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(54) Titre : ASSEMBLAGE STRATIFIE
(54) Title: LAMINATE ASSEMBLY

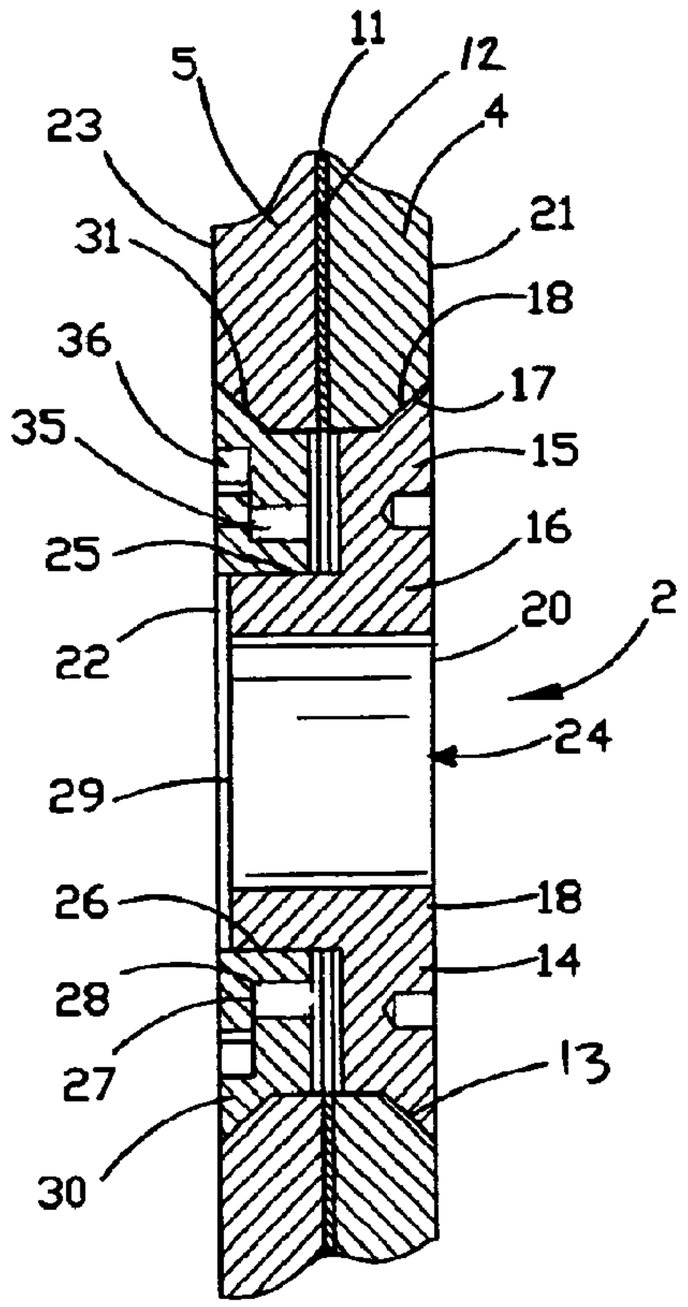

Figure 2c

(57) Abrégé/Abstract:
An assembly including: a laminate which has two parallel panes with a substantially aligned pair of apertures; a fixing device fitted in the apertures, the device having component parts coupled through the apertures from opposed sides of the laminate; wherein sides of the apertures have a taper and the parts of the device are profiled to match the taper.

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[Continued on next page]

(54) Title: LAMINATE ASSEMBLY

(57) Abstract: An assembly including: a laminate which has two parallel panes with a substantially aligned pair of apertures; a fixing device fitted in the apertures, the device having component parts coupled through the apertures from opposed sides of the laminate; wherein sides of the apertures have a taper and the parts of the device are profiled to match the taper.

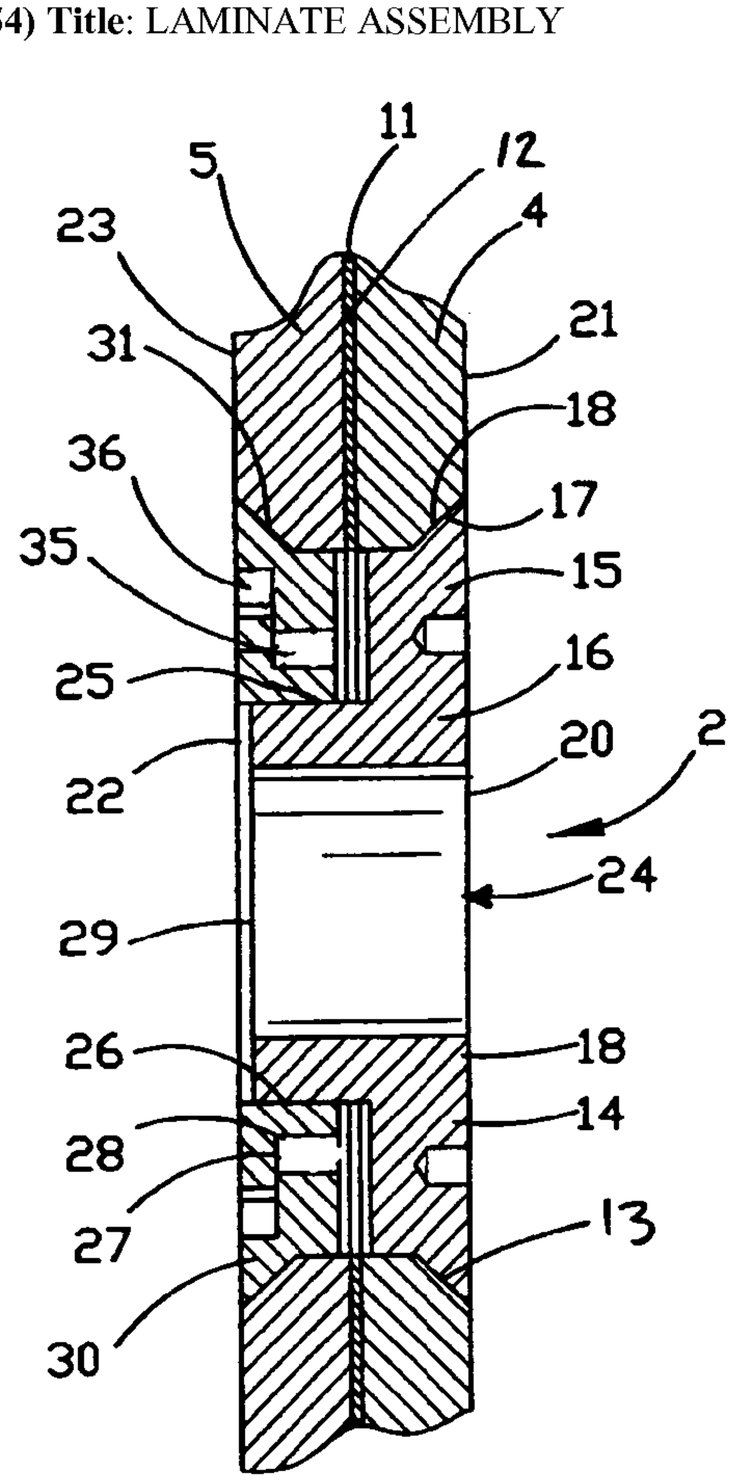

Figure 2c

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LAMINATE ASSEMBLY

Related Application

This application claims priority from Australian Patent Application No. 2010904086, the contents of which are incorporated by reference.

Field of the Invention

The invention relates generally to a laminate particularly, but not exclusively, a glass laminate.

Background of the Invention

A glass laminate typically comprises two or more panes of glass disposed side by side with an interlayer therebetween. The interlayer may for example be in the form of a plastics material such as polyvinyl butyral. Glass laminates have many applications, for example, in glass fins attached to a building facade. Glass laminates may in some instances have support devices secured thereto. The support devices may include a shaft which, when assembled, extends through coaxially aligned holes in the two panes of glass to apply a compressive load to the panes of glass in order to hold the laminate. However, in the event the compressive load is insufficient to grip the laminate, the support device may place shear loads onto inner annular surfaces of the corresponding holes in each pane of glass.

A problem with compressing an interlayer glass laminate is that the compressive forces can have a detrimental effect on the interlayer between the glass panes. For example, if the interlayer is over compressed the glass laminate may delaminate. To alleviate this problem, it is known to insert aluminium shims, between the glass panes. These shims have a thickness similar to the thickness of the laminate so that the panes are retained at a

spacing to prevent the laminate from becoming over compressed. Typically, these aluminium shims include pre-cut holes which are configured to align with the holes in the panes of glass so that the shaft of a support device may pass through the disks and the glass panes. The aluminium shims are typically the same size as a splice plate which may be utilised to couple one or more of glass laminates together.

To manufacture a laminated glass unit with these aluminium shims with pre-cut holes, the process may be as follows: cutting corresponding holes in the two panes of glass, placing interlayer material on a first glass pane, inserting the aluminium shim concentric with the hole, abutting a second glass pane onto the first glass pane so that the hole of the first and second panes as well as the shim are concentric, feeding the panes though a roller unit which compresses the panes together to squeeze out the air and finally putting the panes into an autoclave to heat the interlayer material to bond the first and second glass panes.

A disadvantage of this manufacturing process is that the aluminium shims usually need to be inserted by hand between the glass panes. Another disadvantage is that the aluminium shims may slip relative to holes when being fed through the rollers and/or during another step of the manufacturing process. Furthermore, the aluminium shims do not maintain alignment of the holes. Accordingly, the holes may become misaligned relative to one another and/or the shim during the manufacturing process.

