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E04B 1/41

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E1D DPW

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GB 2364720 A **GB 2325257 A**
GB 0252730 A **GB 0231702 A**
EP 1101989 A1

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INT CL[7] **E04B, E04C, F16L**
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(54) Abstract Title
Vertical suspension assembly for buildings

(57) A vertical suspension assembly 1 is mounted in an elongate reentrant recess (5, Fig 1) of a building component and comprises a first channel element 2 partially nested within a second channel element 3. A biassing component 5 imparts a linear motion between the two channels such that the main body 1 may be adjusted between a first position in which the suspension assembly is inserted into the mouth of the elongate reentrant recess (5, Fig 1) and a second position in which the assembly is anchored within the aforementioned recess. The first and second channel elements may have a substantially V-shaped cross-section with a flattened base 4 between the side walls 3a, 3b. The biassing means may be a substantially circular, elliptical or hemispherical rotary cam, and the cutout portions 9a, 9c are received by the roof (9, Fig 1) of the elongate recess (5, Fig 1).

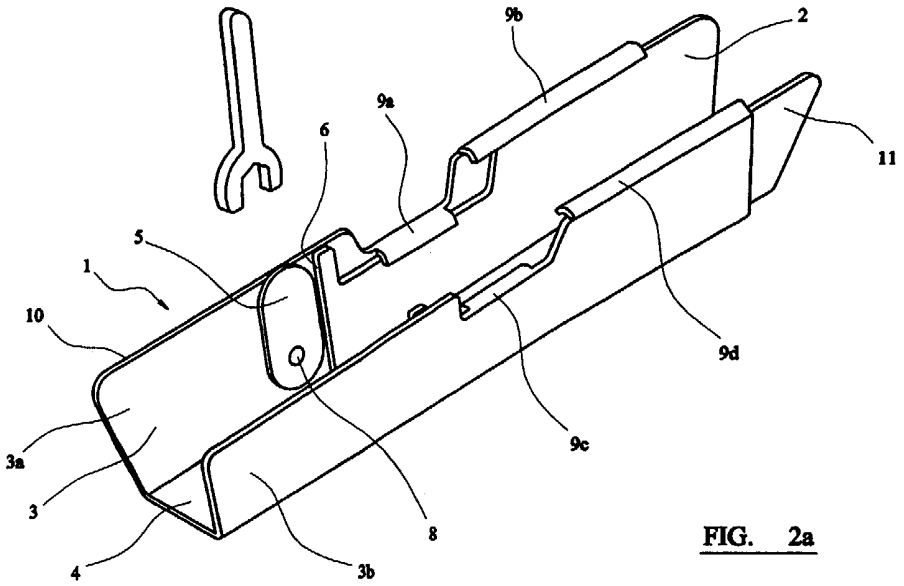

FIG. 2a

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

GB 2 385 070 A

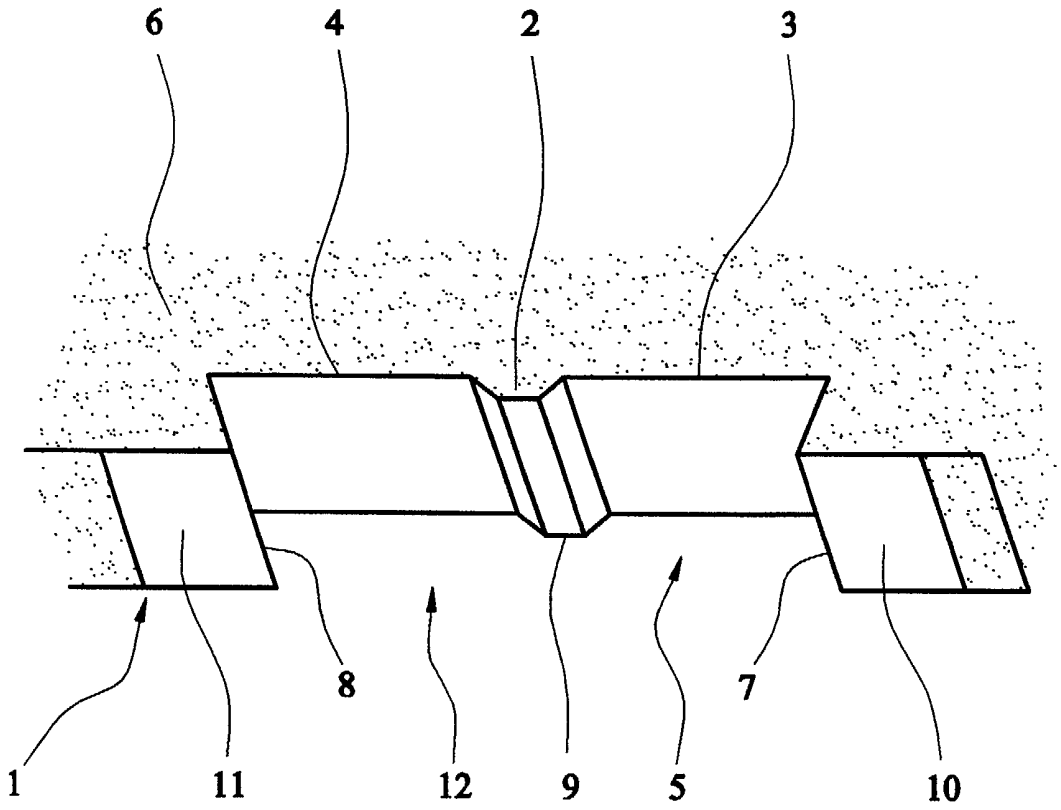

FIG. 1

