METHOD FOR FORMING AND APPLYING TRAFFIC MARKERS TO PAVEMENT

Grant A. Wiswei, Palo Alto, Calif., assignor to Botts-Line, Inc., Redwood City, Calif.
Filed July 16, 1964, Ser. No. 383,076
3 Claims. (Cl. 94—22)

This is a continuation-in-part of application Serial No. 135,668, filed September 1, 1961.
This invention relates to a new and improved method for applying traffic markers to pavement. At the present time, traffic markers, formed in accordance with pending patent applications Serial Nos. 135,668, filed September 1, 1961, and 320,466, filed October 31, 1963, are conventionally manufactured at a central source, shipped to the job site, and applied to the pavement using an adhesive to secure the markers in place. The present invention provides an apparatus and method wherein the markers are formed at the job site and are applied to the pavement before the plastic resin of which the markers are composed has set, thereby eliminating the use of a separate adhesive. The markers cure while in place on the pavement.

Accordingly, the present invention provides a method for marking pavements, roadways, streets, parking and storage areas, and the like, by means of raised markers which are formed in place upon the surface to be marked and thereafter remain permanently bonded therewith.

In aforementioned patent applications, Serial Nos. 320,466 and 135,668, various shapes and compositions of markers are disclosed and such shapes and compositions may be employed in conjunction with the present invention. On the other hand, more conventional shapes also are used commercially at the present, and the instant invention may be employed in conjunction with such conventional use.

The present invention uses a plurality of molds, preferably uniform in configuration, having cavities into which a plastic composition is dispensed from apparatus installed in a moving vehicle which can be driven along the line to which the markers are applied. Before the plastic composition with which the molds are filled has been cured, the contents of the molds are applied to the pavement which is preferably prepared by sand-blasting or the use of a detergent, or both. The molds remain in place a sufficient length of time so that when they are removed the plastic retains its desired shape. In one modification of the invention the molds may be used repeatedly, whereas in other forms of the invention, the molds are disposable. In still a further feature of the invention, a permanent mold is lined with a thin film of plastic material which helps to retain the plastic in the desired shape after the mold has been removed and during completion of curing.

A feature of the invention is the fact that the marker which is in effect cast in place is bonded to the road surface as a more integral structural extension of the road surface than in the case where the markers are applied by using a separate adhesive.

The molds may be formed of any of the conventional plastics or metals used for matched die molding or gravity flow molding. Alternatively, the molds may be of a polyethylene-coated paper product such as paper-mache. As a further alternative, conventional factory-type molds may be lined with a very thin plastic film insert so that the mold may be removed from a casting leaving behind a film which will eventually wear away or which can be torn away from the completed raised marker.

The apparatus and method hereinafter described are subject to certain variations, but have a simplicity of procedure and equipment which is quite desirable. Thus, the mixing equipment for the plastic may be installed in a vehicle which also carries equipment for sandblasting or otherwise cleaning the pavement, storage facilities for the plastic ingredients, glass beads (where used), and for a stock of molds.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

In the drawings:
FIG. 1 is a vertical sectional view through one form of mold which may be used in accordance with the invention.
FIG. 2 is a top plan view thereof.
FIG. 3 is a vertical sectional view through a modified mold.
FIG. 4 is a view similar to FIG. 3 showing the mold lined with a thin film of plastic material and filled with plastic.
FIG. 5 shows the inversion of the mold and contents of FIG. 4 on pavement.
FIG. 6 is a view similar to FIG. 5 showing on the left-hand side of the plastic film in place after the mold has been removed and on the right-hand side showing the completion of the marker by removal of the plastic film.
FIG. 7 is a view similar to FIG. 3 of a further modified form.
FIG. 8 is a schematic view illustrating the steps in the practice of the method using the mold of FIGS. 1 and 2.
FIG. 9 is a view similar to FIG. 8 showing the use of a mold of the type of FIG. 7.