Another disadvantage is that in a completed unit, these shims are retained between the glass panes by the laminate and are therefore not directly bonded to the glass. Furthermore, these aluminium shims are not adapted to provide sheer force support between the support couplings to the glass.

Object of the Invention

The present invention seeks to provide an alternative form of laminate and supporting structure.

Summary of the Invention

In accordance with the invention, there is provided an assembly including: a laminate which has two parallel panes with a substantially aligned pair of apertures; a fixing device fitted in the apertures, the device having component parts coupled through the apertures from opposed sides of the laminate; wherein sides of the apertures have a taper and the parts of the device are profiled to match the taper.

In another aspect, there is provided a construction element, including a plurality of assemblies as described above, with plates interconnecting the assemblies via fasteners coupled to associated fixing devices.

In another aspect, there is provided a laminate for connection with a device, as described above, including two parallel panes with a substantially aligned pair of apertures, each aperture being counter sunk to form a bevelled surface for engagement with an associated part of the device.

In another aspect, there is provided a method forming an assembly, as described above, the method of forming an assembly as claimed in claim 1, including: providing an interlayer between two panes of glass; and heating the interlayer so as to bond with the panes of glass, the method further including: forming a pair of tapered apertures, one in each pane of glass, in substantial alignment; and fitting a device, as claimed in claim 13, through the apertures to clamp the panes of glass together.

Brief Description of the Drawings

The invention is described, by way of non-limiting example only, by reference to the accompanying drawings, in which;

Figure la is a front view illustrating an assembly including a glass laminate and a fixing device;

Figure lb is a side view illustrating the assembly shown in Figure la;

Figure 1c is a perspective view of the assembly;

Figure 2a is a front sectional view illustrating the assembly;

Figure 2b is a side sectional view illustrating the assembly;

Figure 2c is a detailed side sectional view illustrating the assembly;

Figure 3a is a front sectional view illustrating a first part of a fixing device;

Figure 3b is a detailed side sectional view illustrating the first part;

Figure 4a is a front sectional view illustrating a third part of the device;

Figure 4b is a detailed side section view illustrating the third part;

Figure 5a is a front sectional view illustrating a second part of the device, in the form of a counter sunk bush;

Figure 5b is a detailed side section view illustrating the counter sunk bush;

Figure 6a is a front view illustrating a construction element in the form of a glass fin including a first glass laminate assembly and a second glass laminate assembly spliced end to end with splicing plates and compression bolts;

Figure 6b is a side view illustrating the glass fin;

Figure 6c is a side view illustrating further detail of the splicing plates and compression

bolts;

Figure 7a is a front view illustrating the glass laminate assembly configured for use as part of a glass fin structure;

Figure 7b is a side view illustrating the glass laminate assembly configured for use as part of a glass fin structure;

Figure 7c is a detailed view of the glass laminate assembly of Figure 7b;

Figure 8a is a top view illustrating a splice plate;

Figure 8b is a side view of the splice plate of Figure 8a;

Figure 9a shows an end view and a side view illustrating the compression bolt; and

Figure 9b is a perspective view of the compression bolt of Figure 9a.

Detailed Description of the Invention

Figures 1a to 1c illustrate an assembly 11 which includes a laminate 3 formed of a first pane 4 and a second pane 5 which are arranged side by side in parallel with an interlayer material 12 therebetween.

The interlayer 12 is described as a single layer but should be construed as being formed of either a single or multiple layers. The panes 4, 5 are described throughout the remainder of the specification as glass panes and the laminate as a glass laminate, however, it should be appreciated the panes 4, 5 may be formed of any suitable material such as Perspex or the like. Each of the panes 4, 5 respectively includes a substantially aligned first aperture 6 and a second aperture 7, which in part define a passageway 10 through the glass panes 4 and 5, and the interlayer material 12.

The assembly 11 also includes a device 1 in the form of a fixing or fitting 2 with a first part 8 seated within the first aperture 6. The first part 8 is adapted to be coupled to a second part 30, which is seated in the second aperture 7, via a third part 9 which extends through the passageway 10.

Referring now to Figures 2a to 2c as well as Figures 3a and 3b, the first part 8 is provided in the form of a first bolt 14 with a tapered head 15 and a neck portion 16 with a reduced diameter relative to the head 15. The head 15 is adapted to be seated in the first aperture 6 which is counter sunk to have a bevelled surface 18 which defines a taper 13. The head 15 has a reverse tapered profile to match the taper 13 so that there is relative abutment between an outer annular surface or bearing face 17 of the head 15 and the surface 18 of the aperture 6.

The top surface 20 of head 15 is substantially flat so that when the first bolt 14 is seated in the first aperture 6, the top surface 20 of the head 15 is substantially flush to the outer surface 21 of the first glass pane 4. By "substantially flush", it is intended to mean the top surface 20 is either flush with the outer surface 21 or marginally proud relative to the outer surface 21 to allow the head 15 to be engaged by an external clamp or fixing device without any compressive load being transferred directly to the laminate 3.

The neck portion 16 extends through the glass laminate 3 and has an end surface 22 which is configured to be substantially parallel in profile to the outer surface 23 of the second glass pane 5. Additionally, the first bolt 14 includes a central passageway 24 which extends from the top surface 20 of the head 15 to the end surface 22 of the neck portion 16. Additionally, the neck portion 16 includes threaded connector 25 on which a correspondingly threaded portion 26 of the third part 9 may be engaged.

Referring now to Figures 2a to 2c as well as Figures 4a and 4b, the third part 9 is provided in the form of a second bolt 19 including an outer head 27 and an inner neck portion 28 which has a bore 29 with an inner threaded portion 26, which receives the threaded

connector 25. The second bolt 19 is adapted to be seated within the second aperture 7 via the second part 30 (shown in more detail in Figures 5a and 5b) which sits between the second bolt 19 and an inner bevelled surface that defines taper 31 of the second aperture 7. In this arrangement, the second part 30 is in the form of a countersunk frusto-conical bush which has a bearing face in relative abutment with the taper formed by counter sinking aperture 7.

Referring also to Figures 5a and 5b, the second part 30 includes an outer annular portion 32 which is stepped inwardly via shoulder 33 to an inner throat portion 34. The inner throat portion 34 has a diameter configured to allow passage of only of the neck portion 28 of the second bolt 19 such that when the second bolt 19 is inserted into the bush 30 the head 27 of the second bolt 19 is seated on the shoulder 33.

To provide for some lateral play between the second bolt 19 and the second part or bush 30, the outer diameter of the inner neck portion 28 of the second bolt 19 is configured to be less than the inner diameter of the inner throat portion 34 of the bush 30 so as to form an inner annular gap 35 (Figure 2c). Furthermore, the outer diameter of the head 27 of the second bolt 19 is configured to be less than the inner diameter of the outer annular portion 32 so as to form an outer annular gap 36 (Figure 2c). In this configuration, the second bolt 19 is laterally moveable within the confines of the inner annular gap 35 and outer annular gap 36.

This provision for lateral movement is advantageous as it allows the device 1 to accommodate misalignment which may exist between the first bolt 14 and the second bolt 19. For example, in instances where the first aperture 6 is not strictly in alignment with the second aperture 7, the second bolt 19 can laterally move to correctly align and couple with the first bolt 14. This alignment is particularly important as the first bolt 14, second bolt 19 and the counter sunk bush 30 are envisaged to be manufactured from a hard non-compliant material, for example a metal such as aluminium. Therefore, as the material is relatively non-compliant a degree of lateral play is important to avoid asymmetrical loading between the first bolt 14, second bolt 19 and the counter sunk bush 30 and their

respective first aperture 6 and second aperture 7.

Accordingly, in light of the above, in an in use condition, it is envisaged that the fitting 2 that may be seated in and retained within respective counter sunk apertures 6, 7 of the opposing panes of glass 4, 5. Furthermore, in the in use condition, there is direct abutment of the first bolt 14 with the bevelled surface 18 of the first aperture 6 and the second bolt 19 is engaged with the first bolt 14 so as to become seated in, and compress the frusto-conical bush 30 within the second aperture 7. It may be appreciated then, that the first bolt 14, second bolt 19 and bush 30 are able to form a ridged metal unit adapted for direct metal to glass contact. Accordingly, the fitting 2 is able to directly transfer thrust and shear loadings into the inner annular bearing surfaces of the apertures 6 and 7 which may be advantageous when the assembly 11 is used as part of glass fin structure as is further described below.

Figures 6a to 6b illustrate an example of a construction element in the form of a glass fin assembly 50, including a first glass laminate assembly 51 and a second glass laminate assembly 52. Each of these glass laminate assemblies are substantially similarly configured to assembly 11 illustrated in Figures 1 and 2 and like reference numerals are used to denote like parts.

Each of the assemblies 51 and 52 include opposing glass panes 4 and 5 each with a plurality of the countersunk apertures 6 and 7 which accordingly define a plurality of passageways 10 into which a respective fitting 2 is able to be received, each fitting 2 being adapted to be retained in and operatively engage with the respective passageway 10.

The assemblies 51 and 52 are coupled together by splice plate assemblies 53 which are shown in more detail in Figure 8. Each splice plate 53 is arranged to extend along either side of first glass laminate 51 and the second glass laminate 52. The splice plate assemblies 53 are configured to abut with and couple to fittings 2 associated with each of the first assembly 51 and second assembly 52 so as to join the units in end-to-end configuration with a spacing 49 therebetween. Each of the splice plate assemblies 53

includes opposing splice plates 54 and 59, each with a series of holes 55 which are configured to correspond with a central passageway 24 of an associated one of the fittings 2.

