June 8, 1937. C. L. METHVEN 2,082,805

EXPANSION JOINT CONSTRUCTION

Filed May 10, 1933 2 Sheets-Sheet 1

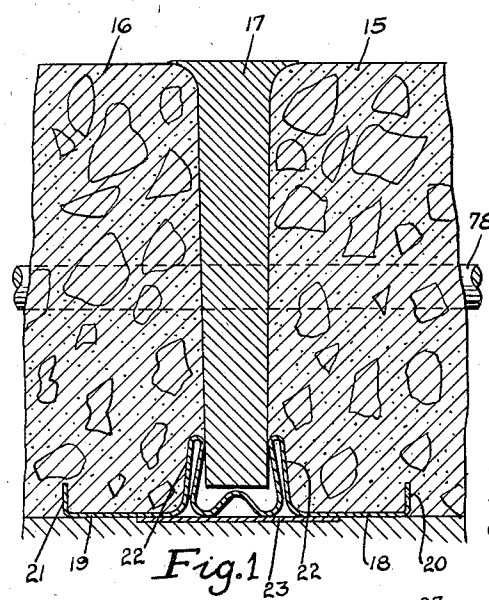


Fig.1

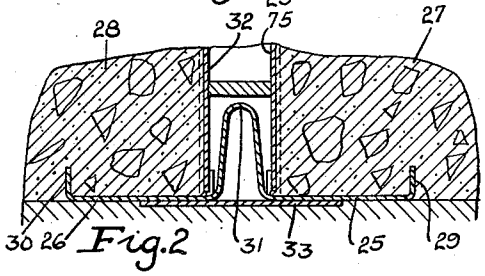


Fig.2

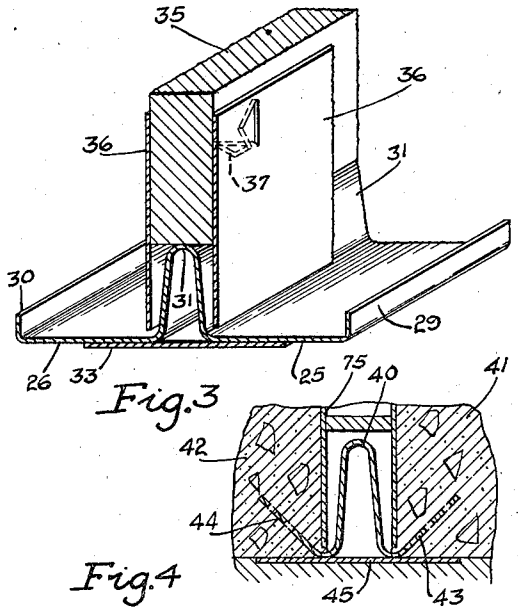


Fig.3

Fig.4

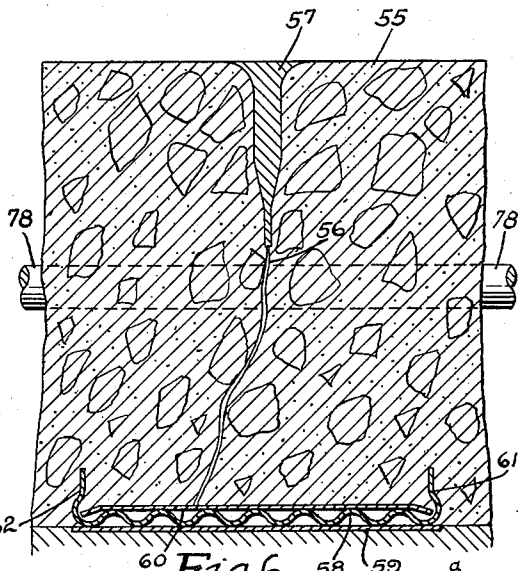


Fig.6

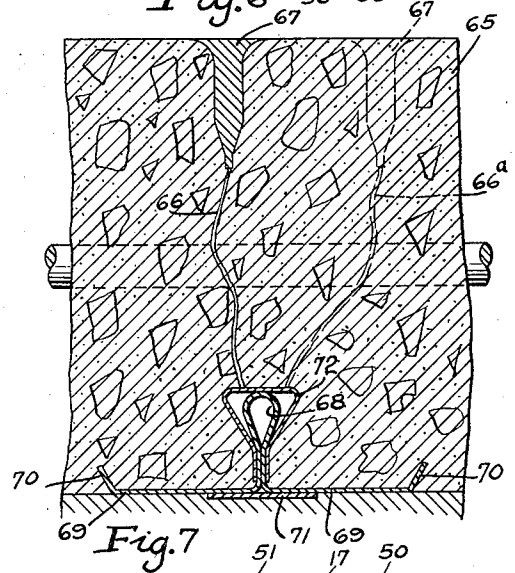


Fig.7

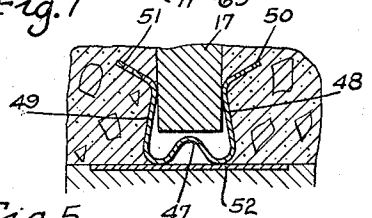


Fig.5

INVENTOR.
CLYDE L. METHVEN
BY Paul, Paul & Thomas
ATTORNEYS.

