Dec. 30, 1941. L. SHUGER 2,267,995

ROAD MARKER

Filed May 19, 1939

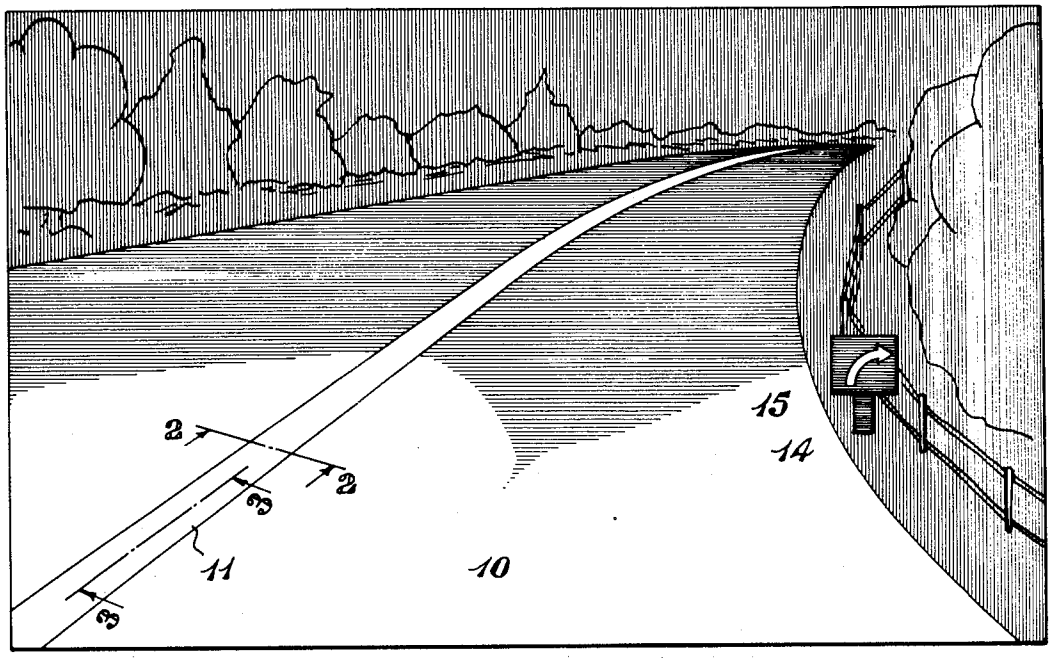


Fig. 1.

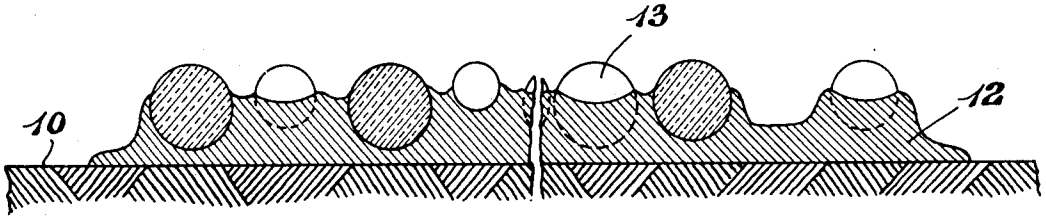


Fig. 2.

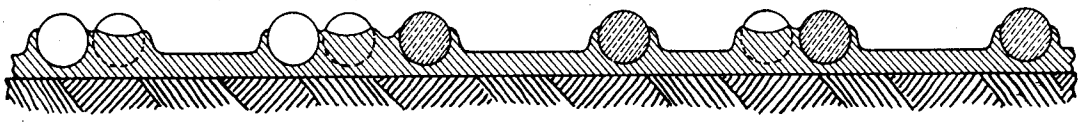


Fig. 3.

Inventor

LEROY SHUGER

By

KARL W. FLOCKS

Attorney

UNITED STATES PATENT OFFICE

2,267,995

ROAD MARKER

Leroy Shuger, Baltimore, Md.

Application May 19, 1939, Serial No. 274,665

4 Claims. (Cl. 94—1.5)

This invention relates to reflecting markers and more particularly to surface markers for use either horizontally or vertically and on curved or flat surfaces.

