Dec. 1, 1942. A. A. HORNE 2,303,463

CONSTRUCTION MATERIALS

Filed April 21, 1941 2 Sheets-Sheet 1

Fig. 1

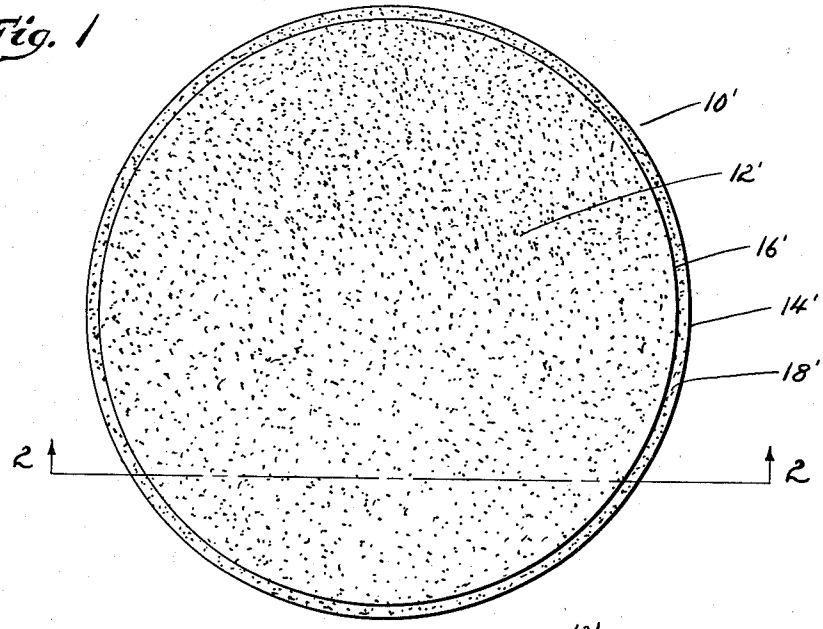


Fig. 2

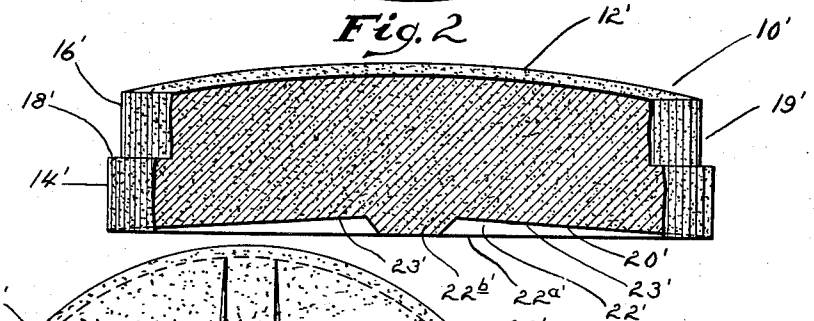
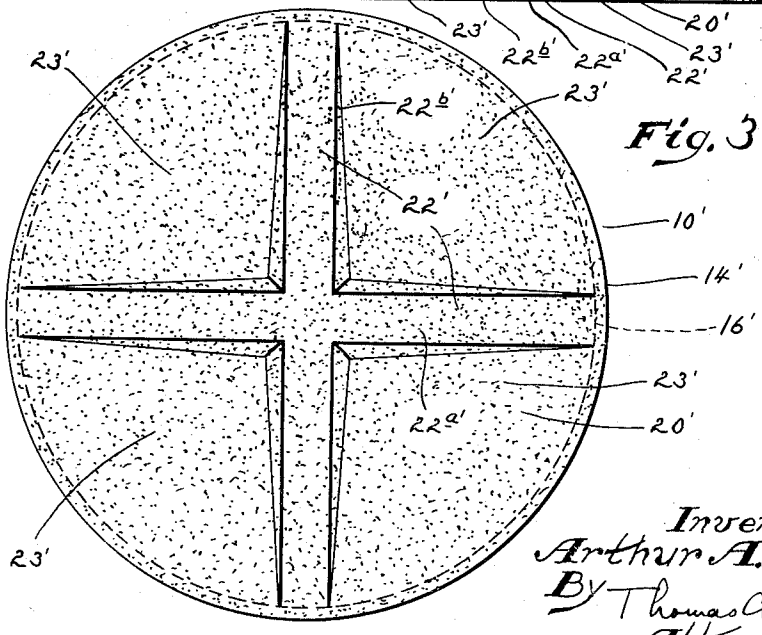