June 8, 1937. C. L. METHVEN 2,082,805

EXPANSION JOINT CONSTRUCTION

Filed May 10, 1933 2 Sheets-Sheet 2

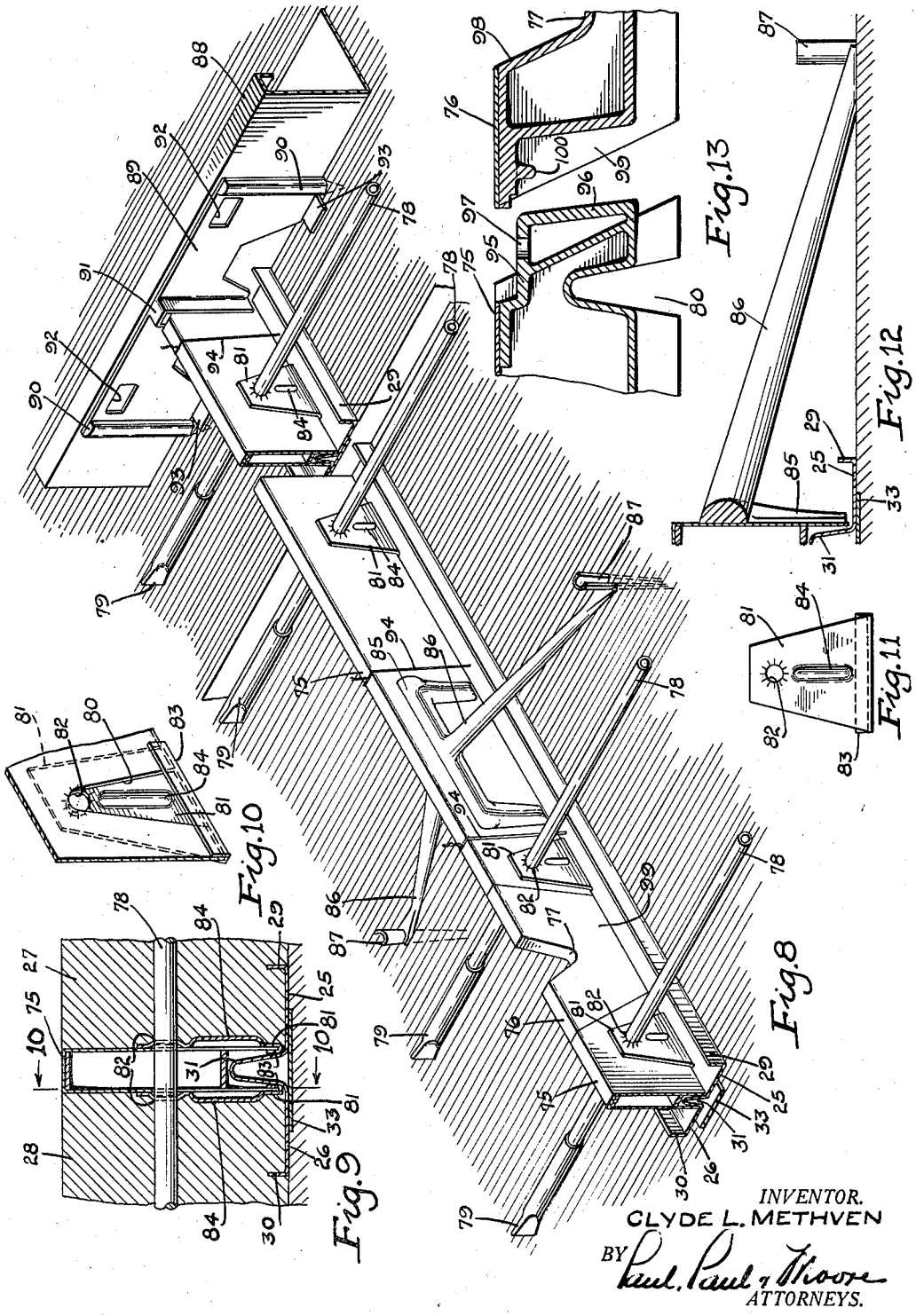


Fig.8

Fig.9

Fig.10

Fig.11

Fig.12

Fig.13

INVENTOR.
CLYDE L. METHVEN
BY Paul, Paul & Moore
ATTORNEYS.

Patented June 8, 1937 2,082,805

UNITED STATES PATENT OFFICE

2,082,805

EXPANSION JOINT CONSTRUCTION

Clyde L. Methven, St. Paul, Minn.

Application May 10, 1933, Serial No. 670,314

2 Claims. (Cl. 94—18)

This invention relates to improvements in the construction of expansion joints for pavements and the like.

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 pre-molded 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 sub-grade below the pavement. In freezing temperatures this moisture freezes into ice lenses in the sub-soil 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 water-tight 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 sub-grade 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 water-tight 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 sub-soil 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 sub-soil 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 sub-soils which may result in permanent deformation of the pavement.

It is the primary object of the present invention to provide an expansion joint with a seal at sub-grade elevation, which will positively exclude the passage of the water through the joint into the sub-grade.

Another object of the invention is to provide a water seal for expansion 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 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.

Still another object of the invention is to provide, in connection with the water seal herein referred to, a removable core mold for expansion joints for providing proper space between adjacent pavement slabs.

A further object of the invention is to provide a removable core mold for producing expansion joint space in pavements which is of simple and durable construction and which may be applied and used in connection with the formation of any of the various designs of joint construction now generally employed.

In addition, the invention aims to provide numerous improvements in details of construction and use of apparatus for forming expansion 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 installation.

