivers, jewelers':  $\frac{1}{32}$ -inch bit;  $\frac{1}{16}$ -inch bit;  $\frac{3}{32}$ -inch bit.

Screwdrivers, regular:  $\frac{1}{8}$ -inch bit, about 6 inches long;  $\frac{5}{32}$ -inch bit, about 8 inches long;  $\frac{3}{16}$ -inch bit, about  $2\frac{1}{2}$  inches long.

Pliers: needle-nose and snub-nose, 6-inch.

Hammer, ball-peen, about 6-ounce.

Tweezers, forceps type, about 6-inch.

Punch, size A,  $\frac{1}{32}$ -inch.

Brush, camel's hair, Rubberset,  $\frac{1}{2}$ -inch.

Bulb, rubber, air syringe type.

Wrenches:  $\frac{3}{16}$ -inch hexagonal socket wrench for Kalart rangefinder arm;  $\frac{1}{8}$ -inch Allen wrench, for adjusting Meyer rangefinder; spanner, for roller bearings; spanner, for tension-winding knob lock nut; clamp, tension-setting.

#### 65. BED (fig. 36).

**a. Removal.** Drop the bed, remove the front from the yoke, and return the bed to the horizontal position. Remove the five screws A-147 from each of the brace plates A-145 and then the plates themselves. The plates are under tension and must be supported firmly. Remove the four yoke guide screws and washers from the bottom of the camera, and the three woodscrews inside the camera that attach the rear section of the bed to the bottom of the body. Then remove the entire bed from the body.

**b. Disassembly.** Remove the yoke guide screws A-14 and then the right and left yoke guides A-308 and A-309. Disengage the body yoke A-345 from the guides on the hinge, thus removing the entire yoke. Remove the six machine screws A-313 holding the bed blocks to the bed assembly. Remove the right and left bed blocks A-311 and A-312. Take care in removing these blocks, which can be broken easily. The bed brace springs A-314 and plungers A-315 and the focusing-shaft springs A-302 are now exposed and can be removed from the bed. Remove the focusing pinion rod A-316. Remove the right and left infinity stops A-306. Note the position of the infinity stops on the bed because they must be replaced in this same position. It is advisable to mark them "left" and "right." Remove the yoke lock lever A-303 and the screw A-304 from the right yoke guide. Be careful not to lose the washer A-317 which is under the yoke lock lever. Before disassembly, note the lock-

ing position of the yoke lock lever because it must be locked in the same position when reassembled. Remove the focusing scales (fig. 19).

**c. Inspection, Cleaning, and Repair.** Wash all metal parts in dry cleaning solvent (SD), benzine, or other similar solvent. Dry all parts thoroughly. The bed blocks may be wiped off with a cloth moistened in the solution. Sight down the sliding yoke to examine. Straighten if necessary. Examine the yoke guides in the same manner and adjust as required. If the hinge has been sprung by damage, replacement will be necessary. If the bed yoke guides A-308 and A-309 and the body yoke guides cannot be aligned, this is an indication that the hinge has been sprung. Place a straight edge on the lower side of the bed assembly, both lengthwise and across the width. The bed should be level in both directions. If it is not, it can be straightened by an even pressure of the fingers over the high spot on the opposite side. Examine the bed blocks A-311 and A-312 and replace if damaged. Examine the links A-336 between the bed yoke A-338 and body yoke A-345. There should be no play in the links. If there is, spread the pins that connect the links to the yoke.

**d. Reassembly.** Place the left infinity stop A-306 in position over the last post on the left side of the bed. Make sure that this stop is positioned correctly. Determine the right or left side of the focusing pinion A-316 by checking with the yoke A-338 for mesh with the gear track, and set it in place on the bed. Place either one of the focusing-shaft springs under the focusing pinion A-316 on the left side of the bed. Set the bed-brace spring A-314 and its plunger A-315 in position on the left side of the bed, under the left bed brace A-331. Replace the left bed block A-312 previously removed, making certain that the bed brace spring and plunger and the pinion rings fit into the spaces provided for them on the bottom left edge of the bed block. Make certain that the bed block now fits snugly to the bottom and left side of the bed. There should be no spaces or high spots. Screw down the left bed block A-312. Fit the right bed block in the same manner as the left. Reassemble the yoke lock lever A-303 on the right yoke guide, making sure that it locks in the correct position as noted before disassembly. This must be done by the trial-and-error method, as the lock screw has a two-way thread. Lubricate the yoke as follows: Rub a small piece of paraffin wax (PF) along the outside edges of the yoke and apply the wax at the groove in all the yoke guides. Attach the bed yoke guides A-308 and A-309 making sure that they align with the body yoke guides and are parallel with the bed. Fit the 10 screws A-14 previously removed.

**e. Final Test.** Rack the focusing pinion and sliding yoke back and forth several times. It should work smoothly, without binding or jumping. There should be enough tension to prevent the yoke sliding by itself when the camera is held vertical. Test the yoke for side-play. If side-play is present, it

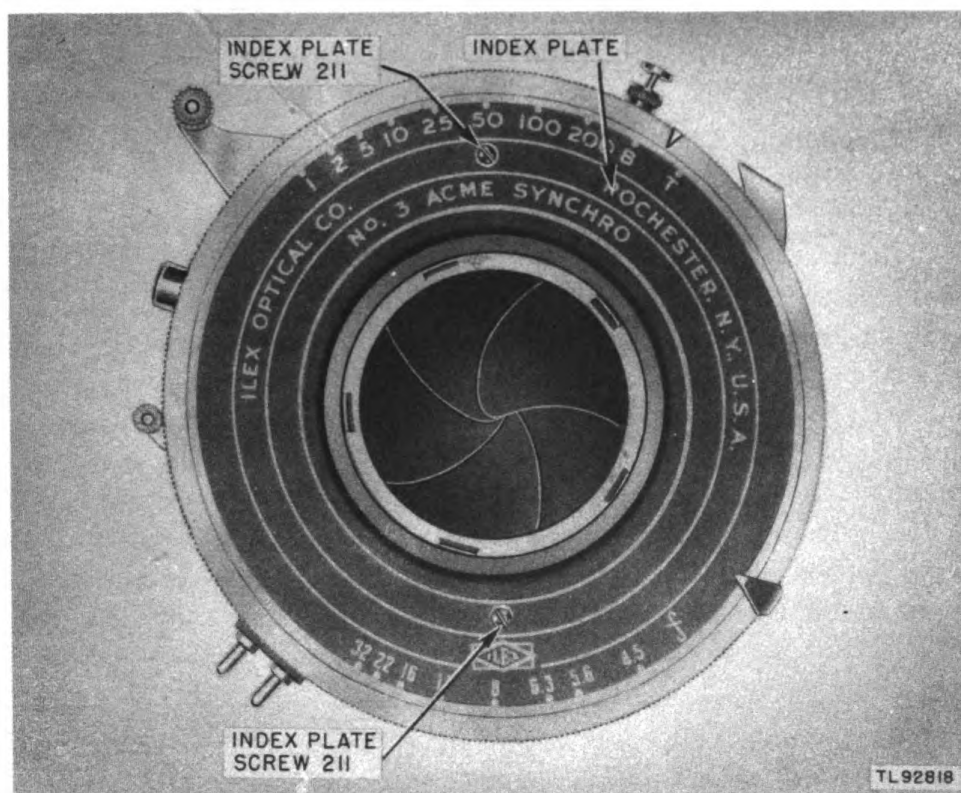


Figure 42. Ilex No. 3 Acme synchronized shutter disassembly, step 1

can be adjusted by bringing the yoke guides A-308 and A-309 closer together. First, loosen the yoke lock lever A-303. Loosen the yoke screws A-14 so that the right yoke guide A-308 can be forced, by the pressure of the thumb, to the left against the sliding yoke A-338. Hold the yoke guide in position while the screws A-14 are tightened. The yoke lock lever should tighten sufficiently to hold the yoke when the camera is tilted, after the bed has been reinstalled on the camera.

**f. Replacement.** Place the bed in position on the camera body. Fasten it in position with the four screws and washers. Attach the three woodscrews A-365 to the case hinge at the inside of the bottom of the case. Engage each bed brace with its proper brace plate A-145 and attach the plates to the camera case with the screws A-147. Test the bed with a straight edge to make certain that it is level with the bottom of the case. Drop the bed and slide the front onto the body yoke. Before dropping the bed, make certain that it has been racked to infinity position. Return the bed to the horizontal position.

## 66. No. 2 SUPERMATIC SHUTTER (figs. 37 through 40).

**NOTE:** During disassembly, note the shape, tension, and condition of all springs before removing them from the mechanism. Those requiring replacement should be noted and replaced during assembly.



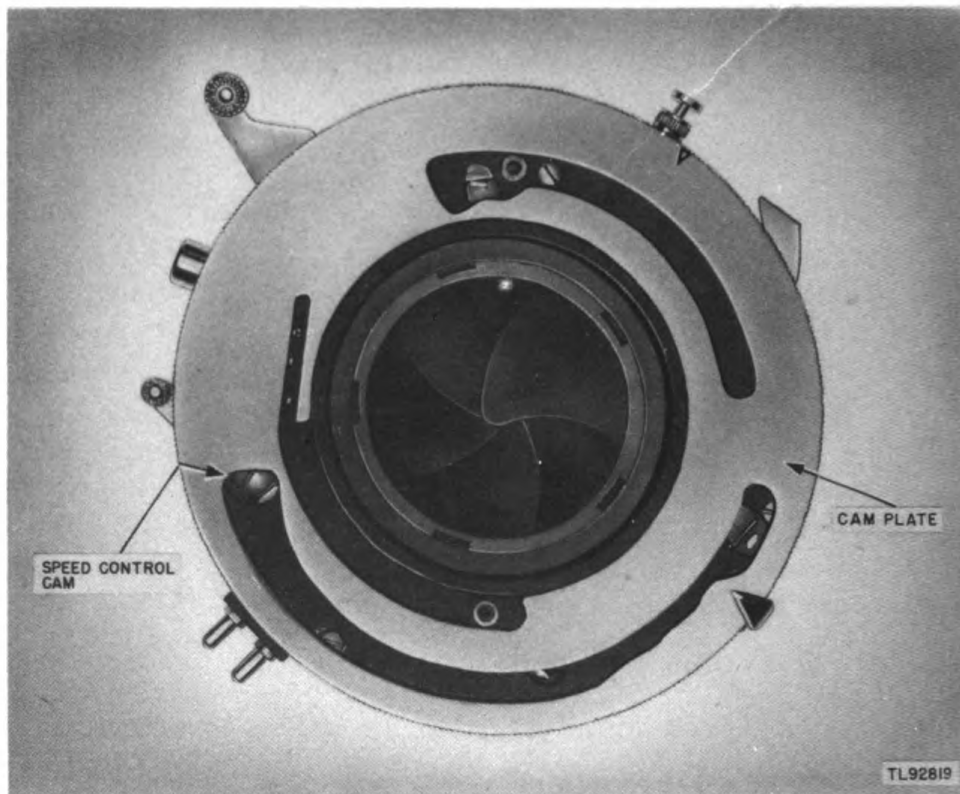


Figure 43. Ilex No. 3 Acme synchronized shutter disassembly, step 2

**a. Removing Shutter from Camera.** Take out the entire lens board to which the lens, shutter, and solenoid release are attached. Move the slide-lock, which is the long plate near the top of the lens board frame, up and to the left by pressing on the turned-out extension at its left end; lift out the lens board at the top and then lift up until it is free. Reverse the operation to replace the lens board.

**b. Removing Shutter from Lens Board.** Unhook the link D-401 (fig. 60) of the solenoid release, remove the three wood screws in the flange at the back of the lens board, and then unscrew the flange itself with a spanner or other suitable tool. Ordinarily it will not be necessary to remove a front shutter from the lens board, but, if this must be done, bear in mind that a locating pin (fig. 41) in the rear of the shutter engages a hole in the lens board to position the shutter properly in relation to the solenoid release of the synchronizer.

**c. Disassembly (fig. 37).** Be sure that the shutter has been tripped. Remove the lens cells by unscrewing them counterclockwise. Remove from the etched index plate the screw below the word GRAPHIC and the screw between the words KODAK and SUPERMATIC. If only one screw is visible, the plate is held in position by a bayonet lock. Remove the screw and turn the plate counterclockwise about  $\frac{7}{8}$  inch to release it from its locked position.

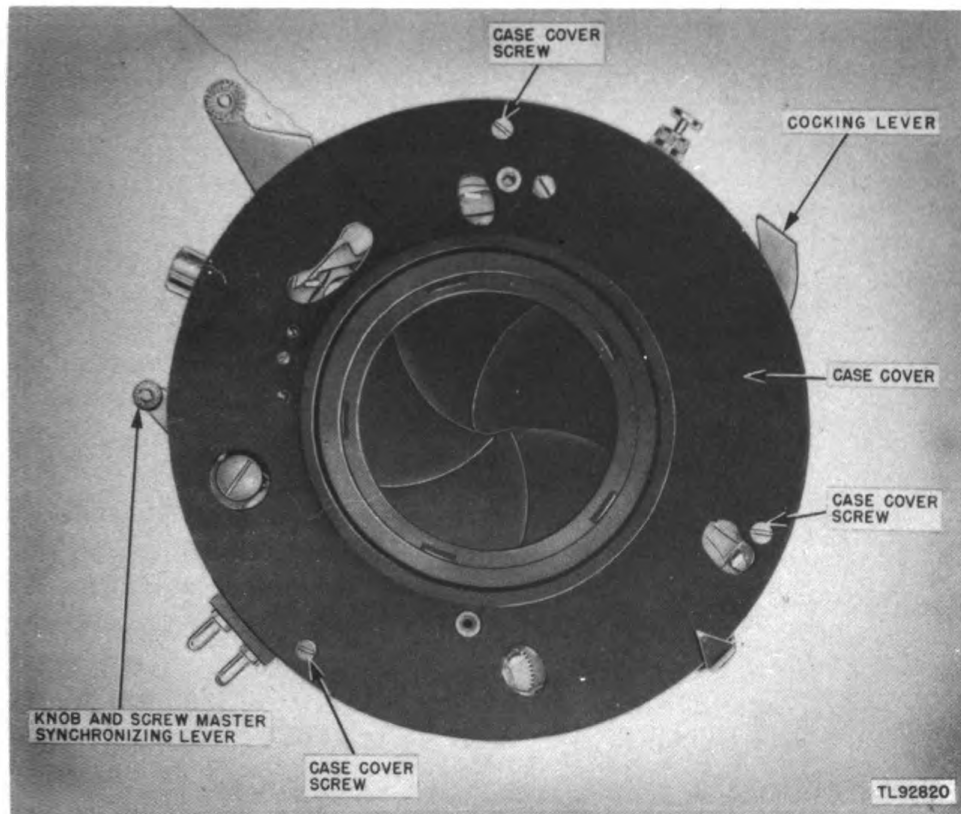


Figure 44. Ilex No. 3 Acme synchronized shutter disassembly, step 3

Lift the index plate from its seat and knurled speed indicator ring. The rings and plate may be removed separately or together. If the shutter is equipped with a delayed-action mechanism lift the delayed action winding lever (fig. 38) which consists of a collar and arm, from its position around the opening. Lift the end of the spring (fig. 39) that holds the curved delayed-action trigger latch in position and let it rest against the lens-opening collar. This will relieve the tension on the delayed-action mechanism, allowing it to run down. Lift the end of the curved delayed-action trigger latch (fig. 39) and swing it outward. Remove the three screws in the cover plate. Note particularly that two are long and one is short; the two long screws are located at the bottom of the cover plate, and the short screw is at the top of the cover plate. Pry loose and remove the cover plate. Remove the high-speed spring and cam. Remove the No. 1 delayed-action gear and spring assembly. Remove the two screws in the gear-plate assembly (the plate over the gear train assembly that controls the shutter speed). The No. 1 gear sector will be attached to the plate and is not removable. Remove the gear plate. Remove the gears No. 2 and No. 3 and the escapement wheel, noting their order before removing. Carefully remove the retard pallet.

**d. Cleaning.** Blow air, not too forcibly, on the gears, springs, and controlling levers by means of an air syringe or rubber bulb. The gears, gear

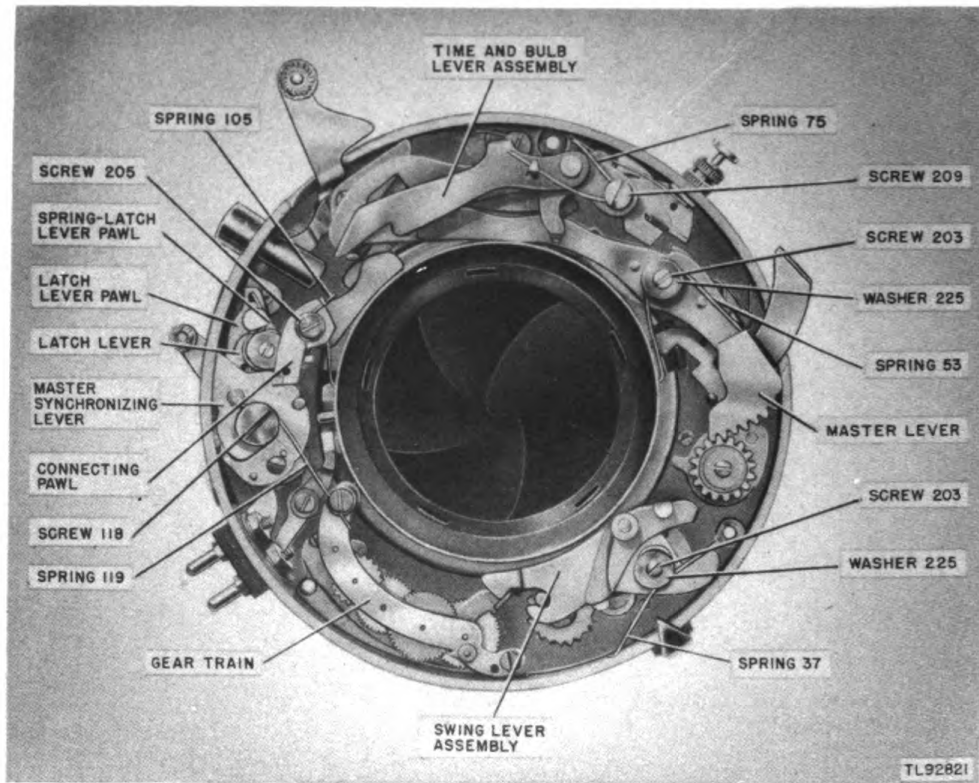


Figure 45. Ilex No. 3 Acme synchronized shutter disassembly, step 4

plate, and retard pallet may be washed in benzine, lead-free gasoline, or dry cleaning solvent (SD).

**CAUTION:** Do not oil any part of the shutter.

**e. Overhaul, Inspection, and Repair.** Examine all springs to determine whether they are out of shape or have lost their tension. Replace any unsatisfactory springs. Operate the shutter-release lever several times. Watch the time and bulb levers to detect any possible binding. Examine the shutter blades for nicks or burrs. If the blades are burred, complete dismantling of the shutter and replacement of defective blades will be necessary. Examine the delayed-action winding spring. If the spring has lost its coil or is deformed, replacement is necessary. Examine the main drive spring. If it has stretched or appears deformed, it should be replaced by a new one.

**f. Reassembly and Test.** Set the No. 3 gear assembly in its bearing with the gear teeth facing upward. Set the No. 2 gear assembly in position with the gear teeth facing upward. Place the escapement wheel in its bearing with the gear teeth facing downward. Carefully set the retard pallet on its stud, making sure that the U-shaped portion encircles the escapement wheel. Place in position the gear plate with its No. 1 gear sector attached, making certain that all gears are seated: From one to three teeth of the gear sector should be showing on the left side of the gear plate when the plate is in position. (The

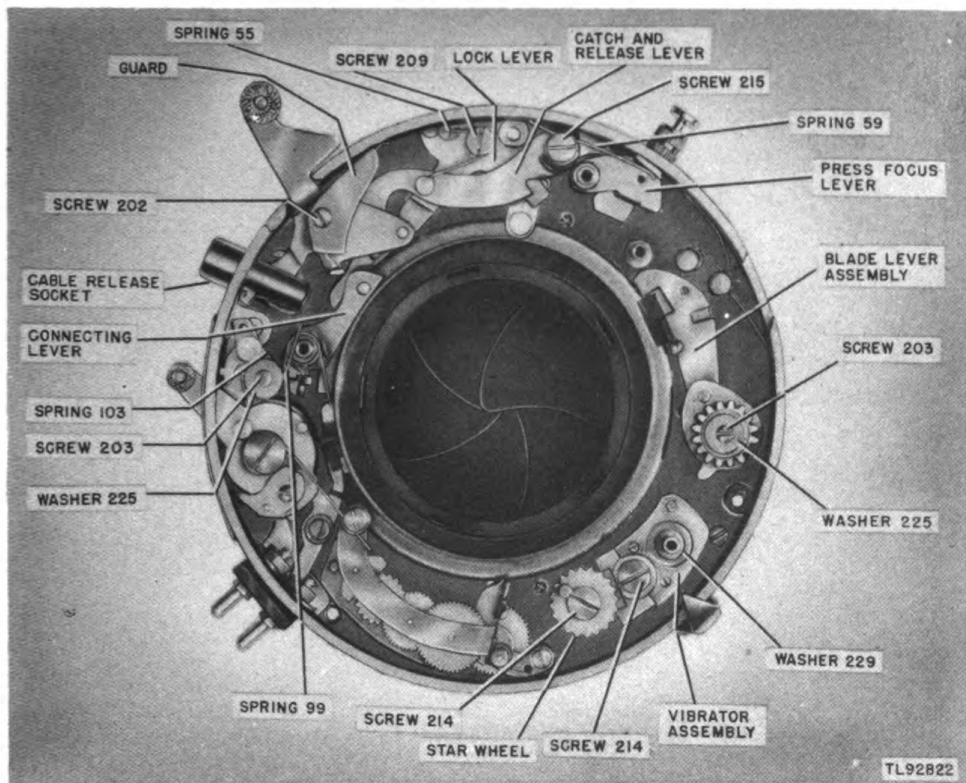


Figure 46. Ilex No. 3 Acme synchronized shutter disassembly, step 5

shutter must not be cocked when positioning the plate.) It may be necessary in some cases, however, to adjust the speed in one of the following ways: If the shutter is fast at 1 second, move the gear sector counterclockwise; if too slow, move the gear sector clockwise until the proper speed is attained. The stud on the retard sector must contact the 1-second notch of the speed control ring when the shutter is cocked; this can be checked when the cover and speed ring have been assembled. It is essential that all gears be in mesh. Screw the gear plate into its position with the gear-plate screws. Cock the shutter. The No. 1 gear sector and the retarding sector should now come into play. If they do not, the teeth of the gears are not meshing properly. Adjust the gears so that they will mesh. Release the shutter. Hold the time and bulb levers free of the main drive when making this test, as the speed-control ring which regulates this section is not in place. The gear train should now operate freely and without hesitation, giving a 1-second exposure. When these adjustments have been made satisfactorily, reassembly may proceed. Set the delayed-action No. 1 gear and spring assembly into its bearing. Be sure that the delayed-action pinion and gear assembly is seated and meshes with the gear next to it. The end of the delayed-action winding spring should rest against the base of the only near-by screw post. Replace the high-speed spring and spring cam, making certain that the base of the springs fits in its anchor hole. Replace the

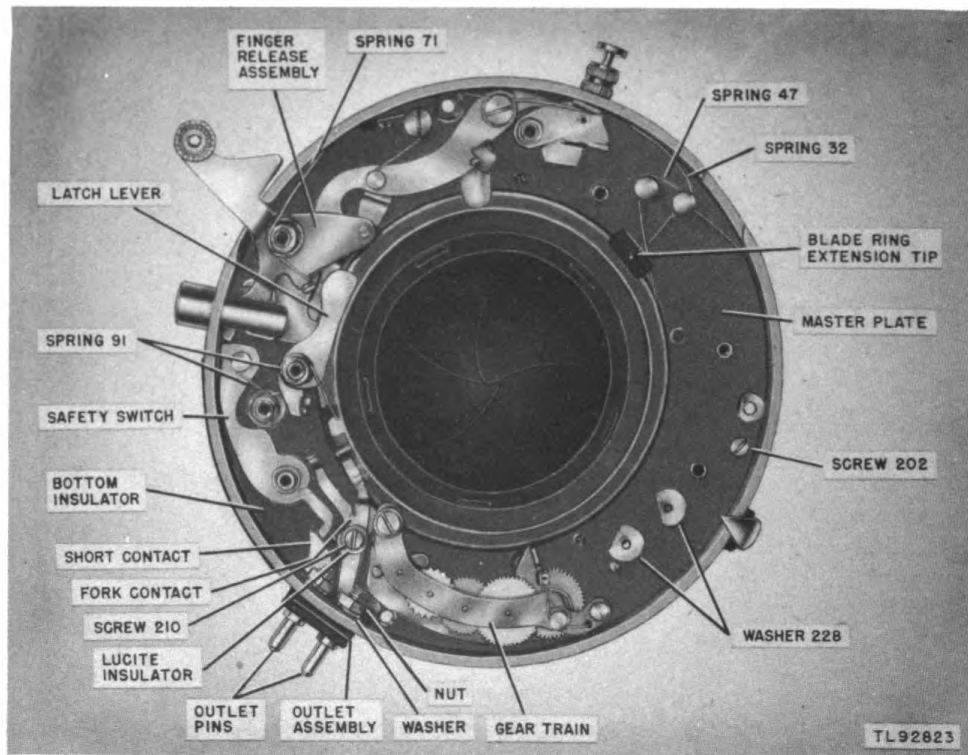


Figure 47. Ilex No. 3 Acme synchronized shutter disassembly, step 6

cover plate. Make certain that the top of the delayed-action pinion and gear assembly fits in the delayed-action pinion bracket, and also that the high-speed spring does not become caught under this cover plate and prevent it from seating when being fitted. Swing the curved delayed-action trigger latch into position and lock it in place with the spring previously rested against the collar of the lens opening. Replace the delayed-action cocking lever. Pull the arm of the lever down once or twice to wind the delayed-action mechanism, but do not wind it any more than is necessary to operate the shutter when set to take a delayed-action picture. Lift up the delayed-action lever and replace it in the position it was in before the winding operation. Replace the knurled speed-control ring, the speed and diaphragm plate, and, finally, replace the lens cells.

