1 Gd
14 U113
in
TM
1944

TM 11-408

WAR DEPARTMENT TECHNICAL MANUAL

U.S. Dept. of Army

PROJECTORS PH-222 AND PH-222-A

UNIVERSITY of CALIFORNIA
LIBRARY
OCT 27 1947
DOCUMENTS DIVISION



RESTRICTED. DISSEMINATION OF RESTRICTED MATTER. The information contained in restricted documents and the essential characteristics of restricted materiel may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work, but will not be communicated to the public or to the press except by authorized military public relations agencies. (See also par. 28, AR 380–5, 15 Mar 1944.)

WAR DEPARTMENT *23 OCTOBER 1944*

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google
Original from
UNIVERSITY OF CALIFORNIA

WAR DEPARTMENT TECHNICAL MANUAL
TM 11-408

PROJECTORS PH-222 AND PH-222-A

WAR DEPARTMENT *23 OCTOBER 1944*

RESTRICTED. *DISSEMINATION OF RESTRICTED MATTER.*
The information contained in restricted documents and the essential characteristics of restricted materiel may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work, but will not be communicated to the public or to the press except by authorized military public relations agencies. (See also par. 28, AR 380–5, 15 Mar 1944.)

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

WAR DEPARTMENT,
WASHINGTON 25, D. C., 23 OCTOBER 1944.

TM 11-408, Projectors PH-222 and PH-222-A, is published for the information and guidance of all concerned.

[A. G. 300.7 (5 Feb 1944).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

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

DISTRIBUTION:

IC and H 4-11, 17(3).

(For explanation of symbols see FM 21-6.)

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

U113
.2
TM11:408
1944

TABLE OF CONTENTS

		Paragraph	Page
SECTION I.	**Description.**		
	General	1	1
	Component parts	2	1
	Technical data	3	7
	Weights and dimensions	4	7
II.	**Installation and operation.**		
	Preparation for use	5	9
	Table of screen image sizes	6	11
	Precautions during operation	7	11
	Threading	8	11
	Focusing	9	15
	Framing	10	15
	Rewinding film	11	17
	Use of slide carrier	12	17
III.	**Functioning of parts.**		
	General	13	23
	Projection of images	14	23
	Parts and their functions	15	23
IV.	**Maintenance.**		
	Cleaning	16	25
	Replacement of heat-absorbing glass	17	29
	Lubrication	18	29
	Moistureproofing and fungiproofing	19	31
	Disassembly for replacement of parts	20	31
	Reassembly	21	35
	Trouble, cause, and remedy chart	22	38
V.	**Supplementary data.**		
	Maintenance parts lists for Projectors PH–222 and PH–222–A	23	40

Digitized by Google
M586408
Original from UNIVERSITY OF CALIFORNIA

LIST OF ILLUSTRATIONS

Fig. No.	*Title*	*Page*
1	Projector PH–222, complete in case	VI
2	Projector PH–222–A, complete with case	2
3	Projector PH–222, assembled	4
4	Projector PH–222–A, component parts	6
5	Projector PH–222, showing film gate	8
6	Projector PH–222, installing automatic slide carrier	10
7	Projector PH–222–A, with slide carrier in place	12
8	Projector PH–222, installing take-up can	13
9	Projector PH–222, removing front aperture mask	14
10	Projector PH–222–A, threading projector	16
11	Projector PH–222, threading projector	18
12	Projector PH–222–A, set for double-frame film	19
13	Projector PH–222, screening the image with tilting lever	20
14	Projector PH–222–A, framing lever	22
15	Projector PH–222, replacing projector lamp	24
16	Projector PH–222, base and lamphouse disassembled	26
17	Projector PH–222, disassembled	28
18	Projector PH–222–A, optical system	30
19	Projector PH–222–A, masking device and take-up magazine assemblies	32
20	Projector PH–222–A, lamphouse assemblies	34
21	Projector PH–222–A, lens assemblies	36

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

DESTRUCTION NOTICE

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

WHEN — When ordered by your commander.

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

2. Cut — Use axes, handaxes, machetes.

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

4. Explosives — Use firearms, grenades, TNT.

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

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT — 1. Smash — Projectors, lamphouse assemblies, bases, film mechanism assemblies, all lenses, aperture pressure glasses, lamps, filters, carrying cases.

2. Cut — Power cords, films.

3. Burn — Films, this technical manual.

4. Bend — Slide carriers, fiber and cardboard mounts for slides, objective lens barrels, take-up mechanism and can.

5. Bury or scatter — All of the above parts after they are completely destroyed.

DESTROY EVERYTHING

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

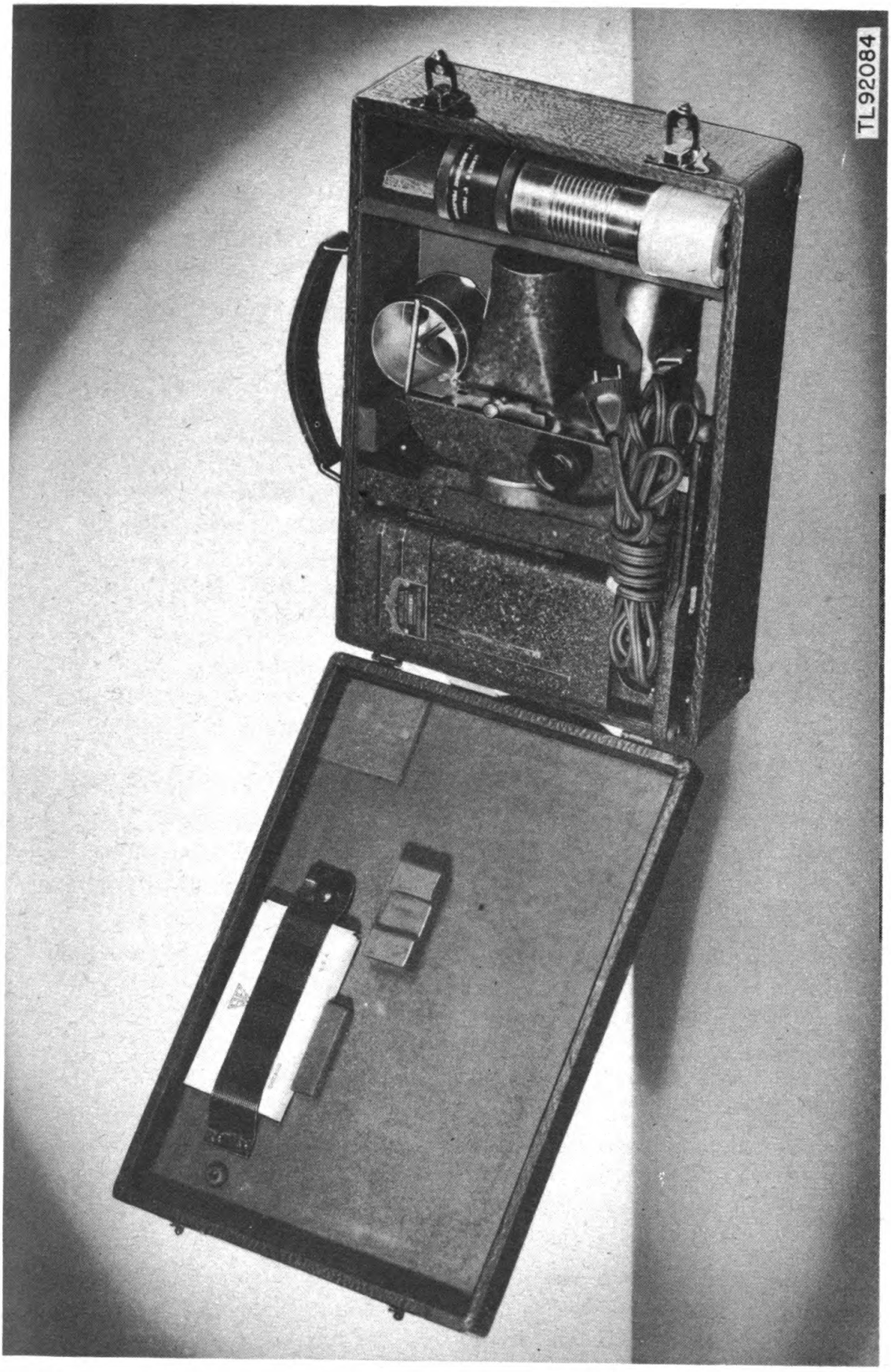


Figure 1. Projector PH–222, complete in case.

Digitized by Google
Original from
UNIVERSITY OF CALIFORNIA

SECTION I
DESCRIPTION

1. GENERAL.

a. Scope. This technical manual covers the description, operation, and maintenance of Projectors PH–222 (figs. 1 and 3) and PH–222–A (figs. 2 and 4). These projectors differ slightly in minor details of construction, certain component parts, and methods of operation.

b. Purpose. Projectors PH–222 (fig. 3) and PH–222–A (fig. 4) are designed to project still pictures from 35-mm perforated film in single frame (¾-inch by 1-inch) or double frame (1-inch by 1½-inch), and from miniature slides (2-inch by 2-inch) in fiber, cardboard, or glass mounts. Both projectors have sufficient illumination to provide satisfactory pictures in any darkened classroom or small assembly hall. Both projectors may be operated on an a-c or d-c power source from 110 to 120 volts. Projector PH–222 may be operated on a 220- to 230-volt line if it is equipped with 230-volt, 330-watt projection lamp.

2. COMPONENT PARTS.

a. Lamphouse Assembly. In both projectors, the lamphouse assembly is constructed of heavy sheet steel, finished inside in optical black and outside in heat-resisting black enamel (figs. 3 and 4). Adequate air vents allow ample air circulation through the housing.

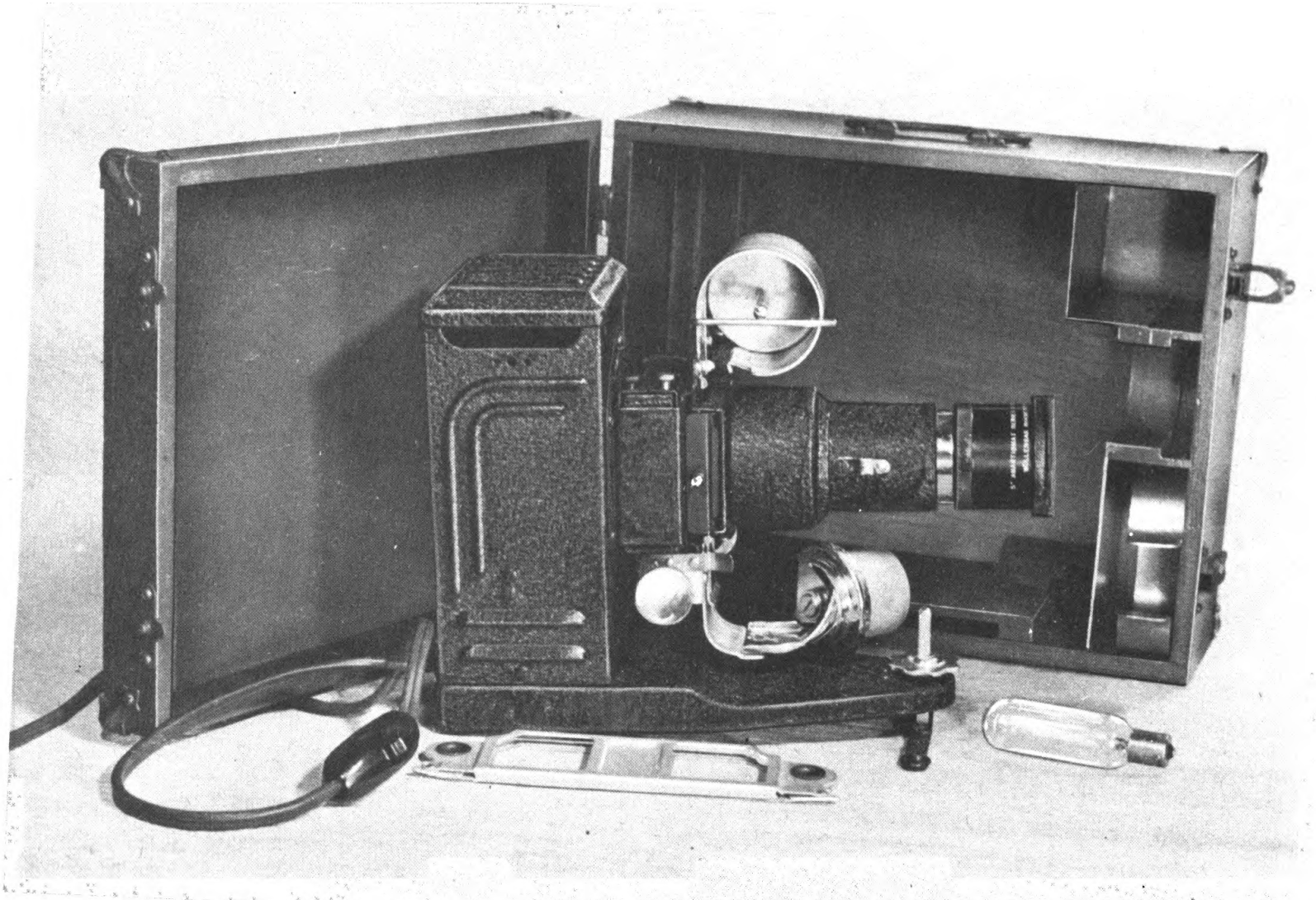
b. Lamphouse Cover Assembly. (1) PROJECTOR PH–222. The cover assembly (figs. 5(1) and 16(1)) is of durable steel construction, with air vents and a circular protective metal inclosure inside the cover assembly for the lamp. The reflector (figs. 15(33) and 17(33)) in Projector PH–222 is in the lamphouse assembly. The outside finish of the cover is also of heat-resisting black enamel.

(2) PROJECTOR PH–222–A. Of the same construction and outside finish as the cover assembly of Projector PH–222, the cover assembly (figs. 4 and 20(AF422)) in this model contains the reflector (fig. 21(AF430)), first condensing lens (fig. 21(AF434)), and heat-absorbing glass (fig. 21(AF439)) assemblies.

c. Film Mechanism Assembly. In both projectors, the film mechanism assembly is of steel, finished in chrome. This construction allows the film to come in contact only with highly polished surfaces at all times, thus

Digitized by Google

Original from UNIVERSITY OF CALIFORNIA



TL92085

Figure 2. Projector PH-222-A, complete with case.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

eliminating danger of scratching the film (fig. 11(54)). The film is held in proper focal plane between the two polished pressure glasses (figs. 11(30)(37) and 10(AF301)) that open as the film is fed from frame to frame. The lower magazine (figs. 5(2) and 10(AF457)) of the assembly is constructed for rewinding the film.

d. Base Assembly. (1) PROJECTOR PH–222. The base assembly (fig. 3(17)) is of cast iron with the body of the projector hinged at the rear. Rubber-tipped legs (fig. 9(4)) attached to the base prevent scratching of table surfaces.

(2) PROJECTOR PH–222–A. The base assembly (figs. 4 and 20(AF414) is of heavy gauge sheet-steel construction with the body of the projector hinged at the rear. The projector is also mounted on rubber-tipped legs.

e. Objective Lens. In both projectors, the objective lens (figs. 3(52) and 4) is mounted at the front of a threaded lens barrel that rides against a springed ball.

f. Condenser Lens Assembly. (1) PROJECTOR PH–222. The condenser lens assembly consists of three lenses: a concave-convex or meniscus rear lens (fig. 17(6)), mounted in the lamphouse in front of the lamp; a plano-convex lens (fig. 17(7)), mounted in the condenser assembly with the heat-absorbing glass (fig. 17(8)); and a bi-convex lens (fig. 17(9)), mounted in the main frame assembly (fig. 3(40)).

(2) PROJECTOR PH–222–A. The condenser lens assembly also consists of three lenses: a convex-concave condenser lens (figs. 18(AF434) and 21(AF434)) mounted on frames in the lamphouse cover asembly, so that when this cover assembly is in place the lens will be in front of the lamp; and two bi-convex lenses (fig. 21(AF436) and (AF437)), mounted on frames that slide into their respective positions in the condenser housing, that, in turn, is turret-mounted to the lamphouse (fig. 4).

g. Heat-absorbing Glass. (1) PROJECTOR PH–222. This is a lens glass (fig. 17(8)), mounted in front of the plano-convex lens condenser (fig. 17(7)) in the condenser assembly. The glass, designed to absorb and dissipate heat from the projector beam, is removable and can be replaced.

(2) PROJECTOR PH–222–A. The heat-absorbing glass (fig. 21 (AF439)) is essentially the same as the corresponding part in Projector PH–222. In Projector PH–222–A, however, the glass (fig. 18(AF439)) is mounted in the lamphouse cover assembly in proper relationship to the convex-concave condenser lens (fig. 18(AF434)) so that maximum heat-absorbing action is obtained. The glass can be removed and replaced.

h. Main Frame Assembly. (1) PROJECTOR PH–222. The main frame assembly is more clearly defined by shape and location in this model than in Projector PH–222–A. Placed between the condenser assembly (fig. 6(36)) in the lamp housing and the rear end of the objective lens

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

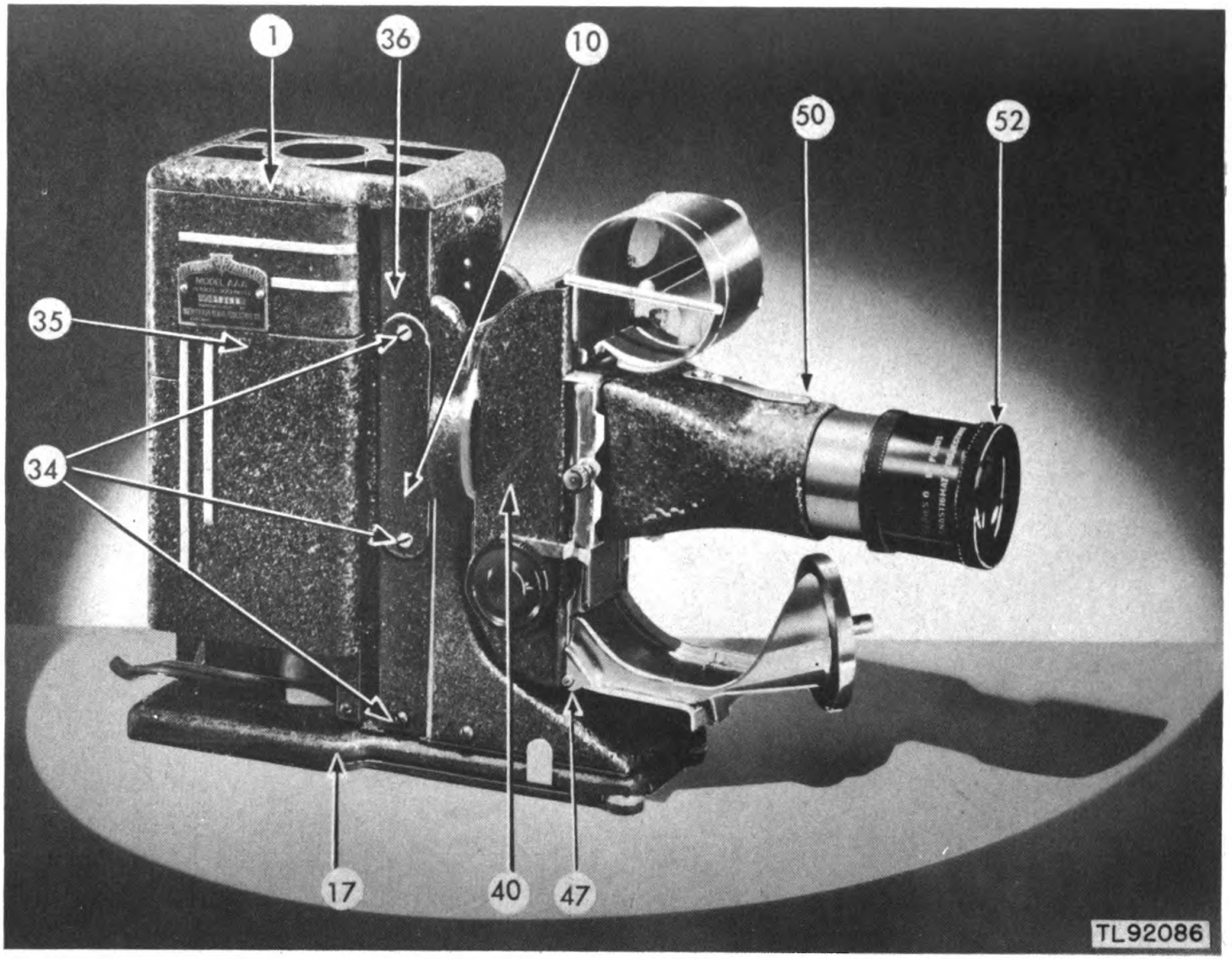


Figure 3. Projector PH–222, assembled.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

housing (fig. 6(12)), the main frame assembly (fig. 6(40)) in Projector PH–222 has a curved top and bottom (fig. 6(39) and (38)) and an exterior finish like that of the rest of the projector. It contains the film mechanism assembly, the aperture plate assembly (fig. 17(11)) including the front and rear aperture pressure glasses (fig. 11(30) and (37)), and the framing mechanism. In addition to these parts, the main frame assembly in Projector PH–222 also contains the bi-convex condenser lens (fig. 17 (9)). Attached to the top of the main frame is the upper film magazine (fig. 6(18)) and attached to the bottom of the main frame is the film take-up assembly (fig. 8(55)). The operating or sprocket feed knob (fig. 8(25)) at one side of the assembly is attached to the sprocket mechanism within the main frame.