Each hole 55 receives a threaded shaft 60 of a compression bolt 56 (described in more detail below with reference to Figure 9) which also passes through the central passageway 24 of the associated fitting 2 to support the respective assembly 51 or 52. A first clamping end 57 and a second clamping end 58 are then threaded onto either end of the shaft 60 and tensioned so as to compress opposing splice plates 54 and 59 together, against the fitting 2.

As aforementioned, the fitting 2 may be configured such that top surface 20 of the first bolt 14 and the end surface 22 of the second bolt 19 marginally protrude from the respective opposing glass panes 4 and 5 such that the opposing splice plates 54 and 59 engage the fitting 2 instead of the respective surfaces 21 and 23 of the opposing glass panes 4 and 5. Accordingly, as the fitting 2 is able to resist compressive loading associated with the splice plate assemblies 53 and the compression bolt 56, the fitting 2 is able to take loading away from the panes of glass 4 and 5 so as to not over compress the laminate interlayer material 11 therebetween. More particularly, when the opposing splice plates 54 and 57 are clamped onto the fitting 2 by the compression bolt 56, the threaded connector 25 and threaded portion 26 of the first bolt 14 and the second bolt 19 take the compressive load. Accordingly, the laminate material 11 between the panes of glass 4 and 5 is protected from over compression.

Furthermore, the fitting 2 is able to directly transfer thrust and shear loadings associated with splice plate assemblies 53 and the compression bolt 56 into the inner annular surfaces of the counter sunk apertures 6 and 7 - thereby providing an advantageous load and stress distribution.

Figures 7a to 7c show further detail of one of the glass laminate assemblies 51 or 52 and the configuration of counter sunk apertures 6 and 7. Figure 7c shows a detailed view of a series of the fittings 2 inserted into and retained within the respective passageways 10

whist Figures 8a and 8b show an example of one of the splicing plates 54 and 59 and the configuration of the holes 55.

Referring to Figures 9a and 9b, the compression bolt 56 is shown with the first clamping end 57 and a second clamping end 58 coupled to either side of the threaded shaft 60. The first clamping end 57 and a second clamping end 58 both include respective recesses 61 and 62 configured to received a tool (not shown) which may be used to tightening the first clamping end 57 and a second clamping end 58 when the compression bolt 56 is in use, coupling the splicing plate assemblies 53 to at least one of the first glass laminate assembly 51 and second glass laminate assembly 52. Each of the first clamping end 57 and a second clamping end 58 includes a split ring 65 between an end nut 66 and a washer 67. As such, in this configuration the end nut 66 is restricted from loosening once tightened onto the treaded shaft 60.

The fitting 2 may also find advantageous use in the process of assembly of a laminate, for example, the glass laminate 3. In this respect, a glass laminate 3 with fittings 2 may be assembled in accordance with the following method steps: forming countersunk apertures 6 and 7 in two panes 4 and 5, for example by drilling; inserting interlayer material 11 between the two panes of glass 4 and 5 and arranging the panes so that the apertures 6, 7 are in substantial alignment; coupling a fitting 2 through corresponding apertures 6 and 7 in the now opposed panes; applying pressure by feeding rollers configured to squeeze air from between the glass panes 4 and 5. The glass laminate is then passed through an autoclave to heat the interlayer material 11, which may be polyvinyl butyral, so that the interlayer is bonded to the first and second panes 4, 5.

Furthermore, as aforementioned the fitting 2 includes a first bolt 14 and a second bolt 19 which provides an annular gap such that lateral play exists between the bush 30, the first bolt 14 and a second bolt 19. Accordingly, the method as described above may also include the step of sliding the first bolt 14 laterally relative to the second bolt 19 to align the respective threaded portions 25 and 26 prior to connection.

Advantageously, in this method the fitting 2 is coupled to the laminate 3 and retained in the counter sunk apertures 6 and 7 by engaging the first bolt 14 and a second bolt 19. As such, the fitting 2 provides a rigid fixing device 1 that serves to not only fix the panes 4, 5 of the laminate relative to each other but also provides a passageway 24 through the laminate 3 that can be utilised to facilitate lifting, support and manipulation of the constructed assembly 11. For example, during the manufacturing process the fitting 2 (or multiples of the fittings) is able to retain the relationship of the glass panes 4 and 5 and the interlayer material 11 whilst allowing the laminate to, for example, be lifted into a vertical orientation, which saves floor space and speeds the overall manufacturing process. Furthermore, the fitting 2 prevents the slippages between the panes 4 and 5 when the laminate 3 is fed thorough a roller unit, thereby maintaining alignment of the counter sunk holes 6 and 7.

Additionally, the method may include the step of tensioning the first bolt 14 and the second bolt 19 to only a selected torque setting, so as not to over compress the laminate material 11. Furthermore, there may also be a further step in the method whereby the first bolt 14 and the second bolt 19 are coupled together such that top surface 20 of the first bolt 14 and the end surface 22 of the second bolt 19 are substantially flush but still slightly protrude from the respective outer surfaces 12 and 23 of the opposing glass panes 4 and 5, respectively. Moreover, as top surface 20 of the first bolt 14 and the end surface 22 of the second bolt 19 may only slight protrude and, in any event, have substantially flat top surfaces 20 and end surfaces 22 respectively, the glass laminated unit 3 is able to proceed through the rollers and also the flat packed for transport.

Many modifications will be apparent to those skilled in the art without departing from the scope of the present invention.

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 that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of

endeavour to which this specification relates.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

List of Parts

1. Device
2. Fitting
3. Laminate
4. First pane
5. Second pane
6. First aperture hole
7. Second aperture hole
8. First part
9. Third part
10. Passageway
11. Assembly
12. Interlayer
13. Taper
14. First bolt
15. Head
16. Neck portion
17. Bearing face
18. Bevelled surface
19. Second bolt
20. Top surface
21. Outer surface first pane of glass
22. End surface
23. Outer surface second pane of glass
24. Central passageway
25. Threaded connector
26. Threaded portion
27. Head
28. Inner neck portion
29. Bore
30. Second part

31. Taper
32. Outer annular portion
33. Shoulder
34. Throat portion
35. Inner annular gap
36. Outer annular gap
49. Spacing
50. Glass fin assembly
51. First glass laminate assembly
52. Second glass laminate assembly
53. Splice plate assembly
54. Splice plate
55. Holes in the splice plate
56. Compression bolt
57. First clamp end
58. Second clamp end
59. Splice plate
60. Threaded shaft
61. Recesses
62. Recesses
65. Split ring
66. End nut
67. Washer

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Claims:

1. A method of forming a laminate assembly, including:

forming a pair of apertures in two parallel panes, the apertures being in substantial alignment;

providing an interlayer between the panes;

fitting a fixing device through the apertures to clamp the panes together; and

heating the interlayer so as to bond with the panes.

2. The method of claim 1, further including forming the apertures with a counter sunk taper and component parts of the fixing device with a profile to match the taper of the associated aperture.

3. The method of claim 2, wherein the component parts are tensioned together so as to be substantially flush with outer surfaces of the panes.

4. The method as claimed in claim 1, further including forming multiple pairs of apertures in the panes and installing an associated plurality of fixing devices.

5. The method of claim 4, further including holding the panes and interlayer, via the fixing devices, in a vertical orientation during manufacture of the laminate assembly.

6. A laminate assembly formed by the method of claim 1, including:

a laminate which has an interlayer bonded between two parallel panes with a substantially aligned pair of apertures; and

a fixing device fitted in the apertures, the device having component parts coupled through the apertures from opposed sides of the laminate; wherein

sides of the apertures have a taper and the component parts of the device are profiled to match the taper.

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7. The laminate assembly of claim 6, wherein a first one of the parts is in the form of a first bolt with a tapered head and a threaded connector.

8. The laminate assembly of claim 7, wherein the second one of the parts is in the form a frusto-conical bush with an internal shoulder that supports a head of a second bolt, which engages with the threaded connector of the first part.

9. The laminate assembly of claim 8, wherein an annular gap is provided between the bush and the head of the second bolt, to accommodate for mis-alignment of the apertures.

10. The laminate assembly of claim 6, wherein the parts of the device are seated in the apertures so as to be substantially flush with the panes.

11. The laminate assembly of claim 6, wherein the device has a passageway extending through the component parts for receipt of a shaft used to support the assembly.

12. The laminate assembly of claim 6, wherein a plurality of pairs of apertures are formed in the laminate and an associated plurality of devices are connected into the apertures.

13. The laminate assembly of claim 6, wherein the panes are glass.

14. A construction element, including a plurality of assemblies formed in accordance with claim 12, with plates interconnecting the assemblies via fasteners coupled to associated fixing devices.

15. The construction element of claim 12, wherein the panes of the laminates are formed of glass and the construction element is in the form of a glass fin.

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16. A laminate for connection with a device of the assembly of claim 6, including an interlayer between two parallel panes with a substantially aligned pair of apertures, each aperture being counter sunk to form a bevelled surface for engagement with an associated part of the device.