Prior to the instant invention, it has been proposed that surface markers comprise small glass spheres held by a paint film, to a base on which the paint film is applied. In the practical application of these prior teachings it has been found that uniform results with regard to reflecting efficiency and durability are not always obtained. For example, installations in accordance with the prior teachings have been relatively inefficient with regard to the reflection of light and further the glass spheres have had a tendency to come loose from the binder after a relatively short period of time due to shock, wear of the binder, atmospheric conditions, or in those cases in which the marker is horizontally applied, the combined action of shock and wear accompanying road traffic.

Installations in accordance with these prior teachings have been relatively expensive per period of time and hence generally unsuitable for universal use where low cost is an important factor.

It is an object of the instant invention to provide a marker of high efficiency and great durability of a nature which is readily applicable to regular or irregular surfaces.

It is a further object of the instant invention to provide a binder for a marker of relatively low cost, of high efficiency and great durability including relatively small autocollimating units.

Other objects and the nature and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawing, wherein:

Fig. 1 is a view in perspective of a highway and a pair of markers associated therewith in accordance with the invention;

Fig. 2 is a view in section taken along line 2—2 of Fig. 1 and looking in the direction of the arrows; and

Fig. 3 is a longitudinal section taken along line 3—3 of Fig. 1 and looking in the direction of the arrows.

Referring to the drawing, a road surface 10 has a center stripe 11 applied thereto comprising a binder 12 and a plurality of generally transparent autocollimating units such as glass spheres 13. At the side of the road is located a vertical sign 14 bearing a curved arrow insignia 15 indicating a turn in the road.

The distribution of the autocollimating units 13 in the binder 12, in center stripe 11, may be a chance scattering. The distribution within the outlines of the arrow 15 on the vertical sign 14 can be such as to completely cover the same.

The autocollimating units 13 may take any of the various forms illustrated in the Gill Patent No. 1,902,440 or may be generally spherical in shape as illustrated in the drawing of sizes ranging from .005 to .040 inch in diameter and may comprise glass, or any other generally transparent material such as that known to the trade as "Lucite" or any natural or synthetic organic or inorganic material. When glass autocollimating units are utilized, it is preferred to use a binder comprising a vehicle which may be readily applied to a road or other surface as by brushing, spraying, flowing, or otherwise coating the same. Such a vehicle may be of the oleoresinous type as set forth in the copending application Serial No. 274,666, filed May 19, 1939, and may further comprise an additional ingredient which will be hereafter described in detail and referred to as a holding medium.

When the autocollimating units are of glass, the holding medium, an ingredient in the binder in addition to the usual pigment and vehicle, may comprise ethyl silicate such as pure ethyl silicate, tetraethyl ortho silicate, or condensed ethyl silicate, or esters of ortho silicic acid such as: diethyl silicate, methyl triethyl silicate, dimethyl diethyl silicate, and trimethyl ethyl silicate. The above silicas and esters include the general formula $Si(OC_{2n}H_{2n+1})_4$.

These silicas and esters are characterized by their organic elements and their silicate radical which provide for great affinity for the organic materials in the binder, such as oils and resins, the glass in the glass autocollimating units, and the surface of the marker particularly when the marker surface is a road surface.

It is contemplated that the scope of the instant invention be such as to include holding mediums of a formula to comprise a molecular chain, one end of which will have an affinity for the material of the autocollimating units and the

surface to be marked, and the other end of which will have an affinity for the remainder of the binding medium.

A binder for a marker in accordance with the invention may comprise a paint as follows:

Paint

	Per cent by weight
Pigment	42–45
Vehicle	58–55

The vehicle in the above paint may include:

Vehicle

	Per cent by weight
Mamla Loba DBB gum	35–37
Liquid mixture	65–63

The liquid mixture in the above may comprise:

Liquid mixture

	Per cent by volume
Raw tung oil (China wood oil)	15
Normal butyl alcohol	17
Acetone	34
Denatured alcohol	34

In order to effect the finished binder ready for application to the surface to be marked, 5 gallons of amylacetate is added to every 500 gallons of above paint. A silica such as ethyl silicate or an ester including the general chemical formula indicated above may be added in an amount from 1 to 20% of the total weight of the finished paint as a holding medium when the autocollimating units are glass.

