

PAVER PRE-STRESSOR APPARATUS AND ASSOCIATED METHODS

Background of the invention

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This invention relates to a paver pre-stressor apparatus, a method of retrofitting a paver pre-stressor, and a method of paving.

Description of the Prior Art

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The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that the prior publication (or information derived from it) or known matter forms part of the common general
15 knowledge in the field of endeavour to which this specification relates.

Paving is a common and popular way of covering a surface area, specifically outside areas like walkways, patios, pool decks and driveways. Paving is typically used instead of casting a concrete slab or asphalt. A paving installation typically comprises a
20 compacted stone sub-base and a leveling bed of sand with a plurality of interlocking pavers arranged thereon. Sand is tamped down between the pavers to stabilize the joints formed between the respective pavers. This arrangement allows some movement between the pavers, which enables a paved surface to absorb stress, such as small earthquakes, freezes and thaws and slight ground erosion. For this reason, paving
25 generally has a higher resistance to cracking or buckling when compared with a solid concrete slab.

In addition, as pavers can be multi-shaped and multi-colored, the combination of different pavers allows for aesthetically pleasing options through which architectural
30 expression can be extended to outside areas. However, over time the sand between the paver joints can be washed or blown away. This can lead to increased movement of pavers which may cause unevenness and even chipping of pavers. As such a

deteriorated paving installation can be hazardous, maintenance is necessary at regular intervals, which can be both time-consuming and expensive.

Summary of the present invention

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It is to be appreciated that reference to the term "paver" throughout this specification includes reference to any brick, tile, stone, or block useable for paving.

According to a first aspect of the invention there is provided a paver pre-stressor
10 apparatus for use with a paved surface having a plurality of pavers, the apparatus including:

at least two body members arranged to be displaceable relative to each other along at least one axis or arc; and

adjustable urging means arranged between the body members, the urging means
15 configured to adjustably urge the body members away from each other along said axis or arc, wherein adjustment of the urging means facilitates compressive interlocking of the pavers when the apparatus is incorporated into the paved surface.

The body members may be arranged as a first body member which is slidably
20 receivable by a second body member. The body members may be configured so that together they are shaped and dimensioned to approximate a size and shape of a paver of the paved surface.

The first body member may include an open-sided hollow rectangular block and
25 the second body member a U-shaped beam, wherein the first body member is slidably receivable into the U-shaped beam. The first body member may include a reinforcing portion to strengthen the rectangular block.

The urging means may include a threaded rod operatively bearing against one
30 body member and engaged with a threaded receptacle bearing against the other body member, wherein suitable rotation of the rod or the receptacle urges said body members along the axis or arc.

According to a second aspect of the invention there is provided a paver pre-stressor apparatus for use with a paved surface having a plurality of pavers, the apparatus including:

- 5 at least two body members each configured so that a first body member is slidably receivable by a second body member with the body members displaceable relative to each other along at least one axis, said body members together shaped and dimensioned to approximate a size and shape of a paver of the paved surface; and
- adjustable urging means arranged between the body members, the urging means
- 10 configured to adjustably urge the body members away from each other along the axis, wherein adjustment of the urging means facilitates compressive interlocking of the pavers when the apparatus is incorporated into the paved surface.

- The second body member may be configured to form a guide for the first body
- 15 member when the first body member is urged along the axis.

- The adjustable urging means may include a threaded rod bearing on one body member and in operative engagement with a similarly threaded aperture defined in the other body member. The threaded rod may pass through an aperture in a body member
- 20 and held in place by a suitably threaded fastener. The adjustable urging means may include locking means configured to lock the urging means in place once the body members have been displaced a required distance from each other.