**g. Final Test.** Test operation at time and bulb setting. Check 1-second operation; there should be no hesitation or sticking. Check the remaining speeds. Test the delayed-action mechanism. Check the diaphragm for smoothness of operation.

**h. Remounting on Lens Board.** When replacing the shutter on the lens board, reverse the procedure described in this paragraph. Make sure that the locating pin is in its hole so that the shutter will be in the correct position in relation to the solenoid release of the synchronizer.

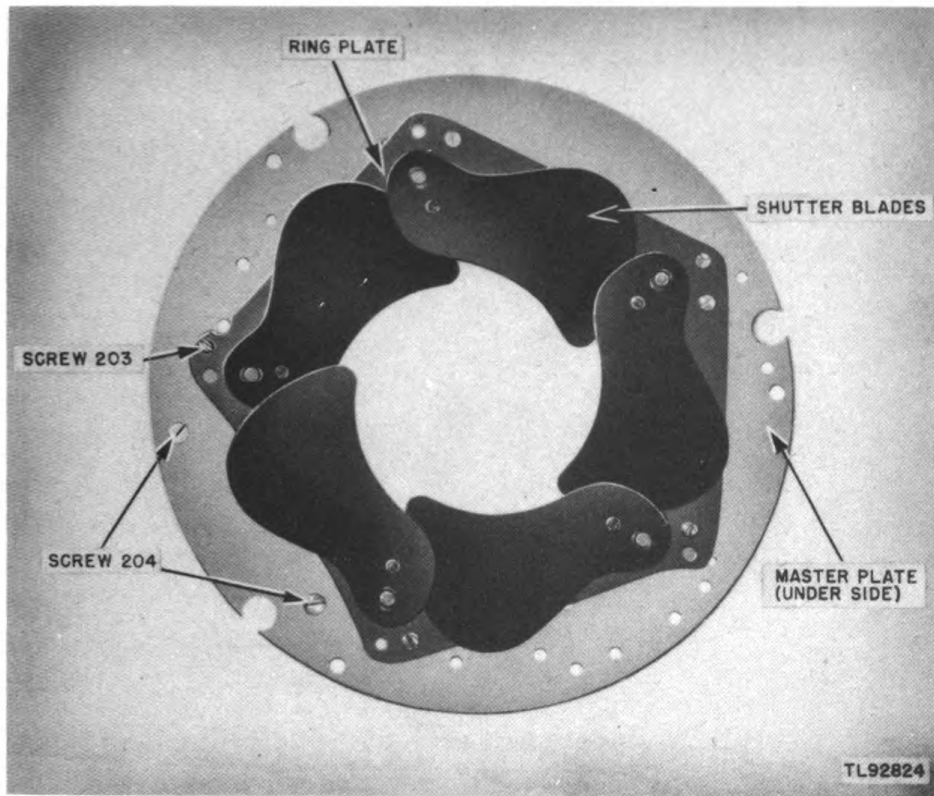


Figure 48. Ilex No. 3 Acme synchronized shutter disassembly, step 7

## 67. ILEX No. 3 ACME SYNCHRONIZED SHUTTER (figs. 42 through 51, and 70).

**a. Removing Shutter from Camera.** Take out the entire lens board to which the lens and shutter are attached. The slide lock is slid up and to the left by pressure on the extension at the left end of the slide lock. Lift out the lens board at the top until free.

### **b. Removing Shutter from Lens Board.**

- (1) Unscrew the lens cells.
- (2) Unscrew the rear flange, using a spanner wrench, if necessary.
- (3) Remove the shutter from the lens board. Note the locating pin in the rear of the shutter which engages a hole in the lens board so that the shutter always is placed in correct position with the auxiliary shutter-release lever.

**NOTE:** During disassembly, note the shape, tension, and condition of all springs before removing them from the mechanism. Those requiring replacement should be noted and replaced during assembly.

**c. Disassembly.** Be sure the shutter has been tripped. Then remove in the following order:

- (1) Two screws (fig. 42) from the index plate.

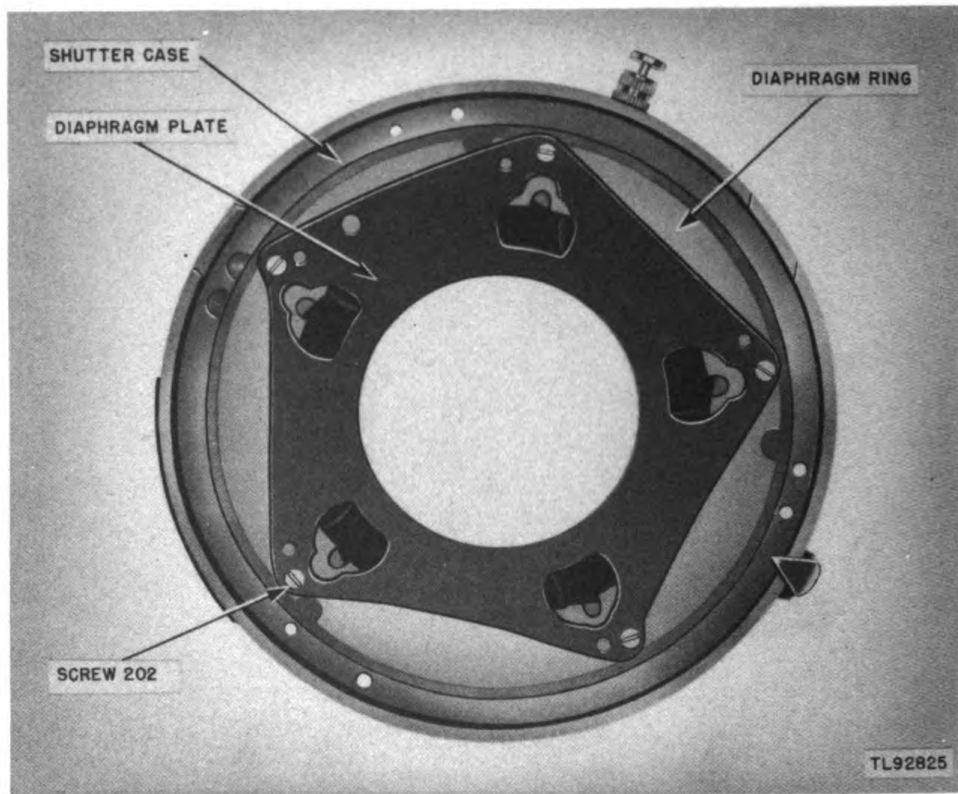


Figure 49. Ilex No. 3 Acme synchronized shutter disassembly, step 8

- (2) Index face plate.
- (3) Speed control cam plate (fig. 43).
- (4) Three screws (fig. 44) which hold the case cover to the shutter.
- (5) Case cover.
- (6) Screw and knob from the master synchronizing lever.
- (7) Two screws from the metal washer (fig. 70).
- (8) Index plate from the shutter case.
- (9) Screw 209 (fig. 45) and spring 75 from the time and bulb lever assembly.
- (10) Time and bulb lever assembly.
- (11) Washer (fig. 70) which is between the shutter lever assembly and the spacer.
- (12) Screw 203 (fig. 45) washer 225, and spring 53 from the master lever.
- (13) Master lever.
- (14) Spacer washer from the master lever post.
- (15) Screw 215 (fig. 46) from the catch and release lever.
- (16) Spring 59 from the catch and release lever.
- (17) Press-focus lever.

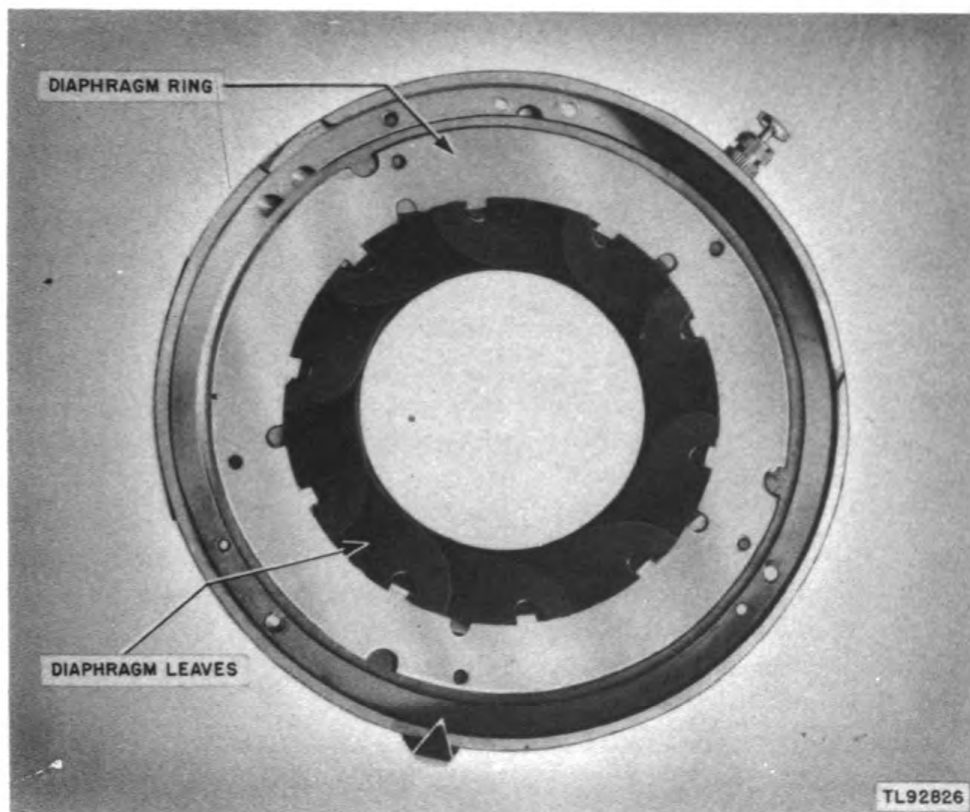


Figure 50. Ilex No. 3 Acme synchronized shutter disassembly, step 9

- (18) Screw 209 and spring 55 from the lock lever.
- (19) Catch and release lever.
- (20) Lock lever.
- (21) Screw 205 (fig. 45), spring 105, and connecting pawl.
- (22) Washer from the connecting lever post.
- (23) Connecting lever spring 103 (fig. 46).
- (24) Connecting lever.
- (25) Screw 203, washer 225, and spring 99 from the latch lever.
- (26) Latch lever assembly (fig. 45).
- (27) Screw 118 and spring 119 from the master synchronizing lever.
- (28) Master synchronizing lever.
- (29) Gear which lies directly under the master synchronizing lever.
- (30) Bronze washer from the master synchronizing lever post.
- (31) Plastic washer from the master synchronizing lever post.
- (32) Bakelite shutter disk (fig. 70), and release spring operating against blade lever assembly.
- (33) Screw 203 (fig. 46) from the blade lever assembly.



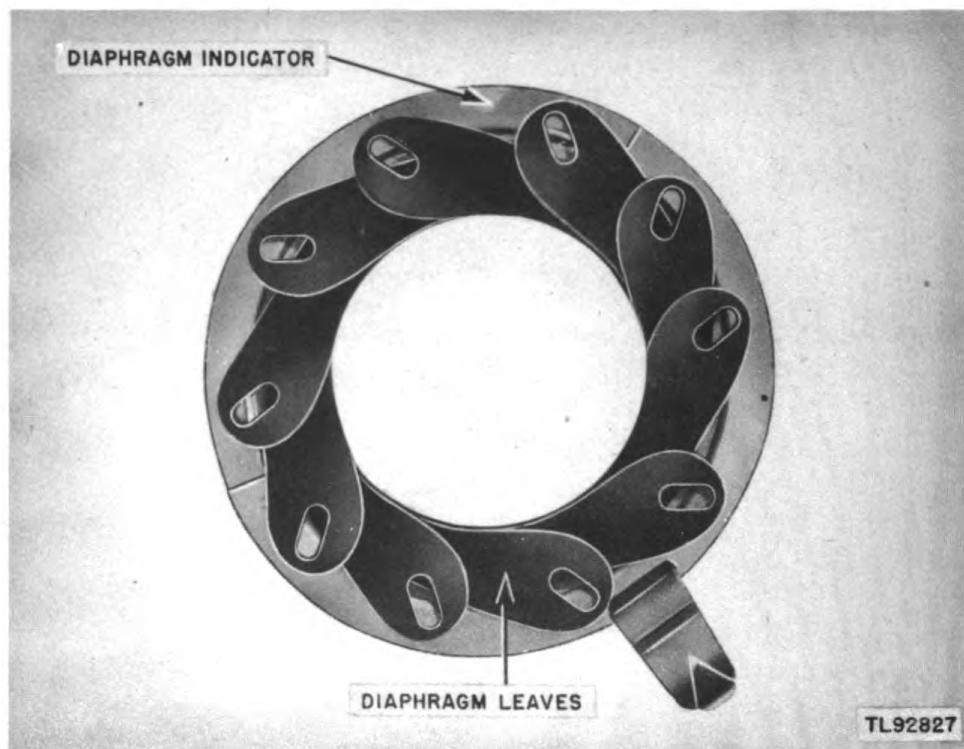


Figure 51. Ilex No. 3 Acme synchronized shutter disassembly, step 10

- (34) Washer 225 from the blade lever assembly.
- (35) Blade lever assembly.
- (36) Two springs (fig. 47) beside the blade lever assembly.
- (37) Screw 203 (fig. 45), washer 225, spring 37, and swing lever assembly.
- (38) Washer 229 (fig. 46) from the post of the vibrator assembly.
- (39) Vibrator assembly, by loosening screw 214.
- (40) Washer 228 (fig. 47) located under the vibrator assembly.
- (41) Screw 214 (fig. 46) from the star wheel.
- (42) Star wheel.
- (43) Washer 228 (fig. 47) located under the star wheel.
- (44) Screw 202 (fig. 46) from the guard.
- (45) Guard from the finger release assembly.
- (46) Spring 71 (fig. 47) from the finger release assembly post.
- (47) Finger release assembly.
- (48) Lucite plunger (fig. 46) from the cable release socket.
- (49) Two screws which hold the cable release socket to the shutter case.
- (50) Cable release socket.
- (51) Spring 91 (fig. 47) from the latch lever post.
- (52) Safety switch.

- (53) Screw 210 and lucite insulator bushing from the fork contact.
- (54) Two washers and nuts on the outlet pins.
- (55) Short contact.
- (56) Fork contact.
- (57) Oblong fiber washer from the outlet assembly.
- (58) Two screws which hold the outlet to the shutter case.
- (59) Outlet assembly, taking care not to lose the two lucite washers.
- (60) Bottom insulator.
- (61) Three screws 202 from the master plate. Set shutter blades in open position.

(62) Master plate with gear train attached from the shutter case, taking care to avoid damage to the shutter blades; turn shutter face downward to do this.

(63) Shutter blades (fig. 48) with blades in position on the master plate. (Locate the double blade and note its position relative to the master plate; make a mark; note position of blades before removal; make a mark across the ring plate and master plate, so that they can be properly placed in reassembly.)

(64) Five screws 203 which hold the ring plate to the master plate.

(65) Blade ring (fig. 70).

(66) Two screws 204 (fig. 48) which hold the gear train to the master plate.

(67) Gear train (fig. 45). (Make a mark across the diaphragm plate (fig. 49), the diaphragm ring, and the shutter case, so that they can be properly placed in reassembly.)

(68) Five screws 202 which hold the diaphragm plate to the shutter case.

(69) Metal diaphragm plate and the paper diaphragm plates.

(70) Diaphragm ring (fig. 50).

(71) Diaphragm leaves.

(72) Diaphragm indicator (fig. 51).

(73) Paper diaphragm washer (fig. 70).

#### **d. Cleaning.**

(1) Blow air, not too forcibly, on the gears, springs, and controlling levers by means of an air syringe or rubber bulb.

(2) Wash the gears and levers in benzine, or lead-free gasoline or dry cleaning solvent (SD).

**CAUTION:** Do not oil any part of the shutter.

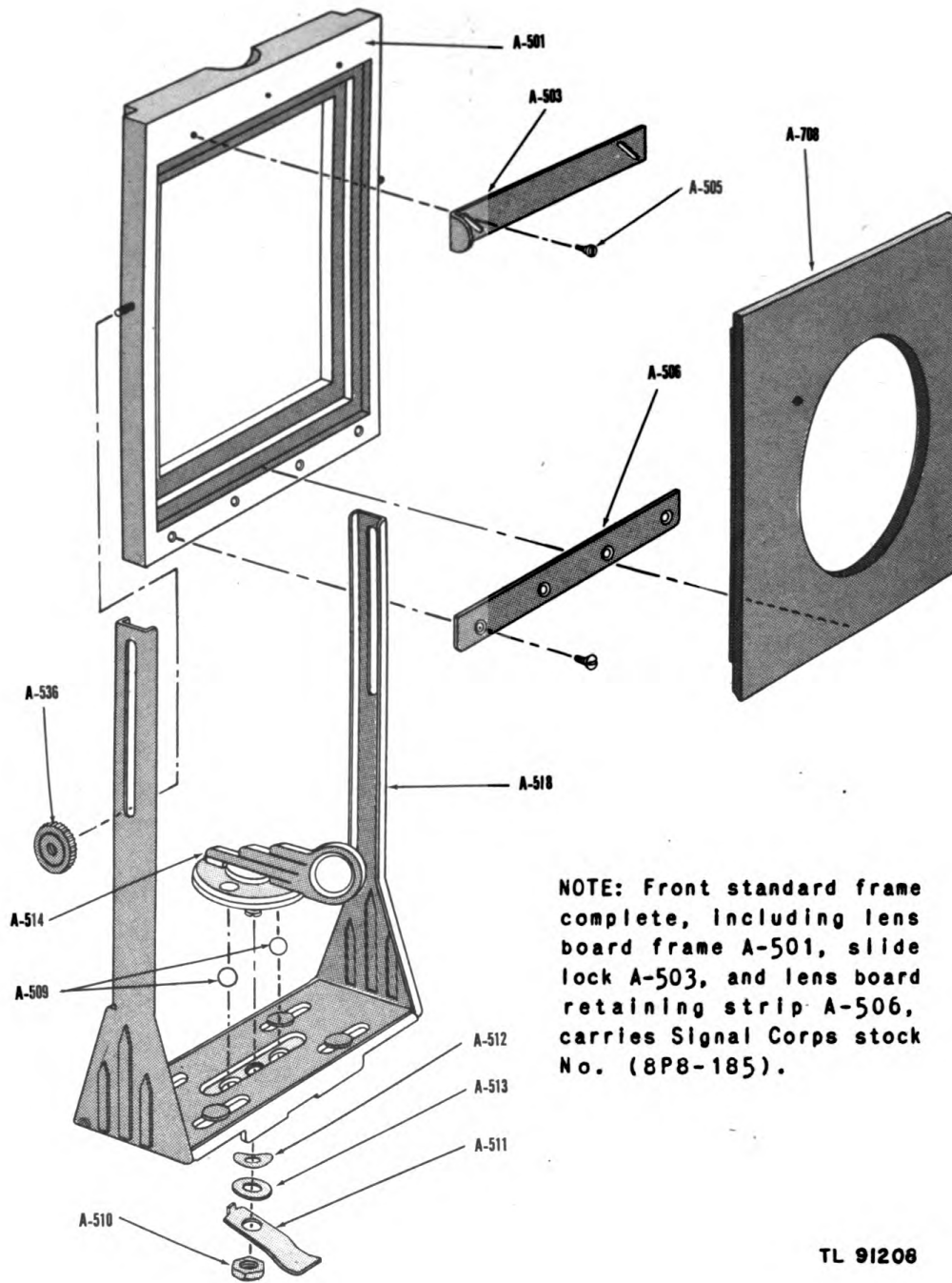
#### **e. Overhaul, Inspection, and Repair.**

(1) Examine all springs to determine whether they are out of shape or have lost their tension, replacing any that are not satisfactory.

(2) Inspect each part carefully for damage, replacing parts when necessary.

**f. Reassembly.** Check all parts for damage or wear, replacing parts when necessary.

(1) Replace the paper diaphragm washer (fig. 70).



NOTE: Front standard frame complete, including lens board frame A-501, slide lock A-503, and lens board retaining strip A-506, carries Signal Corps stock No. (8P8-185).

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- A-501. Lens board frame
- A-503. Slide lock (8P8-268)
- A-505. Slide lock screw
- A-506. Retaining strip
- A-509. Lock balls
- A-510. Locknut
- A-511. Spring catch

- A-512. Front standard spring washer
- A-513. Front standard flat washer
- A-514. Front lock lever
- A-518. Front standard assembly (8P8-605)
- A-536. Rising front locking nut
- A-708. Lens board (8P8-6251)

Figure 52. Camera front, exploded view

- (2) Replace the diaphragm indicator (fig. 51).
- (3) Replace the 10 diaphragm leaves, placing them in counterclockwise position, so that the extension on the end of the leaf engages in the hole in the diaphragm indicator.
- (4) Replace the diaphragm ring, with the extensions down, so that they engage the respective holes in the diaphragm leaves (fig. 50).
- (5) Replace the two paper diaphragm plates and the metal diaphragm plate, aligning the marks made as directed in subparagraph c (67) above (fig. 49).
- (6) Replace and tighten the five screws.
- (7) Place the gear train (fig. 47) on the master plate and secure with two screws 204 (fig. 48).
- (8) Replace the blade ring (fig. 70) on the back of the master plate, engaging the extension in the  $\frac{1}{4}$ -inch slot in the master plate.
- (9) Place the ring plate (fig. 48) aligning the marks made in subparagraph c (63) above.
- (10) Replace the five screws 203.
- (11) Place the shutter blades in clockwise position on the ring plate with the double blade located as marked in subparagraph c (63), and sandwich adjacent blades.
- (12) Holding the master plate face down with the shutter blades up, insert it into the shutter case so that the contact point on the diaphragm indicator is opposite the master synchronizing slot.
- (13) Replace the three screws 202 (fig. 47) which hold the master plate to the shutter case.
- (14) Replace the bottom insulator.
- (15) Position the outlet assembly so that the two lucite washers fit snugly into the body of the shutter case.
- (16) Replace the two screws (fig. 70) which hold the contact points to the shutter case.
- (17) Replace the oblong fiber washer on the outlet assembly (fig. 47).
- (18) Replace the fork contact on the right outlet pin so that the lower prong makes contact with the silver contact point on the blade ring.
- (19) Replace the short contact on the left pin of the outlet.
- (20) Replace the two washers and nuts on the outlet pins.
- (21) Replace the screw and lucite insulator bushing on the fork contact.
- (22) Replace the safety switch.
- (23) Place the safety switch spring 91 on the latch lever post with the angular edge hitting against the rivet on the safety switch, and the other end hitting against the post.
- (24) Replace the cable release socket (fig. 46).
- (25) Replace the two screws which hold the cable release socket to the shutter case.
- (26) Replace the lucite plunger in the cable release socket.

- A- 5. Screw
- A- 10. Screw
- A- 11. Screw
- A- 16. Screw
- A- 19. Screw
- A-602. Back panel
- A-607. Back top molding
- A-610. Back bottom molding
- A-616. Focusing frame
- A-621. Focusing-screen cover
- A-628. Light shields
- A-629. Focusing-panel catch
- A-630. Ground glass
- A-632. Screw
- A-634. Screen spring
- A-638. Screen spring
- A-642. Focusing-frame spring screw
- A-643. Focusing-frame spring washer

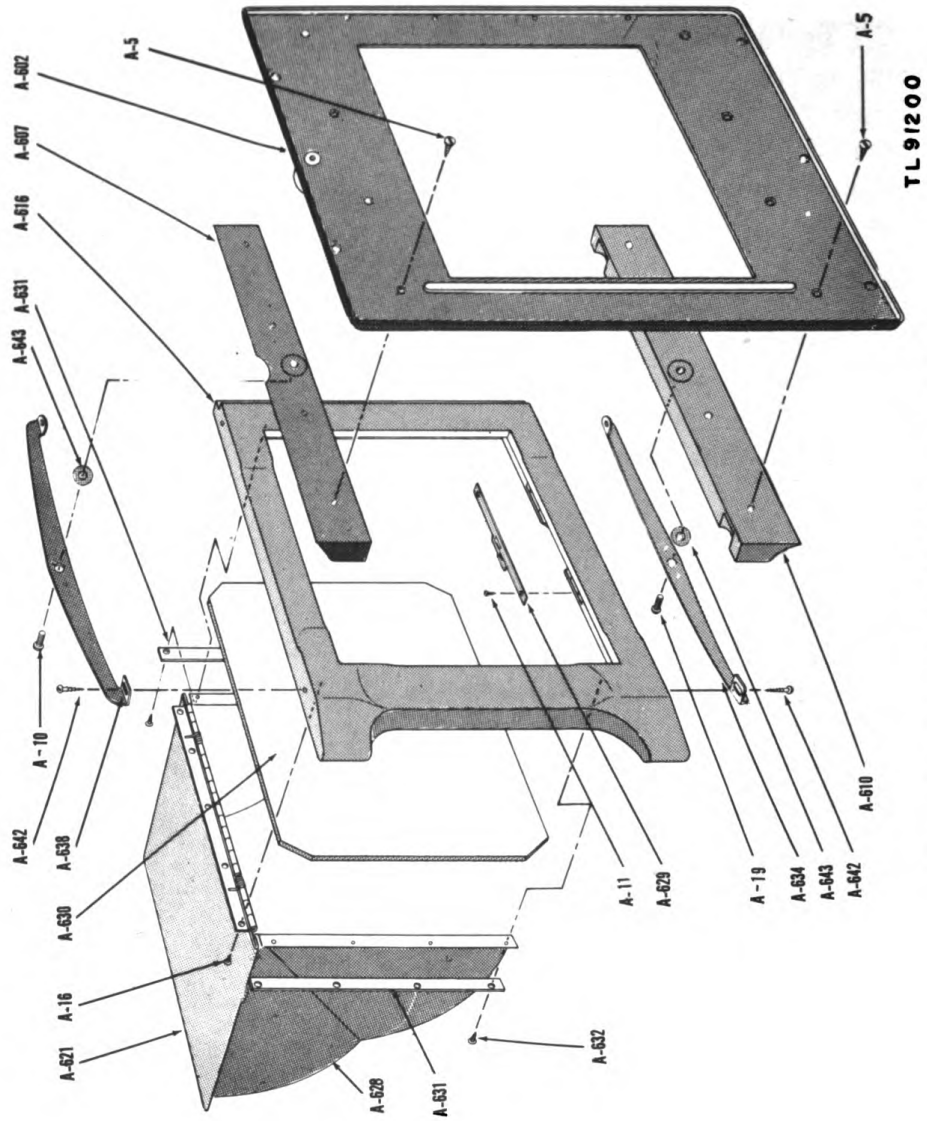


Figure 53. Camera back (8P8-13), exploded view

(27) Replace the finger release assembly (fig. 47). Be sure the finger release lever fits smoothly into the slot of the cable release socket.