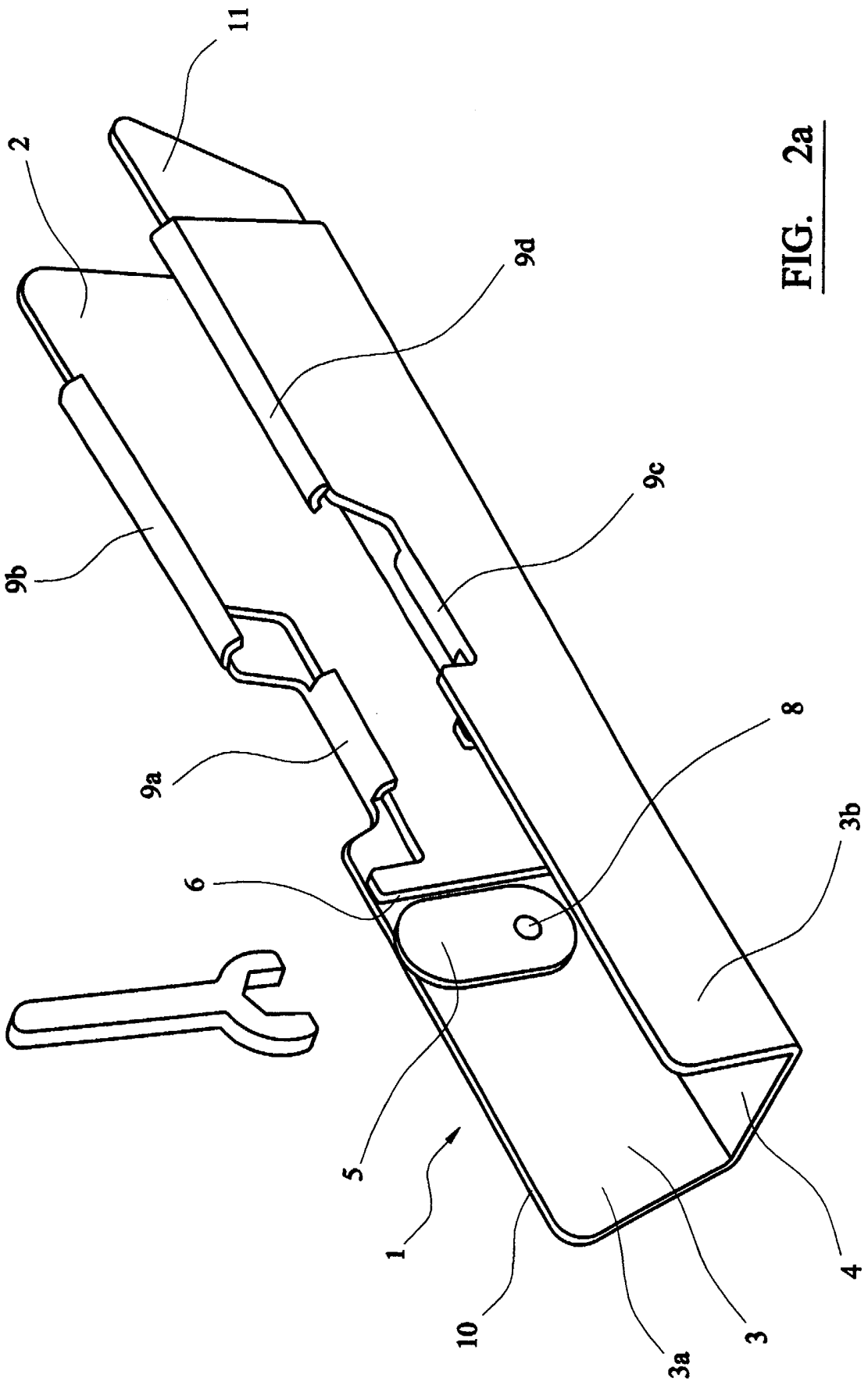

FIG. 2a

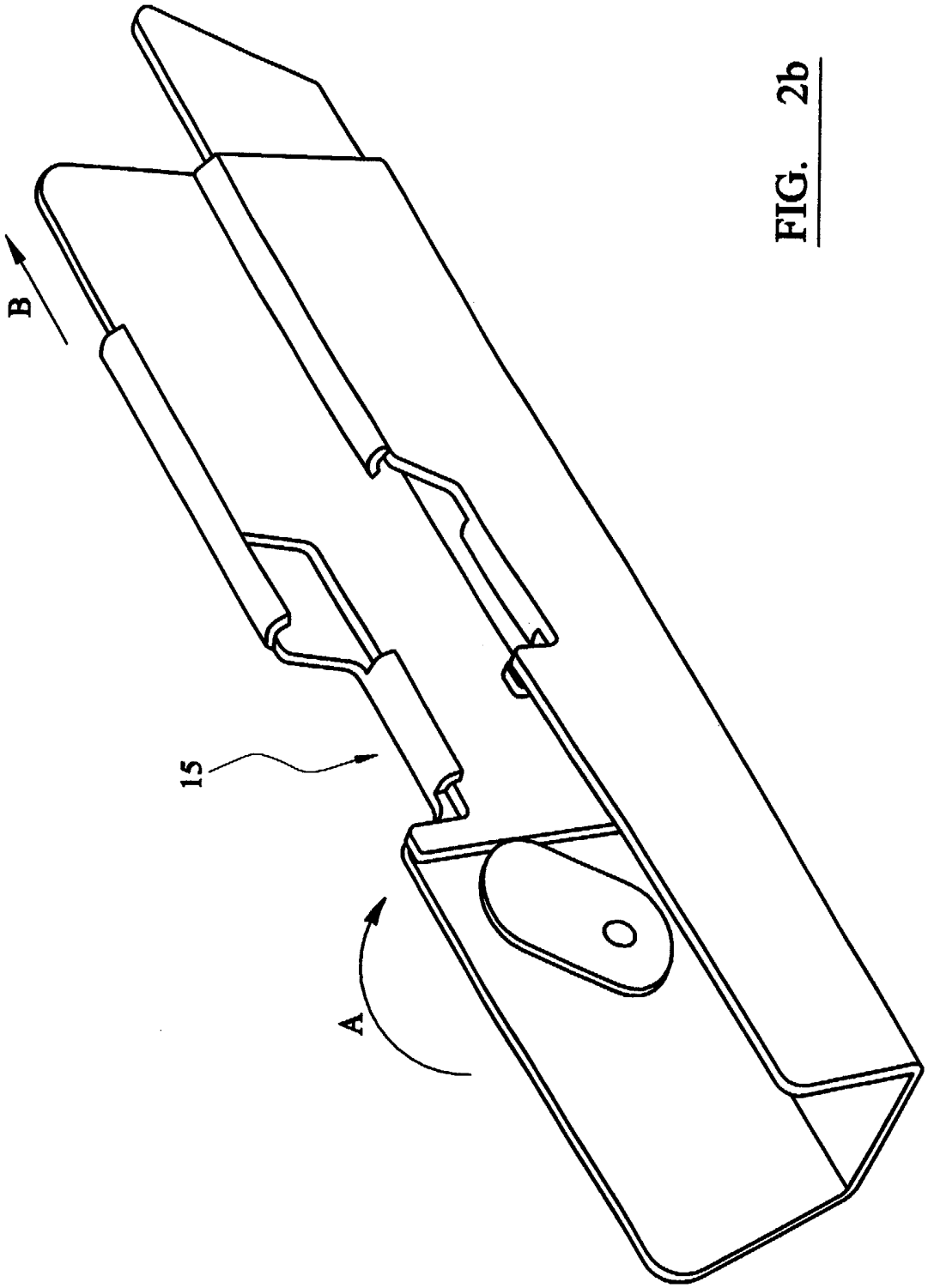

FIG. 2b

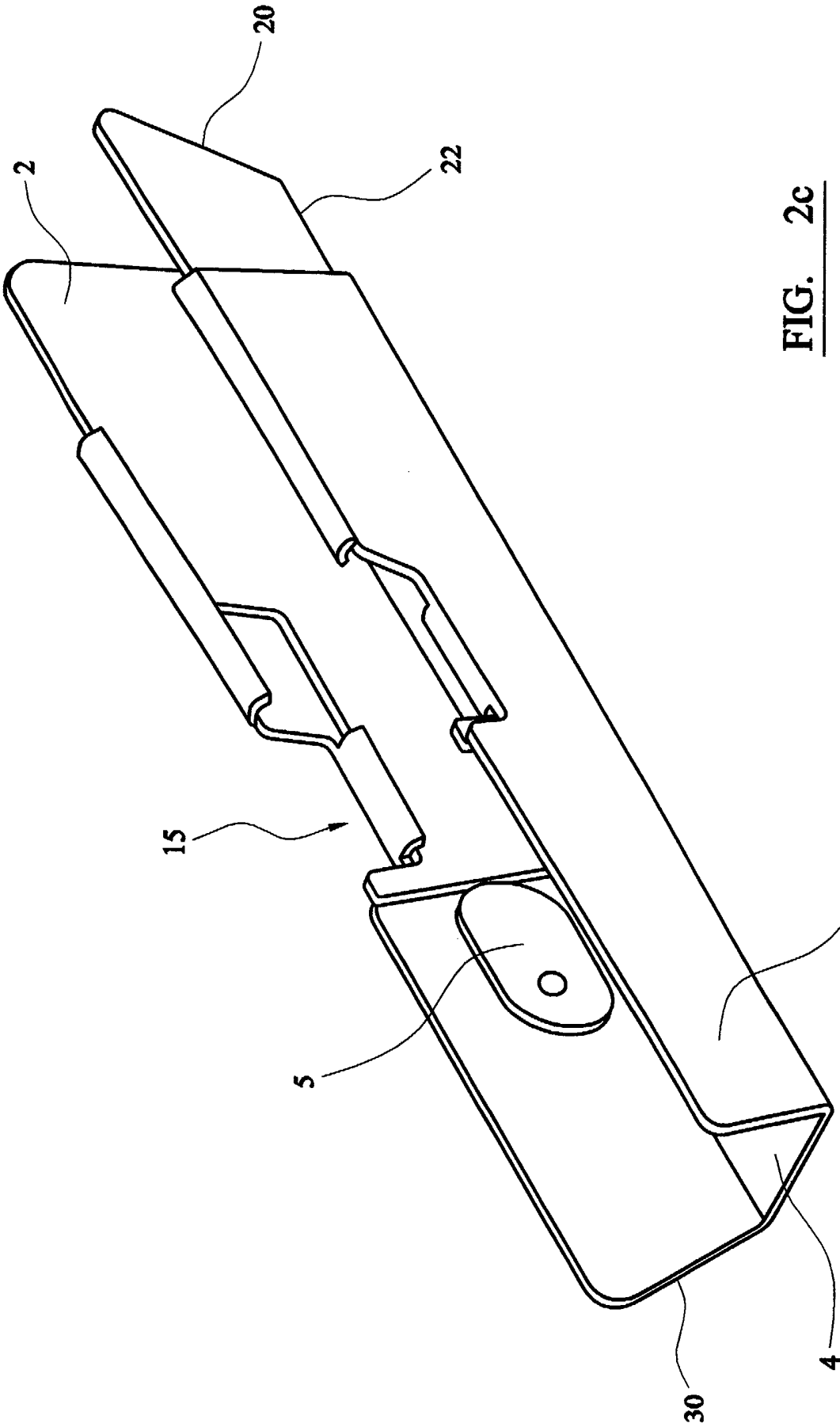

FIG. 2c

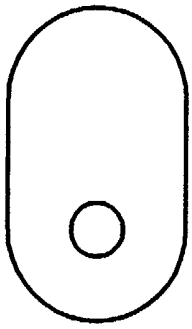

FIG. 3a

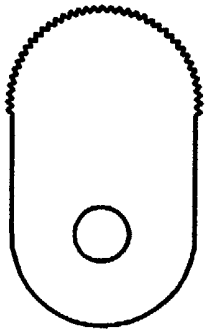

FIG. 3b

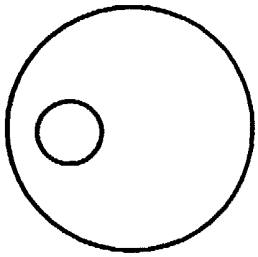

FIG. 3c

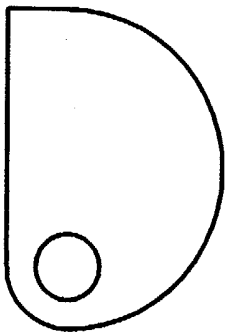

FIG. 3d

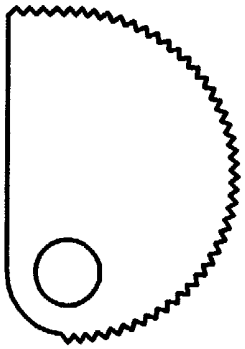

FIG. 3e

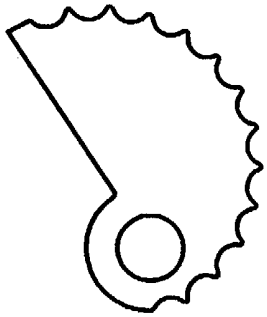

FIG. 3f

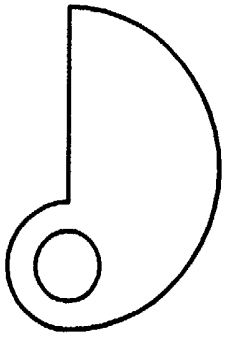

FIG. 3g

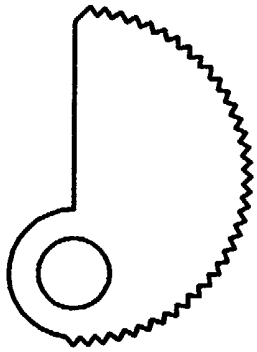

FIG. 3h

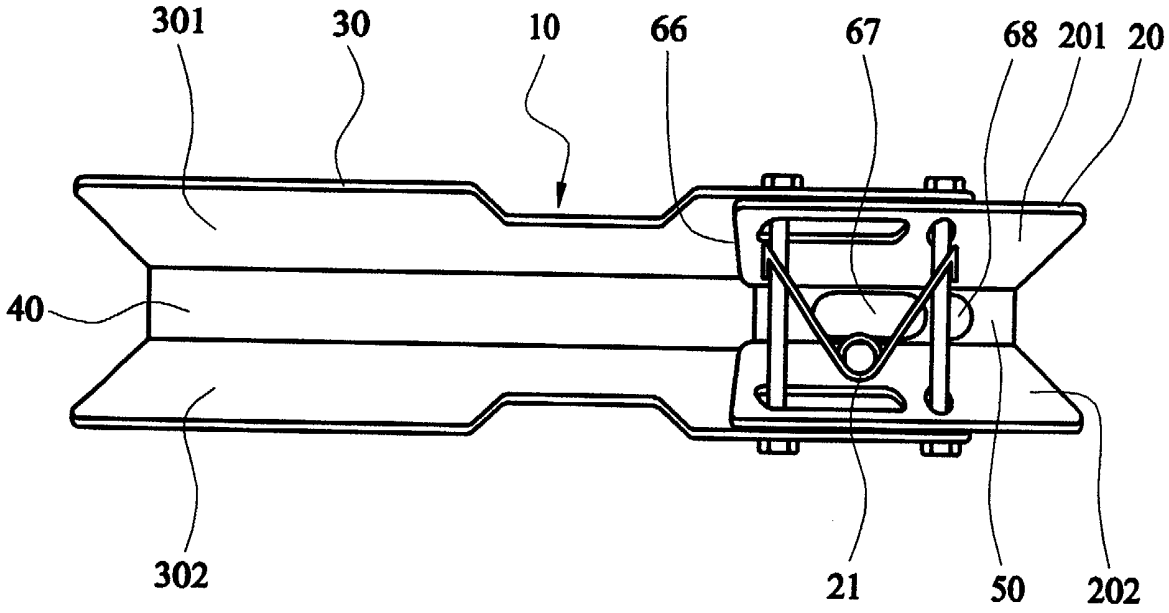
301
30
10
66
67
68
201
20
40
302
21
50
202

FIG. 4a

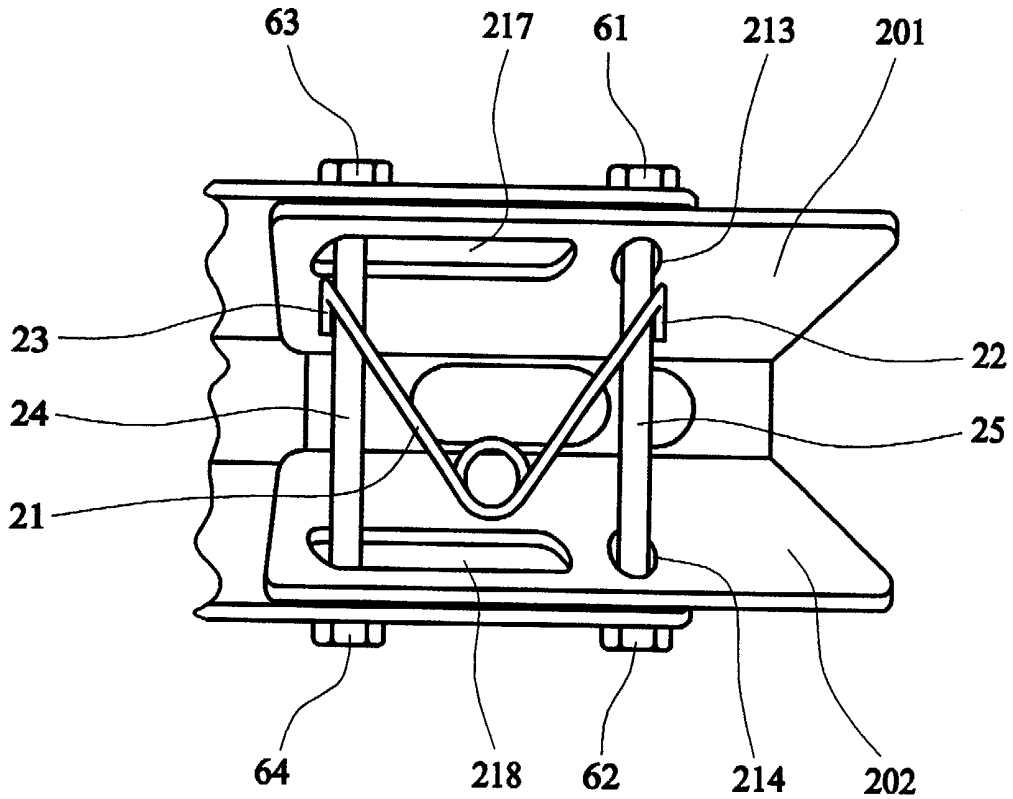
63
217
61
213
201
23
22
24
25
21
64
218
62
214
202

