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(54) A joint for reinforced concrete pile sections

(57) A joint for joining reinforced concrete pillars (10a, 10b) together, wherein a first connecting element (20a) comprises a cylindrical projecting part (30) provided with an annular groove (31) and a second connecting element (20b) consists of a cavity (40, 63) provided with an annular groove (41, 65). An annular spring (50) interlocks the grooves (31, 41, 65). The groove of the joining element of at least one of the objects to be joined is provided with a wedge-like part (34, 44) on which the spring-like locking element (50) is wedged, forming a joint free of backlash.

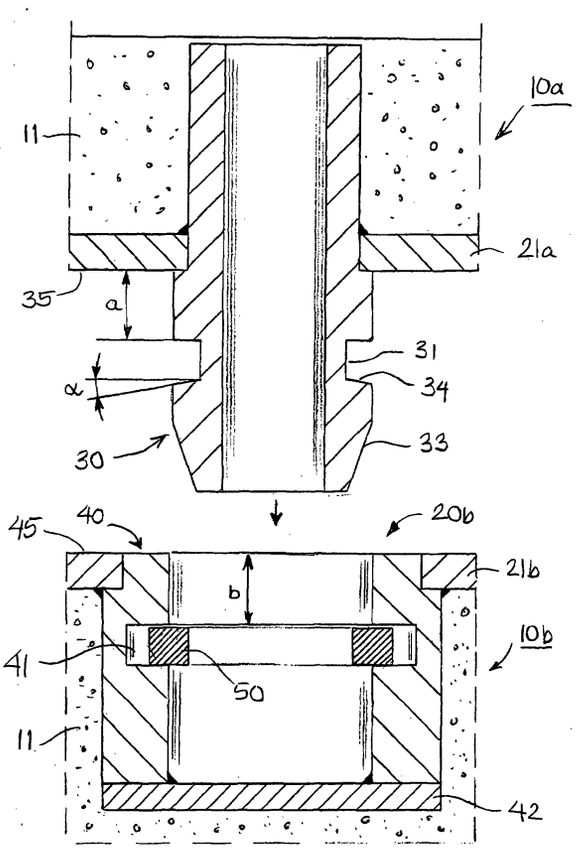

FIG. 2

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Description

SUBJECT OF THE INVENTION

[0001] The present invention relates to a joint between two objects to be joined together, such as reinforced concrete pillars, said joint comprising

- a first connecting element at the end of a first object to be joined, such as a pillar, consisting of a projecting part, preferably a spigot having a circular cross-section and provided with an annular groove,
- a second connecting element at the end of a second object to be joined, such as a pillar or equivalent, said connecting element consisting of a cavity, preferably a dead hole having a circular cross-section and provided with an annular groove,
- a spring-like locking element, preferably an annular spring or a part of one, which locks the groove of the first connecting element to the groove of the second connecting element.

PRIOR ART

[0002] There are various solutions for making a butt joint between reinforced concrete pillars. Generally used is a butt joint solution in which each pillar to be joined has at its one end four guiding and locking spigots provided with a transverse hole, which fit into corresponding cavities provided at the end of the opposite pillar when the pillars are set end to end to form extensions of each other. The butt joint is locked by inserting locking splines laterally through the transverse holes in the pillar ends and through the holes provided at a corresponding position in the guiding and locking spigots. However, this method of making a joint has proved to be difficult and laborious in practice. The transverse holes in the pillar ends and the holes of the guiding and locking spigots are not always properly aligned, so it is difficult to drive the transverse locking splines into position. In this case, one or more of the locking splines of the joint are left out, so a weak butt joint is formed between the pillars.

[0003] As the above-mentioned types of butt joint have proved to be very problematic in practice, there has arisen a need to develop different bayonet-connector type joining elements even for butt joints between reinforced concrete pillars. According to one solution, the joining element at the end of a pillar to be extended comprises a round spigot, which is fitted into a round cavity at the end of another pillar, said cavity being provided with an annular groove and an annular spring. The end of the spigot is conically shaped so that, when inserted into the cavity, it opens and strains the annular spring in the cavity. When the ends of the reinforced concrete pillars to be joined together meet at the end of the insertion movement, being pressed against each other, the annular spring latches into the annular groove of the spigot, thus locking the joint.

