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No. 659,353.

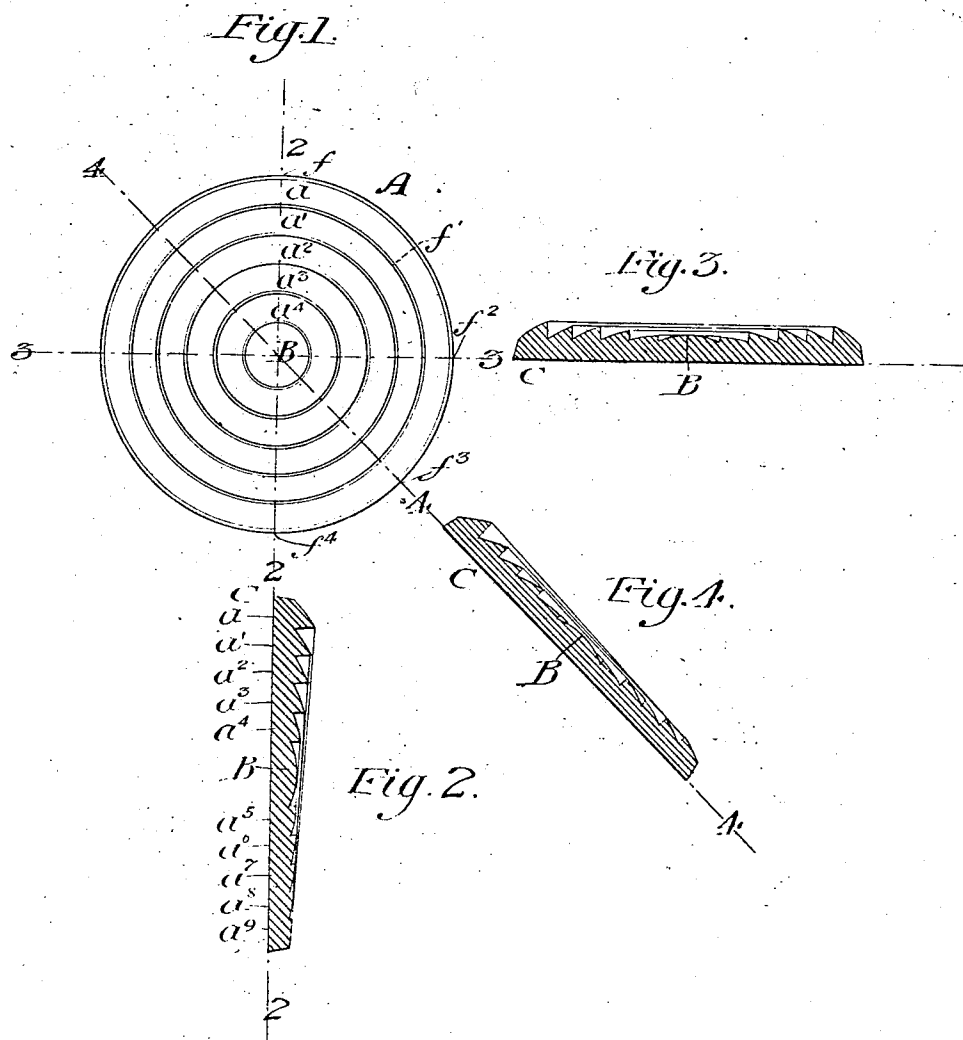
Patented Oct. 9, 1900.

J. H. PITKIN.
HEADLIGHT LENS.

(Application filed May 11, 1900.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses:

