TM 11-421

WAR DEPARTMENT TECHNICAL MANUAL

CEILING LIGHT PROJECTORS

ML-121-A, ML-121-B, ML-121-C, ML-121-D, ML-121-E, ML-121-F, AND ML-121-G

WAR DEPARTMENT • 6 OCTOBER 1944

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This manual supersedes TM 11–421, 26 June 1943.

CEILING LIGHT PROJECTORS

ML-121-A, ML-121-B, ML-121-C,

ML-121-D, ML-121-E, ML-121-F,

AND ML-121-G

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Washington: 1944

WAR DEPARTMENT,
WASHINGTON 25, D. C., 6 October 1944.

TM 11–421, Ceiling Light Projectors ML–121–A, ML–121–B, ML–121–C, ML–121–D, ML–121–E, ML–121–F, and ML–121–G, is published for the information and guidance of all concerned.

[A. G. 300.7 (24 Aug 44).]

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TECHNICAL MANUAL

CEILING LIGHT PROJECTORS ML-121-A, ML-121-B, ML-121-C, ML-121-D, ML-121-E, ML-121-F, ML-121-G, AND ML-121-H

CHANGE
No. 1

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *19 June 1952*

TM 11-421, 6 October 1944, is changed as follows:

The title of the manual is changed to read—

CEILING LIGHT PROJECTORS ML-121-A, ML-121-B, ML-121-C, ML-121-D, ML-121-E, ML-121-F, ML-121-G, AND ML-121-H

Section 1. DESCRIPTION

Note (Added). Ceiling Light Projector ML-121-H is similar to Ceiling Light Projector ML-121-G. All information in the technical manual which applies to Ceiling Light Projector ML-121-G applies also to Ceiling Light Projector ML-121-H, unless specified otherwise in this Change.

4. Drum

(figs. 1 and 2)

* * * * * * *

b. Points of Difference.

Model	Construction	Net weight (lb.)	Shipping weight (lb.)	No. of perches	Where located	Door frame is clamped by—	Drainage holes	Where located
*		*		*	*	*	*	*
ML–121–G	Cast iron	127	185	2	Outside of drum	2 bolts and wingnuts	1	Bottom of drum.
ML–121–H	Aluminum	90	128	2	Outside of drum	2 bolts and wingnuts	1	Bottom of drum.

5. Optical System

a. Lamp (figs. 3, 4 **and 4.1**). The lamp used * * * with two lamps.

b. Primary Reflector (figs. 3, 4 **and 4.1**). The primary reflector * * * the primary reflector.

c. Secondary Reflector (figs. 3, 4 **and 4.1**). (1) General. The secondary reflector * * * heating and cooling.

* * * * * * *

d. Socket Assembly (figs. 3, 4 **and 4.1**). The socket assembly * * * the secondary reflector.

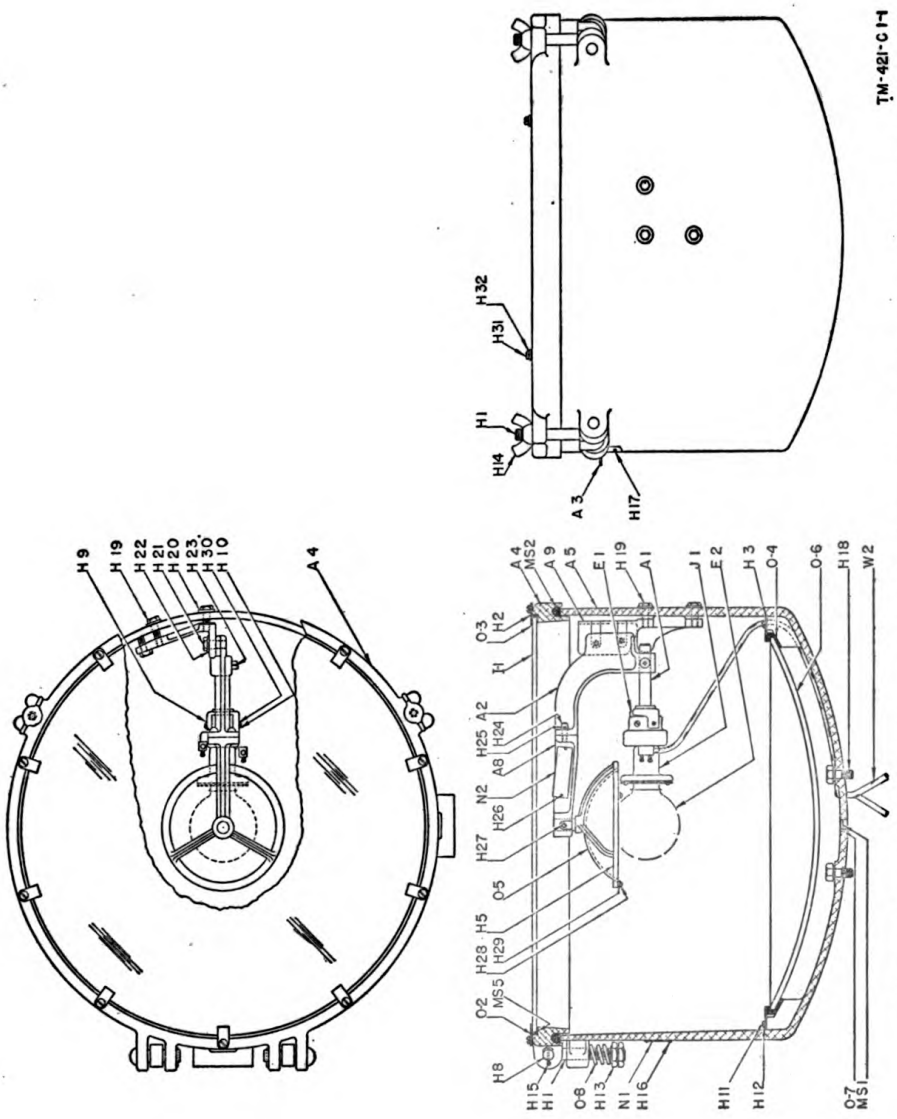

Figure 4.1 (Added) *Ceiling Light Projector ML-121-H, housing assembly.*

A1. Base, lampholder.
A2. Bracket.
A3. Bracket.
A4. Door.
A5. Housing.
A8. Support, leg.
A9. Support, mounting base.
E1. Insulator, plate.
E2. Lamp.
H1. Eyebolt.
H2. Clamp.
H3. Clamp.
H5. Holder, reflector.
H8. Pin, hinge.
H9. Washer, flat asbestos padded.
H10. Washer, flat.
H11. Machine screw.
H12. Lockwasher.
H13. Nut, jam.
H14. Wingnut.
H15. Cotter pin.
H16. Drivescrew.
H17. Machine screw.
H18. Cap screw.
H19. Cap screw.
H20. Washer, flat.
H21. Cap screw.
H22. Lockwasher.
H23. Setscrew.
H24. Machine screw.
H25. Lockwasher.
H26. Drivescrew.
H27. Setscrew.
H28. Machine screw.
H29. Washer, flat.
H30. Machine screw.
H31. Machine screw.
H32. Lockwasher.
I-1. Lens, spotlight.
J1. Lampholder.
MS1. Cloth, wire.
MS2. Gasket.
MS5. Insulating compound.
N1. Plate, identification.
N2. Plate, instruction.
O-2. Cushion, lens.
O-3. Cushion, lens.
O-4. Cushion, lens.
O-5. Reflector, light.
O-6. Reflector, light.
O-7. Ring, retainer.
O-8. Spring.
W2. Cable assembly, special purpose.

Figure 4.1 (Added) *Ceiling Light Projector ML-121-H, housing assembly.*—Con.

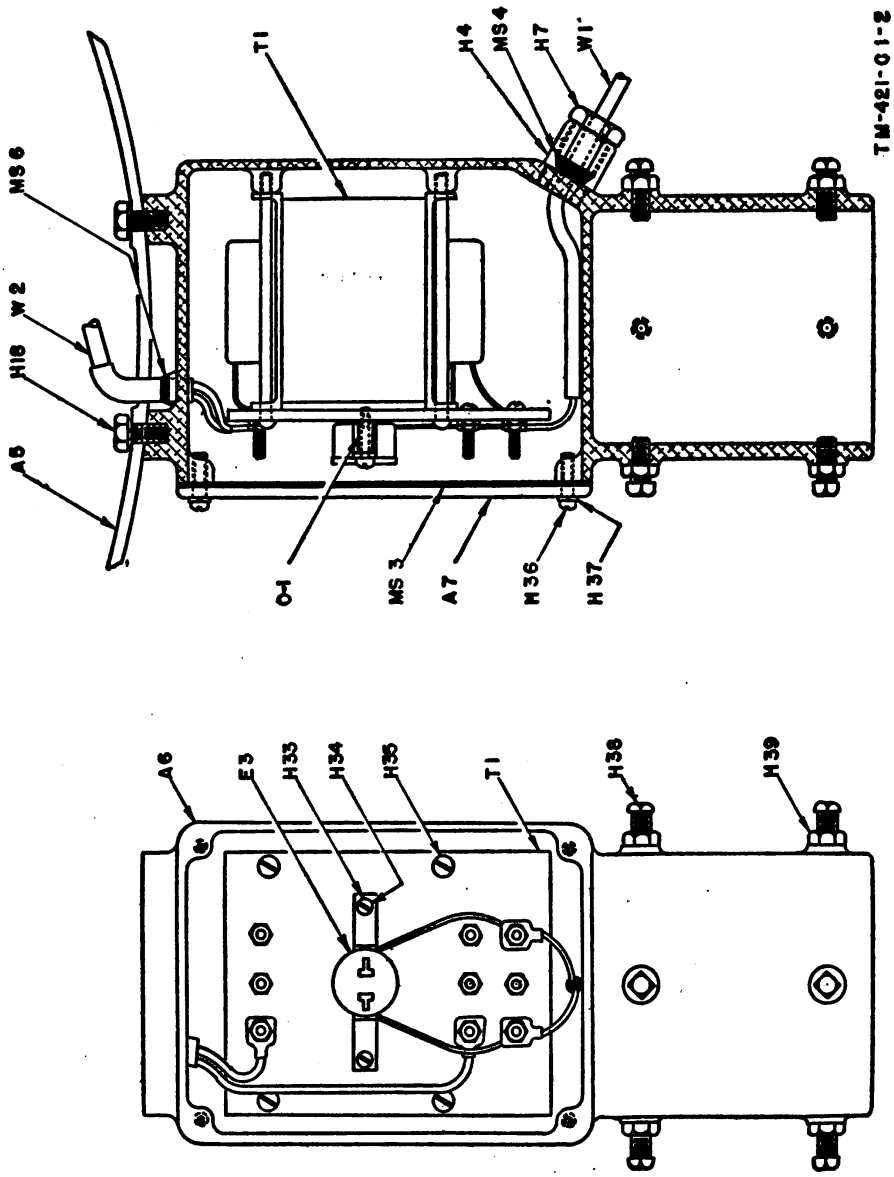

Figure 5.1 (Added) *Ceiling Light Projector ML-121-H, transformer housing assembly.*

A5. Housing.
A6. Housing, transformer.
A7. Plate, cover.
E3. Connector, receptacle.
H4. Gland.
H7. Nut, packing.
H18. Cap screw.
H33. Machine screw.
H34. Lockwasher.
H35. Machine bolt.
H36. Machine screw.
H37. Lockwasher.
H38. Setscrew.
H39. Nut.
MS3. Gasket.
MS4. Gasket.
MS6. Insulating compound.
O-1. Bushing.
T1. Transformer, power, step-down.
W1. Cable assembly, special purpose.
W2. Cable assembly, special purpose.

