Dec. 21, 1965 G. A. WISWELL 3,225,123

METHOD OF PRODUCING TRAFFIC MARKERS

Filed Sept. 1, 1961 3 Sheets-Sheet 1

Fig. 1.

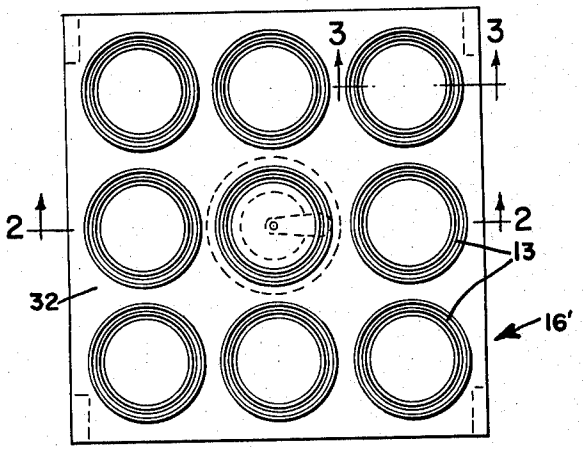



Fig. 2.

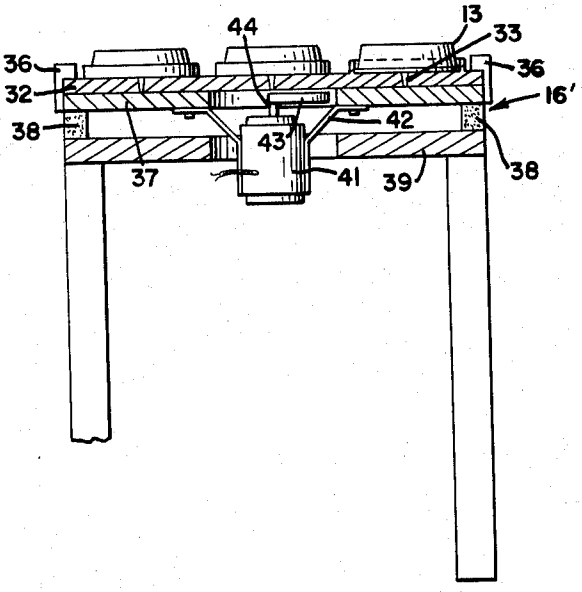
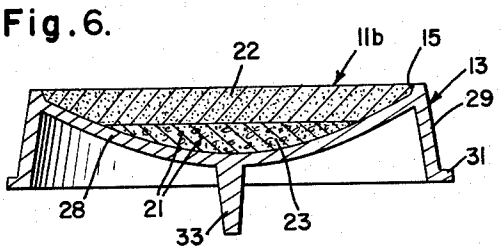



Fig. 6.




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METHOD OF PRODUCING TRAFFIC MARKERS

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Fig. 3.

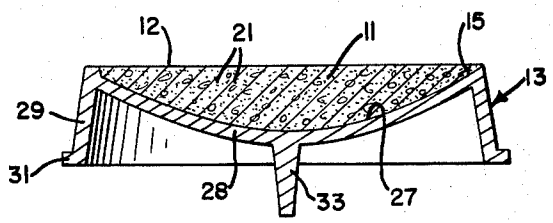
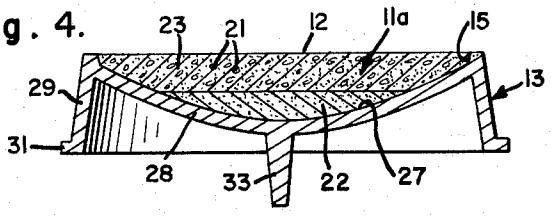



Fig. 4.




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METHOD OF PRODUCING TRAFFIC MARKERS

