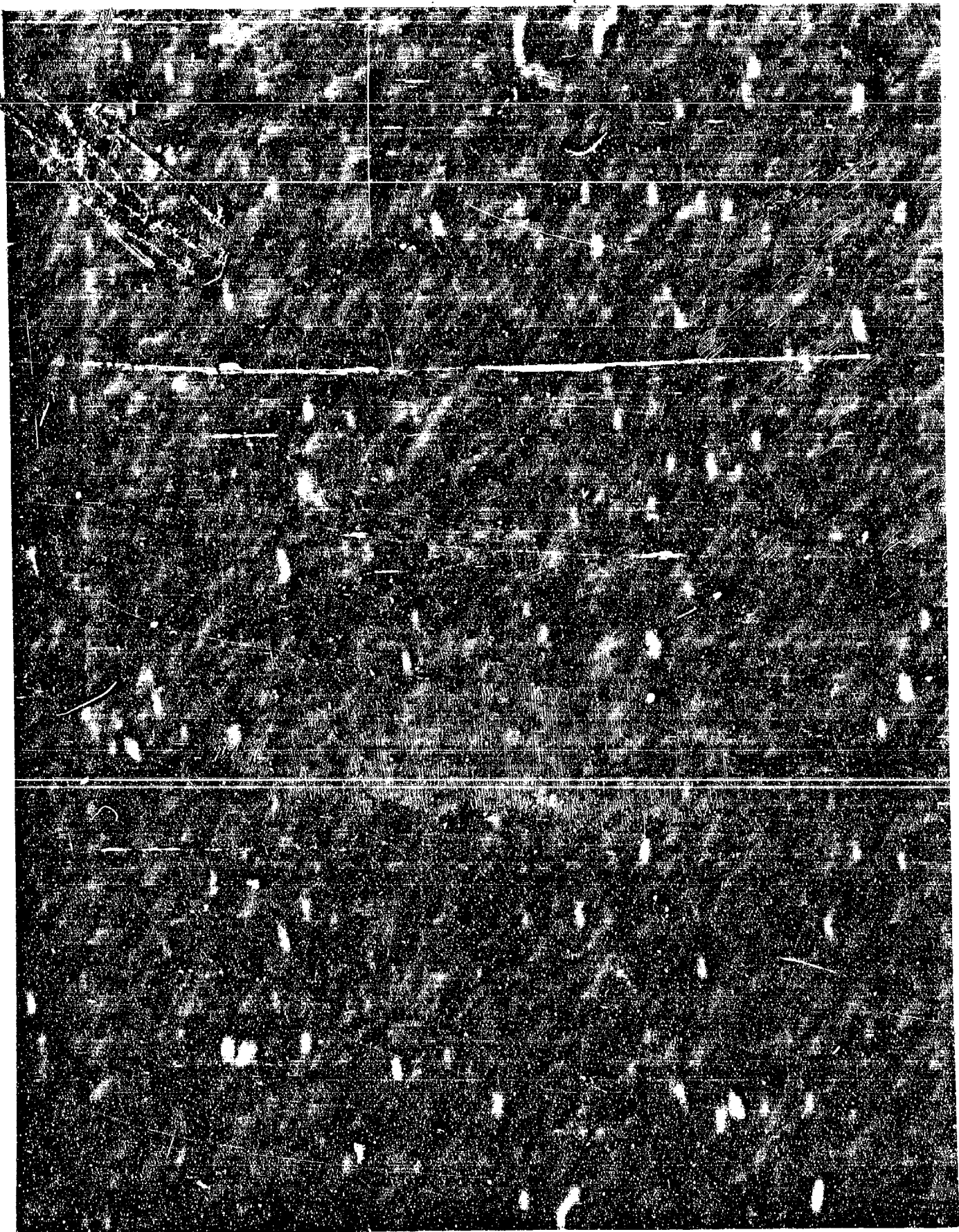
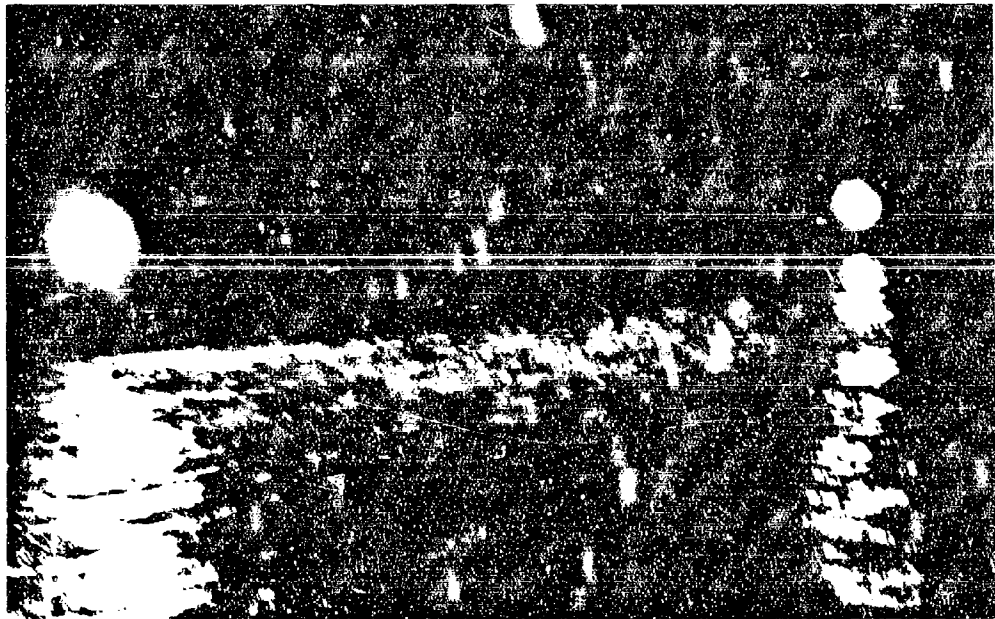
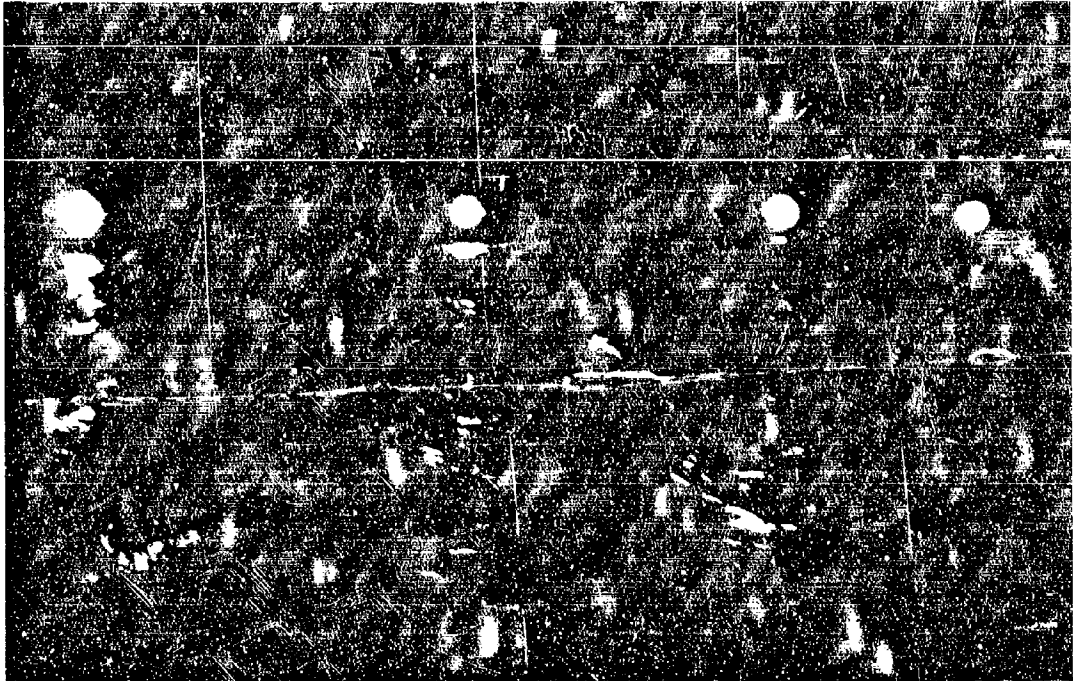