Figure 5.1 (Added) *Ceiling Light Projector ML-121-H, transformer housing assembly.*—Continued.

7. Transformer

(figs. 5, 5.1, and 6)

* * * * * * *

d. Table of Taps for Line Voltage. The proper transformer * * * are as follows:

(1) Ceiling Light Projectors ML–121–A, ML–121–B, ML–121–C, ML–121–E, ML–121–F, and ML–121–G.

Ceiling Light Projectors ML–121–A and ML–121–B		Ceiling Light Projectors ML–121–C, ML–121–E, ML–121–F, and ML–121–G	
Line voltage	Use primary taps	Line voltage	Use primary taps
*	*	*	*

(2) Ceiling Light Projector ML–121–D.

Ceiling Light Projector ML–121–D	
Line voltage	Use primary taps
*	*

(3) (Added) *Ceiling Light Projector ML–121–H.*

Ceiling Light Projector ML–121–H	
Line voltage	Use primary taps
90	± and 90
95	± and 95
100	± and 100
105	± and 105
110	± and 110
120	± and 120

Note. Ceiling Light Projector ML–121–D has one * * * two movable leads.

10.1. Connecting Ceiling Light Projector to Control Set ML–212

(fig. 7.1)

(Added)

Control Set ML–212 consists of an auxiliary equipment that permits control of the ceiling light projector at the point from which cloud height observations are made.

a. The control set consists of six individual units: a heavy-duty relay, a safety switch, a light-duty relay, a transformer, a pilot light and switch, and a fuse block.

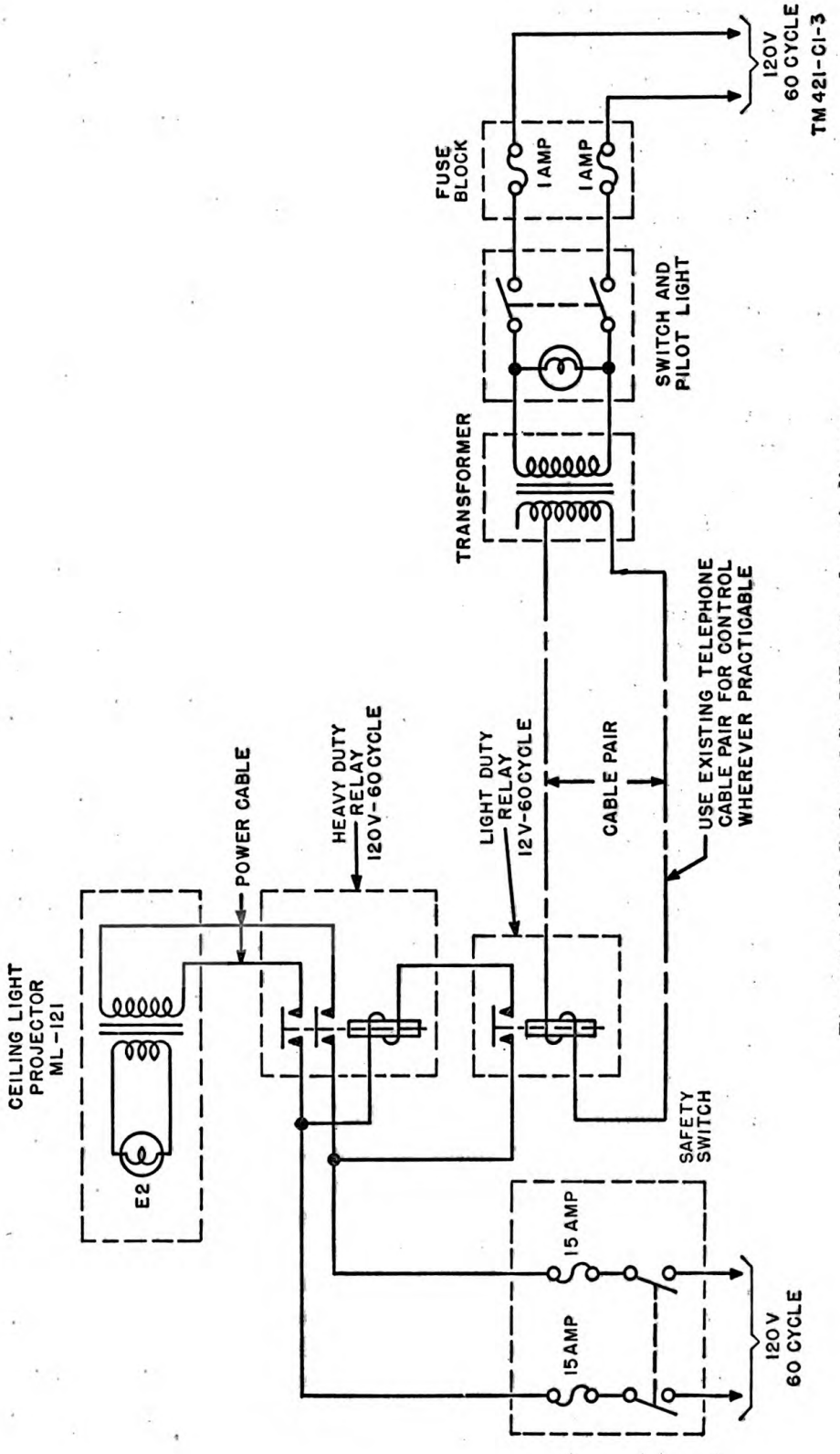

Figure 7.1 (Added) *Control Set ML–212, schematic diagram.*

b. Where conditions permit, locate the ceiling light projector 25 feet, or less, from a building in which a 110-volt a-c supply is available. Install both relays and the safety switch in the building where the current supply is located. Terminate the telephone cable, or field wire, near the door of the building used by the observer. Install the pilot light and switch and the transformer at or near the point where observations are made.

c. This transformer steps down the voltage applied to the light-duty relay. The light-duty relay is energized; it closes the circuit and allows a full 120 volts to be applied to the heavy-duty relay. The current then is applied directly to the transformer of the ceiling light projector.

Note. Check the safety switch to make sure it is in the closed position before attempting to operate the projector. The equipment will not operate unless this switch is in the closed position.

15.1. Replacing Level Perches
(Added)

During normal use, no replacement or adjustment of the level perches is necessary. If the level perches become broken or bent, they must be replaced and adjusted with respect to the optical system. Proceed as follows:

a. Remove the two screws that hold the level perch to the drum.

b. Fasten the new level perch to the drum by using the two screws, but do not tighten the screws firmly at this time.

c. Make certain that the adjustment of the optical system is correct by following the procedure outlined in paragraph 15*b* (1) through (7).

d. Place a spirit level on the level perch and adjust the perch until the bubble is centered in the spirit level. Then tighten the two screws that hold the level perch to the drum.

24. Replacing Transformer

* * * * * * *

d. (Added) *Ceiling Light Projector ML-121-H.*

(1) Remove the cover plate of the transformer housing by removing the four screws that hold the cover plate.
(2) Disconnect the power line from the terminal block.
(3) Disconnect the two wire leads from the convenience outlet.
(4) Disconnect the two lamp leads from the terminal block.
(5) Remove the ¼-inch machine bolts that hold the transformer.
(6) Remove the transformer from the housing.
(7) Install and connect a new transformer in the housing by reversing the procedure described above for removing the defective transformer.

28. Identification Table of Parts for Ceiling Light Projector ML–121–H (Sig C stock No. 7A481)

(Added)

Note. The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as specific T/O & E, T/A, T/BA, SIG 7–8–10, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7 & 8 ML–121. For an index of available supply catalogs in the Signal portion of the Department of the Army Catalog, see the latest issue of SIG 1.

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
A3	BRACKET: L-shaped; steel; 2¾″ lg x ⅞″ wd approx.	Provides shelf for spirit level	7A8110–327/82
H2	CLAMP: phosphor bronze; ½″ x 1″ x .04″ thk	Holds lens in place	7A481A–1/11
MS1	CLOTH, wire: cadmium plate, bronze finish; .015″ dia wire; ⅝″ dia.	Covers drain hole in bottom of housing	7A8110–327/C5
	CONNECTOR RECEPTABLE: cylindrical; phenolic; 2 contacts.	Receives a male plug for checking primary voltage	6Z7811–8
I–1	COVER: glass	Glass cover for projector	7A481C/13
O–2	CUSHION, lens: cork; ½″ x 5/16″ x 3/32″ thk	Cushion between lens and mounting frame	7A481C/1C
O–3	CUSHION, lens: cork; ½″ x 1″ x 1/16″ thk	Cushion between lens and clamp	7A481C/15
O–4	CUSHION, mirror: cork; ½″ x 1¾″ x ⅛″ thk	Cushion to guard reflector light from shock	7A8110–327/C4
MS2	GASKET: graphite asbestos; ⅜″ dia x 59½″ lg	Provides weatherproof seal between housing and door.	7A8110–327/G2
MS3	GASKET: cork; 8⅞″ x 6⅝″ x 1/16″ thk; four 5/16″ dia holes.	Provides weatherproof seal between cover plate and transformer housing.	7A8110–327/G1
E2	LAMP, incandescent: 12 v, 420 w; mogul base, prefocus; G–25, clear, C–2, filament; 100 hr life.	Light source	7A481/2
J1	LAMPHOLDER: mogul base, prefocus; 600 v, 1500 w; 3¼″ lg x 2⅜″ dia x 2″ d.	Holds lamp	7A481A–1/6
H6	LEVEL, spirit: machinist; 4″ lg x ⅝″ square; steel	Used to level ceiling light projector	6Q63141
	PROJECTOR, ceiling light: bare unit	Replaces Ceiling Light Projector ML–121–H less remaining items on latest parts control list.	7A481HZ
O–5	REFLECTOR, light: mirrored glass; 5″ dia; 2⅞″ focus; spherical curve.	Eliminates front spill and stray light	7A481A–1/4

Reference symbol	Name of part and description	Function of part	Signal Corps stock No.
O-6	REFLECTOR, light: mirrored glass; 16¾″ dia; 7⅞″ focus; parabolic; ¼″ hole in center.	Projects light beam	7A481A-1/2
T1	TRANSFORMER, power: step-down; input 90/95/100/105/110/120 v ac, 60 cycles; single-phase; output 12 v at 35 amp; 5½″ lg x 5″ x 4½″.	Provides source of 12-volt power for lamp in ceiling light projector.	2Z9621-192

[AG 300.7 (15 May 52)]

BY ORDER OF THE SECRETARY OF THE ARMY:

J. LAWTON COLLINS
Chief of Staff, United States Army

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U. S. GOVERNMENT PRINTING OFFICE: 1952

AGO 4072B

CONTENTS

DESTRUCTION NOTICE

WHY —To prevent the enemy from using or salvaging 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—Drum, cover glass, reflectors, lamp, level, transformer housing, slip fitter, terminal board, convenience outlet.
2. Cut—Transformer leads, gaskets, cables, screening.
3. Burn—Technical manuals.
4. Bend—Bezel (door frame), reflector holders, moisture seals.
5. Bury or scatter—Any or all of the above pieces after destroying them.