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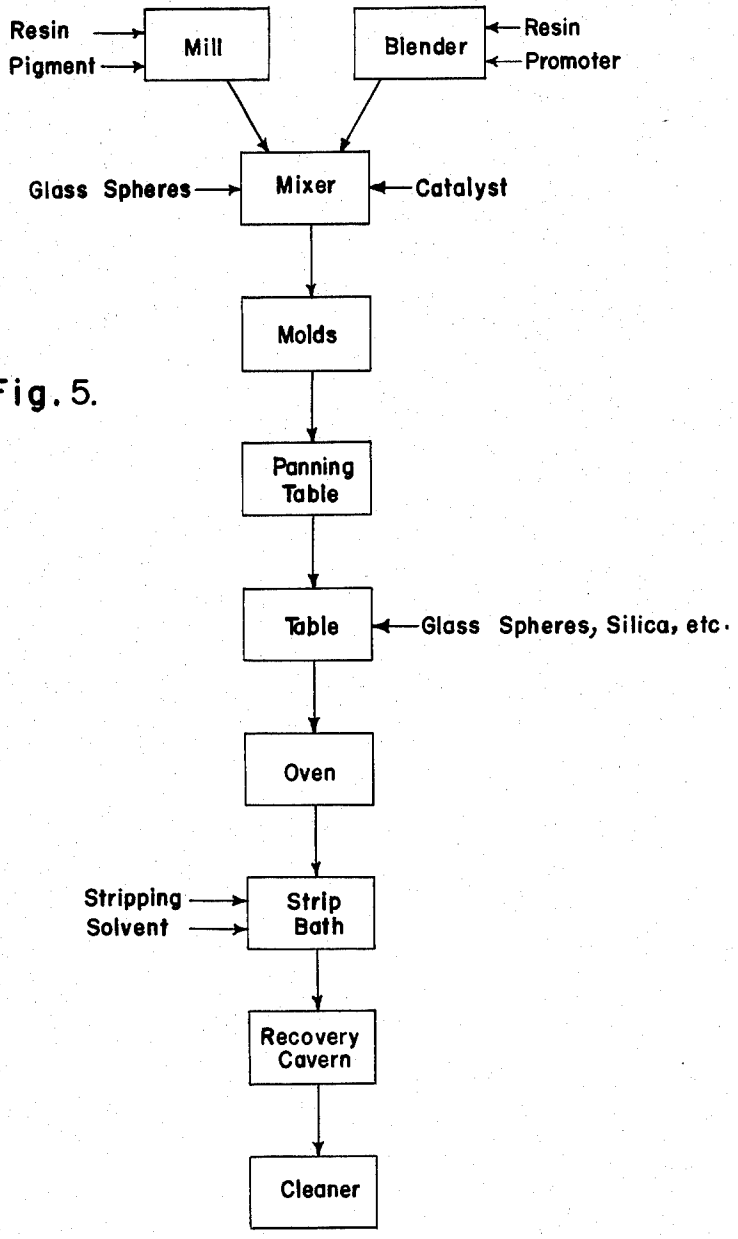



Fig. 5.

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3,225,123

# METHOD OF PRODUCING TRAFFIC MARKERS

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2 Claims. (Cl. 264—1)

This invention relates to a new and improved method of producing markers to delineate traffic lanes.

One of the features and advantages of the marker produced by this method is the fact that it provides a highly visible, tough plastic device which may be affixed to the pavement by a suitable adhesive. Preferably, a plurality of such markers is affixed in a pattern, such as an interrupted line, to mark traffic lanes or the like. For such purpose, the device hereinafter described in detail has numerous advantages, among which are the following:

(a) Provides optimum visibility under all lighting conditions, whether daylight, artificial light from fixed sources adjacent to roadways or from moving sources such as car headlights, such visibility being effective day and night and regardless of weather;

(b) Is sturdy enough to withstand the severe service of heavy automobile and truck traffic for many years;

(c) Can be produced at low cost and installed at low cost;

(d) Notifies car drivers, by rumbles or bumps, that a car wheel is beginning to cross into another or the wrong lane, or right of way;

(e) Does not present an obstruction or skid-promoting shape on the road.

Road markers have been installed on streets and highways which give fair to good reflectivity at night, but which are relatively unnoticeable in the daytime. Others show up well in good daylight, but do not do so in bad weather or at night. Furthermore, some markers will do a fair job of delineating at night when lighted by headlights, but a poor job when the same markers are installed where there is overhead street or freeway lighting. Since lighted intersections and freeway interchanges, involving numerous lanes of fast-moving traffic, must have the best possible delineation of lanes, gores, islands, bend-outs, etc., a good day or night, fair weather or foul weather type of marker is badly needed. This is provided by the present invention.

