

May 29, 1951

J. C. HAGGART, JR
REFLECTOR UNIT

2,555,191

Filed Oct. 3, 1947

2 Sheets-Sheet 1

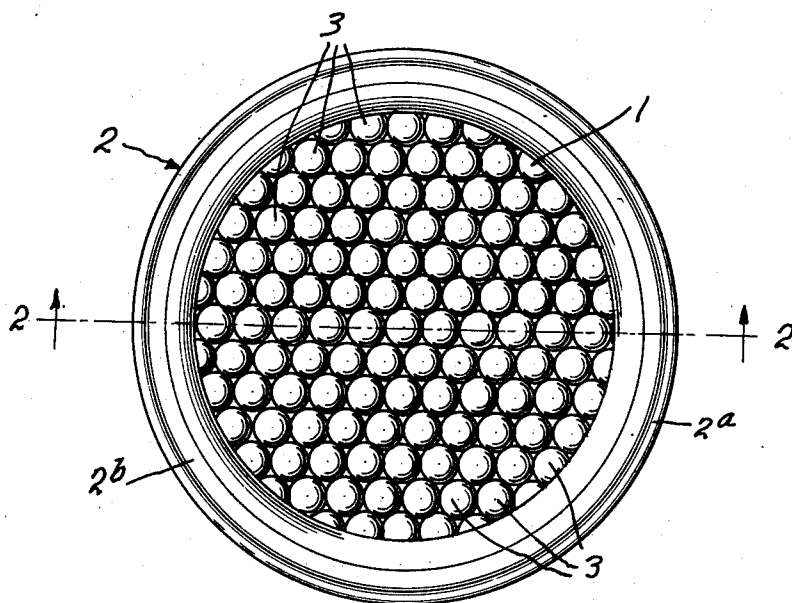


Fig. 1

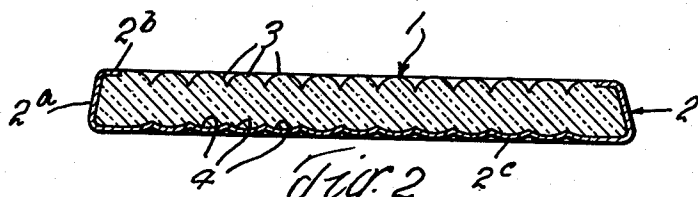


Fig. 2

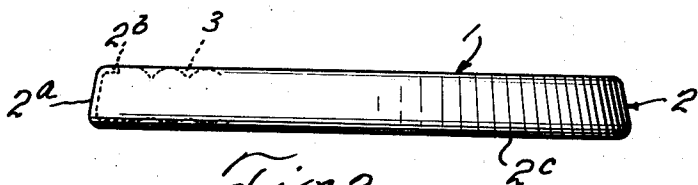


Fig. 3

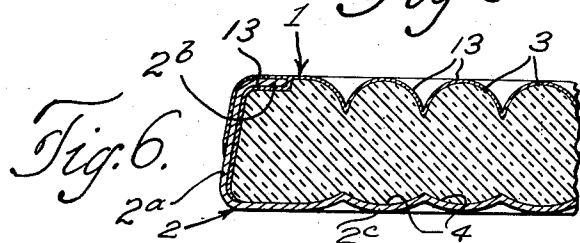


Fig. 6

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2 Sheets-Sheet 2

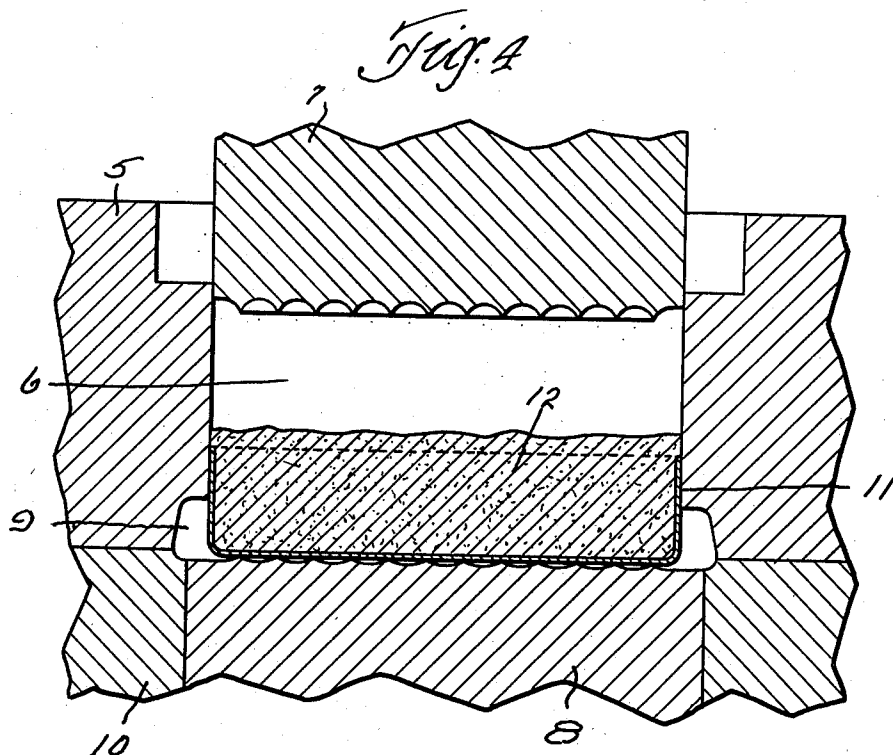
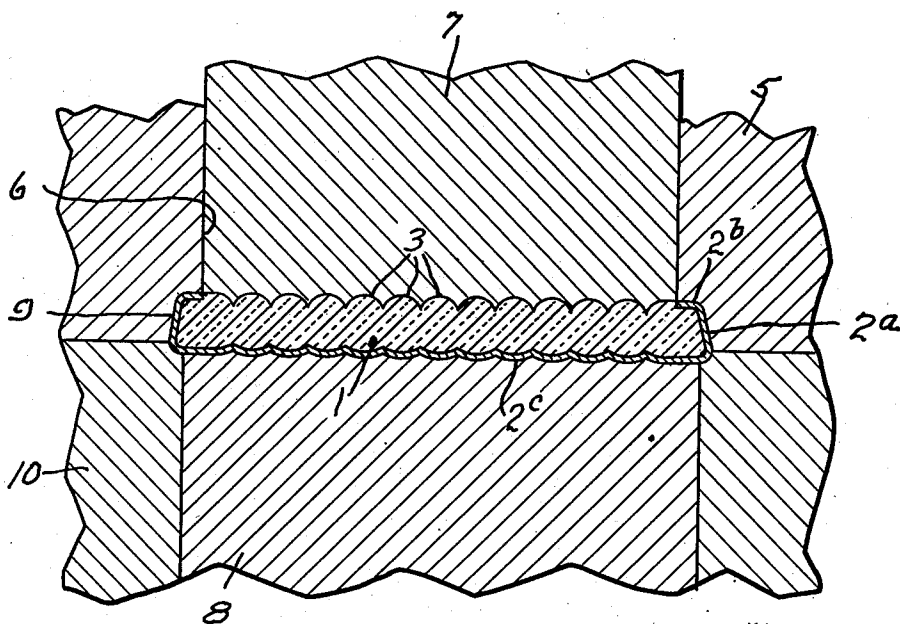


Fig. 5

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2,555,191

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2 Claims. (Cl. 88—82)

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This invention relates to reflector units of the retro-directive or auto-collimating type which are employed to make the characters in signs and signals and return incident light substantially to its source and thereby become luminous, for example, to the occupants of a vehicle the light from the head lamps of which falls upon the sign or signal.

More particularly this invention relates to such reflector units in the form of discs of glass or other plastic material with the individual reflecting units so closely associated that the effect is that of a single large reflector. While the invention is broadly applicable to such units of either the central triple type, such as shown in my prior Patent No. 2,286,085, or of the lens reflector type, it is especially useful in units of the latter type which have but a single refraction. For that reason the invention will be illustrated and described as it is embodied in the product produced by the method which is the subject of my copending application, Serial No. 7,315, now Patent No. 2,498,489.

Such units have a reflector area on their rear face for each lens on the front face, this area being convexly spherical or substantially so, being ideally of a shape to occupy the focal field of the lens throughout its angular range of function. Commonly the rear face has been silvered to make these areas reflective.