DESTROY EVERYTHING

This manual supersedes TM 11-421, 26 June 1943.

SECTION I

DESCRIPTION

1. Purpose

Ceiling Light Projectors ML-121-A, ML-121-B, ML-121-C, ML-121-D, ML-121-E, ML-121-F, and ML-121-G project a vertical beam of light from the ground to the zenith, and are used to illuminate a spot on the clouds. A ceiling light projector is used with other instruments to determine the heights of clouds. Ceiling heights to 10,000 feet may be measured in this manner. Ceiling Light Projector ML-121-(*) refers to all models of the equipment discussed in this manual.

2. Major Components (fig. 1)

The major components of Ceiling Light Projector ML-121-(*) are:

- 1 drum
- 1 optical system which includes:
  - 1 lamp
  - 1 primary reflector
  - 1 secondary reflector
  - 1 socket assembly
- 1 supporting base
- 1 transformer

3. Dimensions and Weight

Ceiling Light Projector ML-121-(*) has a maximum diameter of 21½ inches and is 28¾ inches high. The net weight of the complete assembly is approximately 127 pounds if constructed of cast iron or 82 pounds if constructed of cast aluminum. (See par. 4b.)

4. Drum (figs. 1 and 2)

a. GENERAL. The projector drum is a weatherproof housing which holds the various parts of the projector in their correct positions. The drum is cast in one piece and is of sufficient dimension (par. 3) to dispel the heat from the lamp which is used with the projector. A ½-inch hole at the bottom of the drum drains any moisture which accumulates by condensation inside the drum. The drainage hole is screened with insect-proof wire mesh. A cast bezel (door frame) holds the cover glass securely over the drum. Sealing compound weatherproofs the joint between the

cover glass and the door frame, while a gasket in the door frame provides a weathertight joint at the edge of the drum. The door frame is hinged to the drum on one side and is held securely in place by clamps. On some models, leveling perches, 90° apart, are so adjusted that the beam is directed at the zenith when the perches are level.

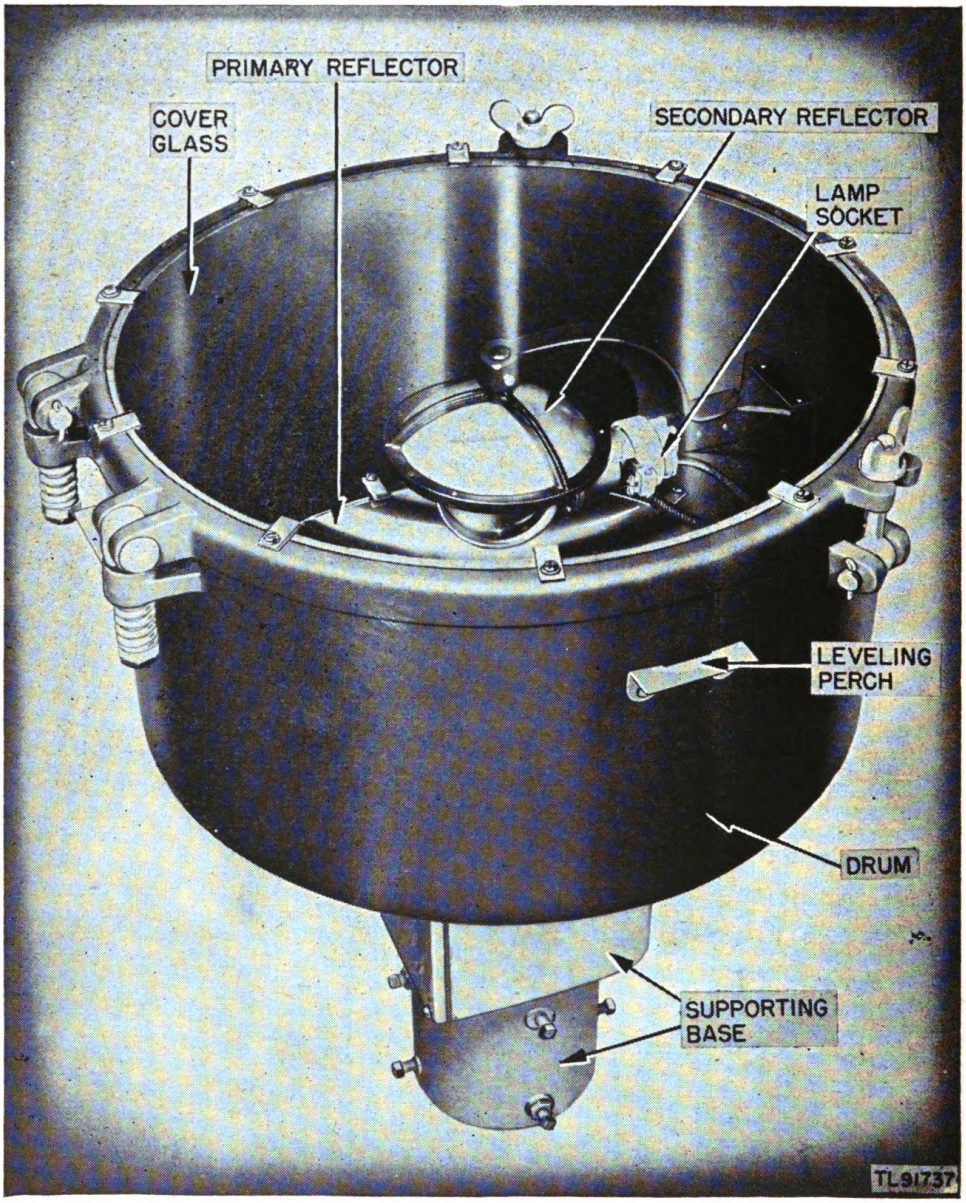

Figure 1. Ceiling Light Projector ML–121–E.

b. Points of Difference.

Model	Construction	Net weight (lb.)	Shipping weight (lb.)	No. of perches	Where located	Door frame is clamped by —	Drainage holes	Where located
ML–121–A	Aluminum alloy	82	135	0	——	2 bolts and wing-nuts	1	Bottom of drum
ML–121–B	Aluminum or iron	82 or 127	135 or 185	0	——	2 bolts and wing-nuts	1	Bottom of drum
ML–121–C	Cast iron	127	185	2	Outside of drum	2 bolts and wing-nuts	1	Bottom of drum
ML–121–D	Iron alloy or aluminum	140 or 90	180 or 128	2	Outside of transformer housing	4 C-clamps and wing screws	2	Back of drum
ML–121–E	Cast iron	127	185	2	Outside of drum	2 bolts and wing-nuts	1	Bottom of drum
ML–121–F	Cast iron	127	185	2	Outside of drum	2 bolts and wing-nuts	1	Bottom of drum
ML–121–G	Cast iron	127	185	2	Outside of drum	2 bolts and wing-nuts	1	Bottom of drum

5. Optical System

a. LAMP (figs. 3 and 4). The lamp used with Ceiling Light Projector ML–121–(*) is a 420-watt, 12-volt, 35-ampere airplane headlight lamp with a G–25 bulb and a mogul prefocus base. The maximum over-all length of the lamp is $5\frac{3}{16}$ inches. During manufacture the lamp filament is located in the correct focal position with respect to the prefocus base. Each projector is furnished with two lamps.

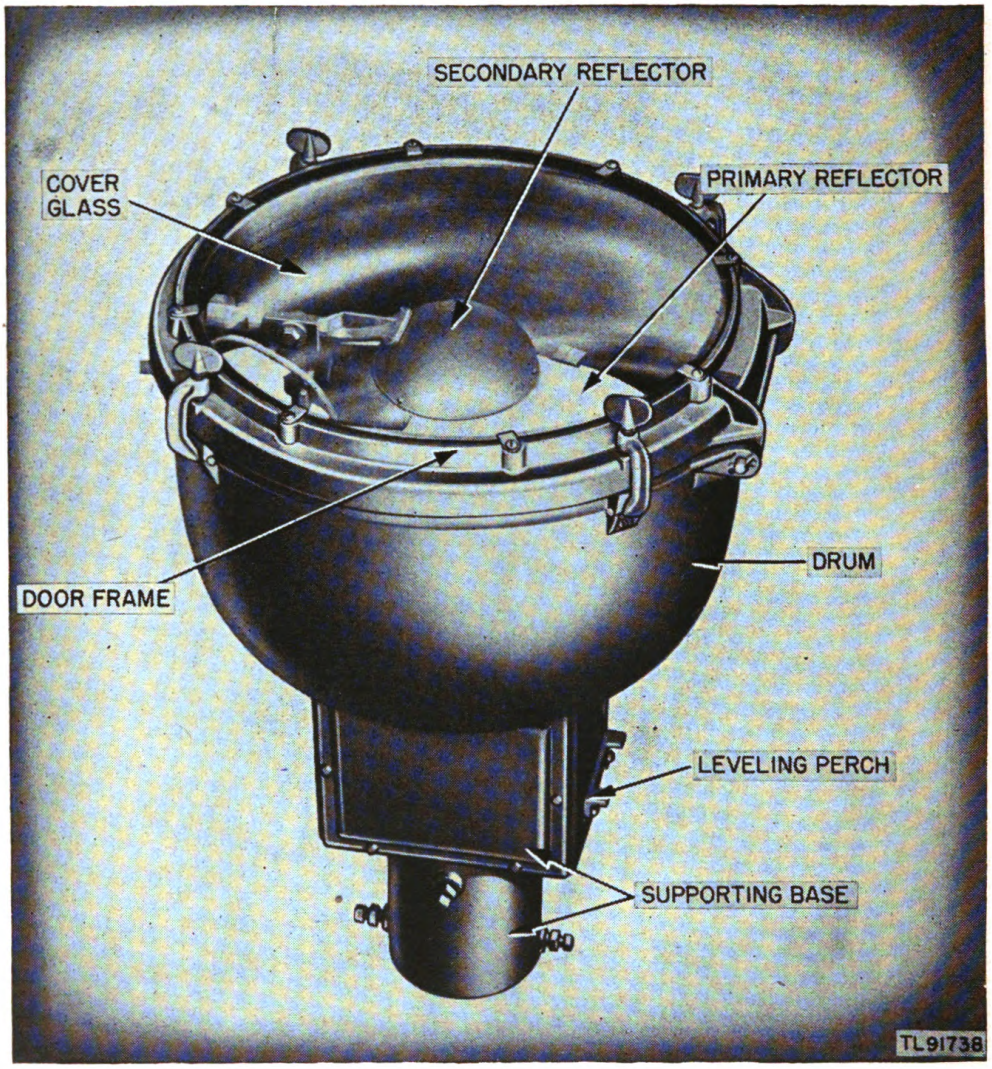

Figure 2. Ceiling Light Projector ML–121–D.

b. PRIMARY REFLECTOR (figs. 3 and 4). The primary reflector is a parabolic mirror constructed of silvered, high-transmission glass which does not crack when it is subjected to repeated heating and cooling. The primary reflector is about $16\frac{3}{4}$ inches in diameter and has a focal length of $7\frac{7}{8}$ inches. It is mounted on felt-covered bosses and is held securely to the bottom of the drum by screws, lockwashers, and clips. A $\frac{1}{4}$-inch drainage hole is located in the center of the primary reflector.

