United States Patent

Kerschner

[15] **3,682,053**

[45] **Aug. 8, 1972**

[54] **SEALING MEMBER**

[72] Inventor: **James J. Kerschner**, Buffalo, N.Y.

[73] Assignee: **Acme Highway Products Corporation**, Buffalo, N.Y.

[22] Filed: **Feb. 16, 1971**

[21] Appl. No.: **115,518**

[52] **U.S. Cl.** **94/18**

[51] **Int. Cl.** **E01c 11/10**

[58] **Field of Search** 94/18

[56] **References Cited**

UNITED STATES PATENTS

3,585,910	6/1971	Brown	94/18
3,323,426	6/1967	Hahn	94/18
3,368,464	2/1968	Thorp	94/18
3,218,941	11/1965	Daum	94/18

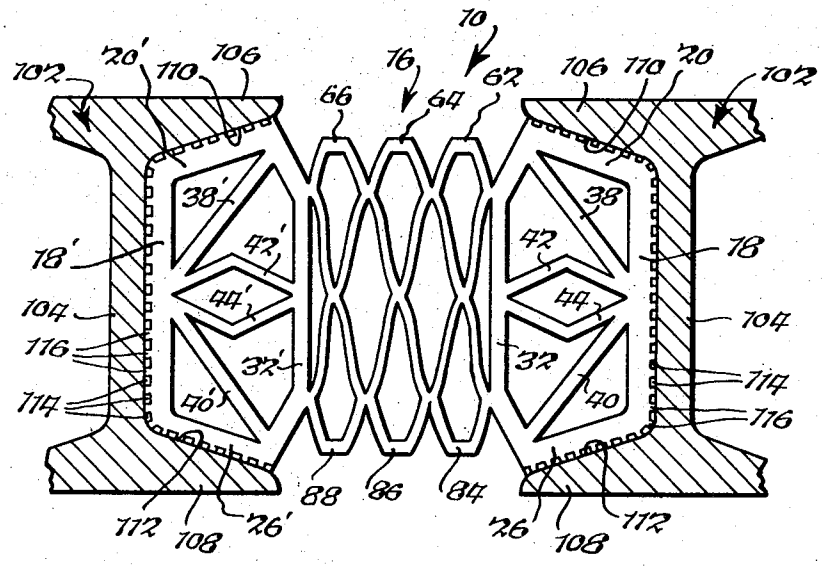
Primary Examiner—Jacob L. Nackenoff

Attorney—Christel & Bean

[57] **ABSTRACT**

An elongated resiliently yieldable sealing member for use in an expansion joint comprising a pair of side sections and a flexible intermediate section interposed between and formed integral with the side sections. The intermediate section has a flexible internal truss structure which is readily compressible and which accommodates movements in various planes while maintaining sealing pressure against adjoining structural members. The outer surfaces of the side sections conform to the flanges of standard structural members.

15 Claims, 6 Drawing Figures



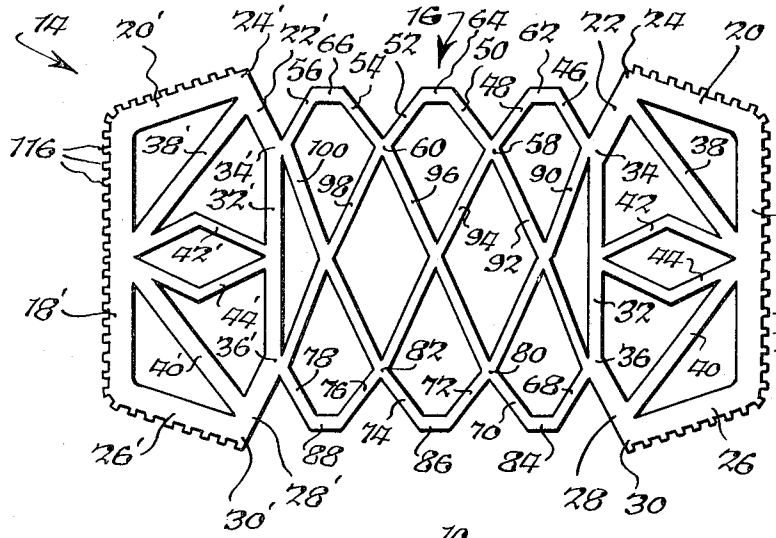


Fig. 1.