- According a third aspect of the invention there is provided a method of
- 25 retrofitting a paver pre-stressor apparatus to an *in situ* paved surface which includes a plurality of pavers, said method including the steps of:

- removing at least one paver from the paved surface to form an aperture;
- inserting the apparatus into the aperture, the apparatus including:
- at least two body members arranged to be displaceable relative to each other
- 30 along at least one axis or arc; and
- adjustable urging means arranged between the body members, the urging means configured to adjustably urge the body members away from each other along said axis

or arc; and

adjusting the urging means to facilitate compressive interlocking of the pavers.

5 The method may include the step of filling a remaining portion of the aperture with sand. The method may include the step of covering the apparatus with a paver of reduced height or thickness so that said paver covers the apparatus and lies flush with the surface.

10 According to a fourth aspect of the invention there is provided a method of paving a surface bound by edge portions protruding from the surface, the method including the steps of:

arranging a plurality of pavers in an interlocking fashion on the surface;

arranging at least one apparatus in abutting fashion between the pavers, said apparatus including:

15 at least two body members arranged to be displaceable relative to each other along at least one axis or arc; and

adjustable urging means arranged between the body members, the urging means configured to adjustably urge the body members away from each other along said axis or arc; and

20 adjusting the urging means to facilitate compressive interlocking of the pavers against the edge portions.

The method may include the step of arranging the apparatus so that one of the body members abuts against an edge portion.

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The invention is now described, by way of example, with reference to the accompanying drawings. The following description is intended to illustrate particular embodiments of the invention and to permit a person skilled in the art to put those embodiments of the invention into effect. Accordingly, the following description is not
30 intended to limit the scope of the preceding paragraphs or the claims in any way.

Brief description of the Drawings

An example of the present invention will now be described with reference to the accompanying drawings, in which: -

5 Figures 1A-1C shows different embodiments of a paver pre-stressor apparatus;
 Figures 2A – 2B show top and side views, respectively, of an embodiment of a
paver pre-stressor apparatus;
 Figure 3 shows a paving installation including paver pre-stressor apparatus;
 Figures 4A and 4B show further embodiments of paving installations with paver
10 pre-stressor apparatus; and

 Figure 5 shows a cross-sectional side view of an embodiment of a paving
installation including the paver pre-stressor apparatus shown in Figures 2A and 2B.

Detailed description of preferred embodiments

15 Persons skilled in the art will appreciate that numerous variations and
modifications will become apparent. All such variations and modifications which
become apparent to persons skilled in the art should be considered to fall within the
spirit and scope of the invention broadly appearing before and now described in more
20 detail.

 With reference now to Figure 1 of the drawings, a paver pre-stressor apparatus is
generally indicated by reference numeral 10. The apparatus 10 is generally for use with
a paved surface 30 comprised of a plurality of pavers 32 (refer to Figure 3). Apparatus
25 10 is used to enhance interlocking forces between the pavers 32 by applying an
expansive force when installed in between the pavers 32.

 Broadly, the apparatus 10 includes at least two body members 12 and 14
(hereinafter "first body member 12" and "second body member 14") that are arranged to
30 be displaceable relative to each other along at least one axis or arc 28. The apparatus 10
also includes adjustable urging means 16 which is arranged between the body members
12 and 14, as shown. The urging means 16 is configured to adjustably urge the body

members 12 and 14 away from each other along said axis or arc 28. In this manner, adjustment of the urging means 16 facilitates compressive interlocking of the pavers 32 when the apparatus 10 is incorporated into the paved surface 30.

5 Figure 1 shows a number of different embodiments of apparatus 10. Figure 1A shows an embodiment having the body member 12 and 14 arranged substantially parallel with urging means 16 between the body members 12 and 14, as shown. In this embodiment, urging means 16 is a telescopic rod, or the like, able to urge the body members 12 and 14 along axis 28, typically with some force.

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 Figure 1B shows an embodiment where the body members 12 and 14 are hingedly connected at an upper end with urging means 16 configured to urge lower ends of the body members 12 and 14 along arc 28. Figure 1C shows a further embodiment with body members 12 and 14 once again substantially parallel with the urging means
15 16 able to urge said members along axis 18.

