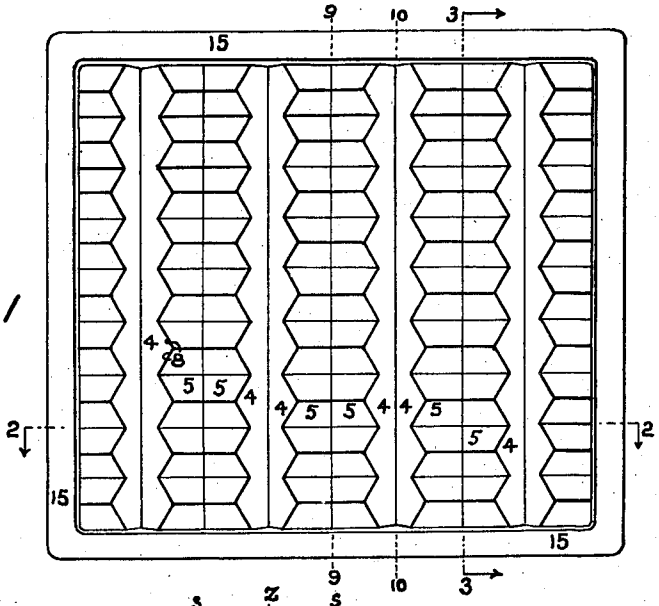
March 10, 1931. C. A. JAMES 1,795,952

HIGHWAY DANGER REFLECTOR

Filed Dec. 29, 1927

FIG. 1



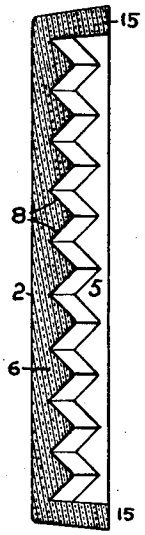


FIG. 3

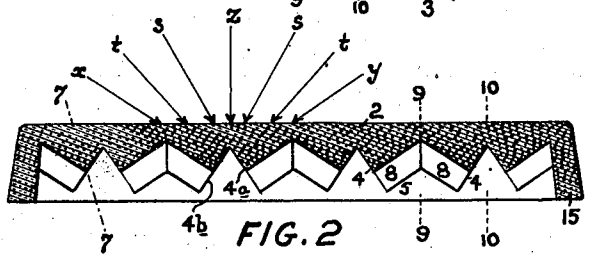


FIG. 2

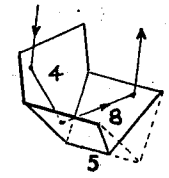


FIG. 6

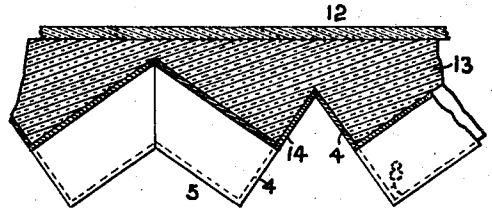


FIG. 5

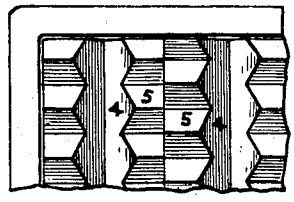


FIG. 4

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Patented Mar. 10, 1931 1,795,952

UNITED STATES PATENT OFFICE

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HIGHWAY DANGER REFLECTOR

Application filed December 29, 1927. Serial No. 243,231.

The object of my invention is to provide a reflector, preferably of pressed glass, which shall have capacity for returning a beam of light to its source when said source is either directly in front of the plane of the reflector or when positioned to the right or left thereof, whereby the beam of light would impinge upon the reflecting surface at an angle thereto less than a right angle.

My invention has particular utility as a danger signal for highways, such as at railroad crossings, or at turns or dangerous positions in roadways traversed by automobiles, and wherein the beam of light from the headlights of approaching vehicles impinges upon the reflecting surfaces of the danger signal when properly placed in position with respect to the roadway or railroad crossing, the construction being such that the said beam of light is reflected back to the driver of the automobile and thereby indicates necessity for caution. The reflected light is usually returned as a red, amber, green or other colored beam, in accordance with the highway regulations under the State laws. The same advantages of a danger signal of this character for highways may be equally effective when the reflectors are employed at street crossings within city limits.

Furthermore, my invention is adapted for use for advertising purposes wherein the sign having words made up of these reflectors may be illuminated by a light derived from a passing automobile. Where the signs are located at elevations, they may be illuminated by spot-lights suitably positioned more or less in the line of vision of the public on the streets, whereby the light is reflected back to and beyond the spot-light and within the vision of the observer.