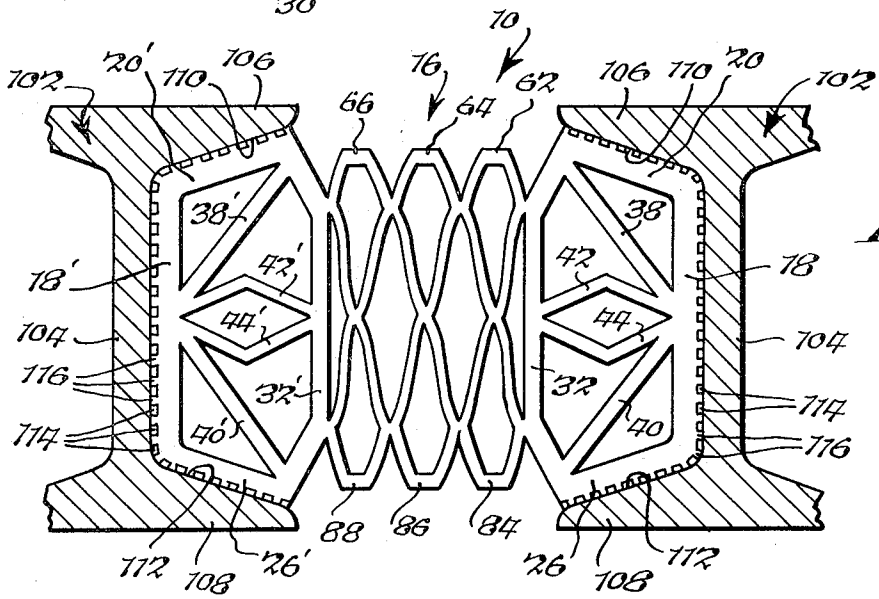


Fig. 2.

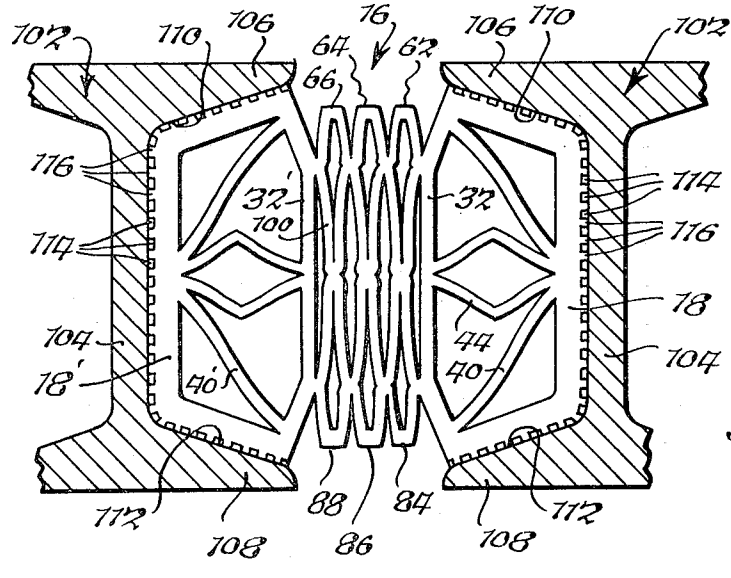


Fig. 3.

INVENTOR.
James J. Kerschner
BY
Christel & Bean
ATTORNEYS.