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300-Watt Type PLB Fixtures Spaced 30 Meters Apart

TECHNICAL MEMORANDUM NO. 70-02

TEST OF DMZ FENCE LIGHTING METHOD IN WHICH LIGHTING
GLARE EFFECT IS USED AS A VISUAL BARRIER TO INTRUDERS

By
Joseph T. Gurganious
Mobility Branch

September 1970

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U. S. ARMY LAND WARFARE LABORATORY
Aberdeen Proving Ground, Maryland 21005

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ABSTRACT

The practice of depending upon the lighting glare effect from standard light fixtures installed on a DMZ line security fence as a visual barrier to intruders was simulated by test, and is evaluated in this report. Results of the evaluation show that regular light fixtures installed six feet high on a fence provide a visual barrier to intruders - 100-watt standard incandescent fixture spaced ten meters apart with regular oval reflectors facing out perpendicular from the fence; or 300-watt Crouse-Hinds Model No. PIB 47574 incandescent fixtures spaced 30 meters apart. The 300-watt Crouse-Hinds light was more effective due to its wider angle light beam (180°) and its higher intensity.

INTRODUCTION

1.

This report is a record of results of a simulated DMZ (Demilitarized Zone) fence lighting test to determine the effectiveness of using a lighting glare screen as an aid to patrolling the DMZ.

In several locations along the DMZ in Korea, local commanders have used improvised lighting systems on the DMZ fence; they placed simple 100-watt incandescent lighting fixtures at eye level height on the fence, spaced 10 meters apart. The lights were intended to light up the area in front of the fence so that potential intruders could be "spotted", while making it difficult for enemy snipers to see the U. S. Army patrol personnel who operate in back of the fence. The U. S. Troops believed that the glare from these lights was effective in shielding the patrol personnel from the view of enemy snipers.

The U. S. Army Land Warfare Laboratory conducted a brief feasibility investigation to evaluate the practice of using lighting glare as an aid in patrolling the DMZ fence line. The scope of the investigation was limited to a simple test in which such practices on the Korean DMZ fence were simulated and evaluated.

The over-all plan of this report is to state the test results in a brief and concise manner.