FIG. 4b

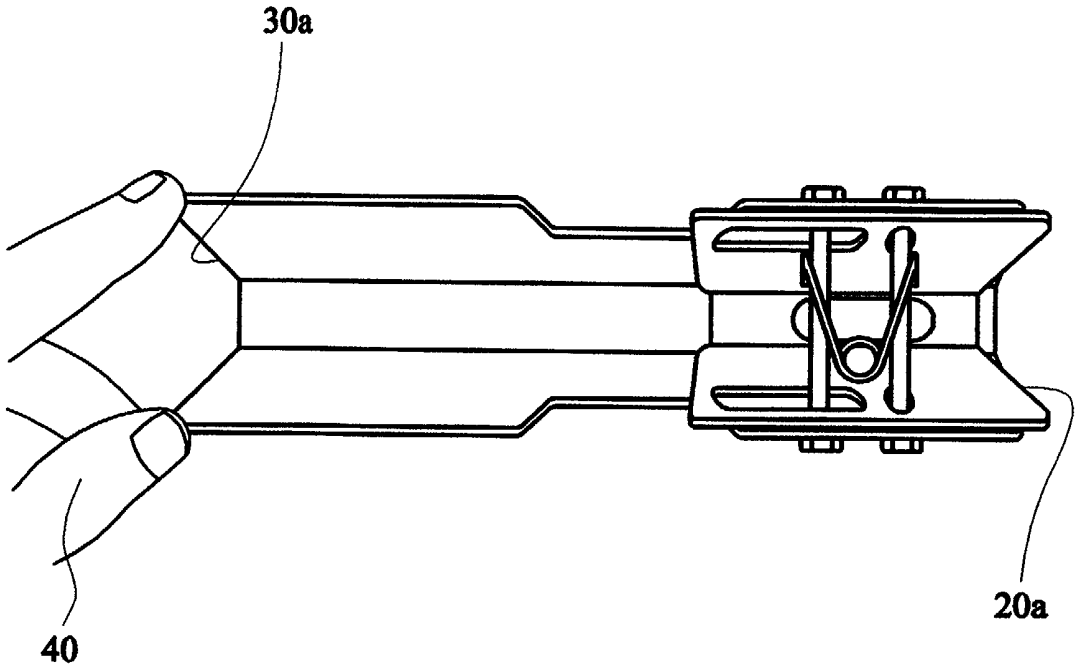

FIG. 4c

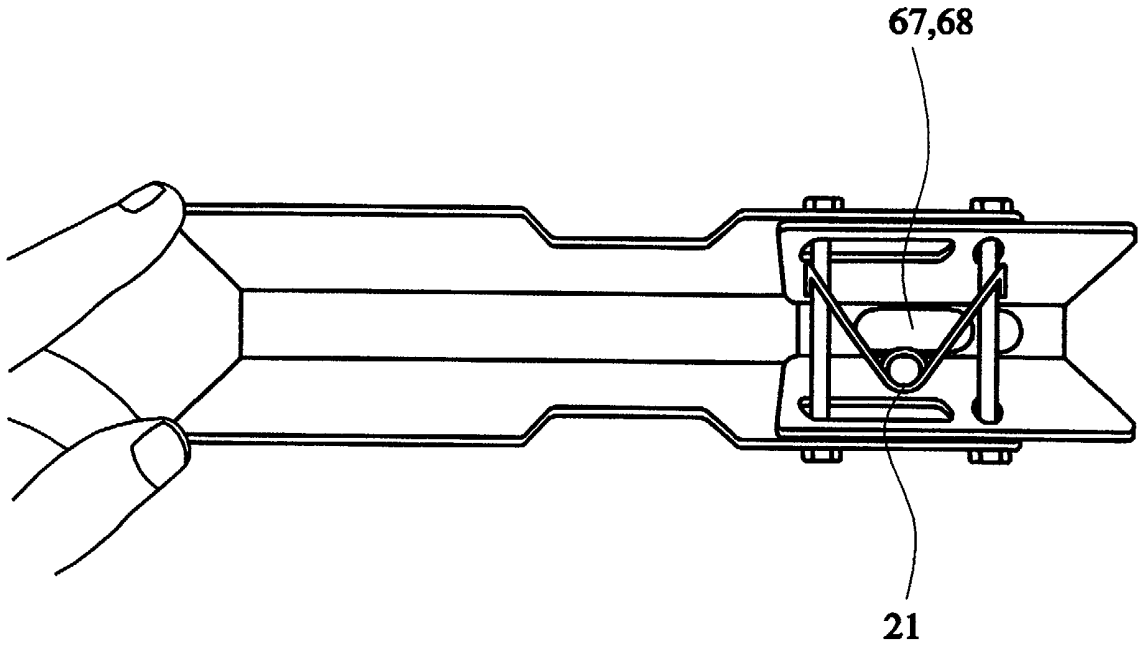

FIG. 4d

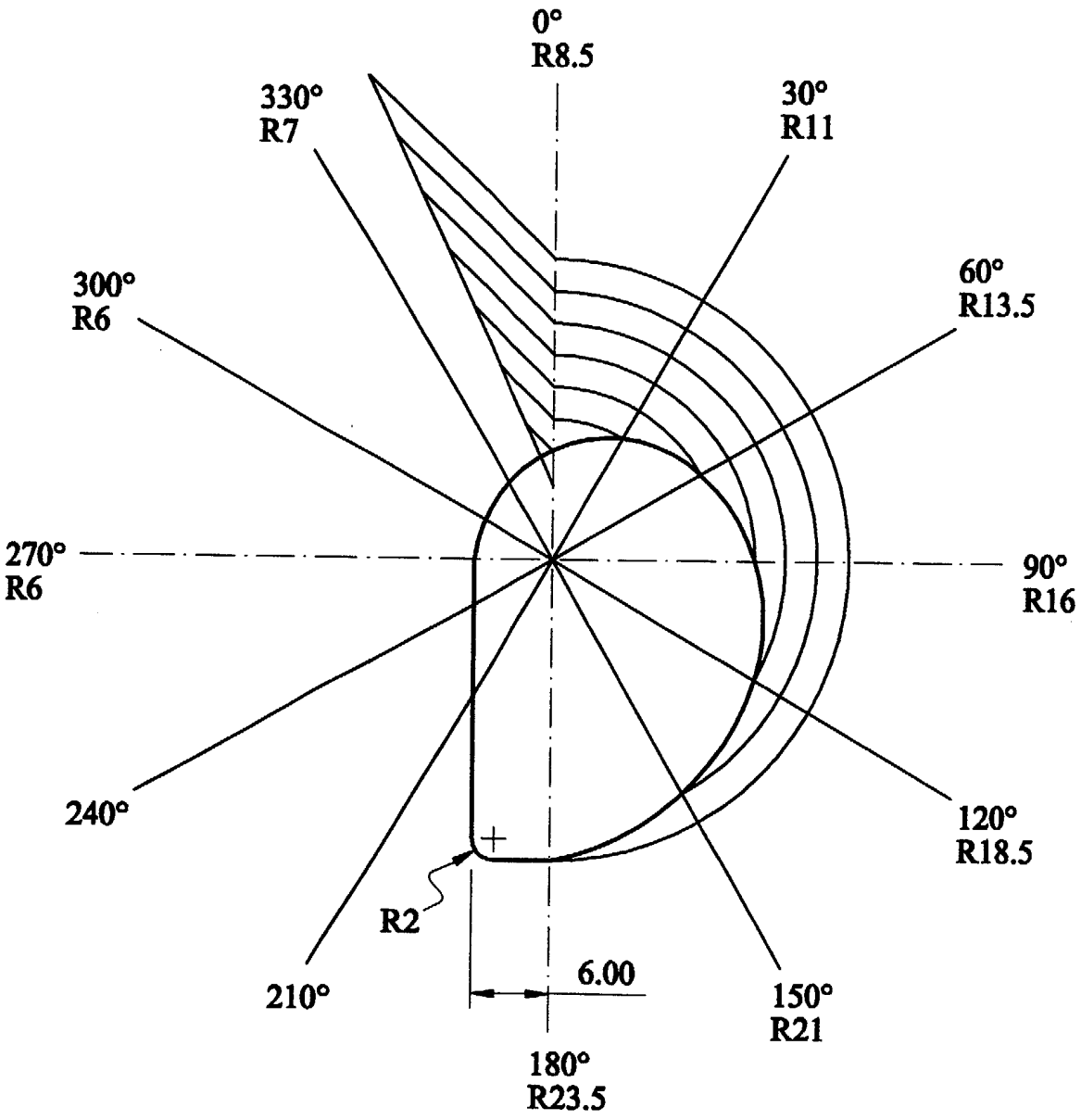
0°
R8.5
30°
R11
60°
R13.5
90°
R16
120°
R18.5
150°
R21
180°
R23.5
210°
240°
270°
R6
300°
R6
330°
R7
R2
6.00