For mounting purposes it is necessary to encase the plastic discs in metallic housings in the form of cup-shape members that generally have their free edge crimped inward over the peripheral margin of the front face of the discs, leaving the lenticular area exposed. The practice heretofore has been to apply the housing to the disc in a separate operation, and it has been difficult to seal the housing hermetically upon the disc without the development of warping strains.

The unit of this invention, as explained in my said copending application, is produced by molding the plastic disc in the housing while shaping the housing to its final fabricated form. The housing, therefore, acts as a mold form and the disc completely fills the housing. Since the housing fits upon the disc and contacts it throughout with its inner surface, this inner surface may be made sufficiently bright, in accordance with the invention, to serve as the reflector and dispense with the need for silvering the back face of the disc when the unit is of the single refractive, lens reflector type.

One embodiment of the invention is shown in the drawings in which

Fig. 1 is a plan of the unit on a scale enlarged over that of the usual commercial unit.

Fig. 2 is a median section of the unit, on the plane of section, for example, indicated by the line 2—2 of Fig. 1.

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Fig. 3 is a side elevation of the unit.

Fig. 4 is a sectional detail of a portion of the molding apparatus and of the unit housing and contents in their initial form.

Fig. 5 is a similar section showing the parts in their position at the conclusion of the molding operation.

Fig. 6 is an enlarged fragmentary section of a unit illustrating a sealing and coating means of the invention disposed between the lens material and the housing and covering the front face of the unit.

The finished unit, as shown in Figs. 1, 2 and 3, is a disc 1 of suitable transparent material, such as the thermoplastic known in the trade as "Lucite" or other moldable thermoplastic, closely encased within a housing 2. The housing is generally of cup shape, having a tapered or frusto conical side wall 2a, terminating in an inturned or overhanging lip 2b.

The disc is what is sometimes referred to as the plaque form, in that its optical area is made up of a plurality of small contiguous or closely associated individual reflective elements which collectively appear as a single reflector when luminous. In the form shown, these individual reflective elements are the combination of a lens and reflector. The front face of each lens element consists of a positive lens 3, and the back face consists of a convex, generally spherical surface 4 which is shaped to conform approximately to the contour of the field containing the foci of the lens for incident light at all angles of incidence within the functional range of the unit. The two convex faces 3 and 4 of each element are axially aligned, and there are, therefore, the same number of faces 4 as there are of lens faces 3.

The bottom 2c of the housing 2 conforms to the rear face of the disc 1 and is in intimate contact therewith. The housing is of suitable sheet metal, such as aluminum, and is preferably made highly reflective on its inner surface. Therefore, by reason of the conformity of the bottom 2c to the rear face of the disc and the fact of intimate contact of the bottom with the rear face, the inner surface of the bottom 2c acts as the reflector and there is but a single refraction of the incident light.

As shown in Fig. 2, the plastic disc 1 completely fills the housing and is in intimate contact with it throughout, the lip 2b being depressed within the top surface so that the general plane of the lenticular face is flush with the top surface of the lip.

This is brought about by the molding method above referred to. That method may be carried out by means of apparatus such as shown in Figs. 4 and 5. A mold plate 5 has a cylindrical cavity 6 in which an upper reciprocating die 7 enters to

cooperate with a lower fixed die 8. The faces of the dies are shaped to form the nodules on the front and rear faces of the unit. About its lower end the cavity 6 is enlarged to form an undercut mold cavity 9, the bottom of which is mainly the face of the lower die 8 and on its outer edge is a portion of the face of a retainer plate 10 for the die 8.

An aluminum cup 11 of the size of the cavity 6 is set into the cavity directly on top of the die 8 if there be no insert in this die to pierce the bottom of the cup, as is sometimes done for coaction with a mounting ferrule, and a measured quantity of molding powder 12 is put into the cup and cavity 6, as shown in Fig. 4. The dies are heated to a temperature which will fuse the plastic powder and the die 7 is brought down to the position of Fig. 5. The descent of the die compresses and molds the fused plastic into the cup 11 and at the same time causes the bottom of the cup to conform to the face of die 8. Continued downward movement of the die 7 causes the side wall of cup 11 to expand into and conform to the cavity 9, as shown in Fig. 5. The mold is thus held closed until the plastic has set, whereupon the mold is opened and the mold plate 5 removed for discharge of the molded unit.

