Oct. 11, 1938. W. O. SNELLING 2,133,059

LEAKAGE INDICATING PAVEMENT JOINT

Filed March 30, 1937

Fig. 1.

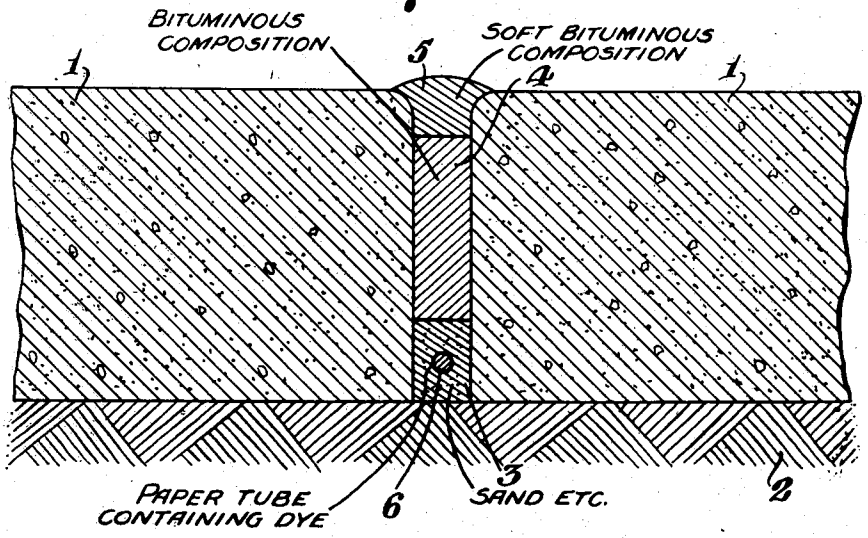
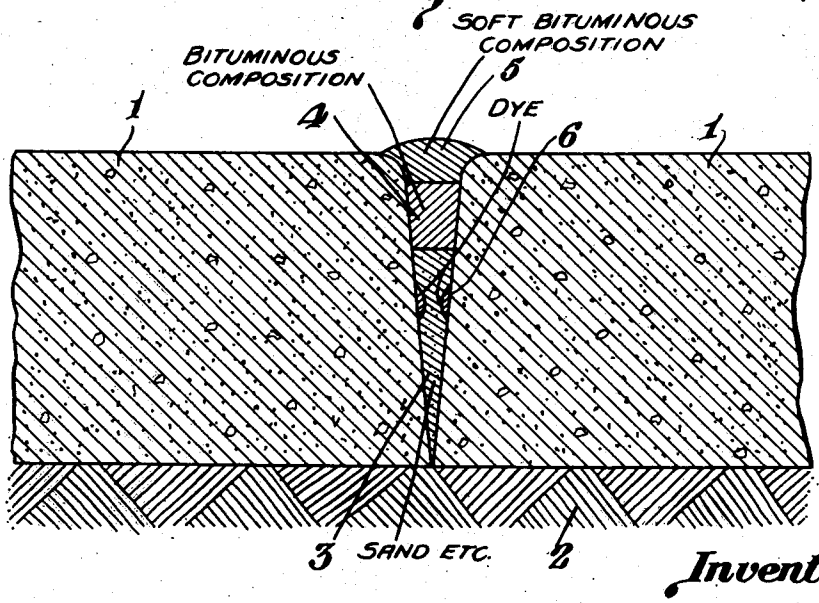



Fig. 2.




Inventor:

Walter O. Snelling.

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## LEAKAGE-INDICATING PAVEMENT JOINT

Walter O. Snelling, Allentown, Pa.

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3 Claims. (Cl. 94—18)

My invention relates to improvements in pavement joints, and more particularly relates to improved methods of making joints or filling seams between adjacent blocks of concrete, bituminous or other massive pavement material, and to the joints so produced. The principal object of my invention is to provide pavement joints that will indicate the presence of any open fissures or crevices through which surface water may penetrate, and will definitely mark the location of such openings.

