April 6, 1965 H. C. ALVERSON 3,176,420

REFLEX SIGN

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Fig. 1

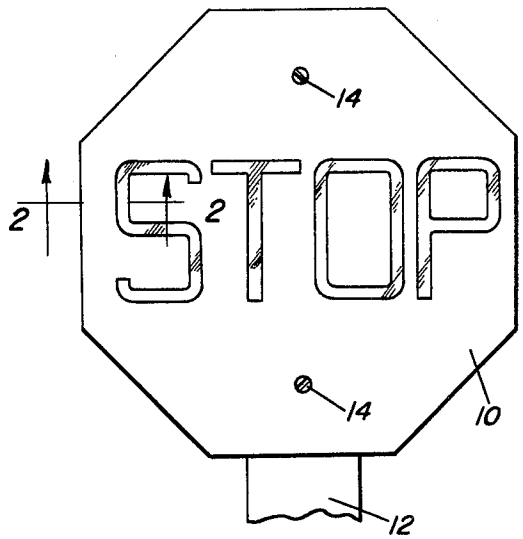
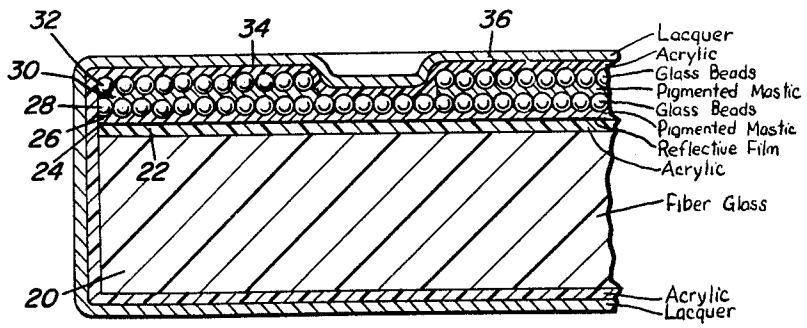


Fig. 2



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REFLEX SIGN

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15 Claims. (Cl. 40—135)

This invention relates to signs and also to the method of making signs as set forth in prior copending application Serial No. 804,324, filed April 6, 1959 now abandoned, with respect to which this application is a continuation.

An object of the invention is to provide a new and improved sign of a flexible, reflex type wherein the sign has a highly reflective and durable face constructed of a plurality of lenticular surfaces arranged for refraction and high reflection of light.

Briefly, the sign is made of a flexible backing on which there are superposed layers of transparent essentially spheroidal beads at least partially embedded in layers of transparent pigmented mastic functioning as a binder for the beads to form a reflex reflective surface. The layer of beads nearest to one face of the backing is embedded in pigmented mastic wherein the pigment is of one color or a mixture of colors producing the effect of a homogeneous color. A second reflex reflective layer of similar beads is embedded in a second mastic layer located on the first lenticulated surface. However, the second mastic layer contains a pigment or combinations of color pigments yielding a different light from that of the first layer of mastic so that there is a contrast between the two colors involved. The second or outer layer of beads covers only selected areas of the lenticulated surface nearest to the backing and the same holds true for the second layer of mastic, thereby leaving exposed a portion of the lenticulated surface. The exposed portion forms a pattern that may be the character of the sign or any configuration such as the letters of a stop sign, railroad code marking and others.

In order to add to the durability of the sign and to aid in holding the glass beads of the second layer in place, there is a plastic coating encapsulating the backing and outermost glass bead layer. Further, the encapsulating coating adds to the weather resistant properties of the sign and being flexible, the coating yields and returns to original shape upon impact and bending of the sign, always maintaining the beads in their correct orientation when the sign is restored to its original position, for instance after deflection due to impact. To further enhance the weather resisting properties of the sign a final transparent coating in one or more layers may be applied to the encapsulating coating. In those instances wherein the light reflection is preferably increased, a film, a sheet or coating of reflective substance, as aluminum, tin foil, or other metals or non-metals having light reflective properties, is electrodeposited or otherwise adhered between the backing and the beads of the lenticulated surface nearest to the face of the backing.

Another object of the invention is to provide a structurally improved flexible, reflex sign made essentially in accordance with the foregoing and which is exceedingly durable, lasting for a long time under various rigors imposed on the sign in both normal and abnormal use, especially in the weather.