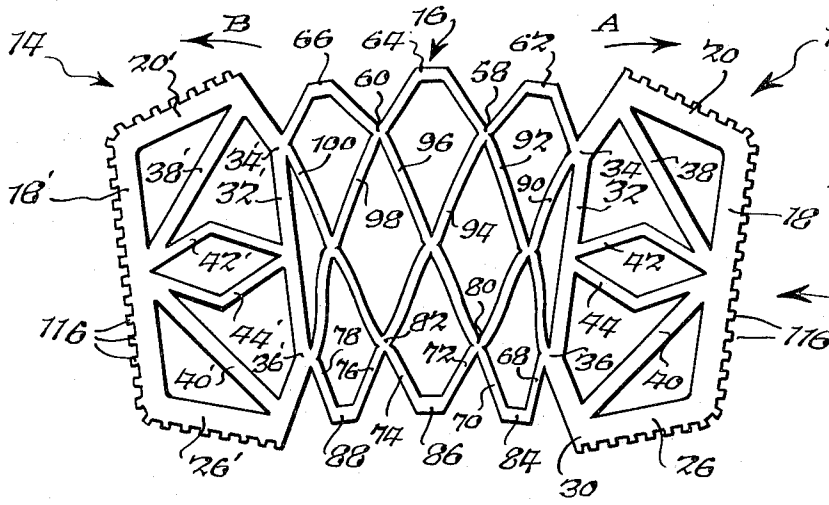


Fig. 4.

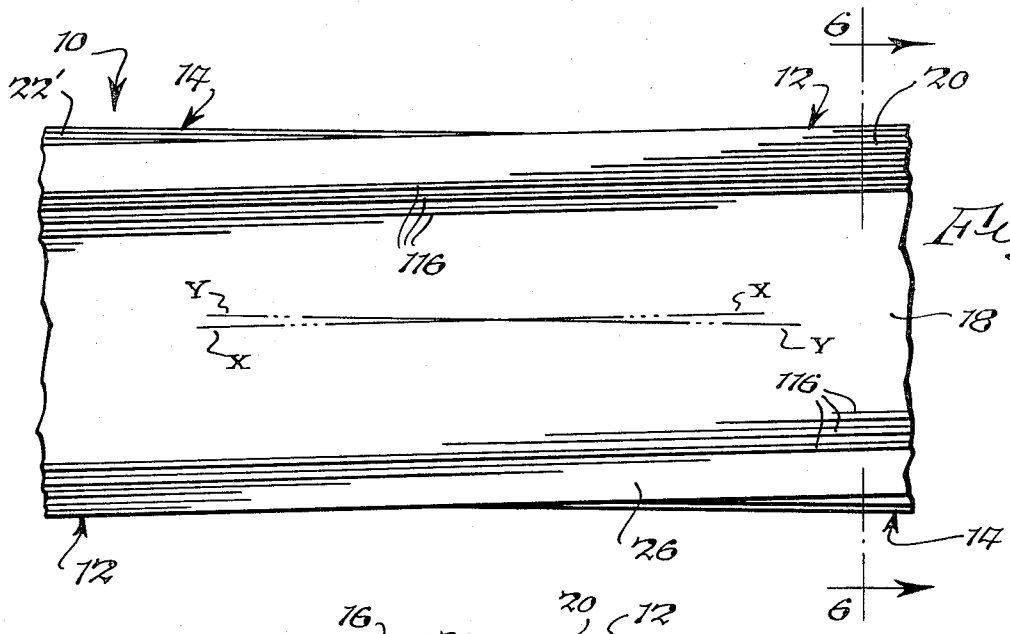


Fig. 5.

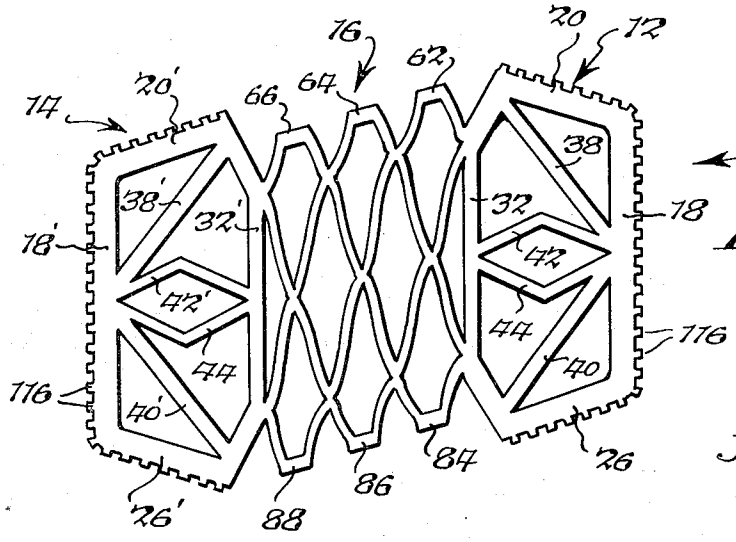


Fig. 6.