 Accordingly, the skilled person will appreciate that there are numerous variations possible with the arrangement of the body members 12 and 14 and urging means 16. Similarly, urging means 16 can include any suitable mechanical arrangement
20 able to urge the body members 12 and 14 apart, e.g. ratchet linkages, hydraulic or pneumatic arrangements, or the like. In one embodiment, the urging means 16 includes a threaded rod bearing against one body member with a suitably threaded receptacle, such as a nut, arranged to bear against the other body member. In this example, rotating the rod or the receptacle will urge the body members apart.

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 Referring now to Figure 2 of the drawings, there is shown another embodiment of the apparatus 10. Figure 2A shows a top view of apparatus 10, with Figure 2B depicting a side view. The apparatus 10 includes body members 12 and 14 and urging means 16. The first body member 12 is configured to be slidably received by the second
30 body member 14, as shown. The body members 12 and 14 are displaceable relative to each other along axis 28.

It is to be appreciated that the body members 12 and 14 may be generally shaped and dimensioned to approximate a size and shape of a paver 32, as shown. Accordingly, different embodiments of the apparatus 10 may have different shapes according to the shape of the pavers 32 used to pave the surface 30. By configuring the apparatus 10 to
5 approximate a shape of a paver typically facilitates installation and/or retro-fitment of the apparatus to a paving installation, as described in more detail below.

In the embodiment shown, the apparatus 10 includes adjustable urging means 16 which is arranged between the body members 12 and 14, as shown. The urging means
10 16 includes two nut-and-bolt arrangements, as shown, with locking nuts 24 and 26. The adjustable urging means 16 includes two threaded rods or bolts 18 which are attached to the second body member 14. Each bolt 18 passes through an aperture defined by the first body member 12. Nuts 24 receive the bolts 18 in an adjustable manner, as shown. The apparatus also includes locking means 26, in the form of additional nuts, which is
15 configured to lock the bolts 18 in place once the body members 12 and 14 have been displaced a required distance from each other.

Accordingly, by adjusting the urging means 16 when the apparatus 10 is installed in between the pavers 32 of the surface 30, the amount of expansion force may
20 be adjusted to facilitate compressive interlocking of the pavers 32. In this particular embodiment, the second body member 14 is also configured to form a guide for the first body member 12 when the body members are urged along the axis 28. This assists in aligned expansion of the body members 12 and 14 when urged along axis 28, to direct the expansive force towards the pavers 32 proximate the apparatus 10.

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The body members 12 and 14 are typically manufactured from galvanized steel or a similar material providing mechanical strength as well as resistance to environmental conditions, e.g. rust. However, as will be understood by a skilled person, there are numerous suitable materials, e.g. metals, polymers, etc., and the invention is
30 not limited by such material choices.

As can be seen in Figure 2B, the first body member 12 is higher than the second

body member 14. This arrangement can be advantageous in certain paving installations as most of the expansion force is directed along an upper part of the paved surface. The difference in height can also be used to direct expansion force along a lower part of a paved surface. Depending on the type of paver used, this can increase the interlocking forces between such pavers, e.g. by introducing a downward force component to secure the pavers in place, or the like. In another embodiment, a height difference between the body members 12 and 14 may indicate a depth of bedding sand used to facilitate placement of the apparatus 10 in a paving installation. An example hereof is shown in Figure 5 and discussed in more detail below.

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Figure 3 shows a paving installation 38 incorporating a number of the apparatus 10. It is to be appreciated that, for the sake of simplicity, the entire paved surface 30 is not shown covered with pavers 32. This is merely for illustrative purposes, as the entire surface 30 is generally covered with pavers 32. The installation 38 comprises edge portions 34 that abounds the pavers 32, such as concrete edges, or the like.

