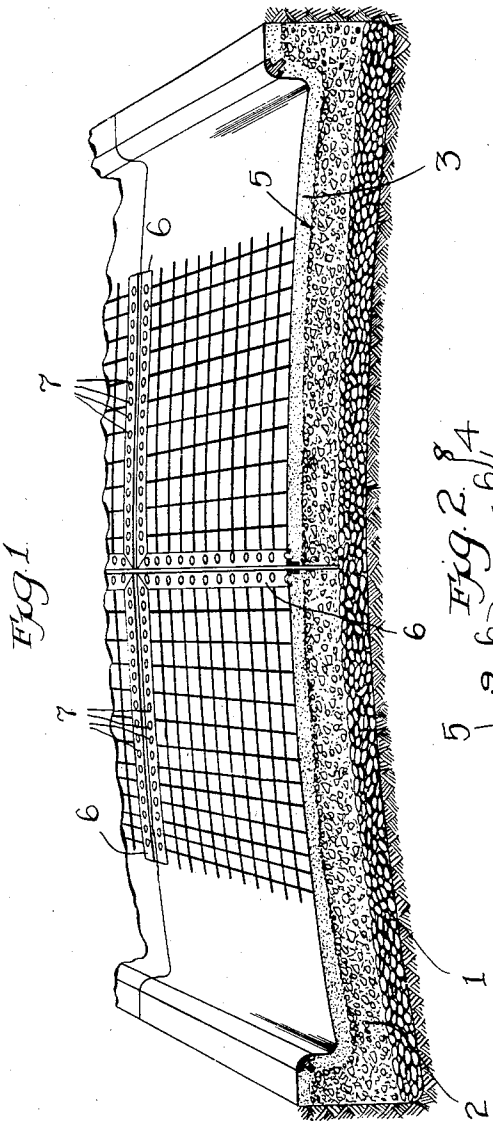
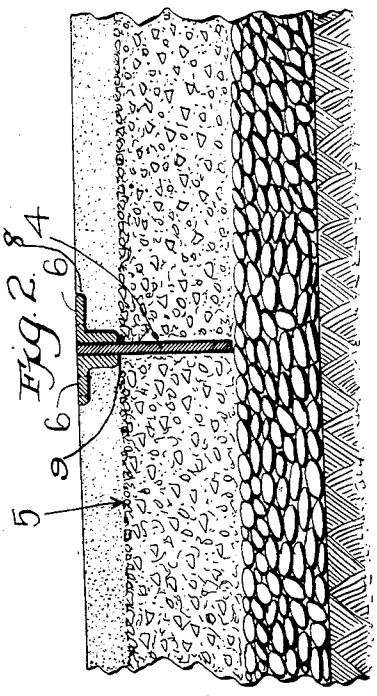
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METHOD OF MAKING PAVEMENTS.

APPLICATION FILED APR. 12, 1916. RENEWED NOV. 6, 1920.

1,383,459. Patented July 5, 1921.





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METHOD OF MAKING PAVEMENTS.

1,383,459. Specification of Letters Patent. Patented July 5, 1921.

Original application filed February 12, 1910, Serial No. 543,592. Divided and this application filed April 12, 1916, Serial No. 90,780. Renewed November 6, 1920. Serial No. 422,363.

To all whom it may concern:

Be it known that I, WILLIAM E. FICKLEN, a citizen of the United States, residing in Norfolk, county of Norfolk, State of Virginia, have invented a new and useful Improvement in the Method of Making Pavements, of which the following is a specification.

This application is derived from my patent referred to below, No. 1,098,792, and is a division of application Serial No. 543,592, filed February 12, 1910, and is a continuation of said application.

The present invention relates to a method of constructing sheet concrete road-pavements and the like, of the class in which the pavement is soft when laid and hardens or sets in place; in which it is divided cross-sectionally, as laid, into large sections or areas, spaced slightly apart to permit of expansion or contraction of the pavement and of independent movement of the several sections thereof, due to heat and other forces, without buckling or cracking; and in which such individually expansible and movable sections or areas are bound, or protected and armored, at the joints or artificial cracks therein by soft steel, or other tough material, against the chipping and grinding action of traffic. Certain forms of such armor, by strengthening the pavement at the joints, also prevent transverse cracking of the individual sections under heavy loads or excessive changes of temperature, and so permit of thinner pavements than would otherwise be feasible. A pavement of the class referred to is shown in U. S. Letters Patent #1,098,792, granted to me under date of June 2, 1914.

