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EXPANSION JOINT

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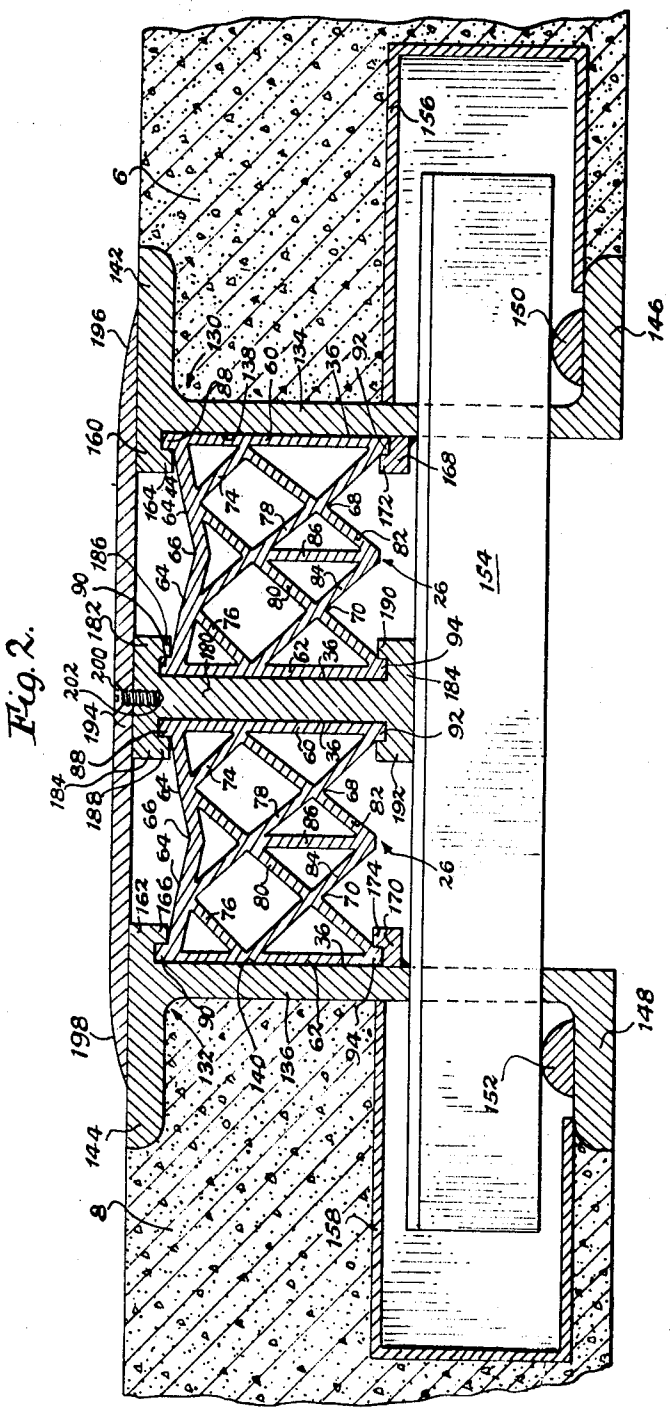

Fig. 2.

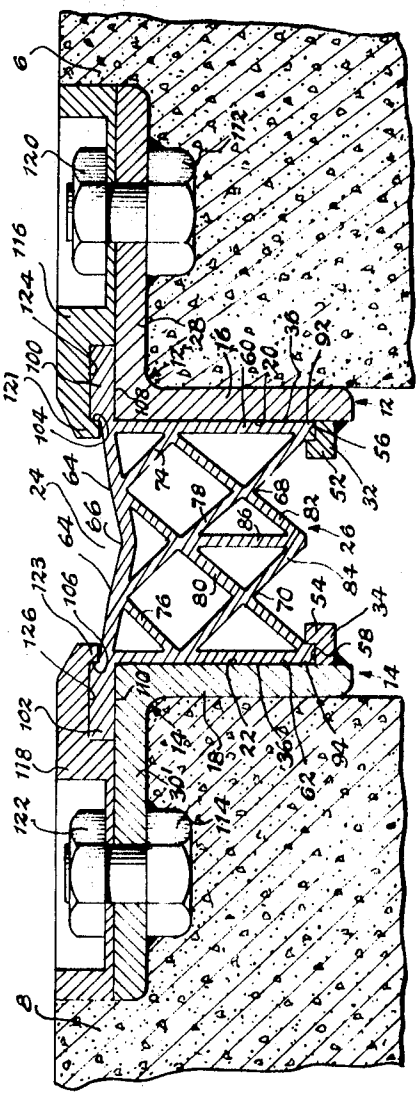

Fig. 1.