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In the embodiment shows, the apparatus 10 are placed in abutting fashion against the edge portions 34, as shown, to provide an expansion force (shown by arrow 40) to facilitate compressive interlocking of the pavers 32 against the edge portions 34 opposite the respective apparatus 10. It is to be appreciated that the apparatus 10 can be placed anywhere in between the pavers 32 and need not be placed alongside the edge portions 34. As the body members 12 and 14 exert a force irrespective of placement, the apparatus 10 can be placed anywhere in the installation 38.

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In this example, the installation 38 has two apparatus 10 placed as shown. The apparatus 10 are placed in a staggered relationship with respect to each other to direct expansion forces 40 through the installation. An advantage of the apparatus 10 is that the shape and design of the pavers 32 typically assists in spreading the force 40 evenly throughout the surface 30. It is to be appreciated that the number and placement of apparatus 10 can be varied according to a design requirement of the installation, or the like, and is not limited to the example shown.

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Referring now to Figure 4 of the drawings, there is shown further paving installations with apparatus 10 indicated schematically. Depending on the installation and as mentioned above, apparatus 10 can be positioned anywhere in the surface 30 between the pavers (not shown). Figure 4A shows the apparatus 10 arranged to provide orthogonal force 40 to improve interlocking between the pavers. Figure 4B shows apparatus 10 positioned to provide force 40 in a single direction, e.g. direction force 40 through the pavers 32 towards a wall 42, or the like.

The invention also extends to a method for retrofitting the apparatus 10 to an existing paved surface 30 comprised of a number of pavers 32. The method typically comprises the steps of removing at least one paver 32 from the paved surface 30, and inserting the apparatus 10 into an aperture thus formed. Once the apparatus 10 has been inserted, method then includes the step of adjusting the urging means 16 to facilitate compressive interlocking of the pavers 32.

The method typically includes the further step of filling the remaining aperture with sand or a similar material, as well as covering the apparatus 10 with a paver of reduced height or thickness so that said paver covers the apparatus 10 and lies flush with the surface 30. This allows installation of the apparatus 10 into the surface 30 so that the apparatus 10 is hidden from view after such installation.

For example, Figure 5 shows the apparatus 10 installed as described with reference to Figure 3 above. The apparatus 10 is placed alongside edge portion 34. The paving installation 38 comprises a ground surface 50 having a compressed layer 52 of earth forming a foundation for the installation. A bedding sand layer 54 is placed on top of layer 52 with pavers 32 generally arranged on top of the bedding sand layer 54. In this embodiment, a height difference between the body members 12 and 14 of apparatus 10 is used to facilitate installation of the apparatus 10. The apparatus 10 is placed on compressed layer 52, as shown, with body member 14 extending over bedding sand layer 54. In this embodiment, the apparatus 10 provides an expansive force along a lower portion of the pavers 32. To conceal the apparatus 10 from view, a paver with reduced thickness 56 is placed over the apparatus 10, as shown.

The apparatus 10 can provide reduced deterioration of paving installations and so minimises the need for regular maintenance on such paving installations. The paving methods described herein can also provide for longer-lasting paving installations.

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It is to be appreciated that reference to "one embodiment" or "an embodiment" of the invention is not made in an exclusive sense. Accordingly, one embodiment may exemplify certain aspects of the invention, whilst other aspects are exemplified in a different embodiment. These examples are intended to assist the skilled person in performing the invention and are not intended to limit the overall scope of the invention in any way unless the context clearly indicates otherwise.

