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Brown

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[54] PAVEMENT JOINT SEAL

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Related U.S. Application Data

[63] Continuation of Ser. No. 787,108, Dec. 26, 1968, abandoned.

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

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

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

[56] **References Cited**

UNITED STATES PATENTS

3,276,336	10/1966	Crone	94/18
3,395,627	8/1968	Barton	94/18
3,595,141	7/1971	Boney et al	94/18

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[57] **ABSTRACT**

Elongated, hollow elastomer seals particularly useful for sealing concrete pavement contraction joints or longitudinal joints and embodying an elongated, concave top wall, a substantially flat or V-shaped, elongated bottom wall, substantially flat, elongated side walls and an internal web structure consisting essentially of a longitudinally elongated, vertical web joined at its longitudinal edges with and extending between said to and bottom walls substantially midway between said side walls and a pair of longitudinally elongated, diagonal webs extending transversely diagonally downwardly from the upper portion of the vertical web to respective lower portions of said side walls.

2 Claims, 3 Drawing Figures

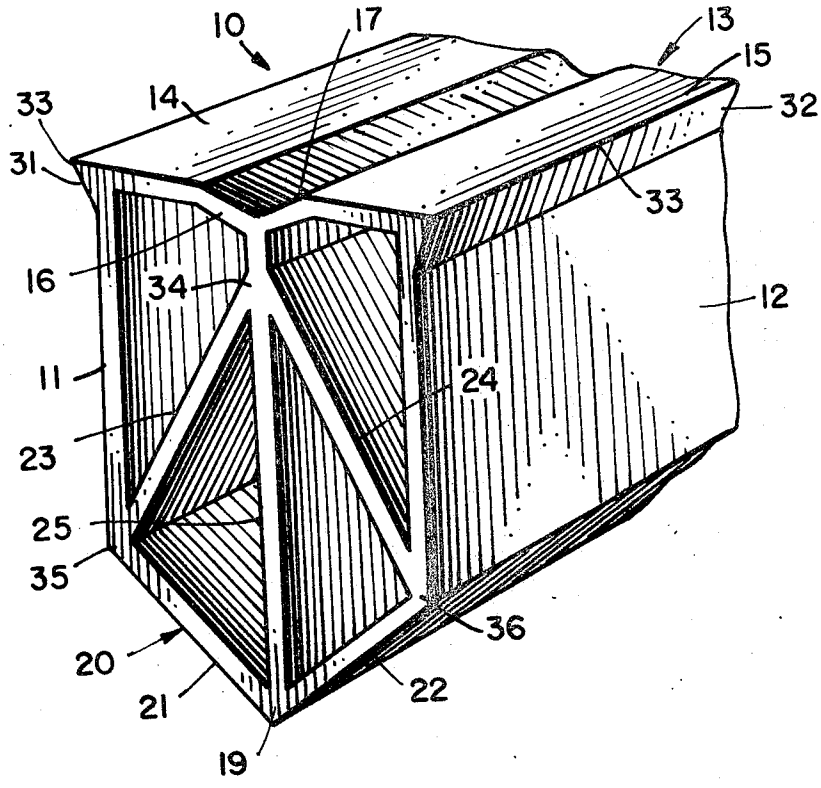


FIG. 1

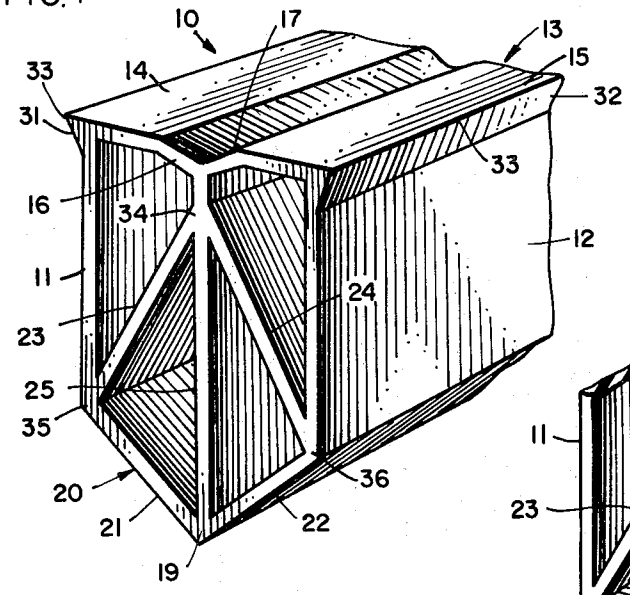


FIG. 3

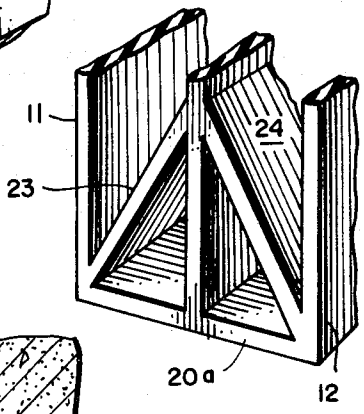
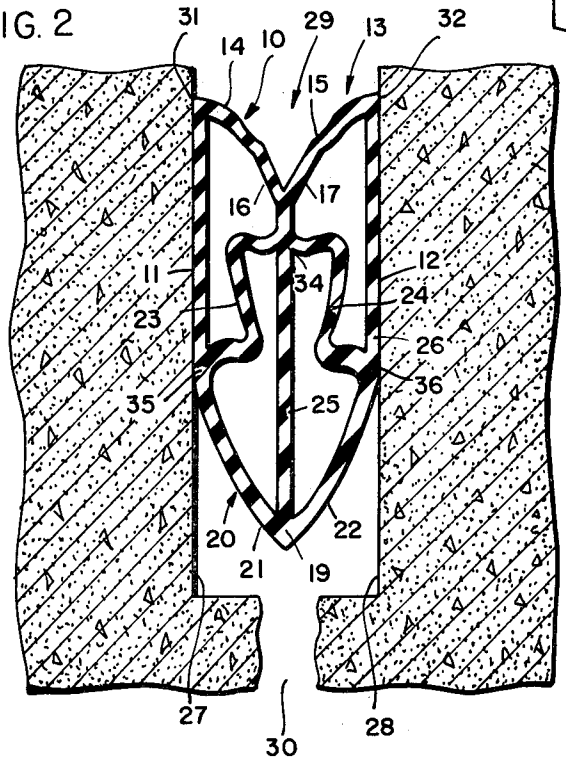


FIG. 2



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PAVEMENT JOINT SEAL

This application is a continuation of Ser. No. 787,108 filed Dec. 26, 1968, and now abandoned.

BACKGROUND OF INVENTION

This invention concerns seals for joints in pavements and is particularly adapted for use in contraction joints and longitudinal joints. Such joints have a relatively narrow width dimension and a relatively small amount of movement, i.e., the distance between minimum and maximum opening of the joint due to contraction and expansion of the concrete pavement. Longitudinal joints generally have even less movement than do contraction joints.