Fig. 3



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CONSTRUCTION MATERIALS

Filed April 21, 1941 2 Sheets-Sheet 2

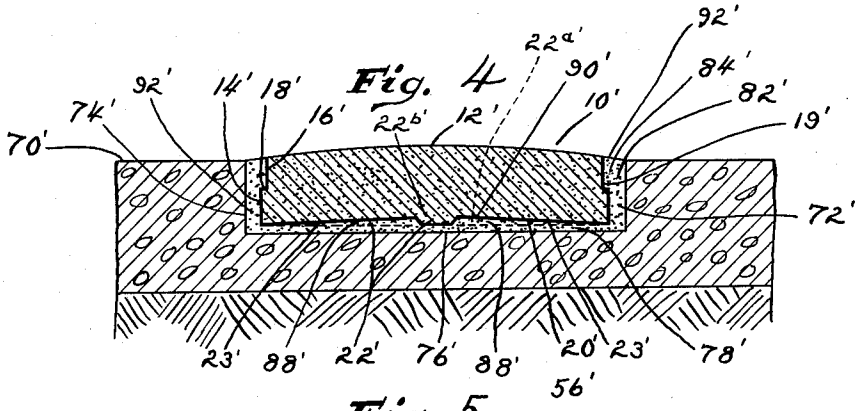


Fig. 4

Fig. 5

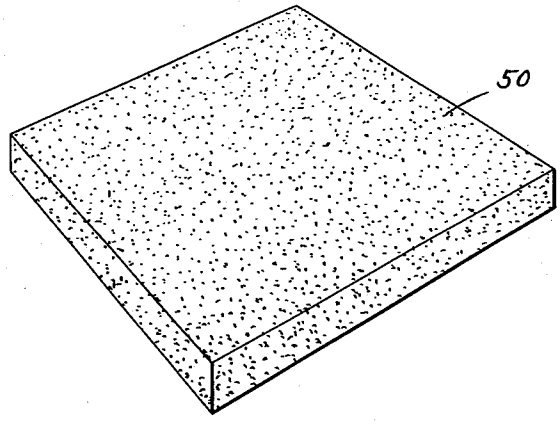
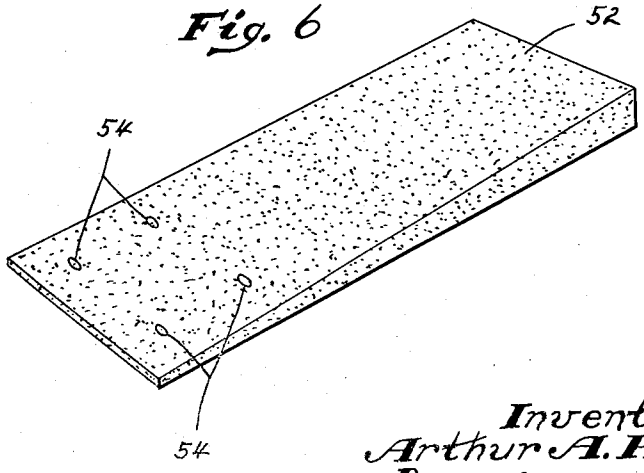


Fig. 6



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Patented Dec. 1, 1942 2,303,463

UNITED STATES PATENT OFFICE

2,303,463

CONSTRUCTION MATERIALS

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Application April 21, 1941, Serial No. 389,537

10 Claims. (Cl. 106—109)

My invention relates to construction materials and includes road markers of the type adapted to be incorporated in suitable holes provided therefor in a road, tile, including roofing tiles, floor tiles, etc., shingles and other solid construction materials particularly of the type adapted to have hard usage and to be exposed to the elements. This application is partially a divisional application and partially a continuation-in-part application of certain subject-matter disclosed and originally claimed in my prior application, "Road marker and method of manufacturing the same," S. N. 359,636, filed October 4, 1940.

An object of my invention is to provide a set cementitious road marker having substantially the same coefficient of expansion as the road into which it is desired to be inserted secured to said road by a cement also having substantially the same coefficient of expansion as said road marker to provide a homogeneous mass when said cement is set comprising the adjacent portion of the road, the road marker and the cement, all portions of which have substantially the same coefficient of expansion so as to expand and contract as a unit with changes in temperature.