O. W. Edelin.

J. E. Hutchinson Jr.

Inventor:
Julian H. Pitkin.By his Attys.
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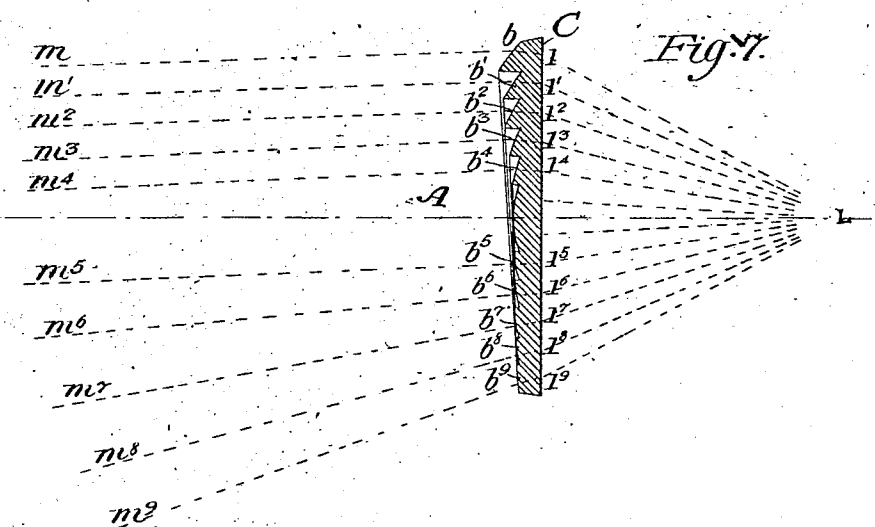
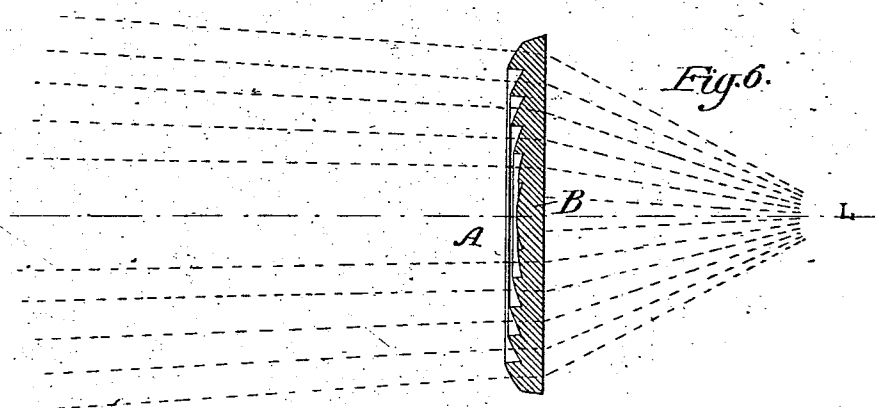
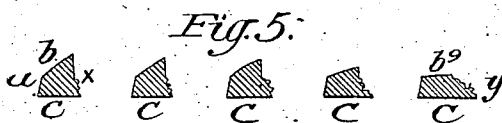
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Fig. 8.

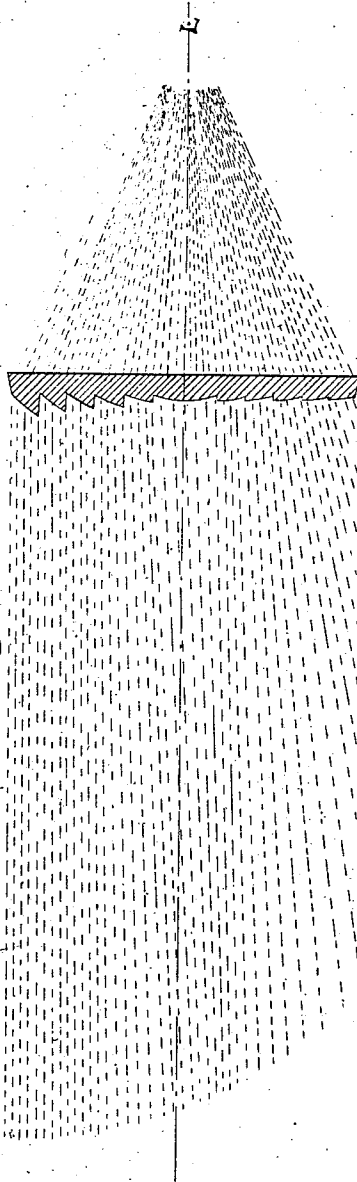
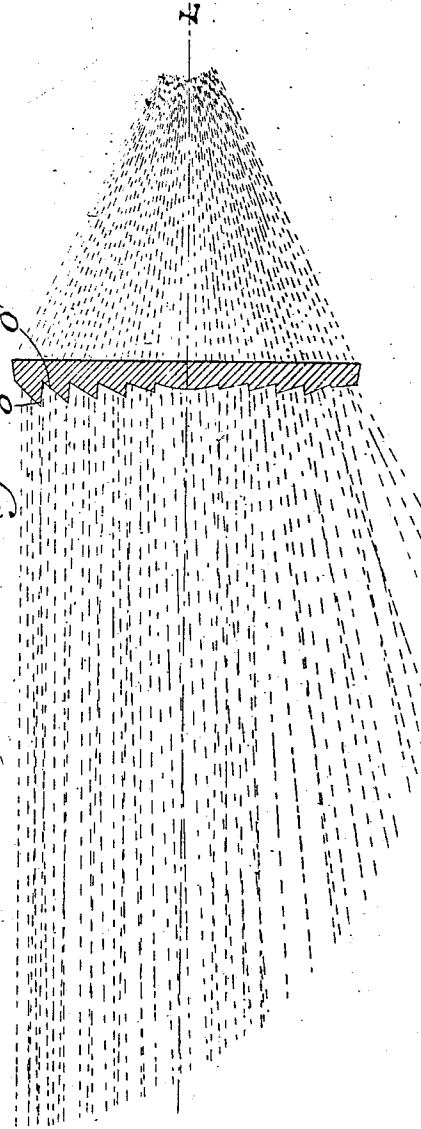