It is well known that pavements are injured by the seepage of water through openings in the joints between adjacent pavement blocks, and the later freezing of this water. Since water expands in freezing, any water that finds its way through openings, cracks or fissures in the pavement surface will produce, in subsequent freezing, expansive effects which produce great local pressure at the point of expansion. The pressure produced by water freezing beneath the pavement surface tends to raise or heave the pavement blocks, and to produce cracks and fissures in the pavement blocks, and these effects lead to the deterioration of the pavement, since each crack or fissure that is produced by the expansive action of ice beneath the pavement affords a new opening through which more water can penetrate to the pavement foundation.

My invention relates to improved pavement joints, so constructed that they automatically indicate the presence of openings leading from the pavement surface to the pavement foundation, and definitely indicate the exact location of the surface opening through which water is finding its way to the lower portion of the pavement joint. It will of course be evident that the cost of upkeep and repair of any pavement thus provided with an indicator that shows the exact location of an opening or fissure will be greatly reduced over the cost of upkeep of any pavement not so provided. Ordinary pavement joints require frequent and detailed observation over their entire length, in order that seepage openings may be promptly detected and filled with sealing composition before great harm has been done to the pavement by the action of water seeping through such openings, while pavements made in accordance with my present invention give prompt and clearly visible indication of the presence of any fissures or openings communicating from the surface to the lower portion of the pavement joint, and accordingly enable repairs to be made only at these points of leakage, the actual location of the seepage opening being clearly and definitely indicated by clearly visible or detectable means.

In the drawing, which forms a part of this specification, Figure 1 represents a vertical section through a pavement joint made in accordance with my invention, and existing between two adjacent initial pavement block units. Figure 2 represents a vertical section through a pavement joint made in accordance with my invention, the joint being a fissure or crack across or through a pavement block or unit.

In both figures, 1 represents the pavement block, which may be any type of bitulithic, concrete or bituminous composition, the actual material of construction of the pavement block not being of significance in connection with my invention. 2 represents the underlying foundation of the pavement, which may be earth, sand, gravel or any other pavement foundation material. 3 represents any porous joint filling material, such as sand, crushed stone, gravel or the like, and 4 represents any suitable joint filling material, such as the usual asphaltic, tar, rubber or other joint filling compositions. 5 represents a top sealing composition, which may be identical with the material used as the joint filling composition 4, or which may be different in composition, to meet the more exacting sealing requirements existing at the pavement surface. 6 is a train of indicator material, of any desired composition as herein described, and existing as a cord, tape, filled tube or other suitable type of train. In Figure 1, the train is shown in cross section as a paper tube filled with indicating material, and present at about the center of the joint opening, and in Figure 2 the train is shown as a painted streak of indicator material present on the side walls of the opening formed by the joint fissure. The figures are not drawn to scale, and the indicator material in particular is shown greatly enlarged, as compared with the other portions of the joint, in order to be clearly indicated. In the practice of my invention, the indicator material is a train or tube usually about one-tenth of an inch in diameter, or a tape or streak, relatively very thin and narrow, and usually less than one-tenth of an inch in thickness, although the width may vary from one fourth of an inch to one or more inches if desired.

I have discovered that when a suitable indicator substance, such as a water-soluble dye, a water-suspensible pigment, or a water-transportable indicating substance such as fluorescene, esculin, copper sulfate or the like, is disposed lengthwise in a pavement joint opening beneath

a subsequently applied pavement sealing composition, and preferably in association with a column of sand or other water-porous material, such indicator substance affords a desirable means of indicating the presence of openings in the pavement joint, communicating between the pavement surface and the pavement foundation. When water falls upon a pavement provided with such a pavement joint, and there is any opening through the pavement surface to the pavement foundation, the water in seeping from the pavement surface to the pavement foundation comes in contact with the indicator substance, and some of the indicator substance becomes dissolved or suspended in the water which has thus seeped through the opening or fissure at the pavement surface. The action of vehicles passing over the pavement surface causes pressure to be exerted on the pavement blocks at intervals, and this periodic application of pressure to the pavement joints causes the water to be alternately sucked in and expelled through the opening or fissure. As the water seeps in, it takes up a minute amount of the indicator material, and as a portion of the water is expelled as vehicles pass over the surface, this expelled water, carrying the indicator substance, discolors or marks the pavement, at the exact point of the location or presence of the opening or fissure.