In recent years, hollow, elongated, elastomer strips have been developed for use as seals in concrete joints such as expansion and contraction joints in concrete roadways, air strips, and the like. These joint seals are inserted in a laterally compressed state into the joints to seal them against intrusion by water, solids and the like. The sides of the joint seal strips are in tight, sealing contact with the side walls of the slots or grooves forming the joint.

Joints of the aforesaid character are used in concrete pavement or similar concrete structures to permit expansion and contraction of a given length of the concrete under varying temperature conditions. Expansion joints, which extend transversely across roadways at predetermined intervals, are wide enough to accommodate the lineal expansion of a pavement under warmer climate conditions. Transverse contraction joints control random cracking by creating transverse lines of weakness and are usually formed by a spacer member which is inserted between adjacent pavement sections before or after the concrete it poured, or by sawing a groove across a continuous strip of pavement, usually after the concrete has taken its initial set.

Expansion joints are formed crosswise of a pavement or highway the full depth of the slab for compensating for expansion of longitudinally extending pavement sections. Contraction joints are usually about one-fourth the depth of the slab. Longitudinal joints are formed between longitudinal strips of pavement, for example, of a two or more lane highway. The major function of longitudinal seals is to prevent foreign material from entering the joints between the side-by-side longitudinal strips or lanes of pavement.

It is desirable that all such joints be sealed in order to prevent accumulation of unwanted particles such as sand, gravel, or other incompressibles from entering the open joint, filling the joint and thereby preventing the joint from closing upon expansion of the concrete in warm weather. Joints are also sealed to prevent infiltration of water, the freezing of which in cold weather can be responsible for heaving and cracking of the pavement or damage to the joint. In warm weather, water entering the joint can be responsible for washing away and erosion of the subgrade.