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EXPANSION JOINT

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ABSTRACT OF THE DISCLOSURE

An expansion joint comprising a pair of spaced-apart structural means supporting at least one resilient sealing member therebetween. In one form the sealing member has laterally extending projections forming locking lugs at the upper transverse corners thereof received within slots formed in removable clamping means to hold the side walls of the sealing member against opposed faces of the structural means. In a modular arrangement an intermediate structural member is disposed between adjacent sealing members and a wear tread member is secured to such intermediate member and overlies adjacent sealing members.

BACKGROUND OF THE INVENTION

This invention relates to expansion joints and, more particularly, to expansion joints having resilient sealing members disposed in grooves formed between adjacent blocks or slabs of concrete or other building materials.

In highway, bridge and architectural concourse designs formed of concrete or other building materials, grooves are conventionally provided in the pavements at intervals lengthwise thereof between pavement slabs which are exposed to variations in temperature to accommodate expansion and contraction of the material of which the pavement is formed. These grooves must be sealed to prevent water and other deleterious liquid and solid materials from passing into the grooves. Generally, these grooves are sealed by means of hollow, resilient, elastomer strips which can be compressed when the groove is contracted due to expansion of the pavement material and which expand to effectively seal the groove when the same is expanded due to contraction of the pavement material. The sealing strips are usually secured in place by means of a suitable lubricant-adhesive between a pair of spaced-apart structural members which form the side edges of adjacent slabs. One problem encountered in these adhesive bonds is that the material of the sealing strip tends to take a permanent set upon compression and resists expansion during contraction of the slabs to impose tension stresses on the adhesive bond resulting in weakening of the bond and severance of the adhering surface of the strip from its associated support.

SUMMARY OF THE INVENTION

The present invention, as hereinafter described, solves the above problem by providing an improved expansion joint comprising a sealing member having means interlocking with the structural support members of adjacent slabs for movement therewith to preclude strain on the adhesive bond between the sealing member and the angle members.

Generally speaking, the expansion joint of the present invention comprises a pair of spaced-apart structural means supporting an elongated resilient sealing member therebetween. The sealing members each comprise a pair of side walls, a top wall and a bottom wall. An internal truss structure is provided within the confines of the walls of the sealing member and is integrally formed therewith. Extensions forming locking lugs are provided at the upper corners of the sealing member and are received within

cooperable slots formed in the spaced-apart structural means so that the side walls of the sealing member will be pressed and held against and move along with the displaceable structural means. In one form the extensions project laterally for engagement by removable clamping members. In a modular arrangement an intermediate structural member is interposed between a pair of sealing members and carries a tread member overlying the same.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view of an expansion joint of the present invention; and

FIG. 2 is a vertical sectional view of another form of expansion joint of this invention.

DESCRIPTION OF ILLUSTRATED EMBODIMENTS

Referring to the drawings, and particularly to FIG. 1, there is shown an expansion joint installed between concrete slabs **6** and **8** and comprising a pair of angle members **12** and **14** elongated in a direction normal to the plane of the paper and having vertical legs **16** and **18**, respectively, provided with opposed faces **20** and **22** defining a groove **24** therebetween for receiving an elongated, resilient, yieldable monolithic seal, generally designated **26**. Angle members **12** and **14** are adapted to be partially embedded in slabs **6** and **8** as they are poured during construction to form the upper corner edges of said slabs. The term "slab" refers to pavement sections which can be used to cover highways, roadways, bridges, sidewalks and the like and which can be formed of building materials other than concrete.

