

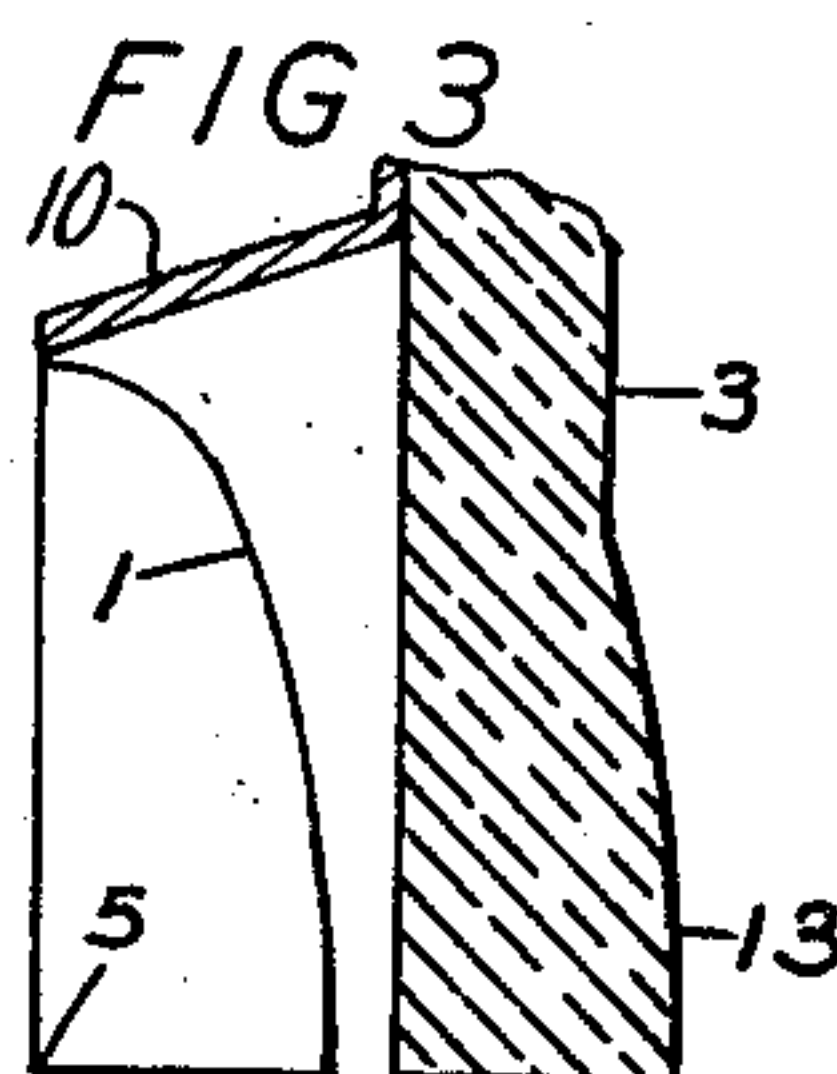
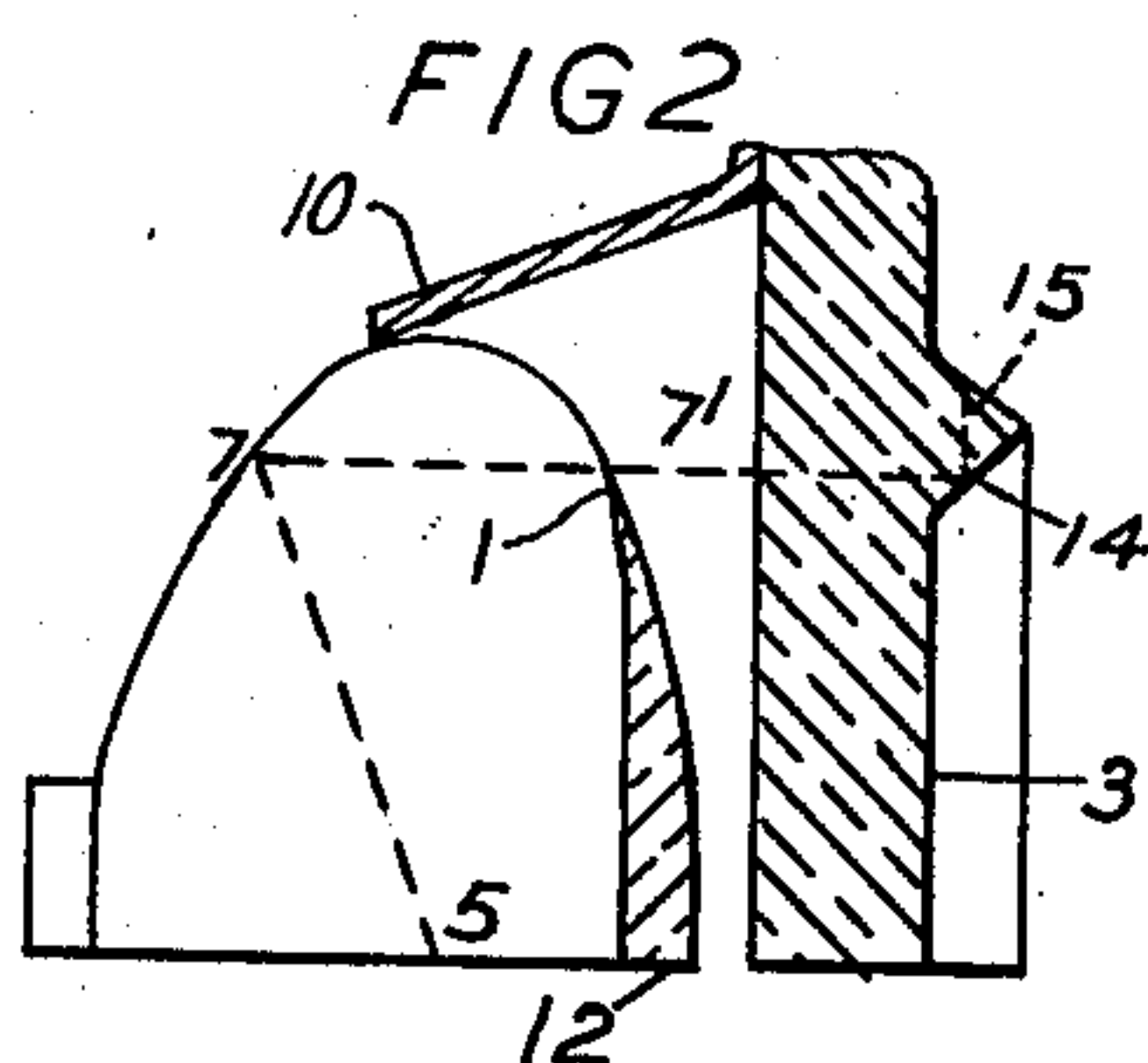