(2) PROJECTOR PH–222–A. The main frame assembly in Projector PH–222–A is square in shape. It appears more as a connecting unit between the condenser assembly and the rear end of the objective lens housing (fig. 4) than as a separately constructed unit like the main frame assembly in Projector PH–222 (fig. 3(40)). The assembly in Projector PH–222–A contains the film mechanism that includes the upper film magazine (fig. 19(AF376)), the aperture plate assembly (fig. 18(AF383)) and frame mask (fig. 18(AF327)), and the film pressure glasses (fig. 18(AF301)). The assembly does not contain any one of the three condenser lenses. The upper film magazine (figs. 4 and 19(AF376)), the film take-up magazine assembly (figs. 4 and 19(AF456) (AF457)), and the operating or sprocket feed knob (figs. 10(AF399) and 19(AF399)) are attached to the main frame assembly in the same manner as that described in subparagraph (1) above.

i. Slide Carrier. (1) PROJECTOR PH–222. The metal slide carrier (fig. 6(14)) for this model is semiautomatic in operation. After inserting the carrier in the film gate (fig. 6(15)) between the lens housing (fig. 5(12)) and the projector main frame (fig. 6(40)), with the main frame in the horizontal position, the head of the projector is swiveled 90° in a clockwise direction so that the slide carrier is operated in a vertical position.

(2) PROJECTOR PH–222–A. For this projector, the metal carrier (fig. 7(AF391)) is inserted in the film gate from the side and remains in that position. The carrier has two compartments that allow for the loading of one slide while another is being shown.

j. Power Cord. (1) PROJECTOR PH–222. The rubber-covered power cord (fig. 16(19)) is 10 feet long, and enters the projector at the bottom of the lamphouse assembly, where an on-off toggle switch (fig. 6(44)) for the lamp is located.

(2) PROJECTOR PH–222–A. A similar rubber-covered cord (fig. 20(AF515)) is provided for Projector PH–222–A, with an on-off switch for the projector lamp set into the cord.

Digitized by Google

Original from UNIVERSITY OF CALIFORNIA

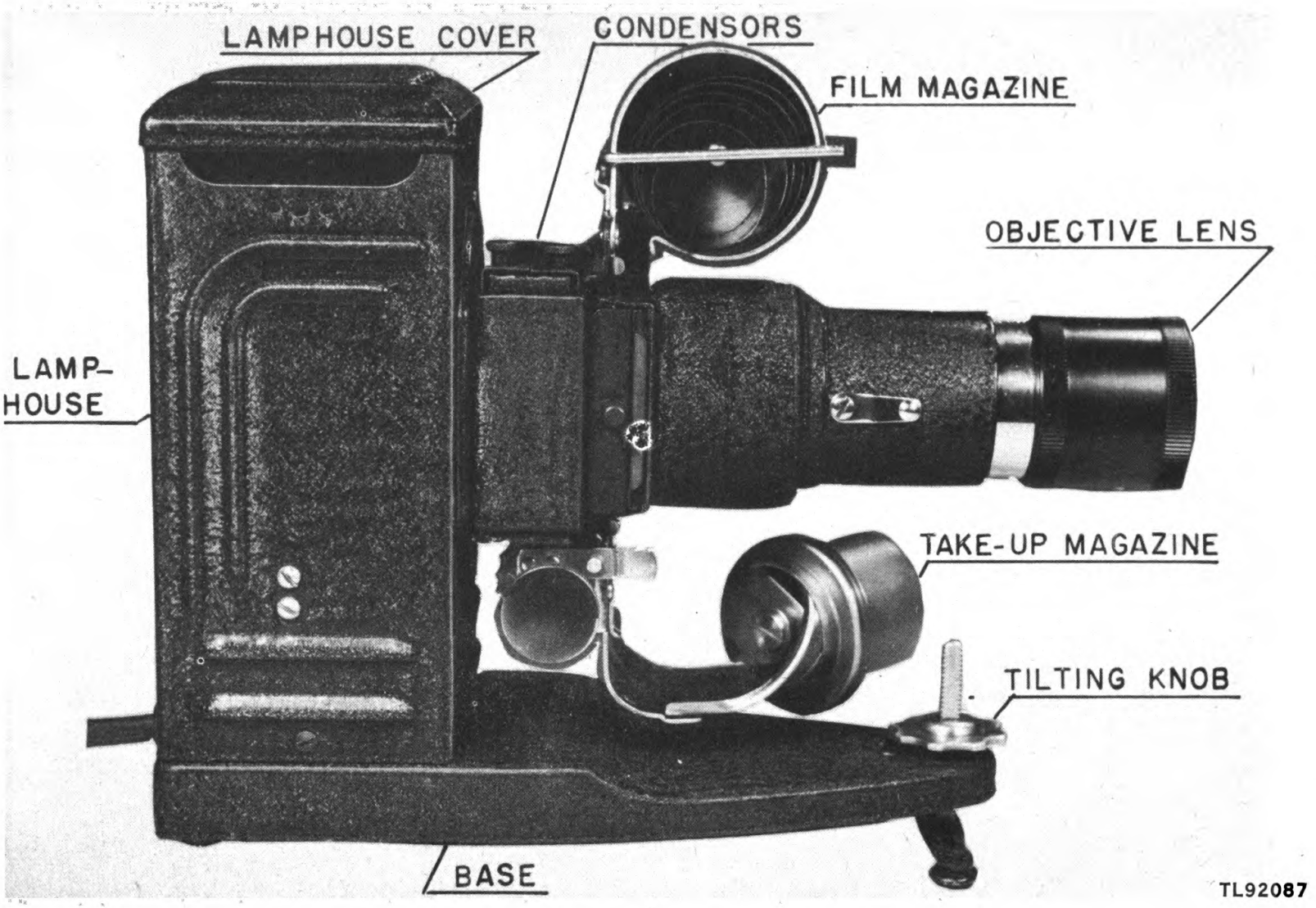


Figure 4. Projector PH–222–A, component parts.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

k. Carrying Case. (1) PROJECTOR PH–222. The case is constructed of heavy plywood covered on the outside with black fabricoid. A handle is provided. The case has space and attachments for the slide carrier and the extra lamp furnished with the equipment as well as space for film cans when needed (fig. 1).

(2) PROJECTOR PH–222–A. Also of plywood, the case for Projector PH–222–A (fig. 2) is finished in olive drab paint. The case has space and attachment for the slide carrier, the extra lamp, and the take-up magazine, all furnished with the quipment, as well as space for film cans when needed (fig. 2).

3. TECHNICAL DATA.

	Projector PH–222	*Projector PH–222–A*
Power supply	110- to 120-v, 220- to 230-v, a-c or d-c, 300-w.	110- to 120-v, a-c or d-c, 200-w.
Lamp required	300-w, T–10 type, 115-v or 230-v with prefocused bayonet mount.	200-w, 115-v, with prefocused bayonet mount.
Projector lens	5-in. anastigmat, and 7-in. anastigmat.	5-in. anastigmat.

4. WEIGHTS AND DIMENSIONS.

Projector	*Width (in.)*	*Depth (in.)*	*Height (in.)*	*Dimensions (lb)*
PH–222	13½	4⅜	9¼	10
PH–222–A	12	5⅜	9	11

Digitized by Google

Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

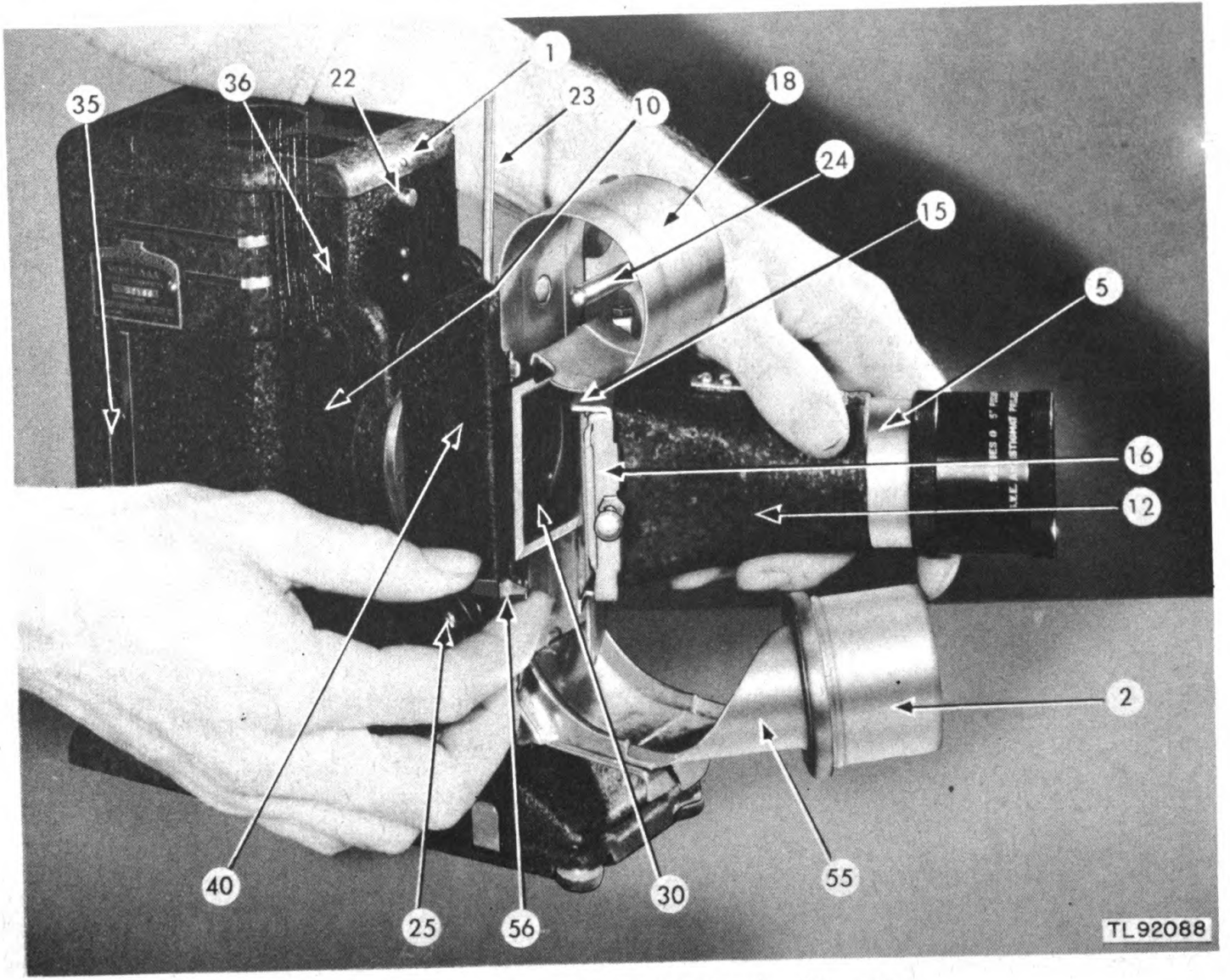


Figure 5. Projector PH–222, showing film gate.

Original from UNIVERSITY OF CALIFORNIA

SECTION II
INSTALLATION AND OPERATION

5. PREPARATION FOR USE.

a. Open the projector case and remove all packing materials.

b. Follow a definite routine in unpacking and setting up the equipment for each showing.

c. Lift the projector from the case and stand it in an upright position on the rubber legs attached to the projector base.

d. Place the projector on a strongly built stand or table well back in the classroom or assembly hall in which the pictures are to be projected. Be sure the projector is mounted high enough that the audience, when seated, will not interfere with the light beam.

e. Loop the power cord of the projector around one leg of the projector stand or table before connecting the cord to the power outlet. This procedure will prevent the projector from being pulled off the stand accidentally.

f. Erect a suitable screen at the front of the classroom or in the position that will afford the best view to the entire audience. Any smooth, white surface may be used for a screen as long as it is perpendicular to the floor. Place the screen in proper position before the arrival of the audience.

g. Remove all dust and foreign matter from the reflector, condenser lenses, aperture pressure glasses, and objective lens with a clean, soft, lint-free cloth.

h. Make sure the toggle switch (fig. 6 (44)) at the rear of the lamphouse on Projector PH–222 is in the OFF position. If Projector PH–222–A is used, make sure the cord switch as shown in figure 2 is in the OFF position.

i. Connect the power cord to an outlet of the voltage specified: 110- to 120-volt alternating current or direct current for Projectors PH–222 or PH–222–A. If a higher voltage is used for Projector PH–222, be sure to change the lamp for one of proper higher voltage. Never use a lamp with higher illumination power than 300 watts for this projector.

j. Check the lamp by throwing the toggle switch at the rear of the lamphouse on Projector PH–222 to the ON position, or the cord switch on Projector PH–222–A to the ON position. Turn the lamp off. Disconnect the cord plug from power outlet.

k. Check the film strip to see that it is properly rewound with the dull side out and the first frame near the beginning of the film.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

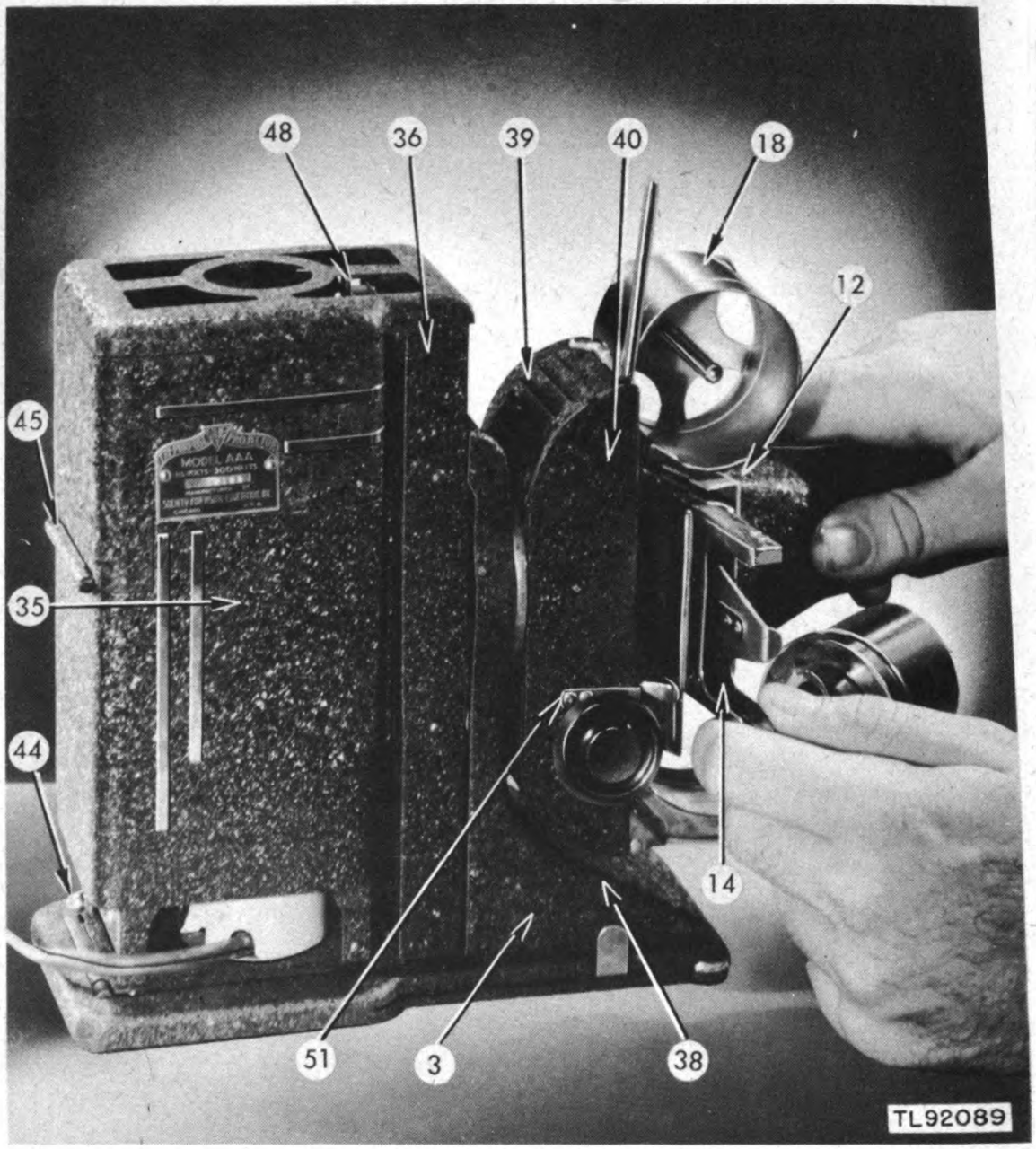


Figure 6. Projector PH–222, installing automatic slide carrier.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

l. Provide means for darkening the room or assembly hall during the showing of the film.

m. Keep a spare lamp at hand at all times so that a quick change can be made if a lamp burns out. Long delays spoil a showing.

6. TABLE OF SCREEN IMAGE SIZES.

a. General. The distance between the projector and the screen determines the size of the projected picture with any given length of objective lens. The farther the projector is from the screen, the larger the projected image will be.

b. Sizes of Images. The following table shows the approximate sizes of pictures obtained on the screen surface with the 5-inch and 7-inch focal length objective lens, at a given distance, using horizontal frames. The proportions are reversed when showing vertical frames. The approximate picture sizes apply equally to Projectors PH–222 and PH–222–A.