(28) Replace the spring guard (fig. 46) on the finger release lever post.

(29) Replace the screw 202 in the finger release guard. Be sure the guard retains the long end of the spring along the edge of the shutter case.

(30) Place the washer (fig. 47) on the hole located to the right of the gear train assembly.

(31) Position the star wheel (fig. 46) on the washer.

(32) Replace the screw 214 which holds the star wheel and washer on the master plate.

(33) Place the washer on the hole to the right of the star wheel.

(34) Position the vibrator assembly on the washer.

**NOTE:** Be sure the vibrator assembly is engaged with the gear train assembly.

(35) Replace the screw 214 which holds the vibrator assembly and washer on the master plate.

(36) Replace the washer 229 on the post which extends through the vibrator assembly.

(37) Place the swing lever assembly (fig. 45) on the vibrator assembly post.

(38) Place the spring 37 on the vibrator assembly post so that the long end of the spring rests in the groove in the edge of the shutter case and the short end rests against the extension of the swing lever assembly.

(39) Replace the screw 203 which holds the washer 225, spring 37, and swing lever assembly on the vibrator post.

(40) Position the spring 32 on the blade ring extension tip on the right rivet so that the long end of the spring points upward toward the left and the other end rests against the left side of the blade ring extension, keeping the shutter blades closed.

(41) Replace the blade lever assembly (fig. 46).

(42) Replace the washer and screw on the blade lever assembly.

(43) Place the blade lever 47 spring (fig. 47) on the left rivet, so that the notched end of the spring falls to the right side along the shutter case and the other end engages in the spring retaining slot of the blade lever assembly.

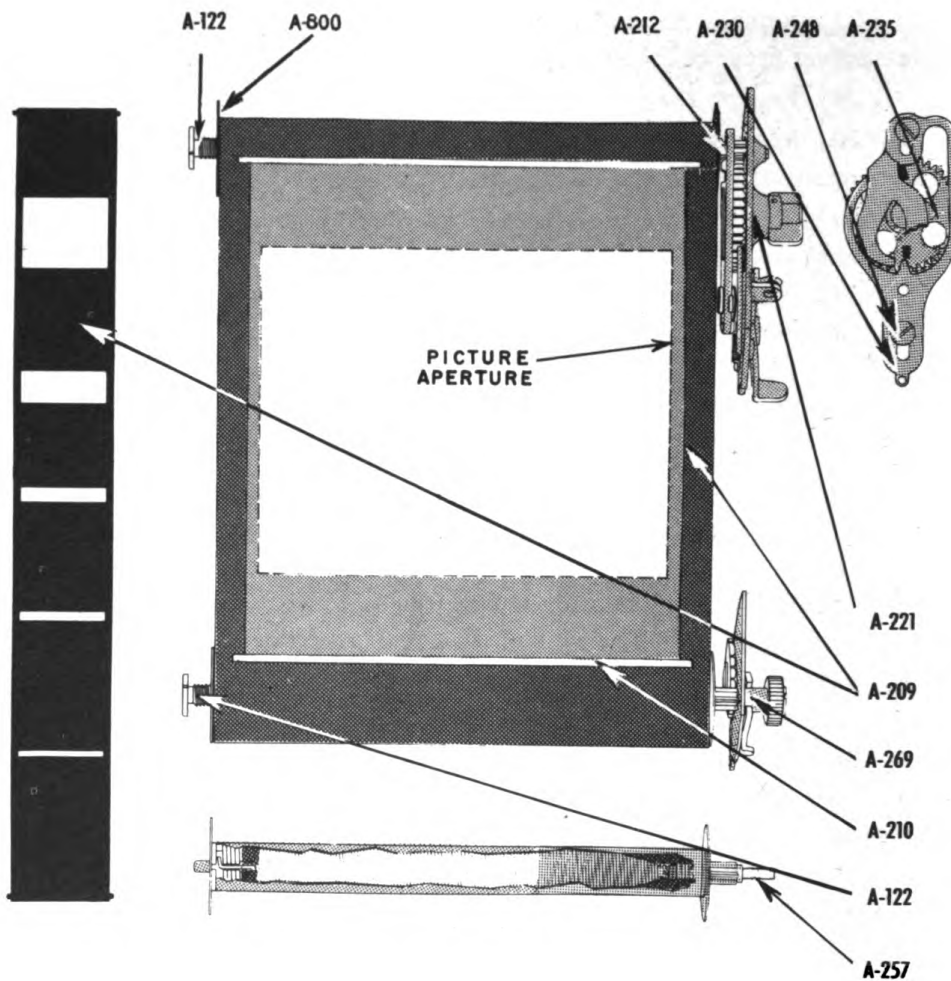
(44) Replace the shutter disk (fig. 70).

(45) Replace the thin bronze washer on the master synchronizing lever post (fig. 45).

(46) Place the plastic washer on the master synchronizing lever post.

(47) Place the star gear in position on the under side of the master synchronizing lever, holding it in place with tweezers until the lever is in position on the bakelite shutter disk.

(48) Replace the spring 119 on the master synchronizing lever assembly so that the long end rests against the screw on the gear train and the short end of the spring hooks around the rivet on the master synchronizing lever.



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- |  |  |
|--|--|
| <i>A-122. Curtain roller bearing</i>   | <i>A-230. Escapement</i>                     |
| <i>A-209. Shutter curtain</i>          | <i>A-235. Master gear</i>                    |
| <i>A-210. Curtain edging slit</i>      | <i>A-248. Screw</i>                          |
| <i>A-212. Top gear roller assembly</i> | <i>A-257. Bottom tension roller assembly</i> |
| <i>A-221. Shutter plate</i>            | <i>A-269. Tension plate</i>                  |
| <i>A-800. Upper shutter roller</i>     |  |

Figure 54. Focal plane shutter mechanism (8P8-125)

(49) Replace the screw 118 which holds the spring, master lever assembly, star gear, and shutter disk.

(50) Replace the latch lever assembly.

(51) Place the spring 99 (fig. 46) on the post of the latch lever assembly (fig. 45) so that the short end hooks into the hole of the latch lever and the long end rests against the upper side of the connecting lever post (fig. 46).

(52) Replace the washer 225 and screw 203, which hold the spring 99 and the latch lever assembly on the post.

(53) Check to be sure that the latch lever pawl spring 103 is on the post of the pawl, positioned so that the short end hooks into a hole in the pawl and the long end extends into the coil of spring 99.

(54) Replace the connecting lever.

(55) Place the spring 91 (fig. 47) on the post of the connecting lever so that the bent end rests against the lower edge of the extension on the connecting lever and the other end rests in a groove in the shutter case.

(56) Replace the washer on the connecting lever post (fig. 46).

(57) Replace the connecting pawl (fig. 45) on the connecting lever post, so that the arm is above the extension of the connecting lever.

(58) Replace screw 205 and spring 105 on the connecting pawl, so that the bent end of the spring rests against the under side of the extension on the connecting lever and the other end rests against the lower side of the extension on the connecting pawl.

(59) Place the lock lever (fig. 46) on the hole to the right of the finger release lever.

(60) Replace the catch and release lever.

(61) Replace the spring 55 and screw 209 on the lock lever so that the short end of the spring rests against the lower side of the lock lever extension and the long end rests against the lower side of the rivet on the catch and release lever.

(62) Replace the press-focus lever.

(63) Replace the spring 59 and the screw 215 on the catch and release lever, so that the long end rests against the upper extension on the press-focus lever and the short end rests against the shutter case.

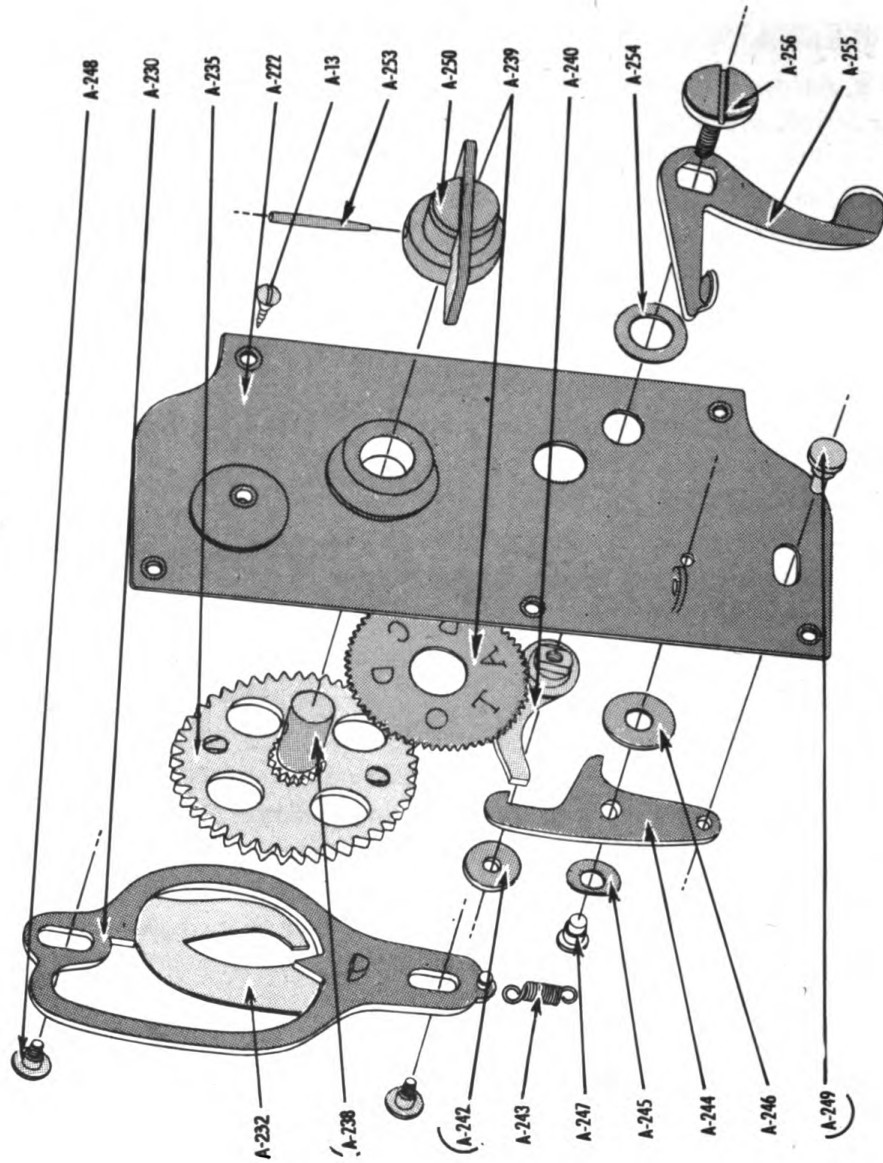
(64) Replace the spacer washer (fig. 45) on the master lever post.

(65) Position the blade lever assembly (fig. 46), replaced as directed in subparagraph (41) above, so that the shutter blades are closed and the extension on the cam plate points toward the center of the shutter.

(66) Place the master lever (fig. 45) on the post in position toward the back of the case, so that only one tooth is engaged in the master pinion gear of the blade lever assembly.

(67) Place the spring 53 on the master lever post so that the hooked edge rests in the groove on the inside wall of the master plate and the straight end rests against the lower side of the extension on the master lever.





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Figure 55. Curtain-setting mechanism

- A- 13. Screw (8P8-500)
- A-222. Shutter plate (8P8-335)
- A-230. Escapement (8P8-140)
- A-232. Curtain brake
- A-235. Master gear
- A-238. Master gear stem
- A-239. Indicator gear
- A-240. Escapement lever
- A-242. Locknut
- A-243. Spring (8P8-575)
- A-244. Shutter latch lock
- A-245. Escapement spring washer
- A-246. Lockwasher
- A-247. Shutter lock latch stud
- A-248. Screw
- A-249. Shutter lock latch
- A-250. Shutter winding key (8P8-225)
- A-253. Taper pin (8P8-300)
- A-254. Spacer washer (8P8-665)
- A-255. Shutter-release lever (8P8-255)
- A-256. Release lever screw

- (68) Replace washer 225 and screw 203 on the master lever post.
- (69) Replace the washer on the press-focus lever.
- (70) Replace the time and bulb lever assembly.
- (71) Replace the screw 209 and spring 75 on the time and bulb lever assembly, so that the long end of the spring is engaged in the hook on the time and bulb assembly and the other end rests against the outside shutter case.
- (72) Replace the plate (fig. 70) on the outside of the shutter case.
- (73) Replace and tighten the two screws which hold the plate.
- (74) Replace the knob and screw (fig. 44) on the end of the master synchronizing lever.
- (75) Replace the case cover.
- (76) Remove the three screws which hold the case cover to the shutter case.
- (77) Replace the speed control cam plate (fig. 43).
- (78) Replace the index plate (fig. 42).
- (79) Replace the two screws 211 which hold the index plate.

**g. Positioning Shutter in Lens Board (fig. 41).** Place the shutter so that the pin on the back engages the hole in the lens board and the top extension of the auxiliary release lever rests against the upper side of the finger release lever. Replace the flange, turning it clockwise until tight. Replace the lens cells.

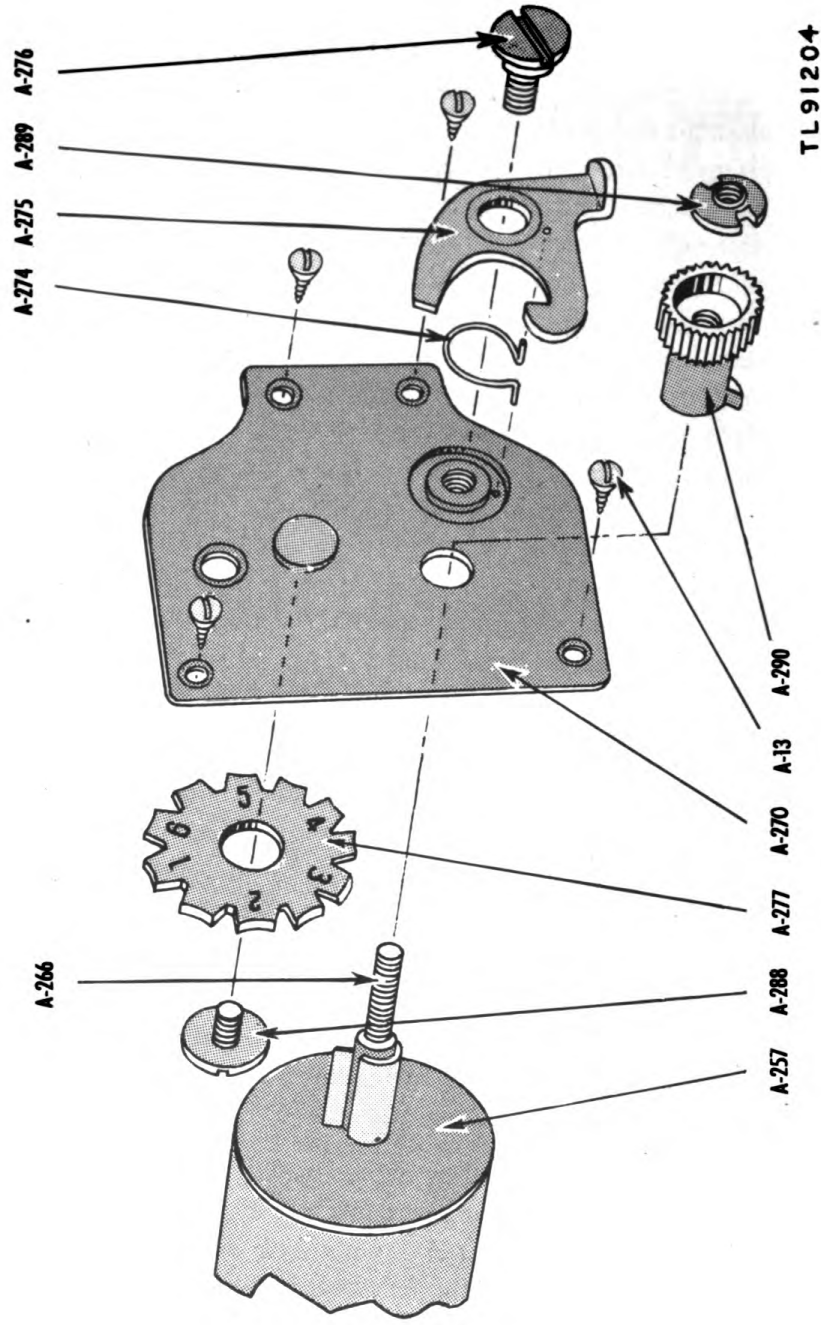
**h. Replacing Spring in Auxiliary Release (fig. 22).**

- (1) Remove the two screws which hold the auxiliary release assembly on the lens board.
- (2) Remove the screw which holds the spring to the lens board.
- (3) Remove the lever from the lens board.
- (4) Remove the screw which holds the spring to the back of the lever.
- (5) Replace the spring and reassemble, reversing the procedure above.

**58. CAMERA FRONT (fig. 52).**

**a. Disassembly.** Release the bed by depressing the push button snaplock (fig. 7) at the top of the case, and place the bed in the dropped position (fig. 5). Release the front lock lever A-514 and pull the front standard forward off the rear yoke. To remove the lens board frame A-501, remove the two rising-front locking nuts A-536 and spread the two uprights of the front standard until the screws are out of the slots; then lift out the lens board frame.

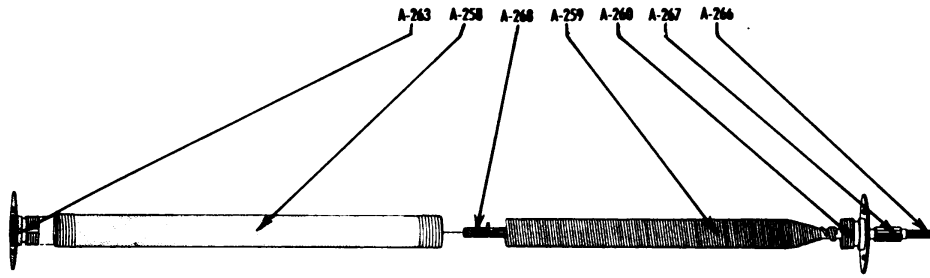
**b. Replacement of Lateral Shift Spring.** Remove the locknut A-510 from the bottom of the standard, turning it in a counterclockwise direction. Remove the front lock lever A-514 by turning the screw in a clockwise direction. Take particular care not to lose the two balls A-509 when removing the lock. Remove the spring catch A-511. Fit new spring. Fit the two lockballs A-509 into their position and replace the front lock lever A-514, turning the front standard screw in counterclockwise direction. Fit the locknut A-510 to the bottom of the front standard screw. Check the front standard to deter-



- A-13. Screw
- A-257. Bottom tension roller assembly
- A-266. Roller rod
- A-270. Plate (8P8-340)
- A-274. Dog spring (8P8-600)
- A-275. Release dog
- A-276. Screw (8P8-490)
- A-277. Indicator gear
- A-288. Screw (8P8-495)
- A-289. Locknut (8P8-285)
- A-290. Snail (8P8-555)

Figure 56. Tension-setting mechanism

TL91204



TL91205

<i>A-258. Tube</i>	<i>A-266. Rod</i>
<i>A-259. Spring (8P8-601)</i>	<i>A-267. Pinion</i>
<i>A-260. Right flange bushing</i>	<i>A-268. Rod</i>
<i>A-263. Left flange</i>	

Figure 57. Tension-roller mechanism (8P8-360)

mine how tightly it will lock, by placing it on the sliding yoke and setting the lock. To tighten the lock, loosen the locknut on the bottom side and turn the screw in a counterclockwise direction and then tighten the locknut.

**c. Reassembly.** To fit the lens board frame A-501 to the front standard, spread the front standard until the screws of the lens board frame can be inserted into the slots in the standard. Fit the wire finder (fig. 4) and replace the rising-front locking nuts A-536 previously removed. Slide the front standard on to the rear yoke. Bring the bed up into the horizontal position by depressing the bed braces and pulling up the bed until it locks in position.

#### 69. BELLOWS (fig. 6).

Remove the entire back from the camera, as instructed in paragraph 70. Open the bed and pull the front out on the yoke to the infinity stops. With a long screwdriver, remove the eight flathead Parker Kalon screws from the inside of the front bellows frame. Remove tacks that hold bellows to the rear frame. Install a new bellows by reversing the instructions for removing in paragraphs above. Check for light leaks, especially where the bellows joins the rear frame. Fill any leaks around the frame with a mixture of lampblack, whiting, and glue, or some other suitable material.

#### 70. BACK (fig. 53).

##### a. Removal.

(1) Remove the five screws around the edge of the back panel and lift the entire back assembly from the camera.

(2) Remove the screw A-19 from the center of each screen spring A-634 and A-638, and lift the ground glass A-630 from the back frame. Remove the two washers from the back frame to prevent loss.

##### b. Disassembly.

(1) Remove the two springs A-634 and A-638 by taking out the screws A-642 at the end of each spring. Mark the springs on the back to indicate top and bottom, as the springs are not interchangeable.

(2) Remove the ground-glass retaining strips A-631 and the two fabric focusing-screen light shields A-628 from each side of the focusing screen.

(3) Remove the ground glass.

(4) Remove the focusing-panel catch A-629.

(5) Remove the focusing-screen cover by lifting the leather at the hinge. Remove the five screws A-16 holding the hinge, and lift the panel from frame A-616. Support the hinge during this operation as it has two coil springs which supply torsion to the focusing screen cover.

#### c. Inspection, Cleaning, and Repair.

(1) Examine the back assembly and glue all loose leather. It is advisable to moisten the leather with water before gluing.

(2) Brush the leather when dry with a good shoe brush or some similar brush.

(3) Wash the ground glass; GI soap may be used if all residue is removed afterward.

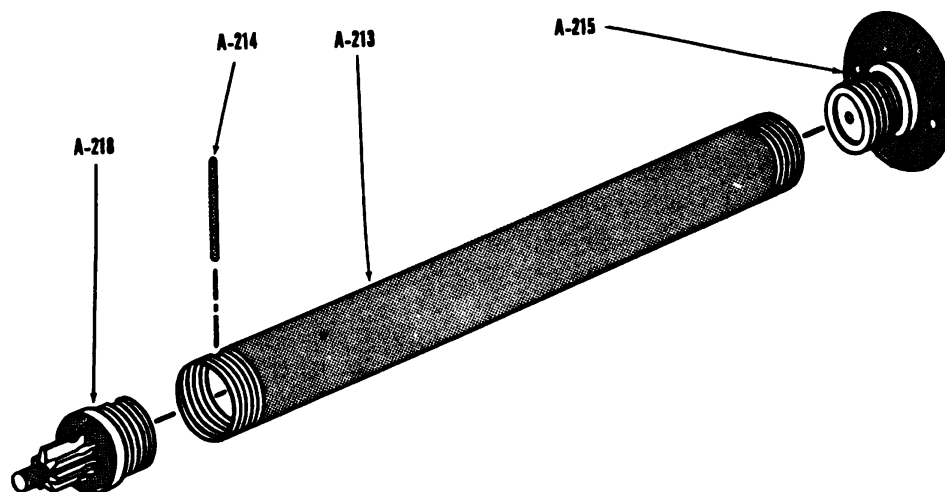
(4) Examine the screen springs A-634 and A-638. If necessary, reform them to give proper pressure to the focusing panel.

(5) Examine the focusing-screen light shields A-628. If damaged, remove from the focusing-screen cover A-621 by prying up the strip that holds them.

(6) Plug all wood screw holes with mahogany plugs, or some similar hard wood, if the screws will not hold tight. Be sure to use the awl to start new holes before replacing the screws, as hard wood will split unless the holes are started before fitting a screw.

#### d. Reassembly.

(1) If the light shields A-628 are damaged, replace them with new ones.

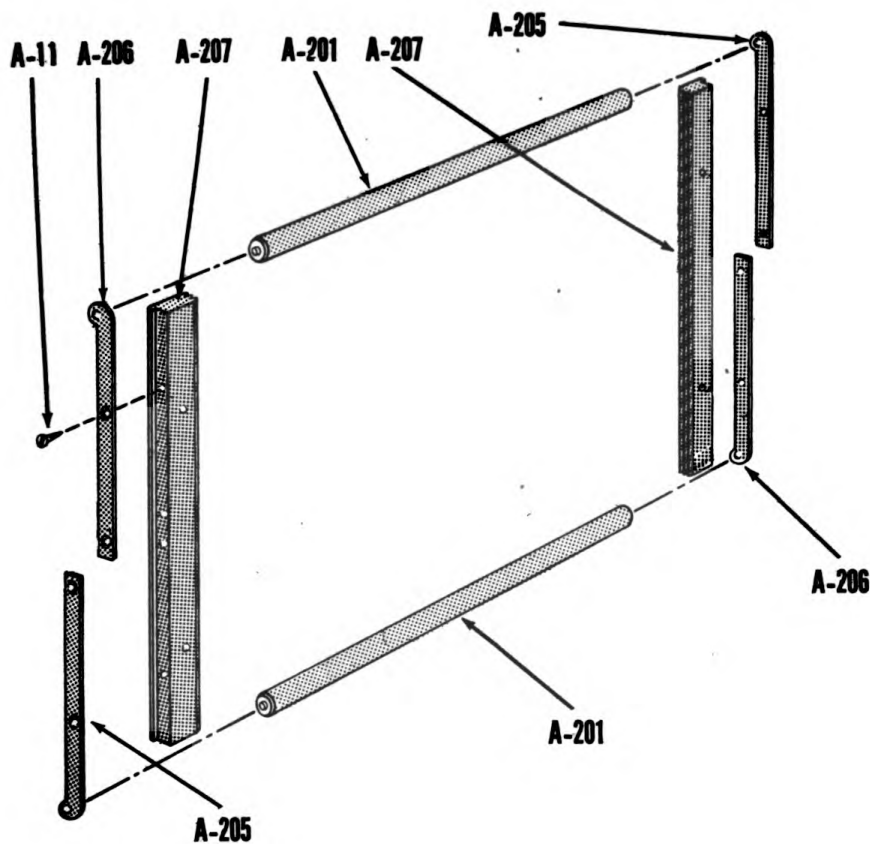


TL 91206

A-213. Tube  
A-214. Pin

A-215. Bushing assembly  
A-218. Pinion assembly

Figure 58. Upper shutter roller mechanism (8PB-190)



### TL 91207

- |   |   |
|---|---|
| <i>A-11. Strip screw</i>                            | <i>A-206. Top left and lower right idler strips</i> |
| <i>A-201. Idler</i>                                 | <i>A-207. Idler block</i>                           |
| <i>A-205. Top right and lower left idler strips</i> |   |

*Figure 59. Idler block assembly (8P8-220)*

Apply a little rubber cement to the edges of the shields and insert them under the flange on the focusing-screen cover A-621. Clamp down the flange securely, and allow the cement to dry.