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

In the accompanying drawings I have shown several practical embodiments of my invention but it is to be understood that these drawings are 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 these drawings,

Fig. 1 is a fragmentary sectional view through a pavement joint showing the water seal of my invention;

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

Fig. 3 is a fragmentary perspective view, partly in section, showing the water seal construction illustrated in Fig. 2 in combination with a support for pre-molded joint material;

Figs. 4 and 5 are fragmentary sectional views, similar to Figs. 1 and 2, showing modifications of the water seal construction;

Figs. 6 and 7 are fragmentary sectional views through a pavement showing a so-called dummy contraction joint with a water seal of my invention applied thereto;

Fig. 8 is a fragmentary perspective view, partly in section, showing a removable core mold of my invention in combination with my water seal construction;

Fig. 9 is a vertical sectional view through the core mold and water seal shown in Fig. 8;

Fig. 10 is a sectional view taken on line 10—10 of Fig. 9;

Fig. 11 is a front view of a cover plate used in connection with the core mold for covering the openings below the dowel bars;

Fig. 12 is a view, partly in section and partly in elevation showing a core mold support; and

Fig. 13 is a fragmentary sectional view showing a means for interlocking the center section of the core mold with the adjacent end sections.

At the offset, it will be understood that the invention herein to be described and the modifications thereof may be applied to any type of pavement, bridge work, roofing and the like, requiring expansion joints.

Referring now to the drawings, and particularly to Fig. 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 pre-molded mixture of bituminous and fibrous substances. As will be seen from the said Fig. 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 seal herein described it will be impossible for water to find its way through the joint into the sub-soil. Also, it would be impossible for moisture existing in the sub-soil, 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. Additional assurance is afforded because of the marginal flanges which are embedded in the pavement slabs.