The plastic material which may be used in the present invention is subject to considerable variation, but essentially should be a thermo setting type resin. A typical batch suitable for practice of the invention is obtained by a thorough mixing of two ingredients, as follows:

**Ingredient A**

Components:

<table>
<thead>
<tr>
<th>Component</th>
<th>lbs.</th>
<th>gal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoxy resin (viscosity 5—9 poise at 25° C)</td>
<td>1.3</td>
<td>3.3</td>
</tr>
<tr>
<td>epoxide equivalent 175—205 mfd. from epichlorohydrin and bisphenol A</td>
<td>26.0</td>
<td></td>
</tr>
<tr>
<td>TiO₂, TT—P—442, type III, class A</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>Colloidal silica, 99% SiO₂, refractive index 1.46—0.015 micron</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td>Talc, 325 sieve; 12 microns</td>
<td>9.5</td>
<td></td>
</tr>
</tbody>
</table>

**Ingredient B**

Components:

<table>
<thead>
<tr>
<th>Component</th>
<th>lbs.</th>
<th>gal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified aliphatic amine hardener #1, amine value 620—630; color, light amber; density 8.1 lbs./gal; viscosity at 25° C, 2—3 poises</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Modified aliphatic amine hardener #2, amine value 300—305; color, light amber; density 8.15 lbs./gal; viscosity at 25° C, 34—45 poises</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>Talc, 325 sieve; 70 microns</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>Colloidal silica</td>
<td>1.2</td>
<td></td>
</tr>
</tbody>
</table>

After thoroughly stirring each ingredient separately, equal volumes of each ingredient are mixed.

The markers may be made reflective by introduction of glass beads. For such purpose the ingredients may be in accordance with the following formulation:

**Ingredient C**

Components:

<table>
<thead>
<tr>
<th>Component</th>
<th>lbs.</th>
<th>gal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoxy resin</td>
<td>26.0</td>
<td></td>
</tr>
<tr>
<td>White sand or marble particles, 20—30 sieve size</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>Colloidal silica</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Talc</td>
<td>9.5</td>
<td></td>
</tr>
</tbody>
</table>
3. Ingredient D Components:

- Modified aliphatic amine hardener #1 6.5
- Modified aliphatic amine hardener #2 13.0
- Glass beads, 20–30 sieve size 30.0
- Colloidal silica 1.2

3. The glass spheres are of the type used for dropping paint stripping on roadways to make the paint reflective. It will be understood, however, that whereas reflective characteristics are not necessary, the use of glass spheres may be eliminated.

In practicing the present invention, the foregoing ingredients are mixed together by means hereinbefore described in detail, and then poured into molds. Directing attention to FIG. 8, there is shown a mixer carrying mixing and metering equipment. Such equipment is shown more or less schematically. Thus, the reference numeral 12 indicates a storage container of plastic ingredient A (or C), all thoroughly dispersed, and 13 indicates a second container with a supply of ingredient B (or D). Reference numerals 14, 15 indicate metering equipment, such as gear pumps forcing ingredients from containers 12 and 13 into mixing chamber 16 in proper proportion.

The ingredients are mixed in chamber 16 by blending blades (not shown) driven by motor 17 and are dispensed from nozzle 17 into molds 21. Molds 21 may be held in the hand of the operator or on any other means below nozzle 17 while dispensed. Alternatively, the operator may place a scoop, such as an ice cream scoop, under nozzle 17, and use the scoop to transfer the material into a mold supported in a tray or other like container. In co-pending patent application No. 135,668, a vibrating table is described and illustrated to support a plurality of molds with certain beneficial effects therein described. Such a table, or a common vibrating table, may be used to compact the resin and fill the molds evenly.

The molds shown in mold 21 are approximately spherical segments. However, as described in application Serial No. 135,668, other surfaces of revolution having different shapes may be used. Various wedge-shaped molds, as described in application Serial No. 320,466 may be used also.

The mold 21 shown in FIG. 8, and in greater detail in FIGS. 1 and 2, has a bottom 22 complementary to the final shape of the marker and depending from the peripheral rim of bottom 22 is a skirt 23 which is slightly outwardly flaring and terminates in a peripheral rim 24. The optional feature of a centrally, downwardly tapered stem 26 may be positioned at the center of bottom 22. Stem 26 is of utility in locating the mold 21 in a table as described in said patent application No. 320,466, or such stem likewise facilitates handling of the mold. It will be noted that the length of stem 26 may be considerably greater than that of skirt 23. A mold of the type of mold 21 may be made of plastic material or of metal. If sufficiently inexpensive, the mold may be discarded after use, but generally such molds may be re-used repeatedly. Other types of molds are hereinbefore described in detail.

