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Crone

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[54] **JOINT FORMING SEAL ASSEMBLY**

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[51] **Int. Cl.**[2] **E01C 11/02**

[58] **Field of Search** 404/68, 69, 60, 67, 47, 404/49, 50, 51, 48; 52/396, 403; 49/475, 472, 486, 487

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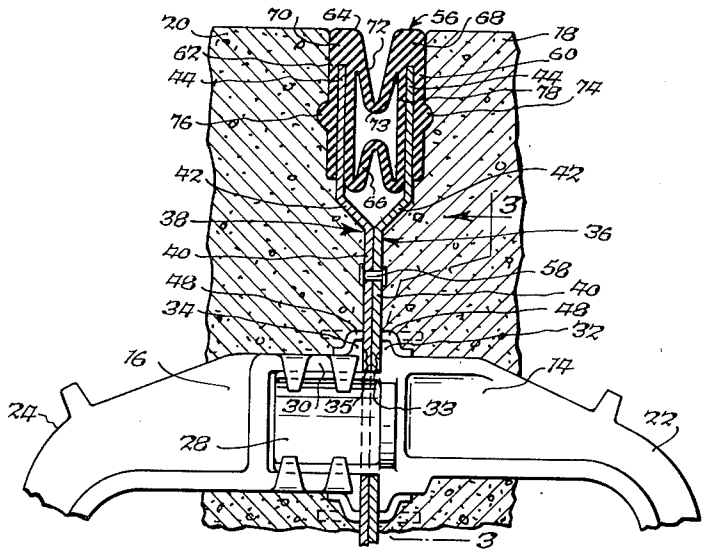
[57] **ABSTRACT**

A sealing member having a pair of opposite side portions mounted on a pair of center plates is installed prior to a pavement pouring operation to form a contraction joint in the surface of the subsequently formed pavement. The center plates are mounted on joint support members for movement therewith upon contraction of adjacent pavement sections to expand the seal and thereafter maintain sealing engagement thereof with the adjacent pavement sections under all conditions of pavement contraction and expansion.