Stop shoulders, in the form of metal strips **32** and **34**, are suitably secured along the lower ends of faces **20** and **22** as by means of welding for example, for supporting the bottom of seal **26** in correct relation to the groove between adjacent slabs. Strips **32** and **34** also prevent downward movement of seal **26** into the groove below the desired position. Seal **26** is fastened to faces **20** and **22** of angle members **12** and **14** by means of a suitable lubricant-adhesive **36** which, when set, cements seal **26** in place.

Seal **26** is expansible and contractable in width in accordance with variations in the width of the groove caused by contraction and expansion of slabs **6** and **8**. Seal **26** comprises side walls **60** and **62** which are substantially parallel and straight from end to end. The upper portion of side walls **60** and **62** are connected by means of a top wall **64**, the opposite sides of which slope downwardly toward the middle of seal **26** and thus form a depressed middle portion **66** which is so formed that when the sides of seal **26** are pressed toward each other, top wall **64** will fold downwardly into seal **26**. The lower portions of side walls **60** and **62** are connected to inverted V-shaped portions **68** and **70** which are connected together and constitute the bottom wall of seal **26**. The top and bottom walls are integrally formed with the side walls to form a unitary tubular construction having an internal truss structure described below.

The internal truss structure comprises a plurality of diagonally extending cross bars formed integral with the side, top and bottom walls. These cross bars include two short bars **74** and **76** which extend upwardly in converging relation at an angle from opposite side walls **60** and **62**, intersecting top wall **64** at equal distances from the middle portion thereof. Also, a pair of relatively longer, intersecting cross bars **78** and **80** are provided which extend from top wall **64** adjacent the upper ends of short bars **76** and **74** downwardly at an angle to the lower portions of side walls **60** and **62**. Another pair of diagonally extending cross bars **82** and **84** are provided which form a portion of the bottom wall and extend up-

wardly at an angle to side walls 60 and 62, intersecting the same at the lower ends of bars 74 and 76. All the interior cross bars are formed integral with each other and with the walls of seal 26 and exert outward pressure against side walls 60 and 62 when these side walls are pressed toward each other.

An intermediate upright wall 86 is arranged approximately midway of side walls 60 and 62 and extends from the juncture of the lower ends of bars 82 and 84 upwardly to the intersection of cross bars 78 and 80 so that intermediate wall 86 terminates short of top wall 64 and leaves a substantially triangular space between middle portion 66 and intermediate wall 86 into which the inner portions of top wall 64 can fold when side walls 60 and 62 are pressed toward each other during compression of seal 26. Intermediate wall 86 connects the bottom wall of seal 26 with top wall 64 through the upper interconnecting portions of cross bars 78 and 80 so that upward bulging of top wall 64 above the pavement surface is positively prevented. Also, intermediate wall 86 divides the internal truss structure of seal 26 into two groups thereby providing substantially uniform action of both groups and distributes the expansion of seal 26 so that outward pressures exerted by the diagonal bars will be substantially equally applied to both side walls 60 and 62.

A significant feature of the present invention is the provision of means for securing or coupling seal 26 to angle members 12 and 14 in order to insure movement of side walls 60 and 62 with legs 16 and 18 of angle members 12 and 14 as such members are displaced away from each other. Such means comprise a pair of locking lugs 100 and 102 of substantially rectangular shape in transverse section which extend laterally outwardly from the upper ends of side walls 60 and 62 and extend slightly above upper wall 64 to form shoulders 104 and 106. Lugs 100 and 102 have bottom surfaces 108 and 110 overlying and abutting the upper surfaces of horizontal legs 28 and 30 of angle members 12 and 14.

Clamping members 116 and 118 are releasably secured to horizontal legs 28 and 30 by mens of bolts 112 and 114 which extend through openings in legs 28 and 30 and clamping members 116 and 118 and receive nuts 120 and 122 thereon for securing clamping members 116 and 118 to angle members 12 and 14. Clamping members 116 and 118 are provided with flanges 121 and 123 at their free end defining cavities 124 and 126 for receiving lugs 100 and 102. Flanges 121 and 123 bear against shoulders 104 and 106 to urge walls 60 and 62 against opposed faces 20 and 22 during movement of angle members 12 and 14 away from each other.