FIG. 5

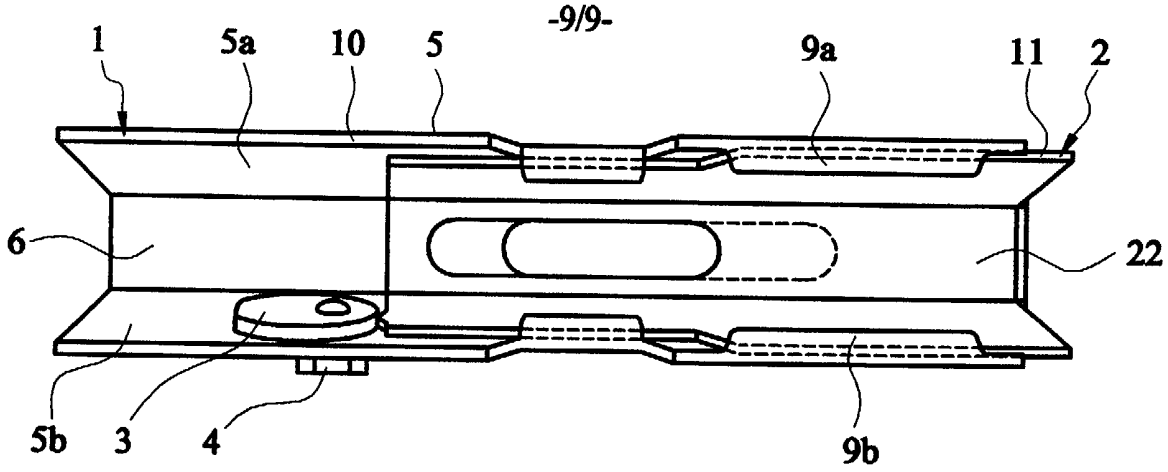

FIG. 6a

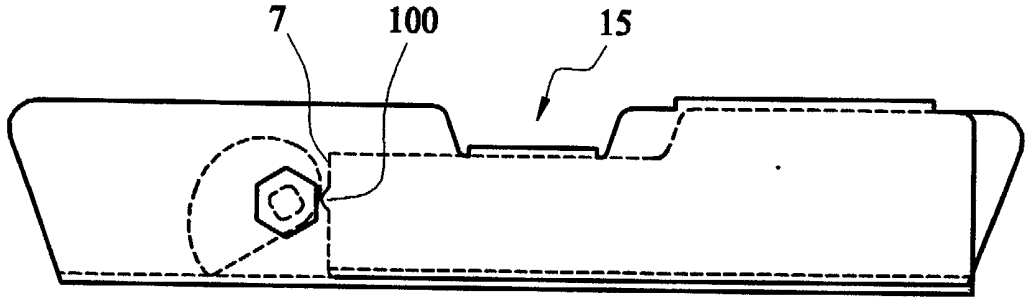

FIG. 6b

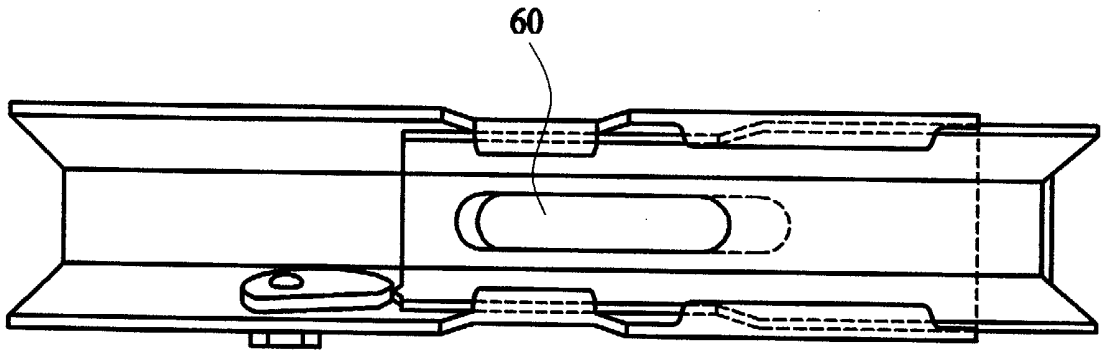

FIG. 6c

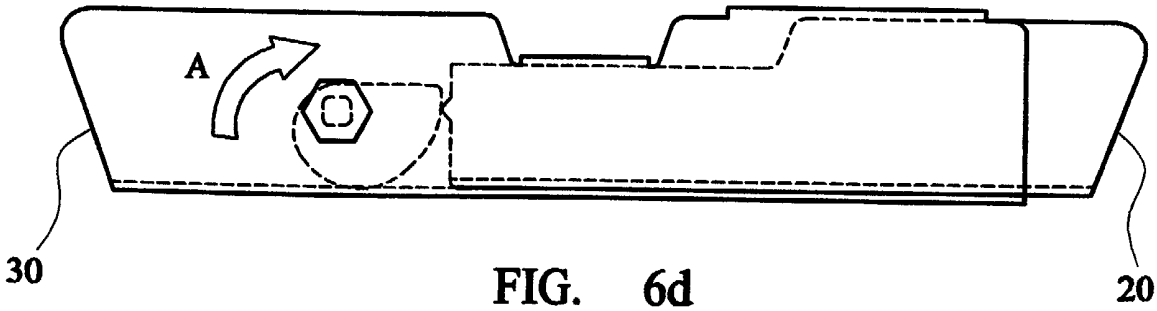

FIG. 6d

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DEVICE

The present invention relates to a vertical suspension assembly for suspending an ancillary structural component from a building component such as a floor decking.

In multi-storey buildings, the ceiling of one storey serves as the floor for the storey above. Such ceilings often have to bear substantial loads (for example in a car park) and so typically are made from reinforced concrete slabs. These reinforced concrete slabs are commonly prepared by using pressed metal decking as a mould onto which concrete may be poured to form a cast slab. The metal decking serves the dual purpose of a) acting as a mould and b) providing tensile reinforcement to the cast slab. After the concrete sets, a composite decking is formed in the underside of which is commonly formed a number of parallel elongate recesses. Such elongate recesses are normally reentrant *ie* have a roof, opposed side walls and a mouth and the spacing apart of the walls increases depthwise (*ie* away from the mouth). By way of example, the elongate recess may be essentially dovetail shaped.

In order for ancillary structural components such as electrical conduits, pipe runs for sprinkler systems and false ceiling panels to be suspended vertically from the underside of a composite decking, a vertical suspension assembly may be used. Generally speaking, a conventional vertical suspension assembly is adapted to enter the mouth of the elongate recess and to be manipulated or adjusted to an anchored position from which it may be used to suspend an ancillary structural component. Resistance to outward deformation of the walls is borne by the concrete and subject to suitably robust design of the vertical suspension assembly, a relatively heavy ancillary structure component may be borne reliably.

A number of vertical suspension assemblies are known. In some cases, the vertical suspension assembly has a main body which may be an adjustable or manipulable head, wedge or nut. The main body may be conveniently rotatable, squeezable or collapsible in order to be inserted into the mouth of the elongate recess from where it adopts an anchored position in which the main body engages with at least the part of the

opposed side walls adjacent to the mouth. For example, the main body may be a two piece body (*eg* a multi-nut, a multi-clip or a collapsible member) or a one piece body (*eg* a wedge nut or a V nut).

A conventional vertical suspension assembly is described in GB-A-2325257 (Glynwed Consumer & Construction Products Limited). This vertical suspension assembly comprises a main body having two pivotally mounted channel elements. In the insertion (unlocked) mode, the main body is inserted into the elongate recess from where the two pivotally mounted channel elements are relatively rotationally adjusted into the anchored (locked) mode. A disadvantage of this arrangement is that it is unable to accommodate inconsistencies in the width of the elongate recess which may arise from manufacturing tolerances and distortion of the elongate recess prior to installation. The former worsens as rolling speeds increase to meet current high demand for deckings.