CONCLUSIONS

1. The lighting effects from light fixtures appropriately located on a security fence provide an effective visual barrier to intruders; troops who are behind such a fence, provided they stay approximately ten feet behind the fence, are not visible to snipers nor intruders.
2. The 100-watt standard incandescent fixtures with standard oval reflectors installed approximately two meters high and thirty meters apart on the fence provided an effective visual barrier. See Figure No. 1.
3. The 300-watt Model PLB incandescent light fixtures, installed approximately 2 meters high and 30 meters apart on the fence, provided a more effective visual barrier and a greater illuminated distance than the standard 100-watt fixtures spaced at 10-meters. Superiority of the Model PLB fixture is attributable to its greater intensity and its 180° lateral coverage of the light beam.
4. Either of the lighting arrangements - the 300-watt Crouse-Hinds fixtures spaced at 30 meters or the 100-watt fixtures spaced at 10-meters - will provide sufficient illumination that intruders can be seen at distances up to 100 meters; BUT ANY LIGHTING IS DETRIMENTAL TO NORMAL NIGHT VISION, AND THESE LIGHTS ARE NOT DIFFERENT IN THAT RESPECT: THEY DESTROY THE SENTRY'S NIGHT VISION IN THAT HE CANNOT SEE FURTHER OUT THAN THE ILLUMINATED AREA.

DESCRIPTION OF TEST

Test Items (Light Fixtures): The light fixtures were installed on the outside of a typical security fence, i.e. Figure No. 1; each fixture was placed at approximate eye-level height above the ground, and positioned so as to shine outward perpendicular from the fence and parallel to the ground. Two different sets of fixtures were installed:

a. One set consisted of 9 each 100-watt incandescent lamps with standard round reflectors, Figure No. 1, spaced approximately 10 meters apart. This type of light fixture simulated the type which had been used on the DMZ fence by the troops in Korea.

b. The other set was composed of 6 each 500-watt incandescent fixtures spaced approximately 30 meters apart. These fixtures were Crouse-Hinds Model No. PLB 47574, designed and manufactured commercially by Crouse-Hinds Company "...for protective lighting of areas such as a fence line...". The manufacturer's data on the PLB line of fixtures is included herein as Appendix A. As set forth in Appendix A, the manufacturer's instructions concerning mounting height are as follow:

"Mounting height for each installation depends upon result desired and contour of ground. Where ground is level, a low mounting height is usually desirable for producing maximum glare to an intruder and best visibility to a watchman."

Test Procedures: The test personnel were divided into two teams; one team operating as simulated watchmen behind the fence, and the other operating as potential intruders. The potential intruders attempted to use optical aids such as binoculars, adjustable range telescopes, and Questar telescopes. During the series of tests the teams alternated, once operating as watchmen and then as potential intruders.

Each test run was conducted in two phases; first without lights of any kind, and then with one set of the lights shining. The objectives in each phase of the tests were to determine:

a. If the potential intruders could see past the fence - if they could see troops walking inside the fence line.

b. If the troops inside the fence could see the potential intruders crawling along or crouched on the ground at distances up to 100 meters out from the fence.

The tests were conducted under the following different climatic conditions:

a. The weather was clear and cold (approximately 30°F). The moon was shining brightly. The ground was covered with new snow.

b. The weather was clear and cold (approximately 35°F). The moon was shining at approximately 1/2 strength. The ground was covered with snow, brightly glazed by previously freezing rain.

c. The weather was cloudy and cold (approximately 36°F), with medium to heavy rain but no fog. The night was dark, with no moonlight. The ground was completely clear of snow.

d. The weather was clear and cold. The night was dark, with no moonlight. The ground was completely clear of snow.

Test Results:

a. With No Lights: Night vision was fairly good during the cloudy nights, and exceptionally good on the nights when the snow covered ground was lighted by the moonlight. With the snow cover prevailing, all areas on both sides of the fence were completely visible out to several hundred feet. Potential intruders would have had no difficulty in sighting the patrol troops; and the patrol troops would have had no difficulty in sighting the potential intruders provided the potential intruders were not crouched in the underbrush which came to within approx. 200 feet of the fence.

b. With the 100-Watt Light Fixtures Spaced 10-Meters Apart; Figures 2, 3, and 4.

(1) As long as the troops inside the fence kept approximately 10 feet away from the fence the potential intruders could not see them; but when the troops came closer to the fence they were at times partially visible to the potential intruders.

(2) Variable range telescopes, binoculars, and a Questar telescope were used in an attempt to see past the fence. These optical aids were found to be of no benefit to potential intruders. Attempts toward overcoming the visual barrier were also tried by using vision blocking devices to narrow down the field of view sufficiently that the lights were not within the observer's field of view; this practice was of no benefit either.

(3) The snow cover, the moonlight, and the rain did not have any observable effect on the potential intruders' capability to see troops activity behind the fence.

(4) As long as the potential intruders were not crouched in the underbrush they were visible to the troops behind the fence at distances as far out or further than 100-meters from the fence.

(5) The patrol troops' night vision - their capability to see further out than the illuminated area - was destroyed. The lighting contrast between the lighted area and the unlighted area prevents visibility into the unlighted area.

c. With the 300-Watt Fixtures Spaced 100-Feet Apart, Figures 5 Through 7:

(1) Personnel walking behind the fence were not visible to personnel in front of the fence. On a moonlighted snow covered night the troops behind the fence were not visible to the potential intruders, not even when the troops put their faces directly against the fence; but on a dark rainy night it was necessary for the patrol troops to keep a few feet away from the fence (approximately 10 feet) in order to remain invisible to the potential intruders.

4

(2) Lateral coverage of the 300-watt Crouse-Hinds fixture was 180° , and vertical spread of the light beam was 20° . Therefore, there were no close-in dark spots, and regardless of the angle at which the potential intruder looked at the light, he was looking into the light beam. This feature can be seen by comparing Figures No. 8 and 9, a side view of the 100-watt fixtures and the 300-watt fixtures respectively. A similar comparison can be seen between Figures 2 and 6.

(3) As long as the potential intruders were not crouched in the underbrush they were visible to the troops from behind the fence at distances as far out or further than 100-meters from the fence.