While in the construction shown the side wall 2a encloses the entire side wall of the plastic disc 1, the lip 2b overlying the front face, in certain designs the height of the side wall 2a will be less than the thickness of the disc, with the result that the side surface of the unit will be, for example, half metal and half plastic. In that case it may be feasible to dispense with the in-turned lip 2b.

In order to maintain an hermetic seal between the plastic and its housing and exclude moisture from the reflective surface of the cup, the invention contemplates the introduction of a sealing medium 13 into that annular space, as indicated in Fig. 6.

A suitable sealing medium for this purpose is a fluid silicon compound of the class known as silicones. Due to the difference in the coefficients of expansion of thermoplastics, such as the aforementioned "Lucite," and metal such as aluminum or nickel, there will be a minute space at atmospheric temperatures between the plastic side wall and the wall 2a of a unit formed by molding as above described.

To introduce the sealing medium into the space, the practice is to take the units direct from the mold while they are still hot and when the plastic is fully expanded, and immerse them in a silicone fluid of proper viscosity which has been reduced to freezing temperature or below. The plastic thereupon contracts more than the metal and produces a void into which the silicone 13 enters, the unit being left in the silicone long enough to effect this purpose.

As shown in Fig. 6, the silicone also forms a coating which adheres to the surface which is immersed, and since silicones maintain their viscosity at ranges of temperature far beyond that of the use of such units, this coating is substantially permanent. This not only forms a protection for the plastic, without affecting the optical properties since its index of refraction is very near that of "Lucite," but it also may be dyed and thus serve as an inexpensive means for achieving reflectors of various colors.

If desired, the bottom surface of the cup may be silvered to improve its reflective properties.

It is obvious that the invention may be other-

wise embodied without departing from its spirit and scope as it is defined in the appended claims.

What is claimed is:

1. A reflector unit comprising a cup shaped metallic housing the bottom of which is reflective on its inner surface, and a disc of transparent plastic material molded into and completely filling the cup and closely contacting the entire inner surface thereof, the diameter of the disc greatly exceeding its thickness and the peripheral edge of the disc being frusto conical with its base at the bottom, the exposed face of the disc being formed into a plurality of similar contiguous spherical lenticular areas and the bottom of the housing and the contacting inner face of the disc being formed into a corresponding number of similar spherical convex reflecting areas respectively axially aligned with the said lenticular areas, the side wall of the housing conforming to the frusto conical edge of the disc and having its free edge turned inward to form an overhanging lip flush with the exposed face of the disc.

2. A reflector unit comprising a cup shaped metallic housing the bottom of which is reflective on its inner surface, a disc of transparent plastic material molded into and filling the cup, the diameter of the disc greatly exceeding its thickness and the peripheral edge of the disc being frusto conical with its base at the bottom, the exposed face of the disc being formed into a plurality of similar contiguous spherical lenticular areas and the bottom of the housing and of the disc being formed into a corresponding number of similar spherical convex reflecting areas respectively axially aligned with the said lenticular areas, the bottom of the disc being in physical contact throughout with the bottom of the cup and the side wall of the housing conforming to and closely embracing the frusto conical edge of the disc and having its free edge turned in to form a lip overhanging the peripheral portion of the disc, and a sealing film of silicone fluid between the frusto conical periphery of the disc and the embracing side wall of the housing.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,488,923	Hitchcock	Apr. 1, 1924
1,668,449	Brackensy	May 1, 1928
2,124,793	Persons	July 26, 1938
2,231,139	Reininger	Feb. 11, 1941
2,274,212	Persons	Feb. 24, 1942
2,319,742	Luce	May 18, 1943
2,330,097	Waters	Sept. 21, 1943
2,421,277	Luce	May 27, 1947
2,422,256	Phillippi	June 17, 1947

FOREIGN PATENTS

Number	Country	Date
289,368	Great Britain	Apr. 26, 1928
398,452	Great Britain	Sept. 14, 1933
536,702	Great Britain	May 23, 1941

OTHER REFERENCES

Silicones, article by L. Sanderson in British Plastics, October 1946, pages 459-464. (Photocopy of article in Division 38, 117—Organic Silicones.)