To understand the advantages provided by the invention, some facts concerning reflectivity of road and street marking and their effectiveness in providing good visibility to drivers should be kept in mind. Although fundamental, and in some respects quite elementary, some characteristics of traffic marking and visual apprehension related thereto are as follows:

(1) For utmost safety to drivers, the delineation of lane separation, obstructions, bend-outs or curves should be visible to the driver so far in advance of the position of the vehicle as to permit him to alter the vehicle's speed or direction, without abrupt change, so that he may change lanes or safely maneuver without conflict with other vehicles.

(2) In dry, daytime driving, a well-painted traffic stripe is usually adequate for delineation and channelizing; however, even good paint does not deter so-called "lane line riders" from unintentionally crowding in upon cars in adjoining lanes.

(3) When roadways become rainswept, traffic paint tends to disappear completely as a film of water forms, and all delineation is lost; furthermore, some types of paint actually become hazardous by providing a smooth base upon which water, plus oil particles and dirt, become a lubricant, thus promoting loss of wheel traction and skidding.



(4) Three dimensional, high visibility traffic delineation is being sought by traffic engineers, generally, and a number of devices are on the market. Various traffic buttons are being offered for lane separators, and cast, elongated pyramids, called "raised bars," are used extensively for channelizing.

(5) Traffic buttons on freeways are intended to replace painted white striping. On some locations the buttons are reflectorized, that is, glass spheres are imbedded in the body of the markers and are exposed at the surface to provide retroreflection of light from car headlights. On some locations the traffic buttons are a solid white color, providing *reflectivity* only, day or night, as from a painted surface. It is observed that the glass sphere type of buttons is very bright at night, but tends to appear gray under overhead lighting or sky light. On the contrary, solid white buttons provide very good delineation under overhead lighting or sky light, but tend to appear gray in front of car headlights. Either type, in day or night driving, provides the three dimension markers desired by traffic engineers, and both are recognized as doing a much better job than afforded by traffic paint.

(6) The visibility of plain white, non-reflectorized markers, in the daytime, is a function of the amount of incident light they reflect in the form of a spheroid—that is, the marker is equally visible from any direction or aspect above the surface. At night, such non-reflectorized markers attain their relative visibility from the light falling upon them, whether overhead lighting or headlights; their visibility is from the light they reflect, in general, over a spheroid pattern. Their effectiveness also depends, to a degree, upon the contrast in color they produce against their background. Also, since they are reflecting the light falling upon them, they appear brightest when the viewer is nearest them and dissolve into the background at a distance, due to the fact that the intensity of the light they are reflecing varies inversely with respect to the distance.

(7) Light reflected from reflectorized markers (glass beads exposed) is returned in more or less the same direction from which the light originated (retro-reflection) and is collimated to a considerable degree. Car headlights are reflected back to the driver with considerable intensity (depending upon the strength of the driver's headlights) over considerable distances and, since the reflected light is more or less a beam of parallel light rays, the distance is not so much inversely related to the efficiency of the reflected light as is the case with markers which are not reflectorized. It is noted, too, that light falling upon reflectorized markers from sky or overhead lighting, no matter how intense, is reflected back toward its sources, and not toward the driver of a car, unless, of course, the light source is immediately in front of the driver (as is the case with headlights) or somewhat immediately behind the driver.

(8) Summarizing points 6 and 7 above, an ideal traffic button would be highly retro-reflective for night drivers and highly reflective for overhead lighted locations or in daytime, but the laws of physical science deny this dual characteristic. The present invention combines in one marker an area which is retro-reflective and an area which is highly reflective. Since compromise or division usually entails a giving up of some values on both characteristics, it is interesting to note that, due to the phychological nature of human sight sense, this invention results in a marker which does not yield very much from optimum nighttime and daytime effectiveness.

In the matter of day or night visibleness, under different types of lighting, from skylight to intense artificial (incandescent, mercury vapor, fluorescent, or a combination of two), almost every individual environment has

particular requirements peculiar to the needs of that environment. In some cases, traffic buttons may be the simple reflectorized type, which reflect light from car headlights; in other cases the traffic engineer may require traffic buttons which have a top portion non-reflectorized and a reflectorized bottom section; in other environments the top should be reflectorized and the bottom section plain surface. There may even be requirements of two different colors, top or bottom, since traffic engineers are beginning to employ color coding for guiding motorists to various areas. This invention, then, provides for such multi-purpose needs and variations in reflectorized and non-reflectorized and color relationships and a method for producing such varied modifications economically.