(4) As was the case with the 100-watt lights, optical aids were of no benefit to the potential intruders.

(5) Also, as experienced with the 100-watt lights, the patrol troops' night vision outside the lighted area was destroyed - the lighting contrast between the lighted area and the unlighted area prevents visibility into the unlighted area.



FIGURE NO. 1: Standard 100-Watt Light Fixtures,
Approximately 6-Feet High and 10 Meters Apart

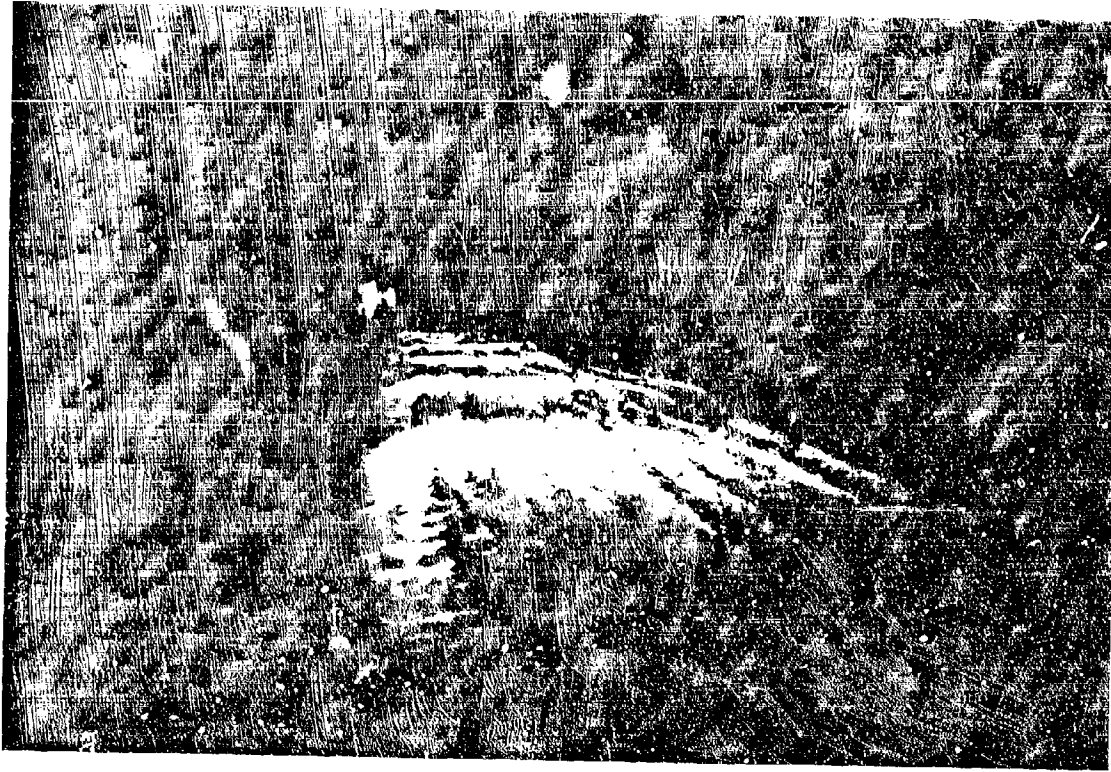


FIGURE NO. 2: 100-Watt Fixtures Spaced 10-Meters Apart



FIGURE NO. 3: 100-Watt Fixtures Spaced 10-Meters Apart -
Shining Over Snow Covered Terrain