14 Claims, 6 Drawing Figures



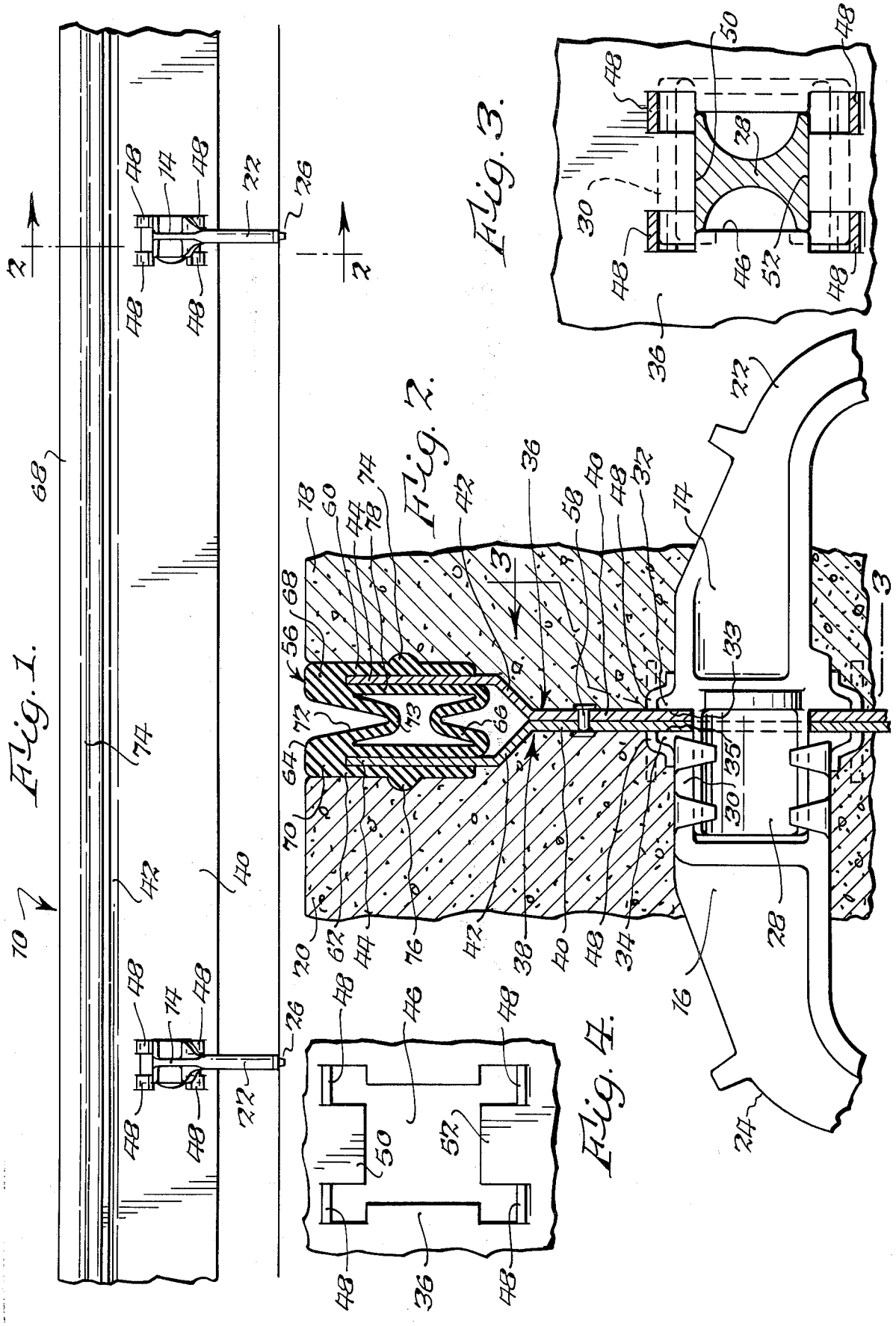


Fig. 1.
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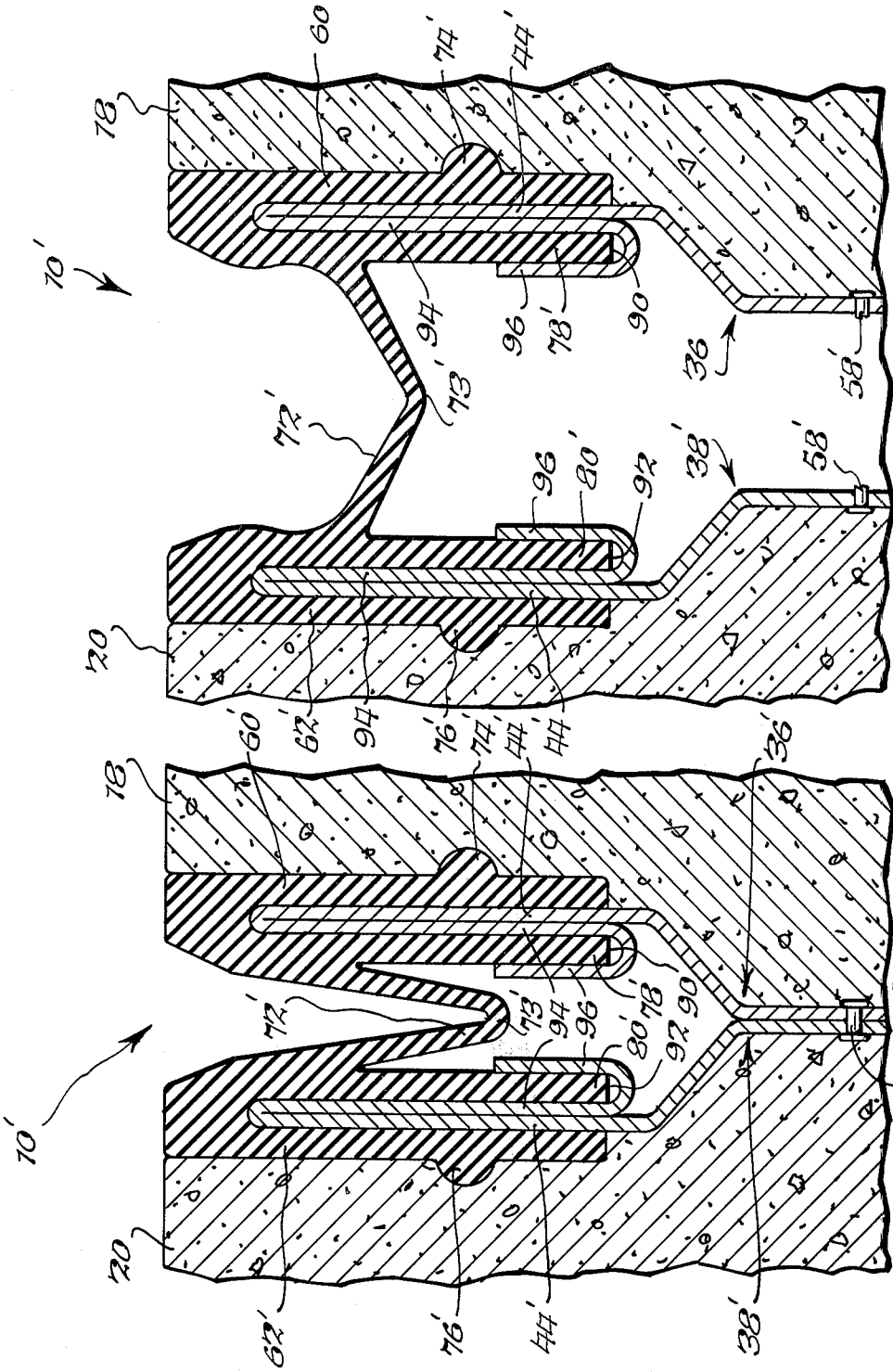