The marker, which has been previously mentioned, may be produced in several ways. However, one of the features of the present invention is an improved method of producing the marker which affords numerous advantages, among which is a saving in labor in the production of the same, the close control in the steps of the method which is made possible by the practice thereof, the adaptability of the method in the manufacture of markers of different visual characteristics and the adaptability of the method to mass production of the markers.

Other features and advantages of the method will appear in the description which follows.

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 plan view of a device useful in the method of manufacture of a marker.

FIG. 2 is a sectional view taken substantially along line 2—2 of FIG. 1.

FIG. 3 is an enlarged view through a mold for a marker as taken substantially along line 3—3 of FIG. 1.

FIG. 4 is a view similar to FIG. 3 of a modified marker construction wherein the crown of the marker is of different composition from the base.

FIG. 5 is a flow sheet of a preferred method of producing a marker.

FIG. 6 is a view similar to FIG. 4, showing a reversal of the different compositions.

In one preferred shape of the invention shown in the accompanying drawings the marker **11** is preferably made of plastic material by the method hereinafter described.

The chemical properties of marker **11** will more fully appear in the description of the method which follows. In brief, the marker is a hard, light-weight plastic material which will withstand the impact of heavy traffic. Dispersed throughout all, or throughout pre-selected portions of, the markers are preferably glass beads **21** or spheres which impart retro-reflectivity and pigment which imparts reflectivity. Either all of the marker **11** may be retro-reflective (FIG. 3), or the top **22** may be reflective and the bottom **23** retro-reflective (FIG. 4), or the top retro-reflective and the bottom reflective (FIG. 6). Choice of the foregoing characteristics depends upon condition of installation and cost considerations. Further, the separate sections may be of different colors.

*Method*

In practicing the method hereinafter described in detail, standard equipment is employed, with the exception of a "panning table" **26** used to hold the molds **13** during and immediately after the material is filled into the molds. The table **26** imparts a motion to each mold **13** which materially improves the characteristics of the markers **11** produced. This motion is akin to that imparted to minerals in panning for gold.

Each mold **13** has a surface **27** complementary to the shape of the crown of marker **13**. Surface **27** may be the top of a thin-walled mold bottom **28** having peripheral skirt **29** with a plurality of outward directed ears **31** which may be used to attach the mold to a supporting tray **32**. Alternatively, a horizontal flange may be substituted for ears **31**. When ears **31** are used, various means of attachment to tray **32** may be employed, such as screws. Cement may be used to fix the flange above mentioned to the tray. A further optional feature of the invention is a central, downward tapered stem **33** depending below the lower edge of skirt **29** which may be inserted in a complementary hole in tray **32** to locate the mold in place. Nine or more molds **13** may be positioned on each tray.

In accordance with the invention and as shown particularly in FIGS. 3 and 4, molds **13** shaped to produce the markers **11** previously described are inserted into tray **32** which is clamped by means of clamps **36** or other convenient means to table **37**. Table **37** is supported by rubber blocks **38** or other resilient means above base **39**. Vertically disposed motor **41** is mounted on table **37** by brackets **42** and the upper end of its shaft **44** carries weight **43** which is slightly eccentric to the axis of shaft **44**, weight **43** lying in the same horizontal plane as table **37**. The eccentricity of weight **43** imparts a circular motion to table **37**, which is of high frequency and small amplitude.

The action of the panning table **26** is such that each mold **13** describes a circular path of small diameter of the general range of .020 to .25 inch on a horizontal plane, with the result that the contents of each mold receive a uniform "panning" action. Small glass spheres, under .001" in diameter, require the smaller diameter circular moment while larger spheres, .030" in diameter and over, require a wider circle of panning, up to .25 inch in diameter. Thus, after the proper amount of "panning" the glass spheres **21** in all molds are worked down against surface **27** of the molds, uniformly.

The panning action also accomplishes rapid leveling of the contents of all molds on the tray and, when the resinous mass is quite viscous, leveling of bottom **12** is accomplished thusly where it would not be if simple gravitational force were used.

The panning action may also be accomplished by different equipment. Thus, panning table **37** may be resiliently mounted on a frame and actuated by two vibrators linked to the free-floating table at right angles to produce a motion similar to that previously described.

The materials used in practicing the method and producing the markers previously described are subject to some variation. Preferred materials are hereinafter described, the quantities mentioned being sufficient to produce about 800 markers 4" diameter and 5/8" high, fully reflectorized.