Distance from lens in feet	SINGLE FRAME		DOUBLE FRAME	
	5″ Lens	7″ Lens	5″ Lens	7″ Lens
10	1′4″ x 1′10″	0′11″ x 1′4″	1′10″ x 2′7″	1′4″ x 1′11″
15	2′0″ x 2′8″	1′6″ x 1′11″	2′8″ x 4′0″	1′11″ x 2′11″
20	2′8″ x 3′7″	1′11″ x 2′8″	3′7″ x 5′5″	2′7″ x 3′11″
25	3′6″ x 4′7″	2′6″ x 3′4″	4′7″ x 7′0″	3′4″ x 4′11″
30	4′0″ x 5′5″	2′11″ x 3′11″	5′5″ x 8′0″	3′11″ x 5′11″
35	4′10″ x 6′5″	3′7″ x 4′8″	6′5″ x 9′7″	4′6″ x 6′10″
40	5′6″ x 7′4″	3′11″ x 5′4″	7′4″ x 11′0″	5′2″ x 7′10″
45	6′2″ x 8′2″	4′6″ x 6′0″	8′10″ x 12′5″	5′10″ x 8′8″
50	6′10″ x 9′0″	4′11″ x 6′7″	9′10″ x 13′7″	6′5″ x 9′7″

These figures are in height and width sequence.

7. PRECAUTIONS DURING OPERATION.

a. Turn off room lights after the audience has been seated and keep the room as dark as possible during the showing of the film in order to obtain brilliant, clearly defined projections on the screen.

b. Turn off the lamp when the last frame of the film strip or the last 2-inch by 2-inch slide in the series has been shown.

c. Be sure to replace the correct lid on the can from which the film was taken and to which it is being returned. A mistake at this point will cause endless trouble to other operators.

8. THREADING.

a. Single-frame Film, 35-mm. (1) Place the take-up magazine (figs. 8(2) and 10(AF457)) in position by inserting the stud (fig. 8(20)) of the

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

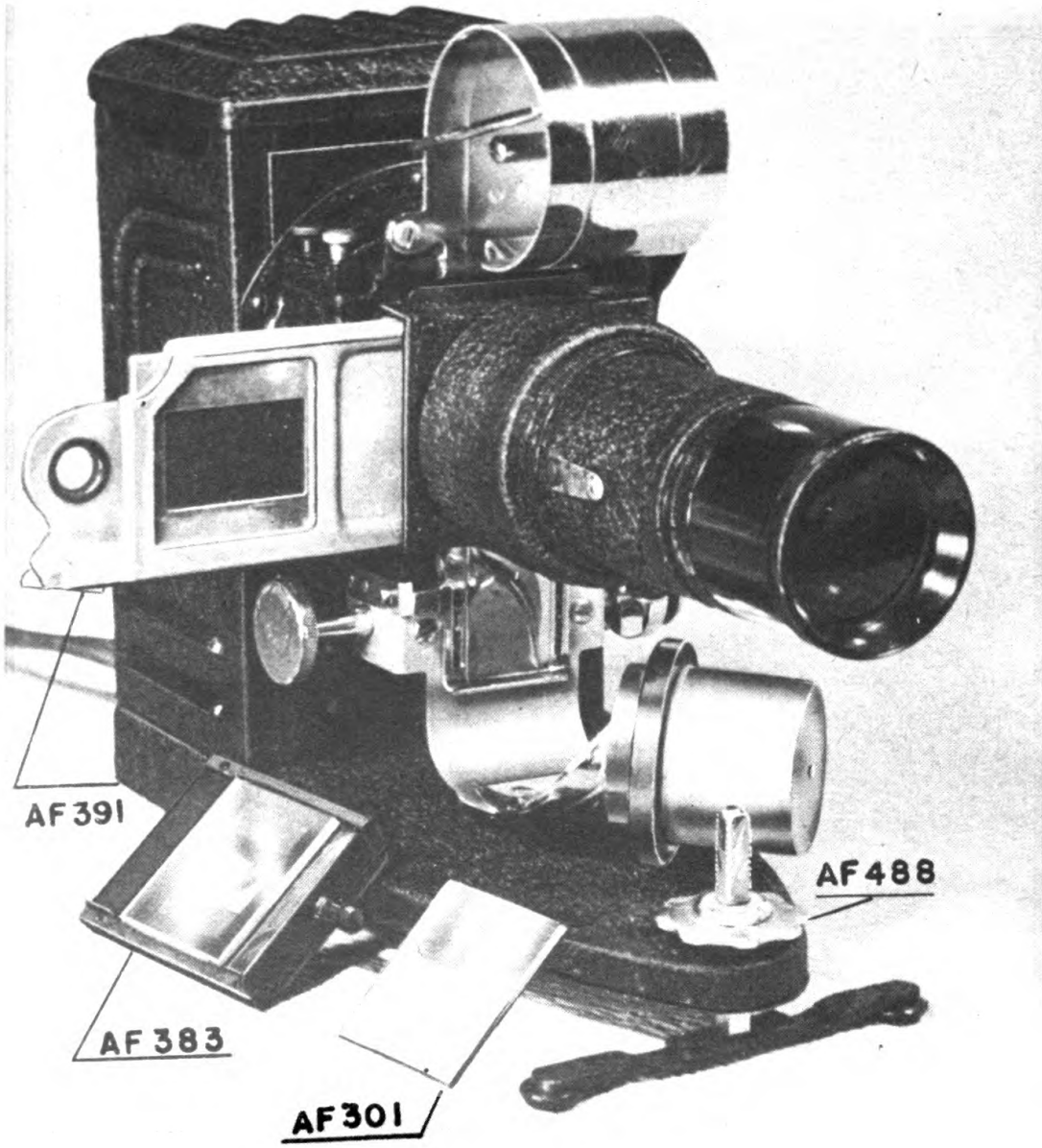


Figure 7. Projector PH–222–A, with slide carrier in place.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

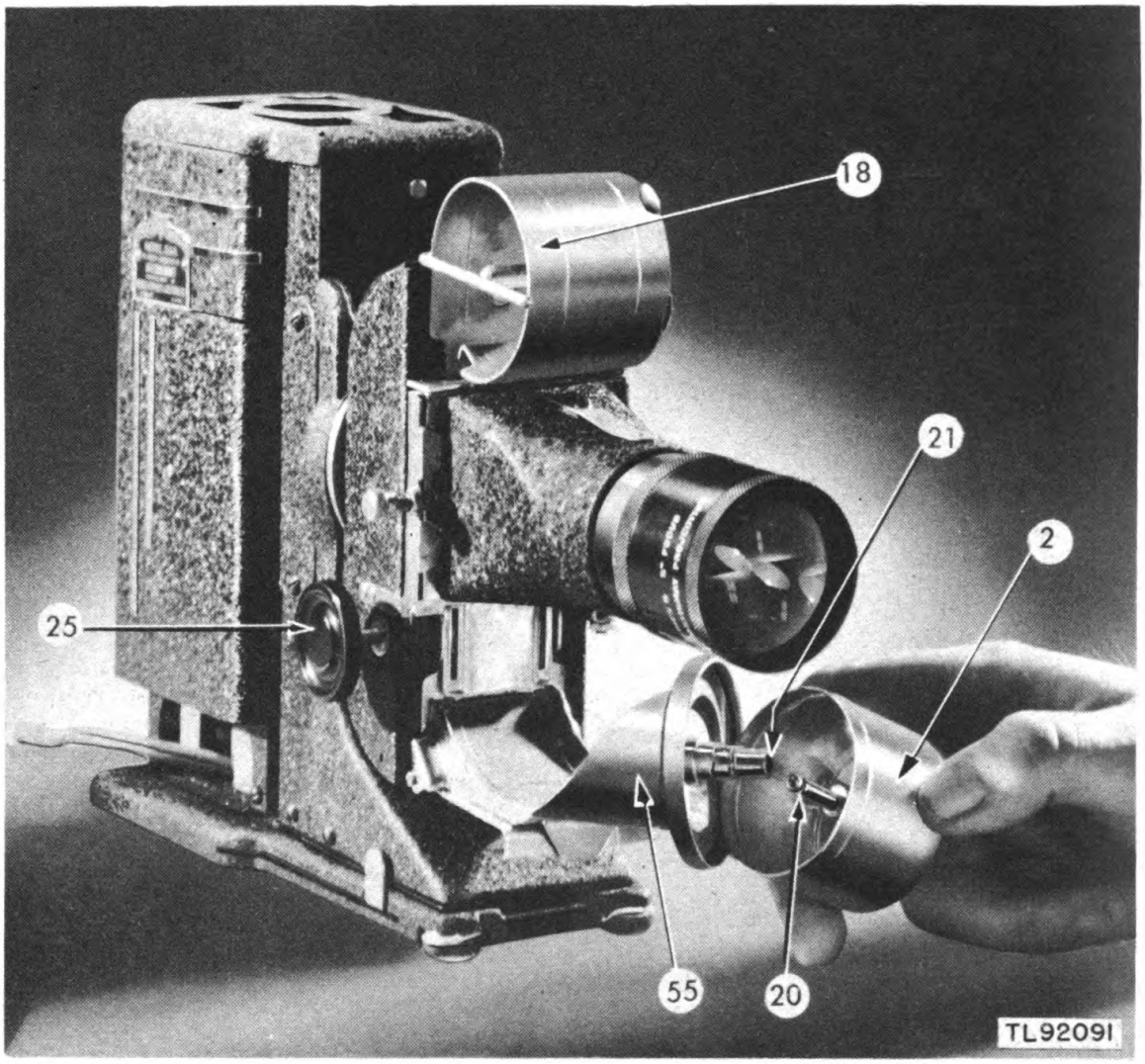


Figure 8. Projector PH–222, installing take-up can.

magazine into the bearing hole (fig. 8(21)) at the front end of the take-up mechanism (figs. 8(55) and 19(AF457)). Push the can in until a snap is heard.

(2) Open the film gate by releasing the catch spring (figs. 5(56) and 10(AF339)) and swinging the objective lens housing (figs. 5(12) and 21(AF448)) to the left.

(3) Unwind about 4 inches of film strip from the roll to be shown. Raise the film-retaining bar (fig. 5(23)) and insert the free end of the film in the slot of film feed track with emulsion (dull side) toward the lamp. At the same time, place the roll of film (fig. 11(54)) on the axis bar (fig 11(24)) of

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

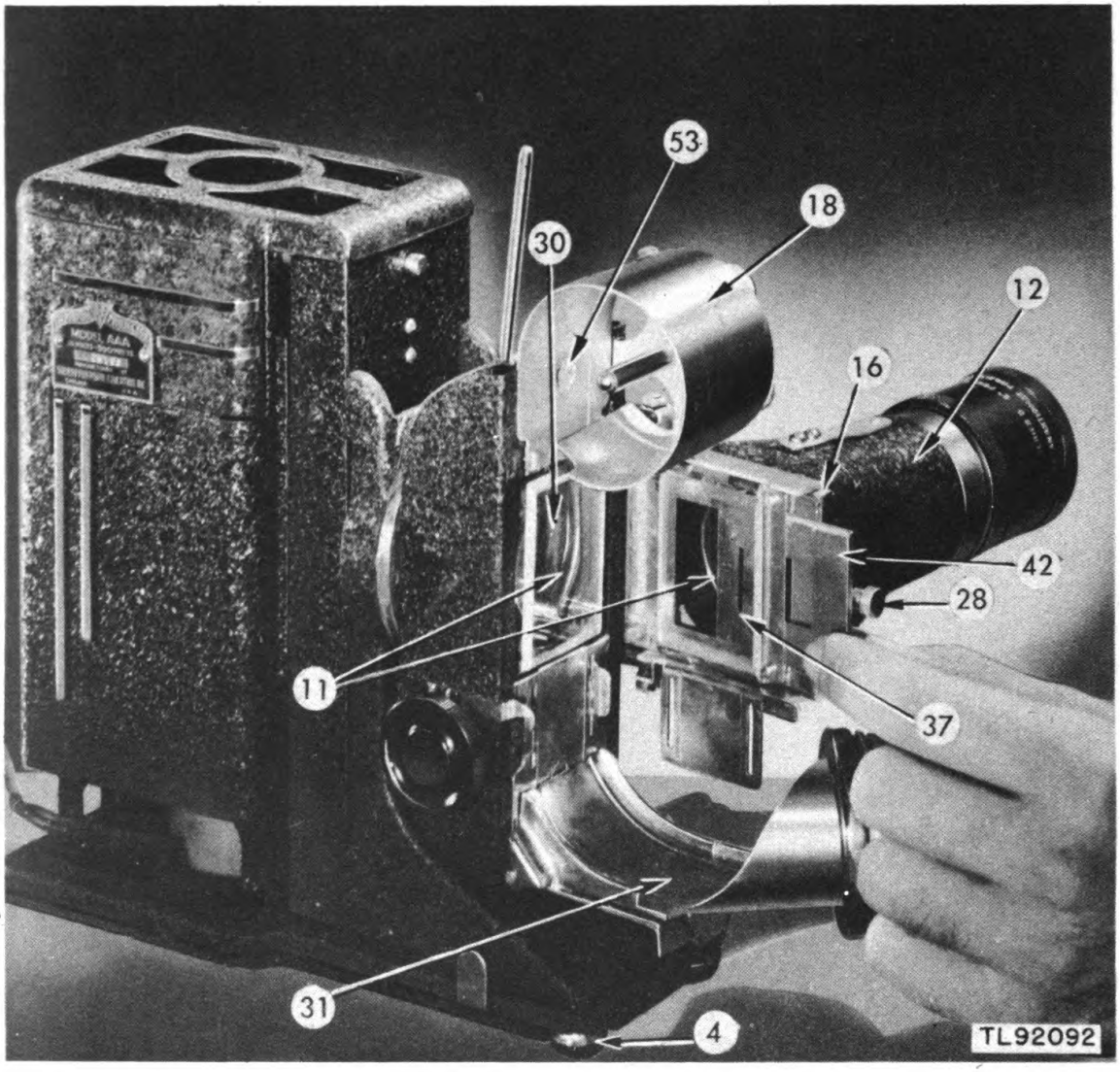


Figure 9. Projector PH–222, removing front aperture mask.

the upper film magazine (fig. 11(18)) and then pull down the retaining bar (fig. 11(23)).

(4) Place the sprocket holes in the loose end of the film over the sprocket teeth (fig. 11(26)) and hold in position while closing the film gate by bringing the objective lens housing (fig. 5(12)) back into place.

(5) Feed the film by turning the operating or sprocket feed knob (fig. 11(25)) until the film begins to enter the take-up can.

(6) Lead the loose end of the film into the take-up can, making certain that it is secured firmly under the guide ledger and that it does not bind.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

b. Double-frame Film, 35-mm. (1) When using double-frame 35-mm film (1-inch by 1½-inch), remove the front aperture mask (figs. 9(42) and 10(AF327)) for single-frame 35-mm film (¾-inch by 1-inch) from the aperture plate assembly (figs. 9(11) and 10(AF383)).

(2) Grasp the metal edge of the single-frame mask (figs. 9(42) and 10(AF327)) and slide it completely out of the mask frame.

(3) If double-frame vertical pictures are to be shown, leave the projector head in its usual position.

(4) If double-frame horizontal pictures are to be used, give the projector head a quarter-turn (fig. 12).

9. FOCUSING.

a. Darken the classroom or assembly hall. Plug the connecting cord into the power outlet and turn on the lamp in the projector.

b. Line the projector up so that the projection will be centered on the screen.

c. Raise or lower the projection on the screen by moving the tilting lever (fig. 13(27)) at the side of the base of Projector PH–222, or by turning the tilting knob (fig. 4) on the front of the base of Projector PH–222–A.

CAUTION: Never tilt either projector from the vertical more than the lever in Projector PH–222 or the tilting knob in Projector PH–222–A will allow, or the filament, softened by the intense heat, will sag out of position or possibly will short-circuit. Set the projector on a higher base if more elevation is desired.

d. Pull out the objective lens (figs. 13(52) and 18(AF446)) at the end of the lens barrel about 2 inches, and turn the operating or sprocket feed knob (figs. 11(25) and 10(AF399)) until the image appears on the screen.

e. Rotate lens clockwise or counterclockwise until a sharp image appears on the screen.

10. FRAMING.

a. Projector PH–222.(1) FORWARD SEQUENCE. Push in the operating knob (fig. 11(25)) and turn clockwise. When the image is properly framed, release the knob. Turn the knob one-quarter turn clockwise to move the film strip from the title frame to each succeeding frame as desired. The special mechanism in the film advancing unit will stop the picture on each frame in proper position for projection.

(2) REVERSE SEQUENCE. To reverse the direction or to repeat a picture, turn the operating knob counterclockwise. Do not reverse the film unless absolutely necessary.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

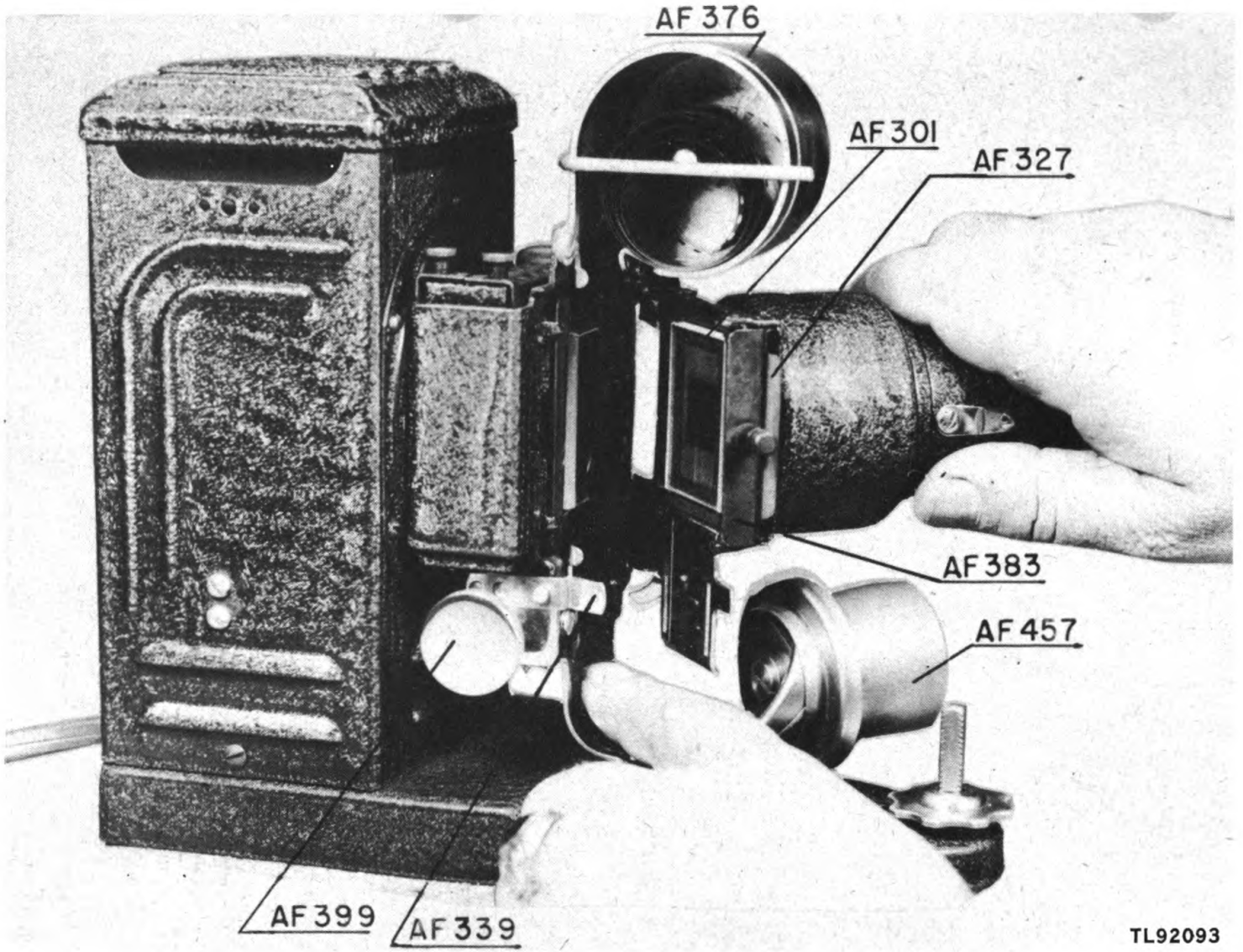


Figure 10. Projector PH–222–A, threading projector.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

CAUTION: This projector is equipped with receding rear aperture pressure glass and automatic film stop. If the picture is framed improperly and the operating knob is held in improper position between stops, the rear aperture pressure glass will remain open, the film will not be held flat in its proper position, and the projector image will be out of focus.

b. Projector PH–222–A. (1) FORWARD SEQUENCE. Adjust by pressing down on the framing lever (fig. 14(AF396)). A clutch built into the film-feeding mechanism allows the film sprocket to be disengaged from the indexing cam for framing. Turn the operating or feed knob (fig. 10(AF399)) until the frames line up and then raise the framing lever (fig 14(AF396)). Continue to turn the knob clockwise for picture sequence.

