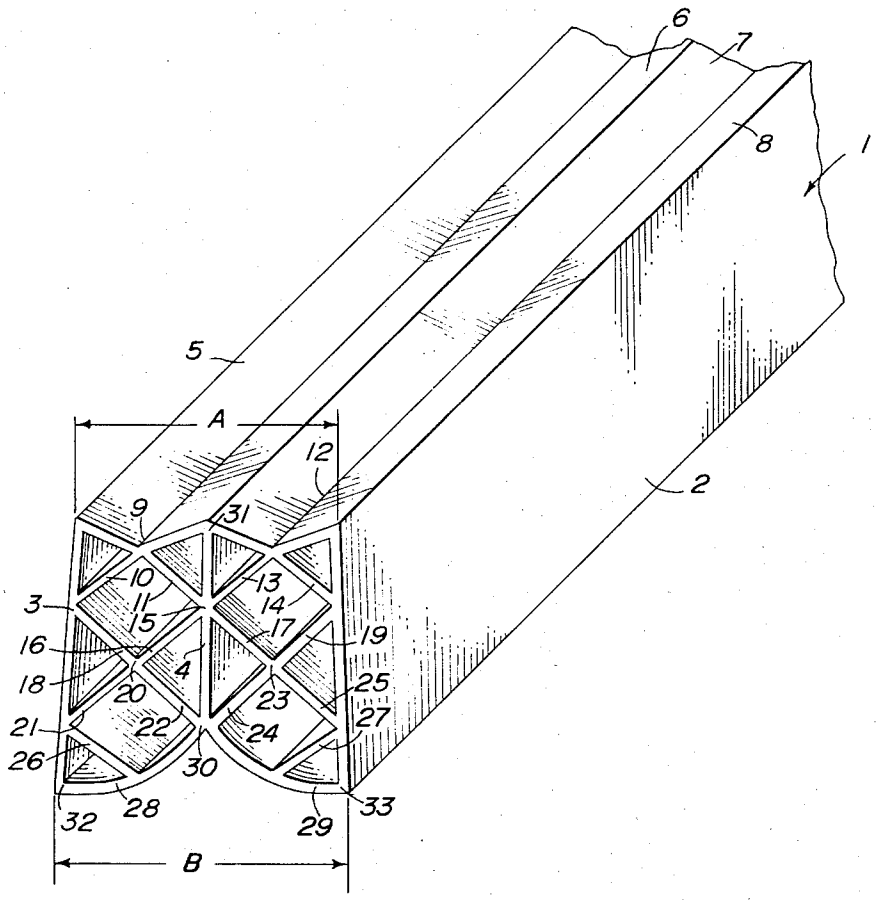
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ELASTOMER SEAL STRIPS FOR MOVING JOINTS

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ELASTOMER SEAL STRIPS FOR MOVING JOINTS

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This invention, in general, pertains to elastomer seals and, more particularly, pertains to resiliently collapsible, webbed seal strips with longitudinally extending hollow spaces therein.

Contraction and expansion joints which allow for thermally induced expansion of slabs, panels, etc., of highways, bridges, building walls, airstrips, etc., are necessary in order to relieve what otherwise would be destructive stresses built up in the slab, panel, etc., when it expands responsive to an increasing temperature. It has been the practice for years to seal such joints with a caulk-type seal such as asphalt or elastomer-based caulking compounds to keep water, dirt, etc., out of the joint. In recent years, compressible and expandable elastomer seal strips have been gaining acceptance as seals for such joints.

This invention pertains to improvements in compressible and expandable elastomer strips especially adapted for such use, particularly as seal strips for wide joints such as automotive highway expansion joints and bridge joints. The latter joints are transverse expansion joints located between highway sections or slabs adjacent to bridges. Bridges present special problems to the highway engineer and designer because the structural steel components have a high degree of thermal expansion and contraction. In many instances, the structural steel expansion is compensated by placing one, two, or three wide (e.g., 1½ to 2½"), transverse expansion and contraction joints between highway sections contiguous to one or both sides of the bridge. The expansion of the bridge's structural steel is compensated by permitting the bridge's expansion forces to shift the concrete sections, which shifting is taken up in the joints therebetween.