The pavement, hereinafter described, in an illustration of the present invention, is a pavement in which the cement is a hydraulic cement, and in which specified concrete mixtures are present; for, although the invention is not restricted in its use to hydraulic cement pavements, yet the latter, perhaps more than pavements of other composition, present problems which are best solved by the sectional construction above described. Reference is made to my above mentioned patent for a fuller understanding of these problems, and of the advantages of constructing sheet pavements and the like in armored sections separated by expansion joints.

The armor should be entirely supported by and form an integral part of the pavement sections which it reinforces and stiffens. That is to say, it should be so attached to the pavement section as to move laterally, up and down, and in any other direction, as a unit with the latter in the expansion and contraction of the pavement, and when the section is vibrated, depressed, or otherwise disturbed by traffic or by other causes. The relation of its armor or fillet, to each pavement monolith may be defined as "floating." Each section of pavement is therefore an independent filleted monolith and each monolith during the setting and hardening of the concrete has a tendency to shrink upon itself toward its own center. In laying the pavement, therefore, the armor should not be supported upon any bed, or be in permanent fixed relation to any other element with respect to which the reinforced, protected, and stiffened section, in shrinking while setting, or after it has set and hardened, has relative movement; because such relative movement would tend to tear or loosen the protector from the concrete. Furthermore, if the cost of the pavement is not to be excessive, the protector should be small, light, and thin, and should not be supported on a bed, or otherwise, in such manner as to require a deep extension of the protecting armor through the pavement within the joints.

An object of the present invention is to construct, by a simple, reliable, and economical method, a pavement consisting of separated, or as far as expansion and contraction are concerned, of substantially separated large sections of any desired shape, bound by, and having in effect integral therewith and firmly fixed thereto, at the upper edges thereof, soft steel or other tough material. It is an object of the invention, so to introduce the edge protector, contractile fillet or armor, to the concrete, while the latter is soft, and so to support the armor in the concrete, that the latter in setting will not draw away from the armor; and that, after the concrete has set, the armor will not engage any element with respect to which the concrete may have movement. It is a further object of the invention, so to cast or mold the concrete about the armor, that the concrete when set will provide certain abutments and shoulders for supporting,

bracing and embracing, the armor, thereby relieving the latter of stresses which may effectively be borne by the concrete, and permitting of a lighter and cheaper armor than would otherwise be required for the purpose for which it is used. An object of the invention is to permit the use of thin and inexpensive, flexible and non-rigid, protecting strips, by the employment of means for supporting the same throughout their length against sagging or bending under the weight of soft concrete, or for other causes. It is an object of the invention so to construct the pavement that the expansion joints may be made of any desired depth without reference to the size of the protecting strips, in that in the present invention the protecting strips need not be relied upon to keep the concrete out of the spaces allotted to the joints.

The above and other features of the invention will more fully appear on reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a section of road pavement constructed in accordance with the present invention.

Fig. 2 is an enlarged view in cross section through one of the joints of the pavement, a form of templet being shown in place between the binding irons of two opposed sections of the pavement.

If a bed for the pavement, other than the earth, is desired, such a bed or sub-grade may conveniently consist of a layer, 1, of suitable thickness, of crushed stone, gravel or cinders evenly spread, and rolled to desired compactness. The pavement itself may be laid in one or more sheets composing a monolithic structure. In the drawings two sheets or layers, 2 and 3 respectively, are shown. The lower of these, sheet 2, in the structure shown is preferably of from $4\frac{1}{2}$ to 5 inches in thickness and is preferably of a concrete composed, first of a mixture by bulk of 40% of stone or gravel substantially $1\frac{1}{2}$ inches in size, 25% of stone or gravel $\frac{1}{4}$ inch in size, and 35% of clear Northport white grit or clean coarse sand or screenings of granite. Mixed with seven parts by bulk of this mixture is one part by bulk of plastic cement. In hot weather the water which is added to form the mix is in sufficient quantity to make what is called a wet mix; in cool weather the mixture is ordinarily of the dampness of brown sugar.

