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(54) EXPANSION JOINT SEAL ASSEMBLY

(71) We, ELASTOMETAL LIMITED, a company organised under the laws of the State of Ontario, Canada of 3334, Mainway Drive, Burlington, Ontario, Canada, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an expansion joint seal assembly for positioning in a gap defined between the facing surfaces of two adjacent sections of a structure such as a roadway.

The proper design of large structures such as road beds and bridges for highways, concrete walls and the like require that provision be made to accommodate expansion and contraction due to temperature changes. Usually this is done by incorporating expansion joints in the structure which provide a gap between sections of the structure and which will accommodate some relative movement due to expansion or contraction.

It is often however necessary that expansion joints include a seal capable of providing a tight barrier against wind, water and dirt, etc. Typically, for instance a roadway or bridge will be designed with intermittent expansion gaps which run transversely across the roadway. Such an expansion joint often requires a seal capable of accommodating expansion and contraction and which can be secured to the road bed on each side of the gap.

Previously known expansion joint assemblies have been expensive to manufacture and difficult to install or replace. Some designs have been subject to failure in maintaining their weather-tight seal under repeated stress of expansion and contraction movement.

It is therefore an object of the invention

to provide an improved seal assembly for expansion joints which will meet the requirements of its purpose and will be easier to install, maintain, or replace.

According to the invention, there is provided an expansion joint seal assembly for positioning in a gap defined between the facing surfaces of two adjacent sections of a structure such as a roadway, the assembly comprising:

two abutments each having a substantially vertical portion positionable along a respective one of said facing surfaces;

a respective resiliently flexible clamping plate corresponding to each abutment and mounted on the vertical portion thereof on the side of the latter facing said gap, the clamping plate being mounted in spaced parallel relationship relative to the vertical portion to define therewith a space extending lengthwise of the assembly;

and a sealing member of elastic material having a web portion spanning between side wall portions disposed substantially perpendicular thereto, each side wall portion being receivable in a respective one of said spaces to be engaged throughout the height of the side wall portion by the corresponding vertical portion;

in which each clamping plate is laterally displaceable from a rest position against the action of its own inherent resilience and outwardly relative to its mounting on the respective vertical portion so as to allow entry into the space of a respective side wall portion of the sealing member, and is subsequently displaceable laterally inwardly by its inherent resilience towards its rest position so as to squeeze the side wall portion against the vertical portion in sealing relation therewith.

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, in which:—

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Figure 1 is a vertical cross-sectional view of an expansion joint seal assembly which forms one of the embodiments of the invention disclosed in the specification and drawings accompanying our United Kingdom Patent Application No. 31794/75 (Serial No. 1521249) and claimed therein;

Figure 2 is a cross-sectional view of an embodiment of expansion joint seal assembly according to the present invention; and

Figures 3 and 4 are part sectional views of two constructions of sealing member for use in the assembly shown in Figure 2.

For ease in understanding the nature of the embodiments of the present invention as shown in Figures 2 to 4, there will first be described briefly the assembly shown in Figure 1, which is described in greater detail in the specification of our United Kingdom Patent Application No. 31794/75 from which the present application has been divided-out, and to which attention is drawn.

As illustrated in Figure 1, an expansion joint is positioned between two sections of roadway slabs 2 which may be on a conventional road bed or a bridge or overpass. For simplicity the roadway illustrated is composed of a single slab the top of which constitutes the travel surface of the roadway. It should be understood of course that the seal arrangement is applicable to other forms of road design such as those with a concrete slab having a traction layer of asphalt on top.

As illustrated the gap 8 between the roadway sections is spanned and sealed by an expansion joint sealing assembly having a flexible elastic sealing member 10 spanning and attached to abutments 12, both of which extend continuously the entire length of the joint (i.e. the entire width of the roadway) and are positioned facing each other on opposite sides of the gap and mounted on the sections of roadway slabs.

The pair of abutments 12 in Figure 1 (which are mirror images of each other), have a right angle member 14 secured in place by anchors 16 and 18 embedded in the roadway, and have a horizontal portion 20, the top of which is level with the travel surface of the roadway, and a vertical flange 22 defining the sides of the gap 8 (although they need not necessarily coincide exactly with the end of the roadway slab). At the upper end of the vertical flange an overhanging portion 24 extends into the gap first horizontally and then downwardly thereby presenting an inverted, downwardly open channel 26.

The abutment also has a clamping plate 28 supported by and adjustably held to the vertical flange by a threaded bolt 30 pro-

truding from the lower region of the vertical flange and extending horizontally into the gap and through corresponding holes in the lower region of the clamping plate. Such a bolt might be fusion-welded to the flange so as to provide a smooth attachment without any shoulder which might obstruct sleeve 34.