In order to prevent the entry of sub-grade 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 Fig. 2 there is shown a modification in which the waterseal 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 Fig. 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 32 which rests on the portions 25 and 26 of the water seal. This structure will be more fully described in connection with description of Figs. 8 and 9. In this case also I have provided a shield 33 which prevents movement of a sub-soil into the loop of the water seal which is located in the space between the adjacent slabs.

In Fig. 3 I have shown the same water seal as that illustrated in Fig. 2. In this case I have indicated a manner of supporting upon the said seal a block or strip of pre-molded bituminous material. Reference numeral 35 indicates a strip of such material which will fill the space between adjacent slabs of the pavement. This pre-molded bituminous material may be supported by means of metal plates 36 which rest upon the water seal and exclude concrete from bonding to and preventing free flexure of said loop 31. The said plates 36 may be provided with punched out tongues 37 which are embedded in the strip 35 so as to securely fasten the same.

It will be noted that the block 35 of bituminous material does not extend to the bottom of the space between the slabs but that it terminates and rests upon the top of the loop 31 of the water seal. This results in a considerable saving of bituminous material in the installation of pre-molded joints.

In Fig. 4 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 40 which is located in the space between adjacent slabs 41 and 42 of the pavement. This water seal is provided with laterally extending portions 43 and 44 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 sub-soil. Here, also I have provided a shield 45 which prevents the sub-soil from entering into the loop 40, thus assuring free flexing movement of the seal.

Fig. 5 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 sub-grade.

Here, again, I have provided a shield 52 for preventing movement of the sub-soil into the loop of the water seal.

In Fig. 6 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 Fig. 6, 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 Fig. 6, 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 sub-soil. 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 sub-soil 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 sub-soil through the crack or crevice 56.

In Fig. 7 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 Fig. 7. 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 sub-soil. 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 66a and 67a in said Fig. 7, the contraction crack or crevice will nevertheless find its place to the seal because the seal locates the weakest cross-section of the pavement.

The foregoing description is directed particularly to various forms of construction of the water seal of my invention. I will now describe how the said seal is arranged in combination with a removable core mold which provides space between adjacent pavement slabs for the formation of an expansion joint.

In Fig. 8 I have shown in perspective and in section an arrangement of a removable core mold in combination with one of the forms of water seal heretofore described. The core mold comprises an inverted U-shaped metal structure of box-like form made up in a pair of end sections 75 and a removable center section 76. The said center section 76 may be secured to the end sections 75 by a suitable interlocking fastening having an extending tenon from the side section into and within the center section permitting upward withdrawal of said center section. When required the center section 76 is provided in its top edge with a substantially V-shaped notch for the purpose of constructing a longitudinal dummy joint in the center of the pavement, usually filled with bituminous material and serving as a traffic lane division mark.

Each of the end sections 75 carries a plurality of dowel bars 78 having sockets 79 at one end thereof. These dowel bars, as is well understood, are left embedded in the pavement and, hence, the core mold must be so constructed as to permit removal of the core while the bars are left in place. To this end, the side walls of the end sections are provided with openings 80 which are covered by plates 81. The said plates 81 have openings 82 therein which are of a diameter slightly less than the diameter of the dowel bars. The edges of said openings are provided with incuts so that when the bars are passed through the said plates they will be held by frictional contact. The lower edges of said plates 81 are provided with bent over flanges 83 which engage under the bottom edges of the core mold. The said plates may be provided with one or more reenforcing ribs 84. This manner of mounting the dowel bars in the sections of the core mold permits removal of the core mold while the dowel bars remain embedded in the pavement. It will be understood that the cover plates 81 also remain embedded in and bonded to the pavement. Since these cover plates are

of inexpensive construction nothing substantial is added to the cost of making the joint.

In order to support the core mold in vertical position during the laying of the pavement and the first striking off operation, I provide a number of braces for each of the end sections 75. These braces comprise a yoke shaped member 85 having a supporting bar 86 which is notched at its outer extremity and rests against a stake 87 driven into the sub-grade. By this arrangement, the core mold is adequately supported in vertical position during the times heretofore stated. After the paving material has been poured, and puddled into place and the preliminary strike off and finishing operations completed, the support 85 may be pulled out, leaving the stake 87 embedded in the sub-grade. This is a very simple operation and is inexpensive because the only material expended is that used in the formation of the stakes 87.

