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NOTES

ON THE

TACTICAL USE OF FOREGROUND ILLUMINATION

COMPILED AT THE
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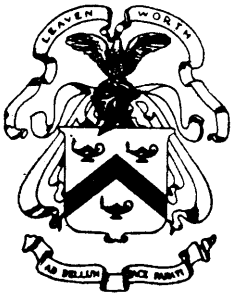
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WAR DEPARTMENT,
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The following notes on the tactical use of foreground illumination are published for the information of all concerned.

[2608038, A. G. O.]

BY ORDER OF THE SECRETARY OF WAR:

TASKER H. BLISS,
Major General, Acting Chief of Staff.

OFFICIAL:

H. P. McCAIN,
The Adjutant General.

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TACTICAL USE OF FOREGROUND ILLUMINATION.

The illumination of the foreground is effected by several means, but the most effective is the searchlight.

SEARCHLIGHTS.

The searchlights used with the mobile army are of the portable 24 and 36 inch types.

The 24-inch type is a single-unit system. Its running gear is of the regular Field Artillery type, using pintle connection between limber and rear carriage. It is horse drawn and capable of going wherever Field Artillery can go. Its total weight does not exceed 4,500 pounds.

The lamp and mast is arranged so that one operator seated in a fixed position can quickly swing the beam around horizontally 360° and vertically between the zenith and about 20° below the horizontal. The lights are equipped with appliances for measuring horizontal and vertical angles similar to those used by the Field Artillery.

The 36-inch type is of the two-unit system. The lamp is a hand-controlled light mounted on a telescoping tower. It is operated by two men, and has the horizontal and vertical movements of the beam as described for the 24-inch type.

This type is either horse drawn or motor drawn. In the latter case the power plant operating the light is separate and distinct from the power plant of the vehicle.

TACTICAL USE OF SEARCHLIGHTS.

CONSIDERATIONS.—Depending upon whether the searchlight is used for reconnoitering the dispositions made by the enemy or for combating him, it takes part in the work of exploration or in the action itself. Apart from these two methods of employment, there exists hardly a means of utilizing it with a tactical object. The searchlight is the most effective auxiliary of fire at night. It surprises the enemy, blinds him, and renders him visible, under conditions which depend principally on the hygrometric condition

of the air, the diameter of the searchlights, and on the angle of site. By its unforeseen appearance it contributes in delaying and in hindering the advance, and directly to nullify the intentions of the assailant. The surprise is prepared by the securing of data of prominent points of the terrain during daytime by means of a special oscillation and inclination device which permits of instantly directing the beam on the point marked.

Independently of the moral effect produced by the surprise, that caused by the dazzling power of the rays prevents the adversary from aiming and firing under good conditions, since it completely prevents him from observing and estimating distances. Furthermore, advance on the searchlight is very difficult. Oscillating illumination (change of direction of the beam from left to right and from right to left) or intermittent (light alternating with obscurity) causes loss of orientation and direction; horses are seized with panic, intrenching has to be suspended, and the enemy is often obliged to discontinue all movement.

The illuminating power of the searchlight varies not only with the diameter and the hygrometric state of the air, but also with the angle of site. The beam forms on the ground an elliptical figure or a parabola, according to the size of the angle formed by the intersection of the beam with the ground. The more the illuminated surface is inclined with respect to the perpendicular from the lower axis of the beam, the greater is the illuminated zone, and the greater is the quantity of luminous beams lost for the object it is desired to illuminate. It will therefore be seen that the form of the ground will increase or reduce the surface of the illuminated zone as well as the luminous efficiency, which would signify that the visibility of the terrain is a function of the angle of site.

Moonlight does not reduce as much as would be thought the use of the searchlight, the illuminating power of the searchlight being far greater that that of a full moon. There results an increase of visibility when the searchlight enters into operation. Field searchlights can furnish in normal weather the visibility of the naked eye, and consequently the vulnerability of the adversary at the following distances:

1. **CHEMICAL LIGHT APPARATUS.**—Owing to their low illuminating power these apparatus can operate only with the use of a cylindrical beam. The useful range of these searchlights for the discovery of a group is at from 150 to 200 meters with the naked eye and 250 meters with a field glass. The width of the front illuminated by these apparatus is about 10 meters.