Fig. 9.



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UNITED STATES PATENT OFFICE.

JULIAN H. PITKIN, OF CHICAGO, ILLINOIS.

HEADLIGHT-LENSES.

SPECIFICATION forming part of Letters Patent No. 659,353, dated October 9, 1900.

Application filed May 11, 1900. Serial No. 16,322. (No model.)

To all whom it may concern:

Be it known that I, JULIAN H. PITKIN, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Headlight-Lenses, of which the following is a specification.

My invention relates to lenses for vehicle-headlights, and has for its object to provide such a device that will assemble and confine the rays of light in a beam that shall be limited laterally to a narrow path and extend along the ground from a point in close proximity to the source of light to a point considerably distant therefrom without at the same time crossing the line of vision.

My improved lens is primarily intended for use on bicycle-lamps, where a thoroughly-illuminated path from the wheel to a distant point ahead is essential in order that the character of the ground may be revealed to enable the rider to avoid obstructions and consequent danger of injury, though it may be applied to any vehicle-headlight. It is desirable in order to secure the best results that the entire number of light-rays be utilized and concentrated throughout the path to be illuminated, which in the ordinary bicycle headlight-lens is not the case. The objection to the ordinary lens in use is that it either illuminates a wide area close to the wheel, while the road in front is left in darkness, or it illuminates a spot at some distance ahead, while the road immediately in front of the wheel remains dark, in either of which cases the probability of revealing an obstruction in the road under conditions that will enable the rider to avoid it are greatly diminished as compared with a lens such as I have devised that will throw a continuous beam of light from the wheel to a remote point in front.

By my improved lens the rays of light are concentrated to strike the ground close to the wheel and to extend in a laterally-confined path from that point along the ground to a considerable distance ahead. These desirable results are secured by constructing the lens of prisms whose angles of refraction vary in different portions of the same prism—that is, each prism is so constructed that the angles of refraction at different portions thereof shall be such as to direct the rays of light in an

extended laterally-confined path along the ground, and the angle as between the prisms themselves is also varied, all as will herein-after more clearly appear.

In a bicycle headlight-lens there are employed a series of prisms arranged concentrically and which occupy substantially the whole of the surface of the lens, the prisms being arranged close to each other. The rays of light proceeding from the flame diverge or spread, and when these divergent rays pass through the plane emergent surfaces of adjacent prisms it is found that this divergence is not corrected and the refracted rays of light from adjacent prisms intercept each other, thus producing a penumbra or shadow at the sides of the line of intersection. To overcome this defect is another object of my invention, and this I do by providing prisms whose emergent surfaces are not plane, but, on the contrary, are slightly convex or curved in cross-section.

In the accompanying drawings, Figure 1 is a face view of my improved lens. Figs. 2, 3, and 4 are sections on the lines 2 2, 3 3, and 4 4. Fig. 5 represents a series of cross-sections of the same prism, showing the variation in the angle at different portions thereof. Fig. 6 is a horizontal section of the lens, showing the light-rays by dotted lines. Fig. 7 is a vertical cross-section, the dotted lines showing the paths of the incident and emergent rays of light; and Figs. 8 and 9 are vertical sectional views showing, respectively, a lens having prisms with curved emergent surfaces and a lens having prisms with plane emergent surfaces, with diagrammatic illustrations of the effect of said constructions upon diverging rays of light.