More particularly, my invention comprises an extended area, the surface of which is made up of a plurality of reflecting units arranged in parallel relation, each unit embodying the principles or essential features of the reflector disclosed in Letters Patent No. 1,552,166 granted to me on September 1, 1925, and, as defined therein, comprising two reflectors at right angles to each other and with their reflecting faces facing one another, one of the reflectors having a plane surface and the other being grooved, the grooves running at right angles to the plane reflector and each groove being composed of two plane surfaces placed at right angles to one another; and wherein further, each unit has its plane and grooved reflecting surfaces respectively in angularly juxtaposition with corresponding surfaces of adjacent units, and wherein also the planes of the plane reflecting surfaces form a greater angle with the general plane of the reflector than is formed therewith by the planes of the grooved surfaces.

The invention further comprehends a plurality of parallel reflector units as above described, wherein the adjacent units are reversed with respect to each other, whereby the adjacent plane surfaces incline in opposite directions relatively to the general plane of the reflector and form grooves at the back of an angularity less than a right angle, and the corresponding grooves of the adjacent units at the back also incline in opposite directions to said general plane of the reflector and form general grooved portions having an angularity greater than a right angle.

My invention also comprehends other features of construction which, together with those above enumerated, are more fully described hereinafter and pointed out in the claims.

Referring to the drawings: Fig. 1 is a plan view of a reflector embodying my improvements; Fig. 2 is a sectional view taken on line 2—2 of Fig. 1; Fig. 3 is a sectional view taken on line 3—3 of Fig. 1; Fig. 4 is a plan view of a portion of a reflector plate slightly modified from what is shown in Fig. 1; Fig. 5 is a sectional view corresponding to a part of Fig. 2, but showing the reflecting surfaces made of metal; and Fig. 6 is a perspective view illustrating the relative shapes and positions of the coacting reflecting surfaces and the direction of a light ray reflected thereby.

Each of the units has a flat front face 2 and embodies a plane reflecting surface 4 and a grooved reflecting surface 5, the latter made up of a plurality of reflecting grooves 8 di-

rected toward the front or plane surface 2 of the reflector and providing a mass of glass 6 between the said flat surface 2 and the grooved surfaces 8 and through which the light rays pass while being reflected back to the source. When the light is to be returned as a colored beam of light, the glass mass 6 is given the desired color at the time of molding the glass, or, if desired, the outer surface 2 may be provided with a translucent or transparent colored layer.

The reflecting surfaces 8, comprising each groove, are arranged along their length at right angles to each other as shown in Fig. 3, and said surfaces are arranged at right angles to the plane reflecting surface 4 as indicated in Fig. 2, so that there are three reflecting surfaces each arranged at right angles to the other and constituting a triple reflector structure which is repeated along the length of the unit, whereby the beam of light entering through the plane surface 2 will impinge upon one of the reflector surfaces and, after being reflected successively from the remaining two surfaces of each triple reflector structure, is reflected back to the source. This operation will take place with every portion of the reflecting structure where the reflecting surfaces 8, 4, 8, occur in juxtaposition, and which, together, form, as it were, a trihedral reflector but whose axis would be at an angle to the plane surface 2, as indicated by the dotted line 7—7 in Fig. 2. It is further pointed out that the reflecting surfaces 8 each are similar to a quadrilateral figure of a trapezoidal form, wherein two opposite sides are of different lengths and parallel, and one end at right angles to the parallel sides, as will be readily seen by an examination of Figs. 1 and 6. This shape for the reflecting surfaces 8 is important, because if it were not for this feature, the beam of light would not be reflected from the entire surface of the plane reflector surface 4. For example, if the reflecting surfaces 8 were limited to two sides of a square, then the reflection of the beam of light passing through those two sides would emerge from a square portion only of the surface 4 instead of its entire surface corresponding to any pair of reflecting surfaces 8.

Considering the structure as shown in the drawing, and confining consideration for the moment to one of the parallel units, it may be said that a beam of light projected upon that unit will illuminate every portion of the unit and be returned to the source, and, therefore, would give the maximum efficiency possible. If the reflecting surfaces 8, 8, were made to correspond to two sides of a square, then the reflection from the surface 4 would only approximate two-thirds of the efficiency of the structure, as shown, and this for the reason that under the assumption the capacity for reflection from the surface 4 would be reduced to two-thirds, the remaining portion of said surface receiving no portion of the reflected beam of light and hence inoperative to that extent.