(2) REVERSE SEQUENCE. Turn the knob counterclockwise to reverse the direction or to repeat a picture.

CAUTION: As the film is being advanced in either projector, make certain the take-up can starts to rotate. To insure proper take-up, give the take-up can a slight turn clockwise. This allows for automatic rewind and prepares the film for the next showing.

11. REWINDING FILM.

a. When the last frame has been projected, a few inches of blank leader will remain in the projector above the aperture gate. Turn this through the projector until the last sprocket holes have passed the film sprocket holes.

b. If the projector is equipped with the usual automatic take-up mechanism (figs. 8(55) and 19(AF457)) and can (figs. 8(2) and 19(AF456)), the film will be rewound when the showing is finished. Transfer the film roll from the take-up can to the packing can from which the film was taken earlier.

c. If for some reason the take-up mechanism and can are missing, roll the film gently from the last frame to the first, emulsion side out. Grasp the edges of the film between the thumbs and index fingers in doing this. Keep the roll small at the beginning and throughout this rewinding procedure. Never reduce the size of the film roll by holding the center of the roll and pulling on the free end. This will scratch and mar film surfaces.

12. USE OF SLIDE CARRIER.

a. Projector PH–222. (1) Open film gate (fig. 5(15)) by swinging the lens barrel (fig. 9(5)) to the left.

(2) Remove front aperture mask frame (fig. 9(16)) by pulling knob (fig. 9(28)) on this frame to the right and away from the film gate.

(3) Remove rear aperture pressure glass (fig. 9(30)) by grasping its sides with thumb and forefinger and lifting the lower end from the trough.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Figure 11. Projector PH–222, threading projector.

Digitized by Google
Original from
UNIVERSITY OF CALIFORNIA

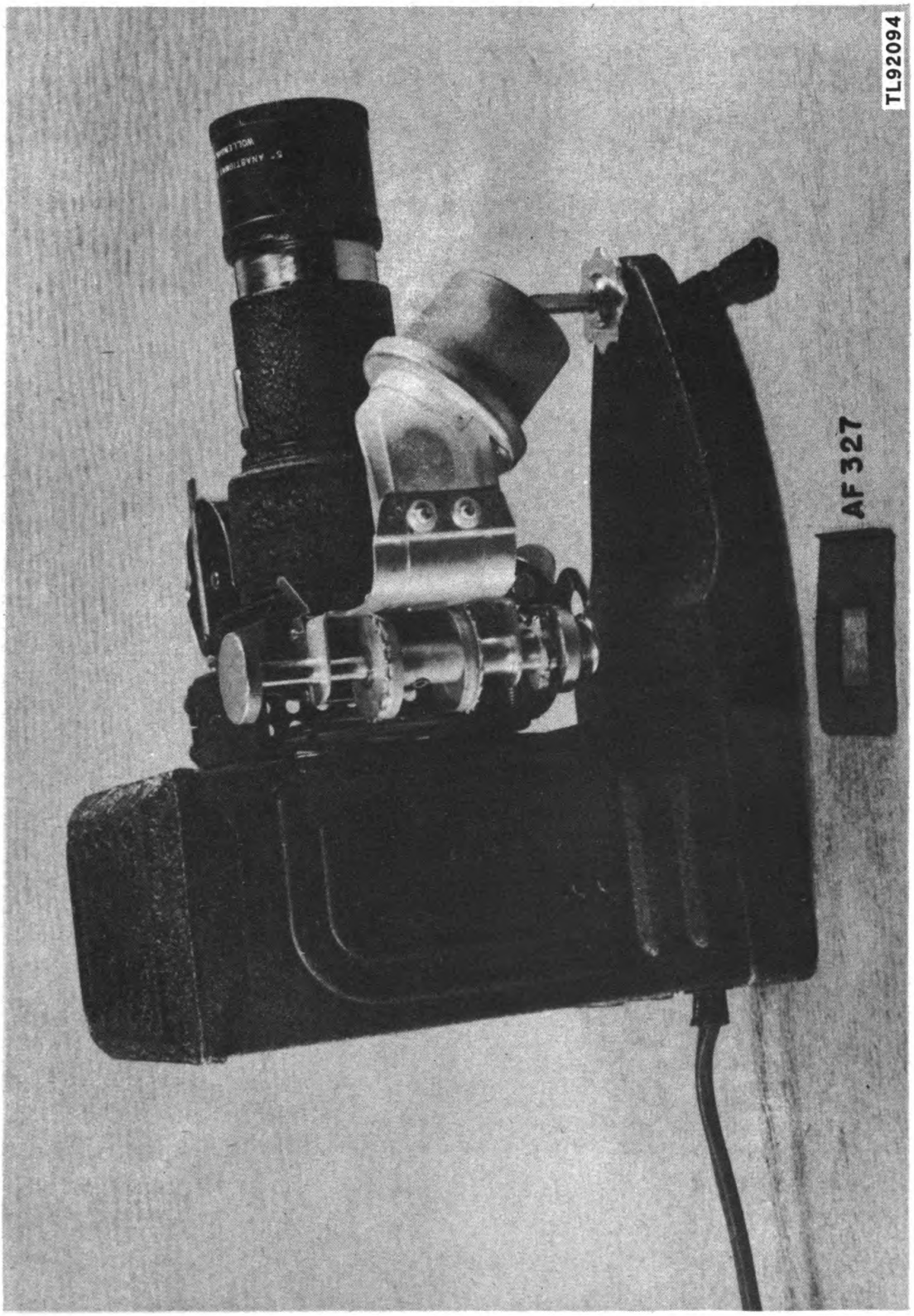


Figure 12. Projector PH–222–A, set for double-frame film.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

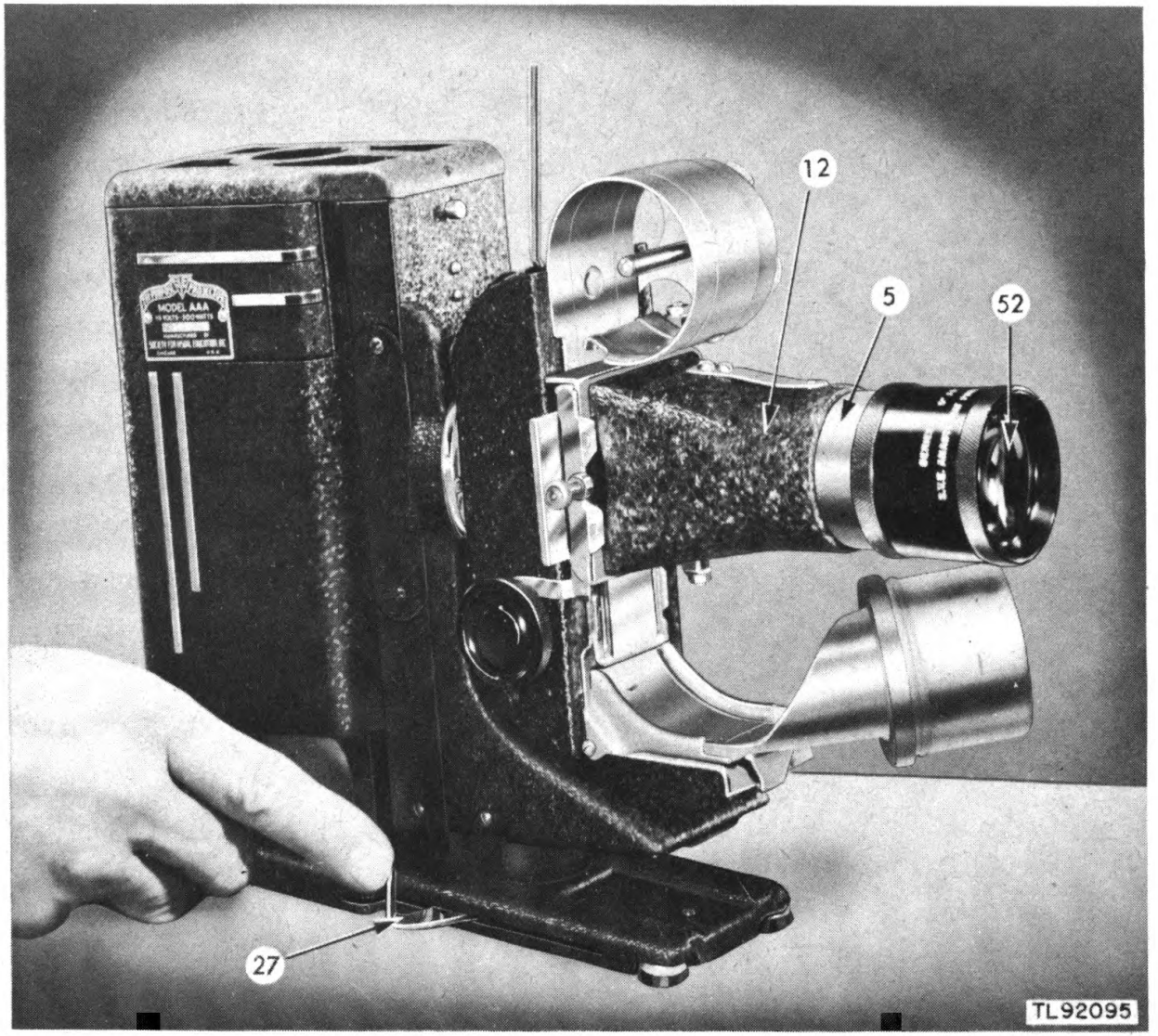


Figure 13. Projector PH–222, screening the image with tilting lever.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

(4) Place the semiautomatic slide carrier (fig. 6(14)) in the film gate (fig. 5(15)) by inserting the small pin on the carrier into the receiving hole and closing the gate.

(5) Revolve head of projector 90°. The slide carrier will then be in a vertical position, ready for operation.

(6) Hold up the operating handle and insert the slide on the front of the carrier. Push the operating handle all the way down to unseat the slide. The image will not be visible until the handle is pulled up. Then raise the slide carrier to its original position. Focus image on the screen as described in paragraph 9.

(7) Place the second slide on the front of the carrier and repeat the operation outlined above. The first slide will be ejected on the back of the carrier. Remove this slide before a third slide is inserted. Slides will jam if not removed.

(8) To remove the last slide in the series, push the slide carrier down and raise to top position.

(9) Remove the slide carrier and replace the aperture pressure plates, reversing the procedure given above.

b. Projector PH–222–A. (1) Slide out the aperture plate assembly (fig. 10 (AF383)), thus removing the front film pressure glass (fig. 10 (AF301)).

NOTE: In Projector PH–222–A, do not revolve projector head 90° to bring the slide carrier into a vertical position. The slide carrier in this model is operated horizontally.

(2) Open the hinged film-holder housing (fig. 7(AF391)) by pulling back on the spring clip lock (fig. 10(AF339)).

(3) Remove the rear film pressure glass by sliding it out along its guides on the rear of the film-holder housing.

(4) Before placing the slide carrier into the projector, engage the framing lever (fig. 14(AF396)) by pushing down on the lever.

(5) Close the hinged film-holder housing and insert the slide carrier (fig. 7(AF391)) into the housing as indicated. Stops mounted on the bottom ends of the slide carrier swing out of the way when the carrier is placed in the projector. When the carrier comes through the film housing, the stops swing down and act as limit stops.

(6) Place the slides in the carrier upside down and reversed to get proper projections.

(7) To frame the slide correctly, move the carrier to either limit stop. Focus the image on the screen as described in paragraph 9.

(8) To remove the slide carrier, swing either limit stop out of the way.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

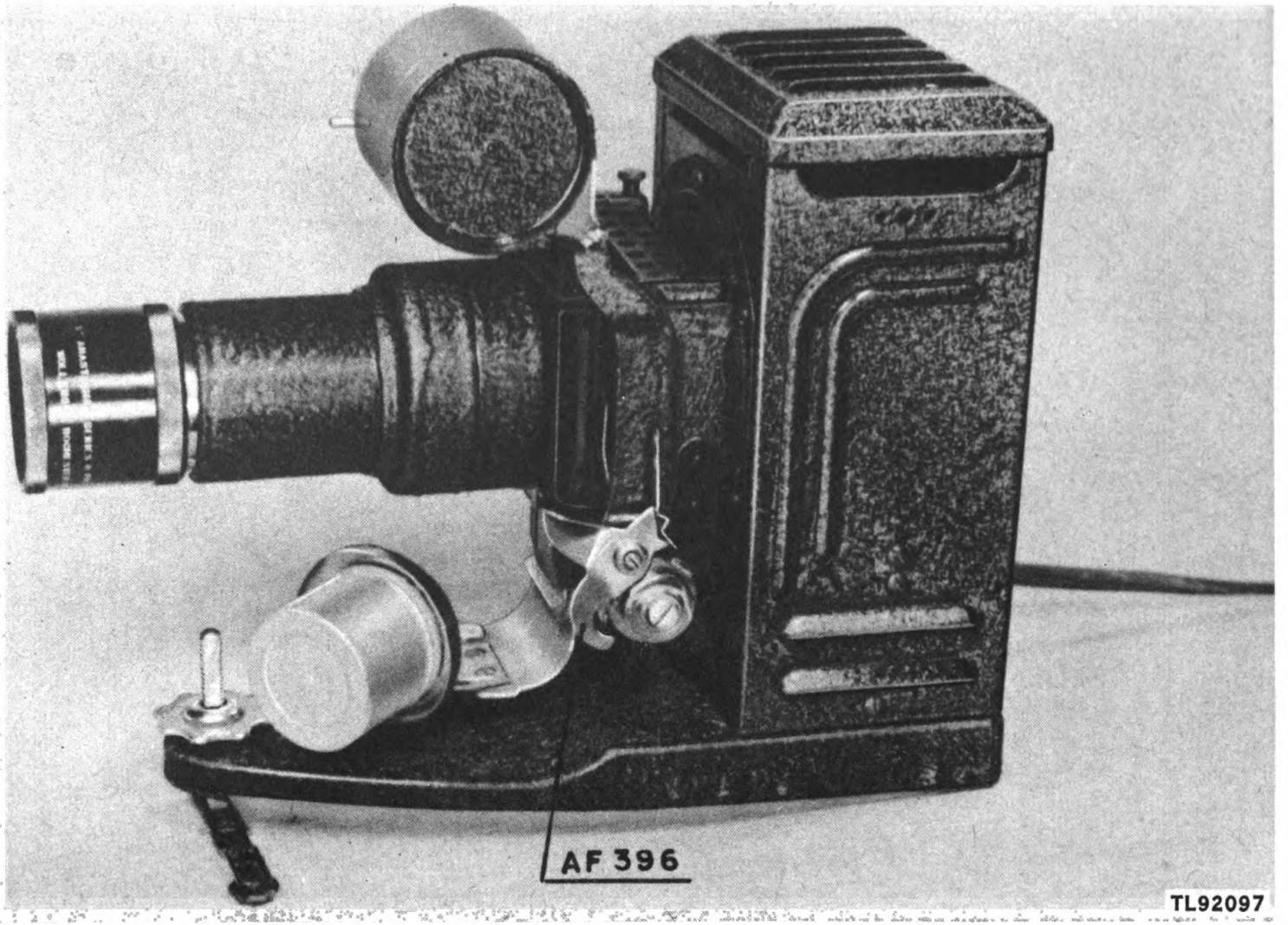


Figure 14. Projector PH–222–A, framing lever.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

SECTION III
FUNCTIONING OF PARTS

13. GENERAL.

a. The function of this equipment is to project on a screen greatly enlarged images from single-frame or double-frame film strips, or from 2-inch by 2-inch miniature slides.

b. The equipment has limitations as to the size of picture it will project clearly under various conditions. If it is used outdoors or indoors where the audience area and the screen are reasonably well-lighted by daylight, the projected picture size must be reduced by moving the projector nearer the screen. Otherwise, the details of the picture will not be clear. In a well-darkened class or assembly room, or even outdoors at night, it should be possible to project a brilliant picture as large as 10 feet in width, or larger.

14. PROJECTION OF IMAGES.

a. Photographic images may be projected onto a screen by inserting the transparent medium containing the photographic image between the light source and a lens which can be so adjusted that all of the light passing through each point of the translucent object is brought to a focus at corresponding points on the screen.

b. The process of adjusting the distance between the transparency and the lens to form a sharp projected image upon the screen is termed *focusing*. Instructions outlined in paragraph 9 can be followed easily.

c. It is extremely important that the screen be mounted at right angles to the center of the line of projection. Otherwise, it will be impossible to obtain a clear focus of the picture at both edges of the screen and at the center simultaneously.