2. ELECTRIC LIGHT APPARATUS.

	Cylindrical beam.	Divergent beam.
36-inch:		
Buildings—	*Meters.*	*Meters.*
With naked eye (about)	2,500	.....
With field glass	3,500	.....
Personnel, company, or group—		
With naked eye	1,400	700
With field glass	2,000	800
Isolated personnel—		
With naked eye	800	600
With field glass	1,200	700
24-inch:		
Buildings—		
With naked eye	2,200	.....
With field glass	3,000	.....
Personnel, company, or group—		
With naked eye	1,000	600
With field glass	1,500	700
Isolated personnel—		
With naked eye	700	500
With field glass	900	600
16-inch:		
Buildings—		
With naked eye	1,500	.....
With field glass	2,200	.....
Personnel, company, or group—		
With naked eye	800	500
With field glass	1,400	600
Isolated personnel—		
With naked eye	600	400
With field glass	800	500

The distances above mentioned give the degree of visibility of the different diameters of field searchlights, supposing the illuminated troop to be standing and dressed in gray or light blue, the shining parts of the equipment being covered with cloth. At the kneeling position the visibility decreases by one-half; it decreases in still greater proportions at the lying position.

The width of the illuminated front when using the cylindrical lunette is about one-twelfth of the distance. With the divergent beam the width of the illuminated zone is about four times greater, but in depth decreased at least by one-half.

The depth illuminated varies proportionally with the magnitude of the angle formed by the perpendicular drawn to the lesser axis of the beam and the terrain illuminated.

Light and yellow colors appear white in the luminous beam; green appears yellowish; troops in white and very dark uniforms are easy to discover, for they are well detached in the luminous beam; gray and light blue uniforms are difficult to distinguish on a green background.

The flashes of arms, tools, buttons, visors of caps render a command very visible. Lights from fires and lanterns are rather difficult to see when they are in the luminous beam.

A fine rain considerably diminishes the range of the searchlight; fog completely checks its action. The same applies to smoke.

Against the dazzling light the only protection is to wear black glasses.

Lowering of visors and leafy branches carried in front give but mediocre results and have the disadvantage of allowing the troops to be discovered by flashes. The eyes of horses appear in the beam like phosphorescent lights.

GENERAL PRINCIPLES ON THE USE OF SEARCHLIGHTS.

In order that the searchlight fill the rôle expected of it, its site should be selected in such manner that it can illuminate the largest possible area with the greatest intensity.

The site should fulfill the following conditions:

Offer easy views of the sector required to be illuminated; not interfere with the means of combat of friendly troops; have easy access and be easy to leave; and, finally, be protected by natural or artificial means against enemy projectiles.

The best positions are points dominating the terrain and those whence a flank action over the zone to be illuminated can be effectuated.

The position for the projector should always be selected in a manner that its security be assured by its own means or by its communication with the troops. In case it be necessary to furnish a support to the searchlight, this support, composed of infantry, should occupy the most favorable position and dig a trench in order to protect itself against the fire that the neighborhood of the searchlight might draw upon it.

Long-range searchlights can be employed for the following purposes:

1. Support exploration and contribute to reconnoitering of the terrain.
2. Illuminate objects for fire.
3. Facilitate the march of columns.
4. Mask the movements of friendly troops.
5. Blind enemy searchlights.
6. Blind the adversary.
7. Deceive the enemy by feints.

8. Produce an effect of demoralization.
9. Illuminate work of all kinds.
10. Insure communication between distant detachments and serve for signaling.
11. Aviation.

1. SUPPORT EXPLORATION AND CONTRIBUTE TO RECONNOITERING OF THE TERRAIN.—The searchlight permits of observing any movement of the enemy, the work he is executing, and his preparations in the zone of action.

2. ILLUMINATE OBJECTS FOR FIRE.—When the searchlight has discovered an object, this object can immediately be fired upon either by the infantry or by the artillery or machine guns. The light permits of suitably directing the fire.

Artillery fire.—When a searchlight is employed in aiding the fire of artillery, it should be in close communication with the battery executing the fire.

The commander of the battery selects the most favorable position for observing the fire of his battery and for commanding the searchlight.

As soon as an object has been discovered, the commander of the battery has the fire prepared for such object, the beam of the searchlight remaining unmasked as little as possible, so as not to draw the fire of the enemy. On firing the salvo the searchlight unmasks for the time necessary for observing the fire and, if required, following the object.

INFANTRY FIRE (RIFLE OR MACHINE GUN).

Rifle.—As for artillery fire, the searchlight has to remain in communication as complete as possible with the officer commanding the troops engaged. The adversary remains illuminated as long as the troops covering it with their fire consider it useful.

A searchlight engaged should not retire, even under a menacing pressure of the assailant, unless it receives order from the commanding officer of the troops to which it is assigned, its natural rôle being to illuminate to the last moment.

Machine gun.—With the machine gun the searchlight operates as has been said for rifle fire.

The machine guns open fire each time the object is illuminated by the luminous beam. The machine-gun chief remains in as close communication as possible with the searchlight.

The use of the searchlight is especially recommended with the machine gun on account of the flexibility of the fire of the latter.