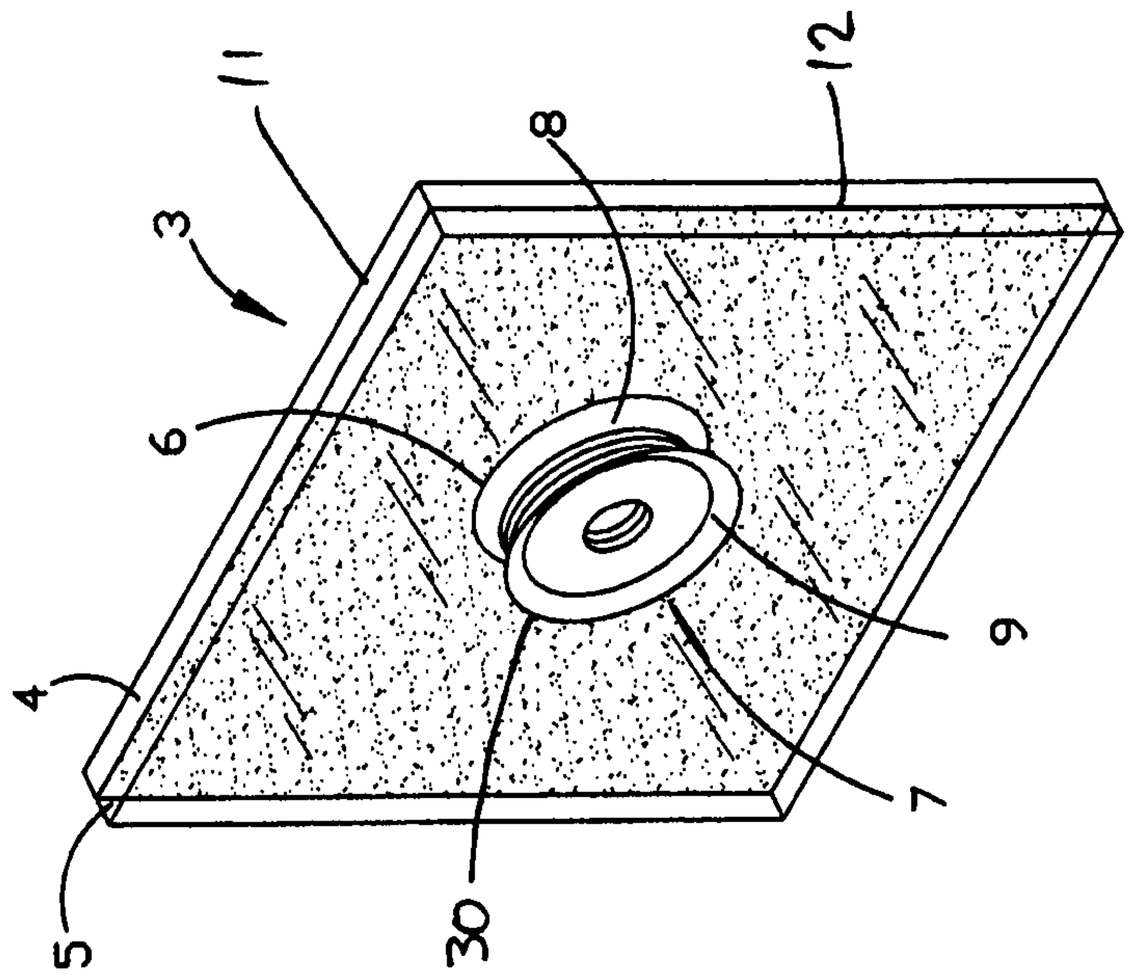

Figure 1c

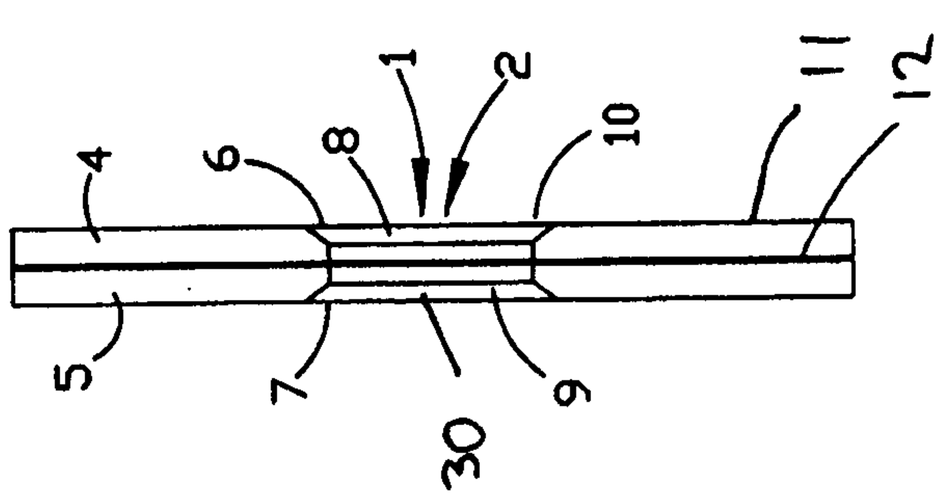

Figure 1b

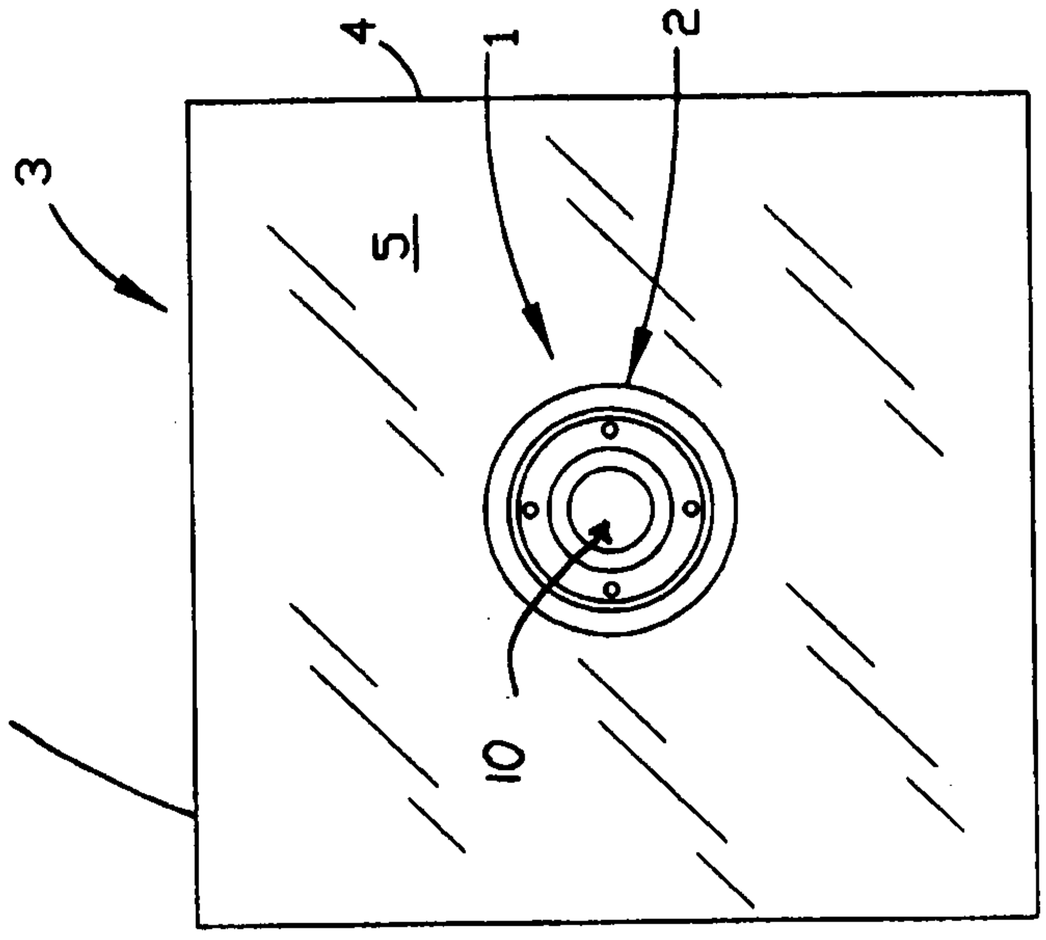

Figure 1a

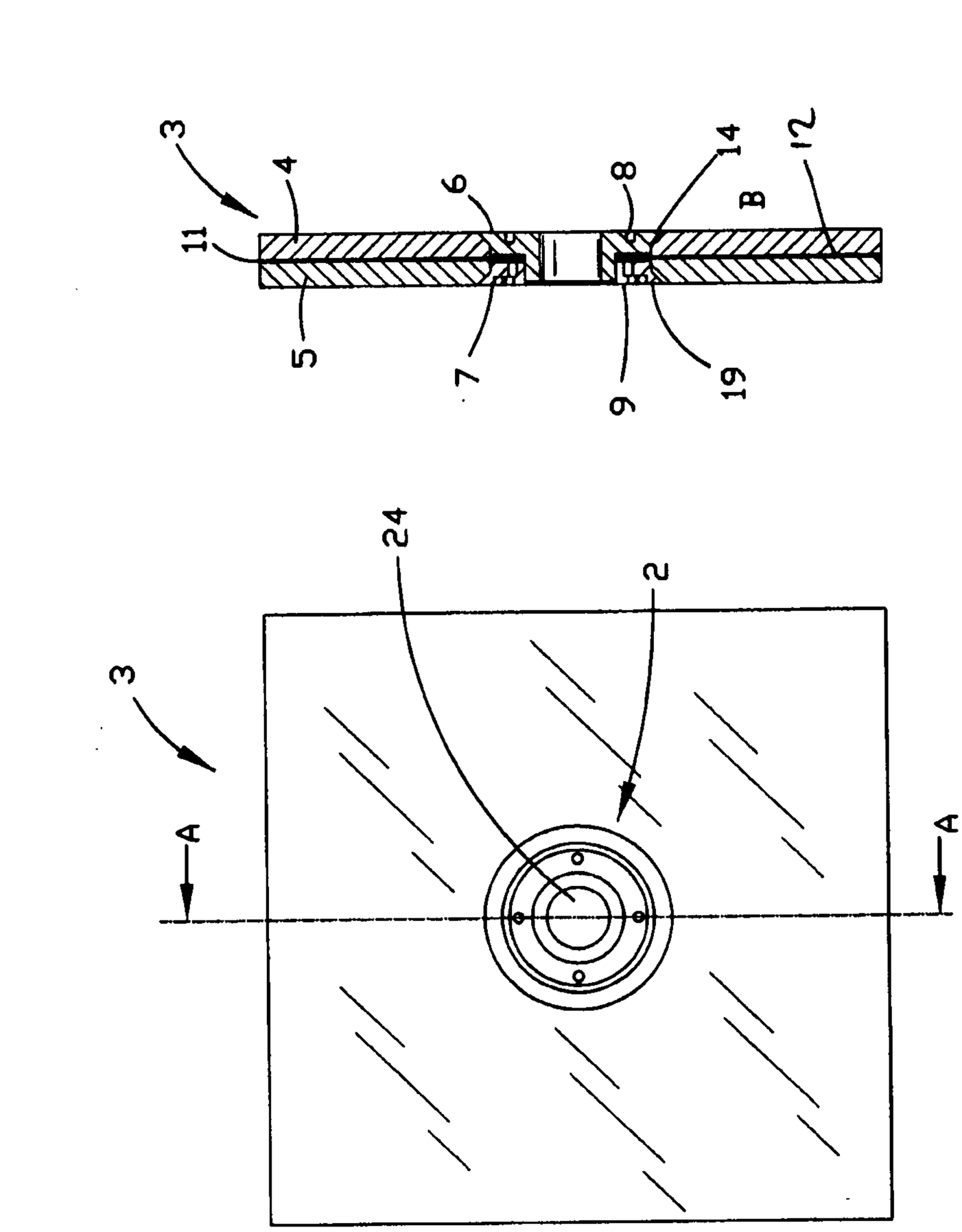