The present invention is based on the recognition that vertical suspension assemblies may be improved by rendering the main body linearly adjustable from the insertion mode to the anchoring mode. More particularly, the present invention relates to a vertical suspension assembly whose main body comprises twin components which are relatively linearly adjustable to permit progressive tightening against the two side walls of an elongate recess thereby accommodating any inconsistency in the width of the elongate recess.

Thus viewed from one aspect the present invention provides a vertical suspension assembly capable of being mounted in an elongate, reentrant recess of a building component (*eg* a decking) in order to suspend an ancillary structural component therefrom, wherein said assembly comprises:

a main body having a first channel element at least partially nested within a second channel element, each of said first channel element and second channel element comprising a base between opposed side walls; and

biassing means secured to either the first channel element or the second channel element for imparting relative linear motion between the first channel element and the second channel element whereby said main body is linearly adjustable between an insertion

mode in which the main body is insertable through the mouth of the elongate, reentrant recess and an anchoring mode in which the main body is anchored within the elongate, reentrant recess.

In a preferred embodiment, the biassing means is secured to the second channel element for imparting linear motion to the first channel element relative to the second channel element.

In an embodiment of the invention, the elongate, reentrant recess has a roof, opposed side walls and a mouth and the spacing apart of at least the part of the opposed side walls adjacent to said mouth increases depthwise, said main body being linearly adjustable to an anchoring mode in which the first and second channel elements engage at least the part of the opposed side walls adjacent to said mouth. By way of example, the elongate, reentrant recess may have a dovetail shaped profile.

Typically, each of the first channel element and second channel element is of a substantially V-shaped section. Preferably the substantially V-shaped section has a flattened head forming the base between opposed, divergent side walls.

Preferably the first channel element is at least partially and intimately nested within the second channel element. For example, the first channel element has a smaller overall dimension than the second channel element to enable it to be snugly nested within the second channel element.

In a preferred embodiment of the invention, the biassing means comprises:
a cam mounted on an interior surface of the second channel element against a trailing edge of the first channel element; and
actuating means for rotating the cam so as to impart linear motion to the first channel element relative to the second channel element whereby said main body is linearly adjustable between the insertion mode and the anchoring mode. Preferably the cam is mounted on the interior surface of a side wall of the second channel element.

The cam may be a linear or rotary cam. Preferably the cam is a rotary cam mounted on an interior surface (preferably a side wall) of the second channel element. For this purpose, the trailing edge of the first channel elements is substantially perpendicular to the direction of relative linear motion. The rotary cam may be mounted by a conventional fastener passing through its fulcrum (*eg* a bolt, pin or rivet) which extends externally into a portion (*eg* a head) cooperable with the actuating means to permit rotation thereof. The actuating means may be a spanner for example.

The rotary cam is generally an irregular shape but may be substantially circular, elliptical or hemispherical. The position and diameter of the cam defines the anchoring mode of maximum extent and the insertion mode of minimum extent and may be tailored accordingly.

The cam may be machined to a predetermined profile such that any tendency for the main body to linearly dislocate from the anchoring mode towards the insertion mode is resisted. This may be achieved by ensuring that any dislocation force passes through the contact between the rotary cam and trailing edge of the first channel element and the fulcrum of the rotary cam. For this purpose, the predetermined profile is preferably essentially an Archimedian spiral.

The (or a part of the) circumferential edge of the rotary cam may be provided with a plurality of flattened portions or teeth. This advantageously helps to resist any tendency for the main body to be dislodged from the anchoring mode.

The trailing edge of the first channel element may be provided with a pip. This advantageously helps to ensure that the any dislocation force passes through the contact between the rotary cam and trailing edge of the first channel element and the fulcrum of the rotary cam so as resist any tendency for the main body to be dislodged from the anchoring mode. Preferably the pip is a substantially triangular pip.

In a preferred embodiment of the invention, the biassing means is a resilient biassing means, a first end of which is secured or (preferably) coupled to the first channel

element and a second end of which is secured or (preferably) coupled to the second channel element such as to adopt a deformed state at all positions between the insertion mode of minimum extent and anchoring mode of maximum extent inclusively.

The first end of the resilient biassing means may be coupled to the first channel element by a first transverse fastener extending between the side walls of the first channel element. The first transverse fastener may be secured to the side walls of the first channel element. Preferably the first transverse fastener is secured through an aperture in the side walls of the first channel element. Particularly preferably the first transverse fastener passes through an aperture in the side walls of the first channel element and through a cut away portion in the side walls of the second channel element. The cut away portion in the side walls of the second channel element is adapted to permit relative linear motion between the first channel element and the second channel element. Preferably the cut away portion in the side walls is an elongate slot which advantageously acts as a means for retaining and guiding the first elongate channel within the second elongate channel during the relative linear motion.

The second end of the resilient biassing means may be coupled to the second channel element by a second transverse fastener extending between the side walls of the second channel element. The second transverse fastener may be secured to the side walls of the second channel element. Preferably the second transverse fastener is secured through an aperture in the side walls of the second channel element. Particularly preferably the second transverse fastener passes through an aperture in the side walls of the second channel element and through a cut away portion in the side walls of the first channel element. The cut away portion in the side walls of the first channel element is adapted to permit relative linear motion between the first channel element and the second channel element. Preferably the cut away portion in the side walls of the first channel element is an elongate slot which advantageously acts as a means for retaining and guiding the first elongate channel within the second elongate channel during the relative linear motion.

In a preferred embodiment of the invention, the cut away portion in the side walls of the first channel element is nearer to the trailing edge than the aperture and the cut away

portion in the side walls of the second channel element is nearer to its trailing edge than the aperture. The respective positions and lengths of the cut away portions define the anchoring mode of maximum extent and the insertion mode of minimum extent and may be tailored accordingly.

The first and/or second transverse fastener may be threaded or non-threaded and may be for example a rivet or a bolt secured by a nut. The resilient biassing means may be a spring such as a coiled or (preferably) flat spring.

In an embodiment of the invention, the first channel element and/or second channel element comprises one or more retaining means for retaining the first channel element within the second channel element. For example, the second channel element may comprise one or more retaining lips extending inwardly and downwardly from at least a part of its uppermost edge, said retaining lip(s) being capable of encapsulating the uppermost edge of the first channel element.

In an embodiment of the invention, the profile of the leading edge of the first channel element conforms generally to the profile of the part of the opposed side wall of the elongate recess against which the first channel element engages in the anchoring mode (*eg* the dovetail profile). Typically the profile of the trailing edge of the first channel element is substantially perpendicular.

In an embodiment of the invention, the profile of the leading edge of the second channel element conforms generally to the profile of the part of the opposed side wall of the elongate recess against which the second channel element engages in the anchoring mode (*eg* the dovetail profile). Typically the profile of the trailing edge of the second channel element is substantially perpendicular.

In an embodiment of the invention, the central portion of the uppermost edge of each of the side walls of the second channel element is cut away to receive (in the mounting mode) a central protrusion on the roof of the elongate, reentrant recess.

In a preferred embodiment, the vertical suspension assembly further comprises: locking means for locking the main body in the anchoring mode. The locking means may comprise male and female elements interlockable in the mounting mode. For example, the male and female elements may be a depression and protrusion respectively (or a plurality thereof) in the first channel element and second channel element (or vice versa). Preferably the base of the first elongate channel is provided with a hole which is coaxial with a hole in the base of the second elongate channel in the anchoring mode, wherein the locking means is a threaded or non-threaded fastener (such as a nut and bolt) capable of passing through the coaxial holes. Preferably the locking means is ratcheted.

In order to suspend the ancillary structural component, the first and/or second channel element may be adapted to receive (*eg* threadedly receive) a fastening member. The fastening member may be a threaded rod (commonly referred to as a drop rod) or suspension wire and may be used to attach directly or indirectly the ancillary structural component. For example, the base of the second elongate channel may be provided with a threaded or non-threaded aperture to receive the fastening member. Where appropriate, the base of the first elongate channel may be provided with a threaded or non-threaded aperture to receive the fastening member. Typically the base of the first elongate channel is provided with an aperture which is coaxial with an aperture in the base of the second elongate channel in at least the anchoring mode.