It has been standard practice for many years to fill such joints with an asphalt or similar type of caulking filler which would yield during warm weather when the width of the joint becomes smaller due to expansion of the adjacent pavement lengths. Joints having such filling materials must be repaired and replaced periodically and normally require inspection and repairs at 6

month intervals. Caulking type fillers have several other disadvantages, a major one of which is that appreciable amounts thereon are squeezed out of the joints in warm weather when the joints are most closed and the sealing of the joints is lost when they open in colder weather.

Contraction joint and longitudinal joint seals heretofore known include elongated, elastomer seals having longitudinally elongated top, bottom and side walls of the general arrangement herein described. One type of prior joint seal is described and illustrated in U.S. Pat. No. 3,179,026, wherein the internal truss structure embodies a lower set of diagonal webs extending between side walls in an X-arrangement and an upper set of diagonal webs extending from the midpoint of the V-shaped upper wall diagonally outwardly to the side walls. Such known elastomer seals are useful for the sealing of contraction joints and may also be used for the sealing of longitudinal joints. Another type of known internal web structure for contraction joint seals embodies two webs, one of which is a vertical web extending approximately medially between the side walls from the top wall to the bottom wall and the other of which is a horizontal web or shallow V-web extending between the side walls and intersecting the vertical web. These webs form an internal structure having the general shape of a cross. Still another type has an internal web structure consisting of a pair of downwardly diverging diagonal webs extending respectively from the longitudinal mid-portion of a V-shaped top wall to the lower edges of the side walls. Elongated elastomer seals heretofore known, useful in sealing joints having more movement than contraction or longitudinal joints, e.g., expansion joints and bridge joints, include seals of the type illustrated in U.S. Pat. Nos. 3,358,568 and 3,276,336.

BRIEF DESCRIPTION OF THE INVENTION

Briefly, the present invention concerns joint seals of the type particularly useful in the sealing of contraction and longitudinal joints in concrete pavement. The subject seals are characterized by a minimum of webs forming the internal web structure without serious sacrifice to the lateral, outward thrust of the side walls of the seals against the side walls of the joint when the seal is in a laterally collapsed state. It is important that such lateral thrust be maintained throughout the entire range of movement of the joint to maintain the sealing of the joint against intrusion of water, ice or snow and dirt or other incompressible solids. The most critical period for maintaining such sealing of the joints is the period from late fall through early spring, at which time the joints have opened to the greatest degree. Intrusion of water into the joint during such time in a warm or thawing spell followed by freezing of the intruded water and subsequent expansion thereof can adversely affect the joint by the expansion pressures created. The intrusion of dirt or other incompressible solids into the joint can ultimately result in a packing of the joint with incompressible solids which then preclude joint movement as the joint begins to close during the period of later spring through early fall. If the joint is unable to move, the pavement sections may become sufficiently stressed so as to cause heaving or random cracking of the pavement slabs.

The subject elongated, hollow elastomer seals have longitudinally elongated top, bottom and side walls defining a hollow, tubular-like elastomer member adapted to be laterally compressed and inserted in the laterally compressed state into joints of the character above described. The lateral or outward thrust of the side walls of the seal against the side walls of the joint is increased by an elastomer internal web structure functioning in coaction with the top, bottom and side walls to provide lines of increased localized thrust along the upper and lower edges of the side walls against the side walls of the joint. The internal web structure of the subject seals consists essentially of a longitudinally elongated, vertical web joined at its longitudinally edges with and extending between the top and bottom walls substantially midway between the side walls and a pair of longitudinally elongated, diagonal webs extending transversely diagonally downwardly from the upper portion of the vertical web to the respective lower portions of said walls. The bottom wall is a substantially flat or V-shaped wall. The lower, longitudinal edge of the vertical web is joined with the V-shaped bottom wall at the apex of the V or the longitudinal mid-line of the flat bottom wall. Upon lateral collapse of the seal in a joint, the apex of the V or said mid-line moves downwardly and pulls the vertical wall and (through the latter wall) the longitudinal midportion of the top wall downwardly with the result that the top wall collapses inwardly into a concave configuration, preferably substantially a V shape.

The top wall of the seals herein may be substantially flat or more preferably has a shallow V configuration along the longitudinal midportion thereof. If desired, the entire top wall may have a shallow V configuration. Furthermore for purposes of effecting a better seal of the upper, longitudinal edges of the side walls with the side walls of the joint, these upper longitudinal edges may have a small, laterally projecting, preferably substantially sharp-edged lip, each of which provides a relatively sharp, longitudinal line of localized lateral thrust against the side walls of the joint along the respective upper corners of the seal. The subject seals have, among others, the advantage of capability of being laterally compressed for insertion into pavement joints without tendency to twist. Therefore, the respective upper longitudinal edges remain even when the seal is laterally collapsed.

