Sept. 18, 1951 A. E. KEELEY 2,568,126

METHOD OF MAKING REFLECTING SIGNS BY LAMINATING

Filed Aug. 10, 1945

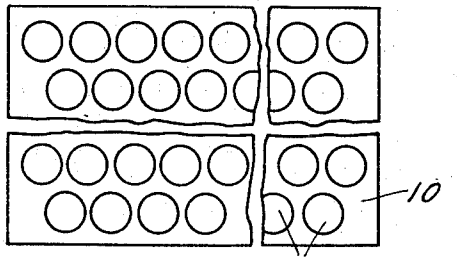


Fig 1

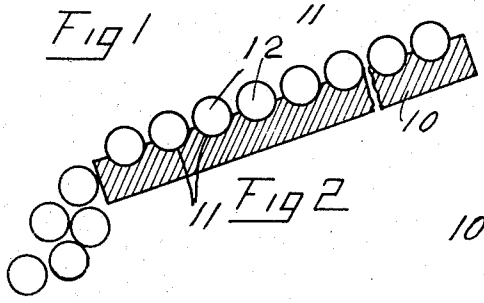


Fig 2

Fig 7

Fig 6

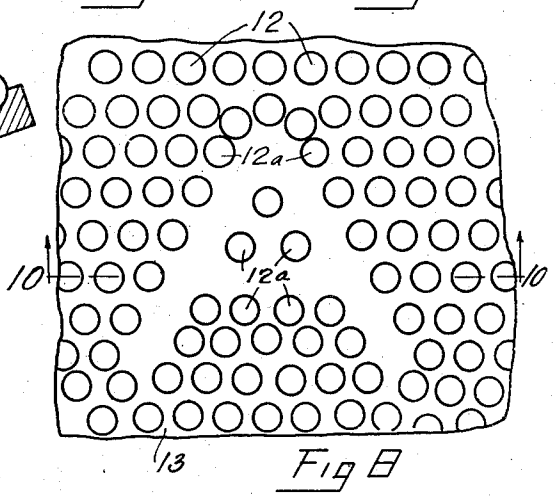


Fig 8

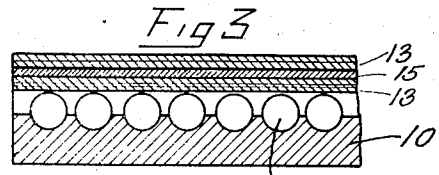
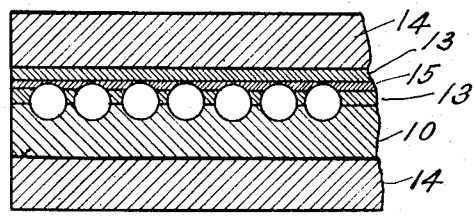


Fig 3

Fig 4



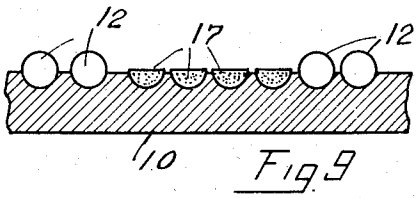


Fig 9

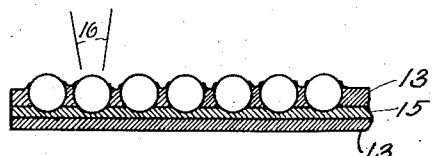


Fig 5

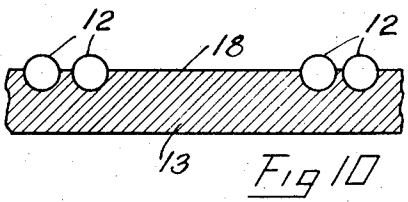


Fig 10

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METHOD OF MAKING REFLECTING SIGNS BY LAMINATING

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2 Claims. (Cl. 154—123)

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This invention relates to reflecting signs and markers and the method of producing the same, and more particularly to upright signs of the type in which reflex reflecting elements, such as translucent spheres, are partially embedded in a binder or body of material having reflecting properties.

One object of the invention is to provide such a sign which can be quickly and easily produced in any desired form.

A further object of the invention is to provide such a sign which can be produced in a completed form by a single operation.

A further object of the invention is to provide such a sign which is of a durable character and will have a long useful life.

A further object of the invention is to provide such a sign which will reflect the light in different colors depending upon the angle at which the light enters the reflecting elements.

A further object of the invention is to provide such a sign which will sharply define a figure to be displayed.

A further object of the invention is to provide a method by which such a sign can be quickly and economically produced.