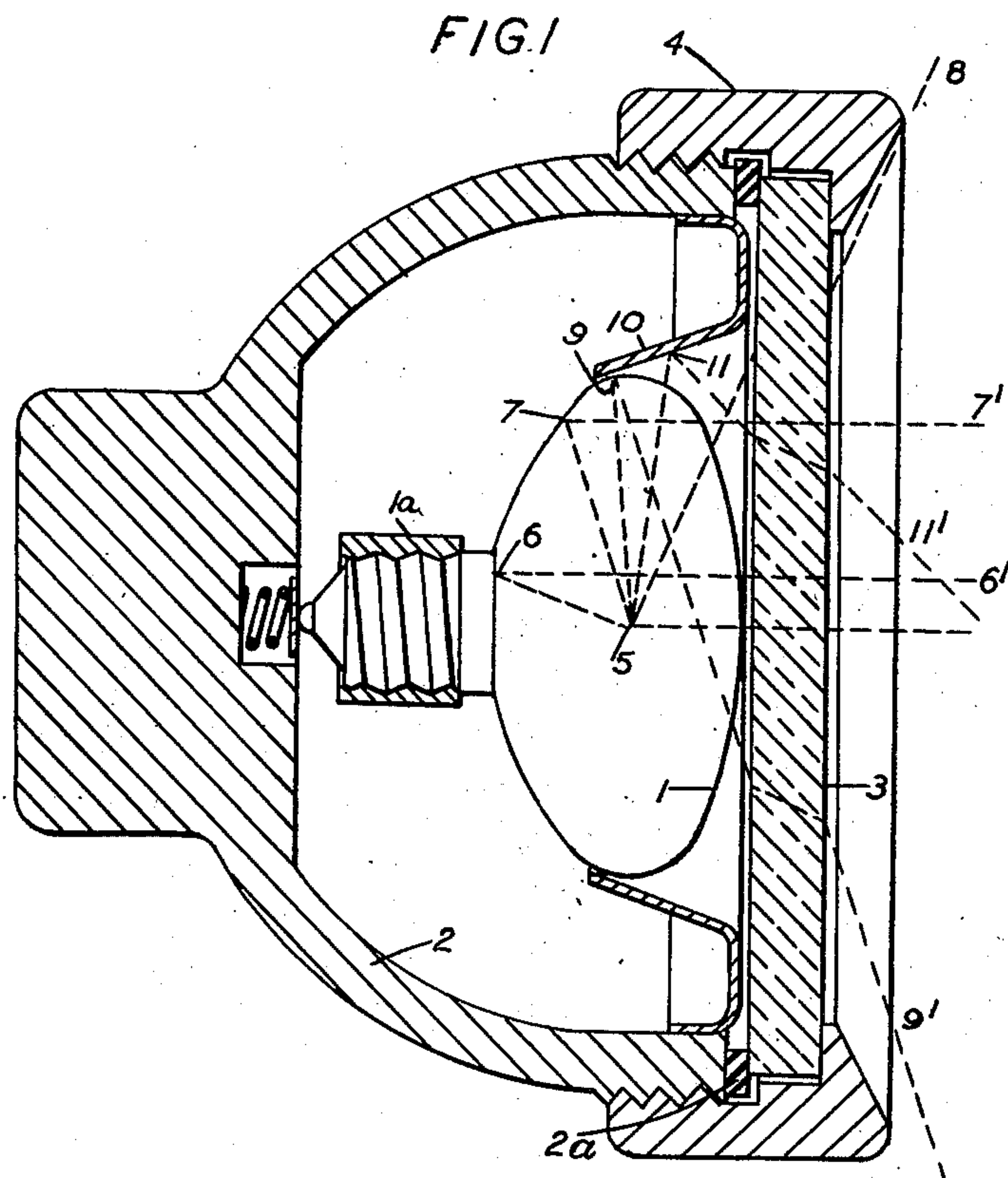
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H. HOLT, JR