Nut 34 threaded onto the end of the bolt 30 serves to hold the plate and to urge it in the direction of the vertical wall portion as desired. For this purpose a lock-nut might be preferred. Alternatively the plate could be attached by a bolt having its head behind the plate in the position of the nut shown in Figure 1. In this case female threads would be required in the flange wall 22 and a recess chamber would be provided behind the flange to allow for the end of the bolt to project therethrough when tightened. This arrangement, although more difficult to make would occupy less space in the gap and provide greater freedom in the dimensions designed for small gaps where space is critical. The sleeve 34 fits over the bolt between the vertical wall and the plate to serve as a spacer setting the minimum spacing between them.

The sealing member 10 has a generally horizontally disposed web portion 36 spanning the gap of the joint between the abutments at approximately the level of the roadway surface.

Although the illustrated sealing member is arched it may be corrugated in a variety of configurations well known to those skilled in the art. Whatever the configuration, it relies on flexibility and elasticity to accommodate the relative movement of the joint due to expansion and contraction.

To grip the sealing member and effect a seal along each side of the gap, the sealing member is provided with substantially vertically disposed side walls 38 running along each side of the web portion 36. The side walls are formed integrally with and normal to the web portion and have an upper bead 40 adapted to substantially fit the channel 26 and a downwardly extending leg 43 which occupies the space between the vertical flange and the plate above the spacer 34.

The spacer is smaller than the thickness of the side wall 38 so that tightening the bolt an appropriate amount will squeeze the downward extending leg of the side wall tending to hold it tightly and sealingly against the vertical face of the flange 22. Furthermore the squeezing effect will tend to deform the elastic material thereby urging the material upward and creating an additionally tight seal between the bead 40 and the channel 26, and in addition, assisting the holding function of the overhanging portion 24 to prevent pulling away

of the sealing member from the abutment. It will of course be realized that a series of bolts will be employed spaced at intervals along the vertical flange of the expansion joint, the spacing depending upon considerations such as the support desired for the sealing member side walls and the rigidity of the plate which must provide adequate pressure against the side walls along the entire length including the area between the bolts.

Where the expansion joint is to be assembled in place, the abutments will usually be placed and anchored to the respective adjacent slabs on either side of the gap. The seal, which of course will have to be designed in terms of dimensions and flexibility and elasticity to span between the abutments and accommodate the maximum movement of the slabs, will then be installed in the abutment on each side of the gap. This can be done by inserting one side wall along one abutment first, with the clamping plate loosened, after which access can still be had to the nuts to tighten the plate the desired amount.

Since in most field locations access will not be available from beneath, installation of the second flange of the seal will be slightly more involved. Although it might be possible to tighten the nut on the second abutment and then force the seal flange in the space between the plate and the vertical member relying on lubrication and the elasticity of the seal material, this is a difficult procedure and presents the problem that it may only be possible when the space affords a sufficiently loose fit that the desired degree of sealing pressure may not be present.

Using the adjustable clamping plate 28 it is possible to insert the side wall of the sealing member at one point (for instance at one end of the joint) and tighten the nuts such as 32 in turn as the insertion advances, the flexibility of the seal allowing the installer to reach the nut where the side wall has been inserted while the advanced portion of the side wall is still out of position.

The embodiments of the present invention will now be described in detail, with reference to Figures 2 to 4, having regard to the preceding disclosure concerning Figure 1.

In Figure 2 is shown an abutment 60 with a horizontal portion 62 and a vertical portion or flange 64 and overhanging portion 66 all similar to the abutment of Figure 1 previously described. However, in place of the clamping plate 28 in Figure 1, there is a resiliently flexible clamping plate 68 having a vertical wall portion 70 running along the length of the expansion joint and being spaced from and parallel

to the vertical flange 64 as illustrated in Figure 2 to define a space in which a side wall portion of a sealing member is received. The clamping plate 68 additionally has an offset portion 72 and a vertical attaching portion 74 which rests against the face of the vertical flange 64.

As illustrated, at 76, the clamping plate is spot welded to the vertical flange at regular intervals along the expansion joint assembly but other means, such as bolting might be employed, especially if welding is difficult.

The clamping plate 68 is adapted for the illustrated use and for ease of application by being made of spring steel to allow it to flex. Thus, during installation of a sealing member such as 78 illustrated in Figure 3, a bar or other form of lever may be inserted between flange 64 and the wall 70, and used to pry the wall 70 laterally outwards from the flange against the action of its inherent resilience, ahead of the progressive installation of the sealing member 78. It should be noted that a side wall portion of the sealing member 78, formed by downwardly extending leg 86, is engaged throughout its height by the flange 64.