A further feature of my invention is that I preferably employ a road marker of a novel type resistant to moisture or other water and spilled gasoline or oil, or road oil, normally present on the road surface. I have discovered that such a road marker may be consructed of the hydraulic gypsum cement material described and claimed in Patent No. 2,090,625, Hydraulic gypsum cement material and manufacturing the same, issued August 24, 1937, to Robert S. Edwards, but that an improved road marker is provided if a suitable oxide pigment, a suitable resin adhesive, and a suitable plasticizer be employed in association with said hydraulic gypsum cement material, it being my opinion that a reaction takes place between said hydraulic cement material and the pigment oxide to provide a stronger and more desirable road marker.

In addition, the incorporation of the resin adhesive and the plasticizer therein not only provides sufficient moisture for the setting of the road marker, but also render said road marker when set, water resistant and gasoline and oil resistant.

A further object of my invention is to provide a road marker which is a pure white in color, a result not possible in standard cements. The plasticizer also is preferably so regulated as to make the marker suitable for use with low winter temperatures and high summer temperatures.

A further object of my invention is to provide a quick setting cement for binding the markers to the road, constructed of substantially the same materials, but with a slightly greater percentage of plasticizer. I have also found that in use under the conditions of heat necessary for cutting a suitable hole in the road for the marker and the heat of the cement when applied, that a certain amount of gum or adhesive from both the marker and cement will melt to provide a tighter bond for the marker to the road.

A further object of my invention is to provide a road marker having better wearing qualities than former types of road markers constructed of rubber, cement, or other material.

A further object of my invention is to provide a road marker which is resistant to wear or abrasion and also one which is non-absorptive and self cleaning, that is cleaned by the contact of rubber automobile tires passing over the marker.

It is apparent that the aforedescribed advantages of my improved cementitious construction material set forth carefully for road markers in the preceding paragraphs apply equally advantageously to whatever form my improved construction material may take. Two main features of my improved construction material stand out: (1) It is resistant to wear, which make it admirably suited for a floor tile or a flooring of any description for dance halls, bowling alleys, tennis courts, etc.; and (2) its pecular ability to withstand moisture, making it particularly adaptable for out-door use. As also stated, the cementitious material is gasoline and oil-resistant, making it particularly adaptable for use in garages and other places where gasoline and oil are apt to be spilled on it.

These and such other objects of my invention as may hereinafter appear will be best understood from a description of the accompanying drawings which illustrate various adaptations of my improved construction material and illustrate three specific forms thereof, namely, a road marker, a tile and a shingle.

In the drawings, Fig. 1 is a plan view of a road marker constructed in accordance with my invention.

Fig. 2 is a cross sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is a reverse plan view of the marker shown in Fig. 1.

Fig. 4 is a diagrammatic vertical sectional view

through a portion of a road and a suitable hole formed therein for the insertion of the marker shown in Figs. 1–3, cemented in the hole in the position it assumes in use.

Fig. 5 is a perspective view of a floor or roofing tile constructed in accordance with my invention.

Fig. 6 is a perspective view of a shingle constructed in accordance with my invention.

In the drawings, wherein like characters of reference generally indicate like parts throughout, 10' generally indicates a road marker constructed in accordance with my invention. While the road marker may be of any desired shape, I have shown in the drawings a specific type of road marker shown and claimed in my parent application Serial No. 359,636, filed October 4, 1940, for Road marker and method of manufacturing the same, made of the same shape and provided with the identical parts shown and claimed in said application, namely, the flange means 14' projecting outwardly from the side wall 16' thereof, projecting circumferentnally from the lower portion of said wall 16' providing the step 18' forming between said lower flange 14' and the upper portion of the marker side wall a cement receiving pocket 19'. The upper wall 12' of the marker may be slightly convex, as shown in said application.