Fig. 6.

Fig. 5.

JOINT FORMING SEAL ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to a joint forming seal assembly and, more particularly, to a combined joint support and seal assembly installed in pavements for connecting adjacent pavement sections and forming an expansion joint therebetween.

In the construction of highways, roadways and the like in which pavement slabs of concrete or other paving materials are used, provision must be made for the expansion and contraction of such slabs due to variations in temperature. Conventionally, grooves are provided between adjacent slabs or sections to accommodate such expansion and contraction, such grooves being sealed to preclude the ingress of liquids, solids and deleterious chemicals. One well known technique of forming these contraction joints is to install a center plate at each location where it is desired to form a contraction joint, the center plate being supported at longitudinally spaced intervals on joint supports which, in turn, are supported on the subgrade. The center plates are embedded in the pavement and extend transversely of the length thereof to induce planes of weaknesses in the pavement in order to control the location of cracks initially caused by the contraction of the pavement as it hardens and thereafter by internal stresses generated in the pavement as a result of temperature variations. After the pavement has been poured and at least partially set, contraction grooves are formed above these plates by sawing through the hardened top surface of the pavement to a predetermined depth. Finally, an elastic sealing strip is inserted within the groove to prevent liquids and solid materials from passing into the grooves. However, the groove must be thoroughly cleaned to remove debris and all the pavement particles accumulated in the groove as a result of the sawing operation prior to the insertion of the seal. Also, the adhesive, when used, must be applied to the opposed faces of the adjacent pavement sections defining the groove prior to positioning the seal in place. The saw cutting, groove cleaning and adhesive applying operations are time consuming and expensive. Moreover, due to human error or inadvertence, the saw cut may be offset or misaligned relative to the center plate thereby causing cracks produced by the groove to migrate away from the desired plane of weakness. Furthermore, the sealing strips employed in the grooves often are provided with an internal structure including cross bars and ribs which are relied upon to provide the necessary pressure sealing against the groove side walls under seal expansion. Sometimes a mechanical interlock is provided between the seal side walls and the groove side walls to provide the same function.

It has been proposed to position seals in place prior to the pavement pouring operation by mounting the seals on support members, in turn mounted on joint supports, such as desclosed in the Crone U.S. Pat. No. 3,324,775. However, reliance is placed on the internal rib structure of the seal, which is inflated, to provide the requisiste pressure sealing against the groove side walls under seal expansion.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to obviate the above disadvantages by providing an improved joint forming seal assembly having means for connecting an elastic sealing member to the joint support members for movement therewith to provide sealing engagement against the adjacent pavement sections under all conditions of pavement contraction and expansion.

It is another object of this invention to provide the foregoing in an assembly which is installed in place prior to the pavement pouring operation to form a contraction joint in the subsequently formed pavement in vertical alignment with a plane of weakness induced in the pavement.