The present invention will now be described in a non-limitative sense with reference to the accompanying Figures in which:

Figure 1 illustrates in underside perspective view a floor decking in connection with which the vertical suspension assembly of the present invention may be used;

Figures 2a to c illustrate the operation of an embodiment of the vertical suspension assembly of the invention;

Figure 3 illustrates various rotary cams which may be used in the embodiment of the vertical suspension assembly of the invention illustrated in Figures 2a to c;

Figures 4a to d illustrate in plan view an embodiment of the vertical suspension assembly of the invention in (a) plan view, (b) partial close-up view, (c) in use in the insertion mode and (d) in use in the anchoring mode;

Figure 5 illustrates a rotary cam which is used in a preferred embodiment of the vertical suspension assembly of the invention; and

Figure 6 illustrates the operation of an embodiment of the vertical suspension assembly of the invention between the insertion mode (a) and the anchoring mode (b) .

A typical decking in connection with which the vertical suspension assembly of the present invention is used is shown in Figure 1 designated generally by reference numeral 1. The decking 1 is shown in partial view only and may in fact be manufactured to any required length with any required depth or width. The decking 1 has a central protrusion 2 extending horizontally into support panels 3, 4 which together form the roof 9 of an elongate recess 5. When in position, the two support panels 3, 4 partially cover the underside of a concrete floor 6. Extending from each support panel 3, 4 is a side wall 7, 8 respectively. The angle of intersection between each support panel 3, 4 and the respective connecting side wall 7, 8 is less than 90° rendering the elongate recess 5 reentrant. Typically, the angle of intersection is in the range 20 to 80°. The side walls 7, 8 are planar thereby defining a dovetailed profile of constant width along the elongate recess 5. Each side wall 7, 8 extends into a tongue 10, 11 respectively, each tongue 10,11 covering a portion of the lower surface of the concrete floor 6. The intersection of the tongue 10, 11 and respective side wall 7, 8 define the edges of the mouth 12 of the elongate recess 5.

Figures 2a to c illustrate the operation of an embodiment of the vertical suspension assembly of the invention designated generally by reference numeral 1. The vertical suspension assembly 1 comprises a first channel element 2 partially nested within a second channel element 3 which together constitute the main body of the assembly. Each of the first channel element 2 and second channel element 3 is of a substantially V-shaped section with a flattened head forming a base (indicated by reference numeral 4 for the second channel element 3) between opposed side walls (indicated by reference numerals 3a, 3b for the second channel element 3). The first channel element 2 has similar but slightly smaller overall dimensions than the second channel element 3 to enable it to be snugly nested within the second channel element 3. Retaining lips 9a-d extend inwardly and downwardly from the uppermost edge 10 of the second channel element 3 encapsulating the uppermost

edge 11 of the first channel element 2 for retaining the first channel element 2 within the second channel element 3.

Mounted on the side wall 3a of the second channel element 3 by a bolt 8 is a rotary cam 5 of a substantially elliptical profile. In the insertion mode of minimum extent shown in Figure 2a, the rotary cam 5 lies against a perpendicular trailing edge 6 of the first channel element 2. By turning a spanner 7 applied to the external nut (hidden) of the bolt 8 in the direction A (see Figure 2b), the rotary cam 5 may be actuated to progressively bias the first channel element 2 (in the direction B) to enable the main body to adopt the anchoring mode. The anchoring mode of maximum extent is shown in Figure 2c where the rotary cam 5 has biassed the first channel element 2 to its fullest extent relative to the second channel element 3. The profile of the leading edge 20 of the first channel element 2 and of the leading edge 30 of the second channel element 3 conforms generally to the profile of the side walls 7,8 of a decking 1 as described with reference to Figure 1. Similarly the profile of a cut away portion 15 conforms generally to the profile of the central protrusion 2 of a decking 1 as described with reference to Figure 1.

The main body may be locked in the anchoring mode by a nut and bolt passing through coaxial holes (hidden) in the base 22 of the first channel element 2 and the base 4 of the second channel element 3.

Although Figures 2a-c illustrate the rotary cam as substantially elliptical, the rotary cam may adopt any irregular shape. Examples are illustrated in Figure 3 and include substantially circular (see c), elliptical (see a, b) or hemispherical (see d-h) profiles. A part of the circumferential edge of the rotary cam may be provided with a plurality of flattened portions (see c) or teeth (see b, e, f and h).

Figure 5 illustrates a preferred rotary cam which essentially adopts the predetermined profile of an Archimedian spiral. The profile is generated by joining each of the illustrated radii (R6 to R23.5mm) to a corresponding angular line.

Figures 4a-d illustrate a preferred embodiment of the vertical suspension assembly of the invention designated generally by reference numeral 10. The vertical suspension assembly 10 comprises a first channel element 20 partially nested within a second channel element 30 which together constitute the main body. Each of the first channel element 20 and second channel element 30 is of a substantially V-shaped section with a flattened head forming a base (40 for the second channel element 30 and 50 for the first channel element 20) between opposed side walls (301, 302 for the second channel element 30 and 201, 202 for the first channel element 20). The first channel element 20 has similar but slightly smaller overall dimensions than the second channel element 30 to enable it to be snugly nested within the second channel element 30.

A first end 22 of a flat spring 21 is coupled to the first channel element 20 by a first bolt 25 and a second end 23 of the flat spring 21 is coupled to the second channel element 30 by a second bolt 24. The flat spring 21 adopts a deformed state at all positions between the insertion mode of minimum extent (see Figure 4c) and the anchoring mode of maximum extent (see Figure 4d).

The first bolt 25 passes through an aperture 213, 214 in the side walls 201, 202 of the first channel element 20 and through an elongate slot (hidden) in the side walls 301, 302 of the second channel element 30. The second bolt 24 passes through an aperture (hidden) in the side walls 301, 302 of the second channel element 30 and through an elongate slot 217, 218 in the side walls 201, 202 of the first channel element 20. The elongate slots 217, 218 in the side walls 201, 202 of the first channel element 20 are nearer to the trailing edge 66 than the aperture 213, 214 respectively.

The bolts 25 and 24 have a head 61, 63 respectively and are secured at the opposite ends by bolts 62 and 64 respectively. The respective positions and lengths of the elongate slots 217, 218 of the first channel element 20 and the elongate slots (hidden) of the second channel element 30 define the anchoring mode of maximum extent and the insertion mode of minimum extent.

In the uninstalled mode (see Figure 4a) of the main body, the flat spring 21 biasses the first bolt 25 to the end of the elongate slots (hidden) in the side walls 301, 302 of the second channel element 30 and the second bolt 24 to the end of the elongate slots 217, 218 of the first channel element 20. The user 40 applies pressure to the leading edges 20a and 30a of the first channel member 20 and second channel member 30 respectively to further deform the flat spring 2 and to adjust the main body into the insertion mode (see Figure 4c). In this mode, the main body may be inserted into the mouth 12 of the elongate recess 5 (see Figure 1). After insertion, the user 40 releases the leading edges 20a, 30a and the flat spring 21 biasses the main body into the anchoring mode (shown at its maximum extent in Figure 4d). In order to lock the main body in the anchoring mode, a bolt may be passed through hole 67 in the base 50 of the first channel element 20 and hole 68 in the base 40 of the second channel element 30 when they are coaxial (67, 68 as shown in Figure 4d).

Figure 6 illustrates the operation of an embodiment of the vertical suspension assembly of the invention designated generally by reference numeral 1 in the insertion mode (a) and anchoring mode (b). The vertical suspension assembly 1 comprises a first channel element 2 partially nested within a second channel element 5 which together constitute the main body of the assembly. Each of the first channel element 2 and second channel element 5 is of a substantially V-shaped section with a flattened head forming a base (indicated by reference numeral 6 for the second channel element 5) between opposed side walls (indicated by reference numerals 5a, 5b for the second channel element 5). The first channel element 2 has similar but slightly smaller overall dimensions than the second channel element 5 to enable it to be snugly nested within the second channel element 5. Retaining lips 9a and 9b extend inwardly and downwardly from the uppermost edge 10 of the second channel element 5 encapsulating the uppermost edge 11 of the first channel element 2 for retaining the first channel element 2 within the second channel element 5.