While my improved marker may be constructed with a flat lower wall, as is often desirable in small sizes, as stated in said application, I also believe I am the first to provide a marker having a concave lower wall 20' for receiving a greater area of cement in the pocket formed thereby to assist in binding the lower surface of the marker to the bottom of the road hole and also believe I am the first to provide means 22' projecting downwardly from such a concave lower wall 20' to provide integral locking ribs projectingd ownwardly within said concavity, bonding it to the cement to prevent relative rotation or turning of the marker on passage of heavy vehicular traffic thereover, in my preferred embodiment, said means comprising the marker ribs 22' extending under said lower wall at angles to each other and projecting integrally downwardly from said body providing cement receiving pockets 23' between them. In the preferred embodiment I preferably employ the two locking ribs $22^{a'}$ and $22^{b'}$ extending diametrically across said concave lower wall 20' at right angles to each other and projecting integrally downwardly from said body to substantially the level of the outer edge of said concave lower wall 20', said edge being also the lower edge of the respective side wall 16'. The construction material may be suitably molded in any suitable manner, such as by the means described in detail in said application.

In addition, as stated hitherto, I believe I am the first to provide a new combination, comprising the road surface 70' having a marker 10' therein contained within a suitable pre-formed hole 72' therefor in said road surface and secured to the edge 74' and base 76' of said hole by a suitable cementitious material 78', with said marker 10', said road surface 70' and said cementitious material 78' all having substantially the same coefficient of expansion, so that the entire mass of the road surface adjacent each marker will expand and contract as a unit with changes in temperature.

While any suitable cement and any suitable set plasticized marker may be employed for this purpose as long as they have substantially the same coefficient of expansion as the road and as each other, I preferably construct my marker and the cement of the materials to be explained in more detail, which have substantially the same coefficient of expansion as concrete, road tar or asphalt.

The method of laying the marker is described in detail in said parent application. Where an adhesive substance is employed in the marker and in the cement and if the cement is applied hot, the adhesive becomes somewhat molten before setting, tending to form the marker, cement and road surface adjacent the marker into a somewhat homogeneous mass. Any suitable type of adhesive may be employed and I employ the word "cement" in its broadest sense, comprising any suitable material for permanently sticking the marker 10' within its respective hole 72', whether it comprises a true cement, a mastic or other type of adhesive. It is obvious that the cement 78' will fill in the quadrant or other shaped pockets 23' between the ribs $22^{a'}$ or $22^{b'}$ and will also exude upwardly in the annular space 84' between the side wall 74' of the hole 72' and the side wall 16' of the marker. The cement which exudes in said pockets 23' forms the quadrant shaped projections 88' projecting upwardly therein also of cooperating convex shape complementary to the concave shape of the lower wall 20' of the marker, which are plasticized not only to the side walls of the ribs $22^{a'}$ and $22^{b'}$, but also to the concave lower surface 20' of the marker and have convex upper surfaces 90' complementary in general to the concave lower surface 20 of the marker and it is apparent that these projections 88' will positively abut the ribs $22^{a'}$ and $22^{b'}$ and thereby prevent any turning movement of the marker on passage of heavy vehicular traffic thereover. While a supplemental amount of cement may be poured in the annular space 84' after the marker is laid, if desired, it is obvious that when said annular space is filled as shown in Fig. 4 at 82', that cement projection 92' is also formed above the circumferential flange means 14', and is also plasticized to the upper surface of the flange means and the side wall 16' of the marker to provide rigid set means above said circumferential flange 14' to positively hold the marker flat on the road against any tendency of heavy vehicular traffic to raise the marker from the road as is often caused by the suction of pneumatic tires passing thereover, or when a brake is suddenly applied to a fast moving vehicle. I have shown in Fig. 4 the embodiment of the marker shown in Figs. 1–3 thus set in the road with a single annular projection 92' overlying the step 18' to hold the marker flat on the road. As also shown in Fig. 4, as the upper surface of each marker is convex as at 12', it will provide a crown to make the road marker visibile over a greater area and not impede the passage of vehicular traffic thereover. It is also apparent that such a shape prevents snow plows, or other road scraping devices from abutting against a straight edge of a marker to tend to lift it from the road, the convex surfaces merely slightly lifting the snow plow, or other scraper as it passes thereover.