A further object of the invention is to provide a new arrangement of steps and association of materials for manufacturing signs. The method of manufacture includes the applying of a smooth layer of approximately spheroidal transparent beads, for instance glass spheres,

over a face of a non-metal backing and holding the glass beads in place to form a lenticulated surface by retention of the glass beads in pigmented mastic that is preferably essentially transparent whereby a film of light reflective substance between the backing and the glass beads increases the reflectivity of the sign. The next step in the procedure is to apply another layer of transparent plastic pigmented with a different color or colors but in a pattern over the lenticulated surface so that the character or characters of the sign are formed by leaving certain portions of the lenticulated surface exposed at the front face of the sign backing. Thereafter, a second layer of beads which are similar to the beads of the lenticulated surface, is applied to the second mastic layer thereby still leaving certain areas of the lenticulated surface exposed at the front face of the sign and preserving the character or characters of the sign.

The final steps are for both weather-proofing the sign construction and for holding the beads of the second layer thereof firmly in place. These final steps include encapsulating with a flexible transparent plastic, for instance an acrylic resin and optionally, coating with a transparent substance possessing greater weather-proof qualities, one example being ordinary transparent lacquer in one or more coats and covering the entire sign face, sides and back surface. An optional step applies a thin layer of acrylic resin or some other plastic substance as the initial step in the process, on the front face of the backing. Acrylic resin is mentioned as a possible plastic since it is contemplated that the best possible backing considering all factors including cost, durability and others, is constructed of pressed fiber glass fortified with acrylic plastic so that the acrylic layer will have an affinity for the fortifying acrylic resin in the essentially fiber glass backing.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a front elevational view of a sign constructed in accordance with the invention.

FIGURE 2 is an enlarged fragmentary sectional view taken on the line 2—2 of FIGURE 1 with the various layers identified.

In the accompanying drawing sign **10** is shown as a stop sign mounted on a post **12** by means of a pair of bolts **14**. It is to be clearly understood though, that the sign need not be a stop sign and it need not be mounted in this way. Sign **10** merely diagrammatically represents a typical sign made by following the techniques of the invention.

Sign **10** is constructed of a backing **20** which is flexible and elastic in the sense that when deflected the backing returns to its original shape. A preferred base is constructed of glass fibers with an acrylic laminating resin. One recommended system for use with acrylic laminating resin employs a semi-continuous lay-up, and over stack cure with the addition of moderate heat (2 hours at 155° F. and 0.3 p.s.i.) with corrugated aluminum cull sheets and conventional trimming equipment. For detailed description reference is made to page 118, Modern Plastics, January 15, 1959, volume 36, No. 5. Numerous other examples are available in literature. The method of actually producing backing **20** is variable in accordance with economic factors such as costs, and also practicability depending on the volume of production. Furthermore,

the compoistion of backing **20** may be varied, one example being given below:

	Parts	Percent
Polyester resin	85	60.28
Monomeric Styrene	5	3.55
Methyl Methacrylate monomer	10	7.09
Pigment	2	1.42
Catalyst	1	.71
Glass fiber mat	38	26.95
	141	100.00

There are several polyester resins available that would do a creditable job on this sign application, and one of the best is Plaskon 9404 made by the Coal Tar & Chemicals Division, Allied Chemical Corporation, 40 Rector Street, New York City. Polymer grade monomeric styrene is available from the Monsanto Chemical Company, Dow Chemical Company, Koppers, etc. Monomeric methyl methacrylate is available from Rohm and Haas and from the E. I. du Pont de Nemours Company. The glass fiber mat is available from Owens-Corning Fiberglas Corporation, Toledo, Ohio, and from the Fiber Glass Division, Ferro Corporation, Nashville, Tennessee. The type used for sign backs is known as HSS (high styrene solubility) and 3 ounces per square foot density would be used.

A layer **22** of acrylic resin is applied onto one face of backing **20**, and it may be applied by any of the known techniques such as spraying, painting and others. Layer **22** is an optional layer which may be included or omitted. When included it forms a foundation for other layers and intimately unites with the acrylic resin of backing **20**. Actually there are two different types of acrylic resins used in the sign. In the backing there is a monomeric methyl methacrylate which improves the wetting of the glass fibers and provides good weather resistance for the backing. One of the final steps in the manufacture of the sign is the coating with an acrylic lacquer which is a mixture of different acrylic polymers dissolved in solvents. Zylene and toluene are the most popular solvents for this type of product. When the lacquer dries the solvents evaporate leaving behind a clear film of the acrylic resin. Layer **22**, when and if it is used has an affinity for the acrylic resin in backing **20** and firmly unites therewith. The next layer **24** in the sign is also optional in that it may be omitted or used as desired. It consists of a reflective film or sheet to obtain light reflectivity from the sign. The film of light reflective substance which may be any of the light metals or predominantly light metals, is electro-deposited, painted or otherwise adhered to the layer **22** when used or directly to the backing **20** when layer **22** is omitted. A pigmented transparent mastic layer **26** is adhered to film **24** when used, or layer **22** when used, or directly to the face of backing **20** when layers **22** and **24** are omitted. The pigmented reflective mastic is essentially transparent with a color pigment therein, or white pigment, and the mastic may be the same as that disclosed in U.S. Patents Nos. 2,354,048, 2,354,049 and 2,379,702. These patents further disclose transparent spheres, usually glass beads which are the same as the glass beads in layer **28**. Layer **28** is made of a number of glass beads partially embedded in the pigmented mastic layer **26** and smoothed to form a smooth lenticulated surface having light reflex reflective properties as disclosed in these patents. Thus, the bead layers are operative as refractive media to modify the pattern of reflected light ultimately emerging from the outer layer of the sign.