It is a further object of the present invention to provide the foregoing in an arrangement permitting use of a sealing member with a simple internal construction having only a minimal amount of material disposed between the sealing member side portions.

The joint forming seal assembly of this invention is characterized by the provision of a pair of center plates each rigidly attached to a joint support member for movement therewith during pavement contraction and expansion. The upper ends of the center plates are spaced from each other and receive the side portions of a sealing member adhesively secured thereto. This assembly is positioned in place prior to the pavement pouring operation to form a contraction joint in the subsequently formed pavement in vertical alignment above the plane of weakness induced by the center plates. Relative movement of the center plates away from each other during pavement contraction causes the sealing member to expand maintaining the sealing member side portions in sealing engagement against the opposed faces of the adjacent pavement sections at all times.

The foregoing and other objects, advantages and characterizing features of the present invention will become clearly apparent from the ensuing detailed description of certain illustrative embodiments thereof, taken together with the accompanying drawings wherein like reference numerals denote like parts throughout the various views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side elevational view of a portion of a joint forming seal assembly of this invention;

FIG. 2 is a vertical sectional view, on an enlarged scale, taken about on line 2—2 of FIG. 1;

FIG. 3 is a cross sectional view taken about on line 3-3 of FIG. 2;

FIG. 4 is a fragmentary side elevational view of a portion of one of the joint forming center plates incorporated in this invention;

FIG. 5 is a fragmentary vertical sectional view of another form of a joint forming seal assembly of this invention, showing the assembly in its initially installed condition with the sealing member at maximum compression; and

FIG. 6 is a view similar to FIG. 5, showning the joint forming seal assembly in an expanded condition.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

Referring now in detail to the illustrative embodiments depicted in the accompanying drawings, there is shown in FIG. 1 a joint forming seal assembly, generally designated 10, constructed in accordance with this invention and supported at longitudinally spaced intervals on joint supports 12. As shown in FIG. 2, each joint

support 12 comprises a pair of members 14 and 16 adapted to be embedded in adjacent pavement sections 18 and 20 and having curved legs 22 and 24 provided at their lower ends with any suitable means for resting on the subgrade, such as projections 26 (FIG. 1) for example, The upper end of member 14 is provided with an axial extension 28 telescopically received in a socket 30 formed in the end of member 16 for axial movement relative to each other. These joint supports 12 provide for load transmission across the contraction joint and permit contraction and expansion of pavement sections 18 and 20 by means of the telescopic arrangement between extension 28 and socket 30. Members 14 and 16 are provided with flanges 32 and 34 defining abutment shoulders 33 and 35 disposed in an opposed relation for mounting a composite center plate therebetween, as will hereinafter be described.

In accordance with this invention, joint forming seal assembly 10 comprises a pair of opposed center plates 36 and 38 extending lengthwise of the groove to be formed and rigidly secured at longitudinally spaced intervals to joint support members 14 and 16, respectively. Since both plates 36 and 38 are identical in construction, it is believed that a detailed description of only one plate 36 will suffice, it being understood that the same reference characters are used to identify similar parts.

Center plate 36 comprises a strip of material, preferably formed of sheet steel, having a straight, vertically extending lower plate portion 40, an outwardly inclined web portion 42, and a straight upper plate portion 44 laterially offset from lower portion 40 but in substantial parallelism therewith. The lower plate portion 40 of center plate 36 is provided at spaced intervals with a generally rectangularly shaped slot or opening 46 (FIG. 4) adapted to receive socket 30 of joint support member 14. Fingers or tabs 48 are struck out from lower plate portion 40 at the corners of opening 46 and are bent laterally outwardly to extend in a direction generally normal to lower portion 40 as shown in dashed outline in FIG. 2. These struck out portions leave downwardly and upwardly extending tabs 50 and 52, respectively, at the top and bottom of the slot which serve as abutment surfaces against which joint member shoulders 33 and 35 abut in the assembled relation. Center plates 36 and 38 are fastened to their respective joint members 14 and 16 by bending tabs 48 (FIG. 2) over flanges 32 and 34 and staking or otherwise fixedly securing such bent tabs 48 thereto. Thus, center plates 36 and 38 will be moved along with members 14 and 16 during their relative movement upon pavement contraction.