15. PARTS AND THEIR FUNCTIONS.

a. Projector Lamp. The lamp is the source of illumination for the picture.

b. Reflector. The reflector, located to the rear of the projector, increases the effective illuminations.

c. Condenser Lenses. The series of condenser lenses in front of the lamp in each projector concentrates the light on the aperture in which the film strip or miniature slide is placed for projection.

d. Heat-absorbing Glass. This glass in both projectors absorbs and dissipates sufficient heat from the projector lamp to protect the film.

e. Aperture. The aperture in the aperture plate assembly is a rectangular opening, varied in size according to the type of film strip or minia-

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

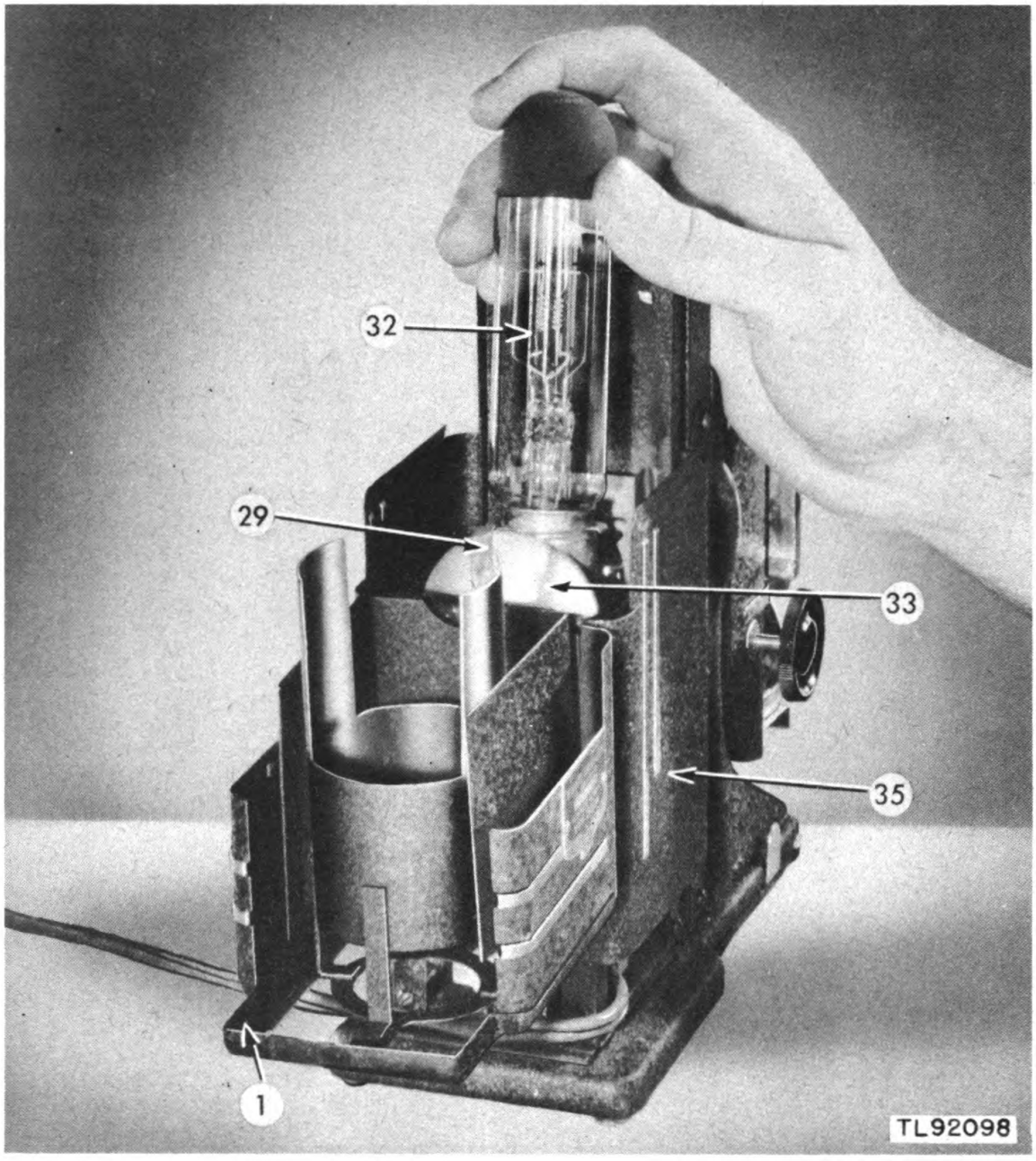


Figure 15. Projector PH–222, replacing projector lamp.

ture slide to be projected. It limits the light beam to the proper size required for the illumination of the picture to be projected.

f. Aperture Pressure Glasses. The aperture pressure glasses hold the film flat and in focus while the film strip is being projected. A mechanical device releases this pressure while the film strip is traveling from one frame to the next.

g. Objective Lens. The objective lens focuses the projected picture on the screen.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

SECTION IV
MAINTENANCE

NOTE: Failure or unsatisfactory performance of equipment will be reported on W. D., A.G.O. Form No. 468. Send the form through channels to the Office of the Chief Signal Officer, Washington 25, D. C. If this form is not available, see TM 38–250.

---

16. CLEANING.

a. Routine Cleaning. Certain routine cleaning operations for Projectors PH–222 and PH–222–A, to be accomplished each time the projector is used, include the following;

(1) Wipe the dust or corrosion from outer surfaces of the projector and case (figs. 1 and 2).

(2) Wipe the film channel and the front and rear aperture glasses (figs. 9(37) (30) and 18(AF301)).

(3) Wipe the front and rear surfaces of the objective lens (figs. 13(52) and 18(AF446)) with either lens tissue or a fine camel's hair brush.

b. Projector Lamp. The life of the projector lamp filament is approximately 25 hours, unless otherwise specified on the lamp. Dark lines on the projected image may be caused by a cracked lens or by a lamp bulb which is installed so that the filament is not at right angles to the optical system. All dirt or foreign matter that cannot be removed by lens tissue alone may be removed by using a swab dipped in Solvent, Dry Cleaning, Federal Spec. No. P–S–661a, then wiping away the foreign matter. Do not use any metal object in cleaning glassware. The projector lamp should be replaced if its filament is sagged or its bulb is darkened to a point level with the filament. The procedure for removing the projector lamp will include the following:

(1) To remove and replace the projector lamp (figs. 15(32), first pull out the lamphouse cover as described in subparagraph *d.* below.

(2) Grasp lamp, exert a slight downward pressure, and turn counterclockwise.

(3) Remove for inspection and cleaning.

(4) Replace by reversing this procedure.

c. Lamphouse Lenses in Projector PH–222. (1) Wipe reflector (fig. 15(33)) with clean, lintless linen cloth, lens tissue, or similar material.

(2) Remove the concave-convex (or meniscus) lens and holder (fig. 17(6)) by sliding holder up and out of guide channels. Wipe lens and replace.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

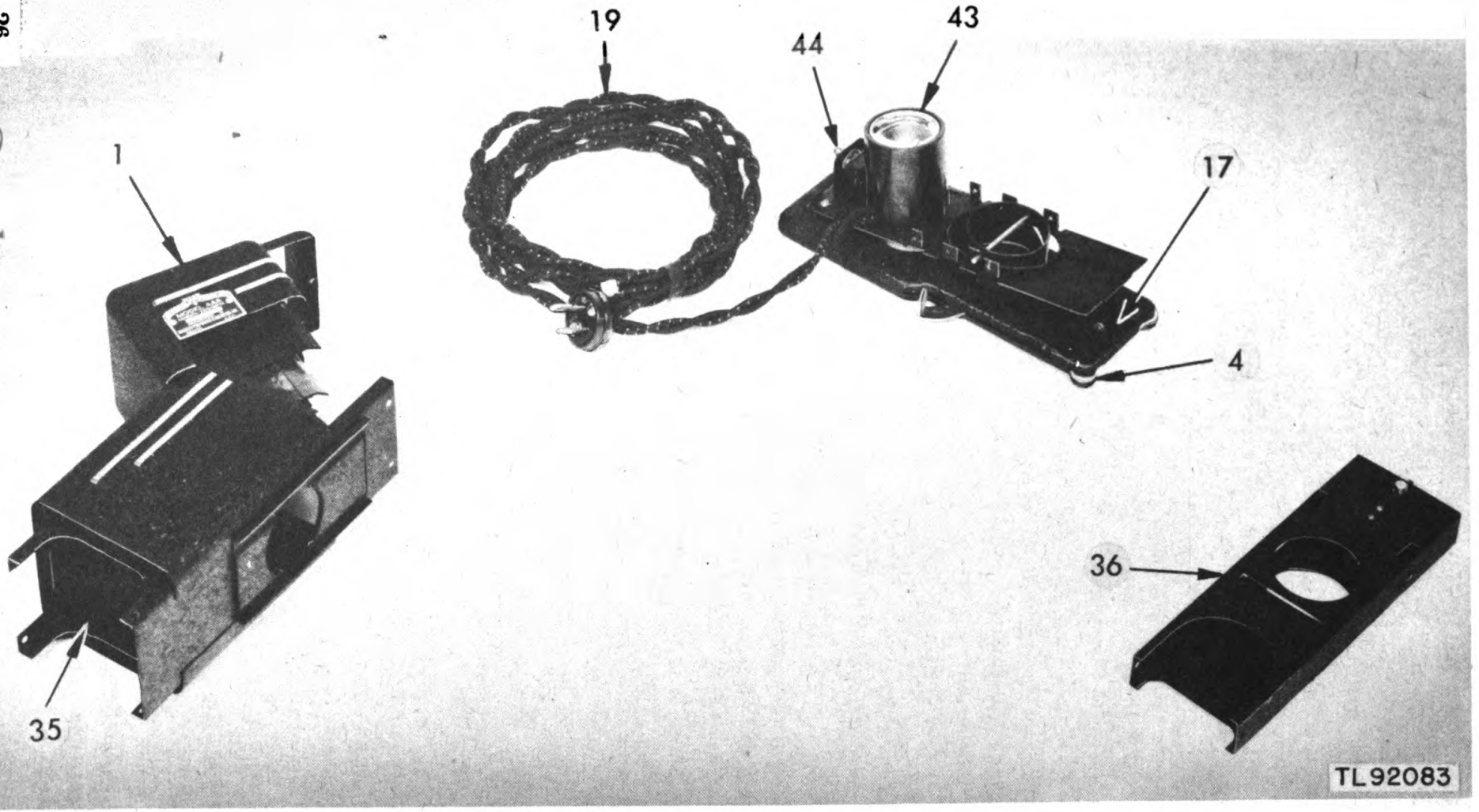


Figure 16. Projector PH–222, base and lamphouse disassembled.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

CAUTION: Never use alcohol or other solvents when cleaning lenses, as solvents may penetrate between holder and lens and separate the elements. Spots may be removed by breathing on lens and then wiping with lens tissue or lintless cloth.

(3) Remove the three sets of screws (fig. 3(34)) that hold the condenser housing (fig. 3(36)) and the condenser-housing side cover (fig. 3(10)) to the lamphouse (fig. 3(1) and (35)). Pull out the plano-convex condenser lens (fig. 17(7)), its holder (fig. 17(7)) and the heat-absorbing glass (fig. 17(8)). Clean the lenses and the filter and replace.

(4) Wipe projector lamp (fig. 15(32)) carefully, replace and close the lamphouse.

d. Lamphouse Lenses in Projector PH–222–A. (1) First remove the lamphouse cover (fig. 4) that telescopes into the lamphouse (fig. 4). The cover comes out easily.

(2) Loosen the locking screws that hold the convex-concave condenser lens (fig. 18(AF434)) in place on its frame that, in turn, is set in guides attached to the lamphouse cover (fig. 20(AF422)).

(3) Slide out condenser lens mount.

(4) With the condenser lens mount removed for cleaning and inspection, check and clean the reflector (fig. 21(AF430)) and the heat-absorbing glass (fig. 19(AF439)) in place.

(5) Do not remove the locking screws holding the lens and glass in place. Loosening the screws permits the condenser-lens mount to be pushed up and over the locking screws.

e. Main Frame Condenser Lens, Aperture Pressure Glasses, and Objective Lens in Projector PH–222. (1) Pry off the top cover (fig. 6(39)) of the main frame assembly (fig. 6(40)) with a key or coin, pull up on the condenser holder and remove the bi-convex condenser lens (fig. 17(9)) for cleaning. In replacing this lens, be sure the surface of greatest curvature is toward the lamphouse, and the lens is in the condenser-holder groove nearest the film or front of the projector.

(2) Open the film gate (fig. 5(15)) and remove rear-aperture pressure glass (fig. 5(30)) by lifting glass upward against the spring. When the aperture pressure glass is free of the small groove on the bottom of the carrier of the rear-aperture pressure glass, pull the bottom of the aperture pressure glass away from the projector and the glass will be free. Wipe clean on both sides and replace.

(3) Unhook the assembled masking device (fig. 9(16)) and front-aperture pressure glass (fig. 9(37)) from the film gate (fig. 5(15)), clean, and replace.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

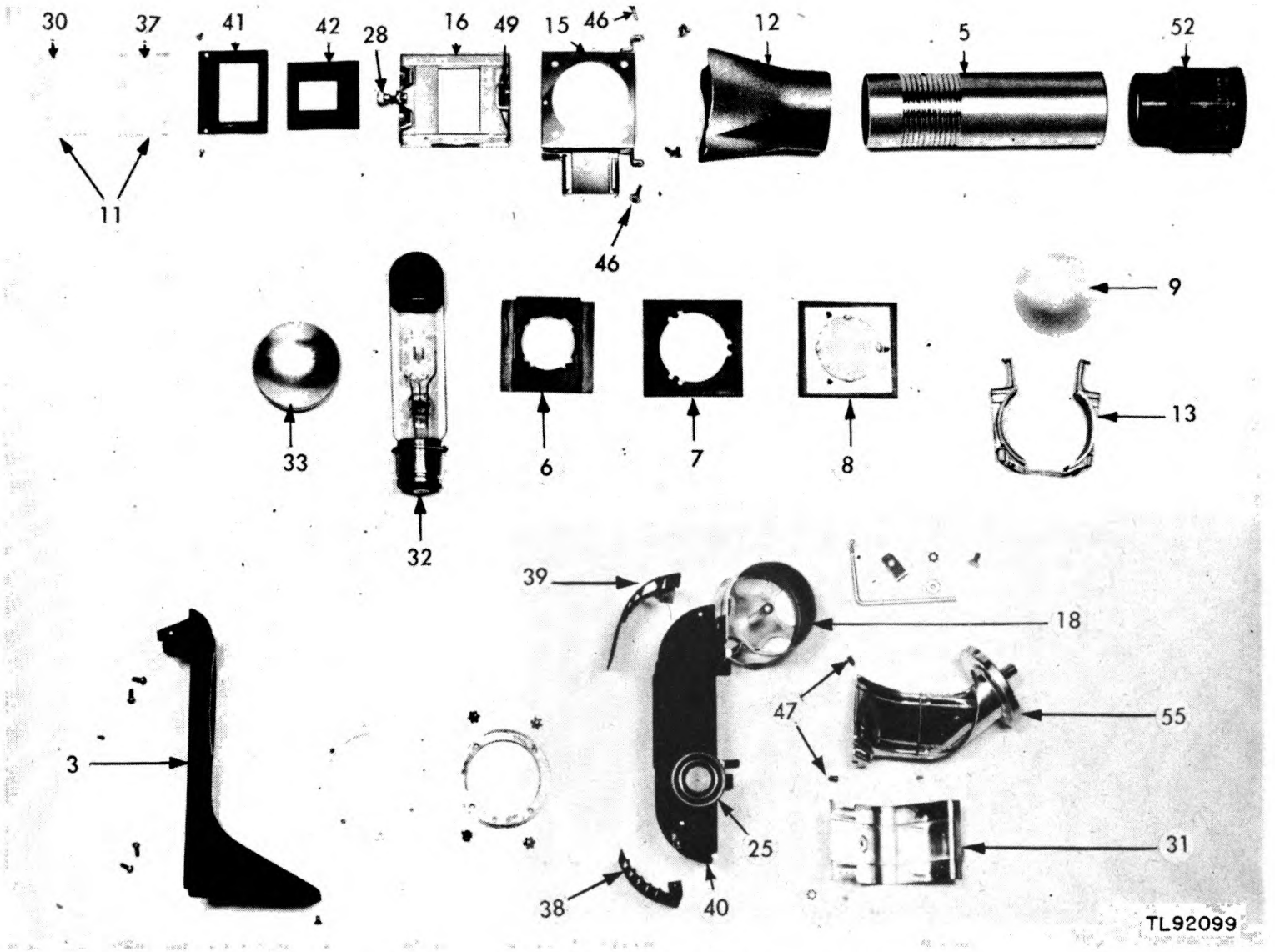


Figure 17. Projector PH–222, disassembled.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

(4) To clean the objective lens (fig. 13(52)) remove the entire lens barrel (fig. 5(5)) and wipe exposed glass at each end of the barrel. Do not remove elements of the objective lens as they are sealed in place.

f. Condenser Housing Lenses in Projector PH–222–A. (1) Note that the top of the lens frames are marked 2 and 3, with No. 2 lens nearest the lamphouse. Always replace lenses in their original positions to insure proper projections.

(2) Remove knurled screws (fig. 21(AF398)) that hold condenser-lens frames in condenser housing.

(3) Lift out the two bi-convex condenser lenses (fig. 21(AF436) and (AF437)) for inspection and cleaning.

(4) Carefully replace the lenses in their proper order.

g. Aperture Pressure Glasses in Main Frame and Objective Lens of Projector PH–222–A. (1) Swing back film-holder housing (film gate) by pulling back spring clip lock (fig. 10(AF339)).

(2) Remove rear-aperture pressure glass (fig. 18(AF301)) by sliding it out along its guides.

(3) Clean and return the glass to its proper position.

(4) Slide out aperture holder (fig. 18(AF383)) and remove front-aperture pressure glass (fig. 18(AF301)) by pushing it out along its guides. The front-aperture pressure glass (fig. 18(AF301)) is mounted in slides to the aperture mask holder.

(5) Clean the glass and return it to its proper position.

(6) To clean the objective lens (fig. 18(AF446)), remove from the lens holder (fig. 21(AF448)) for inspection and cleaning. Wipe exposed glass at each end of the barrel. Do not remove elements of the objective lens, as they are sealed in place.

17. REPLACEMENT OF HEAT-ABSORBING GLASS.

a. In case of burning or buckling of film, remove and check the heat-absorbing glass (figs. 17(8) and 18(AF439)). Any obvious defect in the glass will require replacement of the glass to prevent further damage to film.

b. To remove the glass (fig. 17(8)) from Projector PH–222, follow the instructions given in paragraph 16*c*(3).

c. To remove the glass from Projector PH–222–A, follow the instructions given in paragraph 16*d*, with the exception of the last step. Loosen and remove the locking screws that hold the glass in place. Lift out for inspection and replacement.

18. LUBRICATION.

No lubrication is required for Projectors PH–222 and PH–222–A.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

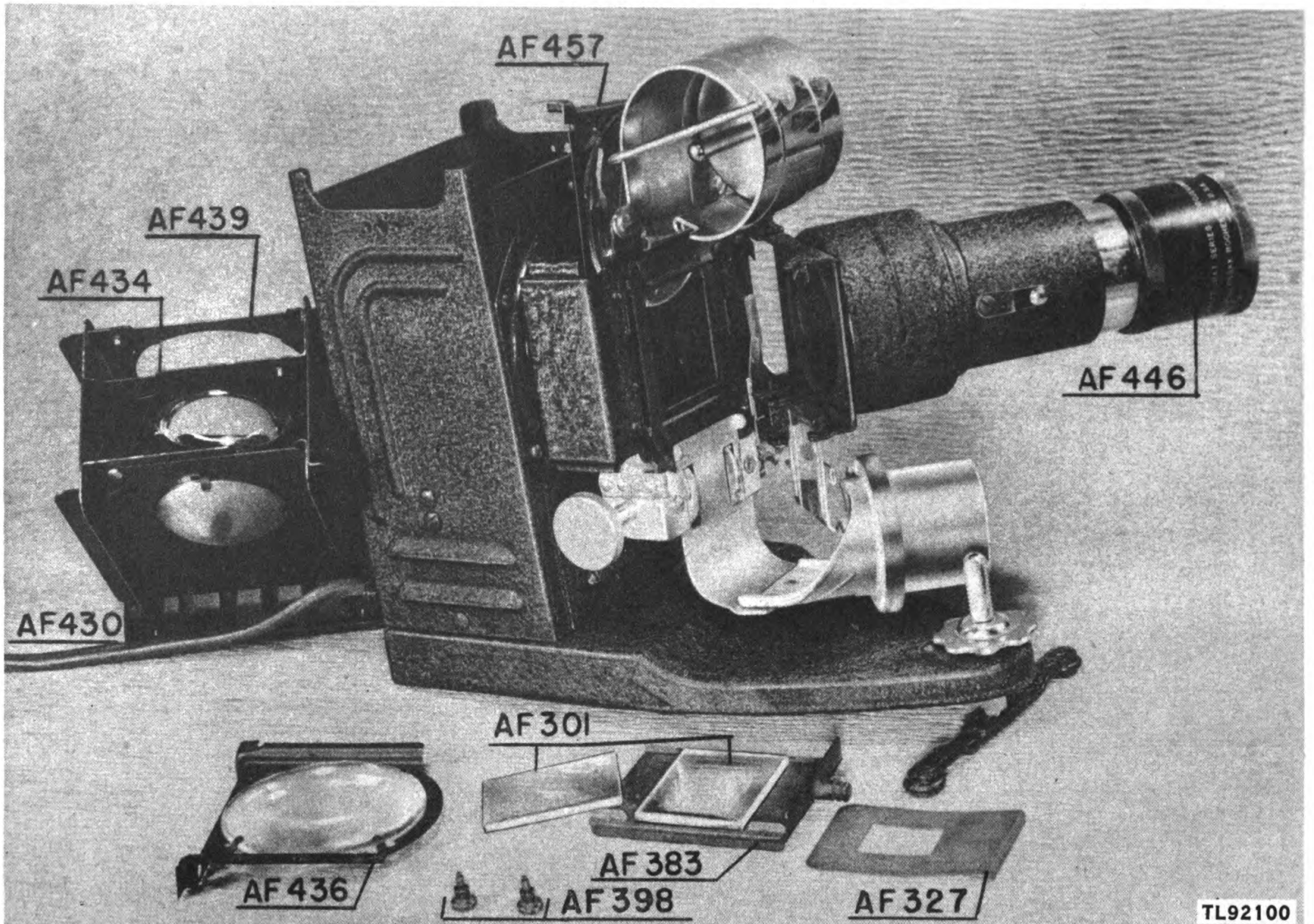


Figure 18. Projector PH–222–A, optical system.