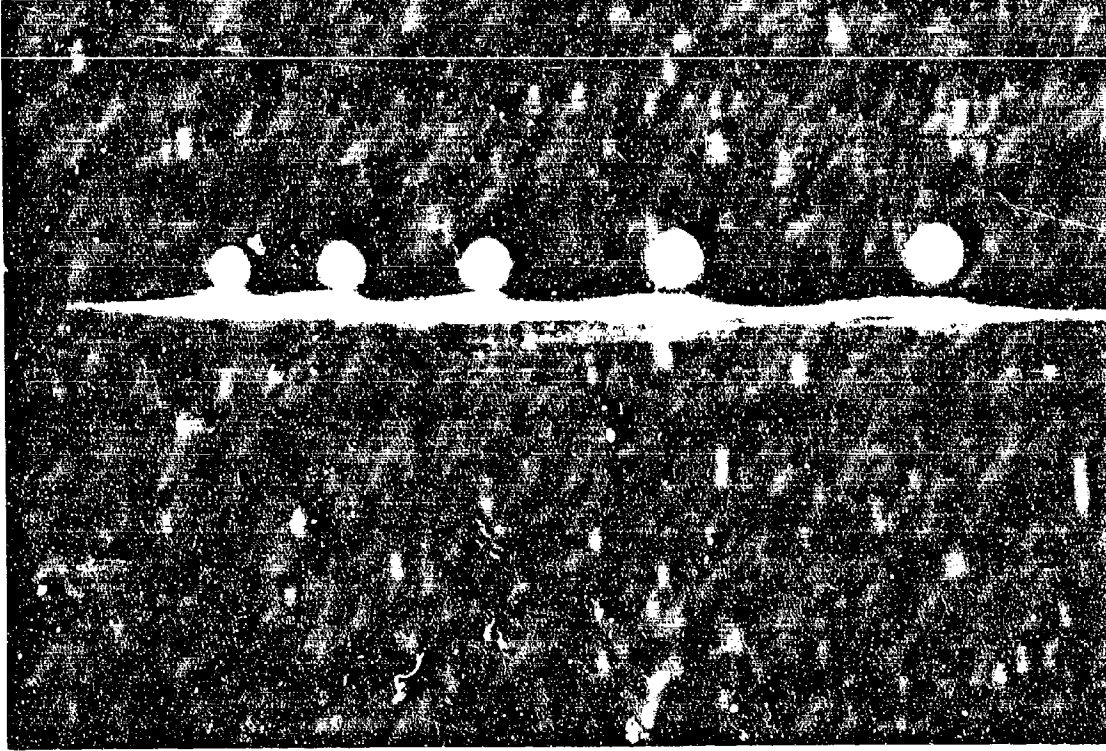


FIGURE NO. 4; 100-Watt Fixtures Spaced 10-Meters
Apart on the Security Fence

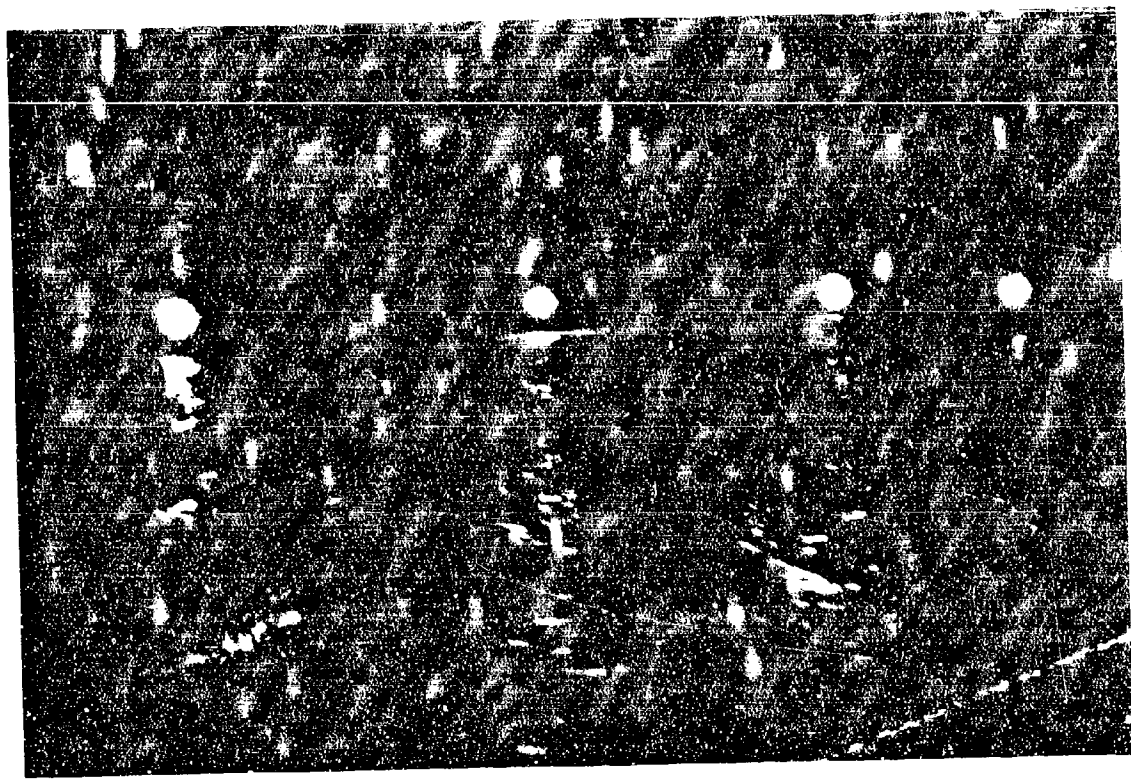
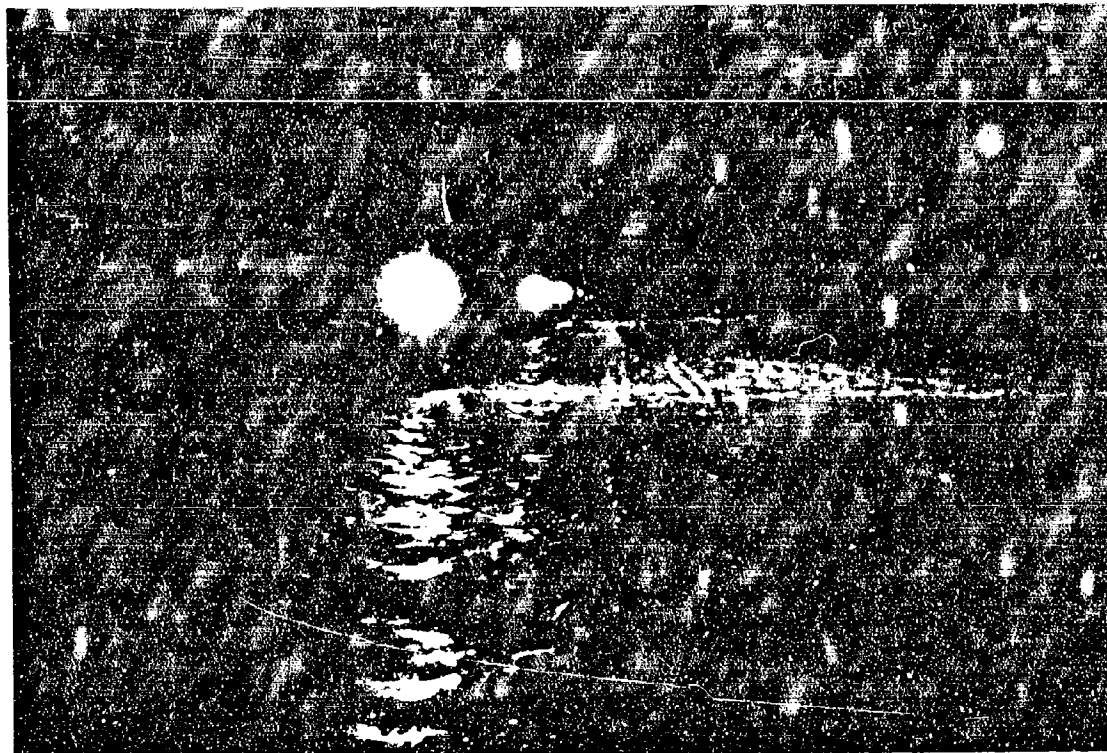


