May 30, 1944. C. L. METHVEN 2,349,910

JOINT CONSTRUCTION

Filed June 19, 1941

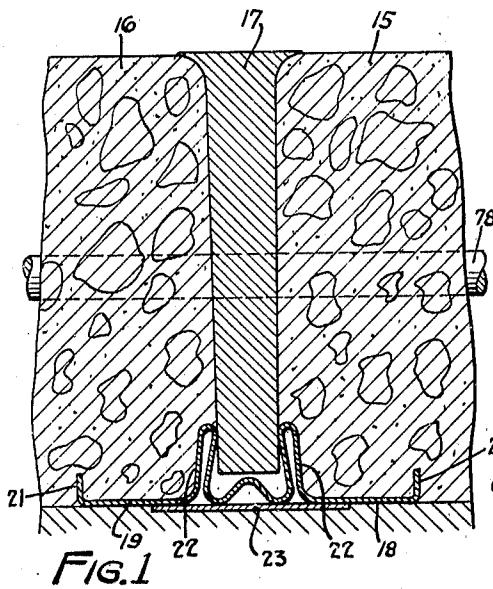


FIG. 1

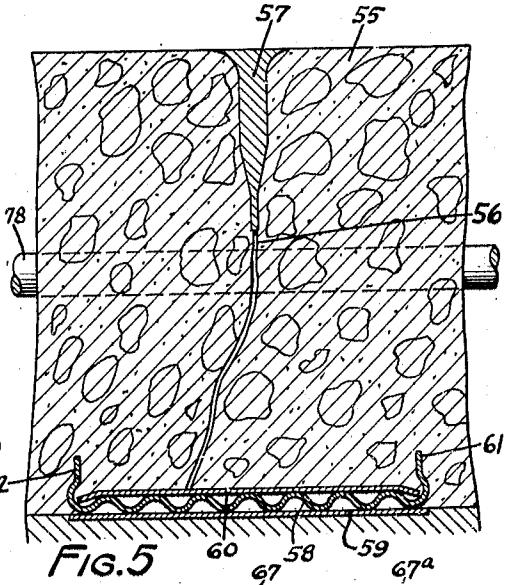


FIG. 5

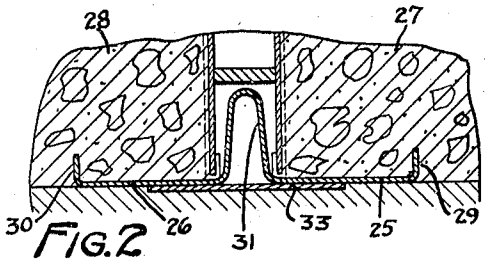


FIG. 2

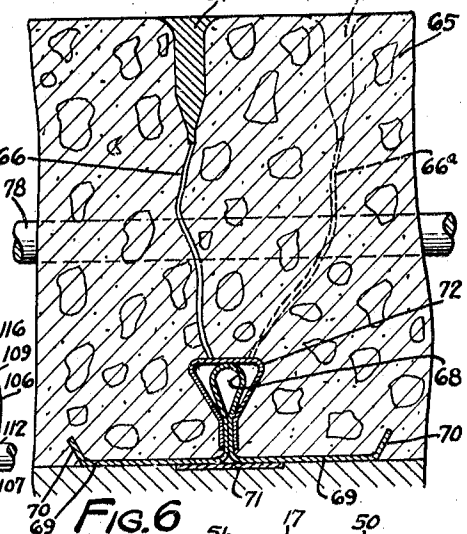


FIG. 6

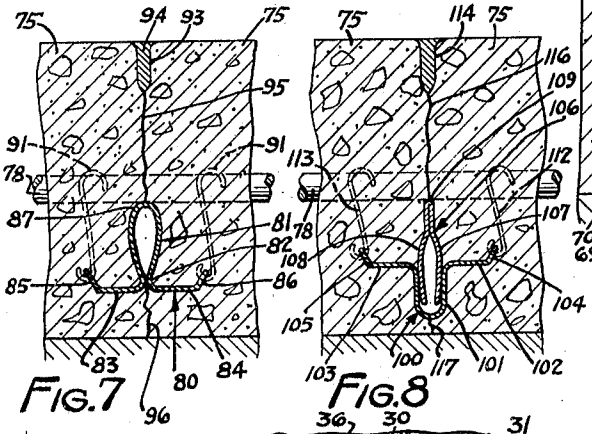


FIG. 7

FIG. 8

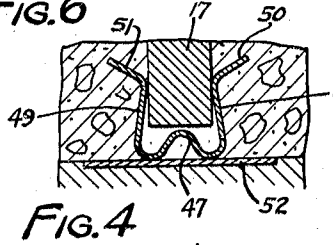


FIG. 4

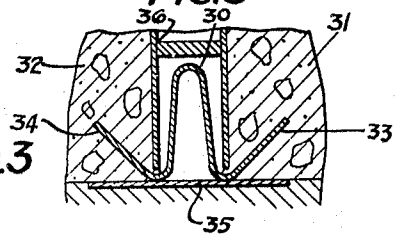


FIG. 3

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UNITED STATES PATENT OFFICE

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JOINT CONSTRUCTION

Clyde L. Methven, St. Paul, Minn.

Application June 19, 1941, Serial No. 398,792

8 Claims. (Cl. 94—18)

This invention relates to improvements in the construction of expansion joints for pavements and the like. The present application is a continuation in part of my application, Ser. No. 146,877, filed June 7, 1937, which was a division of my application, Ser. No. 670,317, filed May 10, 1933.

Paving practice of the present day requires expansion and contraction joints which are usually filled by some sort of bituminous material. Such joints are of two general types, the premolded in which bituminous materials are combined with fibrous or elastic material to fill the joint space, and the poured type in which plastic bituminous material is poured into a molded joint space formed in the pavement.

When pavements are contracted in cold weather, infiltration of water frequently occurs at the joint, most of this water being surface water which finds its way through the joint to the subgrade below the pavement. In freezing temperatures this moisture freezes into ice lenses in the subsoil which causes heaving of the pavement slabs at the joints. It is also to be noted that the shrinkage of the paving material and of the bituminous material is in opposite directions so that in cold weather the bond between the pavement and the bituminous material is broken thus forming crevices through which water finds its way to the soil below the pavement.