From the foregoing, it follows that in arranging the parallel units, the juncture between the grooved reflector surfaces 5, 5, of the adjacent units should each meet in a plane perpendicular to the general plane of the surface 2 of the reflector, corresponding to the dotted line 9—9 of Fig. 1; and similarly, the adjacent plane surfaces 4, 4, of adjacent reflectors should lie in a plane perpendicular to the plane of the general surface 2 indicated by dotted lines 10—10 of Fig. 1, and parallel to the plane 9—9. With these provisions, the entire surface of the reflector will be illuminated and reflect back the beam of light to the source.

Considering now the feature wherein the adjacent units are reversed in respect to their plane and corrugated surfaces, the benefits from this may be explained as follows: While the maximum efficiency results by a beam of light which projects at right angles to the surface 2 of the reflector and while the beam of light will be reflected back to the source when the angle of the surface 2 of the reflector is oblique to the line or direction of the beam of light, the efficiency of this reflection will decrease with the increasing of the angle of the incident rays with the said surface 2 of the reflector, and this is true whether the angle is in the direction of the arrow x or y (Fig. 2), as compared with the results when the beam is directed at right angles to the surface 2 as indicated by the arrow z. If we turn the angle of the reflector (Fig. 2) sufficiently to bring the beam of light corresponding to the arrow x at right angles to the plane reflector surface $4b$ and in alinement with the grooved reflector surfaces 8, it is manifest that those surfaces no longer act as reflectors, and consequently the triple reflector effect of that unit would disappear, and this same action would, of course, result with each of the alternate units. If, on the other hand, the reflector was turned in the opposite direction, so that the beam of light corresponding to the arrow y would impinge at right angles to the surface $4a$, then said surface would be put out of action as a reflector and the triple reflector effect lost, as in the first instance. There is, therefore, a limit as to the extent of angle through which the beam of light may be projected upon the reflector to insure that every portion of it shall act to return the beam of light. It is seen, however, that in adjusting the beam of light to the different angles to the right or to the left within operative possibility, while maintaining the device as a reflector, at least one-half of the same will act as an efficient reflector. It will, therefore, respond to beams of light coming from a right handed or left handed approach. For example, if the ap-

proach of the beam of light took place anywhere between the right and left angle indicated by the arrows *s*, *s*, there would be full illumination by reflected light, and, moreover, if the beam of light was projected from a position between the arrows *s* and *t*, (either at the right or left side), the efficiency of the reflector would be diminished as the light beam changed from *s* to *t* proportionally to the extent that the light passed through the reflector surfaces 4*a* and 4*b* without being reflected to the surfaces 8. If the beam of light is then caused to be projected in the direction of the arrows *x* or *y*, and hence respectively at right angles to the surfaces 4*a* and 4*b*, said surfaces would cease to be reflectors and, therefore, the unit having the surface 4*a* would cease to be a reflector for the beam corresponding to the arrow *y*; and similarly, with respect to the arrow *x*, if the beam came from the extreme opposite direction. However, in practice, the normal angles in which the beam may project upon the reflector with approximate full efficiency would be within the scope of the arrows *s*, *s*, and would gradually lose in efficiency on the alternate units as the angle of the beam shifted to a greater angle, namely, from *s* to *t*, but at all times the reflection for the angular approach of the beam would be the same, whether it approached from the right or from the left hand direction. For these reasons, the reflector embodies equal efficiency when the light comes from either the right or the left direction.

These features are not possible in any other construction of pressed glass triple reflector that I am aware of, for in the case of reflecting surfaces in the form of semi-cubes, which is efficient when the beam of light is projected upon it at right angles to its general surface, the reflection of the light fades out entirely when the approach is from the right or from the left, according as to the installment of the reflector. As far as I am aware, the present reflector is the only one which gives good positive reflection back to the source from an approach, both from the right side and the left side, and with a maximum efficiency when the approach is directly at right angles to the plane of the reflector.

By making the reflector of pressed glass and with a multiplicity of reflecting units, it is manifest that an extended area of reflecting surface can be provided with relatively small depth, and furthermore, is more accurate in its construction in that it may be produced by being pressed in molds of definite shape and size. Furthermore, it is easily kept clean, as the only surface that requires attention is the flat surface 2, since the reflecting surfaces of the parts 4 and 8 are the surfaces formed in shaping the back and as this is not affected by mere accumulation of dust, it is not material as to accumulations of anything on that surface that does not scratch or abrade the surface.

As in pressed glass reflectors of the character herein described the prismatic portions thereof are located at the back and hence at the side that would be in contact with the support, it is advisable to provide means of sustaining the reflector in such manner that the prismatic portions will not contact with the support. This is easily accomplished by providing a flanged rim about the side edges of the glass and which has a depth sufficient to extend slightly beyond the prismatic portions of the back, as will be readily understood by reference to Figs. 2 and 3, and in which 15 represents the said flanges. These flanges rest upon the boards or other supports for the reflectors and permit them to be clamped in position without injury to the prismatic portions.