In the prior art, great difficulty has been experienced with both metal and rubber road markers as they do not expand evenly with the road on changes in temperature and thus tend to work out in time. With such an uneven expansion, water is apt to seep in between the road hole and marker, which, when the road is frozen tends to cause the usual frost cracks in the road

surface. While it has been suggested to make road markers out of cement, in most instances it is desirable to have white road markers and it has been found impossible to make a pure white out of "Portland" or other common cements now on the market. Great difficulty has been also experienced in providing a road marker which is resistant not only to the elements, but to other materials normally on traveled roads, such as water or moisture, spilled gasoline or oil from vehicles, or road oil, where employed, and I have endeavored to provide a road marker constructed of a suitable set cementitious material which is water resistant and gasoline and oil resistant and at the same time has the desired adhesive and wearing qualities and substantially the same coefficient of expansion as concrete, road tar or asphalt of which roads are usually constructed to expand and contract evenly therewith on changes in temperature to overcome the objections of the road markers in the prior art as described above. I have found for this purpose that the hydraulic gypsum cement material described in Patent No. 2,090,625 for Hydraulic gypsum cement material and manufacturing the same, issued August 24, 1937, to Robert S. Edwards of Milton, Massachusetts, is such a desirable material. As said material has not as yet acquired a trade name known in the art, although it is now sold under the name "Calcibrite," for shortness of description in the specification and claims I will refer to this material as "Edwards phospho-gypsum cement" and where such a phrase is employed henceforth in the specification it will refer to the hydraulic cement covered and claimed in said Edwards patent. As stated in claim 13 of said patent, said cement comprises "a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F. Cement made from natural rock, gypsum and cement made from anhydrite, as described in said patent may be alternatively employed. Such a material when used alone is not as oil resistant, gasoline resistant, or water resistant as desirable. I have also discovered that such a material may readily have an oxide pigment incorporated therein to impart the desired color thereto, and I believe that a certain reaction takes place between such an oxide pigment and the cement itself during setting, as to improve the wearing and other qualities of the marker or cement if such materials be employed as the base for the marker or cement. Oxide pigment, such as zinc oxide or titanium dioxide, acts upon the phospho-anhydrous gypsum cement to accelerate the setting, densifying and hardening of the cement. A certain amount of water is also required to initiate the starting of the setting of the cement, sufficient water to complete the setting being furnished by the atmosphere. To prevent any excess of water from adversely affecting the cement or marker and hence the moisture resistant characteristics of the set cement or marker and to improve the resistance of the set marker and cement against gasoline, steam, or other waste materials which are often spilled on the road surface and to act as an adhesive bond, I preferably, in association, with the pigment employ a suitable resin adhesive and also preferably employ in association therewith a suitable plasticizer. Whether the adhesive and/or plasticizer react with the Edwards phospho-gypsum cement, or the pigment oxide is not known, but I have found by experience that a marker constructed of these materials when set, or a cement so constructed for binding the marker to the road, when set has the desirable characteristics of a suitable marker or cement for all of these purposes. The resin adhesive is preferably ground fine. The Edwards phospho-gypsum cement is graded from ⅛" down to .325 mesh. The pigment oxide is in powder form. The resin adhesive, the Edwards phospho-gypsum cement and the pigment oxide are first measured or weighed. They are then put in a steam jacketed mixer in suitable proportions, and after the plasticizer is then added, heated up to 200°–300° F. While they are being mixed by this heat treatment the pulverant materials are rendered semi-plastic to provide a semi-plastic mass to be inserted in a die in the manner hitherto explained. If desired, steam under pressure may be inserted in an annular jacket surrounding said die to initially maintain these materials at this high temperature and the die is then forced into the mold under a pressure of from 60 to 125 tons as shown and explained in more detail in said parent application. I have found that the materials will become set in about thirty seconds and if desired cool water may be passed through the annular chamber during this setting operation. The resin adhesive contains a certain amount of free water even in dry pulverant form and a certain amount of water is contained in the plasticizer and I have found that the water derived from the resin adhesive and plasticizer is sufficient to initiate sufficient setting of the marker within the die in said period of thirty seconds, so that when the complete marker 10' shown in Figs. 1–3 is removed from said mold, it will be in solid, at least partially set form. If desired, the marker after fifteen seconds may be thrown into a bath of cold water to complete the setting and/or cooling.