FIGURE NO. 5: 300-Watt Crouse-Hinds Model PLB 47574
Fixtures Spaced 30-Meters Apart



NOTE: Although the light fixture is positioned to direct the light out perpendicular from the fence, even when standing adjacent to the fence the intruder is looking into the light beam - because the light beam has 180° lateral coverage.

FIGURE NO. 6: 300-Watt Crouse-Hinds Model PLB 47574
Fixtures Spaced 30-Meters Apart

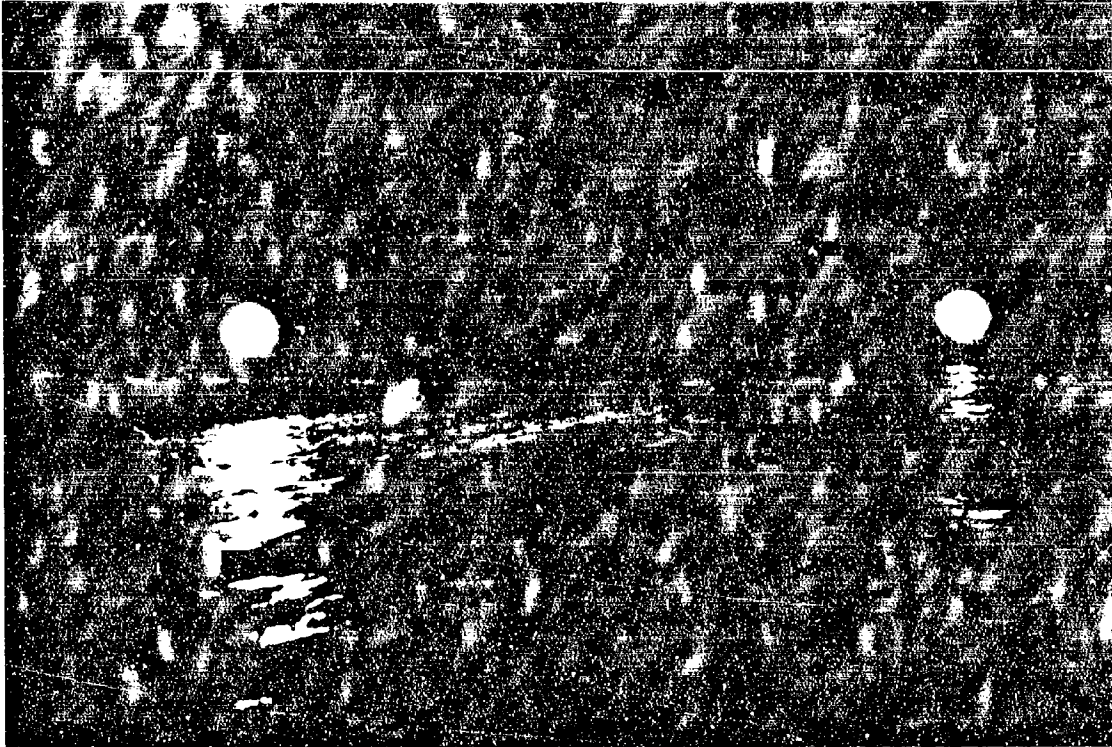


FIGURE NO. 7: 300-Watt Crouse-Hinds Model PLB 47574
Fixtures Spaced 30-Meters Apart

