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VISIBILITY THROUGH SMOKE WITH ADMIRALTY HAND-LAMPS

by

D. J. Rasbash

Summary

The maximum candlepower which may be obtained in the beams of three Admiralty Hand-lamps have been measured. From this information it was possible to assess the visibility which each hand-lamp would give in smoke. None of the lamps was of such a design as to give the best type of beam for use in smoke, and a 10-20 per cent increase in visibility would have been obtained if a good focussing device had been included in the lamps.

Introduction

The Admiralty requested that an assessment be made on the efficiency of some of their hand-lamps when used for seeing in smoke. Work had previously been carried out in an experimental smoke chamber on the efficiency of hand-lamps in smoke, in which it was found that there was a relationship between the maximum candlepower of the beam and the efficiency of the lamp (1). By making use of this relationship it was possible to obtain the required estimate without resorting to actual tests in a smoke chamber.

Experimental

Description of lamps. Three hand-lamps, described in Table 1, were provided for testing. All of them had parabolic reflectors, but none had any means on the outside of the lamp to adjust the focussing of the bulb.

TABLE 1
ADMIRALTY HAND-LAMPS

	Lamp number	Admiralty pattern number	. Type of lamp	Bulbs	Battery
	1	A₽ 19570	Hand torch 10 in. long x $1\frac{3}{4}$ in. diam.	One; several spares provided	년 volt đry
!	2	AP 54	Hand torch 9 in. long x 12 in. diam.	One; several spares provided	4½ volt dry
4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3	16034 A	Hand-lamp with separate case for battery.	Two; one in centre of reflector and the other at the side; no spares provided.	2½ volt wet

Method of test The lamp under test was clamped so that it illuminated a light coloured surface 4-5 ft. away. In the region where the maximum amount of light fell on this surface, a photo-electric cell was moved about with its sensitive surface facing the lamp, and the maximum reading which was obtained was recorded. From this reading and the distance of the cell from the lamp, the maximum candlepower in the lamp beam was determined.

Tests with lamp 1 It was found with lamp 1 that by taking out the reflector an adjustment could be made to the fitting at the base of the reflector which altered the relative position of the bulb and reflector. In all the tests which were carried out the bulb was adjusted by these means to give the most highly focussed beam possible. The maximum candlepower given by five different bulbs in the lamp was determined and the effect of continuous and intermittent discharge of fully charged batteries was also determined. In the tests on the effect of intermittent discharge the lamp was turned on and off for alternate periods of two minutes.

Tests with lamp 2 No way could be found of adjusting the focussing of the bulb. The maximum candlepower given by 5 bulbs was determined.

Tests with lamp 3 Tests were carried out on the lamp as received, to determine the maximum candlepower given by both bulbs and the effect of continuous discharge on that given by the central bulb. It was found, after breaking the seal of the lamp, that the bulb could be adjusted to give a better focussing. The tests were, therefore, repeated with the bulbs focussed to give the most intense beams possible.

Results

Lamp 1 The bulbs varied to such an extent that it was not always possible to pre-set the bulb to give a good focussed beam. As a result, on varying the bulbs the maximum candlepower obtained varied between 80-250. With a continuous discharge of the lamp, the maximum candlepower fell to 45 per cent of its initial value in half-an-hour; with an intermittent discharge it fell to 84 per cent of this value in the same time.

Lamp 2 This lamp gave a very diffuse beam. The maximum candlepower varied from 25-35 for the different bulbs.

Lamp 3 The maximum candlepower from the central bulb was 46 with the lamp as received and fell to 41 in half-an-hour. When this bulb was adjusted to give the most intense beam the maximum candlepower was 120 and fell to 110 in 30 minutes. The maximum candlepower which could be obtained by the side bulb was about 5 and could not be varied appreciably by altering the position of the bulb.

Discussion

The tests which were carried out in the experimental smoke chamber showed that the efficiency of a lamp used in smoke increased as the maximum candlepower of the beam increased. Be ond a candlepower of about 200, however, the increase in visibility was small even for large increases in candlepower. It is desirable therefore to design handlamps for use in smoke capable of giving a candlepower of about 200 for the time which they are required to be used by the operator.

If a lamp with a maximum candlepower of 200 is accepted as a standard and if the concentration of a certain smoke is such that it would be possible for a given observer to see with the aid of such a lamp for a distance of 10 ft. through the smoke, then it is possible to estimate the distances which would be seen with the lamps tested above. These distances are shown in Table 2.

TABLE 2

VISIBILITY THROUGH SMOKE GIVEN BY ADMIRALTY HAND-LAMPS (related to a visibility of 10 ft. with a standard lamp)

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Lamp	Condition	Visibility (ft.)#		
Lamp 1 (pre-set focus)	Initial. After 30 minutes continuous discharge. After 30 minutes intermittent discharge.	9·3 - 10·2 8·6 - 9·6 9·1 - 10·0		
Lamp 2	Initial. After 30 minutes continuous discharge.	8•3 - 8•6 7•8 - 8•2		
Lamp 3 (Central bulb)	As received, initial. After 30 minutes discharge. Adjusted for good focussing.	8•8 8•7 9•6		
Lamp 3 (Side bulb)	As received.	6•4		

^{*}Range for a number of bulbs tested given where appropriate.

It will be seen that only lamp 1 and possibly lamp 3 could equal the performance of the standard lamp, and even this could happen only with some bulbs and after pre-setting the focus. The focusing adjustments made in the tests for lamps 1 and 3 were necessarily very approximate, but there is little doubt that all the above lamps would reach the standard if a good focusing system, capable of focusing any bulb placed in the lamp, were included in the design. The inclusion of this system would thus improve visibility by about 10-20 per cent.

References

(1) D. J. Rasbash. The efficiency of hand-lamps in smoke. Inst. of Fire Eng. Quart. 1951, 11 p.46.