In the practice of the method it is desirable that the truck 11 be driven along the line to which the markers are applied. It is desirable that the surface of the roadway be cleaned preliminary to application of the markers. Such cleaning may be done by sandblasting equipment, which may be installed in truck 11, or in a separate vehicle. As an alternative to sandblasting, wire brushing may be used. A detergent such as Triton-X-100 (Rohm & Haas) may be used followed by rinsing with water. Where new pavement is involved, the concrete is best cleaned by sandblasting and the concrete curing agent may be removed by hydrochloric acid applied with a brush followed by rinsing with water.

The workmen remove molds 21 filled with plastic 27 from the truck 11 after the molds are filled and before they have cured. The molds 21 are inverted as indicated by reference numeral 21A in FIG. 8 and applied to the cleaned pavement 28. The molds 21 are retained in place as indicated by reference numeral 29 for a sufficient time to allow the plastic 27 to set. If the plastic 27 is compounded, the epoxy resin causes the entire marker to be bonded to the pavement 28 as the marker cures. After the plastic has cured sufficiently so that the marker 31 will retain its shape, mold 21 is removed and discarded. Reference numeral 32 and therewith the completed marker 31 is allowed to remain in place and to cure. It thus becomes in effect an integral part of the pavement 28 and its application does not require the use of a separate adhesive as is presently used to apply factory-produced markers to pavement.

FIG. 3 shows a mold 36 having a bottom 37 complementary to the marker to be produced. Such a bottom 37 has a central pedestal 38 which locates the mold 36 horizontal during the filling operation and also serves as a means for manually gripping the mold when it is being used to apply the plastic material. A peripheral rim 39 rigidifies the upper edge of the mold. As shown in FIG. 4, preliminary to filling of the mold 36 a plastic liner 41 such as a thin sheet of polyethylene is placed inside mold 36, the material stretching so that the mold is smoothly filled. The plastic material 27A is then applied as in the preceding modifications. FIG. 5 shows the inversion of mold 36 so that plastic material 27A is deposited on pavement 28 and bonds thereto as curing proceeds. The left-hand side of FIG. 6 shows mold 36 removed with liner 41 still in place and assisting in holding the desired shape of marker 31A. The right-hand side of FIG. 6 shows the liner 41 having been stripped or worn away leaving the completed marker 31A exposed.

FIG. 7 illustrates a still further form of marker of a disposable nature. Papier-mâché, such as is used in making egg crates, is a suitable material for the mold 46 of FIG. 7. Such a mold 46 has a bottom 47, complementary to the shape of the marker to be formed. A peripheral rim 48 is formed around the upper edge of bottom 47 and the mold is reinforced by radial gussets 49 or lugs, here shown four in number. Preferably, the bottom 47 is lined with a material which will resist penetration of the ingredients of the plastic dispensed into the mold 46, such a material being a polyethylene substance. FIG. 9 shows a mold 46 in accordance with the structure of FIG. 7. The mold is essentially the same as previously described and may be compounded using equipment similar to that shown in FIG. 8, or it may be mixed in more simple equipment. The mold is inverted on pavement 28 and the plastic allowed to cure. As shown by reference numeral 51, after the marker 31B has cured, the mold 46 may be removed and discarded, leaving the completed marker 31B in place. However, after having been exposed for a short period of time to traffic and to wind, the molds 46 will blow away or otherwise be stripped from the markers 31B.

Molds of the type of mold 21 of FIG. 1, or mold 36 of FIG. 3, may be used repeatedly, being reclaimed after each use. On the other hand, disposable, low cost molds such as mold 46 may be discarded after a single use.

Molds of the type of FIG. 3 may be heated by electric coils, hot oil, etc.

What is claimed is:

1. A method for applying thermo-setting plastic traffic markers to pavement comprising advancing a vehicle along said pavement, mixing plastic components in said vehicle, dispensing mixed plastic components into each of a plurality of molds complementary to the markers to be applied, inverting and depositing at variously selected spaced locations on said pavement remote from said machine and from said vehicle molds containing mixed plastic components, leaving said molds in place as said vehicle adv-
vances away from said molds until said plastic compo-
nents have thoroughly adhered to said pavement and said
marker has set sufficiently to maintain its desired final
shape, and removing said molds.

2. The method of claim 1, which comprises the fur-
ther step of recovering said molds for re-use.

3. The method of claim 1, in which said molds are lined
with thin-film liners and in which said molds are first
removed, leaving said liners in place over the markers
and subsequently said liners are removed, said molds
being recovered for re-use.

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