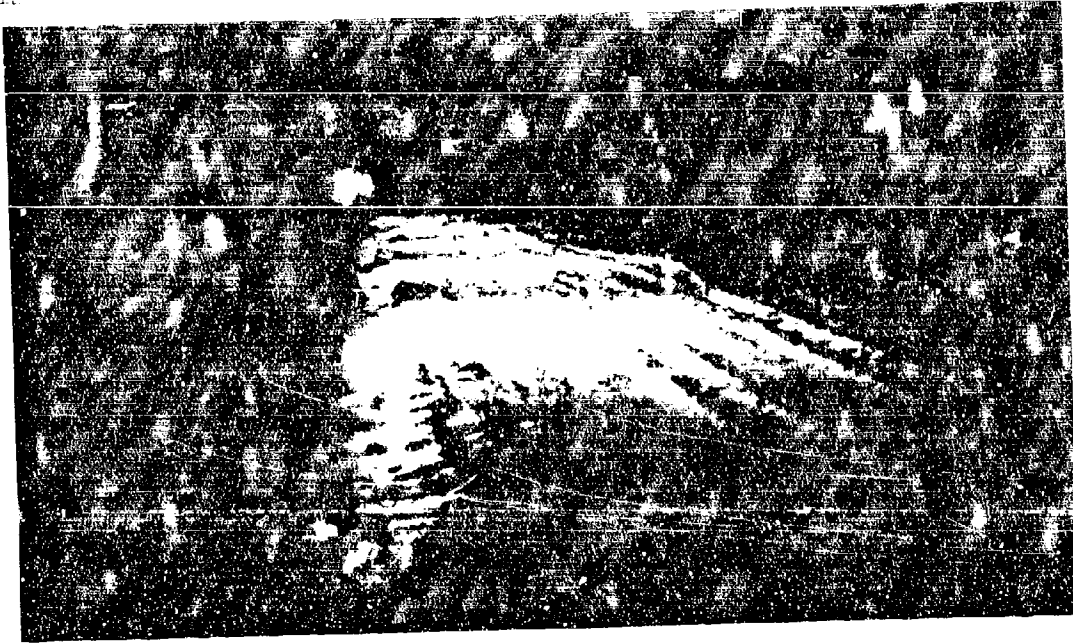


FIGURE NO. 8: 100-Watt Fixtures Spaced 10-Meters Apart

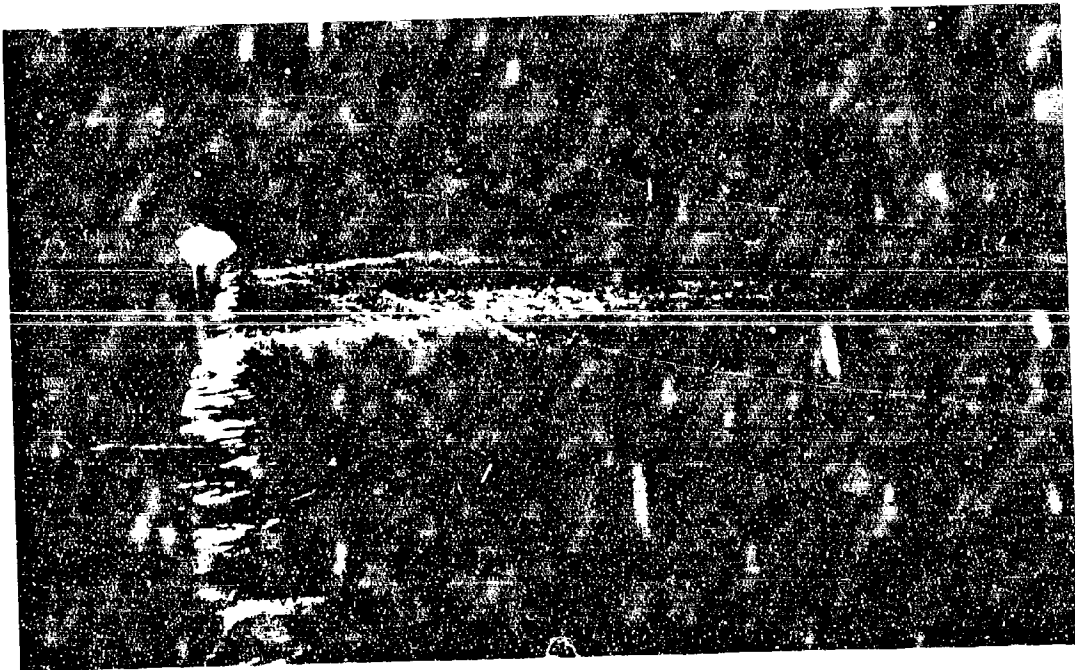


FIGURE NO. 9: 300-Watt FIE Fixtures Spaced 30-Meters Apart

APPENDIX A

Manufacturer's Data on the Crouse-Hinds Security
Fence Light Fixtures Model No. PLB 47574.

PLB

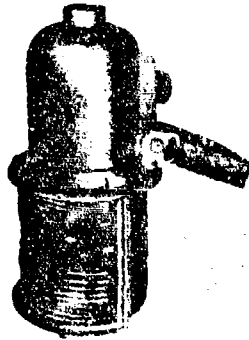
CROUSE-HINDS

Designed for protective lighting of areas such as a fence line where a lighting unit with wide horizontal beam spread and narrow vertical beam spread is reduced.

Model	Lamp Wattages Acceptable*
PLB	200 or 300 watt, PS-30; 300 or 500 watt, PS-35; 2500, 4000, 6000 or 10000 lumen, 7" LCL, street lighting service.

*Lamps not included.

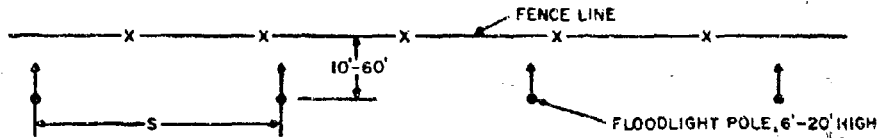
Special incandescent lighting fixture for protective lighting. Series or multiple lamps. Cast aluminum construction. Fresnel lens, 200 to 500 watt, 2500 to 10000 lumen.