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MINER'S ELECTRIC CAP LAMP

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Inventor  
Harry Holt, Jr.  
by  
J. F. Fuirie  
Attorney



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## MINER'S ELECTRIC CAP LAMP

Harry Holt, Jr., Denton, England, assignor to  
Oldham and Son Limited, Denton, England, a  
British company

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1

This invention relates to miners' electric cap lamps or the like, i. e. to other lamps similarly designed to throw a directed beam of light.

Cap lamps hitherto used have been provided with a reflector of approximately parabolic form held within the casing of the lamp, for the purpose of producing a beam with maximum intensity on the central line. When this reflector has a polished surface, the lamp throws a divergent beam of high intensity but at wide angles the intensity is too low. It may be noted that a parabolic reflector does not throw a parallel beam because the filament is too large in relation to the size of the reflector.

In order to increase the light intensity at wide angles, the reflector has been given a matt surface; the effect of this is to make the distribution of light intensity more uniform, and then, with sufficient intensity at wide angles, there is unnecessarily high intensity at moderate angles, and insufficient intensity centrally.

Further, the light intensity from the lamp depends largely on the reflective power of the reflector, whether this is polished or matt and, in the conditions obtaining in coal mines, the reflective power of the reflector becomes impaired and, when the reflector is matt, its cleaning is difficult and troublesome and, when the reflector is polished, its cleaning tends to scratch the surface. Apart from dirt, the exposed surface of the reflector is liable to lose reflective power in consequence of gradual tarnishing.

The main object of the present invention is to construct a cap lamp which will throw a central narrow beam of high candlepower to illuminate the small area of coal face on which the miner is working at any moment and at the same time to throw a cone of light of comparatively very low candlepower with a total angle of some 130°, but of sufficient intensity to enable objects within this angle to be visible to the miner when his gaze is directed centrally.

A further main object of the invention is to provide in a miner's electric lamp of the kind referred to, distributing means for the beam of light which maintains its efficiency throughout use, or can easily be cleaned when required.

According to the invention, the lamp bulb has an approximately parabolic back surface, with the filament close to the focus, the said back surface being made reflecting and being approximately parabolic over a solid semi-angle extending from as near the axis as is practicable to at least 60 degrees measured from the focus, and means for distributing outside the casing and

2

mainly at wide angles the light from the filament which is directed towards the walls of the casing beyond the parabolic reflecting surface.

It is a salient feature of the invention that the reflecting surface on which the central beam depends is not exposed to dirt or tarnishing or scratching. To secure this feature the reflecting surface is made on the back surface of the lamp bulb and, to secure a narrow central beam of high intensity, the surface is made parabolic. For construction reasons, however, the parabolic reflecting surface can receive only a portion (about half) of the light from the filament which is directed towards the walls of the lamp casing. Accordingly it is also a salient feature of the invention that, combined with the above mentioned feature, means are provided for utilizing the light directed towards the walls of the casing beyond the parabolic reflecting surface, to increase the intensity of the beam at wide angles. Without such means, the formation of a parabolic reflecting surface on the lamp bulb confines the wide angle illumination to direct light from the filament, not enhanced by any reflection, and this illumination is insufficient.

Since the battery supplying the lamp has to be carried by the miner, it is of great advantage to him that the distribution of light intensity in the whole beam from the lamp be as nearly as possible that actually required, so that the energy of the battery may be used as efficiently as possible. A lens may be located in the path of the central beam, adapted to condense it. The means for directing the rays from the filament, which pass beyond the parabolic reflecting surface and are directed towards the walls of the casing, may comprise a reflector outside the lamp bulb. The front cover glass may have a rib located so as to intercept some of the rays of the beam reflected from the parabolic reflecting surface and divert them to increase the wide angle illumination.

In the accompanying diagrammatic drawings, are shown, by way of example, several preferred embodiments of the present invention.

In the drawings:

Figure 1 is a central section of a miner's cap-lamp, and

Figures 2 and 3 are similar views, showing parts only of the lamp bulb and front glass, of alternative ways of forming a condensing lens in front of the filament.

In the drawings like references designate similar parts.

Referring to Figure 1, the lamp bulb 1 is mounted in a casing 2, by the lamp holder 1a, and the



3

front glass 3 is held to a gasket 2a on the casing 2 by the screwed on cover 4. The filament 5 is, for the purposes of this description, assumed to be a point.

The back surface of the bulb 1 is made parabolic and reflecting from the point 6 to the point 7. The light ray 5, 6, defines a solid semi-angle of about 20 degrees; with ordinary lamp construction, it is impracticable to form a parabolic surface nearer to the axis than the point 6. The ray 5, 7 defines a solid semi-angle of 70 degrees. The extent of the solid angle over which the back surface can be made parabolic depends on the lamp construction, and the extent over which it is desirable to make it parabolic depends on the intensity desired in the central beam. The angle shown of 70° has been found suitable in practice; an angle less than 60 degrees has been found to give an inadequate intensity in the central beam.