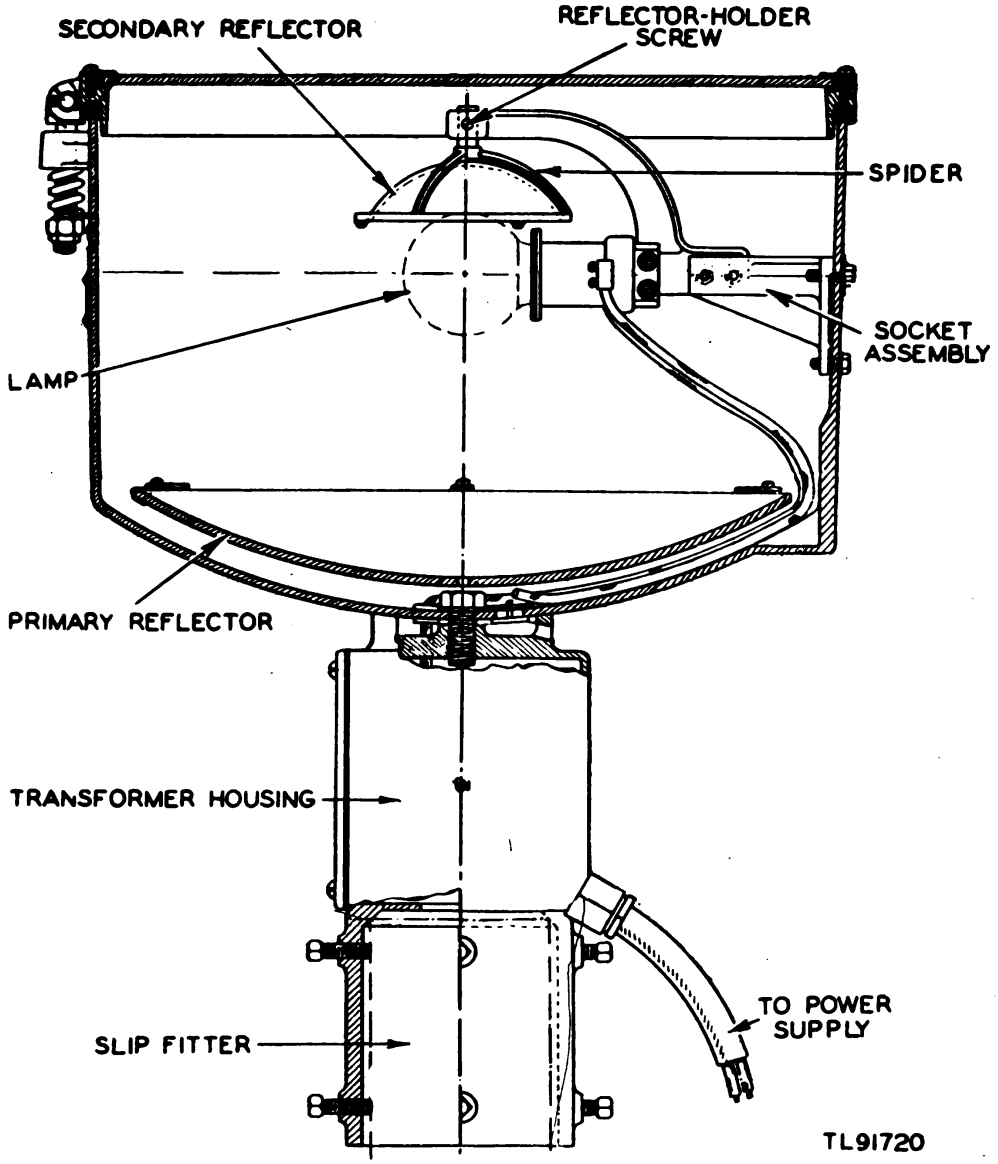

Figure 3. Ceiling Light Projector ML–121–E, general assembly.

c. SECONDARY REFLECTOR (figs. 3 and 4). (1) *General.* The secondary reflector is a 5-inch, silvered-glass mirror. It is spherical in shape and has a radius of 2¾ inches and a face diameter of 4½ inches. The reflector does not crack when subjected to repeated heating and cooling.

(2) *Difference in mounting.* (*a*) In Ceiling Light Projector ML–121–D the secondary reflector is held in a spherical reflector holder by a clamping ring and three machine screws. The reflector holder is rigidly mounted on an arm of the socket assembly by two screws so that the focal points of the reflector and lamp coincide. (See fig. 9.)

(*b*) In Ceiling Light Projectors ML–121–A, ML–121–B, ML–121–C, ML–121–E, ML–121–F, and ML–121–G the secondary reflector is fastened to an iron or aluminum spider (par. 4b) by three machine

screws. A fillister-head machine screw secures the spider to an overhanging bracket so that the filament of the lamp coincides with the focal point of the reflector. (See fig. 3.)

Note. In Ceiling Light Projector ML–121–G the bracket is provided with a spider arm which supports the spider.

d. SOCKET ASSEMBLY (figs. 3 and 4). The socket assembly consists of a cast aluminum or cast-iron base (par. 4b) which rigidly supports a mogul prefocus socket and the secondary reflector assembly. The socket assembly is so located that it supports the lamp at the focal point of the primary reflector and the radius point of the secondary reflector.

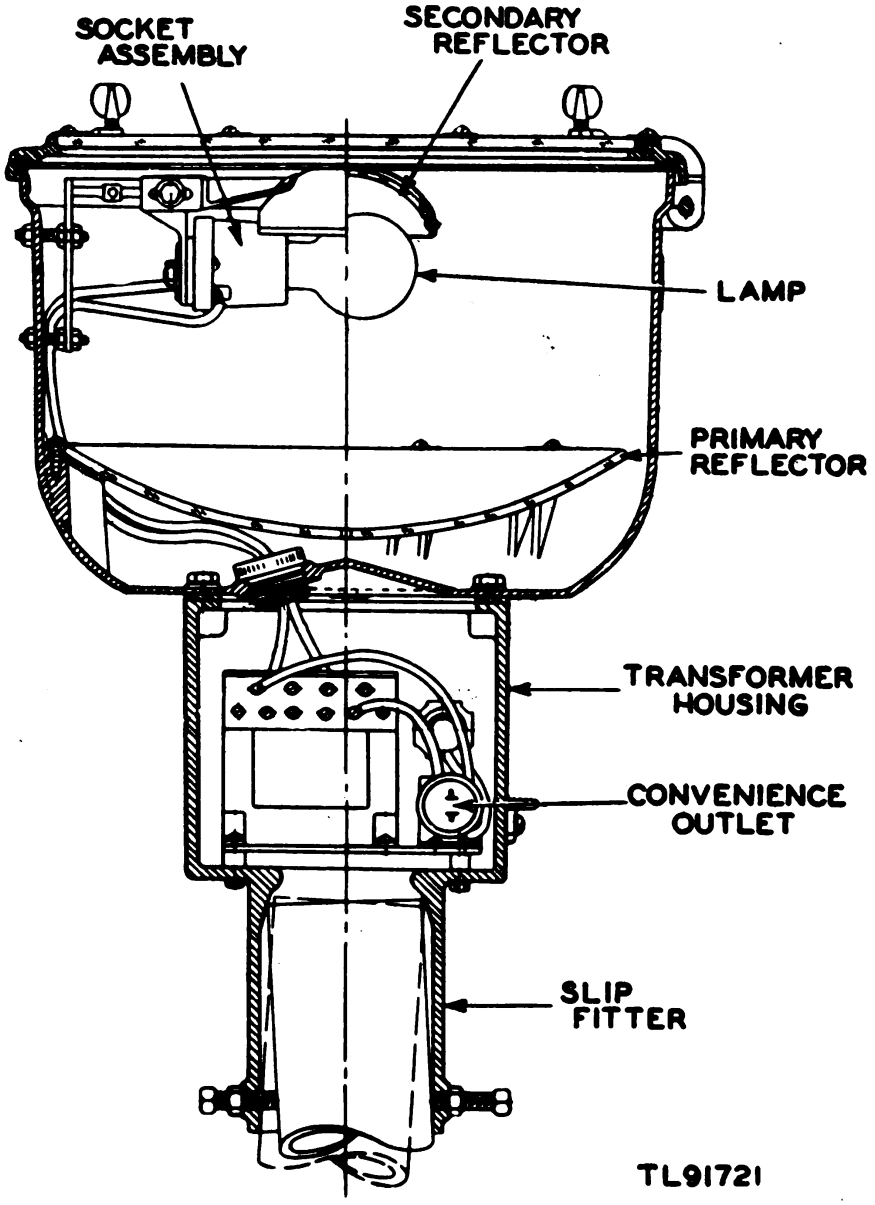

Figure 4. Ceiling Light Projector ML–121–D, general assembly.

6. Supporting Base (figs. 1 and 2)

The base of the projector is a single casting for both the transformer housing and slip fitter. A gasketed, weatherproof cover protects the transformer housing. A removable cover plate provides access to the transformer terminal block and to the convenience outlet. (See par. 7.) The slip fitter is designed to fit over a 4-inch, standard pipe with sufficient play to permit leveling of the drum by four setscrews in Ceiling Light Projector ML–121–D or by eight setscrews in all other models of the projector.

Note. The 4-inch standard pipe is not a component of the equipment and must be furnished at the place of installation. The pipe is usually supported by a base of concrete. (See fig. 7.)

7. Transformer (figs. 5 and 6)

a. Ceiling Light Projector ML–121–A. The transformer is a single-winding, 25-cycle, step-down autotransformer which supplies the