(2) Fit the focusing-screen cover A-621 to the focusing frame A-616, and reglue the leather in place.

(3) Fit the focusing-panel catch A-629.

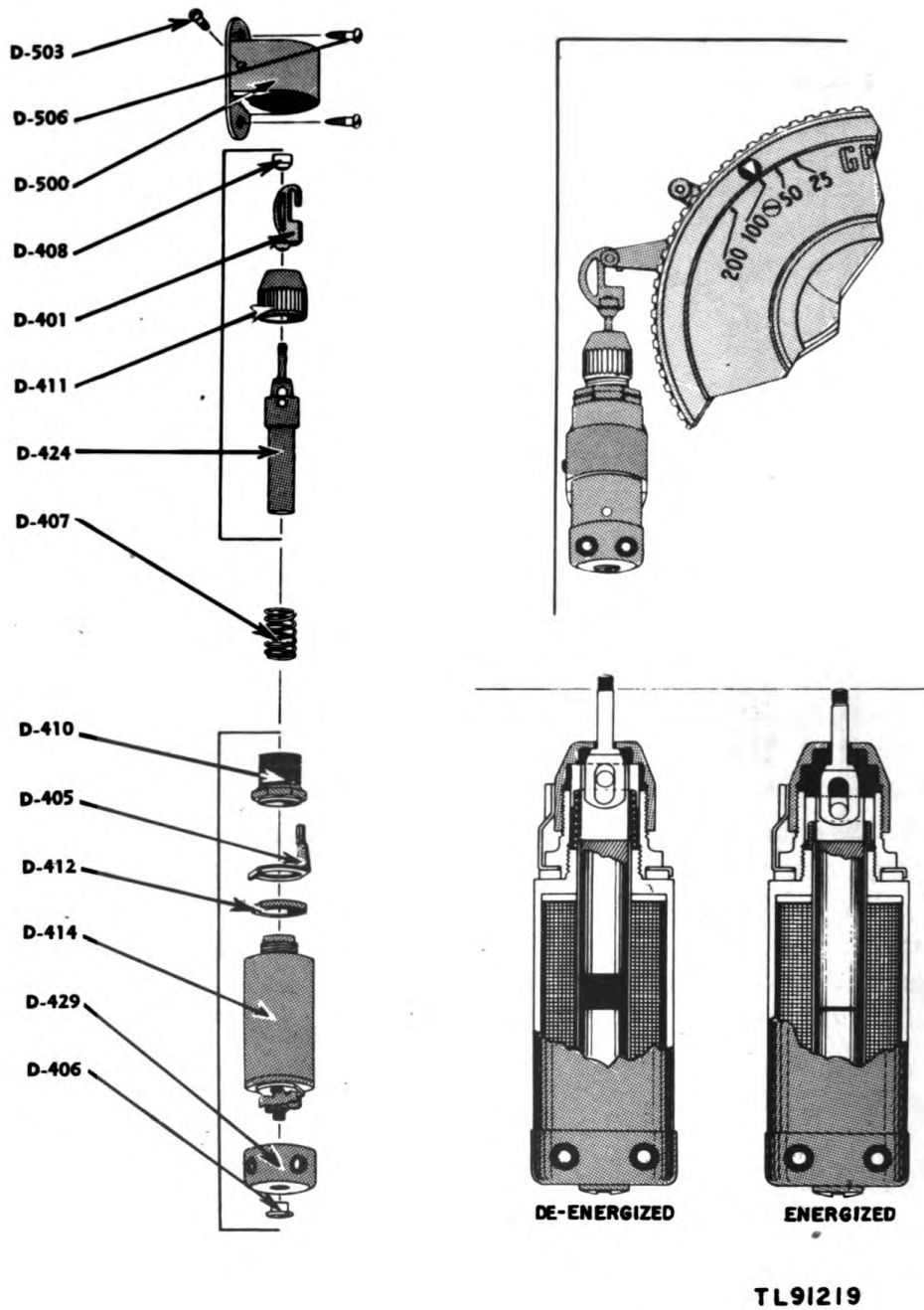
(4) Fit the ground glass into the focusing frame.

(5) Fit the free end of the light shields into the focusing frame, and screw the two ground-glass retaining strips A-631 into place.

(6) Fit the top and bottom screen springs A-634 and A-638.

(7) Fit the complete focusing frame to the back frame.

(8) Attach the complete back to the camera with the five screws previously removed.



- |                        |                                     |
|------------------------|-------------------------------------|
| D-401. Link            | D-414. Terminal assembly            |
| D-406. Cap nut         | D-424. Armature                     |
| D-407. Armature spring | D-429. Cover cap                    |
| D-408. Ball            | D-500. Mount                        |
| D-410. Armature cap    | D-503. Mounting bracket clamp screw |
| D-411. Solenoid cap    | D-506. Release mount screw          |
| D-412. Spacer          |                                     |

Figure 60. Solenoid-release mechanism

## 71. FOCAL PLANE SHUTTER.

### a. Removal.

- (1) Remove the back as directed.
- (2) Remove the rangefinder extension eyepiece as directed.
- (3) Remove the shutter plate complete A-221 (fig. 54) after removing the five screws A-13 (fig. 56) by which it is attached to the case.
- (4) Remove the tension plate A-270 as follows: Unscrew the tension snail locknut A-289 from the tension snail A-290, holding the snail with a suitable wrench or pliers and turning the locknut counterclockwise with the special wrench until it is removed. Then turn the tension snail in the same direction (counterclockwise) until it is removed. Finally, remove the four screws A-13 from the tension plate and disengage the plate from the camera.
- (5) Remove the rollers and curtain.

**CAUTION:** On some cameras spacer washers are fitted at the left, or bearing end of the roller shafts. If this is the case, a note should be made of the fact to assure that they are replaced in reassembly. Set the curtain aperture at 0 (wide-open) and place a pencil mark on the curtain at the upper strut (metal strip); at the same time, mark the back edge of the body to correspond to this point. The rollers and curtain may now be removed from the body.

### b. Disassembly of Shutter Plate A-221 (fig. 54).

- (1) Remove the escapement A-230 (fig. 55) and its spring A-243.
- (2) Remove the winding key A-250 by driving out the taper pin A-253. Care should be taken to determine the large and small side of the taper pin. The pin should be driven out from the small end and the key may then be pulled off the master gear shaft.

**NOTE:** Before disassembly, note the position of winding key A-250 on the master gear stem A-238. The new master gear must be drilled in this same position for the taper pin A-253 that secures the winding key to the shaft.

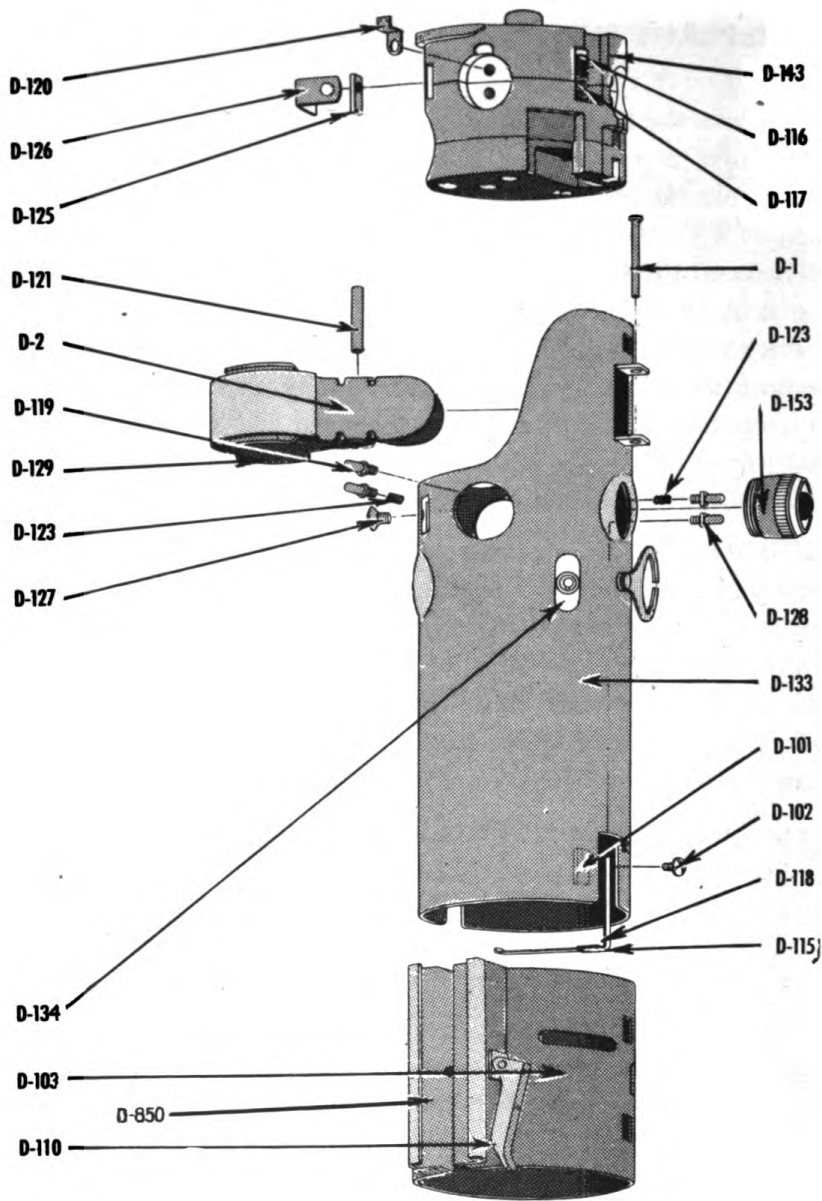
- (3) Remove master gear A-235.
- (4) Remove indicator gear A-239.
- (5) Remove shutter release lever A-255.

**CAUTION:** Before attempting to remove this lever, note that the screw A-256 holding it has been riveted over the locknut A-242 on the reverse side of the plate. Do not attempt to turn this screw. Carefully file the riveted end of the release-lever screw A-256 until it can be turned easily without danger of breaking. Remove the locknut A-242 first, and then remove the screw. The release lever A-255 can then be taken from the plate. Be careful not to lose the spacer washer A-254 located underneath the release lever. Remove escapement lever A-240 and its bushing.

### c. Disassembly of Tension Plate A-270 (fig. 56).

- (1) Remove the tension plate dog A-275.





TL 92922

- |                             |  |
|-----------------------------|--|
| D- 1. Lamp clamp pin        | D-121. Lamp clamp spacer               |
| D- 2. Lamp clamp            | D-123. Contact screw spring (8P8-5417) |
| D-101. Nut                  | D-125. Top nut                         |
| D-102. Locking screw        | D-126. Left contact                    |
| D-103. Battery clamp case   | D-127. Top section-to-tube screw       |
| D-110. Clamp lever          | D-128. Connector plug screw            |
| D-115. Insulating tube      | D-129. Clamp                           |
| D-116. Spring plug          | D-133. Battery case                    |
| D-117. Bracket spring       | D-134. Slide switch                    |
| D-118. Connector            | D-143. Top assembly                    |
| D-119. Connector plug screw | D-153. Push-button switch              |
| D-120. Top connector        | D-850. Battery clamp                   |

Figure 61. Graflex flash synchronizer, upper battery tube and clamp mechanism

**CAUTION:** When removing the dog screw, the dog must be held firmly, as it is under torsion.

- (2) Remove the tension dog spring A-274.
- (3) Remove the screws A-288 holding the tension indicator gear A-277.
- (4) Remove the tension indicator gear.

**d. Disassembly of Tension Roller (A-257).**

- (1) Remove the left flange A-263 (fig. 7) of the tension roller.
- (2) Remove the right flange A-260 by turning it counterclockwise.

**e. Cleaning, Inspection, and Repair.**

(1) All metal parts of the focal plane shutter may be immersed in dry cleaning solvent (SD), benzine, or other cleaning solvent, and wash thoroughly to remove all dirt and foreign matter. All parts should be dried thoroughly before reassembly.

(2) Examine the curtain for pin holes, tears, or weak points. Replace if necessary. Before disassembly, note the position of the winding key A-250 (fig. 55) on the master gear stem A-238. The new master gear must be drilled in this same position or the taper pin A-253 that secures the winding key will not be in its correct position upon assembly.

(3) Examine the escapement A-230 and, if found to be worn, replacement will be necessary. A simple test can be given to determine whether the escapement is worn: Before the focal plane shutter mechanism is removed from the camera, set the tension at 6 and the curtain slit at D. Release the shutter slowly. If the escapement is worn, the shutter will loop; that is, it may pass two, three, or all of the slits before stopping. When operating correctly it should drop only one slit at a time.

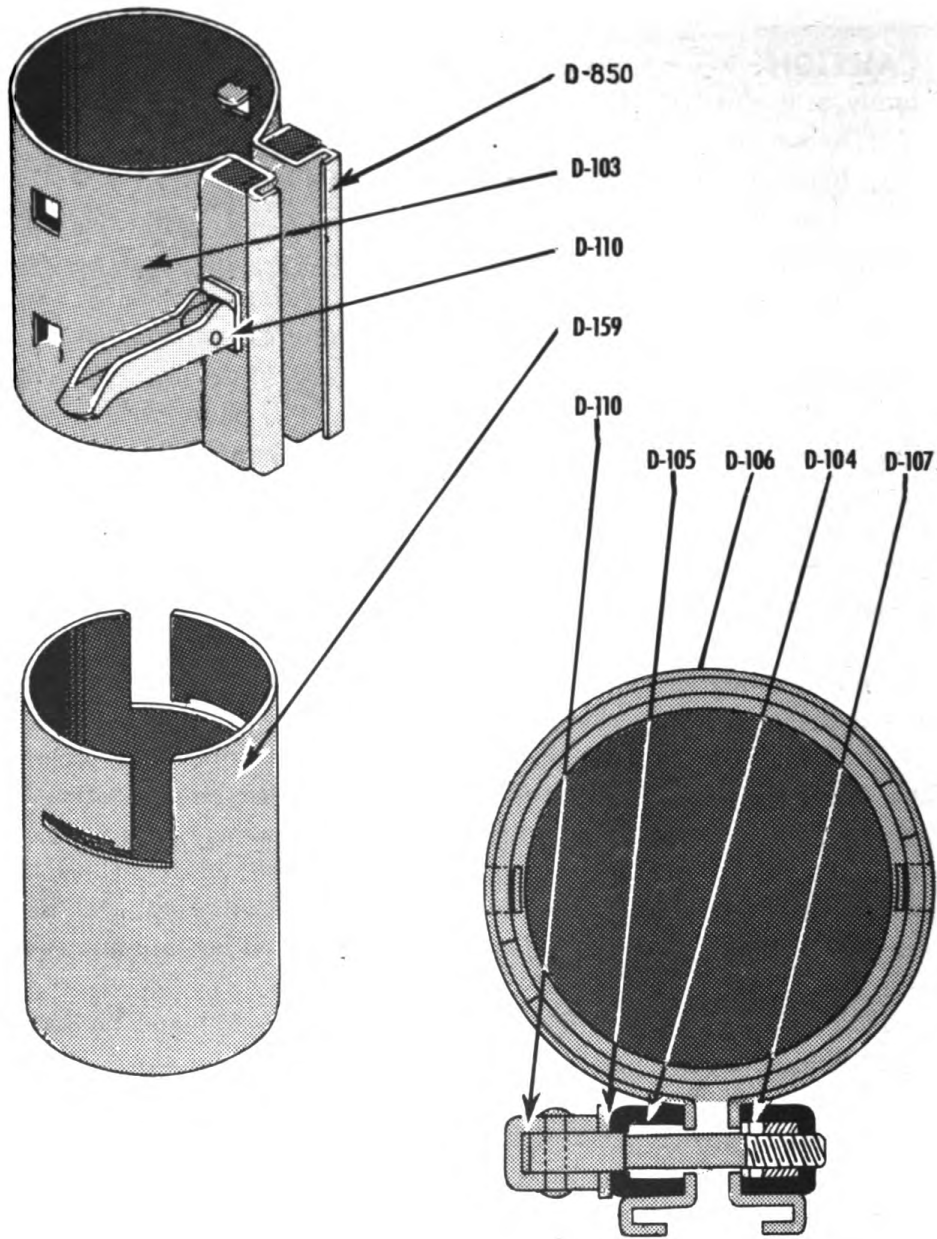
(4) Examine the tension-roller spring A-259 (fig. 57) and replace if found to be deformed.

(5) When it has been found that the shutter curtain A-209 (fig. 54) is worn or damaged, it should be replaced with a new curtain assembly. After the old curtain assembly and rollers have been removed from the camera, and before removing the old curtain from the rollers, examine the old assembly carefully to note length and width, and the roller to which each end is attached. After removing the old curtain, clean the rollers thoroughly of all old cement or glue.

(6) Apply cement or glue to the rollers and the curtain ends. Attach the curtain ends to the rollers, securing approximately the same amount of cloth to the rollers as was on the old assembly. It is essential that the ends of the curtain be placed as nearly parallel as possible to the longitudinal axes of the rollers to insure perfect alignment in the roll up. Check the ends of the curtain for squareness before applying the cement. When thoroughly dry, the curtain and rollers are ready for replacement in the camera.

**f. Reassembly of Shutter Plate A-221 (fig. 54).**

(1) Fit the escapement lever A-240 (fig. 55) and its bushing into the reverse side of the shutter plate A-222.



**TL 92923**

- |                                    |                           |
|------------------------------------|---------------------------|
| D-103. Battery clamp case (8P8-90) | D-107. Clamp bar assembly |
| D-104. Clamp lever bar             | D-110. Clamp lever        |
| D-105. Lever post washer           | D-159. Lower tube         |
| D-106. Clamp                       | D-850. Clamp              |

Figure 62. Graflex flash synchronizer, lower tube and clamp mechanism

(2) Fit the spacer washer A-254 and shutter release lever A-255 to the front side of the plate.

(3) Fit a new shutter release lever screw A-266 (fig. 56).

(4) Fit the locknut A-242 (fig. 55) to the end of the shutter release lever screw A-256 on the reverse side of the plate.

(5) Rivet the end of the shutter release lever screw A-256 over the nut A-242 with a ball-peen hammer. After riveting, check the shutter release lever to make sure it pivots freely. If any binding is evident, the assembly A-254, A-255, and A-256 has been fitted too tightly.

(6) Place the indicator gear A-239 in position; the letter O should appear in the window.

(7) Fit the master gear A-235 into its bearing, with the two stop pins on the reverse side of the master gear parallel with the length of the plate A-222.

(8) Determine the large side of the taper hole drilled into the master gear stem A-238. Place the winding key A-250 on the master gear stem A-238 with the large side of its drilled hole directly over the larger end of the hole in the master gear stem. Fit the taper pin A-253 through the winding key and master gear stem holes, making sure that it fits snugly. Now spin the winding key; the whole assembly should turn freely without binding. If binding is evident, check the plate for damage such as might have been caused by a blow, and straighten if damaged.

(9) Fit the escapement A-230 and its spring A-243 over the master gear A-235.

(10) Check the indicator gear A-239 to determine whether the numbers are centered in the window. If not, keep turning the winding key until this is accomplished.

#### **g. Reassembly of Tension Plate A-270 (fig. 56).**

(1) Fit the tension plate indicator gear A-277 into place on the reverse side of the plate, and replace its screw previously removed during disassembly.

(2) Place the tension dog spring A-274 in position on the front side of the shutter plate.

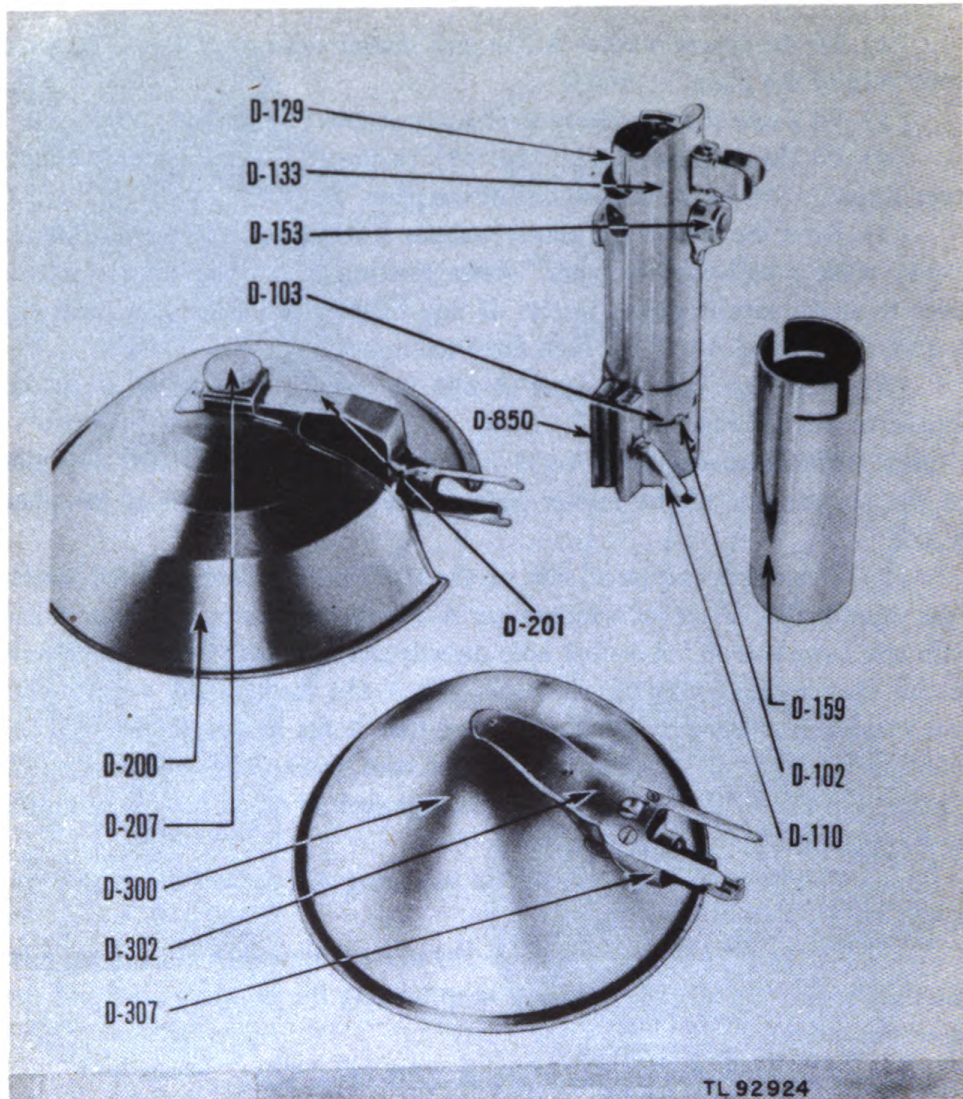
(3) Fit the tension dog A-275 and screw A-276 and make sure the tension dog spring engages the dog.

#### **h. Reassembly of Tension Roller A-257 (fig. 54).**

(1) Screw the bushing A-260 (fig. 57) of the tension roller snugly into the tension roller tube.

(2) Insert a pair of tweezers into the opposite end of the tube, and grasp the end of the tension roller spring A-259. Insert the formed end of the roller spring into the left flange A-263 and screw the flange into the tension roller tube.

**i. Placing Rollers and Curtain in Camera.** Wind the curtain on the rollers with its large opening showing and place in position in the camera. Set the camera on its left side and fit the tension plate A-270 (fig. 56) in



- |                           |                                     |
|---------------------------|-------------------------------------|
| D-102. Locking screw      | D-200. Reflector, 7-inch (8P8-350)  |
| D-103. Battery clamp case | D-201. Support for 7-inch reflector |
| D-119. Clamp lever        | D-207. Reflector adjusting screw    |
| D-129. Bezel (8P8-50)     | D-300. Reflector, 5-inch (8P8-350)  |
| D-133. Battery tube       | D-302. Support for 5-inch reflector |
| D-153. Push-button switch | D-307. Socket                       |
| D-159. Lower tube         | D-850. Clamp                        |

Figure 63. Battery case and reflectors

place. Set the gear A-277 on the plate at 1, and set the plate in position on the camera. Fit the winder-tool on the tension roller rod A-266 (fig. 57) by giving it a few turns and then tightening its lock screw. Lift the plate to disengage the pinion from the gear tension indicator A-277 (fig. 56) and rotate the winder counterclockwise until the curtain is fully wound on the roller. Fasten the tension plate temporarily with two of the wood screws A-13.

**NOTE:** Tension may be put on the lower roller by rotating the entire tension plate A-270 counterclockwise without the use of the winding tool, if the tension snail A-290 and the locknut are attached.

**j. Fitting Shutter Plate A-221 (fig. 54).** Set dial A-239 (fig. 55) at 0. Wind the shutter curtain on the top roller until the pencil mark previously made on the curtain corresponds with the mark on the case. Set the plate in place and bring into alignment the pencil marks on the curtain and the case, to assure that the slits will be in proper position.