Referring now only to semi-angles, reckoned from the diametral plane, the direct ray 5, 8 from the filament which can issue from the lamp casing is, in the construction shown, at an angle of 113 degrees from the axis. Thus rays between 5, 7 and 5, 8, if the reflecting surface ceases at 7, are directed against the lamp casing and are lost, as far as useful illumination is concerned.

In the construction shown, two devices are provided for utilizing these rays. First the reflecting surface is continued beyond the extent of the parabolic surface, that is from about 7 to about 9. The reflected rays from this reflecting annulus issue from the lamp mainly at wide angles, up to the angle of the ray 9, 9'. Beyond a point about 9, a reflecting surface is no longer useful with the form of lamp bulb shown.

An annular reflector 10 is provided outside the lamp bulb to distribute between 5, 9 and 5, 8 outside the lamp casing and, mainly at wide angles. The ray 5, 11, 11' is an example of such a ray. The annular reflector 10 extends inwardly sufficiently to catch the rays that escape the back reflecting surface of the bulb 1. Rays between 5, 7 and 5, 8 so directed outside the casing either by silvering between 7 and 9 or by a reflector such as 10, or by both, serve to increase the illumination from the central beam over an angle of about 65 degrees, and the distribution of the illumination over this angle may be varied by varying the form of the peripheral part of the bulb or by varying the angle or shape of the reflector 10. Further, the surface of the reflector may be matt instead of polished so as to distribute the impinging light by diffusion instead of by reflection.

Now the central beam, reflected by the parabolic reflecting surface is not in practice a parallel beam as indicated by the reflected rays 6, 6' and 7, 7'. First, the filament is of appreciable length compared with the size of the parabolic reflecting surface; secondly, lamps cannot be produced commercially with a back surface accurately parabolic or, thirdly, with the center of the filament accurately at the focus. The beam in practice therefore, is divergent, and is found to have a semi-angle of some 5 degrees.

If it is desired to have a more concentrated central beam, or to secure such a degree of concentration with less accurately made lamps, a condensing lens may be placed in the path of the central beam. The lens may be formed in the front surface of the lamp bulb as shown at 12 in

4

Figure 2, or it may be formed on the front glass of the lamp, as shown at 13 in Figure 3.

If it is desired to increase the wide angle illumination at the expense of the intensity or size of the central beam, ribs may be formed on the front glass located to intercept some of the rays of the central beam, and shaped to direct the rays in the desired direction, or given a matt surface to disperse the intercepted rays. An example of such a rib is shown in Figure 2, where the ray 7, 7' is reflected from the surface 14 and directed to the surface 15 which may be matt.

The reflecting surface on the back of the bulb may be produced by silvering or by deposition of aluminum or in other known ways, and, preferably, on the outside of the bulb, the deposited metal being protected against tarnishing or scratching in one of the customary known ways. The surface of the reflector 10 may be protected by a layer of plastic or varnish. Since some dispersion of light is generally desirable from this reflector, scratches produced by cleaning are not harmful.

By the present invention a miner's lamp, or other lamp designed to throw a directed beam of light, may be produced which not only produces a brilliant central beam but also produces sufficient intensity of light at wide angles; moreover a reflector according to the invention either maintains its efficiency throughout use or can easily be maintained in clean and fully efficient condition, that is to say a consistent light characteristic for the lamp is obtained and, so far as miners' cap lamps are concerned, without elaborate servicing of the reflector.