[0004] The above-described bayonet-type joint, which in principle is easy to use, has not, however, proved to be a workable solution for joining reinforced concrete pillars end to end. One of the reasons for this is that, when the pillars are being set end to end as extensions of each other, they have to be brought into tight contact and perfect alignment with each other before the annular spring in the cavity of the joining element at the end of one of the pillars is locked in the annular groove of the spigot of the joining element of the opposite pillar. However, this is difficult because the joining elements must be made to tolerances allowing no large backlash. Therefore, even a slight defect, a deformation caused by a bruise or a small foreign object caught on the joining elements may prevent locking of the joint. On the other hand, if larger clearances are provided between the joining elements, then the joint will not be sufficiently firm and rigid.

OBJECT OF THE INVENTION

[0005] The object of the present invention is to achieve a butt joint for pillars that does not have the above-described disadvantages.

FEATURES OF THE INVENTION

[0006] The joint of the invention for joining two objects, such as reinforced concrete pillars, is characterized in that the groove of the joining element of at least one of the objects to be joined is provided with a wedge-like part on which the spring-like locking element is wedged.

EMBODIMENTS OF THE JOINT OF THE INVENTION

[0007] A preferred embodiment of the joint of the invention is characterized in that the annular groove in the projecting part of the first joining element has a wedge-shaped cross-section so that at least one of the side walls of the groove forms an element, such as a conical surface, that produces a wedging effect on the spring-like locking element.

[0008] A second preferred embodiment of the joint of the invention is characterized in that the spring-like locking element is a severed annular spring having a rectangular cross-section.

[0009] A third preferred embodiment of the joint of the invention is characterized in that

- the spring-like locking element is a severed annular spring having a wedge-shaped cross-section such that the conical wedge surface of the annular spring mainly corresponds to the conical surface of the annular spring of the joining element, and that
- the conical wedge surface of the annular spring and the conical surface of the annular groove of the join-

ing element are fitted against each other.

[0010] A fourth preferred embodiment of the joint of the invention is characterized in that the spring-like locking element is a severed annular spring of circular cross-section.

[0011] A fifth preferred embodiment of the joint of the invention is characterized in that

- the first object to be joined is a reinforced concrete pillar with a joining element at its end consisting of a projecting part having a circular cross-section and provided with an annular groove, and
- the second object to be joined is a rock shoe with a joining element consisting of a cavity of circular cross-section provided with an annular groove, and that
- the joining elements of the reinforced concrete pillar and the rock shoe are locked together by means of an annular spring that is fitted into the annular grooves of the joining elements, at least one of said grooves having a wedge-like shape.

[0012] A further preferred embodiment of the joint of the invention is characterized in that the annular groove in the cavity has a wedge-shaped cross-section such that at least one of the side walls of the groove forms an element, such as a conical surface, that produces a wedging effect on the spring-like locking element.

EXAMPLES OF EMBODIMENTS

[0013] In the following, the invention will be described in detail by the aid of examples with reference to the attached drawings, wherein

LIST OF FIGURES

[0014]

Fig. 1 presents the ends of two reinforced concrete pillars and their mutually fitting joining elements in an axonometric view partially sectioned.

Fig. 2 presents the ends of two reinforced concrete pillars and their mutually fitting joining elements in vertical section.

Fig. 3 presents a joint between reinforced concrete pillars in vertical section.

Fig. 4 corresponds to Fig. 3 and presents a joint between reinforced concrete pillars according to a second embodiment.

Fig. 5 presents a diagrammatic vertical section of a joint between two objects according to a third embodiment.

Fig. 6 corresponds to Fig. 5 and presents a joint between two objects according to a fourth embodiment.

Fig. 7 presents a joint between a reinforced concrete pillar and a rock shoe in vertical section.

Fig. 8 corresponds to Fig. 3 and presents a joint between reinforced concrete pillars according to a fifth embodiment.

DESCRIPTION OF THE FIGURES

[0015] Fig. 1 illustrates a situation where two reinforced concrete pillars 10a and 10b are being joined together end to end, with the pillar ends brought close to each other but still remaining apart. The principal material of the pillars 10a and 10b is concrete 11, in addition to which they also contain numerous steel reinforcements as is known in the art, which are not shown. Instead, Fig. 1 presents a detailed illustration of the structure of the joining elements 20a and 20b. Each joining element 20a and 20b comprises an end plate 21a and 21, an edge collar 22a and 22b welded on it and anchor bars 23a and 23b welded to the end plates 21a and 21.