**k. Adjusting Tension.** Slightly loosen the two wood screws A-13 that temporarily hold the tension plate A-270 (fig. 56). Lift the plate with the left hand until the pinion disengages the tension indicator gear A-277. Turn the tension roller rod A-266 with the winder until there is sufficient pull on the curtain to lock it at the end of its travel. Lift the tension plate, and give two more turns. Be sure the indicator gear is still set at 1, and fasten the plate with the two screws A-13.

**l. Replacing Tension Snail A-290.** Reverse the procedure for removal in subparagraph a above.

**m. Testing Curtain for Spacing and Rebound.**

(1) Place the back panel assembly on the camera with the focusing frame removed. Wind the curtain to slit A, and set the tension indicator gear at 1. Release the curtain, and note whether it rebounds at the lower edge of the opening. If tests show this, remove the wood screws A-13 from the shutter plate, drop the gear on the upper shutter roller one tooth, and replace the plate in position. If tests show that the curtain is not rebounding, further tests should be made as follows:

(2) Set the curtain at tension 6 and slit D. Release it and rewind five times at this setting; then release the curtain, one slit at a time; observe the position of each slit in relation to the opening in the back frame. If the curtain has been set too low this will be noticeable at slit A, because a space will show between the lower metal strut of this opening and the top inside edge of the frame opening. If adjustment is necessary, this condition may be corrected by following the instructions given under subparagraph (1) above. However, raise the gear on the roller one tooth instead of lowering it. The curtain setting should be tested further and, if found correct, the remaining screws can be inserted in both the shutter and tension plates.

**n. Lubrication.** After reassembling the shutter, lubricate as follows:

(1) Apply grease (GG) to both curtain roller bearings A-122 located on the left side of the body, to all friction points on the inner side of the shutter plate A-222 (fig. 55), principally on the two stop-pins on the master

gear A-235 and the inner end of the escapement assembly A-230; also to the shutter plate, where the shutter winding key A-250 joins the plate, and between the large screws A-248 and the escapement A-230 on the inner side of the plate.

**CAUTION:** Do not use any ordinary or heavy oil, as this will cause gumming of the bearings and moving parts.

(2) Apply oil (MO or PS) sparingly, using a quill or toothpick. One drop of oil generally is considered sufficient. Oil the tension plate where the tension winding knob (fig. 55) joins the plate; the inside idler frame at both ends of both idlers A-201 (fig. 59); the top and bottom curtain rollers. Apply one drop of oil to each end of the top roller. The bottom roller is oiled in the same manner, allowing several drops of oil to penetrate into the ends of the tube to lubricate the inner spring.

**CAUTION:** Be sure that none of the lubricating material is applied in such a manner that it can come in contact with the shutter curtain cloth. Wipe off all excess oil.

(3) Make sure that the lower edge of slit A does not lie below the upper idler, or the upper edge above the lower idler, after several trials. Turn the camera on its side, and make sure that the curtain, when set at tension 1 and slit 0, runs down smoothly and locks; maintain pressure on the release lever A-255 (fig. 55) until a click is heard at the end of the curtain travel to indicate that it has locked.

## **72. GRAFLEX FLASH SYNCHRONIZER (figs. 60 through 64).**

Paragraphs 72 through 77 cover the disassembly, reassembly, and adjustment of the Graflex flash synchronizer and related parts. Parts not described can be disassembled readily by reference to the exploded view (fig. 60).

## **73. DISASSEMBLY AND INSPECTION OF SOLENOID RELEASE (fig. 60).**

### **a. Removal from Lens Board.**

- (1) Unhook the link D-401 from the shutter release lever.
- (2) Remove the mounting-bracket clamp screw D-503.
- (3) Remove the solenoid release from the clamp D-500 by pulling it down from the bottom.

### **b. Disassembly.**

- (1) Remove the armature cap D-410. It will be necessary to loosen the cap with a  $\frac{3}{8}$ -inch open-end hexagonal wrench before attempting to unscrew it from the terminal assembly D-414.
- (2) Remove the cap spring D-405 and its spacer D-412.
- (3) Unscrew the cap D-411 from the armature cap D-410.
- (4) Remove the cover cap nut D-406 and the cover cap D-429 from the bottom of the solenoid release.

### **c. Cleaning.** The terminal assembly D-414 may be swabbed gently out

with a piece of cotton wrapped around a match stick. After all dust or foreign matter in the terminal has been cleaned out another swab moistened with carbon tetrachloride or benzine may be used for further cleaning.

**CAUTION:** Do not allow excess cleaning fluid to drip into the terminal. The swab should be moistened only.

**d. Reassembly.**

(1) Fit the cover cap D-429 and nut D-406 to the bottom of the solenoid release.

(2) Slip the armature D-424 through the armature cap D-410 and screw the cap D-411 and armature cap together.

**NOTE:** The cap should be screwed approximately half way down the armature cap.

(3) Fit the cap spring D-405 to this assembly.

(4) Fit the spacer D-412 to the terminal D-414.

(5) Set the armature spring D-407 in place on the terminal D-414.

(6) Screw the armature cap D-410 to the terminal D-414 and tighten with the wrench.

**e. Testing.**

(1) Depress the armature assembly several times with the fingers. It should return each time when released. If it does not, the armature coil spring has not been positioned correctly and must be adjusted.

(2) Connect the solenoid release to the battery case with the connecting cord. Depress the main switch on the battery case, thus energizing the solenoid. The solenoid should trip each time the switch is pressed. If it does not, turn the cap one or two turns until it trips.

**NOTE:** If the solenoid refuses to trip, check for correct assembly and clean the contact points.

**74. CHANGING BATTERIES.**

**a.** It will be found necessary at times to change the batteries in the battery case. Special batteries are not necessary: any reputable make of Size D (1¼-inch or 32-mm diameter) U. S. Signal Corps BA-30 or equivalent rated at 1.5 volts, is satisfactory.

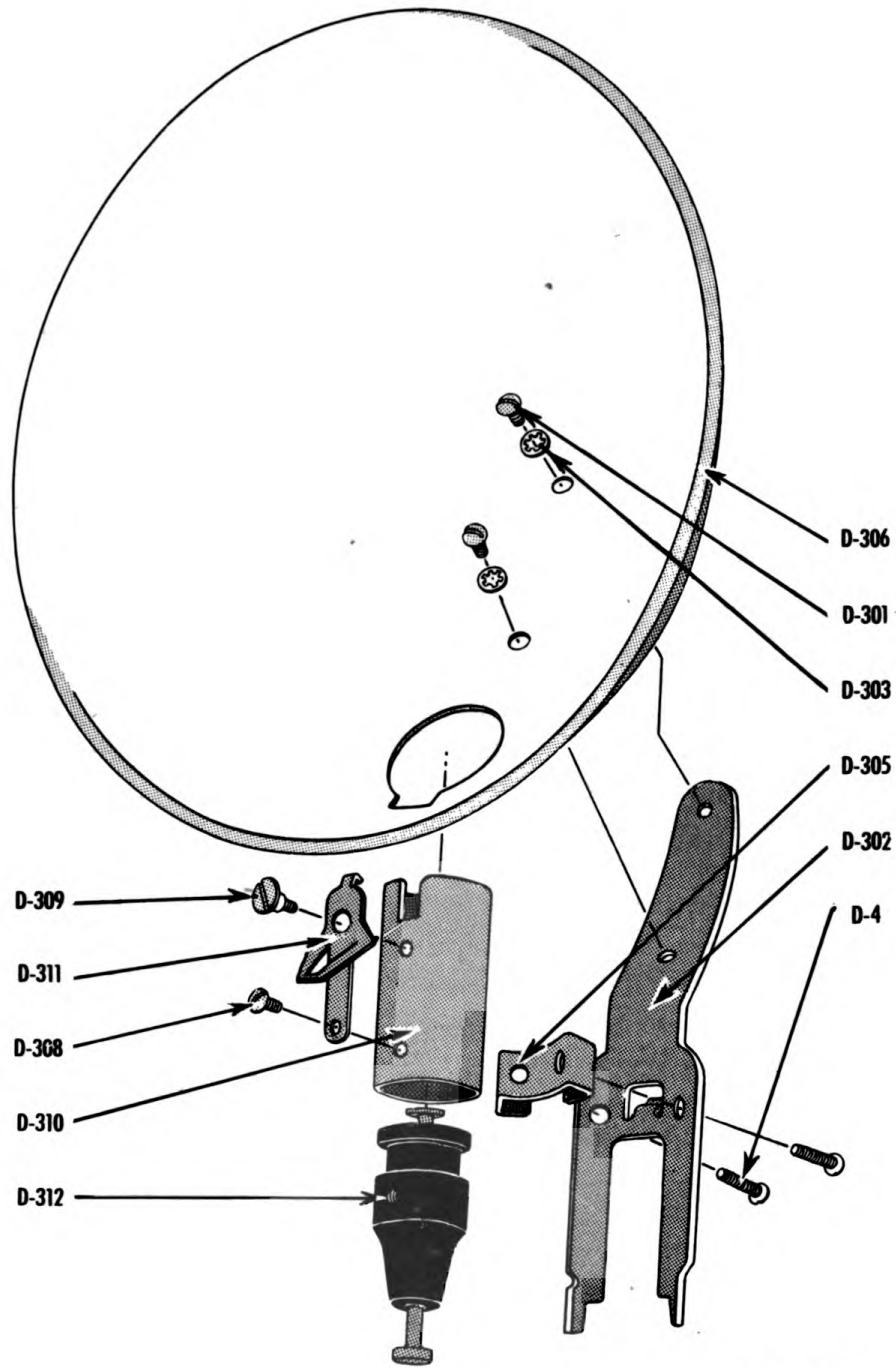
**b.** To remove the batteries, raise the clamp lever D-110 (fig. 61) and remove the entire battery case from the camera. With the clamp still open, push up the lower tube D-159 (fig. 63) of the case and turn it counterclockwise. It may then be pulled apart to permit replacement of the batteries with any good grade flashlight cells of the same size (subpar. a).

**c.** Replace the lower section of the battery case by reversing the procedure above.

**75. ADJUSTMENT OF SYNCHRONIZER CLAMP LEVER TENSION.**

To adjust the tension on the clamp lever D-110 (fig. 61) remove the lower half of the battery case as directed in paragraph 74 b, remove the case nut screw D-102 (fig. 61) and its nut D-101, and remove the battery clamp case





TL91222

- D- 4. Socket shell screw
- D-301. Reflector support screw
- D-302. Support for 5-inch reflector
- D-303. Lockwasher
- D-305. Spacer
- D-306. Reflector, 5-inch
- D-308. Insulator screw
- D-309. Lamp release spring screw
- D-310. Shell socket
- D-311. Lamp release spring
- D-312. Contact assembly

Figure 64. Reflector assembly.

D-103 from the battery tube D-133. Then pinch two sides of the clamp D-103 together with the fingers and turn the clamp lever D-110 clockwise to tighten or counterclockwise to loosen. Reassemble by reversing the instructions above.

## **76. ADJUSTMENT OF SOLENOID RELEASE.**

**a.** It is unlikely that any adjustment of the solenoid release will be found necessary; possible adjustments may be required, however, when fitting to a new shutter, or by the use of lamps having a lag characteristic differing from the normal.

(1) Graflex solenoid releases are adjusted at the factory to cause the shutters, with which they are mounted on the lens board, to be fully open at 18 to 20 milliseconds after the circuit is closed by the main switch D-153 (fig. 61). The retaining spring D-405 (fig. 60) on the adjusting head D-411 will prevent this adjustment from being changed accidentally by vibration, shaking, or normal use.

(2) If it is desired to shorten the time interval between the closing of the electrical circuit and the operation of the shutter, the adjusting head D-411 is turned clockwise (as viewed from above) until the desired time delay is obtained; to lengthen the time interval between closing of the electrical circuit and operation of the shutter, the adjusting head can be turned counterclockwise until the desired timing is effected.

**b.** Adjusting the position of the solenoid in its mount is required when it is transferred from one lens board or shutter to another, or when the factory setting has been disturbed. The procedure is as follows:

(1) Remove the lens board from the camera.

(2) Slightly loosen the clamp screw D-503 (fig. 60) in the mount D-500 so that the solenoid release may be moved vertically in its mount.

(3) Connect link D-401 with the shutter release lever.

(4) Set the shutter at its top speed and cock it.

(5) Connect the solenoid with one of the parallel outlets in the front of the battery case by means of the connecting cord.

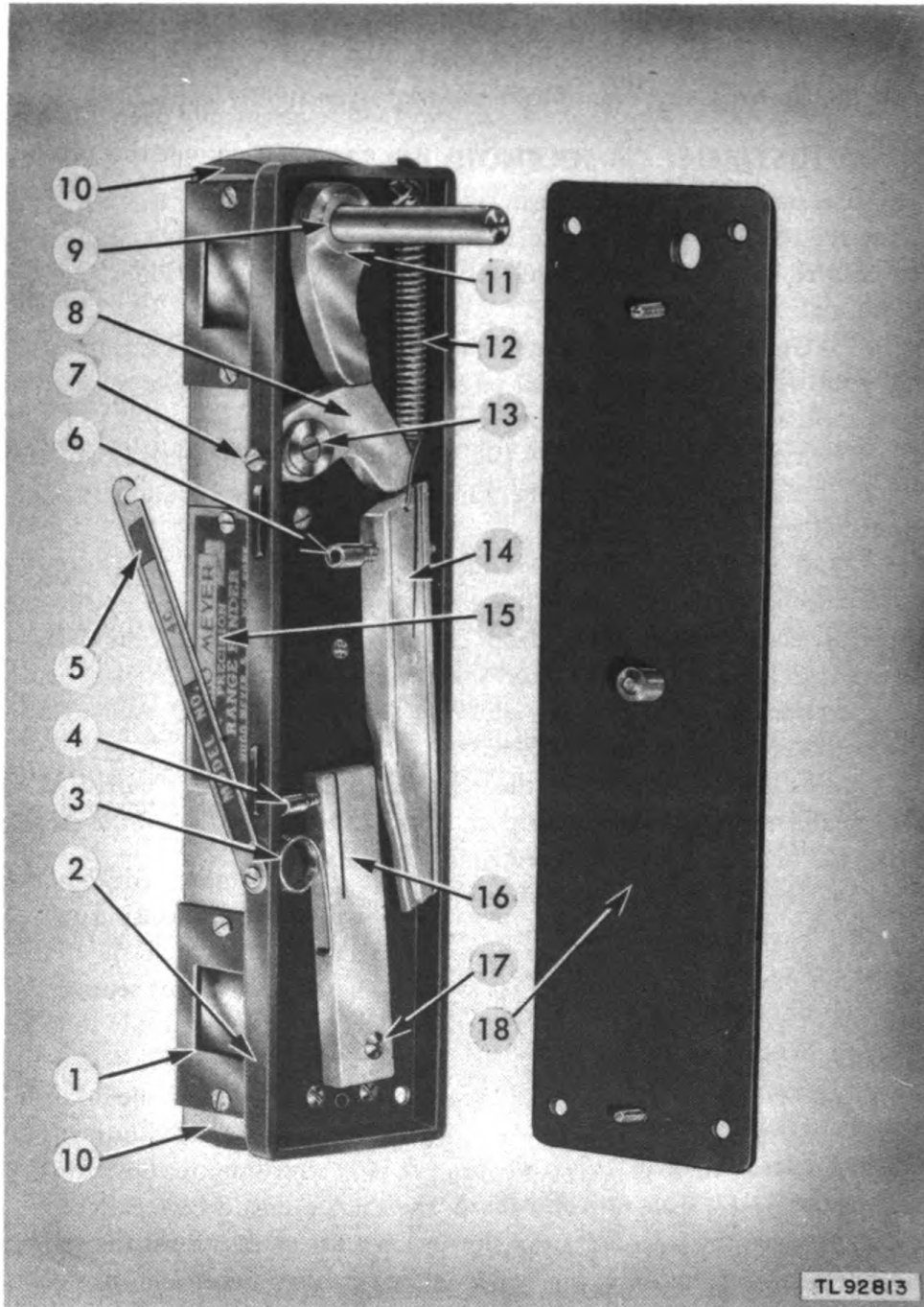
(6) Close the main switch D-153 (fig. 63) and hold it closed so that the armature D-424 (fig. 60) remains down.

(7) Move the solenoid away slowly from the shutter until the shutter just releases.

(8) Open the main switch D-153.

(9) Hold the solenoid in this exact position and tighten the clamp screw D-503 (fig. 60).

(10) The solenoid armature should be at the bottom of its stroke when the release lever is at the point of tripping. To test this, cock the shutter and move the release lever down very slowly by hand. At the exact point where the lever releases the shutter, energize the solenoid by pressing the push-button. This should not cause any further movement of the release lever, and if the adjustments have been made correctly (the push-button switch



- |                                 |   |
|---------------------------------|---|
| 1. Window frame                 | 11. Celluloid washer                        |
| 2. Base                         | 12. Curved cam retracting spring (8P8-1071) |
| 3. Pressure spring (8P8-1070)   | 13. Intermediate cam pivot screw            |
| 4. Coincidence adjustment screw | 14. Curved cam                              |
| 5. Front plate                  | 15. Nameplate                               |
| 6. Infinity adjustment screw    | 16. Opaque mirror arm                       |
| 7. Front plate screw            | 17. Opaque mirror arm shaft                 |
| 8. Intermediate cam             | 18. Baseplate assembly                      |
| 9. Finger cam and shaft         |   |
| 10. End cover                   |   |

Figure 65. Hugo Meyer rangefinder, Model 4C view

being kept down during this process) the shutter-release lever will not move back when the finger is removed.

(11) Slowly unscrew the solenoid cap D-411, meanwhile operating the shutter frequently at 1/400 by energizing the solenoid. Continue this process as long as the solenoid will continue to operate the shutter.

(12) Test the time and bulb positions. When cocking the shutter in these positions, wait at least 1 second after cocking before pressing the main switch. The shutter may operate satisfactorily at both positions without making any further adjustments. If it does not, note the following faults and their remedies:

(a) The shutter may fail to open because the solenoid is not adjusted properly. To correct this, screw the solenoid cap down slowly until the shutter does operate, testing after each slight turn.

(b) Occasionally a shutter may not hold its open position as it should on time and bulb exposures; that is, it may slide past the open position as it does when operating on the instantaneous settings. If it does this, even when there has been a pause after cocking the shutter, the shutter should be adjusted.

(c) If the solenoid opens the shutter on time or bulb settings, but fails to close it again, try closing the shutter manually by operating the release lever. If it is found that the shutter had not latched after the opening movement of the release lever, the closing movement cannot be accomplished. This calls for adjusting the shutter, provided the solenoid cap was not screwed down farther than necessary, as described in subparagraph (a) above.

(d) If the release lever does latch after the opening movement, but the solenoid armature travel was not sufficient to accomplish the closing movement, the solenoid release must be reset in its mount D-500 (fig. 60). In this case, instead of having the shutter set at the highest instantaneous setting, the adjustments should be made with the release lever latched and ready to close the shutter on the time setting.

(13) Having reset the shutter in this manner, the solenoid should operate it for both the time and bulb setting with, perhaps, some adjustment of the solenoid cap. If it is not possible to get satisfactory shutter operation by carefully following the procedure above, the shutter should be repaired.

(14) Test the synchronization by making negatives, or with a testing device which does not upset the synchronizer circuit or depend, in its operation, on battery condition.

## **77. USE OF TIMER PH-191-A.**

If available, Timer PH-191-A, a gravity type synchronizer tester, may be used to adjust the flash synchronizer. Instructions for its use will be found in TM 11-2378, Timer PH-191-A.

## **78. HUGO MEYER RANGEFINDER (fig. 65).**

Focusing adjustments of this rangefinder are made with the coincidence adjustment screw (4) and the infinity adjustment screw (6) by means of a  $\frac{1}{8}$ -inch Allen wrench, inserted through the two slots in the base which lie

under the front plate (5) and which are accessible when this plate is moved aside. Lateral coincidence of the two images is controlled by the two screws in the outside face of the body which are accessible to a small screwdriver through corresponding holes near the upper end of the flashgun mounting bracket.

**a.** To remove the bracket, remove the rangefinder coupling arm (fig. 10) by loosening the  $\frac{3}{16}$ -inch hexagonal setscrew with the socket wrench. Slide the arm off the finger-cam shaft (9). The rangefinder coupling arm has a torsion spring engaged with it; do not lose this spring in removing the arm. Note the method of engaging the spring to facilitate reassembly. Remove the four screws holding the rangefinder to the camera body and lift off the rangefinder.

**b.** To install, place the rangefinder in position on the camera body, and fasten it to the body with the four screws provided. Slide the rangefinder arm and spring on the finger-cam shaft. Set the adjusting stud eccentric (fig. 10) located on the camera yoke in its farthest forward position with the slot horizontal. Set up the camera 36 inches from ground glass to target. Focus the target sharply on the ground glass and tighten the yoke lock lever. Tighten the hexagonal nut on the rangefinder coupling arm with the  $\frac{3}{16}$ -inch hexagonal wrench. Replace the flashgun mounting bracket.

**NOTE:** If lateral adjustment is necessary, the two adjustment screws can be found on the side of the rangefinder. They are accessible through the two holes in the mounting bracket. Turn clockwise or counterclockwise as necessary to adjust.

**c.** To adjust the rangefinder, focus the camera sharply on the ground glass, at 36 inches from ground glass to target. Sighting through the rangefinder at the target, bring the images into coincidence by adjusting the coincidence adjustment screw with the Allen wrench. Repeat this operation with the lens focused at infinity, using the upper socket. Repeat these operations until the rangefinder is in perfect coincidence in both cases (36 inches and infinity).

## 79. KALART MODEL E-1 RANGEFINDER (fig. 66).

**a. Removal.** Remove the rangefinder arm by loosening the  $\frac{3}{16}$ -inch hexagonal nut with the special socket wrench. Slide the arm off the rangefinder cam shaft. Remove the extension eyepiece. Remove the rangefinder housing by removing the four screws at its corners that attach it to the camera body and lifting it *straight* off. Remove the four screws that attach the mounting plate to the camera body, and lift it off.

**b. Installation.** Attach the rangefinder mounting plate to the camera body with the wood screws previously removed. Replace the housing and the extension eyepiece. Set the eccentric adjusting stud on the rangefinder bracket, in its rearmost position. Slip the rangefinder arm on the rangefinder cam shaft, in contact with the eccentric adjusting stud. It is important not to let the rangefinder arm disengage the bracket during the next operation. Set the mirrors with the rangefinder key-tool, and tighten the rangefinder arm to the

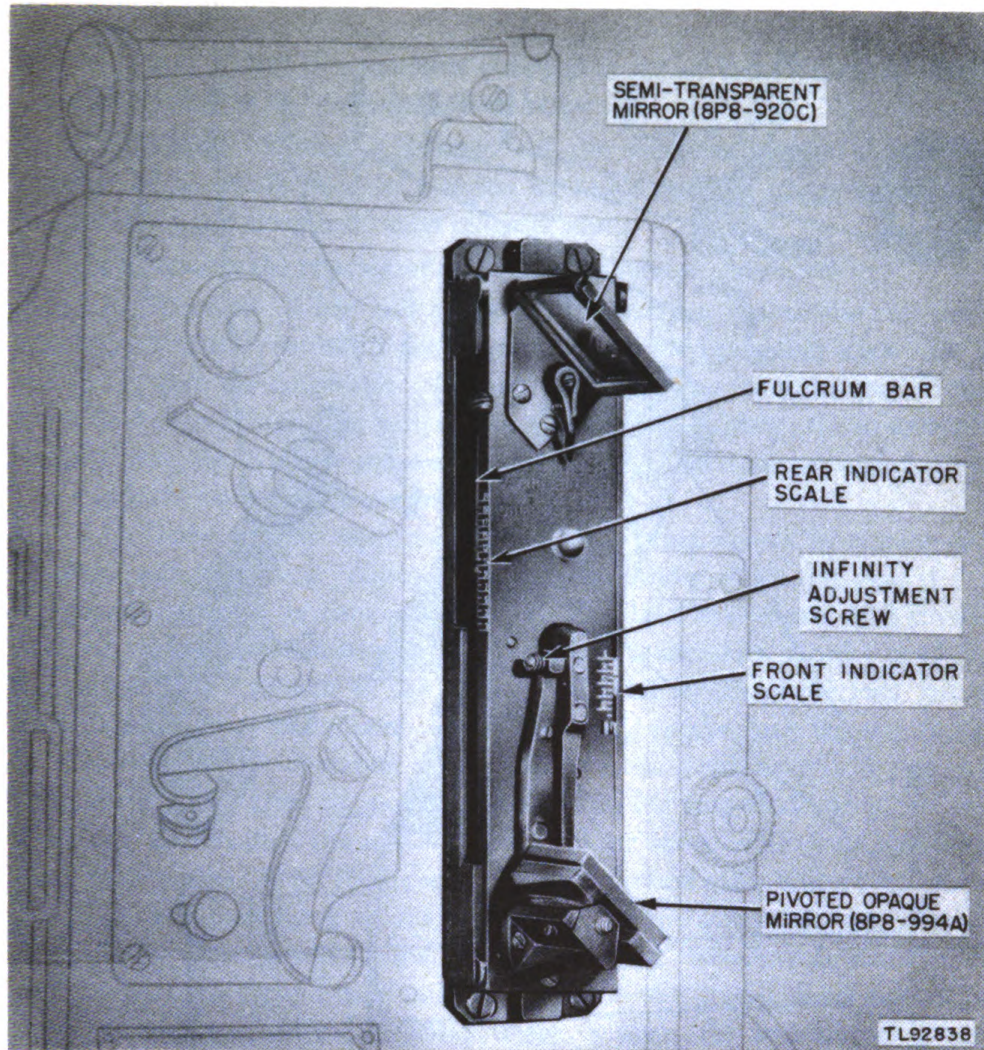


Figure 66. Kalart rangefinder, interior view

shaft with the  $\frac{3}{16}$ -inch hexagonal socket wrench. Align with two images on infinity by rotation of the eccentric adjusting stud.