Figure 2c

Figure 2b

Figure 2a

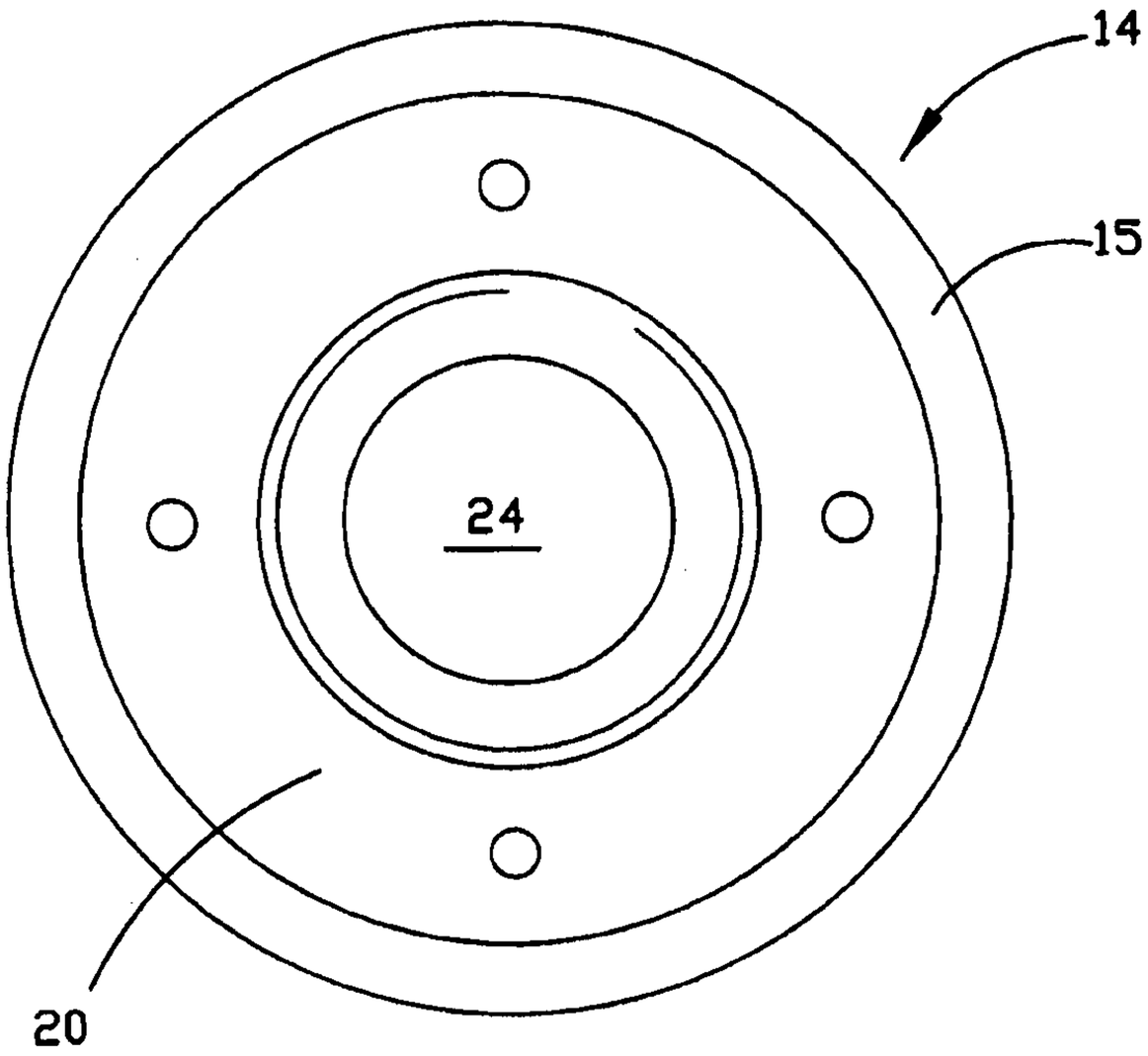

Figure 3a

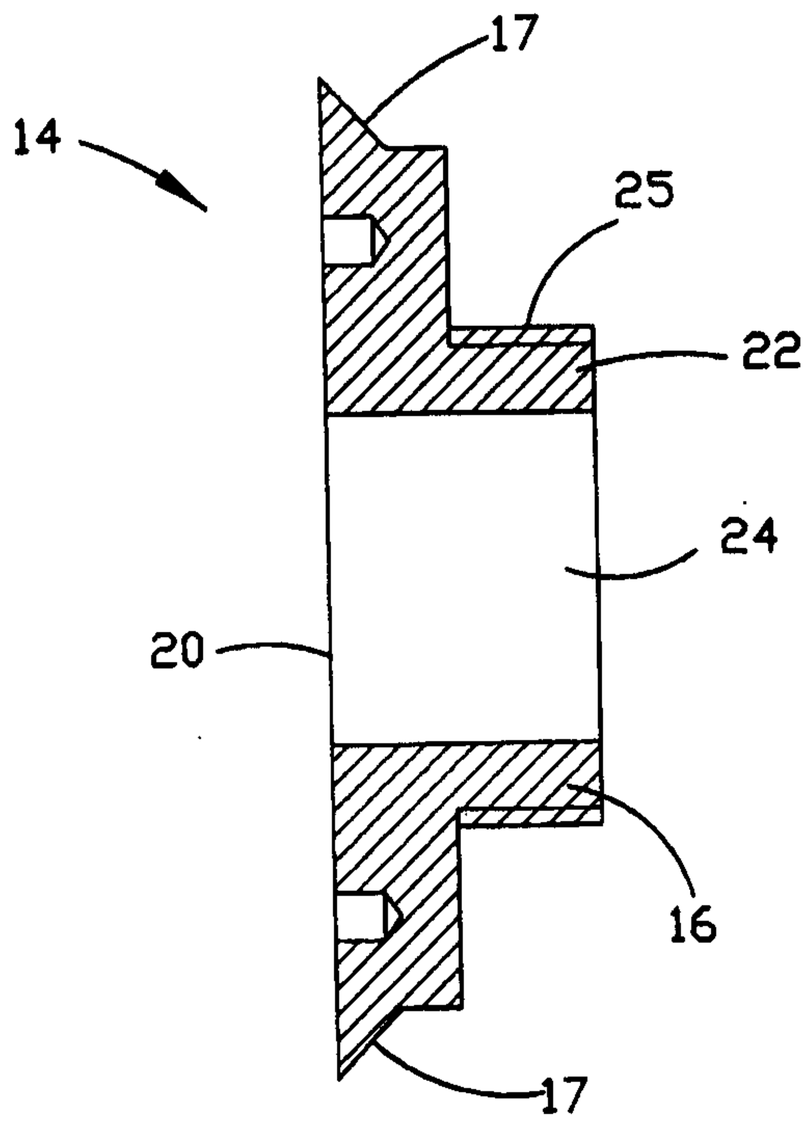

Figure 3b

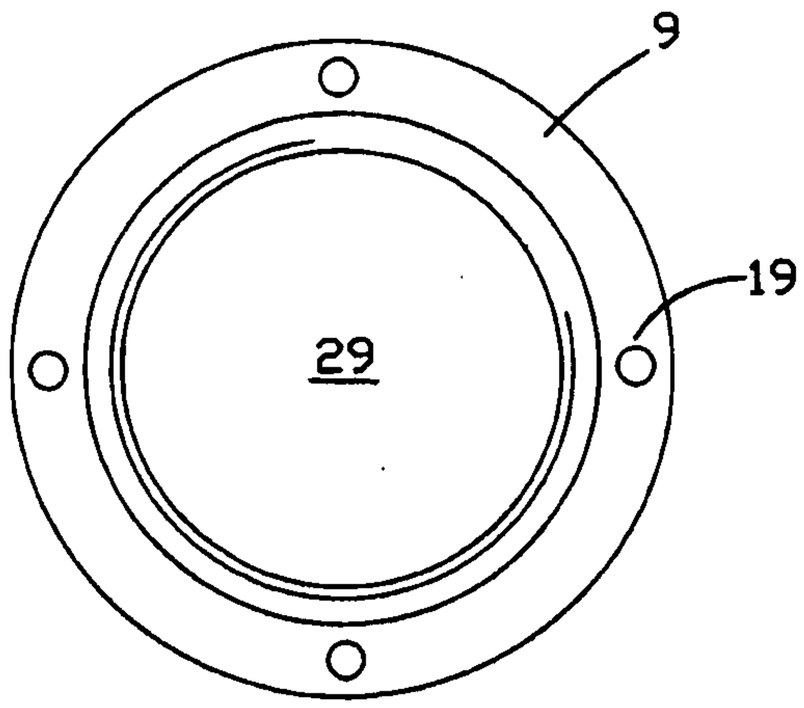