As shown in the assembled relation of FIG. 2, extension 28 of member 14 passes through the aligned openings 46 in plates 36 and 38 into socket 30 of joint member 16. Abutment shoulders 33 and 35 are engaged against the outer faces of center plate tabs 50 and 52 of plates 36 and 38 and the opposed inner faces of plate portions 40 abut each other. The upper plate portions 44 of plates 36 and 38 are spaced from each other for mounting a sealing member, generally designated 56, thereon, such sealing member being at maximum compression when installed, as shown in FIG. 2. One or more shear rivets 58 secures portions 40 of plates 36 and 38 together and is adapted to be ruptured at a predetermined force exerted by pavement contraction urging at least one of the pavement sections away from the other causing relative movement between joint members 14 and 16 and center plates 36 and 38 therewith.

Sealing member 56 preferably is composed of a resiliently yieldable elastomeric material, such as neoprene for example, or any other suitable elastic material having similar properties of durability, sufficient compression and expansion capabilities, high abrasion resistance and capable of withstanding temperature extremes, sunlight, weathering, oxidation and deleterious chemicals. Sealing member 56 is formed of a unitary, one-piece construction by a suitable extrusion process and can be of any length desired. Sealing member 56 can take various outside dimensions to conform to the widths of the grooves in which it is used and can be of any length to accommodate varying widths of pavements.

As shown in FIG. 2, sealing member 56 comprises a pair of vertically extending side walls 60 and 62, a recessed top wall 64, and a recessed bottom wall 66 of an inverted V-shaped configuration. Top wall 64 comprises a pair of side sections 68 and 70 of substantial thickness to increase the resistance to wear caused by vehicular traffic passing thereover and an intermediate V-shaped section or cross bar 72 in the form of a chevron and comprising angularly related portions extending from the inner lower ends of side sections 68 and 70 and converging downwardly to form a downwardly directed knee 73. The U-shaped configuration of cross bar 72 influences downward movement of knee 73 as the straight portions of cross bar 72 move relatively toward each other during seal compression. Side walls 60 and 62 are provided with rounded projections or ribs 74 and 76 formed integral with the outer faces of side walls 60 and 62 and extending lengthwise thereof to provide a mechanical interlock preventing vertical shifting of sealing member side walls 60 and 62 relative to the opposed faces of pavement sections 18 and 20.

A pair of inner walls 78 and 80 extend downwardly from top wall side sections 68 and 70 in substantial parallelism with side walls 60 and 62 and are laterally spaced inwardly relative thereto defining grooves for the reception of the upstanding upper portions 44 of center plates 36 and 38, respectively. The upper ends of inner walls 78 and 80 are connected to the opposite ends of cross bar 72 by means of the thickened side sections 68 and 70. The lower ends of inner walls 78 and 80 project below the ends of side walls 60 and 62 and are formed integral with the opposite ends of bottom wall 66. The opposed faces of walls 60, 78 and 62, 80 are adhesively secured to the opposite sides of center plate upper portions 44 by means of a suitable adhesive which cements sealing member 56 in place on center plates 36 and 38.

A significant feature of this invention is that the entire joint forming seal assembly 10 is assembled and installed as a unit in place on the subgrade prior to the concrete pouring operation. Center plates 36 and 38 are fixedly secured to their respective joint members 14 and 16 by means of tabs 48 for movement therewith. The lower portions 40 of plates 36 and 38 are fastened together in an abutting relation by shear rivets 58 and the side portions of sealing member 56 which are comprised of walls 60, 78 and 62, 80 are adhesively secured to the upper portions 44 of plates 36 and 38 in the manner shown in FIG. 2. In this initially installed condition, sealing member 56 is at maximum compression. After

the joint forming seal assembly **10** is assembled and installed in position, concrete or other suitable paving material can be poured onto the subgrade up to a level substantially flush with the upper surfaces of top wall side sections **68** and **70**. Sealing member **56** is embedded in the pavement with the outer surfaces of side walls **60** and **62** being mechanically sealed to the adjacent pavement sections **18** and **20**. Projections **74** and **76** form a mechanical interlock with the adjoining pavement sections **18** and **20** to prevent relative vertical displacement between the latter and side walls **60** and **62** to further facilitate the retention of sealing member **56** in the contraction groove.