DESCRIPTION OF THE DRAWING

A preferred embodiment of the invention is illustrated in the drawing wherein:

FIG. **1** is a perspective view of a fragmentary end segment of the embodiment;

FIG. **2** is a vertical section through a contraction joint in concrete pavement (shown in fragment) with the sealing strip embodiment of FIG. **1** mounted therein in a laterally collapsed state; and

FIG. **3** is a fragmentary perspective view of the illustrated seal with an alternate shape of the bottom wall.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawing, the elongated, hollow elastomer seal **10** comprises side walls **11** and **12** which are preferably substantially parallel, elongated, elastomer walls. The upper longitudinal edges of the side walls are connected by an elongated elastomer top wall **13**. The latter wall comprises substantially flat or planar, outer wall segments or strips **14** and **15** and a shallow V-shaped midwall portion **16** which extends longitudinally of the midportion of upper wall **13**. The upper wall **13** preferably is substantially symmetric as viewed in end elevation or transverse cross section and has its apex **17** extending substantially longitudinally midway of the upper wall **13**.

The bottom wall **20** may be a substantially V-shaped wall and comprises transversely diagonal wall segments **21** and **22**. The V-shaped bottom wall **20** preferably also is substantially symmetric and has its apex **19** substantially directly below the apex **17**. As shown in FIG. **3**, the bottom wall **20a** may also be a substantially flat or planar wall when the seal is uncollapsed. Upon lateral collapse of the seal, the bottom wall becomes V-shaped or U-shaped.

The internal web structure of the seal consists essentially of the vertical web **25** and the diagonal webs **23** and **24**. The vertical web **25** is joined at its upper longitudinal edge with the apex **17** of the top wall **13** and at its bottom longitudinal edge with the apex **19** of the bottom wall **20**. As can be seen by comparing FIGS. **1** and **2**, the V-shaped bottom wall elongates when the seal **10** is laterally collapsed. This vertical elongation of the bottom wall draws the web **25** downwardly and by virtue of its connection to the longitudinal midportion of top wall **13**, the top wall is pulled downwardly into the general configuration of a V as shown in FIG. **2**. It is desirable that the top wall **13** collapse inwardly so that none of the top wall projects above the pavement surface, where it could be struck by tires passing over the joint. Continual striking of the sealing strips by tires tends to work the seal out of the joint.

The diagonal webs **23** and **24** are longitudinally elongated, diagonal webs respectively extending transversely diagonally downwardly from the upper portion of the longitudinally elongated vertical web **25** to respective lower portions of the side walls. The resultant internal web structure collapses substantially as shown in FIG. **2** when the seal is laterally collapsed. The diagonal webs **23** and **24** bend or fold into longitudinal bends or folds not substantially exceeding about 90°. Bends or folds approaching 180° are undesirable because such bends or folds place high amounts of stress in the web truss structure, particularly at hot temperatures in the order of 120°–140°F. The latter temperatures are relatively common in pavements during the hot summer months. At such temperatures, the joints are in their most closed state and the seal is in its most laterally collapsed state.

The longitudinally bent or folded elastomer webs **23** and **24**, by virtue of their elastic properties, seek their original, substantially planar shape as shown in FIG. **1**. In so doing, these diagonal webs exert at their lower longitudinal edges lateral thrust against the respective lower portions of the side walls **11** and **12** and thus create localized lines of thrust force along the lower longitudinal edges of the side walls against the side walls **27** and **28** of the joint **29**. The joint **29** is in FIG. **2** a contraction joint, the crack **30** therebeneath being a plane of weakness crack as aforedescribed.

The elastomer, substantially V-shaped top and bottom walls **13** and **20**, in the laterally collapsed state of

the strip **10**, also seek by virtue of their elastic properties their original shape as shown in FIG. **1**. An upward thrust vector is imparted to the vertical web **25** by the longitudinally bent or folded diagonal webs **23** and **24**. The upward thrust on the vertical web **25** coacts with the force of elastic recovery in the concavely collapsed top wall **13** to augment the thrust force of the seal against the side walls **27** and **28** along localized longitudinal lines of thrust at the upper longitudinal edges of the side walls **11** and **12**. For purposes of effecting a better seal between said upper longitudinal edges and the side walls of the joint, the sealing strip **10** may be provided at said upper longitudinal edges with outwardly projecting ribs **31** and **32**. These ribs preferably have a substantially sharp edge **33** whereby the primary line of thrust force along the upper longitudinal edges of the side walls is concentrated at the sharp edges.