The selection and preparation of the components for molding thermo-setting types of resins combined with glass spheres are very important in the case of producing serviceable traffic buttons. For utmost tensile strength, elongation, etc., there shall be a maximum of resinous binder; for strong color there must be a practical minimum of pigment; for optimum reflectance there must be a maximum amount of exposed glass spheres. Practical balance of major components for a 100-pound batch of molding materials requires:

20 lbs. isophthalic polyester resin
5 lbs. finely ground pigment
70 lbs. clean glass spheres
Foregoing quantities, plus 5%, minus 0%

The above batch is processed and partially cured, as per the below step-by-step method, at which time from 1.0% to 3.0% of either glass spheres or round silica particles is added by sprinkling over the top of the mold (bottom **12** of the button being molded) to construct the roughened bottom surface.

The isophthalic polyester resin may be Reichhold Chemicals, Inc., Polylite 31–830. The characteristics of this product are as follows:

| | |
|---|---|
| Viscosity, Brookfield, 77° F., cps. | 600–900 |
| Specific gravity | 1.14–1.15 |
| Weight per gallon, lbs. | 9.56 |
| Percent polymerizable | 100 |
| Color, APHA | 300–500 |
| SPI gel test:[1] | |
| Gel time, min. | 4–5 |
| Cure time, min. | 7–8 |
| Peak exotherm temperature, ° F. | 305–325 |

[1] 3'' depth of resin in 19 x 150 mm. test tube immersed in 180° F. water bath. Resin catalyzed with 1% benzoyl peroxide.

A suitable peroxide catalyst for the above resin is between .05% and 2.0% of 60% methyl ethyl ketone peroxide and a promoter of between 0.30% and 0.75 of 6% cobalt naphthenate or equivalent. Curing at these proportions is best carried out at from 100° to 200° F. for three to five minutes.

Pigment suitable for white markers may be finely ground $TiO_2$ of a size of about 0.3 micron.

The method employs the following steps:

*Step 1.*—18 lbs. titanium dioxide ($TiO_2$) finely ground to a particle size of about .3 micron is thoroughly ground or milled, until thoroughly dispersed in 18 lbs. of polyester resin.

*Step 2.*—About ½ lb. of 6% cobalt naphthenate is blended into 54 lbs. of polyester resin, using a conventional blender.

*Step 3.*—36 lbs. of the pigmented white paste produced by Step 1 is combined with the 54 lbs. of cobalted resin produced by Step 2, and thoroughly blended together by mechanical mixing. When this mass is homogeneous, an amount of catalyst such as methyl ethyl ketone peroxide is added and quickly and thoroughly mixed into the mass. The amount of catalyst added varies from about 30 cc. to about 100 cc., depending upon the ambient temperature at time of mixing. This amount of catalyst is a carefully controlled variable which is adjusted for each type of button being made, so that the cure time will be correct for button size and curing conditions.

*Step 4.*—200 lbs. of clear glass spheres **21**, of the type used for dropping on paint striping on roadways to make them reflective, is dispersed into the catalyzed resin mixture by mechanical mixer and prepared for the mold-filling operation immediately following. In a preferred form of the invention the glass spheres **21** are of two sizes mixed between 60% and 40% by weight. The larger spheres are preferably in the range 700 to 1,000 microns and the smaller in the range 20 to 50 microns.

*Step 5.*—Molds **13** in tray **32** are already at hand for the mold-filling operation. The blended mass is served into the individual mold cavities by means of a hand dipper, of the type commonly used for ice cream, or by automatic or other suitable means. The scoop is first loaded and then leveled off at the top so that the correct amount of blended mass is dropped into the mold. Molds **13** are on trays **32** in multiples of nine or more, and tray **32** for each group is held on the panning table **37** tightly, so that the molds and contents receive the panning effect required to settle and level the resinous mass. Each tray of molds is removed from the panning table as soon as the material in the molds is settled and leveled and placed on a conveyor which carries the loaded tray to the next operation. As soon as one tray of molds is completed and transferred off, another tray is fixed upon the panning table and the filling operation cycle repeated.

*Step 6.*—As soon as the resinous mass in molds **13** starts to "gel," glass spheres or various silicas or similar material are sprinkled onto the bottoms of the molded pieces. Sufficient of this is sifted on to insure that, as some spheres are settled into the uncured resinous layer present over the tops of the curing buttons, there will be an ample quantity of the spheres exposed so that there will be no area of resin without glass or silica after the button completely cures.