**c. Adjustment.** The Model E-1 coupled rangefinder is adjusted for use with the particular camera and lens to which it is fitted when it leaves the factory. It may require recalibration, however, if the camera or the rangefinder is damaged or if a new lens is fitted to the camera, even if it is of the same nominal focal length. It is only on rare occasions that the necessary adjustments cannot be made by any one with an elementary knowledge of mechanics and a little care and common sense. In most cases a correction of the infinity adjustment will be all that is required. This is carried out with the camera focused on infinity (500 feet or more) by rotation of the eccentric adjusting stud attached to the right rear section of the sliding bed yoke, until the images in the rangefinder coincide. When this adjustment has been made, check in the same manner for agreement at 15 feet and 25 feet from the

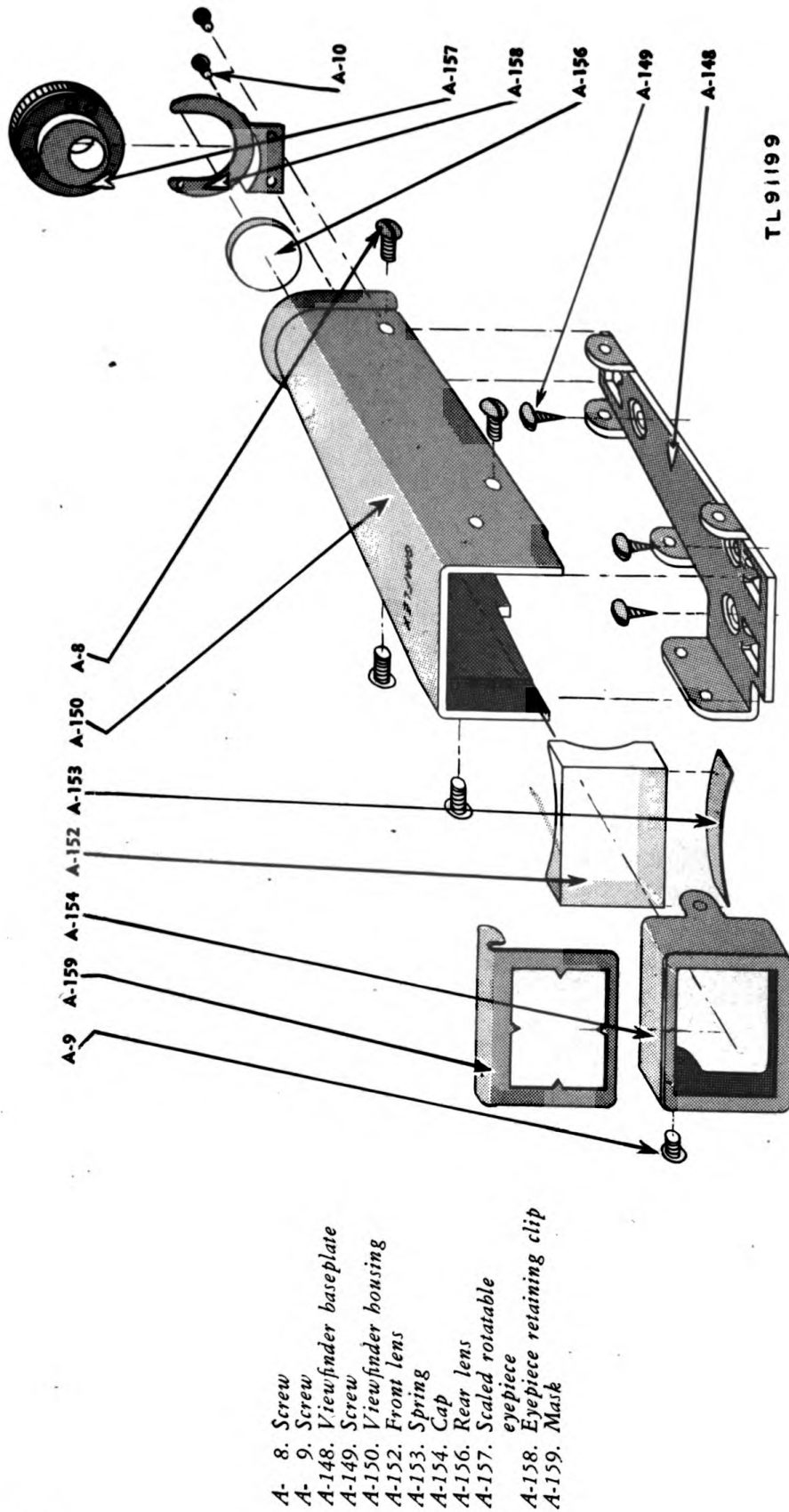


Figure 67. Tubular viewfinder, exploded view

ground glass. If lack of agreement is found at any of these distances, which is not likely, follow the procedure given below.

**CAUTION:** During adjustment of the rangefinder, the camera should be firmly fixed to a tripod or bench and the image on the ground glass examined under magnification.

(1) Remove the housing of the E-1 rangefinder as instructed.

(2) Focus on 15 feet and adjust the fulcrum bar against the rear indicator scales as follows: With the key-tool, loosen the hexagonal screw that is visible between the rangefinder plates only when viewed from the rear. If the movable image is high, the indicator is moved down slightly; if the movable image is low, the indicator is raised slightly. Now tighten the hexagonal screw and check the rangefinder at infinity.

(3) If the infinity adjustment has shifted, bring it back by turning the eccentric adjusting stud. Again check the rangefinder at 15 feet, and if the images still are not in coincidence, repeat the directions above until coincidence is attained. This method of trial and error is necessary in order to adjust the rangefinder accurately to the exact actual focal length of the lens, rather than to an arbitrary adjustment which would only approximate the true focus.

(4) Repeat the operation described in preceding subparagraphs (2) and (3), about 6 feet from the target. When using the rangefinder at such close distances, be sure that the upper eyepiece of the rangefinder is on the same level as the target. First, focus carefully on the ground glass, using a magnifying glass, and then check on the rangefinder. If the images do not coincide at either of these distances, the front indicator is moved; this indicator is secured by a spring and need only be moved in the proper direction with a small screwdriver. If the movable image is high, the indicator is raised slightly; if it is low, the indicator is lowered.

**CAUTION:** Do not at any time disturb the screw on this indicator. Each time the indicator is moved, the rangefinder should be checked at infinity, and if that adjustment has shifted, it is readjusted with the eccentric adjusting stud as heretofore.

(5) Replace the housing. By checking the rangefinder against the image as focused on the ground glass at the close distance of 6 feet and at the far distance of 15 feet, as well as at infinity, and making the necessary adjustments as explained in subparagraphs (3), (4), and (5), the rangefinder will focus at all distances and the resulting negatives will be as sharp as if the focus had been obtained with the aid of a magnifying glass on the ground glass.

**NOTE:** A point may be reached at which no further adjustment can be made with the eccentric adjusting stud. In this event, the infinity position is adjusted by turning the screw very slightly.

(6) If the two images cannot be brought into coincidence because of a lateral shift, correct by slightly turning the screw at the rear of the housing. This adjustment is made while sighting the images through the rangefinder with the housing installed.



(7) Climatic and atmospheric conditions may cause the windows and mirrors of the rangefinder to become clouded. This film may be removed from the surface of the glass with soft cloth or lens tissue. Clean carefully and rub gently, to avoid disturbing the position of the mirrors or damaging their surface.

**d. Removal, Repair, and Reassembly of Extension Eyepiece.**

(1) Remove the extension eyepiece by unscrewing it counterclockwise from the bracket; it will be necessary to hold the eyepiece tube during this operation.

(2) Remove the tube.

(3) Remove the two screws by which the bracket is attached to the curtain-setting plate.

(4) Remove the bracket.

(5) Examine the threads on the eyepiece and eyepiece bracket. Replace with new parts if necessary.

(6) Examine the eyepiece tube for deformation.

(7) Attach the eyepiece bracket to the curtain-setting plate by means of the two screws removed previously.

(8) Place the eyepiece tube in position and screw on the eyepiece to retain it.

(9) Align the extension eyepiece with the rangefinder by loosening the two screws on the bracket and sliding the bracket up and down as necessary.

**80. TUBULAR VIEWFINDER (fig. 67).**

**a. Removal and Disassembly.**

(1) Remove the two screws A-9 from the right and left side of the viewfinder cap; remove the mask A-149, and then the cap A-154.

(2) Remove the four screws A-8 in the viewfinder housing (two on each side) and lift the housing from the base. Be careful that the front lens A-152, and spring A-153 are not dropped when removing the housing.

(3) Remove the two screws A-10 from parallax eyepiece clip A-158 and then remove eyepiece A-157, clip A-158, and rear lens A-156.

**b. Inspection and Cleaning.** Examine the screw threads in the bakelite housing to find any possible stripped threads.

**c. Repairs.**

(1) Replace with new viewfinder housing if examination shows threads to be stripped.

(2) Replace with a new front or rear lens if examination discloses chipping.

(3) Replace all burred or worn screws with new screws.

**d. Reassembly.**

(1) Fit the rear lens A-156 in the housing A-150. Before fitting, determine the concave and convex side of the lens; the convex side of the lens faces outward.

(2) Fit the eyepiece A-157 and eyepiece clip A-158.

(3) Fit the housing A-150, spring A-153, and front lens A-152 to the baseplate A-148. The plane side of the front lens must face outward. Fasten the housing to the base with the four screws A-8.

(4) Fit cap A-154 and mask A-159 and replace screws A-9.

**e. Final Test.**

(1) Revolve the viewfinder eyepiece. It must rotate without binding, but should have a small amount of tension.

(2) The eyepiece must be flush with the housing. If it is not, the eyepiece clip has been sprung and must be reformed.

**81. OPTICAL REPAIR.**

Under no circumstances should optical repair be attempted. If a lens is damaged it must be sent to the factory for regrinding, recementing, or remounting. Tampering with lenses can result only in an aggravation of the fault, as lens repairs require precision machines of great accuracy.

**82. EMERGENCY REPAIRS.**

It is to be understood that the repair procedures and tools mentioned in the following chart are for emergency use only. The camera should be sent to higher echelons for replacement of parts and repairs.

<i>Damage</i>	<i>Repair</i>
Bed out of alignment.	Line up bed by lowering the bed brace plates as required.
Bed badly bent.	Replace with a new bed and hinges.
Focusing pinion bent by a blow.	Remove and straighten the focusing pinion. Place the pinion on a hard, level surface; gently tap the pinion at its bent section. In an emergency any suitable hard object such as a rock may be used. Do not strike the metal directly with the rock. Place the pinion between two pieces of flat wood, to prevent damage when it is struck. Reassemble the bed.
Broken bed blocks.	Replace the blocks as required. If the bakelite bed block is cracked at the pinion section, no harm will be done. The yoke guide and bed-block screws will support it sufficiently until it can be replaced.
Sliding yoke slightly bent.	Proceed as for bent focusing pinion, above.
Bent front standard.	Gently force the standard forward or backward as required to straighten it.

<i>Damage</i>	<i>Repair</i>
Broken lens board frame.	Replace with a new lens board frame, or use friction tape.
Torn focal plane shutter curtain.	Remove the camera back. Carefully pull down the curtain onto the lower roller until 0 appears on the curtain-setting plate dial or until the curtain is at its widest aperture. Replace the back. Use the between-the-lens shutter.
Jammed focal-plane shutter.	<p>If the trouble is in the shutter plate: Remove the camera back. Remove the curtain from the upper roller. Lower the curtain onto the tension roller. Replace the camera back. Use the between-the-lens shutter. Return for repair when convenient.</p> <p>If trouble is in the tension plate: Proceed as above, but remove the curtain from the tension roller and wind it onto the upper roller.</p>
Tension spring broken.	Remove the camera back. Set the curtain at 0 (its widest aperture), using the fingers if necessary to turn the tension roller. Replace the camera back. Use the between-the-lens shutter. Return for repair when convenient.
Bent back panel.	Remove the camera back. Remove the focusing frame. Straighten the back panel. In an emergency any suitable object may be used. Place the piece to be straightened between two flat pieces of wood before striking with tool.
Front shutter jams in half-open position.	Remove the lens and open the shutter. Examine for levers that may be jammed. If unable to adjust, re-cock the shutter and use the press-focus button for focusing. If the shutter can be released to its closed position, use the time setting to hold the leaves open. Use the focal plane shutter to make pictures.
Front shutter jams in closed position.	Remove the lens and open the shutter. Examine for levers that may be jammed. Use the time setting to hold the shutter open. Use the focal plane shutter to make pictures.

<i>Damage</i>	<i>Repair</i>
Tripod leg split.	Lower to length of shortest leg. Return for repair when convenient.
Completely broken tripod leg (bottom section).	Same as above.
Upper member of tripod (section that fits into tripod head) broken.	Replace.
Screw for adjusting tripod height on tripod leg lost or damaged.	Wedge a small piece of wood between the leg and the bracket.
Sheet-film holder broken.	Replace.
Lens hood and filter holder bent.	Gently form the slit collar inward by hand.

### **83. UNSATISFACTORY EQUIPMENT REPORT.**

**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, W. D., A.G.O. Form No. 468 should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C. Refer to TM 38-250 for complete instructions on the handling of this report.

**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.

# APPENDIX

## SECTION XI MAINTENANCE PARTS LISTS

### 84. MAINTENANCE PARTS LIST FOR CAMERA EQUIPMENT PH-104.

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig 16	8A10A	ADAPTER: film pack, metal, 4 x 5", complete with slide graphic, all metal or equal. (See list for Adapter PH-110-A, paragraph 93.)	1						
Fig 2	8A3275-308	CABLE RELEASE: Folmer Graflex; PH-308; 7½" lg; fits super-matic #2 shutter.	1		*		**	**	*
Fig 3	8A347E	CAMERA: Folmer Graflex; PH-47E; 4" x 5" speed graphic; w/127mm Ektar lens.							
Fig 2	8A523D	CASE: camera carrying Folmer Graflex; PH-83-D; compartment type; size about 19½" x 11¼"; fibre material. (See list for Case PH-83-D, paragraph 95.)							
Fig 2	8A830A	CLOTH: focusing; EKCo; 40" x 48"; bound at all edges.	1				**	**	*
Fig 2	8P8-110 F	CORD: extension: Folmer Graflex catalog #150; 15 ft lg w/ molded peanut size female right angle connectors at both ends; w/ standard female receptacle.	1		*		**	**	*
Fig 2	8A1099/x1-2	FILTER: Wratten X-1, 1½" diam, in B glass (Kodak Series VI or equal).	1				**	**	*

Fig 2	8A1099/2-2	FILTER: Wratten K-2, 1½" diam, in B glass (Kodak Series VI or equal).	1			**	**	*
Fig 2	8A1099/G-2	FILTER: EKCo; Wratten G; Kodak Series VI; EKCo or equal.	1			**	**	*
Fig 2	8A1100-380	FILTER: PH-380 (Wratten Aero 2, Eastman Kodak Co., 4" square, in B glass; used to vary tonal relationship in the photography of colored objects; u/w but not part of PH-120A and PH-195A).	1			**	**	*
Fig 17	8A1701	HOLDER: cut film: Folmer Graflex; PH-81; 4" x 5"; wooden construction; w/ opaque dark side; complete w/ septums graphic type.	6			•		
Fig 18	8A2576A	LENS HOOD: and filter holder; EKCo Series VI; PH-106A; includes 1½" Kodak adapter ring and Kodak lens hood.	1			**	**	*
Fig 12	8P8-538	LIGHTING UNIT: side.	1		*	**	**	*
Fig 24	8A3698.3	SYNCHRONIZER: flash; Graflex #37 (metal battery case w/ 7" adjustable reflector for standard base bulbs; used with supermatic shutter on Camera PH-47E).						
Fig 14	8A4121	TRIPOD PH-121: (overall dimen 4" diam by 16¼" lg; Crown #1, or equal).	1					

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed for depot stocks.

**85. MAINTENANCE PARTS LIST FOR CAMERA PH-47-E.**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 36	8P8-25	BEARING: roller.	2				**	**	*
Fig. 36	8P8-40	BED: complete.	1		*		**	**	*
Fig. 6	8P8-45	BELLOWS: complete, interior-cloth, exterior-black leather.	1				**	**	*
Fig. 36 (A-312)	8P8-55	BLOCK: bed, left, bakelite, black, moulded.	1		*		**	**	*
Fig. 36 (A-311)	8P8-55A	BLOCK: bed, right, bakelite, black, moulded.	1		*		**	**	*
Fig. 36 (A-331)	8P8-60	BRACE: bed, left.	1				**	**	*
Fig. 36 (A-346)	8P8-6A	BRACE: bed, right.	1				**	**	*
Fig. 9 (16)	8P8-75	CATCH: focusing panel.	1				**	**	*
Fig. 54	8P8-125	CURTAIN: assembly, focal plane shutter, with struts.	1				**	**	*
Fig. 56 (A-275)	8P8-490	DOG: tension, brass; used as stop for tension snail.	1				**	**	*
Fig. 55 (A-230)	8P8-140	ESCAPEMENT: shutter.	1				**	**	*
Fig. 9 (5)	8P8-155	FEET: rubber; for bottom of camera case.	4				**	**	*
Fig. 9	8P8-165	FINDER ASSEMBLY: wire (for swinging peepsight).	1		*		**	**	*
Fig. 9	8P8-175	FRAME: complete, focusing; with strips, catch and ground glass.	1				**	**	*
Fig. 52	8P8-52	FRAME: complete, front standard, with slide lock and lens board strip.	1				**	**	*

Fig. 24	8A 3698-3	FLASHGUN: and Synchronizer Graflex #37. (See list for Folmer Graflex Flashgun, paragraph 92.) GUIDE: bed yoke, left.	1	**	**	*
Fig. 36 (A-322)	8P8-200	GUIDE: bed yoke, right.	J	**	**	*
Fig. 36 (A-323)	8P8-205	HANDLE: carrying, leather; with ring and pad.	1	**	**	*
Fig. 3	8P8-210	HOUSING: tubular viewfinder, bakelite, black, moulded.	1	**	**	*
Fig. 11 (6)	8P8-215	IDLER ASSEMBLY: with idler pin.	1	**	**	*
Fig. 59	8P8-220	KEY: shutter winding.	2	**	**	*
Fig. 55 (A-250)	8P8-225	LEVER: shutter release.	1	**	**	*
Fig. 55 (A-255)	8P8-255	LEVER: yoke lock.	1	**	**	*
Fig. 5 (6)	8P8-260	LOCK: lensboard slide, for locking lensboard in place; SAE #101CCR steel, .040 inch thick with two diagonal slots $3\frac{3}{8}''$ lg x $\frac{3}{8}''$ w length.	1	**	**	*
Fig. 3	8P8-268	MASK: viewfinder, removable.	1	**	**	*
Fig. 11 (7)	8P8-270	NUT: rising front screw, for raising front frame.	1	**	**	*
Fig. 3	8P8-280	NUT: tension.	2	**	**	*
Fig. 56 (A-289)	8P8-285	PIN: taper; winding key.	1	**	**	*
Fig. 55 (A-253)	8P8-300	PINION ASSEMBLY: focusing, complete with knobs.	1	**	**	*
Fig. 36	8P8-295		1	**	**	*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed from depot stocks.



**85. MAINTENANCE PARTS LIST FOR CAMERA PH-47-E (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 23	8P8-310	PLATE: aperture.	1				**	**	*
Fig. 68	8P8-315	PLATE: brace, left side.	1				**	**	*
Fig. 68	8P8-315A	PLATE: brace, right side.	1				**	**	*
	8P8-320	PLATE: handle.	1				**	**	*
Fig. 55 (A-222)	8P8-335	PLATE: shutter, complete.	1				**	**	*
Fig. 56	8P8-340	PLATE: tension, complete.	1				**	**	*
Fig. 65	8P8-345	RANGEFINDER: Hugo Meyer #4C. (See list for Hugo Meyer rangefinder (Model 4C), paragraph 90.)	1				**	**	*
Fig. 57	8P8-360	ROLLER ASSEMBLY: tension.	1				**	**	*
Fig. 58	8P8-190	ROLLER ASSEMBLY: upper shutter.	1				**	**	*
Fig. 68	8P8-365	SCREW: back frame.	5				**	**	*
Fig. 68	8P8-370	SCREW: back spring.	2				**	**	*
	8P8-375	SCREW: back to case.	5				**	**	*
	8P8-380	SCREW: bed catch, handle catch and spring.	2				**	**	*
	8P8-400	SCREW: focusing frame catch, idler block strip.	4				**	**	*
	8P8-410	SCREW: foot.	4				**	**	*
Fig. 6 (8)	8P8-415	SCREW: front bellows.	4				**	**	*
	8P8-435	SCREW: handle lug or side plate.	2				**	**	*
	8P8-440	SCREW: hinge, focusing frame.	4				**	**	*
	8P8-445	SCREW: idler block.	4				**	**	*
	8P8-450	SCREW: lensboard slide lock 1-56 x $\frac{1}{8}$ inch F.H.-M.T.	2				**	**	*
	8P8-455	SCREW: lensboard retaining strip $\frac{1}{8}$ inch #2 O.H. Parker Kalon Type Z.	2				**	**	*

Fig. 11 8P8-460	SCREW : viewfinder housing to base $\frac{1}{4}$ inch #3 R.H. Wood.	3			**	*
Fig. 68 8P8-470	SCREW : peepsight (swing type).	3			**	*
Fig. 55 (A-948)	SCREW : shutter escapement.	2			**	*
Fig. 55 (A-256)	SCREW : shutter release lever.	1			**	*
Fig. 56 (A-276)	SCREW : tension dog, 2-56 R.H.-T.M.	1			**	*
Fig. 56 (A-288)	SCREW : tension indicator.	1			**	*
Fig. 55 (A-13)	SCREW : tension or shutter plate.	10			**	*
Fig. 36 (A-304)	SCREW : yoke guide.	10			**	*
8P8-535	SCREW : yoke lock, 8-40 x $\frac{1}{4}$ inch.	1			**	*
6L6256-3.2 (A-313)	SCREW : bed block, 2-56 x $\frac{1}{8}$ inch brass, O.H.	6			**	*
Fig. 68 6L6348-6.1	SCREW : handle catch, brass 3-48 x $\frac{3}{8}$ inch R.H.	2			**	*
Fig. 11 (8)	SCREW : viewfinder cap, brass 2-56 x $\frac{1}{8}$ inch R.H.	2			**	*
Fig. 69 8A-3651	SHUTTER : Supermatic #2 FG#69939. (See list for Supermatic Shutter, paragraph 88.)	1				
Fig. 9 (4)	SIGHT : peep, swing type.	1		*	**	*
Fig. 56 (A-290)	SNAIL : tension plate.	1			**	*
Fig. 55 (A-243)	SPRING : escapement.	1			**	*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed from depot stocks.

**85. MAINTENANCE PARTS LIST FOR CAMERA PH-47-E (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	8P8-585	SPRING: handle catch; leaf type.	1			**	**	**	*
	8P8-590	SPRING: screen bottom.	1			**	**	**	*
	8P8-590A	SPRING: screen, top.	1						
	8P8-600	SPRING: tension dog.	1						
Fig 56 (A-274)	8P8-605	STANDARD: front.	1		*	**	**	**	*
Fig 52 (A-518)	8P8-640	TACKS: aperture plate, round-head.				**	**	**	*
Fig 23	8P8-635	TACKS: ¼ inch #21 bellows, flat-head.				**	**	**	*
Fig 6 (3)	8P8-665	WASHER: escapement lever.	1			**	**	**	*
Fig 55 (A-254)	8P8-685	YOKE: complete.	1			**	**	**	*
Fig 36	8A-1201	GLASS: ground; 4" x 5", for Ground Glass Focusing.	1		*	**	**	**	*
Fig 9 (17)									

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed for depot stocks.

**86. MAINTENANCE PARTS LIST FOR CAMERA PH-47-F.**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 53	8P8-13	BACK: FG #16037; complete w/panel, frame assem, peepsight and ground glass (8A1201); consist of first frame FG 21993; second frame FG 21973; aluminum back FG 20609; mahogany top moulding FG 21945; mahogany bottom moulding FG 21998; top and bottom cover FG 16015 Morroco leather; sides cover FG 25059 Morroco leather; glass 2670 (8A1201); per TM-11-2352; p/o Camera PH-47E; u/w Camera Equipment PH-104.	1		*		**	**	*
	8P8-16	BALL: steel; FG #22194, positioning; ( $\frac{1}{8}$ " diam for swing peepsight; Ref A-647. TM-11-2352; p/o Camera PH-47E; u/w Camera Equipment PH-104).	2		*		**	**	*
	8P8-25	BEARING: roller.	2		*		**	**	*
Fig. 36	8P8-40	BED: complete.	1		*		**	**	*
Fig. 6	8P8-45	BELLOWS: complete, interior-cloth, exterior-black leather.	1		*		**	**	*
Fig. 36 (A-312)	8P8-55	BLOCK: bed, left, bakelite, black, moulded.	1		*		*	**	*
Fig. 36 (A-311)	8P8-55A	BLOCK: bed, right, bakelite, black, moulded.	1		*		*	**	*
Fig. 68	8P8-171	BODY Assembly: FG #25042; Ref A-100-TM-11-2352; ( $\frac{1}{4}$ " mahogany wood frame and sides with $\frac{7}{8}$ " diam brass lug; p/o Camera PH-47E; u/w Camera Equipment PH-104).	1		*		**	**	*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed for depot stocks.