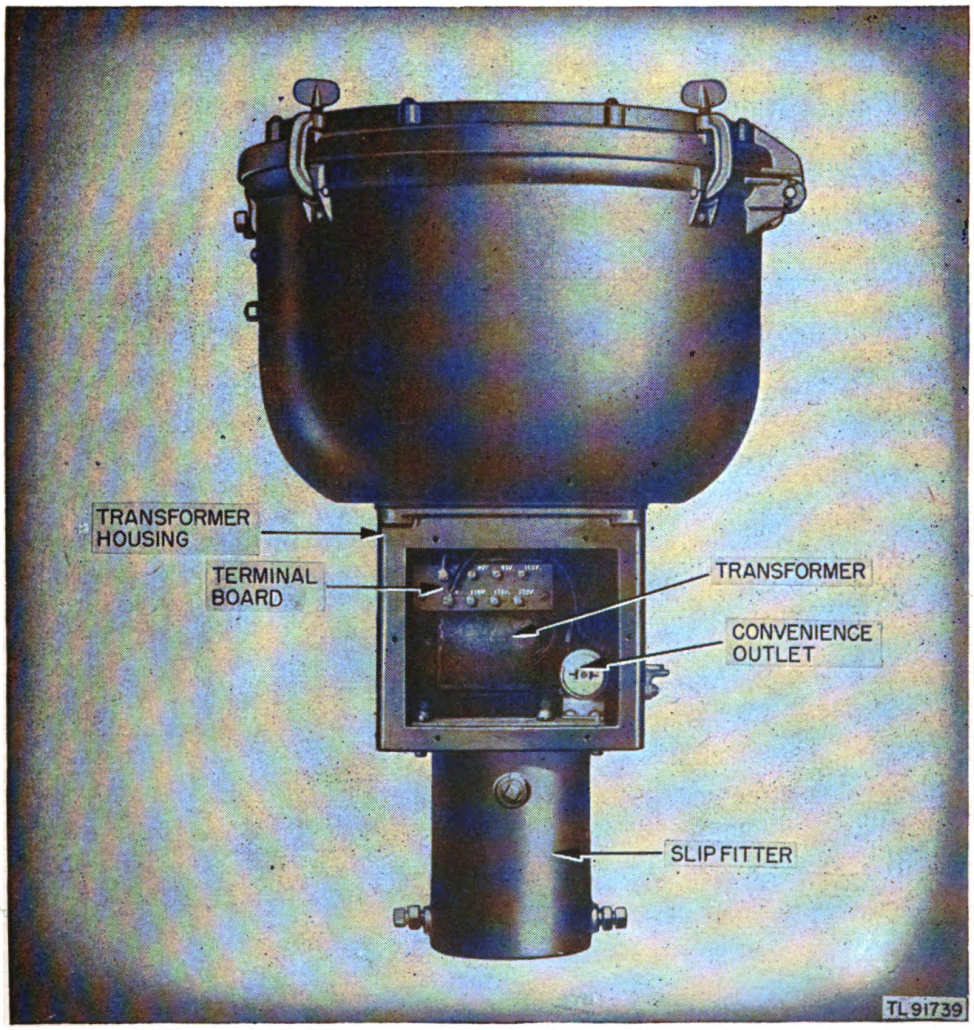

Figure 5. Ceiling Light Projector ML–121–D, supporting base, transformer-housing cover removed.

correct voltage for the 12-volt lamp used in the projector. The transformer is located inside the transformer housing. Taps on the primary winding are provided for input voltages of 90, 95, 100, 105, 110, 115, and 120 volts to obtain the rated secondary voltage over a wide range of input (line) supply conditions. The transformer provides a secondary voltage of approximately 12 volts across a lamp load of 34.7 amperes. The transformer has a capacity of 450 volt-amperes. A convenience outlet with two T-slots is mounted in the transformer housing, and is connected in parallel with the primary terminals for convenience in measuring the primary voltage.

b. CEILING LIGHT PROJECTOR ML–121–B. The transformer is a single-winding, step-down autotransformer which is used with a 60-cycle source of supply. Otherwise, this autotransformer is similar to the autotransformer used with Ceiling Light Projector ML–121–A (a above).

c. CEILING LIGHT PROJECTORS ML–121–C, ML–121–D, ML–121–E, ML–121–F, AND ML–121–G. These models of the ceiling light projector are each provided with a 2-winding, step-down transformer which is used with a 60-cycle source of supply. (See par. 10.) The other characteristics of the 2-winding transformer are similar to those of the autotransformer described in a above.

d. TABLE OF TAPS FOR LINE VOLTAGE. The proper transformer taps for various existing line voltages are as follows:

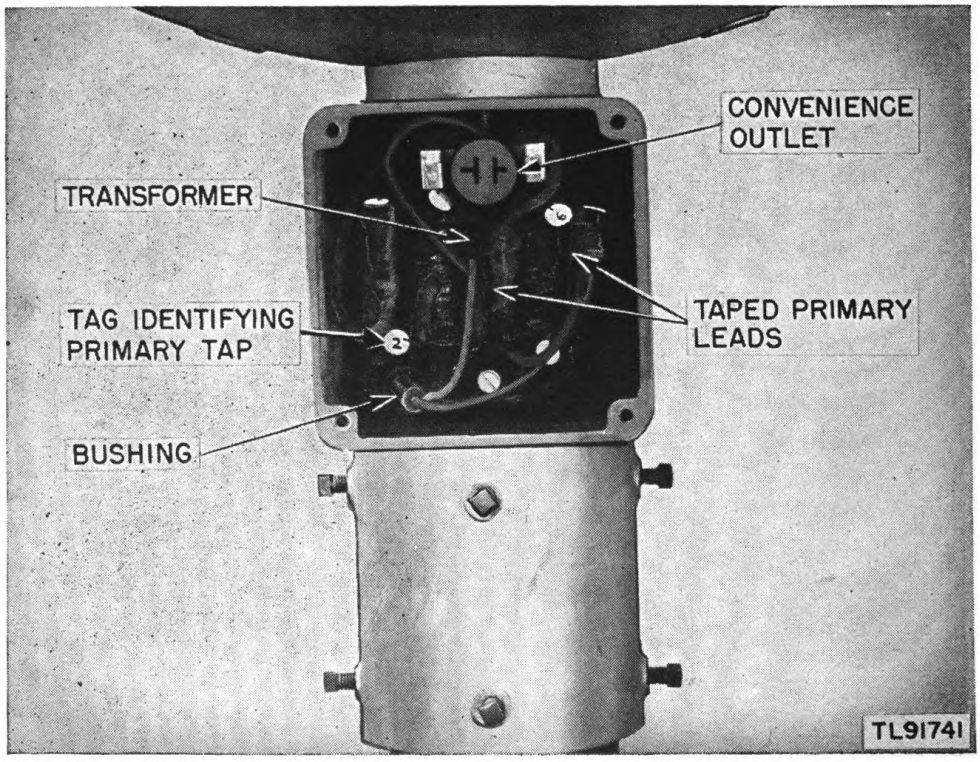

Figure 6. Ceiling Light Projector ML–121–B, supporting base, transformer-housing cover removed.

Ceiling Light Projectors ML–121–A and ML–121–B		Ceiling Light Projectors ML–121–C, ML–121–E, ML–121–F, and ML–121–G	
Line voltage	Use primary taps	Line voltage	Use primary taps
90	3 and 6	90	3 and 4
95	2 and 6	95	2 and 4
100	3 and 8	100	3 and 5
105	2 and 8	105	2 and 5
110	1 and 6	110	2 and 6
115	1 and 7	115	1 and 5
120	1 and 8	120	1 and 6

Ceiling Light Projector ML–121–D	
Line voltage	Use primary taps
90	N and 90
95	N and 95
100	N and 100
105	N and 105
110	N and 110
115	N and 115
120	N and 120

Note. Ceiling Light Projector ML–121–D has one connector lead permanently attached to the terminal marked "N." All other models of the projector have two movable leads.

SECTION II

INSTALLATION AND OPERATION

8. Unpacking Ceiling Light Projector

Before unpacking a ceiling light projector, make sure that the pipe standard on which the projector is to be mounted is installed.

a. Open the side of the crate which is next to the top of the projector. This side is marked with arrows and is labeled "This side up." Be careful not to scratch or break the cover glass.

b. Remove the blocks and wedges which hold the projector in place.

c. Lift out the projector and proceed as instructed in paragraph 9.

d. If the projector must be transported to the place where it is to be installed, lay the projector on its side and haul it to its destination. Avoid rough handling.

Caution: Never place on the cover glass any tool or heavy object which may scratch the glass.

e. Remove the two lamps which are stored in an excelsior-filled compartment in one corner of the crate. No maintenance parts other than the lamp accompany the equipment.

9. Mounting Ceiling Light Projector

a. CEILING LIGHT PROJECTORS ML–121–A, ML–121–B, ML–121–C, ML–121–E, ML–121–F, AND ML–121–G. (1) Loosen the eight setscrews in the slip fitter, and unscrew them until they do not penetrate through the walls of the casting.

(2) Mount the projector on the 4-inch vertical pipe standard provided for this purpose.

(3) Place a spirit level on one of the leveling perches.

Note. Ceiling Light Projectors ML–121–A and ML–121–B are not provided with leveling perches. When mounting these models, place the level on the cover glass.

(4) Use four of the eight setscrews on the slip fitter (two each on opposite sides of the slip fitter) at a time to adjust the projector in a horizontal position in one direction. The other four setscrews level the projector in a position at right angles to the first setting.

(*a*) Use the setscrews which are in a position parallel to the perch on which the level is placed. Slowly tighten the lower setscrew on each side of the slip fitter. Adjust first one and then the other setscrew until the spirit level indicates a horizontal position.

(*b*) Gently tighten the upper setscrews on the same sides of the slip fitter. Be sure that the horizontal position of the projector is not disturbed during this operation.

(5) Place the level on the other perch. When using Ceiling Light Projector ML–121–A or ML–121–B, place the level at right angles to its previous position on the cover glass.

(6) Use the remaining four setscrews, and repeat the operations of (3) and (4) above until the drum is level.

(7) Securely tighten all the setscrews gradually. Check the level on both perches to make sure that the horizontal position remains unchanged.

(8) Tighten the locknuts which are provided on four of the screws. These locknuts are not provided on Ceiling Light Projectors ML–121–A and ML–121–B. The projector is now level so that the beam will be directly vertical.

Note. Construct a rail around the ceiling light projector to protect it. (See fig. 7.)

b. Ceiling Light Projector ML–121–D (fig. 2). (1) Loosen the four setscrews in the slip fitter, and unscrew them until they do not project through the walls of the casting.

(2) Mount the unit on top of the 4-inch vertical pipe provided for this purpose.

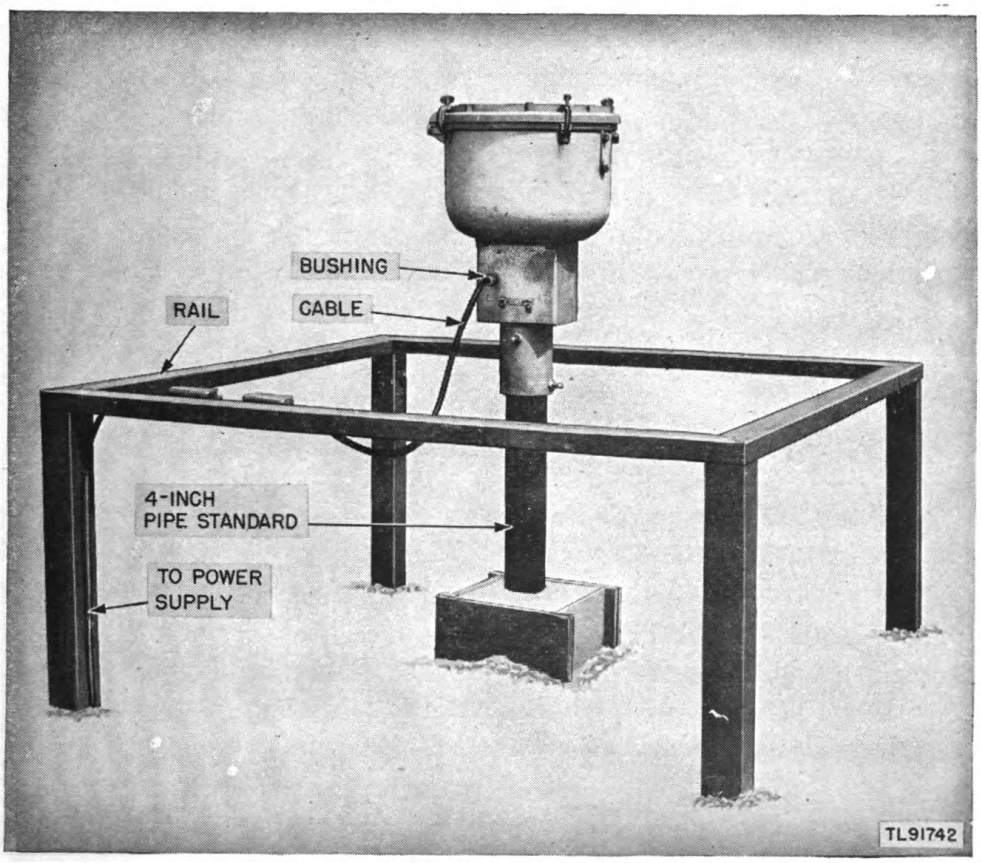

Figure 7. Ceiling Light Projector ML–121–D, installed.