I also provide a means for supporting the core mold at its ends, that is to say at the end adjacent the longitudinal edge of the pavement. In Fig. 8, reference numeral 88 indicates the side form or support for the pavement. 89 indicates an end support for the core mold comprising a plate provided at its edges with stakes 90 welded or fastened securely to said plate and which are adapted to be driven into the sub-grade. In part these stakes support the plate 89 in vertical position, but are particularly intended to resist displacement along the face of the side form during the placement and the striking off of the pavement material.

Substantially centrally of the said plate 89 I have provided an open bottom inverted U-shaped housing 91 which is also open at its front so that the end of the core mold section 75 may be inserted therein and held rigidly in vertical position. The plate 89 is provided with suitable openings 92 into which a tool or the fingers of an operator may be inserted when the plate 89 is to be removed.

In order to prevent the end plate 89 from overturning in extremely soft sub-grade soil I provide a number of scrap metal plates 93 which when slipped under the edge of plate 89 and the bottom of the side form, provides any needed bearing area for support.

It will be understood by those skilled in the art that the core mold of my invention will be assembled in sections before it is laid down in position to form the space required for the expansion joint in the pavement. Each of the end sections 75 is assembled with its dowel bars and cover plates 81 in place and the water seal secured thereto by means of suitable tie wires 94. The end plates 89 are driven into place between the end of the core mold and the face of the side form and thereupon the end sections 75 of the core mold are positioned within the housing or flanges 91 of the said end plates. Then the center section 76 is slipped into place interlocking the adjacent end sections.

In Fig. 13 I have shown a means for interlocking the center section with the end sections of the core mold. The end sections 75 are provided with a casting 95 inserted in the end thereof and held in place by any suitable means. The casting 95 has a tongue 96 and an aperture 97. The metal sides of the center section 76 forms a recess or loop, into which the tongue 96 is adapted to fit. The casting 98 is provided with a lug 100 which is adapted to seat in the aperture 97 in the casting 95. This forms a simple means for locking the sections of the core mold together. Also the parts may be readily separated when the core mold is to be removed.

This being accomplished, the braces 85 are positioned with the extremities of the brace bars 86 resting on the sub-grade. Stakes 87 are then placed in the notches provided in the extremities of the brace bars and driven into the sub-grade. When the concrete or other paving material has been puddled into place and the preliminary strike off and finishing operations completed and while it is still soft, the braces 85 and end plate supports 89 are removed. During all construction operations up to this point, which includes all of the major puddling and casting movements of the paving material with the incidental displacement strains and stresses, the core mold has been rigidly supported in a vertical plane against overturning or displacement from position. After the removable joint braces 85 and end supports 89 are withdrawn, only a surface finishing operation remains, which of itself cannot deform the position of the core mold.

After the initial set of the concrete has occurred the core mold assembly is removed. The center interlocking section 76 is first removed after which the end sections are raised and partially removed. While in this raised position any required edging of the adjacent slab ends is done using the sides of the core mold for a guide. After the edging operations the sections are entirely removed which completes the construction of the expansion joint space or opening. Filling this space with bituminous or other materials follows later.

It will be understood that during the pouring of the paving material, the cover plates 81 prevent the passage of any of this paving material through the openings 80 into the interior of the core mold. These plates are left in place embedded and bonded to the concrete.

The dowel bars are left in place in their proper positions to function in the customary manner.

The water seal band is left in its proper position with its 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.

It will be understood that with very little modification the removable joint braces 85 and end supports 89 may be applied to the installation of any types of pavement joint assembly or material, such use of these devices being covered by this invention.

I claim as my invention:

1. In combination with adjacent slabs of a pavement separated by a joint space, a water seal adjacent the bottom of the joint space comprising a member of flexible material having a bending loop and provided with sharply upturned flanges imbedded in the adjacent slabs of the pavement, and a sealing member underlying the adjacent slabs of said pavement and also said flexible member.

2. In combination with a joint space in pavements formed by the cracking of the pavement to produce separated slab portions, a water seal adjacent the bottom of the pavement comprising a flexible member adapted to yield with movements of the pavement slabs, said member having sharply upturned flanges imbedded in the pavement on each side of the joint space, and a shield underlying the pavement and said member.

CLYDE L. METHVEN.