Other objects of the invention may appear as the sign and method are described in detail.

In the accompanying drawings, which are on a greatly exaggerated scale, Fig. 1 is a plan view, partly broken away, of a platen used in producing the sign; Fig. 2 is a sectional view of the platen, partly broken away, illustrating the method of introducing the translucent spheres into cavities in the platen; Fig. 3 is a transverse section, partly broken away, showing the platen, spheres and plastic laminae assembled prior to the molding operation; Fig. 4 is a similar section showing the assembly in the press; Fig. 5 is a transverse section of a portion of a completed sign; Figs. 6 and 7 are fractional sections showing different relations between a sphere and a colored stratum in the molded sign; Fig. 8 is an elevation of a portion of a sign showing the latter provided with an unreflectorized figure; Fig. 9 is a section through a portion of the platen illustrating the method of securing the unreflectorized surface; and Fig. 10 is a section taken on the line 10—10 of Fig. 8.

In these drawings I have illustrated certain preferred embodiments of the invention and the method of producing the same. The illustrated embodiments are upright signs but it is to be understood that the invention and the several parts thereof may take various forms and may be embodied in signs or markers of various kinds.

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The term "sign," as used herein, is intended to include signs, markers or displays of any kind to which the invention may be applied.

The sign comprises a supporting member or body in which the translucent elements are partially embedded, the body having reflecting properties so that light entering the elements will be reflected back to its source. The body may be of any suitable size and shape, as determined by the character of the sign, and is preferably of such thickness and rigidity as to be self-supporting in an upright position. The body is formed of a plastic material which can be molded about portions of the translucent reflecting elements to form a one piece structure in which the reflecting elements are securely retained. It is preferably formed from a plurality of laminae or layers of plastic material which are united one with the other and with the reflecting elements by heat and pressure, whereby the laminae become strata in a one piece structure. The reflecting elements are preferably spheres of glass, or other suitable translucent material, of uniform diameter, usually from .002 of an inch to .030 of an inch.

The translucent elements and the plastic material may be assembled and subjected to heat and pressure to form a unitary structure in any suitable manner. In accordance with the present method a platen 10 of the desired size and shape, and preferably of steel, is provided in the upper surface thereof with a multiplicity of cavities 11, to receive the translucent elements 12 and support the same in predetermined positions with relation one to the other. When, as preferred, the elements are spherical in form, they should be embedded in the body of the sign for at least half of their diameters in order that they may be securely retained therein. Therefore the cavities 11 are shown as conforming to the shape of the spheres and of a depth less than half of the diameter of the spheres, say from twenty-five percent to forty percent of said diameter. The spheres may be inserted in the cavities in any suitable manner, as by supporting the platen in a slightly inclined position and flowing a quantity of spheres over the same until the spheres have entered and are retained in all the cavities, the excess spheres falling from the lower edge of the platen.

The platen with the spheres in the cavities is then moved to a horizontal position and plastic material is superposed on the spheres. The plastic material is preferably in sheet form and may conveniently consist of sheets of paper or other suitable thin material which have been

impregnated with a plastic, such as a resin. A plurality of sheets or laminae 13 of the plastic are superposed on the spheres in sufficient number to form a body of the desired thickness when they have been united by heat and pressure. The platen 10 with the spheres and plastic laminae assembled thereon is then subjected to heat and pressure to soften the plastic, press the same about the spheres and into contact with the surface of the platen between the spheres and to unite the laminae one with the other and with the spheres in an integral structure. This may be accomplished by placing the assembled platen, spheres and laminae between the heated platens 14 of a hydraulic press, as shown in Fig. 4, and subjecting the same to the heat and pressure necessary to the unification thereof. It is desirable that those laminae adjacent to the platen 10 should be rich in plastic so that the latter may, under the influence of heat and pressure, flow completely about and into contact with all parts of the exposed surfaces of the spheres. After the laminae have been merged into a unitary structure and have solidified, the completed sign is removed from the press and from the platen 10, as shown in Fig. 5.