INVENTOR.
James J. Kerschner
BY
Christel & Bean
ATTORNEYS.

SEALING MEMBER

BACKGROUND OF THE INVENTION

This invention relates to sealing members and, more particularly, to sealing members employed in expansion joints which are disposed in grooves formed between pavement blocks or slabs.

In the construction of highways, bridges, sidewalks, architectural concourses 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 to accommodate the expansion and contraction thereof. Such grooves are sealed to preclude the entry of liquids and solid particles therein and to prevent such foreign matter from passing through the grooves beneath the pavement. These grooves often are sealed by means of hollow, resilient, elastic strips which can be compressed when the groove is contracted due to expansion of the pavement material and which expand to maintain the groove seal when the groove is expanded due to contraction of the pavement material.

While many such seals are suitable for absorbing normal movement of the adjacent pavement slabs in one plane toward and away from each other, they are not as satisfactory in accommodating various movements of adjacent slabs occurring in different planes as a result of pavement deck loading, vertical deflection and racking of adjacent slabs.

Also, these seals often are mounted in structural members which have been expecially designed or modified to receive them, thereby materially increasing fabrication and installation costs. Sometimes such modification of conventional structural members seriously impairs the strength thereof, whereby either the joint is weakened or larger and more expensive members must be employed to compensate for the loss of strength resulting from the modification.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a sealing member obviating the above deficiencies.

It is another object of this invention to provide an improved sealing member accommodating and facilitating the use of standard structural members in a manner securely retaining the seal in place therebetween.

It is a further object of the present invention to provide the foregoing sealing member with an intermediate section having sufficient flexibility to accommodate movements of adjacent pavement slabs in various planes while maintaining the desired sealing action.

Still another object of this invention is to provide the foregoing in a seal providing a wide range of movement for expansion and contraction.

The sealing member of the present invention is characterized by the provision of a pair of side sections and an intermediate section interposed between and formed integral with the side sections. The intermediate section has a flexible, pantograph configuration which is readily compressible and which facilitates the accommodation by the sealing member of movements in various planes without reducing sealing pressure against the adjacent structural members. The outer surfaces of the side sections conform to the flanges of standard structural members and form a mechanical lock therewith.

The foregoing and other objects, advantages and characterizing features of the present invention will become clearly apparent from the ensuing detailed description of an illustrative embodiment 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 an end elevational view of a sealing member constructed in accordance with this invention, shown in its natural expanded condition;

FIG. **2** is a transverse sectional view of the sealing member of FIG. **1**, shown in a compressed condition between opposed, conventional structural members;

FIG. **3** is a view similar to FIG. **2**, showing the sealing member in substantially a maximum compressed condition;

FIG. **4** is an end elevational view of the sealing member of FIG. **1**, shown in a compressed state and subjected to rotational forces;

FIG. **5** is a fragmentary side elevational view of the sealing member of FIG. **1**, shown subjected to torsional stresses; and

FIG. **6** is a transverse sectional view, taken about on line **6—6** of FIG. **5**.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

Referring now in detail to the drawings, there is shown in FIG. **1** an elongated, resiliently yieldable sealing member, generally designated **10** constructed in accordance with this invention. Sealing member **10** is shown uncompressed in FIG. **1**, prior to assembly with the structural members which form a part of the expansion joint assembly.

Sealing member **10** preferably is composed of a resiliently yieldable elastomeric material, such as neoprene for example, or any other 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 **10** is formed of a unitary, one-piece construction by a suitable extrusion process and can be of any length desired. While sealing member **10** can take various outside dimensions to conform to the width of the grooves in which it is to be used, the width is generally of a greater dimension than the height thereof. Also, it should be understood that although sealing member **10** is especially adapted for use between adjacent pavement slabs of a bridge deck construction, it has general utility in various expansion joint applications such as those employed in highways, sidewalks, airfields, architectural concourses, building structures and the like.