*Step 7.*—Trays received from Step 6 are placed on a continuous conveyor which conveys them through a baking oven with very accurate thermostatic controls. The conveyor runs the length of this oven carrying stacks of trays and the molds thereon. Average sized markers, made of the formulation shown above, require a full hour of post-curing treatment at a temperature of 200° F. for complete curing of the buttons so that they will have the high-strength characteristics required.

*Step 8.*—At the end of the oven, trays are removed from the conveyor and the molds are emptied of the cured buttons and the excess glass, silica and the like is salvaged. The emptied molds continue along the conveyor to be ready for the beginning of a new molding cycle at Step. 5.

*Step 9.*—The markers produced in Step 8 are stripped. In this step preferred equipment is a tank of methylene chloride. The molds are set on racks which slide on tilted glides to take the buttons into the bath. The length of time in the bath may vary from about 60 to 180 seconds, depending upon the type of finish desired on the buttons. If an extremely coarse finish is desired the bath is continued for 180 seconds. When polyester resin-cured is immersed in methylene chloride the resin absorbs the methylene chloride at the surface, causing the resin to increase in volume, or swell. This reaction, upon the thin films of cured resin covering the individual glass spheres causes the film to burst, causing surfaces of glass-containing buttons to take on a "feathery" or "snow-flake" texture. The smaller glass particles are in terspersed between the larger spheres **21** and hence the spheres **21** are held apart by the smaller ones. The stripping agent undermines the sockets for the smaller particles, thereby facilitating their later removal. At the same time, the penetration of the stripping agent is slowed and kept adjacent the surface.

*Step 10.*—This step recovers the solvent and completes stripping. Preferred equipment is a closed, low-topped cavern where air and methylene chloride vapor are trapped without turbulence. The vapor is in contact with the markers and allows the surfaces to uniformly "feather." This economizes on methylene chloride and makes full use of the vapors. The recovery procedure is terminated to prevent over-reaction from the treatment.

*Step 11.*—Cleaning of the surface of the markers. Equipment may consist of an arrangement of brushes and/or air jets which mechanically or pneumatically remove the fluffy surface cover of the treated buttons. Because methylene chloride is so volatile and reactive, it is important that the fluffy cover be removed as quickly as possible after the buttons come out of the vapor soak, Step 10, and that the fluffy cover be removed to expose the underneath surface (glass bead surfaces) to quick evaporation of residual methylene chloride. The brushing operation has to be a "gentle" action so as not to tear glass spheres out of sockets or crack and weaken the resinous margins around the spheres. For this reason, non-metallic brushes are employed or air jets. When the marker, is cleaned, the top two or three layers of small glass particles are removed because the stripping agent has dissolved the resin surrounding them. This exposes the larger spheres at the surface, without undermining such spheres. When the markers are installed in place this effect is beneficial, particularly at low angles of visibility, because of the fact that the spheres stand out from the surrounding matrix.

Subsequently, the buttons are inspected and, if necessary, re-stripped in that Steps 9 to 11 may be repeated. The completed markers are stored, packaged and shipped.

A feature and advantage of the invention is the use of procedures making possible the production of markers having composite physical characteristics. Thus, as in FIG. 4, a portion **23** of the marker **11***a* may be retro-reflective and another portion **22** reflective, or different portions may be pigmented with different colors. The following is an alternate to Step 5, above:

When markers are required in two finishes or in two colors, FIG. 4, two separate filling operations are entailed. Catalyzed and blended mixture corresponding to the characteristics desired for the crown **22** of the marker (i.e., with or without glass beads and with any desired color material) is dropped into molds **13** at Step 5, above, except that a smaller dipper is used so that the mold is only partially filled. Following this filling, the molds and contents are "panned" on table **16** and then allowed to set until the beginning of "gel," at which time there is a second filling to the proper mold level. The mixture for this second filling has been earlier prepared of components dissimilar to those used in the first filling. To further explain:

When a traffic button is required with a reflective top portion **22**, see FIG. 4, the first filling shall be of a glass-containing catalyzed, resinous mixture with pigment and without glass spheres, and the second filling shall be with a type of filler **23**, such that a retro-reflective finish will result in the finished product as by use of glass spheres **21** in the resin. Reverse order is illustrated in FIG. 6.