Thus far, the effort of engineers working in this field has been directed to making the expansion joint as watertight as possible at the top of the pavement. But the results attained have not been satisfactory because of the formation of crevices in cool weather herein referred to, resulting in inevitable infiltration of surface water through the joint and into the subgrade soil.

In cool weather there is also a crevice along the sides of a pavement adjacent to the earth shoulders. Any joint, whether of bituminous material or the so-called air cushion metal box type, which is not absolutely watertight on the ends may still, through these ends, admit much infiltration of water above the elevation of the bottom of the slab. This water flows into the lower section of the joint and thus passes through into the subsoil below. Hollow metal box types of expansion joints are not made with enduring metal in their lower portions. In a comparatively few years, disintegration of this portion permits the infiltration of water through the ends and thus through the corroded metal into the subsoil below the pavement.

In addition to the heaving caused by water freezing below the pavement in the cold climates, there is the disadvantage that in the warmer climates the moisture seeping through the joint produces an expansion of the subsoils which may result in permanent deformation of the pavement.

It is the primary object of the present invention to provide an expansion or contraction joint with a seal at subgrade elevation, or intermediate the upper and lower surfaces of the pavement which will positively exclude the passage of the water through the joint into the subgrade.

Another object of the invention is to provide a water seal for expansion or contraction joints so constructed and arranged that it will expand and contract with movement of the adjacent pavement slabs.

Another object is to provide a water seal for expansion or contraction joints of simple, durable and inexpensive construction and which may be employed in connection with any type of expansion joint or so-called dummy contraction joint.