The plastic body may be of any desired color having the necessary reflectivity and the light will be reflected in the color of the plastic. The light may be reflected in different colors by providing plastic of different colors in different parts of the body. In Figs. 3, 4 and 5 the arrangement is such that light entering the spheres on lines substantially normal to the front surface of the body will be reflected in one color and light entering the spheres at an acute angle will be reflected in another color. For this purpose the solidified plastic body is provided with strata of different colors, the stratum with which the rearmost surfaces of the spheres contact being of a color different from the color of the stratum in front thereof and through which the spheres extend. This may be accomplished by interposing in the stack of laminae, prior to the heating and pressing operation, one or more laminae 15 of a desired color, for example, silver color, the other laminae 13 in front of the laminae 15 and through which the spheres will extend being of another color, for example yellow, so that when the plastic is solidified these laminae constitute strata of different colors. In the arrangement illustrated the silver stratum is an intermediate stratum but it could be the rear stratum because the color of those parts of the body with which the spheres do not contact have no affect on the color of the reflected light. It is only necessary that the silver stratum be placed such a distance from the front surface of the body that, in the completed sign, the rearmost surfaces of the spheres will extend into but not beyond the same. Thus light entering the spheres at an angle of approximately ninety degrees to the front surface of the body will be reflected by the silver stratum in a cone-shaped pattern, as shown at 16 in Fig. 5, and the light entering the spheres at an acute angle will be reflected by the yellow stratum through which the spheres extend. Therefore the color in which the sign appears will depend on the angle of vision of the observer. The angle of the cone in which the light from the silver stratum is reflected depends upon the area of the contact between the sphere and the silver stratum and may be predetermined for a given sign by providing a silver colored stratum of such thickness

that it will extend forwardly from the rearmost surfaces of the spheres a distance sufficient to provide the desired area of contact with the spheres. In addition to reflecting the light in different colors the silver stratum has greater reflectivity than the yellow stratum and imparts greater reflex reflection to the spheres when viewed at an angle of approximately ninety degrees.

If desired, the spheres may be so arranged in the body as to define a figure or figures, such as letters, symbols or the like, which will be clearly outlined by light directed onto the sign. In the arrangement illustrated in Fig. 8 portions of the spheres, 12*a*, are arranged in lines so spaced with relation one to the other as to expose portions of the front surface of the plastic body conforming to the letter A. The unreflectorized portions of the surface of the body are thus sharply defined by the illuminated spheres and by giving the exposed portions of the surface a color substantially different from the color of the other portions of the front surface of the body the figure so outlined may be rendered clearly visible in daylight as well as at night.

The unreflectorized surfaces constituting the figure may be provided in any suitable manner but it is desirable that these exposed surfaces shall be smooth, and the removal of the spheres from the cavities in the platen, prior to molding, to form the figure would leave those surfaces rough and, further, it would be a tedious operation owing to the small size of the spheres. Therefore I prefer to fill the cavities in those portions of the platen corresponding to the surface or surfaces to be exposed with material which will prevent spheres from entering the same and will be substantially flush with the adjacent portions of the platen surface after being subjected to heat and pressure. This may be satisfactorily accomplished by filling the selected cavities with a metal 17, preferably in powdered or granulated form, having a melting point lower than the melting point of the metal of the platen and which will be fused in and fill the cavities when subjected to the heat and pressure of the molding operation, such as ordinary white metal or babbitt. As shown in Fig. 9, a portion of the cavities are filled with the metal to a level slightly above the surface of the platen so that when fused it will completely fill the cavities and the corresponding surface of the molded body will be smooth, as shown at 18 in Fig. 10.

A sign produced in accordance with the invention comprises a one piece supporting structure in which the reflecting elements are firmly embedded and is so formed by a single operation and at a low cost. Due to this integral construction and to the fact that the plastic body is highly resistant to weather there is little likelihood of the reflecting elements being loosened and falling out of the body and the body has a long life.

While I have shown and described certain embodiments of my invention and the preferred method of producing the same, I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A method of producing a reflecting sign, which comprises supporting a plurality of translucent spheres in fixed positions substantially in a common plane and with the lower portion of

each sphere enclosed in a rigid supporting member, superposing on said spheres a plurality of relatively thin laminations of resinous material and subjecting said laminae and said spheres to heat and pressure to soften said laminae and unite the same one with the other, to embed the upper portion of said spheres in said laminae and to thereby unite said laminae and said spheres in a unitary solid structure.

2. A method of producing a reflecting sign, which comprises supporting a plurality of translucent spheres in fixed positions substantially in a common plane and with the lower portion only of each sphere enclosed in a rigid supporting member, superposing on said spheres a plurality of relatively thin laminations of resinous material, at least one of said laminae above the lower lamina being of a color different from the color of said lower lamina, subjecting said spheres and laminae to heat and pressure to soften said laminae and unite the same one with the other, to press said laminae about the upper portions of said spheres until the uppermost surfaces of said spheres enter said differently colored lamina, and to thereby unite said laminae and said spheres in a unitary mass with the lower portions of said spheres projecting beyond the lower surface of said united laminae.

ARMAND E. KEELEY.

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