Also, a pair of depending locking lugs 92 and 94 project downwardly from side walls 60 and 62 of seal 26, in the plane thereof, and extend below the bottom wall of seal 26. Lugs 94 and 96 are received in slots 56 and 58 defined by flanges 52 and 54 provided on strips 32 and 34. Thus, when angle members 12 and 14 are moved away from each other during contraction of slabs 6 and 8, flanges 121, 123, 52 and 54 bear outwardly against the locking lugs 100, 102 and 92, 94 of seal 26 and exert a force thereagainst to urge side walls 60 and 62 in the same direction as moving angle members 12 and 14. Side walls 60 and 62 are accordingly pressed and held against opposed faces 20 and 22 to minimize tension stress in the adhesive bond and prolong the useful life of the expansion joint.

The relatively large width or transverse area of locking lugs 100 and 102 in the direction of lateral expansion of seal 26 reduces the possibility of shearing such lugs. Also, since clamping members 116 and 118 are removable, a worn seal can be readily removed and replaced without having to break up portions of slabs 6 and 8 as would be necessary in a conventional expansion joint.

FIG. 2 illustrates another form of the expansion joint of the present invention comprising a pair of edge channel members 130 and 132 forming the ends of adjacent slabs 6 and 8 and having vertical legs 134 and 136, respectively, provided with opposed faces 138 and 140 defining a groove therebetween for receiving a modular seal arrangement consisting of a pair of laterally spaced seals 26. If desired, more than two seals 26 can be employed within the purview of this invention. Seals 26 are similar to seal 26 of the first form of the invention described with the exception that locking lugs 88 and 90 project upwardly from side walls 60 and 62, in the plane thereof, and extend above top wall 64. Of course, locking lugs 88 and 90 can be identical to that of seal 26 first described and project laterally outwardly from the upper ends of side walls 60 and 62, if desired.

Channel members 130 and 132 have upper legs 142 and 144 flush with the upper surfaces of slabs 6 and 8 and forming the upper edge corners of slabs 6 and 8. Lower legs 146 and 148 extend outwardly from the lower ends of channel members 130 and 132. Bearing blocks 150 and 152 are provided on lower legs 146 and 148 to support a plurality of beams 154 which extend transversely through openings in channel members 130 and 132. Beams 154 are spaced at intervals along the expansion joint. To prevent the entry of material which would interfere with movement of beams 154 on bearing blocks 150 and 152, the end portions of beams 154 are encased within protective containers 156 and 158, secured to the outer faces of vertical legs 134 and 136. Containers 156 and 158 must provide sufficient space to accommodate beams 154 during expansion of slabs 6 and 8. Projections 160 and 162 extend inwardly from the upper ends of legs 134 and 136 toward each other and terminate in downwardly extending flanges 164 and 166 defining elongated slots for receiving the locking lugs of seals 26. Stop shoulders in the form of metal strips 168 and 170 are welded or otherwise fixedly secured to faces 138 and 140 for supporting the bottoms of seals 26. Strips 168 and 170 are provided with upstanding flanges 172 and 174 defining slots for receiving the lower locking lugs 92, 94 of seals 26.

An I-beam member 180 supported on beams 154 is positioned within the groove defined by channel members 134 and 136 and extends longitudinally of said groove. Shoulders 182 and 184 extending laterally outwardly from both sides of beam 180 are provided on the opposite ends of I-beam 180 and have flanges 186, 188 and 190, 192, respectively, defining elongated grooves for receiving the locking lugs of adjacent seals 26 which are positioned between I-beam 180 and channel members 134 and 136, respectively, and fastened thereto by a lubricant-adhesive 36. Of course, more than one I-beam 180 can be employed in the expansion joint depending on the number of seals 26 that are used.

This form of the invention has particular utility in sidewalks and architectural concourses subjected to pedestrian traffic. For this purpose, a wear tread member 194 covers the groove between channel members 134 and 136 and has side portions 196 and 198 which overlie and rest on upper legs 142 and 144 of channel members 134 and 136. The upper exposed surfaces of side portions 196 and 198 are curved downwardly adjacent their outer edges to merge smoothly with upper legs 142 and 144 and preclude any sharp corners or edges that can be hazardous to pedestrian traffic. Tread member 194 can be secured to I-beam member 180 by any suitable fasteners, such as a plurality of countersunk screws 200 received in threaded bores 202 spaced longitudinally along I-beam 180. Member 194 provides a continuous, uninterrupted and safe tread surface while permitting channel members 130 and 132 to slide relative thereto during expansion and contraction of the expansion joint. Also, wear tread member 194 serves as a protective cover for the expansion joint against the entry of solid and liquid foreign materials.