(3) Place the spirit level on one of the leveling perches.

(4) Use two setscrews which are on opposite sides of the slip fitter and are in a position parallel to the perch on which the level is placed. Manipulate these screws until the level indicates that the drum is exactly horizontal in this plane.

(5) Tighten the screws against the pipe.

(6) Mount the level on the other perch, and repeat the operations of (3) and (4) above with the remaining setscrews.

(7) Check the first adjustment to make sure that it was not disturbed during the second setting.

(8) Securely tighten all four of the setscrews against the pipe. Turn the check nuts tightly against the casting to prevent the setscrews from becoming loose.

Note. Construct a rail around the ceiling light projector to protect it. (See fig. 7.)

10. Connecting Ceiling Light Projector to Power Supply

For Ceiling Light Projectors ML–121–B, ML–121–C, ML–121–D, ML–121–E, ML–121–F, and ML–121–G, a 60-cycle source of alternating current is required to supply a voltage of 90 to 120 volts at the projector when the lamp is on. Ceiling Light Projector ML–121–A is designed for a 25-cycle, a-c supply. The normal power consumption when the lamp is on is 450 watts. The power supply is not a component of the equipment.

a. Connect the 2-wire supply line from the control switch of the power supply to the cable which projects through the bushing on the back of the transformer housing. (See fig. 7.) Unless special connectors are provided for making this connection, splice the power line to the cable; solder the joints; and wrap them with both rubber and friction tape. (See fig. 6.)

b. If one side of the transformer is grounded to the ceiling light housing, the grounded side of the power line must be connected to the grounded side of the cable.

11. Making Transformer Connections

a. Selecting Transformer Taps. (1) Remove the cover plate of the transformer housing. Be sure that the power switch is off.

(2) Connect the two connectors of Ceiling Light Projectors ML–121–A and ML–121–B to transformer taps 1 and 6. In Ceiling Light Projectors ML–121–C, ML–121–D, ML–121–E, ML–121–F, and ML–121–G, connect the two movable terminals to the 120-volt taps. (See par. 7.)

(3) Close the switch which connects the projector to its power supply. *The connectors or movable terminals are now at line voltage. Do not touch them.*

(4) Plug the two leads of an a-c voltmeter, o- to 150-volts range, into the convenience outlet (figs. 5 and 6), and measure the line voltage.

Note. The life of the lamp is highly critical to over-voltage. Check the line voltage with no additional load on the circuit in order that adjustment may be made under the highest possible voltage conditions.

(5) Open the switch. Do not change the connections of the terminals or connectors while the control switch is closed.

(6) Determine the proper transformer taps for the measured line voltage, and connect these taps to the connectors. (See par. 7d.)

Note. Never use voltage taps for a rating lower than the measured line voltage. Use taps for a voltage equal or next higher to that of the line. For example, if the line voltage reads 117 volts, connect the line leads to the 120-volt taps.

(7) Install a lamp in its socket. (See par. 23.)

(8) Close the switch, and measure the voltage across the lamp terminals.

(*a*) If the voltage across the terminals of the lighted lamp is lower than 12 volts, connect the next lower tap in the primary circuit.

(*b*) If the voltage across the terminals of the lighted lamp is higher than 12 volts, connect the next higher tap on the primary of the transformer in the circuit.

Note. Use the primary taps which give a secondary voltage, with the lamp connected, close to 12 volts, but not higher than 12 volts.

b. Special Precautions for Ceiling Light Projectors ML–121–A and ML–121–B. (1) Tape the four unused transformer leads. (See fig. 6.) *Be sure that the power switch is turned off.*

(*a*) Fold back the bare end of the wire against the remaining insulation.

(*b*) Bind the conductor to the insulation with rubber tape.

1. Start to tape a tape's width before the bare wire. Make a half-lap winding of rubber tape.

2. Form a double-end closure with the tape, and wrap back toward the transformer to make a double layer of rubber tape.

(*c*) Wind a half-lap, double layer of friction tape over the rubber tape. Use the procedure described in (*b*) above. Extend the layer of friction tape 1 inch farther over the insulation than the rubber tape.

(2) Tape the bare connectors in the same manner.

12. Using Ceiling Light Projector ML–121–(*)

a. Turn the control switch on the power supply to the ON position. The vertical beam of light produces a visible illuminated spot on the clouds.

Note. There is no switch on the ceiling light projector itself.

b. Sight on the illuminated spot with Clinometer ML–119, and determine the ceiling height.

c. Occasionally check the line voltage at the projector to insure proper operating conditions. (See par. 21.)

SECTION III

FUNCTIONING OF PARTS

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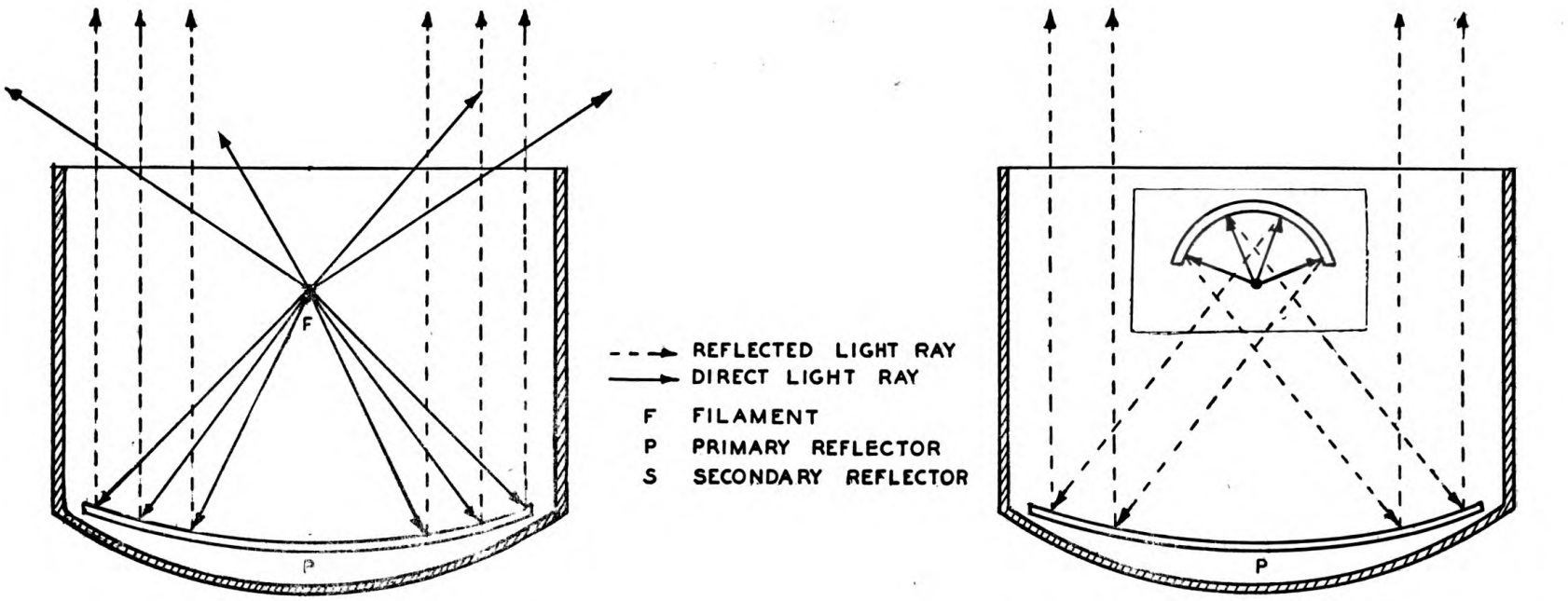
13. Primary Reflector (fig. 8)
The primary reflector collects all the light rays (from the lamp) which fall on its surface and reflects them in a vertical beam of concentrated parallel rays.

14. Secondary Reflector (fig. 8)
The secondary reflector intercepts all the light rays which would go directly through the projector cover glass and be wasted. The secondary reflector collects and reflects these rays through the filament to the primary reflector where they are again reflected as part of the vertical beam. The use of the secondary reflector results in an increase of approximately 35 percent in beam candle power.



FUNCTION OF PRIMARY REFLECTOR

DIRECT LIGHT RAYS FROM THE FILAMENT SPREAD OUT IN ALL DIRECTIONS. THE LIGHT RAYS WHICH STRIKE THE PRIMARY REFLECTOR ARE REFLECTED AS A VERTICAL BEAM. THE LIGHT RAYS WHICH DO NOT STRIKE THE PRIMARY REFLECTOR DO NOT BECOME PART OF THE BEAM AND ARE WASTED.

FUNCTION OF SECONDARY REFLECTOR

THE SECONDARY REFLECTOR COLLECTS ALL THE OTHERWISE WASTED LIGHT RAYS AND REFLECTS THEM TO THE PRIMARY REFLECTOR WHERE THEY ARE AGAIN REFLECTED AS PART OF THE VERTICAL BEAM.

TL 91740

Figure 8. Function of primary and secondary reflectors.

SECTION IV

MAINTENANCE

Note. Failure or unsatisfactory performance of equipment will be reported on W.D., A.G.O. Form No. 468. If this form is not available, see TM 38-250.

15. Adjustment of Optical System

a. The optical system of Ceiling Light Projector ML-121-(*) is accurately focused during manufacture. No further adjustment is necessary in the field.

b. The relation of the leveling perches to the optical system is accurately set during manufacture. No further adjustment is necessary in the field unless the optical system is thrown out of focus. In this case, the beam is not directed exactly toward the zenith when the projector is leveled. Use the open sights on the telescope of Theodolite ML-47-( ) or ML-247-( ) to adjust the optical system with respect to the leveling perches.

(1) Place the theodolite about 500 feet from the projector in line with two of the setscrews used for leveling the light.

(2) Level the theodolite.

(3) Sight on the base of the projector through the open sights of the theodolite.

(4) Rotate the theodolite about its horizontal axis until the theodolite points at the center of the illuminated spot.

(5) If the beam is exactly vertical, the sights of the theodolite align directly on the center of the illuminated spot. If the theodolite sights do not align directly on the illuminated spot, adjust the projector until they do. This adjustment is made by resetting the setscrews that are at right angles to the line between the ceiling light and the theodolite.

(6) Move the theodolite to a new position approximately the same distance from the ceiling light, but at right angles to a line from the ceiling light to the first theodolite position.

(7) Repeat the adjustment of (5) above until the ceiling light beam points vertically upward when viewed from either position.