A still further object of the invention is to provide a novel method of placing a water seal at the bottom of the joint space or at an intermediate position in pavements and the like.

In addition, the invention aims to provide numerous improvements in details of construction and use of apparatus for forming expansion or contraction joints in pavements and the like having many advantages from the standpoint of efficiency in use, economy in cost and maintenance, and ease of assembly and installations.

Other objects of the invention and further advantages thereof will be more fully brought out as the description proceeds.

In the accompanying drawing I have shown several practical embodiments of my invention but it is to be understood that this drawing is illustrative merely and I do not confine myself to the details of construction therein shown. It will be readily appreciated by those skilled in the art that my invention may be embodied in other forms without departing from the scope thereof or sacrificing any of its advantages.

In the drawing,

Figure 1 is a fragmentary sectional view through a pavement joint showing one of the water seals of my invention;

Figure 2 is a fragmentary sectional view through a pavement expansion joint showing a modification of my water seal;

Figures 3 and 4 are fragmentary sectional views, similar to Figures 1 and 2, showing modifications of the water seal construction;

Figures 5 and 6 are fragmentary sectional views through a pavement showing a so-called dummy contraction joint with a water seal of my invention applied thereto;

Figures 7 and 8 are other modifications of the invention showing dummy contraction joint seals and a method of placing them in the pavement.

At the outset, it will be understood that the invention herein to be described and the modifications thereof may be applied to any type of pavement such as ordinary road pavement or bridge work, roofing and to inclined or vertical sections such as wall structures, dams and the like, requiring water-tight expansion or contraction joints.

Referring now to the drawing, and particularly to Figure 1, the reference numerals 15 and 16 indicate adjacent separated slabs of pavement made of concrete or any other suitable material which expands and contracts with temperature changes. The space between the adjacent edges of said slabs is usually filled with suitable bituminous material 17 which is either poured into the space while in liquid condition or is occupied during construction as a premolded mixture of bituminous and fibrous substances. As will be seen from the said Figure 1, said expansion joint material extends from the top of the pavement to a point substantially near the bottom of the said slabs.

The water seal of my invention comprises a flexible metallic member which extends along the joint from one longitudinal edge of the pavement to the other conforming to the cross-section design of the pavement and contour of the subgrade. The said metallic member is provided with laterally extending portions 18 and 19 which underlie the slabs 15 and 16. The outer marginal edges of said portions 18 and 19 are bent upwardly to form flanges 20 and 21 which are embedded in the slabs 15 and 16. At the center, the said metal member is bent to form a number of loops 22 which are provided for the purpose of permitting expansion and contraction of the metal member in accordance with movements of the adjacent slabs due to temperature changes. Preferably, these loops or bends will not be too sharp, thereby avoiding the danger that the continued flexing of the metal member over a period of years might cause rupture.

The member comprising the water seal may be made of any suitable metal but, preferably, the metal should be enduring and non-corrosive in order to increase the life of the joint and to eliminate, so far as possible, maintenance costs. Suitable metals such as copper and the like may be best used for this purpose.

While from practical considerations of installation and maintenance the water seal of my invention is preferably made of enduring metal, I wish it to be understood that I do not limit my invention to use of such metal. Under certain conditions it will be quite possible to employ a fibrous material or fabric coated with a suitable flexible substance to make it water proof and sufficiently rigid to retain the shape of the bends and loops formed in the seal. Such materials as composition roofing and the like may be employed for this purpose as well as the enduring metals referred to.

It will now be seen that because of the construction and arrangement of the water seals herein described, it will be impossible for water to find its way through the joint into the subsoil. Also, it would be impossible for moisture existing in the subsoil, and the soil itself, to find its way into the joint. This is assured by reason of the fact that the laterally extending portions of the water seal underlie a substantial part of the adjacent pavement slabs and for their entire length. Additional assurance is afforded because of the marginal flanges which are embedded in the pavement slabs.