As the pavement cures or hardens, pavement sections **18** and **20** will contract and generate pressures urging center plates **36** and **38** apart. Upon a predetermined pressure, shear rivets **58** will rupture, allowing plates **36** and **38** to be moved apart along with their associated joint members **14** and **16** to expand sealing member **56**. Upon complete curing, sealing member **56** will be in a normally compressed condition somewhat relaxed or expanded from the condition shown in FIG. **2**, and will thereafter expand and contract as pavement sections **18** and **20** contract and expand due to temperature variations. Center plates **36** and **38** provide the plane of weakness to control the areas of crack formations in the pavement and the upper portions **44** thereof together with sealing member **56** form the contraction groove directly above such plane of weakness to accommodate contraction and expansion of the pavement.

The mechanical seal formed between the sealing member side walls **60** and **62** and the opposed faces of pavement sections **18** and **20** during the pavement hardening stage maintains side walls **60** and **62** in sealing engagement with pavement sections **18** and **20** at all times during pavement contraction and consequent sealing member expansion and prevents separation of side walls **60** and **62** from such opposed faces. Also, the upper portions **44** of center plates **36** and **38**, which are moved along with joint members **14** and **16** during relative movement of pavement sections **16** and **18** also serve as reinforcement members for side walls **60** and **62** and assist in maintaining pressure sealing against the pavement sections **18** and **20**. Because of this arrangement, the internal structure of sealing member can be made simple without the necessity of a complex network of cross bars and ribs commonly employed in many seals.

FIGS. **5** and **6** illustrate another form of a joint forming seal assembly **10'** of this invention which is mounted on joint support members **14** and **16** in the same manner as the form of invention hereinbefore described, and the same reference characters primed are used to identify similar elements. Sealing member **56'** differs from sealing member **56** by the deletion of the bottom wall whereby inner walls **78'** and **80'** terminate in free end portions **90** and **92** substantially level with the lower ends of side walls **60'** and **62'**. Also, the V-shaped cross bar **72'** is located further downwardly than cross bar **72** of sealing member **56** and the angularly related straight portions thereof extend from side walls **60'** and **62'** and converge downwardly to form a downwardly directed knee **73'**.

Upper plate portions **44'** of center plates **36'** and **38'** are provided with reversely bent portions **94** contiguous with portions **44'**, respectively, and which are further reversely bent in the opposite direction at their lower ends to form clamping end portions **96**. As shown in FIGS. **5** and **6**, portions **94, 96** define grooves for receiving and clamping the lower ends of inner walls **78'** and **80'** therebetween to insure movement of the latteralong with center plates **36'** and **38'** during contraction of pavement sections **18** and **20**. The lower portions **44'** of center plates **36'** and **38'** are initially connected together in an abutting relation by means of one or more shear rivets **58'**.

FIG. **5** illustrated sealing member **56'** in its maximum compressed condition as initially installed. After the concrete or other paving material has been poured to form pavement sections **18** and **20** and such sections begin to harden, the contraction thereof will generate pressures urging center plates **36'** and **38'** apart. Upon a predetermined pressure caused by the contraction of pavement sections **18** and **20**, shear rivets **58'** will rupture, permitting plates **36'** and **38'** to move away from each other along with their associated support joint members **14** and **16** to expand sealing member **56'**. Upon complete curing of pavement sections **18** and **20**, sealing member **56'** will be in a slightly compressed condition and will thereafter be compressed or expanded upon movement of joint members **14** and **16** and thereby center plates **36'** and **38'** toward and away from each other as pavement sections **18** and **20** expand or contract due to temperature variations. FIG. **6** depicts sealing member **56'** in an expanded condition whereby center plates **36'** and **38'** have been moved apart along with joint members **14** and **16** by contraction of pavement sections **18** and **20**. It should be noted that the sealing member side walls **60'** and **62'** are maintained in sealing relation along their entire depths with the opposed faces of pavement sections **18** and **20**.