Mounted on the side wall 5b of the second channel element 5 by a pin is a rotary cam 3 of a predetermined profile described above with reference to Figure 5. In the insertion mode of minimum extent shown in Figure 6a, the rotary cam 3 lies against a perpendicular trailing edge 7 of the first channel element 2. By turning a spanner applied to the external drive head 4 of the pinin the direction A (see Figure 6b), the rotary cam 3 may

be actuated to progressively bias the first channel element 2 to enable the main body to adopt the anchoring mode. The rotary cam makes contact with a pip 100 on the trailing edge 7 of the first channel element 2. This ensures that the line of action between the rotary cam 3 and the first channel element 2 passes through the fulcrum of the rotary cam 3 so that the rotary cam 3 is able to push the first channel element 2 towards the anchoring mode but the first channel element 2 is not able to push the rotary cam 3 back towards the insertion mode. The anchoring mode of maximum extent is shown in Figure 6b where the rotary cam 3 has biassed the first channel element 2 to its fullest extent relative to the second channel element 5.

The profile of the leading edge 20 of the first channel element 2 and of the leading edge 30 of the second channel element 3 conforms generally to the profile of the side walls 7,8 of a decking 1 as described with reference to Figure 1. Similarly the profile of a cut away portion 15 conforms generally to the profile of the central protrusion 2 of a decking 1 as described with reference to Figure 1. The main body may be locked in the anchoring mode by a nut and bolt passing through coaxial holes 60 in the base 22 of the first channel element 2 and the base 6 of the second channel element 5.

CLAIMS

1. A vertical suspension assembly capable of being mounted in an elongate, reentrant recess of a building component in order to suspend an ancillary structural component therefrom, wherein said assembly comprises:

a main body having a first channel element at least partially nested within a second channel element, each of said first channel element and second channel element comprising a base between opposed side walls; and

biassing means secured to either the first channel element or the second channel element for imparting relative linear motion between the first channel element and the second channel element whereby said main body is linearly adjustable between an insertion mode in which the main body is insertable through the mouth of the elongate, reentrant recess and an anchoring mode in which the main body is anchored within the elongate, reentrant recess.

2. A vertical suspension assembly as claimed in claim 1 wherein the biassing means is secured to the second channel element for imparting linear motion to the first channel element relative to the second channel element.

3. A vertical suspension assembly as claimed in any preceding claim wherein the elongate, reentrant recess has a roof, opposed side walls and a mouth and the spacing apart of at least the part of the opposed side walls adjacent to said mouth increases depthwise, said main body being linearly adjustable to an anchoring mode in which the first and second channel elements engage at least the part of the opposed side walls adjacent to said mouth.

4. A vertical suspension assembly as claimed in claim 3 wherein the elongate, reentrant recess has a dovetail shaped profile.

5. A vertical suspension assembly as claimed in any preceding claim wherein each of the first channel element and second channel element is of a substantially V-shaped section.

6. A vertical suspension assembly as claimed in claim 5 wherein the substantially V-shaped section has a flattened head forming the base between opposed, divergent side walls.

7. A vertical suspension assembly as claimed in any preceding claim wherein the first channel element is at least partially and intimately nested within the second channel element.

8. A vertical suspension assembly as claimed in claim 7 wherein the first channel element has a smaller overall dimension than the second channel element to enable it to be snugly nested within the second channel element.

9. A vertical suspension assembly as claimed in any preceding claim wherein the biassing means comprises:
a cam mounted on an interior surface of the second channel element against a trailing edge of the first channel element; and
actuating means for rotating the cam so as to impart linear motion to the first channel element relative to the second channel element whereby said main body is linearly adjustable between the insertion mode and the anchoring mode.

10. A vertical suspension assembly as claimed in claim 9 wherein the cam is mounted on the interior surface of a side wall of the second channel element.

11. A vertical suspension assembly as claimed in claim 9 or 10 wherein the cam is a rotary cam mounted on an interior surface of the second channel element.

12. A vertical suspension assembly as claimed in any of claims 9 to 11 wherein the trailing edge of the first channel element is substantially perpendicular to the direction of relative linear motion.

13. A vertical suspension assembly as claimed in either of claims 11 or 12 wherein the rotary cam is substantially circular, elliptical or hemispherical.

14. A vertical suspension assembly as claimed in either of claims 11 or 12 wherein the rotary cam is generally an irregular shape.

15. A vertical suspension assembly as claimed in any of claims 11 to 14 wherein the rotary cam is machined to a predetermined profile such that any tendency for the main body to linearly dislocate from the anchoring mode towards the insertion mode is resisted.

16. A vertical suspension assembly as claimed in claim 15 wherein the rotary cam is machined to a predetermined profile such that any dislocation force passes through the contact region between the rotary cam and trailing edge of the first channel element and the fulcrum of the rotary cam.

17. A vertical suspension assembly as claimed in either of claims 15 and 16 wherein the predetermined profile is essentially an Archimedian spiral.

18. A vertical suspension assembly as claimed in any of claims 11 to 17 wherein the (or a part of the) circumferential edge of the rotary cam is provided with a plurality of flattened portions or teeth.

19. A vertical suspension assembly as claimed in any of claims 11 to 18 wherein the trailing edge of the first channel element is provided with a pip.

20. A vertical suspension assembly as claimed in claim 19 wherein the pip is a substantially triangular pip.

21. A vertical suspension assembly as claimed in any of claims 1 to 8 wherein the biassing means is a resilient biassing means, a first end of which is secured or coupled to the first channel element and a second end of which is secured or coupled to the second channel element such as to adopt a deformed state at all positions between the insertion mode of minimum extent and anchoring mode of maximum extent inclusively.

22. A vertical suspension assembly as claimed in claim 21 wherein the first end of the resilient biassing means is coupled to the first channel element by a first transverse fastener extending between the side walls of the first channel element.

23. A vertical suspension assembly as claimed in claim 22 wherein the first transverse fastener is secured through an aperture in the side walls of the first channel element.

24. A vertical suspension assembly as claimed in either claims 22 or 23 wherein the first transverse fastener passes through an aperture in the side walls of the first channel element and through a cut away portion in the side walls of the second channel element, wherein the cut away portion in the side walls of the second channel element is adapted to permit relative linear motion between the first channel element and the second channel element.

25. A vertical suspension assembly as claimed in claim 24 wherein the cut away portion in the side walls is an elongate slot.

26 A vertical suspension assembly as claimed in any of claims 22 to 25 wherein the second end of the resilient biassing means is coupled to the second channel element by a second transverse fastener extending between the side walls of the second channel element.

27. A vertical suspension assembly as claimed in claim 26 wherein the second transverse fastener is secured through an aperture in the side walls of the second channel element.

28. A vertical suspension assembly as claimed in claim 26 or 27 wherein the second transverse fastener passes through an aperture in the side walls of the second channel element and through a cut away portion in the side walls of the first channel element, wherein the cut away portion in the side walls of the first channel element is adapted to permit relative linear motion between the first channel element and the second channel element.

29. A vertical suspension assembly as claimed in claim 28 wherein the cut away portion in the side walls of the first channel element is an elongate slot.

30. A vertical suspension assembly as claimed in any preceding claim wherein the first channel element and/or second channel element comprises one or more retaining means for retaining the first channel element within the second channel element.

31. A vertical suspension assembly as claimed in claim 30 wherein the second channel element comprises one or more retaining lips extending inwardly and downwardly from at least a part of its uppermost edge, said retaining lip(s) being capable of encapsulating the uppermost edge of the first channel element.

32. A vertical suspension assembly as claimed in any preceding claim further comprising:

locking means for locking the main body in the anchoring mode.

33. A vertical suspension assembly as claimed in claim 32 wherein the locking means comprises male and female elements interlockable in the anchoring mode.

34. A vertical suspension assembly as claimed in claim 33 wherein the male and female elements are a depression and protrusion respectively (or a plurality thereof) in the first channel element and second channel element (or vice versa).

35. A vertical suspension assembly as claimed in claim 33 wherein the base of the first channel element is provided with a hole which is coaxial with a hole in the base of the second channel element in the anchoring mode, wherein the locking means is a threaded or non-threaded fastener capable of passing through the coaxial holes.

Application No:	GB 0217951.3	**Examiner:**	Gerrie Mullen
Claims searched:	1 to 35	**Date of search:**	25 April 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
A	-	GB 2325257 A	(Kippel)
A	-	GB 2364720 A	(Kippel et al.)
A	-	GB 252730	(Halfen)
A	-	GB 231702	(Halfen et al.)
A	-	EP 1101989 A1	(van Groos et al.)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[V]:

E1D

Worldwide search of patent documents classified in the following areas of the IPC[7]:

E04B, E04C, F16L

The following online and other databases have been used in the preparation of this search report:

EPODOC, WPI, PAJ