Original from UNIVERSITY OF CALIFORNIA

19. MOISTUREPROOFING AND FUNGIPROOFING.

a. During operation, Projectors PH–222 and PH–222–A reach a very high temperature. Because of this fact, fungus growth is inhibited and moisture is driven from the projectors.

b. If, after initial use, the projectors are idle for more than 24 hours, turn on the projector lamp to drive out the condensed moisture and to prevent fungus growth, if conditions warrant.

20. DISASSEMBLY FOR REPLACEMENT OF PARTS.

It is seldom necessary to disassemble any portion of the projectors except to replace parts which have been damaged by rough handling. When disassembling various units for inspection or repair, care should be taken to observe the order in which they are taken apart. Take one assembly apart at a time, inspect it, repair if necessary, and set it back into the projector. Take particular care in handling the reflector and lenses.

a. Objective Lens in Projector PH–222. (1) Unscrew objective lens (fig. 13(52)) out of the lens barrel (fig. 13(5)).

(2) Unlock masking device (fig. 9(16)) by pulling against the tension of the spring (fig. 17(49)) and unlocking the two lugs nearest the screw. Then move it away from the gate (fig. 5(15)). Unhook the lug nearest the spring so that the masking device can be removed.

b. Objective Lens in Projector PH–222–A. If there is any sign of cracked lenses, replace the complete unit. The objective lens unit (fig. 18(AF446)) can be removed from the lens housing (fig. 21(AF448)) for inspection and cleaning. Since the threaded barrel of the lens rides on a springed ball, the objective lens can either be threaded out or pulled out.

c. Lamphouse Lenses in Projector PH–222. (1) Remove the top cover (fig. 5(1)). Grasp the protruding handles of the condenser holder (fig. 17(13)) and lift out of the projector. Bi-convex condenser (fig. 17(9)) will fall free when the handles of condenser holder are released.

(2) The plano-convex lens and holder (fig. 17(7)) and heat-absorbing glass holder (fig. 17(8)) may be removed by sliding them out of the side of the condenser housing (fig. 5(10)) after the screws and plate have been removed.

(3) To remove the meniscus lens (fig. 17(6)) open the upper lamphouse (fig. 5(1)), push the latch spring (fig. 5(22)), and open the rear upper lamphouse, pivoting on the hinge (fig. 6(45)).

(4) The reflector (fig. 17(33)) may be removed easily if one of the holder prongs (fig. 15(29)) is sprung just far enough to permit removal.

d. Lamphouse Lenses in Projector PH–222–A. Refer to figure 18 and paragraph 16*d* for removing the reflector (fig. 18(AF430)), condenser lens

Digitized by Google

Original from UNIVERSITY OF CALIFORNIA

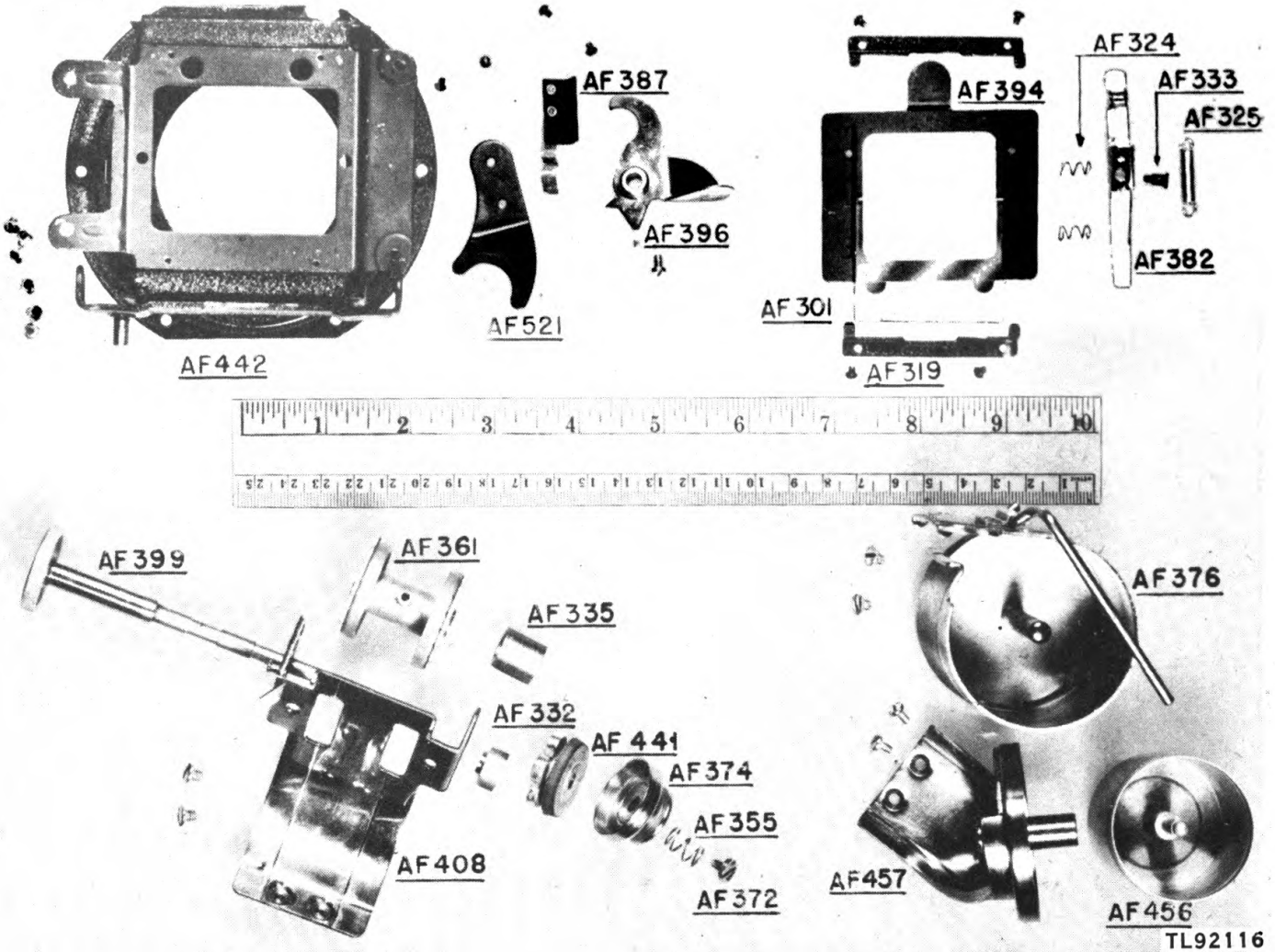


Figure 19. Projector PH–222–A, masking device and take-up magazine assemblies.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

(fig. 18(AF434)) and heat-absorbing glass (fig. 18(AF439)). A clipped or cracked lens must be replaced.

e. Lamp in Projector PH–222. Remove the lamp (fig. 15(32)) by lightly pushing it down into the socket and turning it counterclockwise until it stops, then lifting it out.

f. Lamp in Projector PH–222–A. (1) Refer to paragraph 16*b* for removing lamp. The candelabra lamp base socket (fig. 20(AF429)) is mounted to the lamp bracket (fig. 20(AF418)) by two screws. To remove the lamp bracket, remove the four adjusting screws holding it in place in the lamphouse. The adjusting screws, on the side of the lamphouse, are shown in figure 18. When replacing the lamp bracket, adjust the lamp so that the filament of the lamp will be in line with the center of the lenses. When the filament in the lamp is centered, the light output on the screen is equally distributed.

(2) To adjust the lamp, place a piece of white cloth over the objective lens, holding it in place by a string or an elastic band. Light the lamp in the projector and the projected image of the lamp filament will be visible on the white cloth covering the objective lens. Loosen the four adjusting screws and center the filament on the cloth by moving the bracket up or down. When the filament is centered, tighten the adjusting screws.

g. Lamphouse in Projector PH–222. To remove the upper and lower lamphouse (fig. 15(1) and (35)), remove four screws near the mounting plate in the lower lamphouse. Then remove two bolts, two spacers (fig. 6(48)), and two nuts. These hold the lower lamp housing (fig. 6(35)) to the top of the condenser housing (fig. 6(36)). Lift the lamphouse (fig. 16(1) and (35)) off the mounting plate.

h. Lamphouse for Projector PH–222–A. Three binding headscrews, which are at the lower end of the sides and back of the lamphouse (fig. 20(AF422)), attach the lamphouse to the base of the projector (fig. 20(AF414)). It is very seldom necessary to remove the lamphouse from the base.

i. Condenser Assembly for Projector PH–222. (1) Loosen the two screws holding the condenser housing (fig. 6(36)) to the mounting plate.

(2) Then loosen one screw holding the condenser housing to the indexing base (fig. 17(31)) and remove the condenser housing. This screw is located on the left side of the projector near the top of the condenser housing.

j. Condenser Assembly for Projector PH–222–A. The condenser housing assembly (fig. 19(AF442)) is turret mounted to the lamphouse (fig. 20(AF417)). Six roundhead screws attach the housing to the lamphouse. The cam retaining fork (fig. 19(AF521)) and the clutch lever spring are mounted on the condenser housing.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

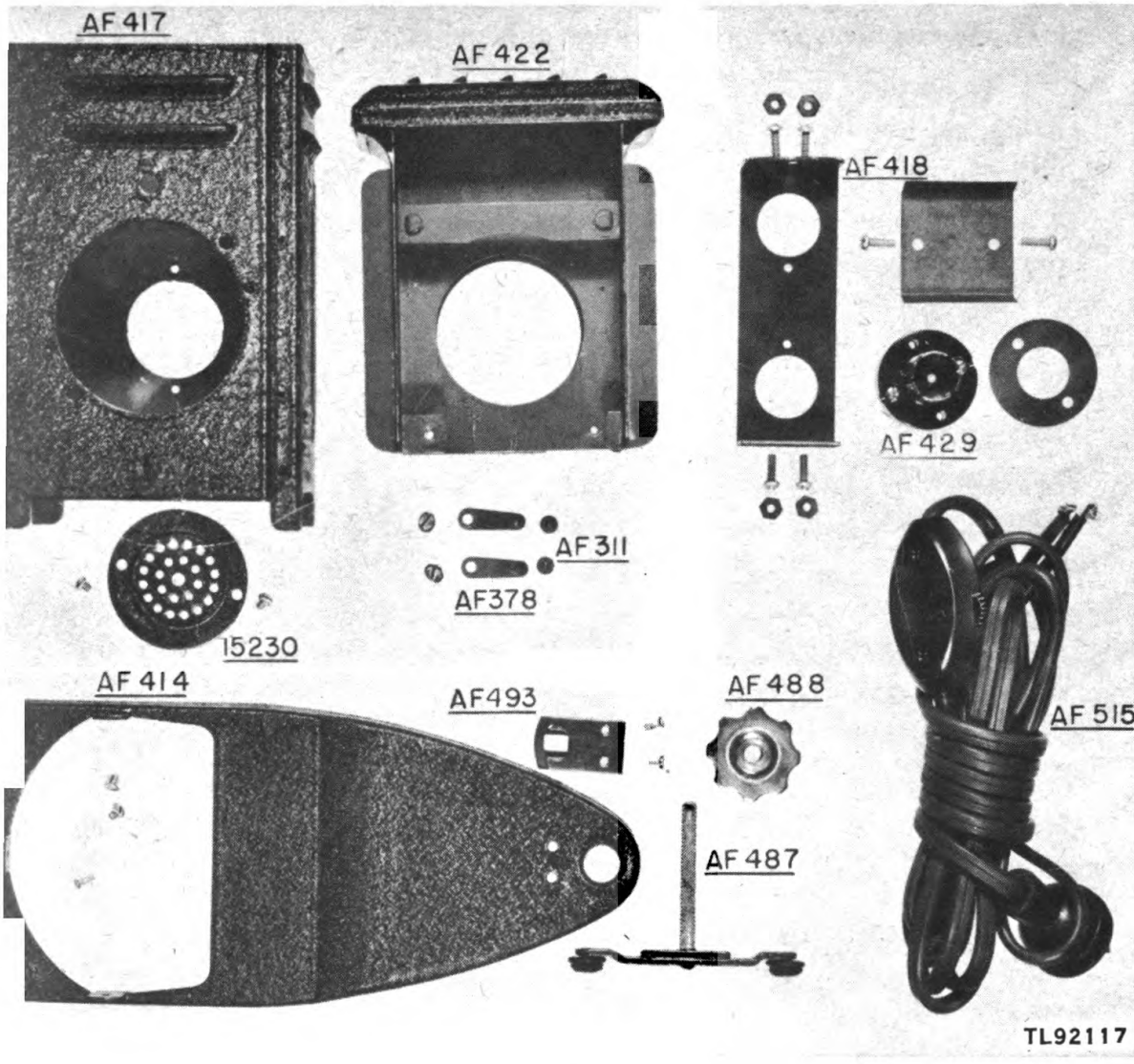


Figure 20. Projector PH–222–A, lamphouse assemblies.

k. Main Frame Assembly for Projector PH–222. To remove the main frame assembly (fig. 6(40)) with lens barrel (fig. 5(5)) and gate (fig. 5(15)) attached, remove four screws from the side nearest the condenser housing. Remove assembly.

l. Gate and Lens Barrel for Projector PH–222. To remove the gate (fig. 5(15)) and lens barrel (fig. 5(5)) from frame (fig. 6(40)), remove the nuts and then remove the screws. The gate can be removed by removing the four screws that hold it to the lens barrel.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

m. Main Frame for Projector PH–222. Disassemble the upper film tract and magazine (fig. 9(18)) as one unit by removing the rivet, loosening the hexagonal-head screw (fig. 9(53)), and unscrewing the nut. Remove the bottom cover (fig. 17(38)) and loosen the pressure arm spring. Spring the main frame (fig. 17(40)) open far enough to remove the following parts: shifting lever assembly, pressure operating arm assembly, film-pressure releasing arm, carrier for rear-aperture pressure glass and release spring stud, spring for pressure glass, shaft for film-pressure operating arm, and spring for rear-aperture pressure glass.

n. Mounting Plate for Projector PH–222. The mounting plate may be removed from the base (fig. 3(17)) by removing screws, washers, and elevating pin. The elevating pin can be removed from either side of the index adjustment cam.

o. Mounting Plate Hinge for Projector PH–222. Mounting plate hinge and hinge pin may be removed from mounting plate by removing the two screws.

p. Socket and Washer for Projector PH–222. After the switch is loosened, socket (fig. 16(43)) and insulating washer can be removed by loosening two screws.

q. Feed Sprocket Knob and Shaft for Projector PH–222–A. (Refer to figs. 4 and 19(AF408).) Remove the two binding-head screws that attach the sprocket plate (fig. 19(AF408)) to turret assembly (fig. 19(AF442)). Removal of screw (fig. 19(AF372)) and the setscrew on sprocket (fig. 19(AF361)) allows the speed sprocket shaft to be disassembled. Change the clutch disk (fig. 19(AF441)) if there is any sign of wear. The indexing cam (fig. 19(AF441)) actuates the indexing lever (fig. 19(AF382)). The indexing lever in turn tightens and loosens the pressure glass (fig. 19(AF394)) as the film moves from frame to frame. The pressure glass is in the loose position while the film is being moved, and in the tight position when the film is positioned for showing. The pressure glass retainers (fig. 19(AF319)) hold the pressure glass in place on the condenser housing.

21. REASSEMBLY.

a. Fasten the switch (fig. 6(44)) to the mounting plate. Place an insulating washer under the sprocket and fasten to the mounting plate with a screw.

b. Attach the mounting plate hinge and the hinge pin with the two screws.

c. Attach the mounting plate to the base (fig. 3(17)) with the screws. Shockproof washers should be used to hold the screws. Put an elevating pin into place in the indexing adjustment cam.