From the foregoing, it is apparent that the present invention fully accomplishes its intended objects and provides an improved joint forming seal assembly installed in place prior to the pavement pouring operation to form a contraction joint in the surface of the subsequently formed pavement. By mounting the sealing member side portions **60–68** and **62–80** directly on the upper portion **44** of a pair of center plates **36** and **38**, the sealing member is accurately positioned and the contraction joint is vertically aligned with the plane of weakness induced in the pavement by means of the center plates. Separation of center plates **36** and **38** along with their associated joint support members **14** and **16** during pavement contraction effects expansion of sealing member **56**. These center plates **36** and **38** connect sealing member **56** to the joint support members **14** and **16** to maintain the sealing member side walls **60** and **62**, which are mechanically sealed in the pavement, in pressure sealing engagement against the opposed faces of the adjacent pavement sections at all times and reinforce such side walls to prevent the collapse thereof. Since the sealing member side walls are adequately reinforced by means of center plate upper portions **44**, the internal construction of sealing member **56** can be made very simply without the necessity of a network of compression crossbars and ribs, as is common with conventional seals employed in contraction joints. Projections **74** and **76** on the outer faces of side walls **60** and **62** provide a mechanical interlock with the adjoining pavement sections preventing vertical displacement of side walls **60** and **62** relative to such pavement sections.

Preferred forms of this invention having been disclosed in detail, it is to be understood that this has been done by way of illustration only.

I claim:

1. A joint forming seal assembly for use in a pavement contruction comprising: a pair of movable joint support members adapted to connect a pair of relatively movable adjacent pavement sections; a sealing member comprising an elongated elastic body having side portions engagable against opposed surfaces of said pavement sections; means connecting said sealing member to said joint supports for movement therewith to provide positive pressure sealing of each said side portion of said elastic body against said opposed surfaces of said pavement sections upon relative movement therebetween, said connecting means comprising a pair of center plates, each of said center plates being respectively mounted on one of said joint supports for relative movement therewith and connected to respective side portions of said sealing member, and locking means for locking each of said center plates in fixed position with respect to its respectively associated joint support.

2. A joint forming seal assembly according to claim 1 wherein said center plates have laterally spaced upper portions adhesively secured to said respective side portions of said sealing member.

3. A joint forming seal assembly according to claim 1 wherein each of said side portions is provided with a groove extending upwardly from the lower end thereof and said connecting means include a pair of movable center plates having laterally spaced upper portions inserted in said side portion grooves for supporting said sealing member during compression and expansion thereof.

4. A joint forming seal assembly according to claim 3 wherein each of said sealing member side portions comprises an outer side wall adapted to be sealed to a pavement section and an inner wall spaced inwardly of said outer side wall in substantial parallelism therewith defining said groove.

5. A joint forming seal assembly according to claim 4 including means for adhesively securing the opposite sides of said center plate upper portion to the opposed faces of said outer side wall and said inner wall defining said groove.

6. A joint forming seal assembly according to claim 1 wherein said sealing member is provided with a cross bar spanning the space between said side portions and having opposite ends formed integral therewith.

7. A joint forming seal assembly according to claim 6 wherein said cross bar has angularly related portions converging downwardly forming a V-shaped recess between said sealing member side portions.

8. A joint forming seal assembly according to claim 7 including a bottom wall formed integral with the lower ends of said sealing member side portions and having angularly related portions converging upwardly to form an inverted V-shaped recess disposed between said side portions.

9. A joint forming seal assembly according to claim 1 wherein said sealing member side portions are provided with projections formed on the outer faces thereof intermediate the opposite ends thereof extending lengthwise of said side portions to provide a mechanical interlock with said adjacent pavement sections preventing relative vertical movement therebetween.

10. A joint forming seal assembly according to claim 2 wherein said center plates are provided with lower portions laterally offset from the planes of said upper portions; and means securing each of said center plate lower portions to one of said joint support members for movement therewith.

11. A joint forming seal assembly according to claim 10 including means for initially fastening said center plate lower portions together and rupturable upon a predetermined pressure urging said center plates apart.

12. A joint forming seal assembly according to claim 10 wherein said securing means comprises a plurality of tabs struck out from said center plate lower portions fixedly secured to portions of said joint support members, respectively.

13. A joint forming seal assembly according to claim 2 wherein each of said center plate upper portions comprises a pair of abutting plate portions; one of said plate portions being reversely bent to form a terminal portion engaging the inner face of one of said sealing member side portions.

14. A joint forming seal assembly according to claim 1 including means for initially holding said center plates against separation and rupturable upon a predetermined pressure urging said center plates apart for relative movement away from each other.

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