16. Cleaning Ceiling Light Projector ML-121-(*)

a. GENERAL. Use pigment, dry, lampblack, Federal stock No. 52-P-11590 (issued by Ordnance Department), to clean the two reflectors, the lamp, and both sides of the cover glass. Clean these parts before using

them for the first time and regularly thereafter. To clean the secondary reflector, remove the lamp from its socket. (See par. 23.) After replacing the lamp in its socket, clean the lamp to remove fingerprints from the bulb.

Note. Metal polish, Quartermaster issue, may be used instead of the lampblack. Lampblack, however, is preferred as the metal polish may scratch the glass surfaces.

b. OPENING AND CLOSING DOOR. (1) *Ceiling light projectors ML–121–A, ML–121–B, ML–121–C, ML–121–E, ML–121–F, and ML–121–G.* (*a*) To clean the reflectors and lamp, open the projector door as follows. Loosen the two wingnuts which hold the door frame against the edge of the drum, and pull open the door. Gently swing back the door on its hinges as far as it will go, and allow it to rest there.

(*b*) When the door is closed, securely tighten the two wingnuts *at the same time* to avoid distorting the door frame. *Never use tools to tighten the nuts.* The normal strength of the hands is sufficient to make the gasketed joint dust-tight and weatherproof.

(2) *Ceiling Light Projector ML–121–D.* (*a*) To open the door, unscrew the four wing screws which hold the C-clamps tightly against the door frame. Move the C-clamps back on their swivels, and swing back the door on its hinges.

(*b*) Close the door. Replace the C-clamps over the door frame.

(*c*) Simultaneously tighten the wing screws on two C-clamps which are opposite each other. Then tighten the wing screws on the remaining two C-clamps. *Never use a tool to tighten the wing screws.* The hands are sufficient to make the gasketed joint dust-tight and weatherproof.

17. Replacing Primary Reflector

a. Remove the setscrews, lockwashers, and clips which hold the primary reflector in place against the felt pads at the bottom of the drum.

b. Remove the old primary reflector. The drum is sufficiently large to clear the primary reflector without removing the socket and secondary reflector assembly. If the old primary reflector is not broken, return it to the repair depot for resilvering.

Note. The felt pads are cemented to the bosses at the bottom of the drum. Do not remove these pads.

c. Place the new primary reflector on the pads in the same position as the old primary reflector.

d. Turn the ends of the felt pads over the edge of the reflector between the clips and the reflector surface. Replace screws, lockwashers, and clips.

e. Tighten the screws gradually and evenly to prevent strain on the primary reflector. The new primary reflector is near enough the position of the replaced reflector to make refocusing of the lamp unnecessary.

18. Replacing Secondary Reflector

a. CEILING LIGHT PROJECTORS ML–121–A, ML–121–B, ML–121–C,

ML–121–E, ML–121–F, AND ML–121–G. (1) Remove the three screws which hold the secondary reflector on the spider.

(*a*) If one of the screws is located in front of the lamp socket and is inaccessible, loosen the screw which holds the spider to the secondary reflector bracket. (See fig. 3.)

(*b*) Rotate the secondary reflector holder slightly. The screw is now accessible. Remove the screw.

(2) Place the new secondary reflector in the holder, and replace the three holding screws and washers.

(3) Check the adjustment of the secondary reflector. (See par. 19.)

b. CEILING LIGHT PROJECTOR ML–121–D. (1) Remove the three machine screws and the clamping ring which hold the secondary reflector in the reflector holder. (See fig. 9.)

(2) Remove the old secondary reflector, and replace it with a new one.

(3) Replace the three machine screws and clamping ring, and securely tighten them in place.

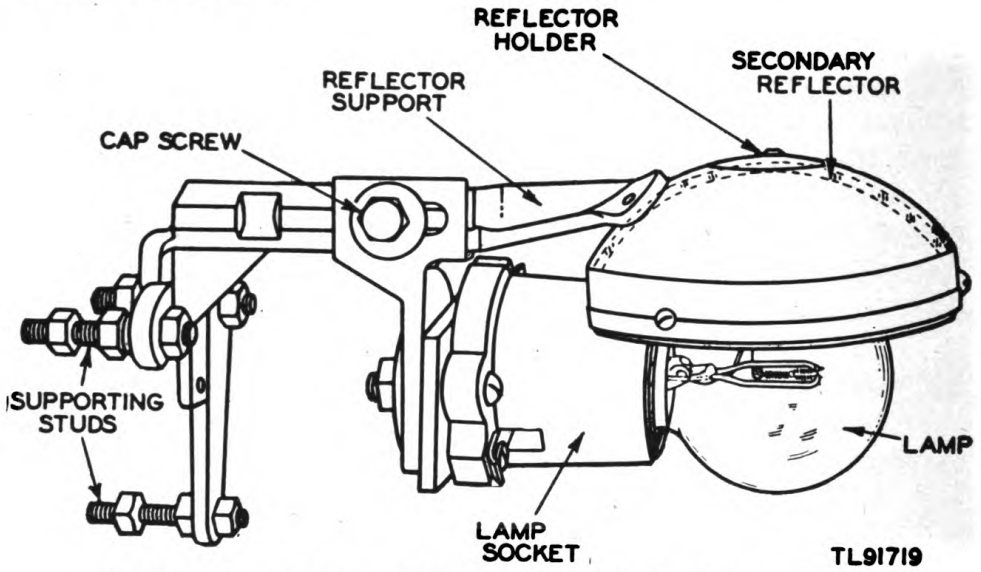


Figure 9. Lamp socket assembly, Ceiling Light Projector ML–121–D.

19. Adjusting Secondary Reflector

a. In the daytime and *with the lamp off,* look directly into the primary reflector near the edge, and observe the two images of the lamp filament. The image thrown directly on the reflector appears as two nearly parallel elements of the filament. The image from the secondary reflector is inverted. The secondary reflector adjustment is correct when the two images are the same size and interlocked.

b. If the two images are not the same size and are not interlocked, loosen the screw which holds the reflector holder to the secondary reflector bracket or spider arm. Rotate the reflector holder on its shaft, and observe the movement of the secondary image. The correct adjustment is indicated by the interlocking of the two images.

c. If the images are interlocked, but are not the same size, move the secondary reflector holder in and out until the two images are the same size.

d. Tighten the reflector holder screw.

20. Replacing Cover Glass

Note. The cover glass is procured as a set which includes the cork pads, sealing compound, and cork-pad cement.

a. Open the projector door (par. 16b) until the spring tension is released from the hinges. Remove the cotter pins and hinge pins in the two hinges.

b. Remove the door assembly, and place it topside up on a flat surface.

c. Loosen the screws, clips, and clip pads which hold the glass in place, and remove the damaged glass.

d. Scrape the old sealing compound and cork pads out of the door frame.

e. Apply a dab of cement on the seating flange of the door frame opposite each of the holes for the clip holding screws.

f. Press a cork pad into place on the cement, and allow the cement to dry.

g. Knead a handful of sealing compound until it is uniform in texture. Shape the compound into a rope about ¼ inch in diameter, and press it tightly in place on the seating flange of the door frame.

h. Lay the new cover glass on the compound, and press down evenly and firmly until it rests on the cork pads. The compound should now fill the space between the glass and the door frame.

i. Replace the screws, clips, and clip pads which hold the cover glass in place. Tighten all the screws evenly to produce equal pressure on the glass at all points.

j. Scrape the excess compound off both sides of the door surface, and smooth the surface.

k. Clean both sides of the cover glass. (See par. 16.) Remove oil stains from the sealing compound with a cloth moistened with gasoline or benzine.

l. Replace the door assembly on the projector by replacing the hinge and cotter pins.

21. Checking Voltage

a. General. Occasionally check the line voltage by plugging the voltmeter leads of an a-c voltmeter, 0- to 150-volt range, directly into the receptacle in the transformer housing. Do this particularly if the lamps burn out before their rated life of 100 hours of continuous burning. A lamp burns out prematurely when it is operating at too high a voltage.

Note. If the lamp is used intermittently, its life may be decreased by half.

b. Adjusting for Line Voltage Variations. (1) If another electrical device is plugged in the same power line or if any other permanent

installation change is made to the projector, adjust the transformer taps to agree with the change.

(2) In case of line voltage variations due to changes in load on the system, study the variations over several periods of operation. Tap the transformer for the highest voltage noted.

22. Trouble Shooting

If a ceiling light projector fails to operate, check the following to locate the trouble.

a. Examine the lamp. Replace a bulb that is burned out. (See par. 23.)

b. Check the power supply circuit to the projector for defective connections.

(1) Test the line at the projector with an a-c voltmeter or test lamp.

(2) If the lamp and supply lines are intact, examine the transformer leads on the terminal block for broken conductors or loose connections.

(3) Examine the secondary leads and the connections at the lamp socket.

c. If the projector still fails to operate, replace the transformer. (See par. 24.)

23. Replacing Lamp

Replace the lamp when the bulb begins to turn black or when the lamp burns out.

a. Allow the lamp to cool. Grasp the lamp and push against the socket with the palm of the hand.

b. Move the lamp a quarter turn to the left, and remove it from the socket.

c. Place the base of the new lamp in the socket. Adjust the lamp until the fins on the base fit into the slots of the receptacle.

d. Press down on the top of the lamp. Turn the lamp as far to the right as it will go. The filament is now in its correct focal position without further adjustment.

Note. When replacing a lamp, be careful not to push against the secondary reflector holder and bend it out of position.

24. Replacing Transformer

a. Ceiling Light Projector ML–121–A and ML–121–B. (1) Remove the cover plate of the transformer housing by unscrewing the four screws which hold the cover plate in place.

(2) Remove the two screws which hold the convenience outlet in place.

(3) Remove the two bolts which hold the transformer in the housing.

(4) Disconnect the 2-wire, incoming power line from the transformer at the sleeve connector.

(5) Disconnect the two wires from the secondary of the transformer to the lamp at the sleeve connector.

(6) Remove the transformer and the plug receptacle from the housing.

(7) Replace the unserviceable transformer with a new one. Connect and mount the transformer by reversing the directions for removing the transformer.

b. Ceiling Light Projectors ML–121–C, ML–121–E, ML–121–F, and ML–121–G. (1) Remove the cover plate of the transformer housing by removing the four screws which hold the cover plate in place.

(2) Remove the two screws which hold the convenience outlet.

(3) Disconnect the power line from the terminal block.

(4) Set up the connecting screws on the terminal block.

(5) Remove the two screws which hold the terminal block in place.

(6) Remove the two screws which hold the transformer in the housing.

(7) Disconnect at the sleeve connector the two wires which lead from the secondary of the transformer to the lamp.

(8) Remove the unserviceable transformer, and replace it with a new transformer.

(9) Connect and mount the new transformer by reversing the procedure for removing the unserviceable transformer.

c. Ceiling Light Projector ML–121–D. (1) Remove the cover from the transformer housing by removing the six hexagonal cap screws.

(2) Remove the four screws at the bottom of the transformer housing which hold the transformer support plate.

(3) Remove the screw which passes through the center of the convenience outlet, and remove the outlet.

(4) Disconnect the 2-wire power line from the convenience outlet.

(5) Disconnect the two wires which lead from the secondary winding of the transformer to the projector lamp.

(6) Remove the transformer and terminal block as a unit.

(7) Connect a terminal block to the new transformer, and mount and connect the transformer in its housing by reversing the procedure described above for removing the unserviceable transformer.