Digitized by Google

Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

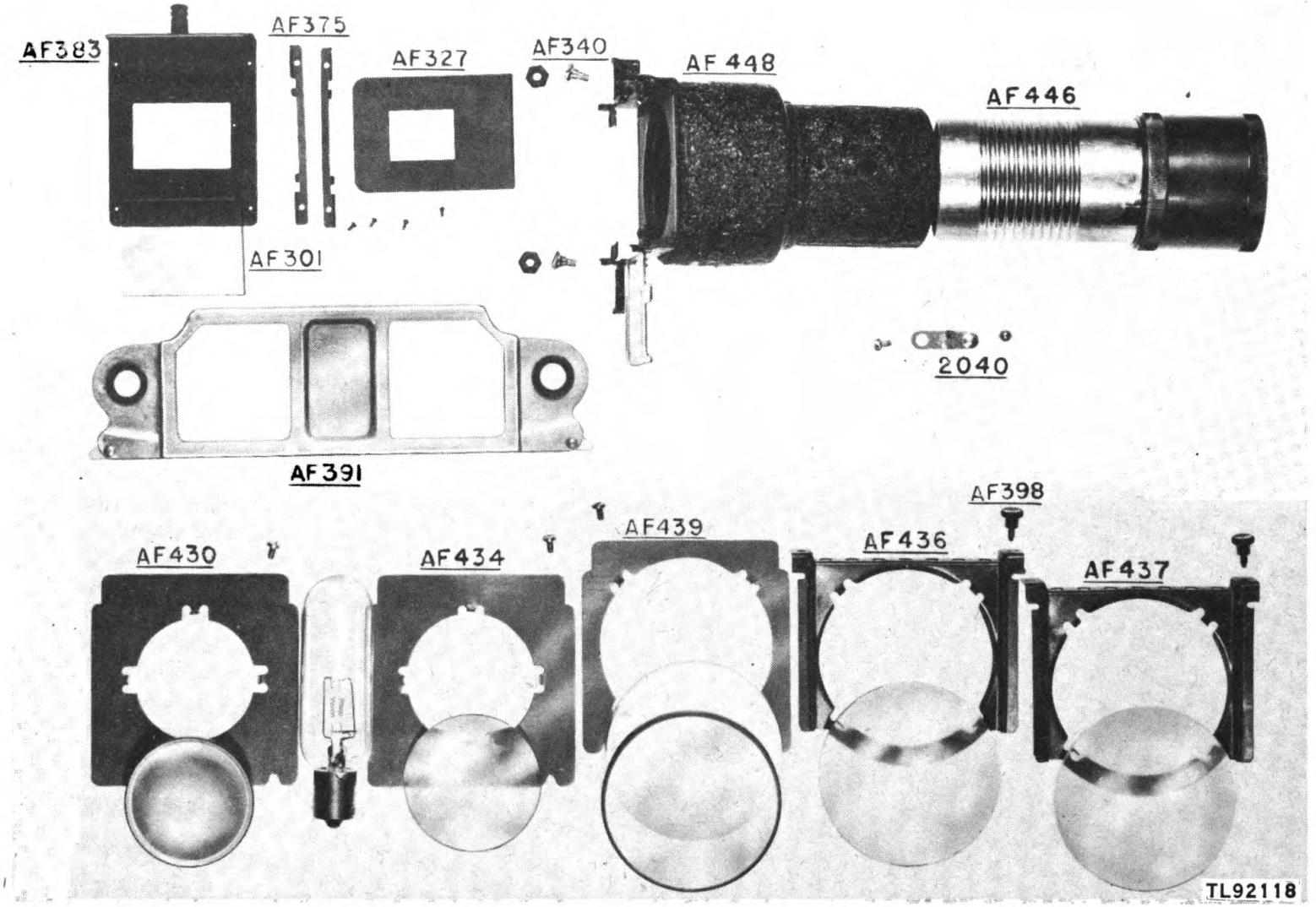


Figure 21. Projector PH–222–A, lens assemblies.

Original from UNIVERSITY OF CALIFORNIA

d. Place the indexing base (fig. 6(3)) on the mounting plate and fasten it with two screws and a mounting plate screw.

e. Assemble the framing mechanism by inserting the shaft into the main frame (fig. 17(40)) from the right side of the projector. Assemble on the shaft these parts in order: sprocket, rocker, intermittent shoe, intermittent drum and square, shaft end, shaft, intermittent spring block, and intermittent spring. Fasten in place with a setscrew. Mount the following units on film-pressure operating arm shaft: shifting lever assembly, pressure operating arm assembly, film-pressure releasing arm, carrier for rear-aperture pressure glass and release spring stud, spring for pressure glass carrier, shaft for film-pressure operating arm, and spring for rear-aperture pressure glass.

f. Spring the main frame open far enough to allow the shaft to be inserted in the holes in the main frame. Fasten the pressure arm spring and replace the bottom plate (fig. 17(38)).

g. The main frame bearing and the intermediate frame bearing are mounted to the main frame (fig. 5(40)) with screws. The upper film track magazine side (fig. 5(18)), and axis bar are fastened to the main frame with screw and nut. Fasten the front assembly to the main frame with screws (fig. 17(46)) serving as a hinge pin, and nuts locking them in place.

h. Attach the main frame and front assemblies to indexing base (fig. 17(3)) with screws.

i. Fasten the condenser housing (fig. 6(36)) to the mounting plate and to the indexing base with three screws.

j. Set the lamphouse (fig. 5(35)) in position on the mounting plate. Fasten the lower lamphouse with four screws, two bolts, two nuts, and two spacers (fig. 6(48)) to the condenser housing (fig. 6(36)).

k. Screw the objective lens (fig. 13(52)) into the lens barrel (fig. 13(5)). Grasping the masking device assembly (fig. 9(16)) by the knob (fig. 9(28)), hook it onto the back of the gate and pull against the adjusting spring (fig. 17(49)). Hook onto the front of the gate and release the grasp. Place the bi-convex condenser lens (fig. 17(9)) in the groove nearest the aperture of the holder (fig. 17(13)). The surface of the greatest curvature must be toward the lamp. Press the holder firmly around the lens and insert the assembly into the main frame. Replace the top cover (fig. 17(39)), slide the plano-convex lens and holder, (fig. 17(7)) heat-absorbing glass and holder (fig. 17(8)) into place in the condenser housing. Replace the side cover (fig. 3(10)) and screws (fig. 3(34)). Replace in position the meniscus lens and holder (fig. 17(6)). Force the reflector (fig. 17(33)) into the prong of the holder (fig. 15(29)). Place the lamp (fig. 17(32)) in the socket (fig. 16(43)), push down lightly, and turn clockwise until it stops. Close the upper lamphouse (fig. 16(1)), making sure that the catch is fastened.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

22. TROUBLE, CAUSE, AND REMEDY CHART.

Trouble	*Possible Cause*	*Remedy*
Film sticks to aperture glass.	Heat absorbing glass broken. Wet film.	Replace heat absorbing glass. Dry the film.
Film does not move when operating knob is turned.	Improper threading. Sprocket teeth not engaged in perforations.	Open the film gate and rethread the film, making certain the sprocket teeth are engaged in the film perforations when the gate is closed.
Film buckles and goes out of focus.	Aperture plates do not close.	Reframe the picture, push operating knob in, and turn clockwise.
Film is advanced 2 frames each time.	Machine is set for double-frame operation while single-frame films are being shown.	Swivel the projector head one-quarter turn clockwise and set the alignment-button indicator on single frame. Then return the projector head to original position.
Film is advanced one-half frame each time.	Machine is set for single-frame operation while double-frame films are being shown.	Swivel the projector head a quarter-turn clockwise, reset the alignment-button indicator on double frame; then return the projector head to its original position.
Film cannot be framed.	Intermediate clutch sticks.	Disassemble the drum square and brake shoe. Replace brake shoe and reassemble.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Trouble	*Possible Cause*	*Remedy*
Uneven light.	Reflector out of alignment.	Remove the objective lens and place a white card approximately 6 inches in front of the empty lens mount. Adjust the reflector until direct and reflected images of the filament are staggered to form a solid source of light.
Dark spot in center of screen.	Condenser and heat-absorbing glass were interchanged while cleaning.	Remove both the condenser and the heat-absorbing glass; place the condenser in the rear slot nearer the lamp, and the heat-absorbing glass in slot nearer aperture gate.
Dark corners on screen.	Front condenser in wrong slot in the condenser holder.	Remove the front condenser holder and put the condenser in the groove nearer the film gate with its surface of greater curvature toward the lamp.
Film does not enter take-up reel.	Film is not properly inserted in the take-up reel channel.	Insert the end and edges of the film in the channel leading to the take-up reel; check to make certain it moves forward freely.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

SECTION V
SUPPLEMENTARY DATA

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH–222 AND PH–222–A.

a. Projector PH–222.

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
23	8P7–5	ARM: film retaining; 1/8" diam; coppered and chrome-plated Bessamer rod with two right-angle bends at right angles to each other; total length 3".	1				*	*	*
	8P7–12	PRESSURE OPERATING ARM ASSEMBLY: includes pressure operating arm, film pressure releasing arm, rear aperture glass carrier plate, release spring stud, spring for glass carrier plate, spring for rear aperture glass.	1					*	*
	8P7–40	BEARING: ball; 3/16" steel.	1				*	*	*
3	8P7–50	BASE: indexing; grey iron die casting; L-shaped; 6" vertical; 3" horizontal; hole in vertical section; OD 2 5/8"; ID 1 11/16".	1					*	*
17	8P7–52	PROJECTOR BASE ASSEMBLY: includes base, rubber feet, tension washer, incline adjustment lever, incline adjustment cam, friction washer, sliding legs, right-hand, sliding head, left-hand, sliding leg fulcrum pin, mounting plate hinge, mounting plate hinge pin.	1					*	*

Original from UNIVERSITY OF CALIFORNIA

2	8P7–76	CAN: take-up; complete; including SVE take-up can and cover and the film can stud.	1		*		*	*	*
	8P7–80	CLIP: for retaining arm; 0.035″ x 5/16″ x 3/4″; annealed spring; chrome-plated.	1				*	*	*
9	8P7–85	LENS: condenser; bi-convex; 2″ diam; optical glass; 3½″ focal length.	1				*	*	*
6	8P7–210	LENS: condenser; meniscus; 1 3/8″ diam; pyrex glass; 4″ focal length.	1				*	*	*
7	8P7–90	LENS: condenser; plano-convex; 1 5/8″ diam; optical glass; 3 3/4″ focal length.	1				*	*	*
19	8P7–95	CORD: lamp; 10′; No. 18 conductors; stranded; shielded black cloth; 1/32″ covered; Hubbell attachment male plug No. 4 on one end, socket on the other.	1				*	*	*
38	8P7–100	COVER: bottom; curved; lowered; 0.025″ x 3″ x 2 5/16″; cold-rolled steel; quarter-head; words DOUBLE—SINGLE printed on it.	1				*	*	*
10	8P7–105	COVER: condenser housing side; 0.20″ x 3 3/8″ x 1″; includes two 1/8″ flanges along the length; two 1/8″ diam screw holes set 1/4″ from each rounded end.	1				*	*	*
39	8P7–110	COVER: top; curved; lowered; 0.025″ x 2″ x 2 5/16″; cold-rolled steel; quarter-head.	1				*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH-222 AND PH-222-A.

a. Projector PH-222 (contd).

Ref Symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
31	8P7-470	FILM TRACK: lower; curved; 0.042" x 2" x 4"; cold-rolled steel; soft; nickel-plated.	1					*	*
8	8P7-115	GLASS: heat absorbing; 1½" diam x ⅛"; Corning Aklo Lt. shade No. 3965.	1				*	*	*
40	8P7-126	MAIN FRAME ASSEMBLY: includes main frame, hinge, left condenser bracket, right condenser bracket, spring post for pressure arm spring, gate lock spring.	1					*	*
15	8P7-130	GATE ASSEMBLY: includes gate, gate hinge bracket, gate hinge screw, locking nut.	1					*	*
30, 37	8P7-135	GLASS: aperture; 2" x 1⅜" x ⅛"; luster glass.	2				*	*	*
13	8P7-146	CONDENSER HOLDER ASSEMBLY: includes condenser holder, condenser holder spring, ball ⅛" diam, ball spring.	1				*	*	*
8	8P7-150	HOLDER: heat-absorbing glass; 0.020" x 2" with 1½" diam hole; cold-rolled steel.	1				*	*	*
6	8P7-155	HOLDER: meniscus lens; V-shaped with two flanges; 0.020" x 2¼" with 1¼" diam hole.	1				*	*	*

Original from UNIVERSITY OF CALIFORNIA

7	8P7–160	HOLDER: plano-condenser lens; 0.020″ x 2 11/32″ x 2 11/32″; includes a 1/8″ flange along one side; made of cold-rolled steel; 1 9/16″ diam hole in center; also used to hold heat-absorbing glass holder.	2				*	*	*
29	8P7–165	HOLDER: with three arms; 0.031 x 2 5/8″; cold-rolled steel; used to hold reflector.	1				*	*	*
36	8P7–170	CONDENSER HOUSING ASSEMBLY: includes condenser housing (AA–9) and a light deflector plate.	1					*	*
12	8P7–175	HOUSING: objective lens; 1 3/4″ diam in front, squaring off at back end; 1 7/8″ x 2 1/8″; 2 7/8″ long; zinc alloy base.	1					*	*
	8P7–180	INTERMITTENT DRUM AND SQUARE; die-cast; zinc alloy base; intermittent shoe fits into drum.	1				*	*	*
35	8P7–10	LOWER INTERMEDIATE LAMP HOUSE ASSEMBLY: includes lower intermediate lamphouse, upper spacer, lower spacer, rear condenser holder guide, left-hand, rear condenser holder guide, right-hand, hinge pin, hinge, lower outer lamp house, decorative strip, light deflector plate.	1					*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH–222 AND PH–222–A.

a. Projector PH–222 (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
1	8P7–15	UPPER LAMPHOUSE ASSEMBLY: includes upper outer lamphouse, upper intermediate lamphouse, inner lamphouse, lamphouse bracket, outer lamphouse cover, latch pin, 3 decorative strips, hinge, nameplate, rivet for nameplate.	1					*	*
22	8P7–410	LATCH: spring; on condenser housing; 0.015″ x 1 3/8″ x 19/32″; chrome-plated steel with two screw holes, one push pin, and one catch hole.	1					*	*
	8P7–205	SHIFTING LEVER ASSEMBLY: consisting of shifting lever and shifting lever stud.	1				*	*	*
18	8P7–14	UPPER FILM TRACK MAGAZINE ASSEMBLY: includes upper film track magazine, magazine side, magazine center rod.	1					*	*
41	8P7–215	MASK: double-frame; 0.020″ x 2″ x 1 5/8″; with hole 7/8″ x 1 3/8″; cold-rolled steel; half-hard.	1				*	*	*
16	8P7–11	MASKING DEVICE ASSEMBLY: consists of main casting, knob, screw.	1				*	*	*
42	8P7–220	MASK: single-frame; 0.020″ x 1 3/4″ x 1 3/8″; with hole 11/16″ x 15/16″; cold-rolled steel; half-hard.	1				*	*	*

Original from UNIVERSITY OF CALIFORNIA

45	8P7–245	PIN: hinge; 3/32" OD x 2¼"; cold-rolled steel; used between upper and lower house assemblies.	1					*	*
	8P7–250	PIN: incline adjustment cam; drill rod; ⅛" x 2¼"; rides in groove of incline adjustment cam; used to raise and lower mounting plate.	1					*	*
	8P7–268	MOUNTING PLATE: 7" x 2⅜" x 0.042"; cold-rolled steel; soft; mechanism mounted on this plate rather than on base.	1					*	*
33	8P7–270	REFLECTOR: 2" diam made of crown glass on metal backing.	1				*	*	*
25	8P7–13	ROD: push, and operating knob rod; 1 15/16" long; 5/32" diam; jeweler's rod, knob, 1¼" diam, 3/16" thick, molded into rod; part of intermittent sprocket mechanism.	1				*	*	*
4	8P7–120	FOOT: rubber; sub-felt; ½" diam; ¼" thick.	4				*	*	*
46	8P7–240	SCREW: hinge and locking nut complete; steel; headless; threaded 3/16"; length 7/16"; diam of unthreaded shaft 0.092".	2					*	*
47	6L18506–4.77	SCREW: machine; steel; headless; 6–32 thread; National Coarse; ¼" long; threaded ¼"; no shoulder; nickel-plated; used to attach lower film track to take-up assembly.	2					*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH–222 AND PH–222–A.

a. Projector PH–222 (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	6L6632–5.81NS	SCREW: machine; steel; hex. head; 6–32 thread; National Coarse; 5/16" long; threaded 9/32"; no shoulder; nickel-plated; used to attach take-up and feed assembly to main frame assembly.	2					*	*
	8P7–300	SCREW: spring; special, brass; special fillister head; 7/16" diam; 3/32" thick; over-all length 11/32"; threaded shoulder 1/4" diam, 1/8" high, 36 thread; shaft 5/32" diam, 1/8" high, 34 thread; shoulder thread fits into take-up assembly while shaft thread holds spring.	1				*	*	*
	8P7–363	SHAFT ASSEMBLY: includes shaft hollow 2 3/8" long; shaft end; shaft plug; part of intermittent.	1				*	*	*
	8P7–30	SHAFT: for film pressure operating arm; 1/8" diam x 2 3/8" long; dull road; mirror-finished.	1				*	*	*
	8P7–368	SHOE: intermittent; 11/16" OD; 3/32" thick; die-cast; zinc alloy base.	1				*	*	*
14	8P7–373	SLIDE-CHANGER: complete; for 2" slider; semi-automatic; consists of main casting for slide changer, slide for changer, slide spring, push-out spring, upper slide spring, lower slide spring, tension spring, slide stop pin, slide spring rivet, push-out spring washer, rivet.	1				*	*	*

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

43	8P7–381	SOCKET: lamp; 1,000-w; 250-v; medium prefocus; molded bakelite; 1 7/8″ long; 1 3/8″ wide; 15/16″ mounting centers; furnished by American Phenolic Corp., Chicago Cat. No. 98.	1				*	*	*
48	8P7–388	SPACER: 5/16″ OD; 1/8″ ID; 9/32″ long; cold-rolled steel.	2				*	*	*
	8P7–393	SPACER: 3/8″ OD; 1/4″ ID; length 17/32″; steel tubing; used with intermittent assembly.	1				*	*	*
49	8P7–397	SPRING: adjusting; for masking device; 0.015″ x 3/16″ x 2 1/2″; Swedish tempered steel.	1					*	*
	8P7–442	SPRING: coil; steel; 9/32″ long; 7/32″ OD; diam of wire 0.021″; one coil pulled away; used to retain take-up cam.	1				*	*	*
	8P7–402	SPRING: indexing ball; 0.025″ x 5/16″ x 1 1/4″; tempered spring steel.	1				*	*	*
	8P7–426	SPRING: intermittent; 1″ long; 1/8″ diam; spring steel; fits into shaft.	1				*	*	*
50	8P7–414	LENS HOUSING SPRING ASSEMBLY: consists of lens housing spring and lens housing spring point.	1				*	*	*
	8P7–418	SPRING: pressure arm; over-all length 1/2″; coil length 3/16″; spring steel; returns pressure arm to position.	1				*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH-222 AND PH-222-A.

a. Projector PH-222 (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	8P7-450	SPROCKET ASSEMBLY: includes sprocket, intermittent shoe pin, rocker, and part of intermittent sprocket mechanism.	1				*	*	*
	8P7-454	STUD: for push rod; 3/32" diam; over-all length 13/32"; threaded portion 1/8" long; part of intermittent sprocket mechanism.	1				*	*	*
44	8P7-458	SWITCH: toggle; 125-v, 6-amp, or 250-v, 3-amp; bakelite casing; 1 3/16" long; 1/2" wide; 17/32" deep behind panel; 15/32" bushing.	1				*	*	*
55	8P7-465	TAKE-UP ASSEMBLY: includes take-up casting, bracket, spring screw, and spring for spring screw.	1					*	*
	6L58024-11	WASHER: 1/2" OD; 1/4" ID; 0.010" thick; steel; part of intermittent sprocket mechanism.	1				*	*	*
	8P7-489	WASHER: 1 11/16" diam x 0.030"; with two screw holes 1/8" on the center line, 3/8" from circumference; black fiber material; used to insulate lamp socket from mounting plate.	1				*	*	*
32	8E74	LAMP: projection; 300-w; 120-v; with medium prefocus base; Mazda.	1		*		*	*	*

Original from UNIVERSITY OF CALIFORNIA

8P7–235	NUT: steel; hex; 2–56; nickel-plated; used for latch spring.	2				*	*	*
8P7–236	NUT: steel; hex; 4–36; nickel-plated; used for condenser housing space.	2				*	*	*
8P7–237	NUT: steel; hex; 6–32; nickel-plated; used for main frame.	2				*	*	*
8P7–275	RIVET: brass; ovealhead; tubular; 1/16″ diam; 1/16″ long; nickel-plated.	2				*	*	*
8P7–276	RIVET: brass; ovalhead; tubular; 3/32″ diam; 1/8″ long; nickel-plated.	4				*	*	*
6L18204–3.8P	SCREW: machine; steel; binder head; No. 2; self-tapping; 3/16″ long; thread 3/16″; no shoulder; parkerized.	2				*	*	*
6L6436–4.7S	SCREW: machine; steel; flathead; 4-36 thread; National Standard; 1/4″ long; threaded 3/16″; no shoulder; nickel-plated.	5				*	*	*
6L18510–2.32	SCREW: machine; steel; headless; cup pointed; 10–32 thread; National Fine; 1/8″ long; threaded 1/8″; no shoulder; nickel-plated; used as part of intermittent sprocket assembly.	1				*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH–222 AND PH–222–A.

a. Projector PH–222 (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	6L6256–2.5S	SCREW: machine; steel; roundhead; 2–56 thread; National Coarse; 1/8" long; threaded 1/8"; no shoulder; nickel-plated.	2				*	*	*
	6L6436–2.5BS	SCREW: machine; steel; roundhead; 4–36 thread; National Standard; 1/8" long; threaded 1/8"; no shoulder; black nickel-plated.	4				*	*	*
	6L6436–3.5S	SCREW: machine; steel; roundhead; 4–36 thread; National Standard; 3/16" long; threaded 3/16"; no shoulder; nickel-plated.	8				*	*	*
	6L6436–4.5S	SCREW: machine; steel; roundhead; 4–36 thread; National Standard; 1/4" long; threaded 1/4"; no shoulder; nickel-plated.	12				*	*	*
	6L6256–3.4S	SCREW: machine; steel; fillister-head; 2–56 thread; National Coarse; 3/16" long; threaded 3/16"; no shoulder; nickel-plated.	2				*	*	*
	6L6436–8.5S	SCREW: machine; steel; roundhead; 4–36 thread; National Standard; 1/2" long; threaded 1/2"; no shoulder; nickel-plated.	4				*	*	*

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

6L18204–3.18	SCREW: machine; steel; roundhead; No. 4; self-taping thread; 3/16″ long; thread 3/16″; no shoulder; parkerized.	14				*	*	*
6L72106BN	WASHER: shakeproof; steel; external teeth; 9/64″ OD; 0.115″ ID; 0.018″ thick; black nickel-plated.	11				*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH–222 AND PH–222–A.

b. Projector PH–222–A.