These wide joints present special problems in successful sealing thereof. The transverse movement required of the seal strips between their state of maximum, transverse compression (maximum contraction of the joint) and of minimum, transverse compression (maximum expansion of the joint) is considerably greater than is the case for the seal strips used in the usual highway joint. Also, in the wider joints, it is more difficult to keep the seal properly seated in the joint with its upper surface substantially level with or slightly below the highway surface. There is a general tendency for such seals to work downwardly in the joint. Also, especially with seals set too high in the joint, they can work upwardly under repeated striking by automobile tires passing thereover.

The elastomer seal strips of this invention are structurally adapted to overcome these tendencies. This is achieved by structural adaptations which provide a maximum pressure between the side walls of the joint and the lower portions of the side walls of the seal in frictional contact or engagement with the side walls of the joint. These improvements are accomplished by outer wall and web structures of the seal strips wherein the opposite side walls of the strips diverge in the downward direction. Also, the seal structure may include a vertical center web having its lower portion branched into flaring webs or walls which redirect downward forces on the seal strip into outward pushing forces along the bottom portions of the opposite side walls of the strip.

A preferred embodiment of the invention is illustrated in the drawing.

In the drawing:

The figure is an isometric view of a fragment of a transversely compressible and expandable, elastomer seal strip constituting said preferred embodiment.

The seal strip **1** comprises an elastomer strip made of elastomer, outer walls embracing a latticework of interconnected, elastomer web strips. The strip **1** is most conveniently manufactured by extrusion of a suitable compound elastomer through an appropriate die. The outer walls and the webs of the latticework extend longitudinally throughout the length of the seal strip **1**.

The opposite side walls **2, 3** are substantially planar and diverge from each other in the top to bottom direction. The divergence is not a sharp divergence, e.g., one unit measurement of change in the transverse distance between outer surfaces of the walls per 6–10 unit measurement of the vertical height of the walls. For example, in a strip having a 2" vertical height and a 2" nominal width, the strip width (distance between outer surfaces of the side walls) at the top may be 2" and at the bottom about 2¼".

Midway between and parallel to side walls **2, 3** is a vertical web **4**. The latticework webbing is substantially symmetrical on each side of the web **4**. The upper wall comprises two, side-by-side, elastomer, symmetric, shallow V-sections formed by a V-shaped pair of walls **5, 6** and a symmetric pair of V-shaped walls **7, 8**. At the juncture **9** of walls **5** and **6**, a web **10** extends downwardly and outwardly to side wall **3**, with which it is joined. A web **11** extends downwardly and inwardly from juncture **9** and is joined at juncture **15** with the vertical, mid-wall **4**. Webs **13** and **14** emanating from juncture **12** are the symmetric counterparts of webs **10, 11**.

From juncture **15**, webs **16, 17** extend outwardly and downwardly. The outer ends of webs **16, 17** are connected at junctures **20, 23** with lower ends of webs **18, 19**, respectively, which are respectively joined with sides **2, 3**. From juncture **20** extends webs **21, 22** which are continuations of webs **16** and **18**. Webs **21, 22** are joined at their lower ends with the side wall **2** and mid-wall **4**, respectively. The symmetrical counterpart of webs **21, 22** are the webs **24, 25** emanating from juncture **23**.

Webs **11, 17** and **25**, and webs **13, 16** and **21** thus form a first set of additional webs extending downwardly and inwardly from the respective bottoms **9** and **12** of the V-sections of the top wall, which set of webs intersect the mid-wall at a common juncture **15**, and continue across the mid-wall **4** to the opposite side walls **2** and **3**, respectively. Webs **18** and **22** and webs **19** and **24** form a second set of additional webs extending downwardly from the upper portions of the side walls **3** and **2**, respectively, to the bottom edge of the mid-wall **4**. They cross the first set of webs at junctures **20** and **23** approximately midway between the mid-wall **4** and the respective side walls **3** and **2**.