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Features that are common to the art are not explained in detail as they are deemed to be easily understood by the skilled person. Similarly, throughout this specification, the term "comprising" and its grammatical equivalents shall be taken to have an inclusive meaning, unless the context of use clearly indicates otherwise.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A paver pre-stressor apparatus for use with a paved surface having a plurality of pavers, the apparatus including:
5 at least two body members arranged to be displaceable relative to each other along at least one axis or arc; and
adjustable urging means arranged between the body members, the urging means configured to adjustably urge the body members away from each other along said axis or arc, wherein adjustment of the urging means facilitates compressive interlocking of
10 the pavers when the apparatus is incorporated into the paved surface.
2. The apparatus of claim 1, wherein the body members are configured so that together they are shaped and dimensioned to approximate a size and shape of a paver of
15 the paved surface.
3. The apparatus of either one of claims 1 or 2, wherein the body members are arranged as a first body member which is slidably receivable by a second body member.
4. The apparatus of claim 3, wherein the first body member includes an open-sided
20 hollow rectangular block and the second body member a U-shaped beam, wherein the first body member is slidably receivable into the U-shaped beam.
5. The apparatus of claim 4, wherein the first body member includes a reinforcing portion to strengthen the rectangular block.
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6. The apparatus of any one of claims 1 to 5, wherein the urging means includes a threaded rod operatively bearing against one body member and engaged with a threaded receptacle bearing against the other body member, wherein suitable rotation of the rod or the receptacle urges said body members along the axis or arc.
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7. A paver pre-stressor apparatus for use with a paved surface having a plurality of pavers, the apparatus including:

at least two body members each configured so that a first body member is slidably receivable by a second body member with the body members displaceable relative to each other along at least one axis, said body members together shaped and dimensioned to approximate a size and shape of a paver of the paved surface; and

5 adjustable urging means arranged between the body members, the urging means configured to adjustably urge the body members away from each other along the axis, wherein adjustment of the urging means facilitates compressive interlocking of the pavers when the apparatus is incorporated into the paved surface.

10 8. The apparatus of claim 7, wherein the second body member is configured to form a guide for the first body member when the first body member is urged along the axis.

9. The apparatus of either one of claims 7 or 8, wherein the adjustable urging
15 means includes a threaded rod bearing on one body member and in operative engagement with a similarly threaded aperture defined in the other body member.

10. The apparatus of either one of claims 7 or 8, wherein the threaded rod passes through an aperture in one body member and is held in place by a suitably threaded
20 fastener.

11. The apparatus of any one of claims 7 to 10, wherein the adjustable urging means includes locking means configured to lock the urging means in place once the body members have been displaced a required distance from each other.

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12. A method of retrofitting a paver pre-stressor apparatus to an *in situ* paved surface which includes a plurality of pavers, said method including the steps of:

removing at least one paver from the paved surface to form an aperture;

inserting the apparatus into the aperture, the apparatus including:

30 at least two body members arranged to be displaceable relative to each other along at least one axis or arc; and

adjustable urging means arranged between the body members, the urging means

configured to adjustably urge the body members away from each other along said axis or arc; and

adjusting the urging means to facilitate compressive interlocking of the pavers.

5 13. The method of claim 12, which includes the step of filling a remaining portion of the aperture with sand.

14. The method of either one of claims 12 or 13, which includes the step of covering the apparatus with a paver of reduced height or thickness so that said paver covers the
10 apparatus and lies flush with the surface.

15. A method of paving a surface bound by edge portions protruding from the surface, the method including the steps of:

arranging a plurality of pavers in an interlocking fashion on the surface;

15 arranging at least one apparatus in abutting fashion between the pavers, said apparatus including:

at least two body members arranged to be displaceable relative to each other along at least one axis or arc; and

adjustable urging means arranged between the body members, the urging means
20 configured to adjustably urge the body members away from each other along said axis or arc; and

adjusting the urging means to facilitate compressive interlocking of the pavers against the edge portions.

25 16. The method of claim 15, which includes the step of arranging the apparatus so that one of the body members abuts against an edge portion.

17. A paver pre-stressor apparatus, or a method of retrofitting a paver pre-stressor apparatus, or a method of paving a surface, substantially as hereinbefore described.
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18. A paver pre-stressor apparatus, or a method of retrofitting a paver pre-stressor apparatus, or a method of paving a surface, substantially as hereinbefore described and

illustrated with reference to the accompanying drawings.

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