The lens is preferably, though not necessarily, made circular in form, and it may be cast or molded in one piece for convenience in manufacture.

In constructing this improved lens advantage is taken of the well-known property of the prism to deflect a ray of light as it passes therethrough first toward the normal of the incident surface and then as it passes from the dense medium of the prism into the less dense air away from the normal of the emergent surface. The direction of any ray of light may thus be controlled as to its direction of re-

fraction by simply changing the angle of the prism through which it passes. If in the same prism the angle is uniform—that is, if the angle between the incident and emergent surfaces is the same throughout—the direction of the refracted rays will be the same, whereas if this angle is made to vary the direction of the refracted rays will likewise vary, and I have taken advantage of this fact to so vary the angle of the prisms at different parts thereof as that the rays of light will be directed in a continuous path along the ground, and I have so varied the inclination of the prisms as between themselves that the path shall extend from the wheel continuously to a great distance ahead.

In the drawings the lens A, shown preferably as circular in shape, has any usual or desired form of center B, either plane or convex, and is provided with a series of continuous prisms $a, a', a'', a''',$ and a^4 of any desired number, which are preferably shown as annular in form, though, as it is quite obvious, they might be made oval, elliptical, or of any other continuous contour, and when I use the term “annular” in the specification and claims I mean of any continuous contour, as here referred to. Each of the several prisms extends continuously around the lens, and on each side of the center of the lens, extending from the bottom to the top, each prism has the angle between the incident surface C and the emergent surface b varied—that is, the angle that the emergent surface b of the prism a makes with the incident surface C at the top of the lens is large, as represented by x , Fig. 5, whereas the angle that the emergent surface b' of the same prism a makes with the incident surface C at the bottom of the lens is quite small, as represented at y , and at the points of the prism between the top and bottom the “angle” of the prism, as I will term the angle between the incident and emergent surfaces, varies between x and y . This variation in angle is well defined in the cross-sections of Fig. 1 represented by Figs. 2, 3, 4, and 5. In the vertical cross-section of Fig. 2 the angles of the prisms at the top of the lens are the maximum desired, while those at the bottom of the lens in the same prism are the minimum in that prism. The cross-section represented by Fig. 3 being horizontal, the angle of the several prisms is intermediate or a mean between the angle of the same prism at the top and bottom, while Fig. 4, being a section midway between the horizontal and vertical on the line 4-4 of Fig. 1, shows the angles of the prisms at the top and bottom intermediate or a mean between the angles of the same prisms in the vertical and horizontal sections.

It will be clear from the above that each prism varies in angle from the top to the bottom of the lens and that the angles of adjacent portions of the same prism differ—that is, the angles of the prisms in the vertical section of Fig. 2 differ from the angles of the same prisms

in the section of the adjacent portion in Fig. 4. The effect of this variation of angle in the same prism is to refract the rays of light differently at different portions of the same prism. For instance, having reference to Fig. 7, let L represent a source of light. Then the rays striking at l will be refracted by the emergent surface b in the direction of m , which would intersect the ground at a long distance from the lens, while the refraction of the rays striking the incident surface at l' will be in the direction of m' , which would intersect the ground at a point close to the lens, and the direction of rays at intermediate points l and l' in the same prism will vary according to the angle of the prism at those points and will be intermediate the directions of m and m' .