Two additional webs **26, 27** connect the side walls **2, 3** at the junctures of webs **21, 25** with the curved webs or walls **28, 29**. The latter webs or walls together may form the bottom wall of the seal strip, which wall is of inverted, V-shape with curved V-legs. The curved walls or webs **28, 29** meet at their upper ends at juncture **30** and connect the lower edge of mid-wall **4** with the lower portions of side walls **2, 3**.

The hollow space defined by flaring side walls **2, 3**, the upper wall with undulating sections **5–8**, and the inverted, substantially V-shaped bottom wall is thus reinforced by a cross-network or latticework of intersecting, diagonal web members. These members are resiliently bent and/or folded into the longitudinal, triangular and diamond-shaped cavities of the seal strip when the side walls **2, 3** are pushed toward each other as the strip is compressed transversely. The upper wall collapses accordion-like under transverse compression of the seal.

As the seal of the character herein expands and con-

tracts transversely with the widening or contracting joint, there is a tendency for the seal to work downwardly into the joint—especially when the seal is in its maximum state of transverse expansion—under the jarring of automobiles or the like passing over the sealed joint. To counteract this tendency, the wider spacing of the lower portions of the side walls of the seal strips results in more resilient pressure being exerted by the lower portion of the side walls of the seal against the side walls of the joint than is the case for the upper portions of said side walls. In this situation, the upper portion of the seal can flux under jarring of the upper wall by automobiles passing thereover while the lower portion of the seal remains essentially unaffected and hence tightly seated in the joint.

Furthermore, the seal structure providing a vertical mid-wall **4** and downwardly and outwardly branching walls or webs **28, 29** from the lower edge of wall **4** to the lower portions of side walls **2, 3** transmits downward flexing pressures on the upper wall of the seal to the branched webs or walls **28, 29**, which in turn, by flexing under the downward movement of mid-wall **4**, exert greater outward pressure to the lower walls **2, 3** as a result of their resiliency and the shortening of the straight line distances between juncture and the lower corners **32, 33** of the seal strip.

The lateral dimensions of the seal strip are such that the seal is always somewhat compressed even when the joint is at maximum expansion. This is necessary in order that there always be a resilient pressure pushing side walls **2, 3** against the side walls of the joint in order to keep the seal tightly seated and prevent dirt, water, etc., from entering the joint. Hence, when the seal is inserted in a joint, it is compressed transversely from the normal state shown in the drawing prior to its insertion and mounting in the joint.

The invention is hereby claimed as follows:

A seal strip for expansion and bridge joints comprising an elongated, elastomer strip having an upper wall composed of two, side-by-side, elastomer, symmetric, shallow V-sections, a pair of spaced, elastomer, downwardly diverging side walls, said side walls diverging at a divergence of one unit measurement of change in transverse distance between outer surfaces of said side walls per **6–10** unit measurement of the vertical height of said side walls, an elastomer, vertical mid-wall extending downwardly from the juncture of said V-sections approximately midway between said side walls, a bottom wall composed of a pair of oppositely and downwardly, convexly curved, elastomer walls extending from the bottom edge of said mid-wall to the bottom of said side walls, and a network of diagonal, elastomer web members including webs extending downwardly and outwardly from the respective bottoms of said V-sections to the upper portions of respective side walls, a first set of additional webs extending downwardly and inwardly from said respective bottoms of said V-sections, intersecting said mid-wall at a common juncture and continuing across said mid-wall to the lower portion of the opposite side wall, a second set of additional webs extending diagonally downwardly from said upper portions of side walls to the bottom edge of said mid-wall and crossing said first set of webs approximately midway between said mid-wall and the respective side walls, and a web extending downwardly and diagonally from said lower portion of said side walls to the respective convexly curved walls of said bottom wall.

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