Preferably before any of this mixture is laid, and, according to the desired depth of the expansion joints, before the mixture is laid to its full depth, the roadway or other space to be paved is subdivided by forms or templets, 4, set at intervals or distances apart, and in positions which accord to the size and positions of the separately expansible areas or sections into which the pavement is to be divided. These distances are ordinarily as large as fifteen feet and over. Where the road is to be crowned, the templet is preferably though not necessarily shaped or demarked to the crown of the road, being shown in the drawings as having its upper edge flush with the road surface. The templets being set and secured in place, the laying of the mixture, 2, within the areas prescribed by the templets is proceeded with, and that mixture may be tamped and its surface shaped to the curve of the crown of the road.

Where, as is sometimes the case, a top or finishing surface having special wearing or waterproof qualities is desired, the mixture, 2, is not laid to the full height of the templets, but stops at a level 5, say from $1\frac{1}{2}$ to 2 inches below what is to be the level of the road surface. Preferably, before the sheet 2 sets and completely hardens, the mixture 3, forming the top surface, is laid within the areas bounded by the templets so that the two sheets by consolidating may form a single monolithic block within each form. A suitable mixture for the sheet or layer 3 may consist of substantially 3 parts by bulk of plastic cement, $1\frac{1}{2}$ parts of crushed granite, from $\frac{3}{8}$ to $\frac{1}{8}$ inch in size, 1 part of clean white Northport grit or flinty sand, $\frac{1}{8}$ to $\frac{1}{4}$ inch in size, $\frac{1}{2}$ part of iron ore tailings, and $\frac{1}{2}$ part of fine crushed slag. This mixture 3 is spread upon the sheet 2, and its top surface is troweled, floated and finished or broomed to the crown of the road.

The templets, 4, not merely determine the areas of the road sections and the width of the expansion joints, but in the present invention control the positioning of the binding strips or irons, 6, and may among other important functions determine joint depth. When the templet is not to form a permanent part of the structure, it may conveniently be of wood of a thickness of $\frac{3}{8}$ of an inch, having a facing 4 of thin steel sheeting, so as to have a total thickness of $\frac{1}{2}$ inch, which under ordinary conditions is a proper width for the expansion joints.

The binding strips or reinforcements may take a variety of forms. In the drawings they are shown as angle irons, the upper surface of one wing of which abuts the templet at the side face of the block at the expansion joint. The templets 4 form continuous supports for the abutting strips 6, so that the latter may be thin and flexible and yet not be bent into the spaces allowed for the joints, under the weight or pressure of unset concrete within the forms, or for other causes. This is of importance, because, to make the bar thick enough to be rigid, and, in this respect, self-supporting, adds to the expense of the pavement. True alinement and true angular setting of the strips is effected by means of the templets; and the upper edge of the templets may as stated serve to de-

mark the proper level of the upper face or edge of the strip, so that the latter shall be flush with the road surface. The smooth steel facing if I use such a facing of the templets assures a snug fit of the binding strips against the same. The strips 6 are positioned on the templets preferably before that part of the concrete in which the strips are to be anchored, is flooded or laid in the forms, and in any event before that part of the concrete has lost its soft and fluid character. The concrete when first placed will ordinarily be soft enough to permit the strips to be forced down through the same into position against the templets, and will have body enough to support the strips against the templets. The strips are shown as having holes, 7, in their upper wing. The soft concrete flows through these, thereby interweaving the strips with the concrete, and providing non-slip surfaces in the wing where the concrete presents itself at these holes. The interweaving of the concrete with the strips is an important feature of the anchoring of the strips in the concrete. As shown in my Patent #1,098,792, above referred to, the vertical members of the strips may also be perforated for interweavement and double interlockment with the concrete. In event of such perforation of the vertical members, the continuity of the templets is of importance in preventing the soft concrete from flowing through the perforations into the space allowed for the joints and there so hardening as to deprive the pavement of its expansibility. Below the armor, the templets also prevent flowing of the concrete into the spaces allotted to the joints.