Ref Symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	8P7–503	BALL: lens focusing guide; steel; polished; 3/16" OD; rides in lens barrel focusing groove to aid in focusing.	1				*	*	*
AF 332	8P7–506	BEARING: sprocket shaft; 0.321" x 0.500" OD; 0.190" ID; one end cut in for 1/32" to 3/8" ID; other end cut in for 3/64" to 0.311" OD; brass.	1				*	*	*
AF 311	8P7–509	BUTTON: turret plate tension; bakelite; 0.185" OD x 5/32"; one end rounded, other end having 1/4" OD x 0.043" head; rides against turret and keeps it tight.	4				*	*	*
AF 441	8P7–513	INDEX CAM AND CLUTCH ASSEMBLY: 2 9/32" OD x 3/8", clutch; fiber, beveled 1/8" thick, cam; five rounded teeth, 1/8" thick, 1/8" cut in section between the two; permits framing of film.	1				*	*	*
AF 518	3E7192	LAMP CORD ASSEMBLY: 12' 8"; No. 14; stranded; 2-wire copper conductors; tinned and looped ends; rubber-insulated; rubber Hubbel male plug on one end; single-throw, single-pole; 10-mp, 250-v switch; 1' from other end of conductor; carries current to lamp.	1		*		*	*	*

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

AF 521	8P7–519	FORK: cam retaining; cold-rolled steel; black; 0.052″ x 1″ x 2″; with 0.530″ ID circle segment at one end; with two 0.090″ ID holes for screws; steadies index cam.	1				*	*	*
AF 301	8P7–523	GLASS: aperture and pressure plate; crown flint glass; 1 3/8″ x 1 3/4″ x 7/64″; beveled and ground edges; chamfered on short ends; holds film strip steady and flat.	2				*	*	*
AF 439	8P7–524	HEAT ABSORBING GLASS ASSEMBLY: 2 1/2″ OD x 0.120″; beveled edge; metal-framed; held by four flanges to a 2 15/16″ square x 0.023″ sheet steel plate with a 2 7/16″ ID hole in its center; notched to accept holding screw; prevents overheating of film.	1				*	*	*
AF 493	8P7–527	GUIDE: lifting screw; two plates spot-welded together; two machines, 6–32, National Coarse, threaded holes at one end; 3/4″ x 1 1/4″ x 0.060″ cold-rolled steel; black; with semicircular notch to hold lifting screw knob; with rectangular hole to guide the lifting screw.	1				*	*	*
AF 457	8P7–528	GUIDE: take-up magazine; steel; chrome-plated; 1 7/16″ wide with 1/8″ sides; twisted; ending in a collar and magazine holder; to guide film into a removable film magazine.	1				*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH-222 AND PH-222-A.

b. Projector PH-222-A (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
AF 391	8P7-532	HOLDER: slide; sheet steel; 2 1/16" x 7 1/8" x 9/32"; space for two 2 x 2 slides; with rubber-cushioned 1/2" OD holes and stop catches at each end; holds and permits rapid changing of film slides.	1				*	*	*
AF 422	8P7-535	LAMP COVER HOUSING ASSEMBLY: sheet steel; black, crackle finish; 0.028" x 3 7/8 x 2 7/8"; with louvers in top; with brackets; to hold condenser lens assembly, reflector assembly, heat glass assembly; to act as light trap.	1				*	*	*
AF 488	8P7-540	KNOB: lifting screw; steel; scalloped; 1 5/16" OD x 0.082"; chrome-plated; on a 1/2" OD x 1/2" shaft with a 5/16-18 machine, National Coarse, inside thread; 1/16" x 1/16" groove; 1/32" from bottom; controls lifting screw.	1				*	*	*
AF 491	8P7-544	LEG: rubber bumper; 1/2" OD x 1/4" with machine, National Coarse, 6-32 x 3/16" screw imbedded in top; steadies projector; screws into base plate.	2				*	*	*

Original from UNIVERSITY OF CALIFORNIA

AF 434	8P7–547	FIRST CONDENSER LENS ASSEMBLY: convex-concave lens; $1\frac{15}{16}$″ OD x $\frac{5}{8}$″; approximately 3″ focal length; held to a $2\frac{15}{16}$″ square x 0.023″ sheet steel plate with a $1\frac{13}{16}$″ ID hole by four flanges; notched to accept holding screw; concentrates light.	1				*	*	*
AF 436	8P7–548	SECOND CONDENSER LENS ASSEMBLY: convex-convex lens; $2\frac{17}{32}$″ OD x $\frac{3}{8}$″; held to a $2\frac{3}{4}$″ x 3″ x 0.023″ piece of sheet steel having four flanges and a $2\frac{15}{32}$″ ID hole; blackened; has a number 2 embossed on the mount; concentrates light from lamp.	1				*	*	*
AF 437	8P7–549	THIRD CONDENSER LENS ASSEMBLY: convex-convex lens; $2\frac{17}{32}$″ OD x $\frac{3}{8}$″; held to a $2\frac{3}{4}$″ x 3″ x 0.023″ piece of sheet steel having four flanges and a $2\frac{15}{32}$″ ID hole; blackened; has a number 3 embossed on mount; concentrates light from lamp.	1				*	*	*
AF 382	8P7–553	LEVER: index pawl; steel; hard; chrome-plated; 0.036″ x $\frac{1}{4}$″ x $2\frac{1}{2}$″ with $\frac{1}{8}$″ OD hole near center; U-shaped bend at one end; engages index cam which positions film.	1				*	*	*
AF 396	8P7–552	FRAMER LEVER ASSEMBLY: steel; chrome-plated; $1\frac{1}{2}$″ x $1\frac{1}{2}$″; with flange for handle; with $\frac{15}{32}$″ ID circle segment at one end; with 2 pointed teeth at other end; with 0.190″ ID x $\frac{5}{32}$″ bushing; releases clutch thus permitting framing of film strip.	1				*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH–222 AND PH–222–A.

b. Projector PH–222–A (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
AF 456	8P7–557	MAGAZINE: take-up; can-shaped; open at one end; 1 3/8" x 1 9/16" OD; with central shaft that fits inside film guide shaft; rotates; steel; takes up and holds viewed film.	1	1			*	*	*
AF 376	8P7–558	MAGAZINE: upper film; steel; chrome-plated and black mottled finish; can-shaped; 2 1/8" OD x 2 13/16"; with shaft in middle; one end open; movable bar to keep film from falling out; slot in side and guide for film to come out; holds film.	1				*	*	*
AF 327	8P7–561	MASK: single-frame; 1 19/32" x 2 1/4" x 0.016" sheet steel; with 1/8" flange along one end; with 11/16" x 57/64" hole 1/2" from flat end; rounded corners; dull black finish; acts as aperture for viewing single-frame picture.	1				*	*	*
	6L–3106–32.1	NUT: machine; National Coarse, 6–32; hex. head; brass; black; holds lamp bracket to lamphousing.	4				*	*	*
	6L–3106–32.1	NUT: machine; National Coarse, 6–32; hex. head; brass; black; holds lens tube and aperture assembly to front frame.	2				*	*	*

Original from UNIVERSITY OF CALIFORNIA

AF 383	8P7–565	PLATE: aperture and glass assembly; 2″ x 2⅝″ x 0.031″; with ⅜″ flange on one end; with 7/16″ x ¼″ OD knob; with guide rails; with flanges for holding a 1⅜″ x 1¾″ x 7/64″ piece of crown flint glass; holds film strip.	1				*	*	*
AF 394	8P7–566	PLATE: pressure; steel; black; 2½″ x 2⅝″ over-all; two plates; loosely riveted together; with spring copper flanges for holding pressure glass; holds pressure glass against aperture plate.	1				*	*	*
AF 408	8P7–567	SPROCKET PLATE ASSEMBLY: steel; chrome-plated; 3″ x 1⅝″; curved; with slots for sprocket teeth, holes for sprocket shaft, spring catch, holes for magazine screws; for holding sprocket and passing film to film magazine guide.	1				*	*	*
AF 430	8P7–571	REFLECTOR ASSEMBLY: glass; metal-backed; concave; 1¾″ OD; held by four flanges to a 2 15/16″ square x 0.023″ sheet steel plate; with a 1 13/16″ ID hole in its center; notched for guide flanges; notched to accept holding screw.	1				*	*	*
	6L6080–1–3.1	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; National Fine; 0–80 x 7/64″; roundhead; brass; holds aperture glass guides to aperture plate.	4				*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH–222 AND PH–222–A.

b. Projector PH–222–A (contd).

Ref. symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
AF 372	6L6440–3.9CS–1	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; National Coarse; 4–40 x 3/16″; 0.067″ x 5/16″ OD binding: head; steel; chrome-plated; holds clutch spring on sprocket shaft.	1				*	*	*
AF 398	6L6440–3	SCREW: holding; special; (to be barred to stock number as inherent component of assembly); machine; National Coarse; 4–40 x 3/16″; undercut tips; 1/8″ x 0.185 OD shoulder; knurled 0.316″ OD x 3/32 head; black; holds condenser lens in front frame.	2				*	*	*
	6L6440–4.3S	SCREW: first condenser; special; (to be barred to stock number as inherent component of assembly); machine; National Coarse; 4–40 x 1/4″; fillister-head; steel; hard; keeps plates from falling out of lamphouse cover.	3				*	*	*
	6L6440–3.9CS–1	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; National Coarse; 4–40 x 3/16″; 0.210 OD x 0.058″ binding-head; steel, chrome-plated; holds framer lever to front frame or turret.	1				*	*	*

Original from UNIVERSITY OF CALIFORNIA

	6L6256–2.1SB	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; National Coarse; 2–56 x 1/8″; roundhead; steel; black; holds framer lever spring to front frame or turret.	2				*	*	*
AF 333	6L6256–1–1SB	SCREW: special; (to be barred to stock number as inherent component of assembly) machine; National Coarse; 2–56 x 3/32″; with 1/8″ x 1/8″ OD shoulder; flathead; steel; black; holds and permits play in index pawl lever.	1				*	*	*
	6L6632–4.1S	SCREW: special; (to be barred to stock number as inherent component of assembly); machine, Natational Coarse; 6–32 x 1/4″; roundhead; steel; holds lamp bracket to lamp housing.	4				*	*	*
	6L6632–2.8SB	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; National Coarse; 6–32 x 1/8″; steel; black; bindinghead; holds lamp housing to base.	3				*	*	*
	6L6632–8.18	SCREW: special; (to be barred to stock number as inherent component to assembly); machine; National Coarse; 6–32 x 1/2″; roundhead; steel; holds lamp socket to lamp bracket.	3				*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH-222 AND PH-222-A.

b. Projector PH-222-A (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
AF 340	6L6632-4-1.9CS	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; NC; 6-32 x 9/32" including a 3/32" x 0.186" OD shoulder; binding head; steel; chrome-plated; holds lens tube and aperture assembly to front frame.	2				*	*	*
	6L6632-1-1.9S	SCREW: special; (to be barred to stock number as inherent component to assembly); machine; NC; 6-32 x 3/32"; steel; nickel-plated; binding-head; holds lens tube tension spring to lens tube.	1				*	*	*
AF 487	8P7-573	SCREW ASSEMBLY: 0.216" square x 2 1/4" long shaft; 5/16-18 threaded edges; steel; riveted perpendicular to a 3 1/4" x 3/8" x 0.130" crossarm; having two felt pad feet; to lift or tilt projector.	1				*	*	*
	6L6632-2-1.83B	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; NC; 6-32 x 5/32"; steel; black; binding-head; holds lifting screw guide to base and lamphouse assembly to base.	5				*	*	*

Original from UNIVERSITY OF CALIFORNIA

6L6256–1–1.PH8	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; NC; 2–56 x 3/32″; round Phillips head; brass; black; holds pressure retaining flanges to front frame; holds cam fork to front frame or turret.	6				*	*	*
6L66440–2.7CS	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; NC; 4–40 x 1/8″; flathead; steel; chrome-plated; holds magazine film guide to sprocket plate assembly.	2				*	*	*
6L7924–5–5.9CS	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; NF; 5/16″–24 x 5/16″; 1/8″ of end undercut to 0.189″ and threaded to receive spring; 0.061″ x 7/16″ OD binding head; chrome-plated; steel; holds take-up magazine spring.	1				*	*	*
6L6440–1–1.1SB	SCREW: special; (to be barred to stock number as inherent component of assembly); machine; NC; 4–40 x 3/32″; roundhead; steel; black; holds turret assembly retaining ring to lamp housing.	6				*	*	*
6L6632–2.8SB	SCREW: turrent plate button tension spring; special; (to be barred to stock number as inherent component of assembly); machine; NC; 6–32 x 1/8″ binding-head; steel; black; holds spring to lamp housing.	2				*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH–222 AND PH–222–A.

b. Projector PH–222–A (contd).

Ref Symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	6L6632–2.9S	SCREW: upper film; special; (to be barred to stock number as inherent component of assembly); machine; NC; 6–32 x 1/8″; binding-head; steel; nickel-plated; holds upper film magazine and take-up film magazine guide to pressure plate assembly.	4				*	*	*
AF 399	8P7–575	SHAFT AND KNOB: sprocket; steel; chrome-plated; knob; 5/32″ x 31/32″ OD serrated; shaft 4″ long; 0.314″ OD for 15/16″; 0.217″ OD for 13/32″; 0.188″ OD for 3/8″; 0.217″ OD for 13/32″; 0.186″ OD for 15/32″; flattened for 3/8″ on both sides of end as key for clutch cone socket; and internally threaded; machine; NC; 4–40; to hold sprocket and clutch assembly.	1				*	*	*
AF 429	8P7–578	SOCKET: candelabra base; 0.685″ OD x 3/4″ brass tube with bayonet type cut-outs; inbedded in a 1 3/8″ OD x 0.311″ bakelite base having two 5/32″ ID holes, 1 1/16″ apart; central contact; two screw binding posts; holds projector lamp.	1				*	*	*
AF 374	8P7–579	SOCKET: clutch cone; steel; 1/2″ x 1″ OD; inside keyed to fit on sprocket shaft; also permits clutch seat; 5/32″ x 15/16″ ID; disengages from clutch cone to permit framing.	1				*	*	*

Original from UNIVERSITY OF CALIFORNIA

AF 335	8P7–582	SPACER: sprocket; steel; ½″ x ½″ OD; 0.190″ ID; one end cut in for 3/32″ to ⅜″ ID; centers sprocket on shaft.	1				*	*	*
AF 355	8P7–588	SPRING: clutch; 0.280″ OD x 7/16″; 0.035″ music wire; strong action; holds clutch socket against clutch cone.	1				*	*	*
AF 387	8P7–590	SPRING: 1 3/8″ x 3/16″ x 0.020″; spring steel; with two rivet holes at one end; other end V-shaped to engage tooth on framer lever; riveted to right-angle flange; each leg being ¾″ x 3/16″ x 0.038; steel; blackened; with rivet and screw holes; engages framer lever.	1				*	*	*
AF 325	8P7–587	SPRING: music wire; 0.033″ OD; ⅝″ x 5/32″ OD; with ends bent to form hooks; very strong action; chrome-plated; holds index pawl lever against index cam.	1				*	*	*
2040	8P7–591	SPRING: spring steel; 0.021″ x 5/16″ x 31/32″; rounded ends; with ⅛″ ID hole at one end and 3/16″ OD x 1/16″ depression at other; screwed to lens tube and holds steel ball in lens barrel focusing groove.	1				*	*	*
AF 324	8P7–586	SPRING: coil; four volutes; 0.180″ OD x 5/16″; 0.010″ spring; steel wire; soft action; holds pressure plate against aperture plate.	2				*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

23. MAINTENANCE PARTS LISTS FOR PROJECTORS PH–222 AND PH–222–A.

b. Projector PH–222–A (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	8P7–585	SPRING: coil-type; 0.020″ OD steel; music wire; 6 volutes; last 2 volutes stretched out; 5/16″ x 0.222″ OD; holds take-up magazine to shaft.	1				*	*	*
AF 378	8P7–589	SPRING: turret plate button tension; flat spring; steel: 5/16″ x 5/16″ x 0.020″; black; 9/64″ OD hole at one end, round indentation at other; to hold button against turret plate.	4				*	*	*
AF 361	8P7–596	SPROCKET: 35-mm; steel; with brass bushing; 1¼″ OD x 1⅛″; Allen setscrew bushing; 0.220″ ID; pulls the film.	1				*	*	*
	3Z9862–1–5	SWITCH: lamp cord; toggle; single-pole, single-throw; bakelite body; 10-amp; 125-v; shorting type contacts; line cord type 1¼″ x 2¼″; rounded; in lamp cord.	1				*	*	*
AF 448	8P7–599	TUBE: tube 1 11/16″ ID x 3⅝″; felt-lined; black crackle finish; aperture 2 9/16″ x 3⅝″ with flat springs; holds and permits focusing of lens; holds slide holder.	1				*	*	*
AF 530	8E71	LAMP: projector; incandescent; 115-v; 200-w; clear; 1″ OD x 3½″ over-all; candelabra; bayonet base; single contact; tungsten; base down burning; 25-hour life; Mazda.		1	*		*	*	*

* Indicates stock available.

Digitized by Google
Original from UNIVERSITY OF CALIFORNIA

Digitized by Google

Original from
UNIVERSITY OF CALIFORNIA

Digitized by Google

Order No. 34248-Phila-43-54; 13100 copies, 21 Oct. 44.

Original from
UNIVERSITY OF CALIFORNIA

Digitized by Google
Original from
UNIVERSITY OF CALIFORNIA