If the several prisms were similar or uniform in their inclination, (if, in other words, the prisms $a, a', a'', a''',$ and a^4 in the cross-sections of Figs. 2, 3, and 4 were of the like or similar inclination,) the tendency would be to direct the rays approximately in the same direction as the prism a just described, with the resulting effect of illuminating the periphery of an oval or ellipse upon the ground, leaving a relatively dark center. To obviate this, I have varied the angles of the prisms as between themselves—that is, on corresponding portions of adjacent prisms the angle of one prism differs from the angle of the other prisms. Referring to Figs. 2, 3, and 4, it will be noticed that the prism a on the cross-sections shown has a larger angle than prism a' , that prism a' has a larger angle than prism a'' , that prism a'' has a larger angle than prism a''' , and so on with the entire series of prisms. The result is that while a ray of light entering the prism a at l is by its refracting-surface b directed toward m , a ray of light entering the prism a' at l' is by its refracting-surface b' directed toward m' , the ray entering at l'' is directed by the surface b'' toward m'' , and so on through the entire series of prisms. The rays entering at $l, l', l'', l''', l''',$ and l'''' are directed by the surfaces $b, b', b'', b''', b''',$ and b'''' , respectively, toward the points $m, m', m'', m''', m''',$ and m'''' in slightly divergent paths, so that while the ray of light emerging at surface b is directed to the most distant point and the ray emerging from surface b'' is directed to the ground close to the lens at m'' the rays emerging from the intermediate prisms strike the ground one in advance of the other, thus forming a continuous path of light from the wheel to the most distant point reached by the refracted ray at surface b .

By reference to Fig. 6 it will be seen that the angles of different portions of the same prism on opposite sides of the center B of the lens are the same, so that the rays of light emerging from the surface of prism a on either side of the center of the lens are directed in nearly parallel paths and form the outer horizontal boundaries of the beam of light, while the several prisms varying in angle as between themselves direct the rays to

light up the entire path between the outer or boundary rays.

In Fig. 5 I have shown a single prism and at different portions thereof have illustrated by cross-sections the angle the prism assumes on the lines f , f' , f^2 , f^3 , and f^4 . These more clearly show the gradual increase in the angle of the prism from the lower portion, where it is represented as of five degrees. At f^4 it is represented as of seventeen degrees; at f^3 , thirty degrees; at f^2 , thirty-seven degrees; at f' and at f , the point of greatest angle, forty-four degrees. Of course these angles may be varied within wide limits; but the illustration is explanatory of the general character of the prisms.

Figs. 8 and 9 are diagrams showing two forms of lens. The former figure shows a lens having prisms whose emergent surfaces are curved and the latter prisms whose emergent surfaces are plane, said figures illustrating the loss of light due to interference of the refracted rays and its remedy. This feature of my invention has for its object to prevent the interference of the rays of light, and the loss consequent of such interference is clearly illustrated in these figures. The rays of light proceeding from the source L diverge and upon emerging from the prism shown in Fig. 9 are still divergent, owing to the fact that said rays enter the incident surface at an angle and are refracted also at an angle corresponding to their angle of divergence.

From an inspection of the diagram Fig. 9 it will be seen that the rays of light refracted from the lower one-third of the upper prism and the upper one-third of the next adjacent prism intercept each other, and the effect is to produce in lines at each side of said points of interception areas of darkness.

By making the emergent surface of the prism of a slightly-curved form transversely, as shown in Fig. 8, this fault is corrected and the rays of light are refracted in parallel lines, avoiding the darkening.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A lens for vehicle-headlights, having a continuous prism, the angle of whose emergent surface varies throughout the length thereof.

2. A lens for vehicle-headlights provided with a series of continuous annular prisms, the angle of each of which varies throughout the prism.

3. A lens for vehicle-headlights provided with a series of continuous annular prisms, the angle of each of which varies from the bottom to the top of the lens.

4. A lens for vehicle-headlights provided with a series of continuous annular prisms, the angle of each of which increases progressively from the bottom to the top of the lens.

5. A lens for vehicle-headlights provided with a series of continuous annular prisms varying in angle as between themselves, and the angle of each of which varies throughout the prism.

6. A lens for vehicle-headlights provided with a series of continuous annular prisms varying in angle as between themselves, and the angle of each prism varying continuously from the bottom to the top of the lens.

7. A lens for vehicle-headlights having a series of continuous annular prisms arranged on one face thereof, the angle of each of which varies throughout the prism, the incident surface of all the prisms being in the same plane.

8. A lens for vehicle-headlights having a continuous prism, the angle of whose emergent surface varies throughout the length of the prism, said prism having its emergent surface curved transversely.

9. A lens for vehicle-headlights having a plurality of prisms arranged concentric to each other and to the source of light, and the angle of whose emergent surfaces varies throughout the length of the prisms, said prisms having their emergent surfaces curved transversely.

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Witnesses:

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CHAS. S. PITKIN.