Photometric Data for estimating purposes

Watts & Type	Lamp Lumens	Beam Spread		Beam Lumens	ER.	Candlepower		Model	Cat No.
		Hor.	Vert.			Ay. Max.	Max.		
Street Ltg. Lamp (10M/66R)	10000	168°	20°	3700	37%	8100	—	PLB	47424 47425 47577
500 w., PS-35 (500)	10750	190°	24°	3510	33%	5800	6570	PLB	47572 47574
300 w., PS-30 (300M/PS 30)	6000	165°	22°	1960	33%	3240	3670	PLB	47573

Application Chart



RECOMMENDED MAXIMUM SPACINGS AND MINIMUM LAMP SIZES FOR FENCE LIGHTING

	Spacing(s)	Lamp
(A) High intensity illumination for important areas, such as munitions manufacturing, electric power plants, and substations	125'	300-Watt or 6000-Lumen
	150'	500-Watt or 10000-Lumen
(B) Low intensity illumination for less important areas such as cantonment areas	150'	300-Watt or 6000-Lumen
	225'	500-Watt or 10000-Lumen

- Notes:
1. Floodlights should be placed far enough behind fence to cause a double overlap of floodlight beam patterns so that failure of a lamp will not leave a section of the fence line in darkness.
 2. Mounting height for each installation depends upon result desired and contour of ground. Where ground is level, a low mounting height is usually desirable for producing maximum glare to an intruder and best visibility to a watchman.
 3. Distance between poles and fence for each installation will depend upon space available and results desired, principally whether it is desired to light a strip more on the inside or more on the outside of the fence line. Average distance back is 25 to 35 feet.

Construction Features

Series Heads— Three types available. Trunnion mounting has porcelain bushing with oval hole (1" x 3/4") for wire entrance. Series receptacle rated 5000 volts.

Multiple Heads— Three types available. Trunnion mounting has one-hole bushing for #14, 2/C cable (cable not included).

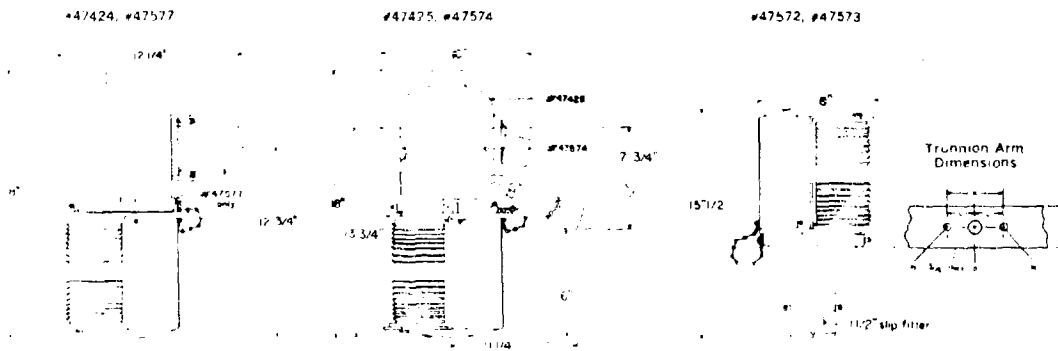
Lens Assembly— Fresnel lens with Alzak aluminum spherical reflector. Heat-resisting outer cover glass available as accessory. Lens assembly attaches to mounting head in bayonet-type joint and is chain-connected for ease in handling during relamping. Set screw holds lens assembly securely in position on mounting head.

Finish— All cast aluminum construction with natural aluminum finish except trunnion arm which is galvanized steel.

Selection Table







Model	Catalog No.	Description	Std. Pkg.	Shpg. Wt. (lbs.)
PLB	47424	1 1/4" suspension mtg. for series lamp	1	18.5
	47425	Trunnion mtg. for series lamp	1	21.0
	47572	1 1/2" pole top mtg. for multiple lamp (mogul)	1	14.0
	47573	1 1/2" pole top mtg. for multiple lamp (medium)	1	14.0
	47574	Trunnion mtg. for multiple lamp (mogul)	1	18.0
	47577	1 1/4" side slip fitter mtg. for series lamp	1	20.0

Dimensions & Weights



Cat. No.	Fixture Net Wt. (lbs.)	K	Trunnion Hole Spac.			E & Dia.	
			L	M	N	P	
47424	14 1/2	—	—	—	—	—	—
47425	17	1 7/8	1 3/4	1 1/2	1 3/4	1 3/4	—
47572	10 1/2	—	—	—	—	—	—
47573	10 1/2	—	—	—	—	—	—
47574	14	1 3/8	1 3/4	1 1/2	1 3/4	1 3/4	—
47577	16	—	—	—	—	—	—

Mounting Arrangements & Accessories

Catalog No.	Description	Std. Pkg.	Shg. Wt. (lbs.)
Mounting Arrangements (#47425 and #47574 only)			
 FL5646	1 1/2" slip fitter (pipe intrudes 2 3/4")	1	3.0
 FL5649	2" slip fitter (pipe intrudes 2 3/4")	1	3.5
 FL5652	2 1/2" slip fitter (pipe intrudes 2 3/4")	1	4.0
 FL8813	Bracket base for 1" 2" pipe or vertical surface	1	2.7
 ML1320	Crossarm base for wood arm	1	2.0
 ML1341	Crossarm base for steel arm	1	2.0
Accessories			
KL4710A	Heat resisting outer cover glass—order PLB arranged for cover glass	1	2.0

How To Order

1. From desired photometric data and type of mounting select appropriate fixture catalog no.
Example: PLB #47425
2. Select desired mounting base catalog no. (if any).
Example: ML1320 base
3. Select desired accessory (if any).
Example: KL4710A cover glass
4. Order each of above items separately indicating quantity desired.

Suggested Specification

Lighting fixture(s) shall be Crouse-Hinds type PLB catalog no. _____ for _____ watt, _____ lamp complete with mounting accessory catalog no. _____

Lighting fixture shall consist of cast aluminum head with (medium, mogul) lamp receptacle, galvanized steel trunnion arm (when furnished), Fresnel lens and Alzak aluminum reflector assembly attaching to head in bayonet-type joint and chain-connected for ease in handling during relamping with set screw to hold in position on head. Unit shall be arranged for (suspension, trunnion, side slip-fitter, pole top) mounting on _____

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