While the illustrated joints are shown only in vertical section, it will be understood that they are in fact elon-

gated, comprising elongated seals **26** of unitary, one-piece construction formed to provide the locking lugs **88, 90, 92, 94, 100** and **102** which extend continuously along the upper and lower side edges of the seal, the seal receiving members **16, 18, 116, 118, 134, 136** and **180** also being elongated and providing continuous lug receiving grooves or slots for anchoring the seals thereto.

As a result of this invention, an expansion joint of a simple and rugged design is provided for sealing grooves provided between pavement slabs in an improved and more efficient manner. Selected forms of this invention having been described in detail, it is to be understood that this has been done by way of illustration only.

What is claimed is:

1. An expansion joint comprising: a pair of spaced-apart structural means each having a vertically extending leg; said vertically extending legs having opposed faces; resiliently yieldable sealing means positioned between said opposed faces and having a top wall and opposite side walls secured against said opposed faces of said legs; projections extending laterally outwardly from the upper ends of said side walls at the juncture of said top wall with said side walls at the juncture of said top wall with said side walls and formed integral therewith; and means detachably secured to said structural means for interlocking engagement with said projections to lock said sealing means thereto.

2. An expansion joint according to claim **1**, wherein said side walls are secured to said opposed faces by an adhesive.

3. An expansion joint according to claim **1** wherein said interlocking means are provided with longitudinal slots for receiving said laterally extending projections.

4. An expansion joint comprising: a pair of spaced-apart structural means each having a vertically extending leg; said vertically extending legs having opposed faces; resiliently yieldable sealing means positioned between said opposed faces and having opposite side walls secured against said opposed faces of said legs; projections extending laterally outwardly from the upper ends of said side walls and formed integral therewith for interlocking engagement with said structural means to lock said sealing means thereto; said sealing means being provided with projections at the lower ends of said opposite side walls; and said structural means having longitudinal slots at the opposite ends of said vertical legs for receiving said projections of said sealing means.

5. An expansion joint comprising: a pair of spaced-apart structural means each having a vertically extending leg; said vertically extending legs having opposed faces; resiliently yieldable sealing means positioned between said opposed faces and having opposite side walls secured against said opposed faces of said legs; projections extending laterally outwardly from the upper ends of said side walls and formed integral therewith for interlocking engagement with said structural means to lock said sealing means thereto; each of said structural means also having a horizontally extending leg; and clamping members detachably secured to said horizontal legs of said structural means; said clamping members having portions defining slots with said horizontally extending legs for receiving said laterally extending projections.

6. An expansion joint according to claim **5** wherein said clamping members have flange portions bearing against inner portions of said laterally extending projections of said sealing means.

7. An expansion joint comprising: a pair of spaced-apart structural members each having a vertically extending leg; said vertically extending legs having opposed faces; at least two laterally spaced-apart resiliently yieldable sealing members each having opposite side walls; at least one intermediate member interposed between said sealing members; said sealing members having means formed integral with said side walls for interlocking engagement with said spaced-apart structural members and said intermediate member; and tread means detachably secured to said intermediate member and overlying said sealing members.

8. An expansion joint according to claim **7** wherein said structural members have horizontallly extending legs and said tread means has side portions abutting said horizontally extending legs of said structural members.

9. An expansion joint according to claim **8** wherein said side portions have exposed surfaces curved toward said horizontal legs of said structural members for smooth merging therewith.

10. An expansion joint according to claim **7**, wherein said sealing member side walls are adhesively secured to said faces and said intermediate member.

References Cited

UNITED STATES PATENTS

3,165,986	1/1965	Hirst	94—18
3,273,473	9/1966	Pare	94—18
3,276,336	10/1966	Crone	94—18
3,394,639	9/1968	Viehmann	94—18
3,396,640	8/1968	Fujihara	94—18
3,435,574	4/1969	Hallock	94—18X
3,447,430	6/1969	Gausepohl	94—18

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