The exact specifications of the spring steel and the dimensions of the wall 70 etc., will be a matter of design choice and other factors. The use of spring steel may present problems in the welding of the clamping plate 68 as illustrated and the alternative of bolting is therefore to be considered. The spacing of the wall 70 from the vertical flange 64 is approximately the same as that for the inverted channel of the overhanging portion 66, although variations of this dimension may be employed.

The sealing member illustrated in Figure 3 has an upwardly curved generally horizontal web portion 80, similar to that illustrated in Figure 1 and has an upper bead 84, also similar to Figure 1 with approximately the same dimension as the inverted channel defined by the overhanging portion 66 of the abutment. However, the vertically downward extending leg 86 of this sealing member is somewhat enlarged and therefore has a horizontal cross-sectional dimension somewhat larger than the spacing in the gap between the retainer wall 70 and the flange 64. Thus, when the retainer wall 70 is pried outwards from a rest position and away from the flange, and the leg of the sealing member 84 is inserted and the spring steel retaining wall 70 is thereafter released, it will press inwards by its inherent resilience against the vertical leg 86 of the sealing member compressing it and causing some upwards squeezing of the material forming the vertical end portion of the sealing member and will tend to urge the upper bead 84

of the sealing member upwards and tightly in place in the inverted channel provided by the overhanging portion 66 of the abutment.

- 5 Thus, this arrangement provides for simplicity of design and construction, relative ease of installation, a tight seal of the sealing member against the abutment, and a relatively firm grip on the upper bead of the sealing member by the over-hanging portion 66.

Figure 4 illustrates a version of the sealing member in which the web portion 88 extends laterally and downwardly instead of extending upwardly as in Figure 3.

15 It will of course be realized that Figure 3 and Figure 4 illustrate only one-half of the sealing members, the other half being a mirror image thereof.

- 20 While the embodiments illustrated in Figures 2, 3 and 4 are one-piece sealing members, the invention is also adaptable to the expansion joint in which the gap is too great to be effectively spanned by a single seal. Such larger joints conventionally use one or more intermediate beam members running along the gap between the sides so that two or more sealing members may be used spanning from one side of the beam and from the beam to the other side respectively. Since these beam members are conventionally supported by cross-members running transversely underneath the joint would merely require abutments such as shown in Figure 1 to employ the present invention.

Although the description of illustrative embodiments herein being referred to as horizontally disposed seals spanning between vertical flanges of a horizontally spaced gap, it will be realized that this invention may be equally useful in expansion joints in vertical or inclined structures, or even non-aligned sections of a structure, and is not limited to horizontal roadway slabs illustrated. The relative position, shapes and functions of the same elements of the invention would remain essentially the same.

50 WHAT WE CLAIM IS:—

1. An expansion joint seal assembly for positioning in a gap defined between the facing surfaces of two adjacent sections of a structure such as a roadway, the assembly comprising:

two abutments each having a substantially vertical portion positionable along a respective one of said facing surfaces;

60 a respective resiliently flexible clamping plate corresponding to each abutment and mounted on the vertical portion thereof on the side of the latter facing said gap, the clamping plate being mounted in spaced

parallel relationship relative to the vertical portion to define therewith a space extending lengthwise of the assembly;

and a sealing member of elastic material having a web portion spanning between side wall portions disposed substantially perpendicular thereto, each side wall portion being receivable in a respective one of said spaces to be engaged throughout the height of the side wall portion by the corresponding vertical portion;

70 in which each clamping plate is laterally displaceable from a rest position against the action of its own inherent resilience and outwardly relative to its mounting on the respective vertical portion so as to allow entry into the space of a respective side wall portion of the sealing member, and is subsequently displaceable laterally inwardly by its inherent resilience towards its rest position so as to squeeze the side wall portion against the vertical portion in sealing relation therewith.

2. A seal assembly according to claim 1, in which each resiliently flexible clamping plate is made of spring steel.

3. A seal assembly according to claim 1 or 2, in which the thickness of each side wall portion of the sealing member is greater than the spacing between the respective clamping plate and vertical portion when the clamping plate is in its rest position.

4. A seal assembly according to any one of the preceding claims, in which each resiliently flexible clamping plate is of stepped construction having a mounting portion secured to the vertical portion of a corresponding abutment, an offset portion underlying the lower edge of the corresponding side wall portion of the sealing member and determining the thickness of the corresponding said space, and a substantially vertical portion which applies squeezing action against said side wall portion.