In order to prevent the entry of subgrade soil into the loops of the water seal, I provide a shield 23 which underlies the water seal and which extends from one longitudinal edge of the pavement to the other. By this arrangement I prevent the possibility of the soil accumulating in the loops or bends of the water seal which would interfere with the free flexing movement of the said water seal.

The foregoing description will make clear a practical embodiment of my invention. It is obvious, however, that the water seal of my invention is susceptible of embodiment in a great variety of other forms and I have chosen to illustrate several such modifications herein.

In Figure 2, there is shown a modification in which the water seal is provided with laterally extending portions 25 and 26 which underlie adjacent slabs 27 and 28 of the pavement. In this case, as in the structure shown in Figure 1, the said laterally extending portions are provided with flanges 29 and 30 which are embedded in the adjacent slabs. However, in this form, the water seal is provided with but one loop or bend 31 which is formed centrally of the metal member comprising the water seal and which extends upwardly into the space between the adjacent slabs. Under ordinary conditions this single loop of the water seal will be sufficient to provide for freedom of flexure due to the movement of the adjacent slabs. In this figure, I have shown a portion of a removable core mold which rests on the portions 25 and 26 of the water seal. This structure is more fully described in my copending application Serial No. 146,877. In this case also I have provided a shield 33 which prevents movement of a subsoil into the loop of the water seal which is located in the space between the adjacent slabs.

In Figure 3 I have shown a further modification of my water seal. In this case the water seal comprises a metal member having a centrally formed loop or bend 30 which is located in the space between adjacent slabs 31 and 32 of the pavement. This water seal is provided with laterally extending portions 33 and 34 which are bent upwardly and embedded in the adjacent slabs. This type of structure will also form an effective seal against the passage of moisture through the joint into the subsoil. Here, also, I have provided shields 35 and 36 which prevent the subsoil and road paving material from entering into the loop 30, thus assuring free flexing movement of the seal.

Figure 4 shows a further modification of the water seal. In this case I have provided a metal member having a centrally formed loop or bend 47 provided with marginal portions 48 and 49 which extend upwardly into the space between the adjacent slabs of the pavement and which are provided at their upper edges with marginal flanges 50 and 51 which are embedded in the

said pavement slabs. This structure also forms a seal against the passage of moisture through the joint into the subgrade.

Here, again, I have provided a shield **52** for preventing movement of the subsoil into the loop of the water seal, and the expansion joint filler material **17** which is gripped between walls **48** and **49** serves to cover the upper surface of the loop and exclude paving material from adhering thereto, thus insuring flexibility of the seal.

In Figure 5 I have shown a so-called dummy contraction joint to which the water seal of my invention has been applied. A dummy joint is merely a crevice formed in the pavement to establish a weakened plane which will predetermine the location of a contraction crack or joint. In the said Figure 5, reference numeral **55** indicates a section of a pavement in which there is a contraction crack or crevice **56** extending from the upper surface to the lower surface of the pavement. At and near the upper surface, the crevice is filled with suitable bituminous material **57**.

In the case of the structure shown in Figure 5, I also employ a water seal extending along the joint from one longitudinal edge of the pavement to the other which will prevent the passage of water through the dummy joint into the subsoil. The water seal proper comprises a corrugated metal plate **58** extending under the dummy joint and under the adjacent parts of the slab for some appreciable distance on each side of the possible location of a crack. This water seal is corrugated so as to provide for flexing movement occasioned by any movement of the adjacent sections of the pavement. The water seal is protected by a shield **59** which underlies the same and prevents the subsoil from packing into the corrugations of the seal which would result in destroying its free flexing movement. To prevent the entry of the paving material into the upper part of the corrugations in the seal, I employ an upper shield **60** which rests upon the water seal **58** in the manner shown. The said water seal **58** is provided with marginal flanges **61** and **62** which are bent upwardly and embedded in the pavement. It will be seen that this structure provides an effective seal against the entry of water into the subsoil through the crack or crevice **56**.