Sealing member **10** comprises a pair of side sections **12** and **14** connected together by an intermediate section **16** extending between and formed integral with side sections **12** and **14**. Side section **12** comprises a straight side wall **18**, the upper end of which is connected to a top wall having a major portion **20** extending inwardly and slightly upwardly at an obtuse angle

from side wall 18 and a minor portion 22 extending inwardly and downwardly at a significantly lesser angle from the outer end of portion 20 and forming a corner 24 therewith. Similarly, the lower end of side wall 18 is connected to a bottom wall having a portion 26 extending inwardly and slightly downwardly at an obtuse angle from side wall 18 and a portion 28 extending inwardly and upwardly at a significantly lesser angle from portion 26 and forming a corner 30 therewith. A generally straight wall 32 in substantial parallelism with side wall 18 is connected at its upper and lower ends to the outer ends of portions 22 and 28, as at junctures 34 and 36, respectively to complete the tubular configuration of side section 12. Intermediate section 16 is joined to side section 12 at these junctures 34 and 36, as will be described.

Side section 12 is provided with an internal truss structure comprising a pair of diagonal bars 38 and 40 extending in a diverging relation from side wall 18 approximately midway between the opposite ends thereof to portions 22 and 28 adjacent corners 24 and 30, respectively. A pair of bent bars 42 and 44 comprising angularly related straight portions forming oppositely directed knees extend from side wall 18 at the intersection of bars 38 and 40 to intermediate wall 32 substantially midway of the opposite ends thereof. These preformed bars 42 and 44 form a diamond shaped configuration and exert pressure against side wall 18 to prevent buckling thereof while permitting inward movement of side wall 32 during compression thereof as will be presently apparent.

Side section 14 is a mirror image of side section 12. Since the configuration of side section 14 is identical to, although opposite from section 12, the same reference characters primed are used to identify corresponding structure.

Intermediate section 16 comprises a corrugated top wall formed, in the illustrated example, of three inverted generally U-shaped sections defined by three sets of upwardly sloping wall or bar portions 46 and 48, 50 and 52, and 54 and 56 spanned at their upper ends by transverse wall portions 62, 64 and 66, respectively. Wall portions 46 and 56 terminate at their lower ends at junctures 34 and 34', respectively and the lower ends of wall portions 48–50 and 52–54 meet at junctures 58 and 60, respectively.

The bottom wall of intermediate section 16 is substantially a mirror image of the top wall thereof and comprises three generally U-shaped sections defined by three sets of downwardly sloping wall portions 68 and 70, 72 and 74 and 76 and 78, the lower ends of which are joined by short, transverse wall portions 84, 86 and 88, respectively. Wall portions 68 and 78 terminate at their upper ends at junctures 36 and 36', respectively and the upper ends of wall portions 70–72 and 74–76 meet at junctures 80 and 82, respectively.

Intermediate section 16 is provided with an internal truss structure comprising a plurality of cross bars arranged in generally a pantograph pattern. These cross bars include a pair of intersecting diagonally extending cross bars 90 and 92 extending downwardly at an angle from junctures 34 and 58 to junctures 80 and 36, respectively, and interserting midway intermediate their opposite ends. Another pair of cross bars 94 and 96 extend downwardly at an angle from junctures 58 and 60 to junctures 82 and 80, respectively and intersect midway between their opposite ends. A third pair of cross bars 98 and 100 extend downwardly at an angle from junctures 60 and 34' to junctures 36' and 82, respectively and intersect midway between their respective opposite ends.