The next layer **30** in the construction of the sign is another layer of pigmented mastic. A difference between the mastic of layer **30** and the mastic of layer **26** is that the pigment in layer **30** is contrastingly different from the pigment in a layer **26**. In a typical example of a stop sign the pigment in layer **26** is white while the pigment in layer **30** is red. Further, layer **30** covers only a portion of the area of the lenticulated surface leaving exposed portions of the lenticulated surface in a definite pattern to form the character or characters of the sign. In a stop sign these characters would be the lettering (FIGURE 1). The technique for so applying the mastic of layer **30** may be a stenciling, silk screening or masking. In this way the referred to portions of the lenticulated surface to form the character or characters of the sign are left exposed.

Layer **32** of transparent essentially spheroidal beads are applied to the entire area of layer **30** of mastic. This automatically leaves the previously mentioned portions of the lenticulated surface exposed because there is no mastic of layer **30** thereon. The next step is the application of an acrylic resinous coating **34** on all edges, the back surface of backing **20** and on the outer surface of the beads of a layer **32**. This acrylic resin is preferably a lacquer as described previously so that when the solvent or solvents are driven off, as by heat and/or air drying, a clear film or acrylic remains to form the encapsulation coating **34**. Further, being in liquid lacquer form when applied, coating **34** flows around the upper parts of the beads in layer **32** forming individual sockets for each bead the same as individual sockets are formed in the various layers of mastic when the beads are applied thereon. Inasmuch as all surfaces of the sign are covered with the encapsulating coating **32**, those portions of the lenticulated surface of layer **28** left exposed when layers **30** and **32** are applied are also coated (FIGURE 2). It has been proven that the material and method of application of the encapsulation does not adversely affect the mastic in which the beads are embedded nor decrease the reflective property of the beads to any appreciable extent.

To increase the durability and weather resistance of the sign a final lacquer coating **36** which may be applied in one or more layers may be sprayed, dipped or otherwise adhered to the acrylic resinous encapsulating coating **34**. The lacquer coating **36** may be of the same substance as coating **34** or of a different substance so long as it is transparent and serves the intended purpose of weather-resistance to a high degree.

When the light rays strike the outer coating on the front face of the sign they pass essentially therethrough undistorted, except for unavoidable absorption maintained low by using a highly transparent substance for the outer coatings. The light rays then pass through the beads of layer **32** and are optically refracted due to the nature of each spheroidal bead functioning as a lens. These rays then pass through the pigmented transparent mastic and undergo a similar action in passing through the beads of the lenticular surface forming layer **28**. The white pigmented transparent mastic layer **26** forms a background for light reflection with some of the light passing through the pigmented mastic to be reflected by film **24** when the metalized film **24** is used. In returning the light rays must pass through the pigmented layer **30** giving a light which is compatible with the pigmentation of layer **30**, for instance the color red for a stop sign, when using a white pigmented layer **26** or a secondary color due to color mixing when a color pigmented layer **26** is used necessarily differing from the pigmentation of layer **30** as hereinbefore indicated.