3. FACILITATE THE MARCH OF COLUMNS.—By this is understood that the searchlight permits illuminating, at a great distance, objects, elevated points, and points of direction. In practice there will be some difficulties in this use of the searchlight, for the attention of the enemy must not be attracted. The searchlight can also illuminate a line of march, the troops marching in the shade by side of the beam.

4. MASK MOVEMENTS OF FRIENDLY TROOPS.—Owing to the very sensible contrast between the shade and the light, it is difficult to observe, through the luminous beam, what is passing beyond. Searchlights can therefore be used to establish a sort of luminous screen, behind which the enemy can see nothing. For this purpose one or more searchlights are employed, which are placed more or less to the flank according to circumstances.

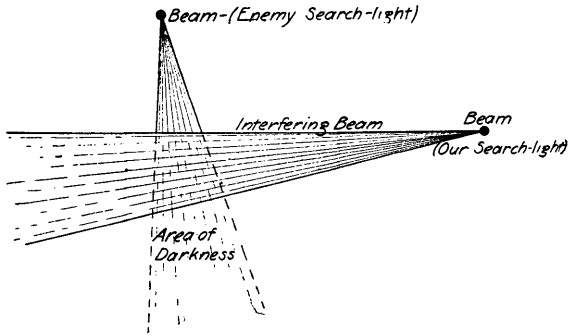


Diagram showing method of "Blinding the Enemy's Search-lights," and annulling their action.

This method is employed particularly on flat terrain, but is not practicable in broken country or in mountainous country, since the searchlight has to be installed at *the same height as the objects to be masked*, and the enemy must not be able to discover them by passing above or below the luminous beam.

Another method, but one of delicate application, consists in moving the luminous beam before a troop advancing, to prevent the enemy discovering it.

5. BLINDING ENEMY SEARCHLIGHTS AND ANNULLING THEIR ACTION.—Observation through a luminous beam is very difficult, even with the aid of another searchlight; a hazy zone is formed in which nothing can be observed. The con-

dition for success is that the beam forming the mask be furnished by a searchlight *of superior strength* or *at least equal* to that of the enemy searchlight.

6. **BLINDING THE ADVERSARY.**—It is impossible for troops in face of a searchlight beam to distinguish anything in the direction of the searchlight or in the neighboring directions. It is therefore possible to approach very closely to an enemy blinded in this manner without being seen, and cases may occur in which an attack with the bayonet can be immediately carried out. This effect is increased if the searchlight be oscillated from side to side, and if a succession of violent contrasts be produced by shutting off the light and reestablishing it several times in succession. Troops marching under these conditions generally lose direction and get in disorder. This effect is still more marked with mounted troops.

7. **DECEIVING THE ENEMY BY FEINTS.**—The searchlights having been adjusted and put in action, the attention of the enemy is drawn in their direction, and this is taken advantage of to make a surprise attack from the opposite side.

8. **EFFECTS OF DEMORALIZATION.**—The Russians are greatly in favor of this, for they noted these effects at the siege of Port Arthur. At night the men are in a state of nervous tension. When the luminous beam is thrown on them they are dazzled and think they are perceived by the enemy. This fear increases, for they are conscious of being unable to defend themselves, and thus feel their destruction imminent.

9. **ILLUMINATION OF WORK OF ALL KINDS.**—Work in progress, parks, supply centers, roads, difficult passages, bivouacs, etc., can be lighted. In order to illuminate a large zone of terrain in width, the divergent lens will be used.

10. **COMMUNICATION BETWEEN DETACHMENTS—SIGNALING.**—At night the luminous beam is visible at very great distances (12 to 62 miles) according to its strength.

For signaling, the Morse signals or conventional signals are used. Another method consists in projecting the luminous beam on the clouds. Its trace is seen from a great distance (43½ to 50 miles).

In daytime the searchlight can replace the heliograph; in this case it has to be oriented.

11. **AVIATION.**—According to aviators it appears that the zone lighted by the divergent lens is sufficient to enable a belated aeroplane to land without too great difficulty.

METHOD OF USE.

It is much more difficult to employ searchlights judiciously in an attack than in defense, for, while the defender will endeavor to explore and minutely search all the terrain in front of him, the assailant will seek obscurity to execute his movements and obtain surprise effects.

DISTRIBUTION OF SEARCHLIGHTS.

The conditions of a good distribution are that each zone of terrain be illuminated with sufficient intensity. It is according to this rule that, in certain foreign armies, the number of searchlights necessary is calculated at the rate of 1 for each 1,000 yards of front.

Searchlights are preferably employed in groups of two each—one for searching for objects, the other for keeping them illuminated and enabling the fire on them to be properly directed. It is thus possible to continue searching the terrain.

ACTION OF THE SEARCHLIGHT.