As a further example:

When a two-color traffic button is required, the first partial filling shall be pigmented with the color specified for the top of the button, and the second filling shall be pigmented as specified for the lower section of the two-color button.

Irrespective of the combination of either colors or fillers required for the first and second filling, as noted above, the second filling is not made until the resin of the first filling starts to "gel." This sequence procedure is necessary; otherwise, the admixture of the second filling would intermix with the uncured first fill.

Subsequent steps are substantially the same as in Steps 6 and following.

A further alternate method of producing a button, which is reflective in one surface area and retro-reflective in another surface area, may be achieved by proceeding as in the preferred method of the invention up through Step 8, i.e., the retro-reflective material such as glass spheres are dispersed throughout the marker. The surface which is to be reflective is then masked as by screening or spraying liquid latex on the surface and allowing to harden, or by applying a pressure sensitive stencil. The marker is then stripped as in Steps 9 and 10 and the mask removed. After cleaning, as in Step 11, the spheres are exposed only in the previously unmasked portion and the previously masked portion is reflective because the spheres are concealed by the resin coating.

Although the foregoing invention has been described in some detail, by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be practiced within the spirit of the invention and scope of the appended claims.

What is claimed is:

**1.** A method of forming traffic markers and the like, comprising mixing together a polymer, catalyst, reflective pigment and glass spheres to impart retro-reflectivity, depositing the mixture into molds, panning said molds to settle said spheres to the bottom and outside of said molds and form a flat bottom of mixture in said mold, said panning comprising moving said mold in a horizontal plane in a circular path of .05 to .25 inch diameter at a frequency of around 1750 r.p.m. until said glass spheres are worked uniformly toward and against the surface of said mold, depositing a roughening agent on the top surface of the mixture in said molds, heating said mixture to cure said polymer, subjecting the molded marker to a bath of stripping solvent, and cleaning said marker to expose said glass spheres at the surface.

**2.** A method of forming traffic markers having a first portion and a second portion, one of said portions having glass beads to impart retro-reflectivity and the other said portion having pigment to impart reflectivity, said method comprising preparing a first mixture for the retro-reflective portion of said marker by mixing together polymer, catalyst, pigment and glass spheres, preparing a second mixture for the reflective portion of said marker by mixing together polymer, catalyst and pigment, depositing one of said mixtures in a mold, the amount deposited being substantially less than the capacity of said mold, panning said mold to form a flat surface at the top of said first mixture, said panning comprising moving said mold in a horizontal plane in a circular path of .05 to .25 inch diameter at a frequency of around 1750 r.p.m. until said glass spheres are worked uniformly toward and against the surface of said mold, allowing said first mixture to at least partially gel, depositing the other of said mixtures in said mold to complete the capacity of said mold, panning said mold a second time, depositing a roughening agent on the top surface of said second mixture in said mold, heating said mixture to cure said polymer, subjecting the molded marker to a bath of stripping solvent to swell the resin at the surface of the marker and burst the film of resin between the sphere and the surface of the marker to produce a fluffy surface coating, and cleaning said marker to remove said fluffy coating and expose said glass spheres at the surface.

**References Cited by the Examiner**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 790,044 | 5/1905 | Fisher | 25—66 |
| 1,513,801 | 11/1924 | Camp | 264—71 |
| 2,018,192 | 10/1935 | Sexton | 264—71 |
| 2,111,742 | 3/1938 | Bloomenthal | 201—76 |
| 2,303,462 | 12/1942 | Horne | 94—1.5 |
| 2,304,345 | 12/1942 | Elliott | 94—1.5 |
| 2,440,584 | 4/1948 | Heltzer et al. | 88—82 |
| 2,569,869 | 10/1951 | Rempel | 18—58.3 |
| 2,624,072 | 1/1953 | Delacoste et al. | 18—58.3 |
| 2,897,733 | 8/1959 | Shuger | 88—82 |
| 2,925,638 | 2/1960 | Friedl | 25—66 |
| 2,971,223 | 2/1961 | Grunin et al. | 264—108 XR |
| 2,992,956 | 7/1961 | Bazinett | 264—108 |
| 3,010,158 | 11/1961 | Broderson | 264—108 XR |

FOREIGN PATENTS

| | | |
|---|---|---|
| 205,333 | 1/1957 | Australia. |

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