The armor being in place between any two opposed sections, and the concrete having been laid, the latter is allowed to set, or automatically to harden in place. Before the concrete has completely hardened however, any attachment of the armor or contractile fillet to the templets, if the latter are rigid, should be removed, as the concrete will shrink somewhat in setting, and as the armor, which is not necessarily continuous, should be free to move with the concrete as an integral part of the blocks or sections during such shrinking. If the templets are hard and rigid and are to be removed, then, after the concrete has set sufficiently to hold the armor but before it has become too stiff, the templets should be gently loosened by tapping, and withdrawn.

It will be noted that in laying the pavement in the manner described, the concrete is cast about the armor plate to form shoulders 8 and 9 in the concrete, which shoulders serve as supports and abutments for the binding strips. These shoulders, furthermore, receive and distribute stresses that might otherwise have to be met by an expensive increase in the amount of metal composing the armor. The strips need not, therefore, rest upon any bed or upon any part which is not integral and monolithic with the surfacing material. Because of the shoulder 8, a downward movement of concrete section relative to its base is therefore not liable to displace the armor, nor will expansion of the monolith relative to its base cause the binder to be displaced or jarred loose. Of importance also from an economical standpoint is the fact that in practising the present invention, the protector need not be set upon the foundation upon which the monolith rests, and so need not have a member of the height of the monolith, involving expensive waste of metal.

I claim:

1. The method of making pavements or the like of settable, shrinkable material which consists in preparing a suitable bed or foundation, forming expansion joints by supporting in position templets running lengthwise of said joints and by supporting against the upper faces of said templets anchored strips for armoring the upper edge of the joint, the shrinkable material below said strips being exposed whereby the templets mold the material below said strips, and as the shrinkable material begins to set permitting said metal strips to shrink away from said templets.

2. The method of making pavements or the like of settable, shrinkable material which consists in preparing a suitable bed or foundation, forming expansion joints by supporting in position templets running lengthwise of said joints, supporting against the upper opposite faces of said templets anchored strips for armoring the edges of said shrinkable material, the shrinkable material below said strips being exposed whereby the templets mold the material below said strips, and filling the spaces defined by said longitudinal templets and by said metal strips with the shrinkable material to the proper level and surface, and, as the material begins to set or stiffen, permitting said metal strips to shrink away from said templets.

3. The method of making pavements or the like composed of settable, shrinkable material which consists in forming expansion joints by supporting in position templets running lengthwise of said joints and releasably supporting against the upper faces of the opposite sides of said templets anchored strips for armoring the edges of said shrinkable material, the shrinkable material below said strips being exposed whereby the templets mold the material below said strips, and as the material begins to set or shrink to permanent form releasing said armoring metal strips from said templets, whereby as each section of pavement shrinks

on setting, it is free to carry with it the armoring metal edge in said shrinking action.

4. The method of making pavements or the like of settable, shrinkable material which consists in preparing a suitable bed or foundation, forming expansion joints by supporting in position templets running lengthwise of said joints and acting to mold the material, supporting against opposite sides of said templets metal strips, provided with holes, for armoring the edges of the shrinkable material, permitting the shrinkable material to enter the holes in said metal strips to provide a better gripping surface, and, as the said shrinkable material begins to set or stiffen permitting said metal strips to shrink away from said templets in setting, whereby each section of the pavement may set and its edges carrying metallic armoring may shrink away from said templets.

5. The method of making pavements or the like of settable, shrinkable material which consists in preparing a suitable bed or foundation, forming expansion joints by supporting in position templets running lengthwise of said joints and by supporting against the upper faces of said templets anchored strips for armoring the upper edge of the joint, the shrinkable material below said strips being exposed whereby the templets mold the material below said strips, and as said shrinkable material begins to set permitting the metal strips to shrink away from the templets as said material sets or stiffens, and removing the templets leaving the expansion joints armored at their upper edges by the aforesaid metal strips.

6. The method of making pavements or the like of settable, shrinkable material which consists in preparing a suitable bed or foundation, supporting in position templets for the purpose of providing expansion joints, supporting against the faces of said templets anchored strips for armoring the edge or face of the joint, and, as said material begins to set or stiffen, permitting said metal strips to shrink away from said templets.

WILLIAM E. FICKLEN.