In Figure 6 I have shown a modification of my invention as applied to a so-called dummy contraction joint. In this figure, reference numeral **65** indicates a section of pavement which is provided with crevice **66** which forms a so-called dummy joint. At and near the upper surface of the pavement, the said crevice is filled with suitable bituminous material **67**. In this figure, I have also provided a water seal comprising a looped member **68** having laterally extending flanges **69** which underlie adjacent sections of the pavement and which are provided with marginal flanges **70** which are bent upwardly and embedded in the pavement. The water seal is protected at the bottom by a suitable shield **71**. To prevent movement of the paving material into contact with the loop of the seal, I have provided a shield **72** which surrounds the said loop, as clearly shown in Figure 6. Thus, by this arrangement there will be no interference with the free flexing movement of the water seal on account of the impacting of the paving material or the subsoil. The arrangement shown in this figure is such that the space around the loop **68** predetermines the weakest cross-section of the pavement, thereby assuring the location of the eventual contraction crack or crevice. For example, if the crevice be somewhat misplaced as shown in dotted lines at **66***a* and **67***a* in said Figure 6, the contraction crack or crevice will nevertheless find its place to the seal because the seal locates the weakest cross-section of the pavement.

In Figures 7 and 8, there are illustrated other forms of dummy contraction joint seals which serve not only to establish a weakened plane for determining the point of cracking upon contraction but also serve to seal the joints thus produced.

In Figure 7, the sections **75** include usual dowel bars **78**, beneath which there is hung a sealing member, generally designated **80**, of thin flexible material such as sheet copper, steel or flexible waterproof material. The member **80** includes a central loop **81** which closes upon itself at **82** and extending edge flanges **83** and **84** terminating in marginal areas **85** and **86** which serve to lock the marginal edges into water-tight relationship to the sections in which they are situated. The loop portion **81** is preferably coated with bitumen or other material to prevent adherence of the material of sections **75—75** thereto and hence, as the pavement contracts, the loop will afford flexibility allowing parts **83** and **84** to pull away from each other thereby opening the loop **81** at the bottom port **82**. The edge flanges **85** and **86** are preferably punched to receive hooks or wire fasteners **91** which hold the joint with the upper extremity **87** of the loop **80** firmly against the dowel bars **78**, from which the entire joint is suspended during placement of the paving material. The joint seal thus is situated on one side the midplane of the sections **75**. As the sections are poured, they are trowelled to include the space **93** which is filled with bitumen or other joint sealing compound **94**. Upon contraction of the pavement, the contraction cracks **95** and **96** form, being directed by the space **93** and the configuration of the seal.

In Figure 8, there is an arrangement generally similar to that shown in Figure 7 in which the joint seal is composed of a channel of flexible metal or non-metal material **100** having a central downwardly extending loop **101** and side flanges **102** and **103** terminating in edge flanges **104** and **105** which form water-tight anchorages with the pavement. Channel portion **101** is open at the top and into it there is forced a covering member **106** which may be either a single thickness of material or a channel section made by folding. The member **106** is made of such size that the portions **107** and **108** nest snugly into the open channel **101** and thereby cover the channel so as to exclude paving material therefrom during placement of the unit in the pavement. The exterior surfaces of the member **106** and the exterior of loop **101** are preferably coated with asphalt, grease or other material to prevent adherence of paving material to these parts. In placing the assembly of Figure 8 in the pavement, it is preferably held by wire ties **112** and **113** fastened through holes in flanges **104** and **105** and to dowel bars **78** so as to hold portion **109** snugly in contact with the bars. The assembly is thus held immovable in a position in the sections **75—75**, while the sections are poured. The material of the sections is then placed and trowelled to provide groove **114** which serves with the contraction joint assembly **100** to initiate the contraction crack **116** which continues from groove **114** down

to portion 109 of member 106 and thence at 117 below loop 101 to the lower surface of the pavement. The flexible portion 101 serves to seal the crack against passage of water therethrough. Groove 114 is ordinarily filled with asphalt or other crack sealing composition.