In use, sealing member 10 is mounted between a pair of spaced structural members 102 (FIG. 2) having webs 104 and flanges 106, 108 at the opposite ends of webs 104, respectively. These structural members can be edge channels anchored to the opposed upper edges of spaced pavement slabs for accommodating a single sealing member 10, or can extend longitudinally in the expansion groove between adjacent, laterally spaced sealing members 10 in a composite sealing joint assembly. In either case, it is a particular feature of my invention that these structural members are conventional, the flanges 106 and 108 thereof having the outwardly flared surfaces 110 and 112 customarily found in I-beams and/or channels. The angle of inclination of wall portions 20, 20', 26 26' of sealing member 10 is such that they are complementary to flared surfaces 110 and 112 and conform therewith to provide a tight fit therebetween.

Sealing member 10 is adhesively secured to the webs and flanges of members 102 by means of a suitable lubricant-adhesive 114 which not only cements sealing member 10 in place but also facilitates insertion thereof between structural members 102. To carry the lubricant-adhesive into place, side walls 18, 18' and wall portions 20, 20', 26 and 26' can be provided with longitudinal ribs 116 on the exterior surfaces thereof defining a multiplicity of grooves extending lengthwise of sealing member 10. Prior to mounting sealing member 10 between structural members 102, lubricant-adhesive 114 is applied to the exterior surfaces of side sections 12 and 14 and is retained or trapped within the grooves between ribs 116 as shown in FIGS. 2 and 3.

FIG. 2 illustrates sealing member 10 in a compressed state caused by relative movement of structural members 102 toward each other. As sealing member 10 is compressed to the condition shown in FIG. 2, substantially only the intermediate section 16 is collapsed while side sections 12 and 14 substantially retain their original configurations. The bars comprising intermediate section 16 bend and fold, permitting side sections 12 and 14 to move with members 102 toward each other. The angularly bent bars 42, 44 and 42', 44' comprising the diamond-shaped formations exert reaction forces laterally between side walls 18, 18' and walls 32, 32', respectively, to prevent the latter from buckling while reinforcing the sealing action of the former, and these forces increase as compression of sealing member 10 continues. Also, diagonal bars 38, 38', 40 and 40' offer support to wall portions 22, 22', 28 and 28' and exert upward forces against corners 24, 24', 30 and 30' to prevent them from rolling away from the surfaces 110 and 112 of flanges 106 and 108, respectively. This latter action also presses wall portions 20, 20', 26 and 26' against flange surfaces 110 and 112 further increasing the sealing pressures at these surfaces. As illustrated in FIG. 2, the intermediate section 16 folds uniformly, spacing bars 62, 64 and 66 and 84, 86 and 88 apart at substantially equal distances.

FIG. 3 illustrates the condition of sealing member 10 under substantially maximum compression. The bars forming intermediate section 16 are collapsed or folded partially against each other with the upper and lower bars 62, 64 and 66 and 84, 86 and 88 closely spaced at substantially equal distances. The internal truss structures of the opposite side sections 12, 14 are only somewhat collapsed.

While diagonal bars 38, 38', 40 and 40' bend or collapse slightly upon maximum compression of sealing member 10 as illustrated in FIG. 3, they offer sufficient support and rigidity to wall portion 22, 22', 28, 28' to enable the same to maintain corners 24, 24', 30 and 30' and sloping wall portions 20, 20', 26 and 26' firmly engaged against their associated flange surfaces. It will be noted that, while not as thick as walls 18, 18', 20, 20', 22, 22', 28 and 28', bars 38, 38', 40 and 40', like walls 32 and 32', are thicker than the walls and bars of the intermediate section. The diamond shaped formations consisting of bars 42, 44 and 42', 44', respectively, deform slightly upon maximum compression of sealing member 10 but exert reaction forces against their respective side walls 32 and 32' to prevent buckling thereof, thereby maintaining the integrity of the side sections and confining the folding action substantially to the intermediate portion 16. The angular bends or knees in these bars control the direction in which such bars will bend. As shown in FIG. 3, the intermediate portions of these bars of each diamond shaped formation tend to move apart, thus shortening their span between side walls 18, 18' and walls 32, 32', and in addition to controlling the direction of bending, such knees facilitate folding of bars 42, 44, 42' and 44' under predetermined compression forces, thereby reducing the maximum reaction force generated by the seal while ensuing the collapsing of the side sections only upon full compression of the intermediate section.