As indicator materials I may use any suitable dye, such as crocein scarlet, soluble blue, Guinea green, Bismarck brown, or water soluble nigrosine, for example, or I may use any suitable water-insoluble finely divided pigment material such as zinc oxide, titanium oxide, iron oxide, chromium oxide, chrome yellow, carbon black or the like, or I may use a non-dye indicator such as quinine sulfate, sodium fluorescene, esculin or the like, which although not having dyeing properties shows its presence by clearly visible or detectable indications. I prefer to use dyes forming colored compounds or lakes with concrete or cement, and crocein scarlet forms an example of such a dye.

I may place or dispose my water-transportable indicator substance along the length of the pavement joint in many ways. I may for example moisten a cord or tape with an agglutinant material, such as glue or acacia for example, and I may then coat the surface of such tape with crystals or powder of the water-transportable indicator material and I may then lay this cord in the joint opening, before applying the sealing material. Instead of employing a cord or tape as the carrier of my water-transportable indicator material, I may make a train of the indicator material, as by wrapping it in thin paper, in much the same manner that ordinary firecracker fuse is made by surrounding a powder train with a paper tube or wrapping. I may apply my water-transportable indicator material lengthwise directly to the lower part of the walls of the pavement joint, by means of a painting or spraying operation, or I may admix my indicator material with sand, crushed stone or gravel within the lower portion of the joint opening. My indicator material is preferably in the form of a continuous train or column, but where individual crystals or particles of a pigment or a dye of high coloring power are used, it will of course not be necessary that these individual particles should be in contact with each other, and I may form a suitable train or column by spacing particles or aggregates of indicator material at desired distances apart, if this is desirable. For example, I may dispose small isolated aggregates of dye at intervals of about one inch, on a thin paper tape, in much the same way that small aggregates of explosive composition are disposed on paper tape in making toy "cap" ribbons. The characteristic feature of my invention is the disposing of an indicator composition in the form of a column or train, which may be either continuous or intermittent, lengthwise within the space defining a pavement joint opening, and beneath the filling or sealing composition, in such a manner that any openings, fissures, cracks or even porous spots or imperfections in the sealing composition will be indicated by the passage of water through such imperfections in the sealing composition and by the taking up of some of the indicator material by this seepage water, and by the subsequent deposition of this indicator material as a marking at the location of the opening at the surface of the pavement in the form of a visible or detectable color or stain on the surface of the pavement.

By "train" as used in this specification and in the claims is meant a linearly disposed mass of material of the general nature of the powder train that is used in fuse. Such train may consist of particles of an indicator material continuously in contact, or of intermittently disposed particles or quantities of the indicator material at such distances apart as to afford a continuous or substantially continuous indicating means for surface water seepage. Such train may be disposed within a tube made of any water-permeable material, or may be in the form of a coating upon a cord or tape of paper or fabric, or may be in the form of a coating spread or sprayed upon the solid walls of the joint opening, or spread, sprayed or admixed with a pulverulent or granular material located at or near the bottom of the joint opening, all these methods of disposing of the water-transportable indicator material leading to substantially equivalent indications of the presence of imperfections in the continuity and efficiency of the joint sealing composition.