I claim:

1. A miner's cap-lamp or the like comprising casing and lamp bulb, the lamp bulb having an approximately parabolic back surface, with the filament close to the focus, the said back surface being made reflecting and being approximately parabolic over a solid semi-angle extending from as near the axis as is practicable to at least 60 degrees measured from the focus, and an annular diverging reflector in association with the said casing spaced about the lamp bulb and forming an extension of said reflecting back surface of the lamp bulb for distributing outside the casing and mainly at wide angles the light from the filament which is directed towards the walls of the casing beyond the parabolic reflecting surface.

2. A miner's cap-lamp or the like comprising casing and lamp bulb, the lamp bulb having an approximately parabolic back surface, with the filament close to the focus, the said back surface being made reflecting and being approximately parabolic over a solid semi-angle extending from as near the axis as is practicable to at least 60 degrees measured from the focus, an annular diverging reflector in association with the said casing spaced about the lamp bulb and forming an extension of said reflecting back surface of the lamp bulb for distributing outside the casing and mainly at wide angles the light from the filament which is directed towards the walls of the casing beyond the parabolic reflecting surface, and a lens located in the path of the central beam and adapted to condense it.

3. A miner's cap-lamp or the like comprising casing and lamp bulb, a front cover glass, the lamp bulb having an approximately parabolic back surface, with the filament close to the focus, the said back surface being made reflecting and being approximately parabolic over a solid semi-



5

angle from as near the axis as is practicable to at least 60 degrees measured from the focus, annular reflecting means in association with the said casing for distributing outside the casing and mainly at wide angles the light from the filament which is directed towards the walls of the casing beyond the parabolic reflecting surface of the said bulb, and a rib on the cover glass located so as to intercept some of the rays of the beam reflected from the parabolic reflecting surface and divert them to increase the wide angle illumination.

4. A miner's cap-lamp or the like comprising casing and lamp bulb, a front cover glass, the lamp bulb having an approximately parabolic back surface, with the filament close to the focus, the said back surface being made reflecting and being approximately parabolic over a solid semi-angle from as near the axis as is practicable to at least 60 degrees measured from the focus, annular reflecting means in association with the said casing for distributing outside the casing and mainly at wide angles the light from the filament which is directed towards the walls of the casing beyond the parabolic reflecting surface of the said bulb, a rib on the cover glass located so as to intercept some of the rays of the beam reflected from the parabolic reflecting surface and divert them to increase the wide angle illumination, and a lens located in the path of the central beam and adapted to condense it.

5. A miner's cap-lamp or the like comprising casing and lamp bulb, a front cover glass, the lamp bulb having an approximately parabolic back surface, with the filament close to the focus, the said back surface being made reflecting and being approximately parabolic over a solid semi-angle from as near the axis as is practicable to at least 60 degrees measured from the focus, an annular diverging reflector in association with the said casing, spaced about the lamp bulb and forming an extension of said reflecting back surface of the lamp bulb for distributing outside the casing and mainly at wide angles the light from the filament which is directed towards the

6

walls of the casing beyond the parabolic reflecting surface of the said bulb, and a rib on the cover glass located so as to intercept some of the rays of the beam reflected from the parabolic reflecting surface and divert them to increase the wide angle illumination.

6. A miner's cap-lamp or the like comprising casing and lamp bulb, a front cover glass, the lamp bulb having an approximately parabolic back surface, with the filament close to the focus, the said back surface being made reflecting and being approximately parabolic over a solid semi-angle from as near the axis as is practicable to at least 60 degrees measured from the focus, an annular diverging reflector in association with the said casing, spaced about the lamp bulb and forming an extension of said reflecting back surface of the lamp bulb for distributing outside the casing and mainly at wide angles the light from the filament which is directed towards the walls of the casing beyond the parabolic reflecting surface of the said bulb, a rib on the cover glass located so as to intercept some of the rays of the beam reflected from the parabolic reflecting surface and divert them to increase the wide angle illumination, and a lens located in the path of the central beam and adapted to condense it.

HARRY HOLT, JUNIOR.

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