As explained hitherto, the exact reaction which takes place between the different materials and the water is not understood, but with such a treatment the road marker is suitably set for practical purposes as I have found from the manufacture of many road markers. The total number of reactions are not fully understood, but it has been positively proven, by numerous laboratory and practical tests, that certain finely divided oxides, such as zinc oxide and titanium dioxide act as accelerants to hasten the setting and strengthen the final cement and adhesive combination. I have found in practice that best results can be obtained in the manufacture of such road markers by employing a mixture prior to setting of 50–75% Edwards phospho-gypsum cement, 12–23% resin adhesive, 15–30% pigment oxide and 2–8% of plasticizer. Any suitable resin adhesive, synthetic or natural, of a type to stand summer and winter temperatures when mixed with a suitable plasticizer may be employed. I preferably, however, employ a suitable type of natural resin, which may or may not be fossilized, in fact, any suitable type of natural resin described in a book entitled "Natural Resins" and sold by the American Cyanamid Company, or otherwise. I have actually employed Congo gum, pontianak gum, Manila gum and kauri, and I have also attained good results with a synthetic resin sold under the trade name of "Rezyl."

Any suitable type of oxide pigment may be employed, depending on the desired color of the marker. I have employed titanium dioxide TiO_2 which I discovered produces the best white and reacts in a desirable manner with the Edwards phospho-gypsum cement to provide a stronger marker; also zirconium oxide ZrO_2 for a white marker; ferric oxide Fe_2O_3 for a red or brown marker; cadmium sulfide CdS for an orange marker; chrome yellows for a yellow marker and other pigment oxides for various other desired colors.

I employ the words "oxide pigment" to include any suitable type of metallic pigment derived from its oxide. In many instances the actual oxides are employed in the trade as pigments for certain colors. For other colors the oxide may be suitably modified to provide the best type of pigment, as for instance commercial chrome yellows for yellow, or cadmium sulfide for orange.

As a suitable plasticizer, castor oil, tung oil, beeswax, or other suitable natural plasticizer may be employed, or any synthetic plasticizer such as tri-cresyl phosphate may also be employed.

Typical formulas which I have employed for making various types of markers are as follows:

1

	Per cent
Edwards phospho-gypsum cement	50
Congo gum	20
Titanium dioxide	30
Castor oil	3

This will produce a white marker.

2

	Per cent
Edwards phospho-gypsum cement	66
Pontianak gum	16
Titanium dioxide	.04
Chrome yellow	14
Tung oil	4

This will produce a yellow marker.

3

Edwards phospho-gypsum cement	75
Manila gum	12
Cadmium sulfide (orange)	12
Castor oil	4

This will produce an orange marker.

4

	Per cent
Edwards phospho-gypsum cement	60
Titanium dioxide	20
Congo gum	20
Castor oil	3

This will also produce a white marker.

As also stated, substantially the same mixtures may be employed as a cement for setting my improved road marker into the suitable hole therefor formed in the road surface, but as a slightly more plastic cement is desirable, I preferably employ the same materials as employed for making the marker in substantially the same proportions but increase the amount of plasticizer employed to 8–14%.

In the actual laying of the road I have attained best results with my improved marker and cement constructed of Edwards phospho-gypsum cement and the other materials hitherto described, by cutting a hole **72** in the road after suitably heating the adjacent road surface and pouring the cement at a temperature of between 350–400° F. This will tend to melt the adhesive both in the road marker and in the cement and effect a better bond between the road marker and the cement.

A discussion of whether the adhesive fills the voids in the marker and adjacent road surfaces, or whether due to its temperature it melts to provide a tighter bond, is believed immaterial, as results have given much better bonding characteristics by employing the adhesive hitherto described in proper proportions in both the marker and the cement. The amount of plasticizer employed in both the marker and the cement is regulated by the lowest temperature in winter and the highest temperature in summer to provide a marker which will still remain plastic and not crack under the cold conditions of winter and not become too plastic to melt and pick up dust particles under the heat conditions of summer.

I preferably employ Edwards phospho-gypsum cement as I have found that when mixed with the other ingredients it becomes the least water soluble and most suitably set of any cement now on the market and thus has a tendency to outlast other types of cement.

As also explained, I am enabled by the use of this material and a suitable whitening pigment to obtain a marker more nearly pure white than any hitherto provided to thus be more readily discernible to traffic in use, the rubber tires acting as an eraser and cleaning the marker.

Tests have also proven that the marker itself is somewhat stronger than markers constructed of other types of cement and when mixed with the materials hitherto described will have moisture resistance, oil resistance and gasoline resistance not present in other types of markers.