However, in the region of the characters of the sign the light rays pass through the outer coating or coatings and then pass directly through the portion of the lenticulated surface forming beads which are not masked by the layers **30** and **32**. Reflected resulting light, therefore, is not optically affected by any pigmented mastic **30**. Instead, it appears unmixed thereby as white where the layer **26** is so pigmented and/or silvery in the case of a stop sign where white for the lettering is desired. It is evident that convention in choice of colors will be followed. For instance, advertising signs may be any color. Railroad sign convention requires yellow and black

for numerous applications. Other colors consistent with convention and personal choice may be used simply by substitution of different color or colors of pigmentation and/or reflective film.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A flexible reflex sign comprising a flexible backing of plastic fortified fibrous substance, a light reflective film adhered in place at the front of said backing, a first layer of pigmented transparent mastic adhered over said reflective film, a first layer of approximately spheroidal transparent beads embedded in said first layer of mastic to form a lenticular surface completely covering said front of said backing, a second layer of differently pigmented transparent mastic covering portions of said lenticular surface and leaving exposed a portion of the lenticular surface in a pattern to form a character of the sign, a second layer of transparent generally spherical beads partially embedded in said second layer of mastic still leaving completely exposed said portion of said lenticular surface which forms the sign character, and a flexible transparent coating encapsulating said backing and said second layer of beads and said portion of said lenticular surface.

2. The sign of claim 1 wherein said transparent beads of said portion of said lenticular surface are only partially embedded in said first layer of mastic.

3. A sign comprising a backing, a first layer of transparent mastic containing color pigment, a first layer of approximately spheroidal transparent beads embedded in said first layer of mastic to form a lenticular surface completely covering said front of said backing, a second layer of transparent mastic covering portions of said lenticular surface and leaving exposed a portion of the lenticular surface in a pattern to form a character of the sign, pigment in said second layer of mastic and being of a color different from the first mentioned pigment, a second layer of transparent generally spherical beads partially embedded in said second layer of mastic still leaving completely exposed said portion of said lenticular surface which forms the sign character, and a flexible transparent coating encapsulating said backing and said second layer of beads and said portions of said lenticular surface.

4. A pattern light reflector comprising, flat, non-patterned reflective backing means, first reflex reflective layer means through which light is optically refracted completely coating said backing means and second reflex reflective layer means through which light is optically refracted coating portions of the first layer means to optically cooperate therewith for passage of light differently from optically exposed portions of the first layer means forming a light pattern of reflex reflections only.

5. The combination of claim 4 wherein said first and second layer means are formed from transparent spheres embedded in transparent mastic pigmented differently from each other.

6. A pattern light reflector comprising, backing means, an underlying light refracting layer completely covering said backing means and united thereto, an overlying light refracting layer mounted in spaced relation to said underlying layer and covering only portions thereof, light transmissive mastic united to said layers for spacing thereof in a predetermined orientation on the backing means to produce a light pattern, and flexible encapsulating means enveloping said backing means and embedding said overlying layer and portions of said underlying layer exposed through the overlying layer.

7. A pattern light reflector comprising, reflective backing means, at least two light refractive layers through which incident and reflected light passes, first light transparent means mounting one of said layers in spaced relation on said backing means for transmitting light to and from the reflective backing means, second light transparent means mounting the other of said layers in spaced relation to said one of the layers optically exposing portions thereof for establishing different patterns of light emerging from the second layer and the optically exposed portions of the first layer respectively.

8. The combination of claim 7 wherein said first and second light transparent means comprise differently pigmented mastic so that said different patterns of emerging light will display contrastingly different colors.

9. The combination of claim 8 including a transparent flexible encapsulation coating the second layer and the optically exposed portions of the first layer.

10. The combination of claim 7 including a transparent flexible encapsulation coating the second layer and the optically exposed portions of the first layer.

11. A pattern light reflector comprising; a backing, a first transparent adhesive layer, a first layer of refractive elements embedded in said first adhesive layer to form a reflex reflective surface completely covering the backing, a second transparent adhesive layer partially covering said reflex reflective surface leaving portions thereof exposed to form a design, and a second layer of refractive elements embedded in said second adhesive layer exposing said portions of said reflex reflective surface.

12. The combination of claim 11 including a transparent coating encapsulating the backing, the second layer of refractive elements and the exposed portions of the reflex reflective surface.

13. The combination of claim 12 wherein said adhesive layers are pigmented differently to contrastingly color the light emerging from the exposed portions of the reflex reflective surface and the second layer of refractive elements respectively.

14. The combination of claim 11 wherein said adhesive layers are pigmented differently to contrastingly color the light emerging from the exposed portions of the reflex reflective surface and the second layer of refractive elements respectively.

15. In combination with a reflex reflective surface, transparent adhesive coating portions of said surface to form a design pattern thereon, a layer of refractive elements embedded in said transparent adhesive for optically modifying reflected light emerging only from the portions of the reflex reflective surface coated by the transparent adhesive, said adhesive containing pigment for producing a color of light emerging from said layer of refractive elements which is contrastingly different from the reflected light emerging from uncoated portions of the reflex reflective surface.

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