The lower longitudinal edges of the diagonal webs **23** and **24** preferably are joined with the lower portions of the respective side walls **11** and **12** substantially along the lower longitudinal edges thereof, i.e., substantially at the longitudinal lines of juncture **35** and **36** of the side walls with the bottom wall. The upper longitudinal edges of diagonal webs **23** and **24** may be joined with the upper portion of vertical web **25** along the upper longitudinal edge of the latter, i.e., substantially at the longitudinal line of juncture of the vertical web **25** and the apex **17** of top wall **13**, but more preferably, these webs are joined at a longitudinal line of juncture **34** which is slightly below the apex **17**.

The joinder of the lower longitudinal edges of said diagonal webs substantially at junctures **35** and **36** is preferred because, with such arrangement, the elastic recovery forces in respective pairs of diagonal webs and bottom wall segments **21**, **23** and **22**,**24** coact to exert lateral thrust forces along localized lines of thrust at longitudinal lines of juncture **35** and **36**, respectively. Thus, the seals herein have primary, longitudinal lines of sealing thrust against side walls **27** and **28** of the joint **29** along the upper longitudinal edges of side walls **11** and **12**. They have secondary longitudinal lines of sealing thrust at lines of juncture **35** and **36** along the lower longitudinal edges of said side walls. The latter lines of thrust are also advantageous for holding the seal in place in the event the upper lines of thrust should be disturbed temporarily, e.g., by downward distortion of the top wall of the seal by automotive tires striking dirt, stones, snow or ice accumulated on the top wall of the seal. The substantially flat or planar shape of the bottom wall (FIG. **3**) or a shallow V-shape is preferred where maximum thrust effect, transmitted via the vertical web **25** from the bottom wall to the top wall as aforedescribed, is desired.

In any of the forms of the invention herein, the seals should be made of good quality elastomer formulations in order that these seals retain their elastic properties with aging under environmental conditions. To this end, the elastomer composition should be an elastomer formulation which is extrudable, and which, upon vulcanization, will be resistant to deterioration and/or loss of resilience after exposure to hot and cold weather conditions, sunlight, and like elements of nature in the use thereof in joints of pavement, air strips, and the like. Care should be exercised in selecting an elastomer formulation whereby the seal will retain its flexibility and elastic recovery force generation at the coldest temperatures to be encountered in the field. The presently best-known elastomer is neoprene, particularly the crystallization-resistant types thereof.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the forms herein disclosed being preferred embodiments for the purpose of illustrating the invention.

I claim

1. An elongated, hollow seal useful for sealing concrete pavement contraction joints which comprises elongated top, side and bottom elastomer walls forming an elongated, hollow, elastomer sealing strip, said side walls being substantially planar, said top wall being substantially symmetrically, transversely concave and consisting of substantially horizontal outer segments connected by a shallow, V-shaped longitudinal midportion, said bottom wall being V-shaped and joined to the lower edges of said side walls, and an elastomer internal web structure comprising a pair of longitudinally elongated, diagonal webs extending transversely diagonally and symmetrically downwardly from the upper midportion of said upper wall to respective lower edges of said side walls, said diagonal webs being connected in said seal only at their respective longitudinal edges to said upper midportion and to said respective lower edges of said side walls, and a vertical web joined at its longitudinal edges with said V-shaped longitudinal midportion of said top wall and the apex of the V of said bottom wall and extending substantially midway between said side walls.

2. An elongated, hollow, elastomer seal useful for sealing concrete pavement contraction joints which comprises elongated top, side and bottom elastomer walls forming an elongated, hollow, elastomer sealing strip, said side walls being substantially planar, said top wall being substantially symmetrically, transversely concave and consisting of substantially horizontal outer segments connected by a shallow, V-shaped longitudinal midportion, said bottom wall being V-shaped and joined to the lower edges of said side walls, an elastomer internal web structure comprising a pair of longitudinally elongated, diagonal webs extending transversely diagonally and symmetrically downwardly from the upper midportion of said upper wall to respective lower edges of said side walls, said diagonal webs being connected in said seal only at their respective longitudinal edges to said upper midportion and to said respective lower edges of said side walls, a vertical web joined at its longitudinal edges with said V-shaped longitudinal midportion of said top wall and the apex of the V of said bottom wall and extending substantially midway between said side walls, and the upper longitudinal edges of said diagonal webs intersecting said vertical web immediately below the apex of the V-shaped longitudinal midportion of said top wall.

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