My improved reflector in its preferred form and as shown is formed of a glass plate having its front surface flat and its rear surface formed with a prismatic construction comprising a plurality of parallel grooved portions 4, 4, each of the surfaces of which grooves are at an angle to each other of approximately 70°, and interposed transversely grooved portions 5, 5, extending obliquely in opposite directions at right angles from the faces of two adjacent parallel grooves and forming an angle to each other of approximately 100°, and said transverse grooves each formed of oblique surfaces 8, 8, of trapezoidal shape and arranged in pairs at right angles to each other.

In Fig. 4 I have shown a slight modification of the structure shown in Fig. 1, in that the units where they have the grooved portions 5 in abutting relation, said units are relatively shifted longitudinally to the extent of a half groove. Even though this is done, there is no change or shifting of the relation between the grooved reflecting surface 5 and the plane reflecting surface 4, and consequently the said shifting, as shown in Fig. 5, or any other extent of shifting longitudinally of the unit, may be made without interfering with the efficiency of the device.

In Fig. 5, I have shown my improved reflector as made of sheet metal, as distinguished from being pressed out of solid glass, but in this case there will be no color to the reflected beam of light unless the said beam of light is required to pass through a colored screen or sheet of some kind. I have indicated in Fig. 5, at 12, such a colored plate or sheet through which the beam of light passes in being projected upon or reflected from the reflector. It is manifest also that, if upon the glass plate shown in Fig. 1, there was deposited electrically or otherwise a metallic deposit, the same might be considered as being a sheet metal reflector of the recessed type, and if employed with the glass, the

color of the glass may control the color of the beam. Such a metal reflector would be the same as what is shown in Fig. 5, if the glass 13 was removed. Moreover, if the glass 13 was crystal glass, it might be used with the metal backing 14 and with a colored sheet 12 for imparting color; or, if desired, the crystal glass may be removed, leaving the reflector 14 and the colored glass screen 12 in the relation shown.

It will now be apparent that I have devised a novel and useful construction which embodies the features of advantage enumerated as desirable, and while I have in the present instance shown and described the preferred embodiment thereof which has been found in practice to give satisfactory and reliable results, it is to be understood that I do not restrict myself to the details, as the same are susceptible of modification in various particulars without departing from the spirit or scope of the invention.

Having now descibed my invention, what I claim and desire to secure by Letters Patent is:

1. A reflector for returning a beam of light in the direction of the source, composed of a plurality of elongated reflecting units arranged in parallel relation, each unit composed of two reflecting surfaces placed at right angles to each other so as to face each other, one of the reflecting surfaces being a plane surface and the other having its reflecting surface formed with grooves arranged at right angles to the plane surface and each groove composed of two plane reflecting surfaces of relatively small area placed at right angles to each other, and the juxtaposed units arranged in reverse relation, so that the plane surfaces of adjacent units are arranged at an angle to each other less than a right angle, and the grooved surfaces of adjacent units are arranged at an angle to each other greater than a right angle, and whereby the reflecting area of the reflector, as a whole, reflects back light rays from the source when said source is positioned either directly in front of the reflector or when positioned equally to the right and to the left of the said front position.

2. The invention according to claim 1, wherein further, colored means is provided for causing the reflected light from all of the reflecting surfaces to be colored before being returned to its source.

3. The invention according to claim 1, wherein the reflector is formed of a plate of pressed glass having a plane surface at the front and the back surface pressed and shaped to provide the reflecting surfaces.

4. A reflector formed of a pressed glass plate having its front face flat and its rear face formed with prismatic construction comprising a plurality of parallel grooved portions each of whose surfaces are at an angle to each other less than a right angle, and interposed transversely grooved portions extending obliquely in opposite directions at right angles from faces of two adjacent parallel grooves and forming an angle to each other greater than a right angle, and said transverse grooves each formed of oblique surfaces arranged in pairs at right angles to each other.

5. The invention according to claim 4, wherein further, the pressed glass plate carries coloring means to impart a color to the reflected light.

6. A reflector formed of a pressed glass plate having its front face flat and its rear face formed with prismatic construction comprising a plurality of parallel grooved portions each of whose surfaces are at an angle to each other of approximately 70°, and interposed transversely grooved portions extending obliquely in opposite directions at right angles from faces of two adjacent parallel grooves and forming an angle to each other of approximately 110°, and said transverse grooves each formed of oblique surfaces of trapezoidal shape and arranged in pairs at right angles to each other.

In testimony of which invention, I hereunto set my hand.

CLEVELAND A. JAMES.