**86. MAINTENANCE PARTS LIST FOR CAMERA PH-47-F (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 36 (A-331)	8P8-60	BRACE: bed, left.	1		*	**	**	**	*
Fig. 36 (A-328)	8P8-60A	BRACE: bed, right.	1		*	**	**	**	*
Fig. 11	8P8-71	CAP: peepsight; brass, black finish; FG #22192; ( $\frac{1}{2}$ " OD x $\frac{1}{8}$ " ID w/ $\frac{1}{4}$ " OD shoulder $\frac{1}{8}$ " thk; Ref A-645-TM-11-2352; p/o Camera PH-47E; u/w Camera Equipment PH-104).	1		*	**	**	**	*
	8P8-72	CAP: viewfinder; soft brass; FG #24777; (.020" thk; pressed to shape; holds front lens in housing; REF 154-TM-11-2352; p/o Camera PH-47E; u/w Camera Equipment PH-104).	1		*	**	**	**	*
Fig. 9 (16)	8P8-75	CATCH: focusing panel.	1		*	**	**	**	*
Fig. 9 (3)	8P8-320	CATCH: handle, sheet steel.	1		*	**	**	**	*
Fig. 54	8P8-125	CURTAIN ASSEMBLY: focal plane shutter, with struts.	1		*	**	**	**	*
Fig. 56 (A-275)	8P8-490	DOG TENSION: brass, used as stop for tension snail.	1		*	**	**	**	*
Fig. 55 (A-230)	8P8-140	ESCAPEMENT, SHUTTER.	1		*	**	**	**	*
Fig. 9	8P8-155	FEET: rubber, for bottom of camera case.	4		*	**	**	**	*
Fig. 65	8P8-165	FINDER ASSEMBLY: wire (for swinging peepsight).	1		*	**	**	**	*
	8A347/F1	FINDER: range, brass; black crinkle finish; couples lens for distance; $4\frac{1}{8}$ " lg x $2\frac{3}{32}$ " h x $1\frac{3}{32}$ " d; Hugo Meyer #4A; 4 # 3 mtg holes in corners; p/o Sig C Camera PH-47-F. See list for Hugo Meyer Rangefinder (model 4A) (par. 89).	1		*	**	**	**	*

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Fig. 9 (18)	8P8-175	FRAME: complete, focusing with strips, catch and ground glass.	1	*	**	**	*
Fig. 52	8P8-185	FRAME: complete, front standard, with slide lock and lens board strip.	1	*	**	**	*
Fig. 36 (A-309)	8P8-200	GUIDE: bed yoke, left.	1	*	**	**	*
Fig. 36 (A-308)	8P8-205	GUIDE: bed yoke, right.	1	*	**	**	*
Fig. 3	8P8-210	HANDLE: carrying, leather; with ring and pad.	1	*	*	**	*
Fig. 11 (6)	8P8-215	HOUSING: tubular viewfinder, bakelite, black, moulded.	1	*	**	**	*
Fig. 59	8P8-220	IDLER ASSEMBLY: with idler pin.	2	*	**	**	*
Fig. 55 (A-250)	8P8-225	KEY: shutter winding.	1	*	**	**	*
Fig. 55 (A-255)	8P8-255	LEVER: shutter release.	1	*	**	**	*
Fig. 5 (6)	8P8-260	LEVER: yoke lock.	1	*	**	**	*
Fig. 52 (A-503)	8P8-168	LOCK: lensboard slide, for locking lensboard in place; SAE #1010CR steel, .040 inch thick with two diagonal slots 3 $\frac{3}{8}$ " lg x $\frac{3}{8}$ " w.	1	*	**	**	*
Fig. 11 (7)	8P8-270	MASK: viewfinder, removable.	1	*	**	**	*
Fig. 3	8P8-280	NUT: rising front screw, for raising front frame.	2	*	*	**	*
Fig. 56 (A-289)	8P8-285	NUT: tension.	1	*	**	**	*
Fig. 55 (A-253)	8P8-300	PIN: taper; winding key.	1	*	**	**	*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed from depot stocks.

**86. MAINTENANCE PARTS LIST FOR CAMERA PH-47-F (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 36 (A-316)	8P8-295	PINION ASSEMBLY: focusing, complete with knobs.	1		*		**	**	*
Fig. 23	8P8-310	PLATE: aperture.	1		*		**	**	*
Fig. 68	8P8-315	PLATE: brace, left side.	1		*		**	**	*
Fig. 68	8P8-315A	PLATE: brace, right side.	1		*		**	**	*
	8P8-320	PLATE: handle.	2		*		**	**	*
Fig. 55 (A-222)	8P8-335	PLATE: shutter, complete.	1		*		**	**	*
Fig. 56 (A-270)	8P8-340	PLATE: tension, complete.	1		*		**	**	*
Fig. 57	8P8-360	ROLLER ASSEMBLY: tension.	1		*		**	**	*
Fig. 58	8P8-190	ROLLER ASSEMBLY: upper shutter.	1		*		**	**	*
Fig. 68	8P8-365	SCREW: back frame.	5		*		**	**	*
Fig. 68	8P8-370	SCREW: back spring.	2		*		**	**	*
	8P8-375	SCREW: back to case.	5		*		**	**	*
	8P8-380	SCREW: bed catch, handle catch and spring.	2		*		**	**	*
	8P8-400	SCREW: focusing frame catch, idler back strip.	4		*		**	**	*
	8P8-410	SCREW: foot.	4		*		**	**	*
Fig. 6 (8)	8P8-415	SCREW: front bellows.	4		*		**	**	**
	8P8-435	SCREW: handle lug or side plate.	2		*		**	**	*
	8P8-440	SCREW: hinge, focusing frame.	4		*		**	**	*
	8P8-445	SCREW: idler block.	4		*		**	**	*
	8P8-450	SCREW: lensboard slide lock 1-56 x $\frac{3}{16}$ inch F.H. —M.T.	2		*		**	**	*

8P8-455	SCREW: lensboard retaining strip $\frac{1}{8}$ inch #2 P.H. Parker Kalon Type Z.	2	*	**	*
Fig. 11 (5) 8P8-460	SCREW: viewfinder housing to base $\frac{1}{4}$ inch #3 R. H. Wood.	3	*	**	*
8P8-470	SCREW: peepsight (swing type).	1	*	**	*
8P8-500	SCREW: shutter escapement.	2	*	**	*
Fig. 55 (A-256) 8P8-485	SCREW: shutter release lever.	1	*	**	*
Fig. 56 (A-276) 8P8-490	SCREW: tension dog, 2-56 R. H.—M. T.	1	*	**	*
Fig. 56 (A-288) 8P8-495	SCREW: tension indicator.	1	*	**	*
Fig. 55 (A-13) 8P8-500	SCREW: tension or shutter plate.	10	*	**	*
Fig. 36 (A-14) 8P8-530	SCREW: yoke guide.	10	*	**	*
8P8-535	SCREW: yoke lock, 8-40 x $\frac{1}{4}$ inch.	1	*	**	*
Fig. 70 8P8-6450	SHUTTER: photographic; cocking, with f4.5 Ilex lens, between the lens; 1 second to 1/200 second press shutter, time bulb; cherry wood 4" sq; metal, iris, $1\frac{3}{8}$ " max diam; Ilex Optical Co. Acme #3 synchro; f4.5, continental; 3 mtg flange, holes 120 deg apart, #3 Hole; press flash shutter; p/o Sig C Camera PH-47-F. See list for Ilex No. 3 synchronized shutter paragraph 87.	1 1	*	**	*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed from depot stocks.

<sup>a</sup> Referred to in text as shutter speed table.



**86. MAINTENANCE PARTS LIST FOR CAMERA PH-47-F (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig 9 (14)	8P8-537	SIDE: FG #2672; focusing panel shield; (cloth; black impregnated sizing; triangular sector 4" x 4" x 5 1/2"; acts as light shade when using the ground glass; Ref A-628-TM-11-2352; p/o Camera PH-47E; u/w Camera Equipment PH-104).	2		*		*	**	*
Fig 9 (4)	8P8-540A	SIGHT: peep, swing type.	1		*		**	**	*
Fig 56 (A-290)	8P8-555	SNAIL: tension plate.	1		*		**	**	*
Fig 55 (A-243)	8P8-575	SPRING: escapement.	1		*		**	**	*
Fig 9 (3)	8P8-585	SPRING: handle catch; leaf type.	1		*		**	**	*
Fig 9 (15)	8P8-590	SPRING: screen bottom.	1		*		**	**	*
Fig 9 (1)	8P8-590A	SPRING: screen, top.	1		*		**	**	*
Fig 56 (A-274)	8P8-600	SPRING: tension dog.	1		*		**	**	*
Fig 57 (A-259)	8P8-601	SPRING: tension roller, steel; FG #2626; SAE 1085; 0.018 music wire. Ref 259-TM-11-2352; u/w Camera PH-47E; p/o Camera Equipment PH-104.	1		*		**	**	*
Fig 52 (A-518)	8P8-605	STANDARD: front.	1		*		**	**	*

Fig. 24	8A3698-3	SYNCHRONIZER: flash; Graflex #37; (metal bat case w/7" adjustable reflector for standard base bulbs; u/w supermatic shutter on Camera PH-47-E). See list for Folmer Graflex flashgun paragraph 92.																						
Fig. 23	8P8-640	TACKS: aperture plate, round-head.	4	*	**	**	**	*																*
Fig. 6 (3)	8P8-635	TACKS: $\frac{1}{4}$ inch #21 bellows, flat-head.	10	*	**	**	**	*																*
Fig. 55 (A-254)	8P8-665	WASHER: escapement lever.	1	*	**	**	**	*																*
Fig. 36	8P8-685	YOKE: complete.	1	*	**	**	**	*																*
Fig. 9 (17)	8A1201	GLASS: ground; 4" x 5", for Ground Glass focusing.	1	*	**	**	**	*																*
Fig. 68	6L6256-3.2	SCREW: bed block, 2-56 x $\frac{1}{8}$ inch brass, O.H.	6	*	**	**	**	*																*
	6L348-6.1	SCREW: handle catch, brass 3-48 x $\frac{3}{8}$ inch R.H.																						
Fig. 11 (8)	*	SCREW: viewfinder cap, brass 2-56 x $\frac{1}{8}$ inch R.H.	2	*	**	**	**	*																*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed from depot stocks.

**87. MAINTENANCE PARTS LIST FOR ILEX No. 3 SYNCHRONIZED SHUTTER.**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 52 (A-708)	8P8-6251	BOARD: photographic: lens; cherrywood, painted black; 4" sq x 1/4" thk; Graflex #1321; (3 3/8" diam csk hole 1/8" d w/2" diam hole drilled completely through; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6241	BLADE: shutter: steel; parkerized; acts as light valve; 1 3/2" lg x 3/4" wd x 0.003" thk overall; Ilex Optical Co #10; (2 mtg holes, one is 1/16" x 1/8", other is 1/16" diam, 1/16" mtg/c; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig. C Camera PH-47F).	5					*	*
Fig. 70	8P8-6266	CONTACT: switch; sterling silver, acts as circuit breaker; 3 v, 2 1/2 amp; 1/16" lg x 3/8" wd x 3/32" thk overall; Ilex Optical Co #84; (5/16" diam mtg hole; 3/16" x 1/8" hole in flange 1/4" sq; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6281	DISK: shutter: bakelite; used to time synchronizer 1 1/4" OD x 3/8" ID x 1/16" thk overall; Ilex Optical Co #92-94; (consists of Ilex Optical Co #93 cont segment, Ilex Optical Co #94 cont ring, 2 Ilex Optical Co #204 sinews; 1 ea red, white, and blue dots on one side; p/o Ilex Optical Co. #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*

Fig. 70	8P8-6316	<p>GEAR ASSEMBLY: spur: brass; nickel pl; controls duration of exp; <math>1\frac{1}{2}''</math> lg x <math>\frac{9}{32}''</math> wd x <math>\frac{1}{32}''</math> h overall; Ilex Optical Co #17-31; (consists of Ilex Optical Co #17-19 retard lever gear, Ilex Optical Co #20-21 pinion gear, Ilex Optical Co #22-23 intermediate gear, Ilex Optical Co. #24-25 star gear, Ilex Optical Co #26-27 pallet, Ilex Optical Co #28-30 bottom plate, Ilex Optical Co #29 top plate, Ilex Optical Co #31 spring; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).</p>	1				*	*
Fig. 70	8P8-6306	<p>GEAR: spur: brass; nickel pl; used as log gear for shutter millisecond peak; 0.410" OD x 0.080" ID x 0.018" thk; Ilex Optical Co #117; (50 teeth; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).</p>	1				*	*
Fig. 70	8P8-6326	<p>GUARD: shutter: brass; nickel pl; used to prevent rebound of shutter blades; <math>\frac{5}{8}''</math> lg x <math>\frac{1}{4}''</math> wd x 0.025" thk overall; Ilex Optical Co #72; (one <math>\frac{1}{16}''</math> diam mtg hole; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).</p>	1				*	*
Fig. 70	8P8-6356	<p>LEAF: dphgm; bronze; black penetrate; used to control amount of light passed through shutter; 2" lg x 1" wd x 0.005" thk overall; Ilex Optical Co #5; (1 elongated mtg hole <math>\frac{7}{32}''</math> lg x <math>\frac{3}{32}''</math> wd; club shaped head <math>\frac{3}{32}''</math> wd x <math>\frac{3}{4}''</math> lg, 120 deg arc has diam <math>1\frac{3}{32}''</math>; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).</p>	10				*	*
Fig. 70	8P8-6388	<p>LEVER ASSEMBLY: shutter: brass; nickel pl; used to connect finger release w/ oper mechanism; <math>\frac{5}{8}''</math> lg x <math>\frac{3}{8}''</math> wd x <math>\frac{1}{32}''</math> thk overall; Ilex Optical Co #95-97, consists of Ilex Optical Co #95 latch lever, Ilex Optical Co #96 pawl, Ilex Optical Co #97 bushing, Ilex Optical Co #221 rivet; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).</p>	1				*	*

\*Indicates stock available.

**87. MAINTENANCE PARTS LIST FOR ILEX No. 3 SYNCHRONIZED SHUTTER (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 70	8P8-6384	LEVER ASSEMBLY: shutter; brass; nickel pl; acts as both shutter release and lock to hold shutter open when focusing; $1\frac{1}{4}$ " lg x $1\frac{3}{32}$ " wd x $\frac{3}{32}$ " thk overall; Ilex Optical Co #56-57; (consists of Ilex Optical Co #57 bushing and Ilex Optical Co #56 lever; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6386	LEVER ASSEMBLY: shutter: brass; nickel pl; used to release shutter mechanism; $1\frac{1}{8}$ " lg x $1\frac{1}{8}$ " wd x $\frac{3}{8}$ " thk overall; Ilex Optical Co #67-70; (consists of Ilex Optical Co #67 release lever, Ilex Optical Co #68 bushing, Ilex Optical Co #69 pin, Ilex Optical Co #70 Knob, Ilex Optical Co #202 screw; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6382	LEVER ASSEMBLY: shutter: brass; silver pl; used to operate shutter blades; $1\frac{1}{4}$ " lg x $\frac{1}{2}$ " wd x $\frac{1}{4}$ " thk overall; Ilex Optical Co #42-45; (consists of Ilex Optical Co #42 blade lever, Ilex Optical Co #43 master member, Ilex Optical Co #44 master pinion, Ilex Optical Co #45 bushing Ilex Optical Co #219 rivet, Ilex Optical Co #207 screw; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6383	LEVER ASSEMBLY: shutter: brass; nickel pl; used to operate shutter; $2\frac{1}{8}$ " lg x $\frac{1}{8}$ " wd x $\frac{1}{4}$ " thk overall; Ilex Optical Co #48-50; (consists of Ilex Optical Co #48 master lever, Ilex Optical Co #50 bushing; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*

Fig. 70	8P8-6381	LEVER ASSEMBLY: shutter: brass; nickel pl; used to connect shutter retard mechanism w/ master oper lever; $1\frac{1}{4}$ " lg x $\frac{1}{2}$ " wd x $\frac{3}{2}$ " d overall; Ilex Optical Co #33-37; (consists of Ilex Optical Co #33 swing lever, Ilex Optical Co #34 pawl, Ilex Optical Co #35 bushing, Ilex Optical Co #37 pawl spring, Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6387	LEVER ASSEMBLY: shutter: brass; nickel pl; used to control time and bulb exp; $1\frac{3}{4}$ " lg x $1\frac{1}{8}$ " wd x $\frac{3}{8}$ " thk overall; Ilex Optical Co #73-74; (consists of Ilex Optical Co #73 time lever, Ilex Optical Co #74 bulb lever, Ilex Optical Co #217 rivet; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6389	LEVER ASSEMBLY: shutter: brass; nickel pl; used to release focusing lever; $\frac{2}{3}$ " lg x $\frac{1}{4}$ " wd x $\frac{3}{2}$ " d overall; Ilex Optical Co #100-102; (consists of Ilex Optical Co #100 connecting lever, Ilex Optical Co #101 bushing, Ilex Optical Co #102 pin; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6385	LEVER ASSEMBLY: shutter: brass; nickel pl; used to hold shutter blades open for focusing; $\frac{9}{2}$ " wd x $\frac{3}{4}$ " lg x $\frac{1}{4}$ " thk overall; Ilex Optical Co #57-58; (consists of focusing lever, Ilex Optical Co #58 and bushing, Ilex Optical Co #57; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6366	LEVER: shutter: silver; nickel pl; used to lock shutter release lever until shutter is set to operate; $\frac{2}{3}$ " lg x $\frac{1}{3}$ " wd x 0.020" thk overall; Ilex Optical Co #54; (one $\frac{3}{2}$ " mtg hole; 'L' shaped; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*

\*Indicates stock available.

**87. MAINTENANCE PARTS LIST FOR ILEX No. 3 SYNCHRONIZED SHUTTER (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 70	6L31C2-56M	NUT: hex: brass; silver plated; #2-56; $\frac{1}{8}$ " thk x $\frac{3}{8}$ " across flats, Ilex #89.	2					*	*
Fig. 70	6L3402-72.1	NUT: knurled: brass; nickel pl; $\frac{5}{32}$ "-72 NF x 0.078 thk x 0.156" OD; Ilex Optical Co #153; (p/o Ilex #3 Acme synchro shutter, u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6409	PALLET: vibrator; brass; nickel pl; retarding action on med speed; $\frac{3}{4}$ " lg x $\frac{3}{4}$ " wd x 0.063" thk; Ilex Optical Co #38-39; (p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6426	SCREW: machine: RH; brass, nickel pl; 0.067"-72, NF; 0.069" lg w/0.050" thk; head 0.100" diam x 0.019" thk; Ilex Optical Co #123; (p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	3					*	*
Fig. 70	6L6256-23.4	SCREW: machine: Fil H; brass, nickel pl; #2-56 NF thd; 0.552" lg w/ 3/16" thd; head 0.125" diam x 0.040" thk; Ilex Optical Co #555; (shoulder $\frac{1}{8}$ " lg x 0.076" diam; p/o Ilex Optical Co #3 Acme synchro shutter, u/w Sig C Camera PH-47F).	3					*	*
Fig. 70	8P8-6433	SCREW: machine: Fil H; brass, nickel pl; 0.066"-72, NF thd; 0.130" lg w/ 0.060" thd; head 0.187" diam x 0.30" thk; Ilex Optical Co #721; (shoulder 0.040" lg x 0.099" diam; p/o Ilex Optical Co #3 Acme Synchro shutter; u/w Sig C Camera PH-47F).	2					*	*

Fig. 70	8P8-6427	SCREW : machine: FH; brass, nickel pl; 0.066"-72, NF; 0.050" lg w/ 0.079" thd; head 0.135" diam x 0.039" thk; Ilex Optical Co #223; (shoulder 0.032" lg x 0.099" diam; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	2	*	*
Fig. 70	8P8-6425	SCREW : machine: Fil H; brass, nickel pl; 0.066"-72, NF thd; 0.100" lg w/ 0.080" thd; head 0.110" diam x 0.020" thk; Ilex Optical Co #122; (p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	4	*	*
Fig. 70	8P8-6428	SCREW : machine; FH; brass, nickel pl; 0.067"-72, NF; 0.102" lg w/ 0.078" thd; head 0.100" diam x 0.024" thk; Ilex Optical Co #225; (p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	8	*	*
Fig. 70	8P8-6430	SCREW : machine: Fil H; brass, nickel pl; 0.066"-72, NF; 0.090" lg w/ 0.060" thd; head 0.100" diam x 0.030" thk; Ilex Optical Co #229; (p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	2	*	*
Fig. 70	8P8-6431	SCREW : machine: Fil H; brass, nickel pl; 0.067"-72, NF; 0.131" lg w/ 0.090" thd; head 0.125" diam x 0.041" thk; Ilex Optical Co #329; (p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	6L6072-2-3-72	SCREW : machine: flat top Bind H; brass, nickel pl; 0.067"-72 NF thd; 0.171" lg w/ 0.080" thd; head 0.001" thk x 0.152" diam; Ilex Optical Co #227; (shoulder 0.090" lg x 0.169" diam; p/o Ilex #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	2	*	*
Fig. 70	8P8-6429	SCREW : machine: Fil H; brass, nickel pl; 0.066"-72, NF; 0.151" lg w/ 0.110" thd; head 0.125" diam x 0.041" thk; Ilex Optical Co. #226; (p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*



**87. MAINTENANCE PARTS LIST FOR ILEX No. 3 SYNCHRONIZED SHUTTER (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 70	6L6080-1-1.50	SCREW: machine: OH; brass, nickel pl; 0-80 NF; #0.089" lg w/0.070" thd; head 0.100" diam x 0.019" thk; Ilex Optical Co #693; (p/o Ilex #3 Acme synchro shutter u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6432	SCREW: machine: RH; brass, nickel pl; 0.067"-72, NF; 0.099" lg w/0.080" thd; head 0.100" diam x 0.019" thk; Ilex Optical Co #673; (p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	2					*	*
Fig. 70	6L6072-1-1.50	SCREW: machine: OH; brass, nickel pl; 0.067"-72 NF; 0.099" lg w/0.080" thd; head 0.100" diam x 0.019" thk; Ilex Optical Co #211; (p/o Ilex #3 Acme synchro shutter u/w Sig C Camera PH-47F).	2					*	*
Fig. 70	8P8-6461	SOCKET: shutter release; brass; nickel pl. used to hold cable release to shutter; $\frac{3}{16}$ " lg x $\frac{1}{2}$ " wd x $\frac{1}{4}$ " d overall; Ilex Optical Co #62-56; (consists of Ilex Optical Co #62 inside tube, Ilex Optical Co #63 outside tube, Ilex Optical Co #64 insulating tube, Ilex Optical Co #56 bracket; two $\frac{1}{16}$ " diam mtg homes on $\frac{3}{16}$ " mtg/c; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	6L6072-1-1.7	SCREW: machine: FH; brass, nickel pl; 0.067"-72 NF thd 0.076" lg w/0.055" thd; head 0.100" diam x 0.023" thk; Ilex Optical Co #230; (p/o Ilex #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	5					*	*

Fig. 70	6L6072-3-1-50	SCREW: machine: OH; brass; nickel pl; 0.067"-72 NF thd; 0.104" lg w/ 0.140" thd; head 0.110" diam x 0.045" thk; Ilex Optical Co #748; (shoulder 0.019" lg x 0.067" diam; p/o Ilex #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	2	*	*
Fig. 70	6L18702-1-3-36	SCREW: set; headless; brass, nickel pl; #2-64 thd; 0.110" lg; Ilex Optical Co #314; (cone point; p/o Ilex #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6474	SPRING: lever; coil type; steel; used to operate shutter master lever; 1/4" OD x 0.028" wire thk; Ilex Optical Co #53; (1 turn, 5/8" extension on ea side; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6482	SPRING: lever; coil type; steel; used to return body release lever to neutral position; 3/2" OD x 1/2" lg x 0.010" wire thk; Ilex Optical Co #152 (closely wound; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6477	SPRING: lever; coil type; steel; used to return finger release lever to neutral position; 3/2" OD, 0.016" wire thk; Ilex Optical Co #71; (2 turns, 1/8" extension on 1 end, 3/8" extension on other end; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6473	SPRING: lever, coil type; steel; used to return lock lever to neutral position; 1/8" OD x 0.010" wire thk; Ilex Optical Co #4; (1 turn, 1/8" extension on 1 side, 3/4" extension on other side; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6481	SPRING: lever; coil; steel; used to return synchronizer master lever to neutral position; 1/4" OD, 0.015" wire thk; Ilex Optical Co #119; (2 turns, 3/4" extension on 1 side, 3/8" extension on other side; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47E).	1	*	*

**87. MAINTENANCE PARTS LIST FOR ILEX No. 3 SYNCHRONIZED SHUTTER (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 70	8P8-6478	SPRING: lever; coil type; steel; used to return bulb lever to neutral position; $\frac{1}{8}$ " ID, 0.012" wire thk; Ilex Optical Co #75; (2 turns, $\frac{5}{8}$ " extension on 1 side, $\frac{1}{16}$ " extension on other side; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6475	SPRING: lever; coil type; steel; used to return lock lever to locking position; $\frac{3}{16}$ " OD x 0.013" wire thk; Ilex Optical Co #55; (3 turns, $\frac{1}{16}$ " extension on 1 end, $\frac{1}{8}$ " extension on other end; p/o Ilex Optical Co #3 Acme synchro shutter u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6476	SPRING: lever; coil type; steel; used to return shutter release catch to neutral position; $\frac{1}{4}$ " OD x 0.018" wire thk; Ilex Optical Co #59; (1 turn, $\frac{1}{2}$ " extension on 1 side, $\frac{1}{4}$ " extension on other side; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6480	SPRING: lever; coil type; steel; used to return shutter connecting lever to neutral position; $\frac{3}{8}$ " OD, 0.010" wire thk; Ilex Optical Co #103; (3 turns, $\frac{3}{8}$ " extension on 1 side, $\frac{1}{8}$ " extension on other side; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	8P8-6479	SPRING: lever; coil type; steel; used to return shutter latch lever to neutral position; $\frac{1}{8}$ " OD, 0.011" wire thk; Ilex Optical Co #99; (2 turns, $\frac{1}{2}$ " extension on 1 side, semi-circle on other side, w/ $\frac{1}{16}$ " rad; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*

Fig. 70	8P8-6472	SPRING: lever: coil type; steel; used to return shutter swing lever to neutral position; $\frac{3}{16}$ " OD x 0.015" wire thk; Ilex Optical Co #36; (2 turns, $\frac{5}{8}$ " extension on 1 side, $\frac{3}{8}$ " extension on other side; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6484	SPRING: pawl: steel: 1 turn, $\frac{3}{2}$ " ID x 0.008" wire thk; $\frac{1}{4}$ " extension from 1 side, $\frac{1}{8}$ " extension w/ $\frac{1}{16}$ " turned at 135 deg angle from other side; Ilex Optical Co #98; (piano wire; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6483	SPRING: pawl; steel; 1 turn, $\frac{3}{4}$ " OD x 0.008" wire thk; $\frac{1}{8}$ " extension on 1 end, $\frac{1}{2}$ " extension w/ $\frac{3}{32}$ " right angle on other end, Ilex Optical Co #37; (piano wire; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6485	SPRING: pawl: steel: 1 turn, $\frac{1}{8}$ " ID x 0.008" thk x $\frac{1}{4}$ " extension from ea side; Ilex Optical Co #105; (piano wire; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6486	SPRING: switch: coil type steel; used to return shutter safety on to neutral position; $\frac{3}{16}$ " OD, 0.008" wire thk; Ilex Optical Co #91; (2 turns, two $\frac{3}{8}$ " extensions crossing ea other, 1 extension bent at 45 deg for $\frac{1}{16}$ " ; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*
Fig. 70	8P8-6487	SPRING: timer: coil type; steel; used to control timing of shutter; $\frac{1}{8}$ " OD, 0.008" wire thk; Ilex Optical Co #31; (2 $\frac{1}{2}$ turns, $\frac{1}{16}$ " extension on 1 side, $\frac{3}{32}$ " extension w/ 135 deg turn for $\frac{3}{32}$ " on other side; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1	*	*

\*Indicates stock available.