By "water-transportable", as used in this specification and in the claims is meant capable of being held or carried by water, in the manner that dyes and pigments are held or carried by water. Dyes are soluble in water, and are held or carried in solution by water, but pigments are insoluble in water, and are held or carried in suspension. My invention covers both finely divided materials that are carried by water in suspension, and dyes and other indicator materials that are water soluble, and that are carried in solution by water. I do not mean to cover by the term "water-transportable" any broader meaning than that which is connoted by the joint terms of water-soluble and water-suspensible, the one relating to materials which are soluble in water and which are carried by water in solution, and the other relating to pigment particles which are insoluble in water, but which are held or carried by water in suspension, and that are or may be carried for such short periods of time as are involved in the expelling action of the pavement blocks during periods of expansion and contraction, and particularly as a result of the passage of traffic over the pavement blocks.

By "indicating material" as used in this specification and in the claims, is meant any material which, by its color, fluorescence or appearance,

will afford readily visible or detectable signs or markings upon the pavement surface, when such indicator material is carried to the surface of the pavement by the means and in the way herein described. Indicator materials are preferably dyes but may be substances such as fluorescene, which have no true staining or dyeing properties, but which are nevertheless clearly distinguishable by visual or by photoelectrical means. The term indicating material also covers water-insoluble pigments, of any desired type. In the practice of my invention I prefer to employ dyes as indicating materials, and I prefer to employ dyes that readily stain or dye cement or concrete, and that may be readily made colorless by appropriate chemical means, so that repair gangs may efface the markings left from a seepage, after having restored the water-resistance of the filling material at such point by a repair operation.

The amount of indicator material that I prefer to use in the practice of my invention is determined primarily by the particular type of indicator material that is employed, fluorescent materials being capable of use in the smallest quantity, dye materials being required in somewhat greater quantity, and pigments being employed in still larger quantity. Using fluorescene, quinine, esculin or other fluorescent materials, I may use as little as one one-hundredth of a gram of indicator material per foot of length of joint opening, under the most favorable conditions of use, as when leakage is detected at night by directing a strong beam of ultraviolet light (from which all visible light has been screened) along the lines of the joint. Using fluorescent materials, and employing ultraviolet light as a detecting means, it is possible to determine leakage from joint openings treated in accordance with my invention at relatively high speeds of linear inspection, and if desired, photoelectric detecting means may be employed to pick up the fluorescent effects produced by the beam of ultraviolet light. Where dyes are employed as indicating materials, I prefer to employ from one-tenth gram to one gram of dye per foot of length of the joint treated, and where pigments or other similar materials are used as indicating materials, I may use from one gram to ten grams of pigment per foot of length of joint, depending upon the contrast strength or indicating strength of the indicator material employed, highly colored or highly contrasting materials being capable of being employed in relatively much smaller quantity than materials offering less contrast with the normal appearance of the pavement or the joint surface.

In the practice of my invention, I find that it is possible to inject additional indicator material at any point of repair, and at the time that such repair is made, as a means of restoring the amount of indicating material that has been lost as a result of the action of the indicating material. Such injection or replacement of indicator material, at a point where a pavement seal has been repaired, does not form, however, any part of my present invention.

It will be evident that many modifications may be made in the application of my invention, without departing from the scope of the disclosure as herein made, and accordingly no limitations should be placed upon my invention except such as are indicated in the appended claims.

I claim:

1. The process of forming a leakage-indicating pavement joint which comprises disposing within the length of the lower portion of the opening between adjacent pavement units a train of a water-transportable indicator material, and subsequently sealing such train of water-transportable indicator material within the joint fissure by means of an overlying mass of a pavement sealing composition.

2. A leakage-indicating pavement joint comprising a train of water-transportable indicator material disposed linearly within the length of a pavement joint and beneath a coating of a pavement joint sealing composition.

3. A leakage-indicating pavement joint comprising a train of water-transportable indicator material disposed along the length of a pavement joint, an associated parallel train of water-permeable material, and a joint sealing composition overlying both the water-permeable material and the water-transportable indicator material.

WALTER O. SNELLING.