Figure 4a

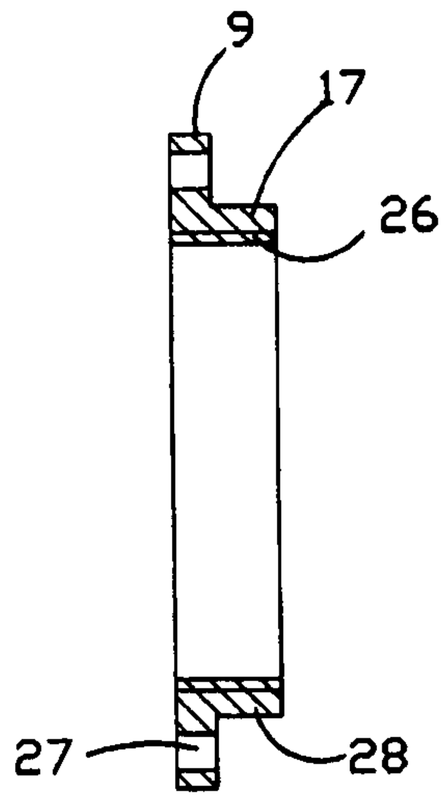

Figure 4a

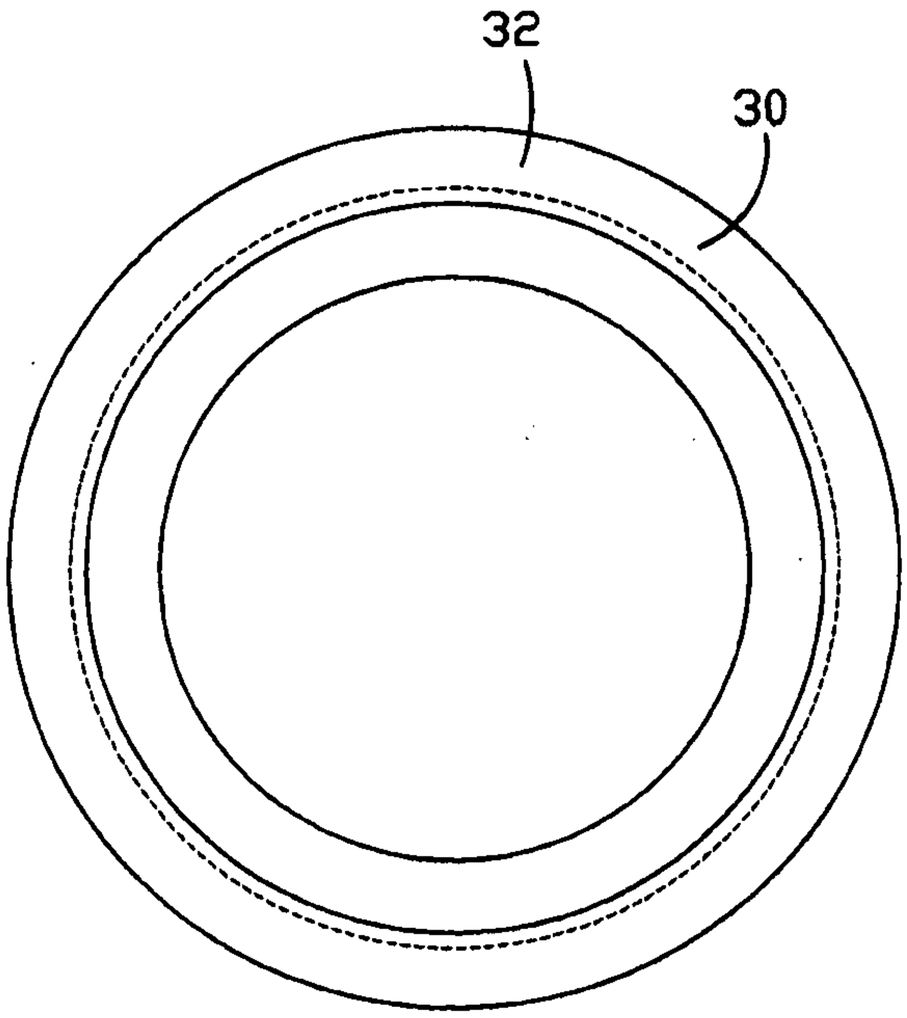

Figure 5a

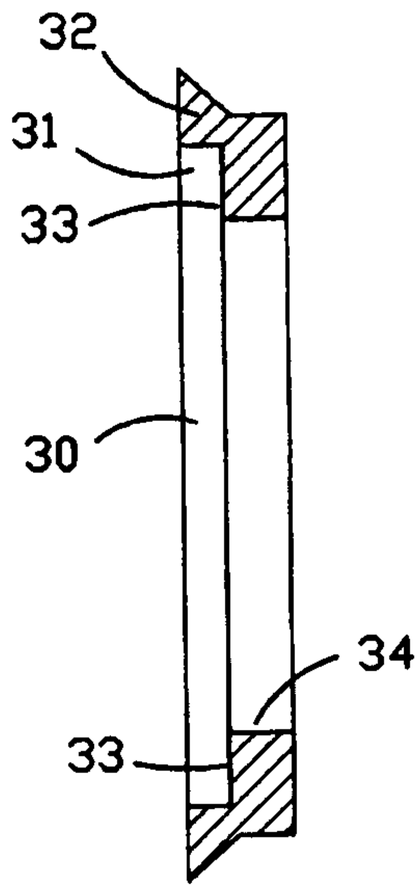

Figure 5a

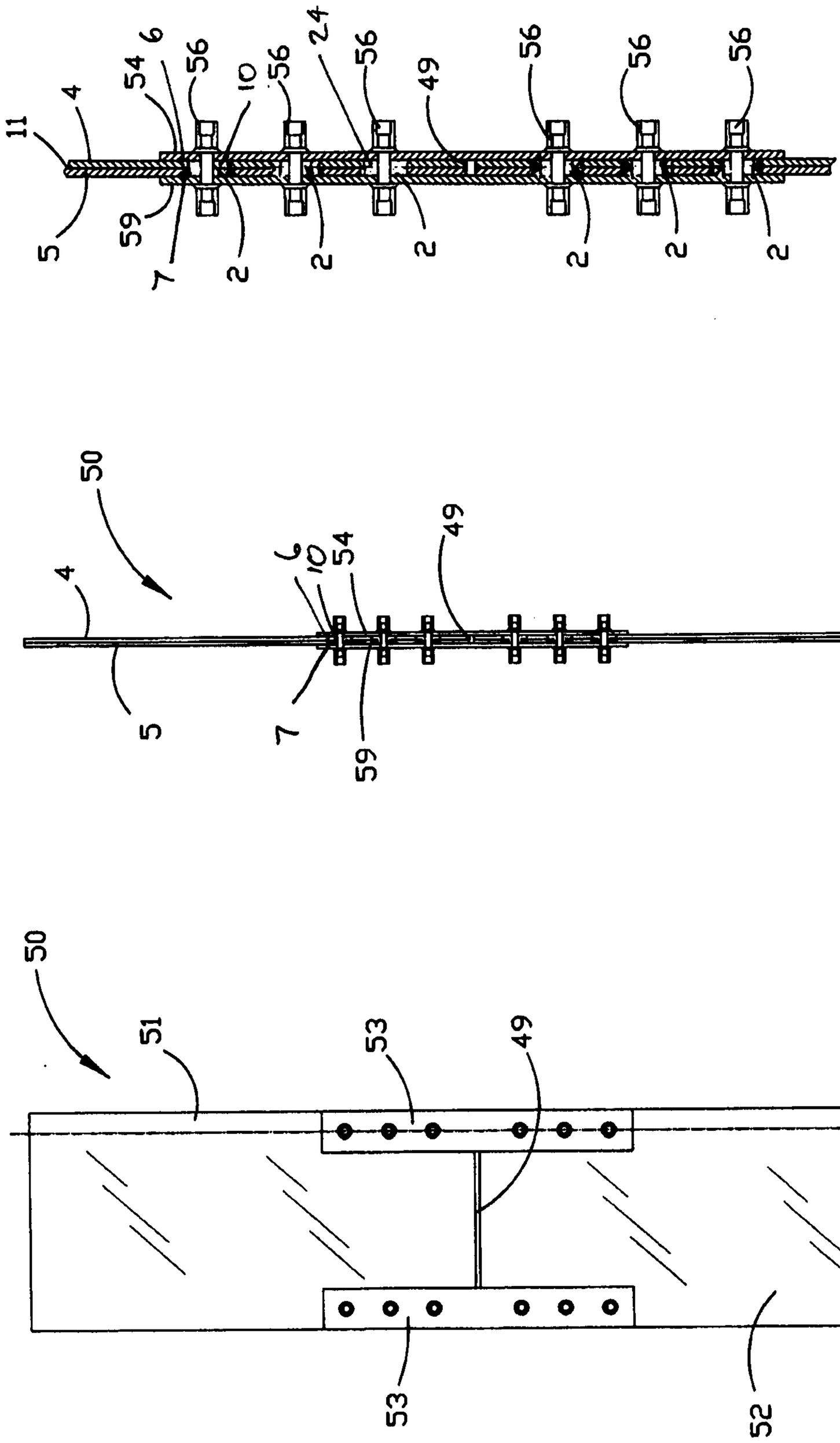