The dowel bars are left in place in their proper positions to function in the customary manner, these being illustrated at 78 in Figures 1, 5, 6, 7 and 8.

The water seal bands of the present invention are left in their proper positions with the edges sealed into the adjacent concrete slabs and providing a bend or loop of the seal band, free of any bond or restraining contact with said adjacent slabs, capable of absorbing such pavement movement as the design of the joint interval and space requires.

Many obvious variations will occur to those skilled in the art and it is intended that such shall be within the scope of the invention herein illustrated, described and claimed.

I claim as my invention:

1. An assembly for use in preventing the passage of water through joints in pavement and the like which comprises a membrane having a central transversely flexible portion and relatively movable edge flanges extending into the space occupied by the pavement or the like, a protection member covering said flexible portion on one side, and a second member covering said flexible portion on the other side, said covering members being permanently attached so as to be irremovable when the assembly is cast into a concrete section.

2. An assembly for use in preventing the passage of water through joints in horizontal sections such as pavement and the like which comprises a membrane having a central transversely flexible portion and relatively movable edge flanges extending into said pavement sections to form water-tight anchorages therewith, and a protection member overlying said flexible portion, said protection member being permanently attached and irremovable when the assembly is cast into a concrete section.

3. A joint seal for use in concrete sections such as pavement and the like comprising a long, narrow membrane having a plurality of uniform central convolutions forming a corrugated central area and edge flanges extending into said concrete sections to form water-tight anchorages therewith.

4. An assembly to be cast into concrete pavement and the like to provide a seal therein at an expansion or contraction joint in said pavement, to seal said joint against the passage of moisture, comprising a relatively long, relatively narrow transversely flexible member having upwardly extending sidewalls forming a cross section of concave shape and sealing fins extending laterally into the space occupied by said pavement so as to form a water-tight anchorage therein, and another member composed of one sheet of metal shaped to have a concave cross section, said latter member being positioned between said sidewalls and in resilient contact therewith so as to form a totally inclosed cross-sectional space to prevent paving materials entering between said walls.

5. An assembly for use in sealing the joints in pavement and the like, which comprises a relatively long unitary member bent so as to have a central flexibility imparting convolution having a cross-sectional shape like a loop closed at one point and edge flanges extending outwardly from the point of closure of the loop into the space occupied by said pavement to form a water-tight anchorage therewith, and a channel having opposed surfaces and a loop cross section sufficiently large to embrace the loop of the unitary member and assembled thereon surrounding said loop-shaped convolution, for preventing adherence of the paving material thereto.

6. An assembly for use in sealing joints in concrete sections which comprises a relatively long member having a central flexibility imparting convolution closed on itself and fins extending therefrom into the space occupied by said concrete sections to form a water-tight anchorage therewith, and a covering over the exterior surface of said central flexibility imparting convolution, for preventing adherence of concrete thereto, said covering being so affixed as to remain attached to the relatively long member when the assembly is cast into a concrete assembly.

7. A unitary assembly for sealing joints in horizontal or vertical concrete sections comprising a membrane having a central transversely flexible portion and relatively movable edge portions adapted to be placed in concrete on either side of the joint and bonded thereto, and protective shielding means affixed to and forming a protective covering for the central flexible portion for withholding contact of the concrete thereto, said protective shielding means being so affixed as to remain permanently in place when the unitary assembly is cast into a concrete section.

8. A unitary assembly for sealing joints in horizontal or vertical concrete sections comprising a membrane having a central transversely flexible portion and relatively movable edge portions adapted to be placed in concrete with one edge portion embedded in the concrete at each side of the joint and a protective covering attached to said flexible portion for preventing adherence of concrete thereto, said protective covering being so affixed as to remain permanently in place when the unitary assembly is cast into a concrete section.

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