The configuration of intermediate section 16 constitutes an important feature of the present invention in that it enables sealing member 10 to be compressed to approximately 50 percent of its original or uncompressed width, as opposed to prior known sealing elements which are compresible to only about 40 percent of their original widths under maximum compression conditions. Also, the intermediate section bars fold evenly whereby intermediate section 16 is not displaced above or below corners 24, 24' and 30, 30', respectively. It will be observed that the intermediate section 16 of seal 10 comprises a series of seal portions (three in the illustrated embodiment) which are connected to adjacent seal portions and to the side sections only at spaced, upper and lower points of pivotal connection 34, 34', 36, 36', 58, 60, 80 and 82. In addition to a highly desirable folding action, this arrangement offers other advantages.

For example, seals, particularly those used in bridge spans, are subjected to various forces and stresses other than those caused by expansion and contraction of the pavement slabs due to temperature variations. Loads applied to the span effect rotation of the adjacent edges of the pavement sections and consequently, rotation of the opposite ends of sealing member 10 in the directions indicated by arrows A and B in FIG. 4. The sealing member of the present invention is especially adapted to accommodate such rotational movement without loss of sealing effect because of the symmetrical, accordian like arrangement of intermediate section 16 with its spaced points of pivotal interconnection. As shown in FIG. 4, the upper portion of intermediate section 16 expands while the lower portion contracts. Pivoting movement is effected about junctures 34, 34', 58 and 60 for the upper portion and about junctures 36, 36', 80 and 82 for the lower portion of intermediate section 16. Intersecting cross bars 90, 92, 92, 96, 98 and 100 react differently above and below their respective intersection. Of course, with rotational movement applied to the opposite lower ends of sealing member 10, an opposite reaction would occur whereby the lower portion of intermediate section 16 would expand and the upper portion contract. As a result of this flexibility of intermediate section 16, the stresses acting on portions 20, 20' 26 and 26' tending to pull them away from their respective adhering surfaces 110 and 112 are materially reduced, thus insuring sealing pressure therebetween.

As shown in FIGS. 5 and 6, sealing member 10 also is particularly adapted to accommodate torsional forces applied thereto causing one side of sealing member 10 to be displaced vertically relative to the other side. This relative deflection of one side to the other alternates along the length of sealing member 10, as indicated in FIG. 5, the longitudinal axis of side section 12 being indicated X—X and the longitudinal axis of side section being indicated Y—Y. FIG. 6 illustrates side section 12 displaced or deflected above side section 14 with intermediate section 16 somewhat compressed and extending upwardly from section 14 to section 12. Due to the flexibility and symmetrical configuration of intermediate section 16, upper bars 62, 64 and 66 lie generally in a common plane at an angle to a horizontal plane cut through the longitudinal axis of sealing member 10 and lower bars 84, 86 and 88 lie generally in a common plane parallel to the top bar plane. While side sections 12 and 14 have been deflected vertically relative to each other, they remain substantially in their true upright positions without any pivotal movement about their longitudinal axis. Thus, any torsional forces applied to sealing member 10 are not effective to displace portions 20, 26 and 20', 26' of side sections 12 and 14 away from the adjoining surfaces 110, 112, respectively, of structural members 102.

From the foregoing, it is seen that the present invention fully accomplishes its intended objects and provides an improved sealing member having a pair of side sections and a flexible intermediate section interposed between and formed integral with the side sections for providing sealing pressure in an improved and more efficient manner. The flexibility of the intermediate section with its pivotal connections between the sealing portions thereof and with the side sections enables the sealing member to accommodate the various movements imparted to the adjacent pavement slabs as a result of temperature variations, pavement deck loading and torsional stresses inherent in elongated spans. The outer surfaces of the side sections conform to conventional structural members providing a mechanical lock therewith which is reinforced upon compression of the intermediate section, and which is not adversely affected by movement of the intermediate section. The side sections are of thicker outer wall form than the intermediate section and are provided with internal truss

structures to prevent buckling during compression and to prevent displacement of the sealing member outer edges away from their adjoining structural surfaces. Whereas heretofore it was the practice to cut down a standard I beam or otherwise especially fabricate the structural members, the seal of my invention is adapted to fit standard structural I beams without modification, and where this results in a beam flange of increased width that is offset by the greater compressibility of the seal. The symmetrical design of sealing member **10** insures equal sealing pressure along both side walls **18** and **18'**.