Figure 6c

Figure 6b

Figure 6a

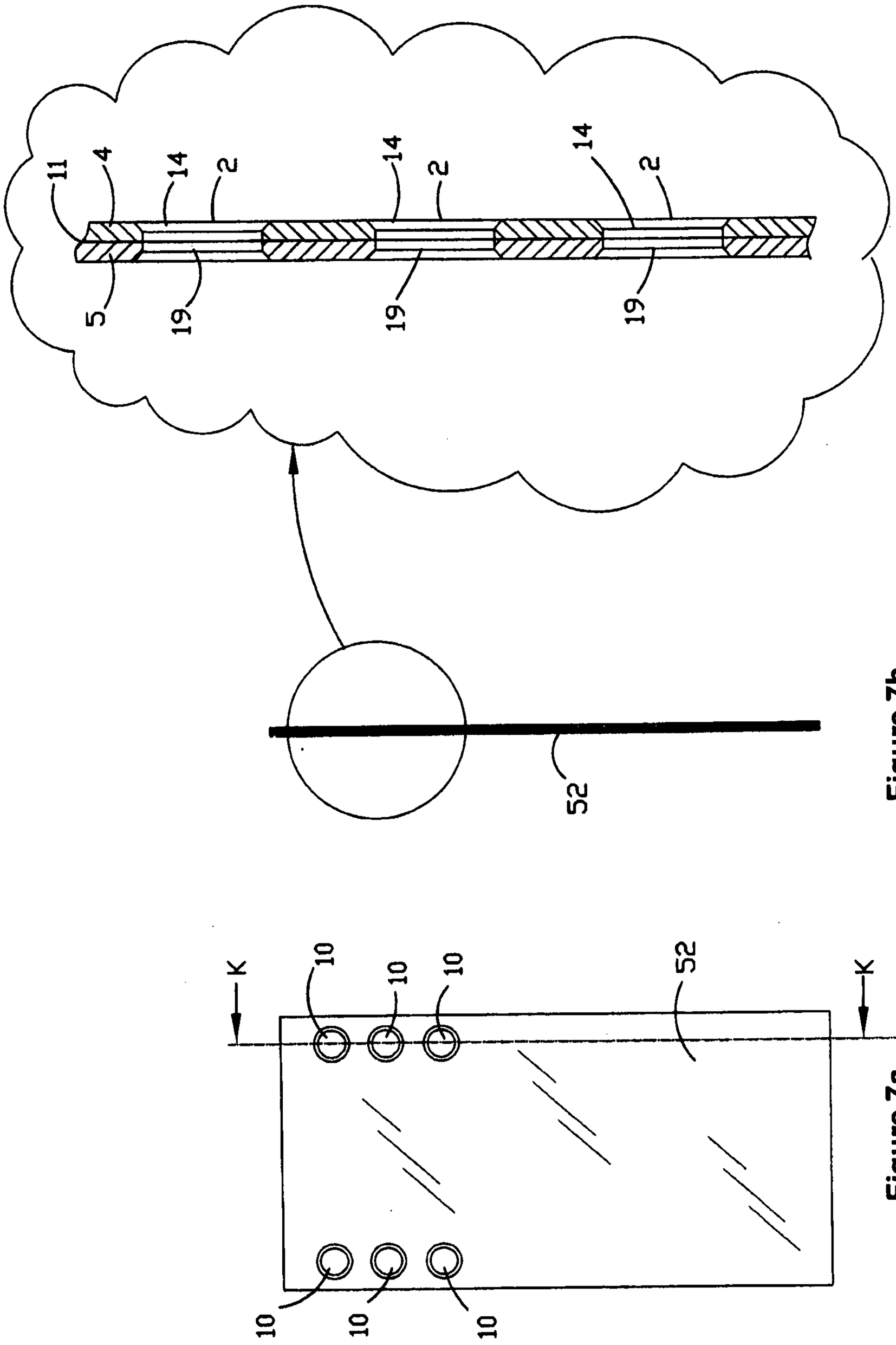

Figure 7c

Figure 7b

Figure 7a

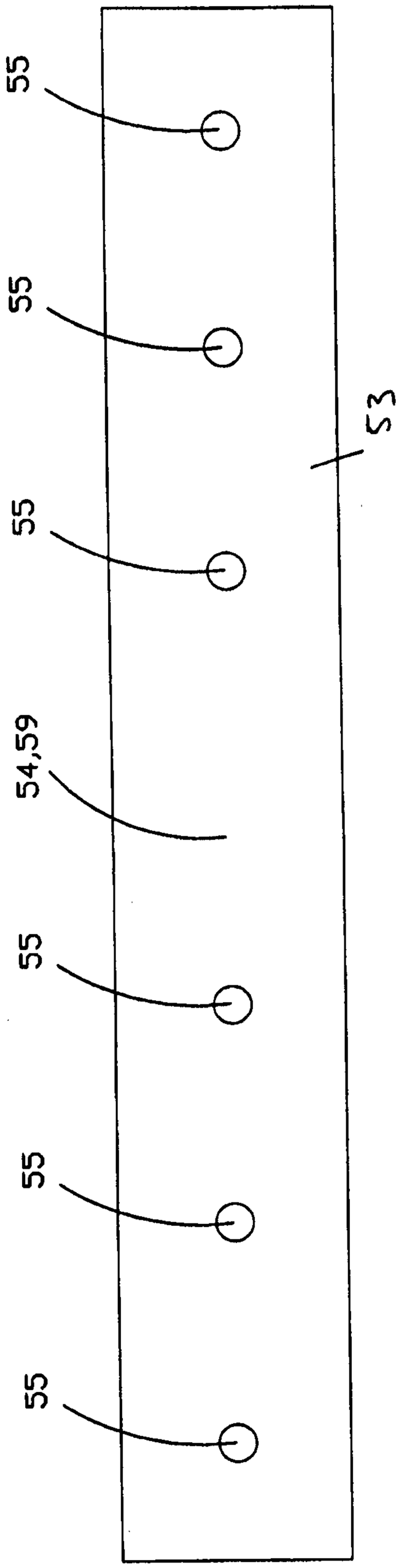

Figure 8a