25. Focusing Ceiling Light Projector ML–121–(*)

Only qualified maintenance personnel should focus the projector.

a. Focus the lamp with respect to the secondary reflector.

(1) Open the projector door. (See par. 16b.)

(2) Disconnect the electrical leads to the lamp socket.

(3) Remove the secondary reflector and socket assembly from the unit. In Ceiling Light Projector ML–121–D, do this by removing the hexagonal nuts from the inside ends of the supporting studs. In all other models remove the assembly by unfastening the bolts which hold it to the drum.

(4) Reconnect the electrical leads to the lamp.

(5) The lamp must be focused by eye. Wear densely colored glasses or welder's glasses. If variable voltage is available, reduce the voltage and the brilliancy of the lamp to such a low intensity that it is possible to

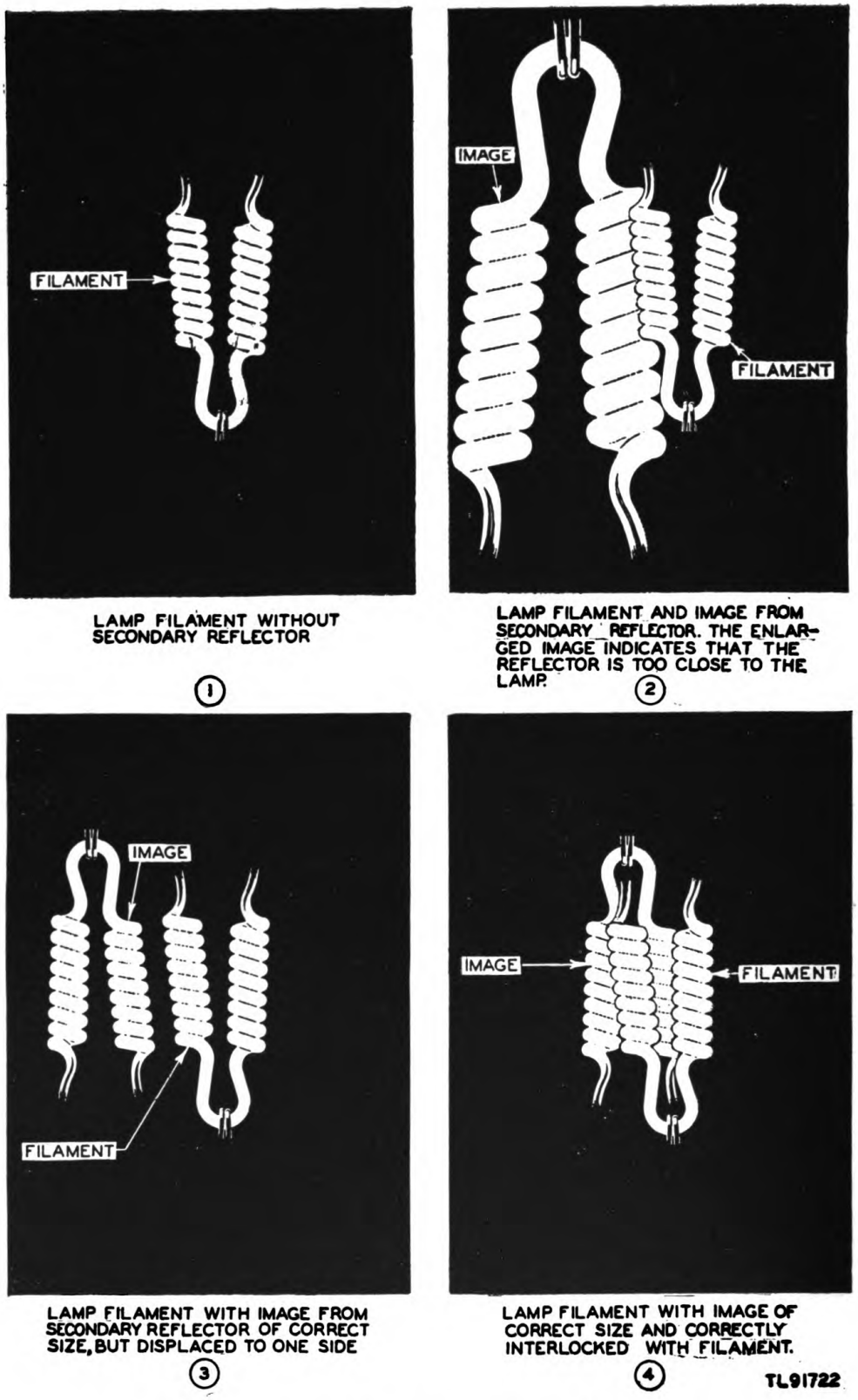


Figure 10. Focusing instructions for secondary reflector.

look into the filament with the unprotected eye. The use of variable voltage is more desirable than the use of welder's glasses.

(6) Look through the center of the filament towards the center of the reflector, and adjust the assembly until the coils of the filament image interlock with, and are the same size as, the coils of the filament itself.

(*a*) In Ceiling Light Projector ML–121–D loosen the cap screw and hexagonal nut which hold the socket in place. (See fig. 9.) An image larger than the filament indicates that the reflector is too close to the lamp. (See fig. 10②.) An image smaller than the filament indicates that the reflector is too far from the lamp. The image may be the correct size but displaced to one side. (See fig. 10③.) Move the socket and lamp with relation to the secondary reflector until the inverted image and filament are the same size, and then lock the cap screw in place. Move the socket and lamp from side to side until the coils of the filament and of the inverted image are interlocked, and then lock the hexagonal nut in place.

(*b*) In Ceiling Light Projectors ML–121–A, ML–121–B, ML–121–C, ML–121–E, ML–121–F, and ML–121–G, loosen the machine screw which fastens the spider to the bracket. Move the reflector holder on its shaft. Moving the reflector holder up and down adjusts the size of the image. Moving the reflector holder from side to side adjusts the position of the image. When the adjustments are made, tighten the reflector holder screw.

(7) Replace the lamp in the drum.

b. Focus the lamp with respect to the primary reflector.

(1) Set the projector on its side so that the axis through the focal point of the primary reflector is horizontal.

(2) Project the lamp beam on a target approximately 200 feet away. The target should be at the same height as the center of the reflector.

(3) Move the lamp assembly until the most intense beam with the narrowest beam spread is obtained. To move the lamp assembly, adjust the bolts or studs which hold it to the drum. The spot of light on the target assumes the shape of the lamp filament and shows the individual coils.

Note. If the source of light is moved past the focal point towards the primary reflector, the beam spreads. If the source of light is moved past the focal point away from the primary reflector, the beam comes together in front of the reflector and then spreads. If the source of light is off to one side of the focal point, the beam is directed to one side.

(4) Fix the lamp assembly in position.

(5) Mount the projector on its pipe standard, and prepare it for use.

SECTION V

SUPPLEMENTARY DATA

26. Maintenance parts list for Ceiling Light Projectors ML–121–A, ML–121–B, ML–121–C, ML–121–E, ML–121–F, ML–121–G

Signal Corps Stock No.	Name of part and description	Station stock	Region stock	Quantity per unit
7A481( )	CEILING LIGHT PROJECTORS ..... ML–121–A, ML–121–B, ML–121–C, ML–121–E, ML–121–F, ML–121–G.	.....	*	1
7A481A–1/9 ..	AUTOTRANSFORMER: special; (for ML–121–A only).....	.....	*	1
7A431/T2	AUTOTRANSFORMER: special; (for ML–121–B only).....	.....	*	1
6L308–4.1C ...	BOLT: eye; special; (for ML–121–A, ML–121–B).....	*	*	4
6L308–4	BOLT: eye; special; (for ML–121–C, ML–121–E, ML–121–F, ML–121–G)	*	*	4
7A481A–1/10 .	BUSHING: body ¾" diam.; 9/16" diam. bore; 14 threads.....	.....	*	1
7A481A–1/15 .	BUSHING: rubber; cable; special.....	.....	*	1
7A481A–1/14 .	BUSHING: cap; 9/16" diam. bore; special.....	.....	*	1
7A481A–1/11 .	CLAMP: special	*	*	1
7A481A–1/16 .	CONNECTOR: sleeve; special	.....	*	1
7A481A–1/12 .	COVER: cast; special; (for ML–121–A).....	.....	*	1

7A481B/2	COVER: cast; special; (for ML–121–B, ML–121–C, ML–121–E ML–121–F, ML–121–G)	.....	*	1
7A481A–1/7 ..	COVER GLASS: complete with asbestos pad, Duxseal compound, Form-a-Gasket cement	*	*	1
7A481A–1/17 .	GASKET: bezel; 59½" x 7/16" x 3/8"; packing No. 1141.....	*	*	1
7A481A–1/18 .	GASKET: cover; cork; special; (for transformer housing cover)	*	*	1
7A481/2	LAMP: mogul prefocus base; 420–w, 12–v; G–25 bulb; C–2 filament	*	*	1
6Q63141	LEVEL: spirit; 4"	.....	*	1
6L3808–13–38 .	NUT: wing; ½"; 13 threads; special; (for ML–121–C, ML–121–E, ML–121–F, ML–121–G)	*	*	4
7A481A–1/20 .	PAD: soft felt; 1" x ½" x ⅛" thick.....	.....	.....	6
6L3508 – 13.16C	PALNUT: ½"; 13 threads.....	*	*	1
7A481–1/21 ...	PIN: hinge; special	*	*	1
7A481A–1/4 ..	REFLECTOR: secondary	.....	*	1
7A481A–1/2 ..	REFLECTOR: primary	.....	*	1
7A481A–1/6 ..	SOCKET ASSEMBLY: special	.....	*	1
7A481A–1/22 .	SPRING: special	*	*	4
7A481D/7	TRANSFORMER: 430 va; 60 c; 120/12 v; special; (for ML–121–C, ML–121–E, ML–121–F, ML–121–G).....	.....	*	1
7A481A–1/8 ..	TRANSFORMER: 50/60 c; (for ML–121–A).....	.....	*	1
6L35016	WASHER: asbestos; 11/16" ID x 17/16" OD x 1/16" thick; (for ML–121–E, ML–121–F, ML–121–G)	.....	.....	1

* Indicates stock available.

27. Maintenance parts list for Ceiling Light Projector ML–121–D

Signal Corps Stock No.	Name of part and description	Station stock	Region stock	Quantity per unit
7A481D	CEILING LIGHT PROJECTOR ML–121–D.....	.....	*	1
7A481D/10 ...	GASKET: bezel; 5/16" x 59 5/8"; (for ML–121–D).....	*	*	1
7A481D/11 ...	GASKET: cover glass clip; (for ML–121–D only).....	.....	.....	12
7A481A–1/18 .	GASKET: transformer house cover; (for ML–121–D).....	*	*	1
7A481D/3	LENS: complete with pads, cement, and caulking; cover glass for ML–121–D	*	*	1
6Q63141	LEVEL: spirit; 4"	.....	*	1
7A481D/6	REFLECTOR: secondary; (for ML–121–D).....	.....	*	1
7A481D/9	SOCKET: mogul prefocus; Crouse-Hinds HL–8892; (for ML–121–D)	.....	*	1
7A481D/7	TRANSFORMER: 430 va; 60 c; 120/12 v; special; (for ML–121–D)	.....	*	1

* Indicates stock available.

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