The ethyl silicate referred to above is tetraethyl ortho silicate which contain 28.8% of available silica. Condensed ethyl silicate and polyethyl silicate have higher silica contents of 31.5 to 34.0% respectively. The remarkable holding action of these mediums with respect to glass autocollimating units when incorporated with an ordinary traffic paint applied to a road surface may be explained by its slow hydrolysis with water to alcohol and silicic acid which in turn dehydrates to an adhesive form of silica. This hydrolysis may be effected by the addition of water to the paint by spraying the finished marker or by permitting hydrolysis to occur by moisture present at a slow rate. It, the hydrolysis, may be effected by the application of water to the marker from natural sources such as rain or dew. The hydrolysis may be accelerated by including the silica or silicon ester in a paint, the type of which is explained in detail above, the liquid mixture of which includes alcohol or acetone or both. Ethyl silicate is not soluble in water, but is soluble in alcohol or acetone. Therefore, ethyl silicate in a mutual solvent such as alcohol or acetone effects hydrolysis rapidly.

The hydrolysis may also be accelerated by the addition of minute qualities of an acid such as hydrochloric acid of a weak base.

Instead of using ethyl silicate as simply a holding medium within a vehicle, it can be used as the exclusive vehicle which together with the pigment makes up the reflecting binder for the glass spheres.

In selecting a pigment for a reflecting binder, including silica or silicon ester, care must be taken to use pigments which are indifferent to silica and silicon ester and which do not effect the rate of hydrolysis. Such pigments include: lead, zinc, iron and chromium pigments, titanium pigments, Prussian blue, cobalt blue, ultramarine, lamp black, as well as organic dyes and metal dust (aluminum and bronzes), cadmium yellows, asbestine (magnesium silicate), and diatomaceous silica.

For example an excellent silicon acid ester paint may comprise some of above polyethyl silicate, and alcohol or alcohol-water mixture. In place of the alcohol or alcohol-water, substitutes may be used such as acetone or any mutual solvent, water and ethyl silicate.

Silica and silicon ester paints thus prepared dry rapidly within an hour and are very suitable for use as traffic paints where drying time is of primary importance. Not only are such paints desirable because of their very short drying time, but their films are inert and very resistant to chemicals. Further these paints resist darkening with age, a characteristic common to ordinary paints.

Not only does the silica or silicon ester act to tenaciously secure the autocollimating units but penetrates therein to and holds the units to the paint and the paint to the road surface, but when alcohol is selected as a solvent with silica or silicon ester, it penetrates the road surface and effects an extremely firm bond therewith. Ethyl silicate paints are advantageous in that they tend to preserve the surface to which they are applied, and such preservation in the case of the marker in accordance with the invention, would prevent failure of the same at the base thereof, an extremely desirable characteristic.

Though paint in accordance with the above becomes dry within an hour, the actual hardening which corresponds to the hydrolysis as explained above, goes on for months until all the ester has been decomposed into an adhesive form of silica.

An example of a paint suitable for use in connection with glass autocollimating units on a marker, which may comprise a silicate as the exclusive vehicle, follows:

Paint

	Parts by weight
Of titanium dioxide (TiO_2)	50
Of ethyl silicate solution	50

Ethyl silicate solution

	Gallons
Ethyl silicate	50
Denatured alcohol	30
Water	1

Before using the above paint one and one-half gallons of water should be added to every one hundred pounds thereof.

In fabricating a marker in accordance with the invention, a reflecting binder including a pigment, a vehicle, and a holding medium as described above is then applied to the surface to be marked by spraying, flowing on, brushing, or otherwise coating the same, and while the paint is still in a fluid or semi-fluid condition, the autocollimating units are associated with the wet, semi-wet, or tacky surface by any form of dispenser to give the desired distribution. The marker is then permitted to dry after which it is suitable for outdoor use and capable of high reflecting efficiency and durability, the autocollimating units protecting the binder from wear and the binder holding the autocollimating units tenaciously to prevent their dislodgement.

It will be obvious to those skilled in the art that various changes may be made in this device without departing from the spirit of the

invention and therefore the invention is not limited to what is shown in the drawing and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. A combined highway and lane line surface marker comprising a road surface, an elongated pigmented binder film and a plurality of autocollimating units ranging in height from approximately .005'' to .040'', said units being held within said binder in partially embedded relation, said binder including a pigment and an organic vehicle, said vehicle comprising an organic silicate.

2. The structure recited in claim 1, said organic silicate being an ethyl silicate.

3. The structure recited in claim 1, said organic silicate being a silicon ester comprising the following in its molecular structure:

$$Si(OC_{2n}H_{2n+1})4$$

4. The structure recited in claim 1, said autocollimating units comprising glass spheres and said organic silicate being an ester of ortho silicic acid.

LEROY SHUGER.