87. MAINTENANCE PARTS LIST FOR ILEX No. 3 SYNCHRONIZED SHUTTER (CONTD).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 70	8P8-6471	SPRING: blade ring; coil type; steel; used to operate shutter blades; $\frac{3}{16}$ " OD x 0.008" wire thk; Ilex Optical Co #32; (1 turn, $\frac{11}{16}$ " extension on 1 side, $\frac{3}{8}$ " extension on other side; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	1					*	*
Fig. 70	6L50111-4N	WASHER: flat; brass, nickel pl; $\frac{1}{16}$ " ID, $\frac{7}{32}$ " OD, 0.030" thk; Ilex Optical Co #288; (p/o Ilex #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	3					*	*
Fig. 70	6L50111-5N	WASHER: flat; brass, nickel pl; $\frac{3}{32}$ " ID, $\frac{5}{32}$ " OD, 0.010" thk; Ilex Optical Co #124; (p/o Ilex #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	4					*	*
Fig. 70	6L58021-5N	WASHER: flat; steel, nickel pl; 0.002" ID, 0.210" OD, 0.010" thk; Ilex Optical Co #225; (p/o Ilex #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	6					*	*
Fig. 70	8P8-6517	WASHER: flat; fibre; $2\frac{1}{2}$ " lg x $2\frac{1}{2}$ " wd x 0.008" thk overall; Ilex Optical Co #7A; (5 sided, five $\frac{1}{32}$ " sq holes in ea of 5 corners, $1\frac{1}{2}$ " diam hole in center; p/o Ilex Optical Co #3 Acme synchro shutter; u/w Sig C Camera PH-47F).	2					*	*

\*Indicates stock available.

**88. MAINTENANCE PARTS LIST FOR No. 2 SUPERMATIC SHUTTER.**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 69	8P8-2013	BLADE: shutter.	1				*	*	*
Fig. 69	8P8-2014	BLADE: shutter, with stud.	4				*	*	*
Fig. 69	8P8-2015	BLADE: shutter, with double blade stud.	1				*	*	*
Fig. 69	8P8-2021	BRACKET: assembly, pallet, retard.	1				*	*	*
Fig. 69	8P8-2027	BUSHING: latch spring.	1				*	*	*
Fig. 69	8P8-2033	BUTTON: blade arrestor.	1				*	*	*
Fig. 69	8P8-2039	BUTTON: setting lever.	1				*	*	*
Fig. 69	8P8-2045	BUTTON: trigger.	1				*	*	*
Fig. 69	8P8-2051	CAM: high speed.	1				*	*	*
Fig. 69	8P8-2057	CLUTCH: assembly, delayed action.	1				*	*	*
Fig. 69	8P8-2063	CONTROLLER: blade.	1				*	*	*
Fig. 69	8P8-2069	ESCAPEMENT: assembly, delayed action.	1				*	*	*
Fig. 69	8P8-2076	FERRULE: blade arrestor.	1				*	*	*
Fig. 69	8P8-2082	GEAR ASSEMBLY: #2, Retard.	1				*	*	*
Fig. 69	8P8-2083	GEAR ASSEMBLY: #3, Retard.	1				*	*	*
Fig. 69	8P8-2089	GEAR PLATE ASSEMBLY: #1, Retard.	1				*	*	*
Fig. 69	8P8-2095	GEAR AND SPRING ASSEMBLY: delayed action, #1.	1				*	*	*
Fig. 69	8P8-2116	LATCH: delayed action trigger.	1				*	*	*
Fig. 69	8P8-2122	LEVER: delayed action winding.	1				*	*	*
Fig. 69	8P8-2168	LEVER: setting with stop stud.	1				*	*	*
Fig. 69	8P8-2120	LEVER: bulb, assembly, brass strip with spring.	1				*	*	*
Fig. 69	8P8-2177	LEVER: time, assembly, brass strip with spring.	1				*	*	*
Fig. 69	8P8-2185	MAIN DRIVE ASSEMBLY: with latch.	1				*	*	*

\*Indicates stock available.

**88. MAINTENANCE PARTS LIST FOR No. 2 SUPERMATIC SHUTTER (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 69	8P8-2191	PALLET ASSEMBLY: delayed action.	1				*	*	*
Fig. 69	8P8-2197	PALLET: retard.	1				*	*	*
Fig. 69	8P8-2203	PLATE: cover.	1				*	*	*
Fig. 69	8P8-2209	PLATE: diaphragm retainer with wing.	1				*	*	*
Fig. 69	8P8-2215	RIVET: trigger button.	1				*	*	*
Fig. 69	8P8-2221	SCREW: blade arrestor, ferrule.	2				*	*	*
Fig. 69	8P8-2222	SCREW: delayed action, mechanism plate.	1				*	*	*
Fig. 69	8P8-2223	SCREW: cover, long.	2				*	*	*
Fig. 69	8P8-2224	SCREW: cover, long.	2				*	*	*
Fig. 69	8P8-2225	SCREW: cover, short.	1				*	*	*
Fig. 69	8P8-2226	SCREW: delayed blade action latch spring.	1				*	*	*
Fig. 69	8P8-2227	SCREW: diaphragm, retainer plate.	5				*	*	*
Fig. 69	8P8-2228	SCREW: carplate, delayed action.	2,				*	*	*
Fig. 69	8P8-2229	SCREW: carplate, retard.	2				*	*	*
Fig. 69	8P8-2230	SCREW: index plate.	1				*	*	*
Fig. 69	8P8-2232	SCREW: main driver.	1				*	*	*
Fig. 69	8P8-2233	SCREW: main drive and stop.	1				*	*	*
Fig. 69	8P8-2234	SCREW: mechanism plate, long.	1				*	*	*
Fig. 69	8P8-2235	SCREW: mechanism plate, short.	2				*	*	*
Fig. 69	8P8-2236	SCREW: retarding section.	1				*	*	*
Fig. 69	8P8-2237	SCREW: trigger.	1				*	*	*
Fig. 69	8P8-2248	SECTOR: retarding.	1				*	*	*
Fig. 69	8P8-2254	SPRING: blade arrestor.	1				*	*	*
Fig. 69	8P8-2260	SPRING: blade controller, latch.	1				*	*	*
Fig. 69	8P8-2266	SPRING: delayed action trigger latch.	1				*	*	*

Fig. 69	8P8-2272	SPRING: delayed action, winding.	1						*	*	*
Fig. 69	8P8-2278	SPRING: high speed.	1						*	*	*
Fig. 69	8P8-2284	SPRING: main drive.	1						*	*	*
Fig. 69	8P8-2290	SPRING: pallet bracket.	1						*	*	*
Fig. 69	8P8-2296	SPRING: retard pallet.	1						*	*	*
Fig. 69	8P8-2302	SPRING: retarding sector.	1						*	*	*
Fig. 69	8P8-2174	SPRING: setting lever.	1						*	*	*
Fig. 69	8P8-2304	SPRING: trigger.	1						*	*	*
Fig. 69	8P8-2308	TRIGGER:	1						*	*	*
Fig. 69	8P8-2314	WASHER: trigger.	1						*	*	*
Fig. 69	8P8-2320	WHEEL ASSEMBLY: escapement retard 3.	1						*	*	*

\*Indicates stock available.



**89. MAINTENANCE PARTS LIST FOR HUGO MEYER RANGEFINDER (MODEL 4A).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 10	8P8-808	ARM: coupling; Hugo Meyer #AR33 rangefinder, steel, curved, 6 1/2" lg from ends, 3/8" wide x .053 thick, widens to 7/8" at one end and 1 1/8" at other end, two 45 deg bends near each end (to allow free passage along camera bellows).	1			**	**	**	*
Fig. 10	8P8-880	EYEPiece: soft rubber; overall length 1 3/4" x 1/2" OD, ID 5/16", peephole 3/16" dia, lip 1/8" at one end, with cut away portion; to clear camera focal plane winding knob.	1		*	**	**	**	*
	6L8002-4	SCREW: wood steel #2, 1/2" lg, length of thread 1/4"; to hold flashgun bracket to camera.	4		*	**	**	**	*
	6L9102-4	SCREW: round head, wood; Graflex #M400; #2, steel; 1/2" lg, lg of thd 3/32" holds rangefinder body to camera.	4			**	**	**	*
	6L6540-4-1.81S	SCREW: machine; hex head; steel; #5-40 thd; 3/32" lg overall; 3/32" lg thd; head 3/16" across flats; Hugo Meyer #hex 7; (p/o Hugo Meyer Rangefinder Arm #AR33).	1		*	**	**	**	*
	8P8-1072	SPRING: torsion assembly; rangefinder arm; HM #SPA32; (1/16" lg x 3/16" diam x 0.022 diam steel wire; 3 turns, 1 1/4" lg at one end, w/ curved band 1 1/8" lg; portion at other end, w/ hook, mtd on bushing, aluminum, 3/4" thk #10-32" x 1/8" lg w/ 1/16" lip at either end (moves arm and mirror in coincidence w/moving bed).	1		*	**	**	**	*
	8P8-910	WINDOW: glass; FG #303; HM #WG 6; clear, 3 3/4" x 3 3/4", 3/32" thick, cover for mirror assembly.	2			**	**	**	*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed from depot stocks.

**90. MAINTENANCE PARTS LIST FOR HUGO MEYER RANGEFINDER (MODEL 4C).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 10	8P8-808	ARM: coupling; range finder; steel; crinkle finish; (curved $6\frac{1}{2}$ " lg, from end to end; $\frac{3}{8}$ " wd x $0.053$ " thk, $\frac{7}{8}$ " wd on top tapering to $\frac{3}{8}$ " center widening to $\frac{1}{8}$ " bottom end; 45 deg bends near ea end; brass bushing narrow end $\frac{1}{4}$ " lg x $\frac{3}{8}$ " OD x $\frac{3}{8}$ " ID; hole for #5-40 set screw; u/w Sig C Camera PH-47-E).	1				**	**	*
Fig. 10	8P8-880	EYE-PIECE: rubber; maintenance part #1-B1-34 for Hugo Meyer Range Finder Model 4C.	1		*		**	**	*
Fig. 7	8P8-345A	FINDER: range; brass crackle finish, range finder for Folmer Graflex Camera; $4\frac{7}{8}$ " lg x $1\frac{3}{2}$ " wd x $\frac{3}{2}$ " h Hugo Meyer #4C DRW#1-B1 Folmer Graflex Part #M-127 or equal.	1				**	**	*
	6L6256-5	SCREW: machine #2-56; $\frac{5}{16}$ " flat head brass.	1				**	**	*
	6L256-3.5B	SCREW: machine round head brass #2-56; thd $\frac{3}{16}$ " lg dull blacked nickel auto elect #47778-351.	1				**	**	*
	6L6540-4-1.81S	SCREW: machine: hex head; steel, 5-40 NF; (overall lg $\frac{3}{2}$ " ; lg of thd $\frac{3}{2}$ " ; head $\frac{3}{16}$ " across flats; for use w/Range Finder Arm, PH-47-E).	1		*		**	**	*
	6L8002-4	SCREW: wood flat head brass $\frac{1}{2}$ " #2.	4		*		**	**	*
Fig. 65 (3)	8P8-1070	SPRING: pressure; maintenance part #1-B-1-20 for Hugo Meyer Range Finder Model 4C.	1				**	**	*
Fig. 65 (12)	8P8-1071	SPRING: retracting; maintenance part #1-B-1-22 for Hugo Meyer Range Finder Model #4C.	1				**	**	*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed from depot stocks.

**90. MAINTENANCE PARTS LIST FOR HUGO MEYER RANGEFINDER (MODEL 4C). (CONTD).**

Ref symbol	Signal Corps stock No.	Name of part and description.	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	8P8-1072	SPRING: mirror; rangefinder arm; $1\frac{1}{8}$ " lg x $\frac{3}{8}$ " diam; 3 turns of 0.022" diam steel wire; Meyers H #SPA32; ( $1\frac{1}{8}$ " lg portion at 1 end w/curved band; $\frac{1}{8}$ " lg portion at other end w/hook; mtd on aluminum bushing $\frac{1}{4}$ " thk, #10 $\frac{5}{32}$ " x $\frac{1}{8}$ " lg, w/ $\frac{1}{16}$ " lip at either end.	1		*		**	**	*
Fig. 10	8P8-910	WINDOW: glass, maintenance part #1-B-1-2 for Hugo Meyer Range Finder Model #4C.	2				**	**	*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed from depot stocks.

**91. MAINTENANCE PARTS LIST FOR KALART RANGEFINDER (MODEL E1).**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 10	8P8-345/1	ARM: coupling, Kalart part #E1-A, flat metal sector, $\frac{1}{16}$ " thick x $\frac{1}{4}$ " wide x approx. 6" overall.	1		*		**		*
Fig. 20	8P8-920A	EYEPIECE: front, assembly, Kalart part #A-233A, metal shield, $\frac{1}{2}$ " dia, chrome with yellow filter glass and sleeve to insert in housing.	1		*		**		*
Fig. 20	8P8-920B	EYEPIECE: rear, assembly, Kalart part #A-266, metal shield, $\frac{1}{2}$ " dia, chrome with clear glass and sleeve to insert in housing.	1		*		**		*
Fig. 66	8P8-994A	MIRROR ASSEMBLY: bottom, Kalart part #A-235, consists of: Opaque mirror #G-42. Bracket, bearing #E-107. Spring #E-119. Set screw #MS-62. Lever, bottom mirror #E-105. Screw #MS-67.	1	1	*		**		*
Fig. 66	8P8-920C	MIRROR ASSEMBLY: top, Kalart part #A-245-1, consists of: Mirror, semi-transparent #G-43. Support, top mirror #E-111. Clip #E-111-1. Screw, special head #MS-72.	1	1	*		**		*
	6L4127-2	RIVET: tubular, copper csk head; $\frac{3}{8}$ " diam; $\frac{1}{4}$ " lg overall.	3		*		**		*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed from depot stocks.

91. MAINTENANCE PARTS LIST FOR KALART RANGEFINDER (MODEL E1) (CONTD).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	6L20750-1-3.3	SCREW: machine, Fil H, nickel silver; 0.054"-66 thd; 0.105" lg w/ $\frac{5}{64}$ " thd; head 0.027" thk, 0.088" diam; Kalart #MS-17-1; (u/w Kalart Range Finder E-1, p/o Sig C Camera PH-47-E).	2		*		**		*
	6L654-5.81SF	SCREW: machine; hex head; steel, blued; #5-40 thd; $\frac{5}{16}$ " lg w/ $\frac{1}{4}$ " thd.	1		*		**		*
	8P8-920D	SCREW: special, Kalart part #MS-73, for lateral adjustment, #8 x 32 with special head $\frac{3}{8}$ " long, $\frac{1}{4}$ " diameter.	1		*		**		*
	8P8-994B	SCREW: special, Kalart part #MS-72, for lateral adjusting lever #590 x $\frac{3}{32}$ " with special head.	1		*		**		*
	6L6172-4-1.51S	SCREW: machine, OH; steel; cadmium pl; #1-72 thd; $\frac{3}{32}$ " lg w/ $\frac{1}{32}$ " thd.	2		*		**		*
	6L18701-2.35	SCREW: set, headless; brass; #1-72 thd, $\frac{1}{8}$ " lg; Kalart #MS-62; (cone point; p/o Sig C Camera PH-47-E).	1		*		**		*
	6L8701-3-1	SCREW: wood, RH; brass, blued; #1 $\frac{1}{16}$ " lg, full thd.	4		*		**		*
	8P8-805A	SPRING: cam, Kalart part #E-121, spring steel V shaped with 3 turns coil at vertex approx. $\frac{1}{2}$ " overall diameter.	1		*		**		*
	8P8-920E	SPRING: eyepiece, Kalart part #E-122, $\frac{1}{2}$ " round spring steel split, $\frac{1}{16}$ " diameter for eyepiece A-233A and A-266.	3		*		**		*
	6L50111-2F	WASHER: flat; brass, blued; $\frac{3}{8}$ " ID, $\frac{11}{14}$ " OD, $\frac{1}{16}$ " thk; Kalart #W24-1.	3		*		**		*

\*Indicates stock available.

\*\*Indicates that parts may be requisitioned as needed from depot stocks.

**92. MAINTENANCE PARTS LIST FOR FOLMER GRAFLEX FLASHGUN.**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot tock
Fig. 63 (D-129)	8P8-50	BEZEL: spotlight, knurled nut; to hold spotlight lens in position.	1		*	*	*	*	*
Fig. 62 (D-103)	8P8-90	CASE: battery clamp; for holding upper and lower tube assembly together.	1		*	*	*	*	*
Fig. 62	8P8-5401	CLAMP AND SPRING ASSEMBLY: overall length 2¼", polished steel, and an outer spring, ⅝" wd x 1⅛" in diam, spring steel, to hold lamp in place.	1			*	*	*	*
Fig. 64 (D-312)	8P8-5408	CONTACT: assembly, plunger of copper mounted inside rubber casting. Over all length 1⅛"; for making and breaking of the electrical circuit.	1			*	*	*	*
Fig. 2		CORD: connector, #22 copper strand wire 1 double conductor, rubber covered, with a peanut male and female plug, 18" in length.	1			*	*	*	*
Fig. 61 (D-126)	8P8-5407	CONTACT: aluminum, ⅜" wide #40 gage flat strip, bent in "L" shape; for making physical electrical contact, with connector cord.	3			*	*	*	*
Fig. 61 (D-118)	8P8-5404	CONNECTOR, aluminum, ⅜" wide, "L" shaped, with horizontal and vertical lengths ¾" long, #40 gage flat, fits bottom of top assembly.	1			*	*	*	*
Fig. 61 (D-115)	3G2501	INSULATOR: tubing, black, varnished cambric.	1			*	*	*	*
Fig. 27	8P8-245	LENS: spotlight, (½" in dia).	1			*	*	*	*
	8P8-275	NUT: for case nut screw (holds top section to case).	1		*	*	*	*	*

\*Indicates stock available.

92. MAINTENANCE PARTS LIST FOR FOLMER GRAFLEX FLASHGUN.

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 61 (D-1)	8P8-5410	PIN: polished sheet steel, round head, $\frac{1}{8}$ " x $\frac{3}{32}$ " dia, dia. of head $\frac{3}{8}$ "; for lamp clamp assembly.	1				*	*	*
Fig. 63 (D-300)	8P8-350	REFLECTOR: polished steel, 5" complete, parabolic and circular in shape.	1		*		*	*	*
Fig. 63 (D-200)	8P8-350-A	REFLECTOR: polished steel, circular shaped, 7" complete; with concentric cascaded geometric indentations).	1		*		*	*	*
	8P8-5411	SCREW: contact plug, silver plated copper, over all length $\frac{3}{8}$ ", #48 thread, x $\frac{1}{8}$ " and a $\frac{1}{8}$ " shank with a $\frac{1}{8}$ " dia., has a hex. shoulder between shank and threads; for making contact with female plug.	4		*		*	*	*
	8P8-4512	SCREW: same as 25861, except for square shoulder between shank and thread.	2		*		*	*	*
	6L6432-2.2S	SCREW: steel #4-36 x $\frac{1}{4}$ " O.H., for top assembly.	1		*		*	*	*
	6L6440-5S	SCREW: steel, 4-40 x $\frac{1}{4}$ " flat head; holds reflector support and socket and socket spacer in place.	2		*		*	*	*
	8P8-395	SCREW: case nut (fastens battery case clamp to upper tube assembly).	1						
	6L6436-2.1S	SCREW: steel, #4-36 x $\frac{1}{4}$ ", round head; holds reflector to support.	2						
	8P8-5413	SPACER: steel, $\frac{1}{2}$ " length, $\frac{1}{8}$ " dia. opening; for lamp clamp assembly.	1		*		*	*	*
	8P8-595	SPRING: spotlight to keep tension on lamp to make electrical contact.	1						
	8P8-5416	SPRING: steel, special type, for lamp release of 5" reflector; for locking lamp in socket shell assembly.	1						

92. MAINTENANCE PARTS LIST FOR FOLMER GRAFLEX FLASHGUN.

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 61 (D-1)	8P8-5410	PIN: polished sheet steel, round head, $\frac{1}{8}$ " x $\frac{3}{32}$ " dia, dia. of head $\frac{3}{8}$ "; for lamp clamp assembly.	1			*	*	*	*
Fig. 63 (D-300)	8P8-350	REFLECTOR: polished steel, 5" complete, parabolic and circular in shape.	1		*	*	*	*	*
Fig. 63 (D-200)	8P8-350-A	REFLECTOR: polished steel, circular shaped, 7" complete; with concentric cascaded geometric indentations).	1		*	*	*	*	*
	8P8-5411	SCREW: contact plug, silver plated copper, over all length $\frac{3}{8}$ ", #48 thread, x $\frac{1}{8}$ " and a $\frac{1}{8}$ " shank with a $\frac{1}{8}$ " dia., has a hex. shoulder between shank and threads; for making contact with female plug.	4		*	*	*	*	*
	8P8-4512	SCREW: same as 25861, except for square shoulder between shank and thread.	2		*	*	*	*	*
	6L6432-2.2S	SCREW: steel #4-36 x $\frac{1}{4}$ " O.H., for top assembly.	1		*	*	*	*	*
	6L6440-5S	SCREW: steel, 4-40 x $\frac{1}{4}$ " flat head; holds reflector support and socket and socket spacer in place.	2		*	*	*	*	*
	8P8-395	SCREW: case nut (fastens battery case clamp to upper tube assembly).	1						
	6L6436-2.1S	SCREW: steel, #4-36 x $\frac{1}{4}$ ", round head; holds reflector to support.	2		*	*	*	*	*
	8P8-5413	SPACER: steel, $\frac{1}{2}$ " length, $\frac{1}{8}$ " dia. opening; for lamp clamp assembly.	1		*	*	*	*	*
	8P8-595	SPRING: spotlight to keep tension on lamp to make electrical contact.	1						
	8P8-5416	SPRING: steel, special type, for lamp release of 5" reflector; for locking lamp in socket shell assembly.	1						



Fig. 61 (D-123)	8P8-5417	SPRING: #40 copper wire, wound $\frac{1}{8}$ " long x $\frac{1}{16}$ " dia.; for making connections between plug and batteries.	6	*	*	*	*	*	*
Fig. 61	8P8-5420	TOP ASSEMBLY: bakelite, $1\frac{1}{2}$ " dia. 1" length; comes in three sections, complete with screw holds, for contact plug screw and case screw.	1		*	*	*	*	*
Fig. 62	8P8-650	TUBE: lower, assembly; with spring in base to keep tension on batteries.	1		*	*	*	*	*
Fig. 63 (D-159)	8P8-5423	TUBE: polished steel, $1\frac{1}{2}$ " dia. with an over-all length of 7", with cutaways for connector plugs, spotlight, female plug, and lamp clamp assembly. Holds batteries.	1		*	*	*	*	*

\*Indicates stock available.

**93. MAINTENANCE PARTS LIST FOR ADAPTER PH-110-A.**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 16 (2)	8A101A/S1	SLIDE: Folmer-Graflex (4 x 5"); Graphic film pack adapter); consists of: 4 3/4" x 6 3/4" hard rubber slide, F. G. #26552; and slide handle aluminum F. G. #26553 P/O Adapter PH-110-A (8A10A).	1	*	*		*	*	*

\*Indicates stock available.

**94. MAINTENANCE PARTS LIST FOR TRIPOD PH-121.**

Ref symbol	Signal Corps stock No.	Name of part and description	Quant per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 2	8A4121/H1	HEAD: wood; (4" diam, w/felt pad 4" diam x 1/8" thk, cemented to tripod head).	1				*		*
Fig. 14 (2)	8A4121/L1	LEG ASSEMBLY: (wood; three piece construction w/metal hardware, extended 52 1/2", 15 3/4" folded).	3				*		*
Fig. 14	8P8-398	LOCK NUT ASSEMBLY: screw #17330 includes: #17329—(Nut, shoulder, brass, round, castellated, 1/4-20 NC; special assembly for PH-121). #17330—(Spl screw, brass, round head, castellated, 1/4-20 NC x 1 3/4" overall lg, 1 3/8" OD x 1/8" overall head, 3/16" undercut between threads).	1				*		*

\*Indicates stock available.

**95. MAINTENANCE PARTS LIST FOR CASE PH-83-D.**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig 15	8A523D	CASE: Camera carrying, compartment type, size about 19½" x 10¾" x 9¼", fibre or similar material for PH-104.	1				*	*	*
Fig 2	8A523D/S1	STRAP: web; 1" wd x 72" lg; w/iron buckle at one end; w/iron tip at other end; p/o Case, PH-83D (8A523D).	1		*		*	*	*
	8A523D/S2	STRAP: web; 1" wd x 36" lg; w/steel buckle at one end; w/steel tip at other end; p/o Case, PH-83D (8A523D).	1		*		*	*	*

\*Indicates stock available.

**96. MAINTENANCE PARTS LIST FOR HOLDER PH-81.**

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Run-ning spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 17	8A1701/1	SLIDE: 4" x 5"; Graphic film holder, consists of: 4 1/4" x 5 1/4" hard rubber slide—FG #3931, riveted steel slide pull—FG #8032; iron slide handle—FG #8035; p/o #Holder PH-81.	2		*				*

\*Indicates stock available.