5. A seal assembly according to any one of the preceding claims, in which each abutment has a horizontal overhanging portion connected to the vertical portion thereof and extending in use into said gap, the respective side wall portion of the sealing member being pressed upwardly into sealing engagement with the underside of said horizontal portion when the side wall portion is squeezed into sealing engagement with the vertical portion.

6. A seal assembly according to claim 5, in which each horizontal overhanging portion defines an inverted channel in



of the sealing member upwards and tightly in place in the inverted channel provided by the overhanging portion 66 of the abutment.

5 Thus, this arrangement provides for simplicity of design and construction, relative ease of installation, a tight seal of the sealing member against the abutment, and a relatively firm grip on the upper bead
10 of the sealing member by the over-hanging portion 66.

Figure 4 illustrates a version of the sealing member in which the web portion 88 extends laterally and downwardly instead
15 of extending upwardly as in Figure 3.

It will of course be realized that Figure 3 and Figure 4 illustrate only one-half of the sealing members, the other half being a mirror image thereof.

20 While the embodiments illustrated in Figures 2, 3 and 4 are one-piece sealing members, the invention is also adaptable to the expansion joint in which the gap is too great to be effectively spanned by a
25 single seal. Such larger joints conventionally use one or more intermediate beam members running along the gap between the sides so that two or more sealing members may be used spanning from one side
30 of the beam and from the beam to the other side respectively. Since these beam members are conventionally supported by cross-members running transversely underneath the joint would merely require
35 abutments such as shown in Figure 1 to employ the present invention.

Although the description of illustrative embodiments herein being referred to as horizontally disposed seals spanning between
40 vertical flanges of a horizontally spaced gap, it will be realised that this invention may be equally useful in expansion joints in vertical or inclined structures, or even non-aligned sections of a structure, and
45 is not limited to horizontal roadway slabs illustrated. The relative position, shapes and functions of the same elements of the invention would remain essentially the same.

50 WHAT WE CLAIM IS:—

1. An expansion joint seal assembly for positioning in a gap defined between the
55 facing surfaces of two adjacent sections of a structure such as a roadway, the assembly comprising:

two abutments each having a substantially vertical portion positionable along a
60 respective one of said facing surfaces;

a respective resiliently flexible clamping plate corresponding to each abutment and mounted on the vertical portion thereof
65 on the side of the latter facing said gap, the clamping plate being mounted in spaced

parallel relationship relative to the vertical portion to define therewith a space extending lengthwise of the assembly;

and a sealing member of elastic material having a web portion spanning between
70 side wall portions disposed substantially perpendicular thereto, each side wall portion being receivable in a respective one of said spaces to be engaged throughout the height of the side wall portion by the
75 corresponding vertical portion;

in which each clamping plate is laterally displaceable from a rest position against the action of its own inherent resilience and outwardly relative to its mounting on
80 the respective vertical portion so as to allow entry into the space of a respective side wall portion of the sealing member, and is subsequently displaceable laterally inwardly by its inherent resilience towards
85 its rest position so as to squeeze the side wall portion against the vertical portion in sealing relation therewith.

2. A seal assembly according to claim 1,
90 in which each resiliently flexible clamping plate is made of spring steel.

3. A seal assembly according to claim 1 or 2, in which the thickness of each side
95 wall portion of the sealing member is greater than the spacing between the respective clamping plate and vertical portion when the clamping plate is in its rest position.
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4. A seal assembly according to any one of the preceding claims, in which each resiliently flexible clamping plate is of stepped construction having a mounting
105 portion secured to the vertical portion of a corresponding abutment, an offset portion underlying the lower edge of the corresponding side wall portion of the sealing member and determining the thickness
110 of the corresponding said space, and a substantially vertical portion which applies squeezing action against said side wall portion.

5. A seal assembly according to any one of the preceding claims, in which each abutment has a horizontal overhanging
115 portion connected to the vertical portion thereof and extending in use into said gap, the respective side wall portion of the sealing member being pressed upwardly into sealing engagement with the underside of said horizontal portion when the side wall
120 portion is squeezed into sealing engagement with the vertical portion.
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6. A seal assembly according to claim 5, in which each horizontal overhanging
130 portion defines an inverted channel in



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which the upper edge of the respective side wall portion of the sealing member is received.

5 7. A seal assembly accordiig to any one of the preceding claims, in which the sealing member is of one-piece construction.

10 8. A seal assembly according to claim 1 and substantially as hereinbefore described with reference to Figures 2 to 4 of the accompanying drawings.

15 9. A roadway including a seal assembly according to any one of the preceding claims.

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