A preferred form of this invention having been disclosed in detail, it is to be understood that this has been done by way of illustration only. Also, the terms upper, lower, top, bottom and the like have reference to the illustrated embodiment and are not used in a limiting sense.

I claim:

1. A sealing member comprising: an elongated, elastic body having a pair of side sections and an intermediate section interposed between and formed integral with said side sections, said intermediate section comprising a plurality of cross bars intersecting intermediate the opposite ends thereof and collapsing upon movement of said side sections toward each other during compression of said body, each of said side sections comprising a tubular structure and an internal truss structure for increased relative rigidity preventing substantial buckling thereof until said intermediate section is substantially fully collapsed.

2. A sealing member according to claim **1** wherein said intermediate section cross bars provide a pantograph arrangement

3. A sealing member according to claim **1**, wherein each of said side sections has a pair of side walls joined at the opposite ends thereof to top and bottom walls to form a tubular structure, said internal truss structure of each of said side sections comprising a pair of angularly related bars forming a diamond shaped configuration and extending between said side walls intermediate the opposite ends thereof.

4. A sealing member according to claim **1** wherein said side sections have top and bottom walls each comprising a pair of sloping portions joined together to form a corner.

5. A sealing member according to claim **4** wherein said side sections also have inner and outer side walls, said internal truss structure of each of said side sections including a pair of diagonal bars extending inwardly in diverging relation from said outer side wall intermediate the opposite ends thereof and joined to said top and bottom walls, respectively, adjacent said corners.

6. A sealing member according to claim **1** wherein said side sections have outer side walls and top and bottom wall portions extending inwardly in diverging relation from said outer side walls adjacent the opposite ends thereof to fit standard structural members and form a mechanical lock therewith.

7. A sealing member according to claim **6** wherein the exterior surfaces of said outer side walls and said top and bottom wall portions are provided with means for retaining and trapping an adhesive applied to said exterior surfaces.

8. A sealing member according to claim **1**, wherein said intermediate section is joined to said side sections at spaced points.

9. A sealing member according to claim **1** wherein said intermediate section comprises a corrugated top wall and a corrugated bottom wall joined at the respective opposite ends there of to said side sections.

10. A sealing member according to claim **9** wherein said interconnecting cross bars of said intermediate section extend from said corrugated top wall downwardly to said corrugated bottom wall, adjacent pairs of said cross bars being interconnected adjacent their opposite ends, and the outermost pairs thereof being connected adjacent their outer ends to said side sections to form a collapsible pantograph arrangement.

11. A sealing member according to claim **1**, wherein said side sections comprise outer side walls, top and bottom walls having major portions extending inwardly in diverging relation from opposite ends of said outer walls and minor portions extending inwardly in converging relation from the outer ends of said major portions thereof, and inner side walls generally parallel to said outer side walls interconnecting the outer ends of said minor top wall portions, said side, top and bottom walls defining said tubular structures.

12. A sealing member according to claim **11**, wherein said major and minor portions of said top and bottom walls form corners at the junctures thereof, and wherein said internal truss structure of each of said side sections includes a pair of diagonal bars extending inwardly in diverging relation from said outer side wall intermediate the opposite ends thereof to said top and bottom walls adjacent said corners.

13. A sealing member according to claim **12**, wherein said internal truss structure of each of said side sections includes angularly related bars extending between said side walls and jointed thereto intermediate the opposite ends thereof, said angularly related bars forming a diamond shaped configuration.

14. A sealing member according to claim **11** wherein the outermost ends of the outermost pair of said intermediate section cross bars are connected to said side structure adjacent the outer ends of said minor portions thereof.

15. A sealing member according to claim **11** wherein said intermediate section cross bars provide a pantograph arrangement connected to said side sections adjacent the junctures between said inner side walls and said minor wall portions.

* * * * *