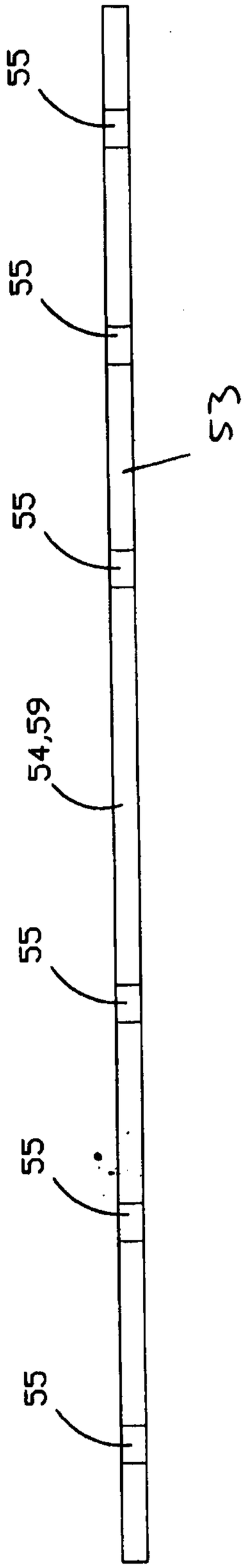

Figure 8b

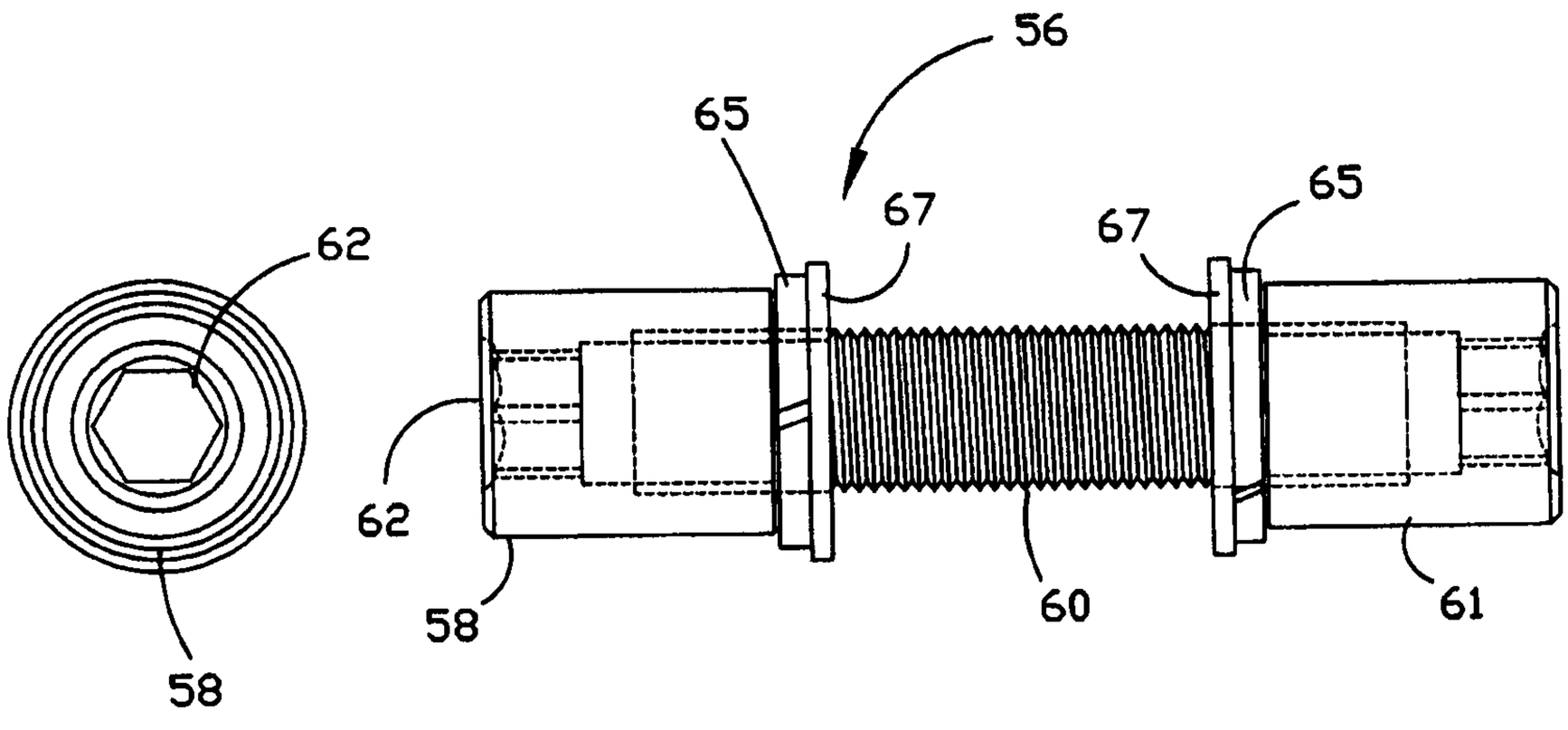

Figure 9a

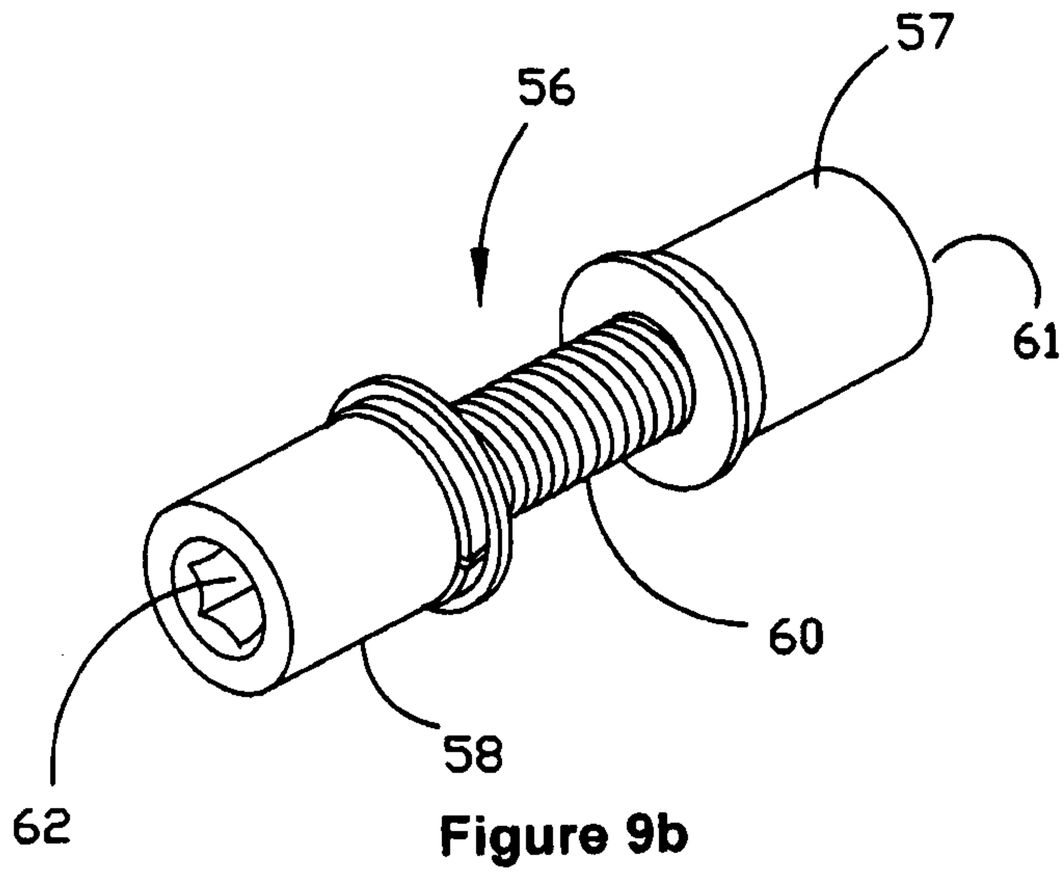

Figure 9b

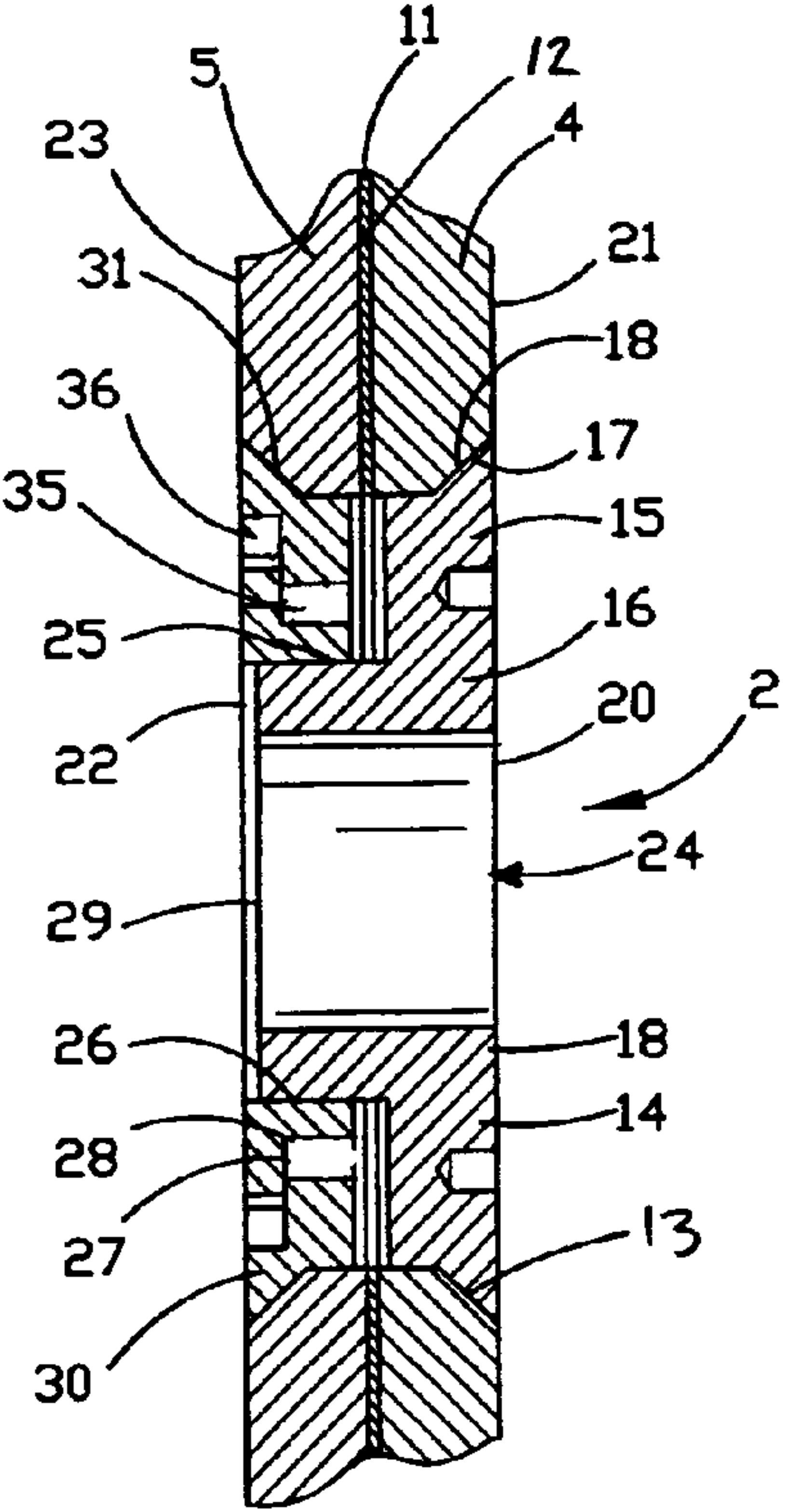

Figure 2c