For searching the terrain it is necessary to operate by alternating light and obscurity, in order that an enemy can not see the beam coming upon it and have the time to avoid it. One should also operate by "bounds," the searchlight remaining unmasked only for the time necessary to allow the observers to see well the illuminated sector. A continuous illumination attracts the fire of the enemy infantry and artillery and facilitates their aim. By means of the sighting device for height and direction fixed on each searchlight, it will be easy to direct the beam instantaneously on a given point that has been marked during daytime. When troops are reported the surprise by the light and the surprise by the fire should be as simultaneous as possible, the adversary remains illuminated as long as the troops covering him with fire consider useful.

The use of the light of a searchlight as a rallying signal at the moment of shock and even during the action is to be condemned, for the friendly troops will almost always be illuminated the same as the enemy.

PROTECTION OF SEARCHLIGHTS AGAINST THE EFFECTS OF THE FIRE OF THE ENEMY.

Effort should always be made to utilize the natural shelters offered by the terrain for the searchlight, and especially for the teams and carts transporting the electric plants. To embarrass adverse ranging

on the searchlight the same can be raised or lowered, varying the intensity of the light by combining changes and variations with periods of obscurity. In this manner changes of position of the searchlight can be simulated.

RÔLES OF THE OFFICER-OBSERVER.

The searchlight, the same as a piece of artillery, can not be expected to give results unless the beam is directed in a rational manner.

Owing to the dazzling effect of the bright light the electrician maneuvering the searchlight is unable effectively to direct the beam; it is therefore indispensable to establish in proximity to the searchlight a sheltered observer, who, by means of a telephone, can give the indications necessary for the training in height and direction. On the other hand, to utilize the beam under the best conditions, the observer should be kept posted on the tactical situation of the moment. If the work of observation is badly done, the searchlight can not render good service and becomes even harmful; in other words, the efficiency of searchlights depends on the quality of the observers. The rôle of officer-observer is therefore extremely important; it comprises a great responsibility.

In armies in the field the searchlights will probably be temporarily attached to different units, and it is the regiments who will have to supply the observers.

The best position for observing is about 40 meters on the flank and a few meters to the rear of the searchlights.

If, in order to observe better, the officer observer has to advance, he will select a position situated at a lower height than that of the searchlight, so as to be always below the beam.

In case of necessity the officer observer may observe from the position of the searchlight, but must place himself below the cone of light.

The observer should not consider himself as bound to his position; he can move, if he sees fit, and, in case of necessity, under the protection of an escort.

Connected telephonically or otherwise with the searchlight and with the regiment on whose account he is observing, the officer observer can thus direct the action of the searchlight, and will be able to receive from the command all indications that may enable him to act as the tactical situation may require.

The officer observer should as a preliminary preparation, study the zone to be illuminated. To facilitate this work he will study the map-

examine the roads and communications included in the zone to be illuminated; then he will note on a perspective sketch the outline forms of the objects, the distances, sighting points, crossings of communications, ridges, defiles, bridges, fords, and in general all information that may be useful to him at night.

By means of the device permitting of training in height and direction, he will mark during daytime all the points of the terrain indicated on the perspective drawing, so as to be able to quickly illuminate any object.

The observer should impress himself with the idea that the illumination of targets will be the most important task of the searchlight. The dazzling, which in certain cases may produce a considerable effect, will be but secondary.

During observation the use of the field glass is indispensable.

ILLUMINATION OF FOREGROUND BY OTHER DEVICES.

The illumination of the foreground by means other than searchlights is accomplished by various contrivances.

Among those most often used are:

Portable lights (automobile headlights), usually electric, using storage batteries.

Rockets shaped like a cartridge, 6 inches long and 1 inch in diameter, fired from a sort of sawed-off shotgun, the light burning about 20 to 30 seconds.

Rockets, a good deal like those used for fireworks, fired from a tube and burning about three minutes.

Flares thrown to the front and so weighted as to stick in the ground upon landing, burning for varied lengths of time.

Rockets which are attached to parachutes and burn as they slowly descend.

Very lights, which burn about one minute.

Bengal flares.

Balls made of a magnesium compound which are lighted and then thrown to the front, burning about two minutes.

Ordinary torches or lanterns backed with reflectors.

Bonfires built by advance sentinels and lighted by them as they withdraw under pressure of the enemy.

These and other contrivances are used for the illumination of the immediate foreground and are effective at ranges from 50 to 300 yards. Some of the lights may be so arranged as to be tripped and lighted by the enemy as he approaches, or may be lighted by men in listening

posts. They are of value only in illuminating the ground for the use of rifle and machine-gun fire, and mainly are of use in defense only.

Their tactical use is governed by the condition and extent of the area to be illuminated and the amount of illumination desired or possible, especial effort being made to keep the enemy in the light and one's own troops as much as possible in the shadow.

The time, method, and extent of illumination by means of the above-mentioned methods is a tactical question to be decided by the immediate commanders.



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