I have also found that the reaction produced by these materials provides such a strong structure that there is much less tendency of the marker itself to chip than in markers constructed of other cements. If desired, however, to render the marker less shatterable, a certain amount of asbestos or other fiber may be incorporated in the mix.

As stated hitherto, my improved set composition of matter may be employed for any type of a construction material, and I have indicated in the drawings two additional types of construction material to which my invention is particularly adapted, namely, a tile **50** shown in Fig. 5 and a shingle **52** shown in Fig. 6. The tile **50** may be employed as a floor tile or a roofing tile. It is particularly resistant to the elements, thereby providing a splendid roofing tile, and it is also wear resistant, providing a good floor tile. As it is oil and gasoline resistant it is particularly adaptable for use for the floor of garages and factories and other places where lubricating and burning oils are apt to be dropped. My improved construction material is quite light for its volume and hence is peculiarly adaptable for use as a tile or shingle.

I have shown in Fig. 6 a shingle **52** constructed out of my improved construction material. This may be plasticized with the usual nail holes **54** formed therein during the molding operation.

It is obvious, however, that any desired shapes may be made for use as floorings, beams, or otherwise, the material itself being not only particularly light, but also of great relative strength. As stated in the manufacture of the road marker, the oxidation or setting may be merely started in the mold or during the initial shaping operation, the final oxidation and hardening taking place when the construction material is exposed

in use. The methods and formulae given for the composition of the road marker may be similarly employed in making up other types of construction materials, such as the tile and shingle shown.

I employ the word "tile" in the claims to include shingles.

It is apparent, therefore, that I have provided a novel type of construction material adapted for many uses with the advantages described above.

It is understood that my invention is not limited to the specific embodiments shown, and that various deviations may be made therefrom without departing from the spirit and scope of the appended claims.

What I claim is:

1. A solid, set, cementitious, water, gasoline and oil resistant road marker having substantially the same coefficient of expansion as concrete, road tar, or asphalt comprising prior to setting 50–75% of a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F., 12–23% resin adhesive, 15–30% metallic oxide pigment and 2–7% plasticizer.

2. A solid, set, cementitious, water, gasoline and oil resistant road marker having substantially the same coefficient of expansion as concrete, road tar, or asphalt comprising prior to setting of a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F., resin, adhesive, metallic oxide pigment and plasticizer.

3. A bonding cement comprising prior to setting 50–75% of a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F., 12–23% resin adhesive, 15–30% metallic oxide pigment and 5–12% plasticizer.

4. A bonding cement comprising prior to setting of a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F., resin adhesive, metallic oxide pigment and plasticizer.

5. A solid, set, cementitious, water, gasoline and oil resistant construction material having substantially the same coefficient of expansion as concrete, road tar, or asphalt comprising prior to setting 50–75% of a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F., 12–23% resin adhesive, 15–30% metallic oxide pigment and 2–7% plasticizer.

6. A solid, set, cementitious, water, gasoline and oil resistant construction material having substantially the same coefficient of expansion as concrete, road tar, or asphalt comprising prior to setting of a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F., resin adhesive, metallic oxide pigment and plasticizer.

7. A solid, set, cementitious, water, gasoline and oil resistant tile having substantially the same coefficient of expansion as concrete, road tar, or asphalt comprising prior to setting 50–75% of a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F., 12–23% resin adhesive, 15–30% metallic oxide pigment and 2–7% plasticizer.

8. A solid, set, cementitious, water, gasoline and oil resistant tile having substantially the same coefficient of expansion as concrete, road tar, or asphalt comprising prior to setting of a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F., resin adhesive, metallic oxide pigment and plasticizer.

9. A solid, set, cementitious, water, gasoline and oil resistant shingle having substantially the same coefficient of expansion as concrete, road tar, or asphalt comprising prior to setting 50–75% of a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F., 12–23% resin adhesive, 15–30% metallic oxide pigment and 2–7% plasticizer.

10. A solid, set, cementitious, water, gasoline and oil resistant shingle having substantially the same coefficient of expansion as concrete, road tar, or asphalt comprising prior to setting of a gypsum material containing phosphoric acid and an alkaline phosphate in an amount sufficient to act as an inhibitor of anhydrite re-crystallization to preclude dissociation of the anhydrite when the same is calcined at temperatures between 1800° F. and 2300° F., resin adhesive, metallic oxide pigment and plasticizer.

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