[0016] The joining element 20a of the reinforced concrete pillar 10a shown above the other one in Fig. 1 comprises a cylindrical projecting part 30 welded to the end plate 21a and having an annular groove 31 in the outer surface of its cylinder barrel. The inner end of the cylinder 30 is closed by a bottom plate 32. Similarly, the joining element 20b of the reinforced concrete pillar 10b shown below the other one in Fig. 1 comprises a cylindrical cavity 40 welded to the end plate 21b and having an annular groove 41 in the inner surface of its cylinder barrel. This cylinder 40, too, is provided with a bottom plate 42. The extremity of the cylindrical projecting part 30 is shaped as a conical surface 33, which, when the reinforced concrete pillars 10a and 10b are being joined together, causes the severed annular spring 50 in the groove 31 of the cavity 40 to open until the spring falls into the groove 31 of the projecting part 30, locking the joint between the joining elements 20a and 20b and therefore the joint between the reinforced concrete pillars 10a and 10b.

[0017] From Fig. 1 it can be seen that it is possible to add a suitable number of reinforcing rods to the circumference of the joining elements 20a and 20b in accordance with the strength requirements regarding the joint between the reinforced concrete pillars 10a and 10b.

[0018] Fig. 2 presents the structure of the joining elements 20a and 20b of reinforced concrete pillars 10a and 10b in vertical section. The projecting cylindrical part 30 attached to the end plate 21a of the upper pillar 10a has a conical end 33 and an annular groove 31. It can be seen from the figure that one 34 of the side walls of the annular groove 31 is inclined, forming an angle α with a plane perpendicular to the longitudinal axis of the cylinder 30. Since the projection 30 is a round cylinder, the inclined wall 34 forms a conical surface. The angle α preferably has a magnitude of only a few degrees. An inclination of e.g. 5-10° is sufficient to cause the annular spring 50 to be wedged against this surface, locking the

joining elements 21a and 21b tightly together. On the other hand, the cylinder 40 of the joining element 20b of the lower pillar 10b is provided with an internal annular groove 41 of rectangular cross-section, with a severed annular spring 50 of rectangular cross-section placed in the groove.

[0019] In Fig. 2, the letters a and b indicate the distances from the edges of the annular grooves 31 and 41 to the stop faces of the reinforced concrete pillars 10a and 10b to be placed against each other. In manufacture, these measurements are essential to flawless functioning of the joining elements 20a and 20b. To allow the annular spring 50 to be effectively locked against the conical surface 34, measurement a must be smaller than or equal to measurement b.

[0020] Fig. 3 shows the reinforced concrete pillars 10a and 10b of Fig. 2 joined together, with the annular spring 50 latched in the groove 31 of the projecting part 30 of the joining element of the upper reinforced concrete pillar 10a. Since the annular spring 50 was expanded by the conical surface 33 of the projecting part 30 during the insertion movement, in the locked state of the joint the annular spring 50 is still exerting compression. Thus, the annular spring 50 is wedged against the conical surface 34 of the groove 31. When the pillar thus extended is jolted by impacts applied to the end of the upper pillar, each impact will cause the annular spring 50 to be more and more tightly wedged against the conical surface 34, a very firm joint being thus formed.

[0021] Fig. 4 presents an embodiment in which a more effective wedging of the annular spring 50 as the conical surface 34 is additionally ensured by using screws 51a and 51b that press the annular spring towards the bottom of the groove 31.

[0022] Fig. 5 presents a diagrammatic vertical section of a joint connecting two objects, in which the cylindrical projecting part 30 has been pressed into the cylindrical cavity of the other object. In this embodiment, both the groove 31 of the cylindrical projecting part 30 and the annular spring 50 have a wedge-shaped cross-section, i.e. both have conical surfaces, which are placed against each other. In this case, the annular spring 50 is wedged still more effectively into the groove 31, interlocking the projecting part 30 and the cavity 40 of the joining elements.

[0023] Fig. 6 presents an alternative annular spring 50, according to which the annular spring 50 has a circular cross-section.

[0024] Fig. 7 presents a joint between a reinforced concrete pillar 10 and a rock shoe 60 in vertical section. The structure of this joint fully corresponds to the above-described joint between two pillars. Thus, a rock shoe 60 as shown here can be joined to the end of any pillar. In the rock shoe 60, an actual shoe part 61 is fastened with a screw 62 to a frame part 63, which corresponds to the cylinder 40 of the joining element 20b at the end of a pillar 10b. This frame cylinder 63 has inside it a corresponding cavity and an annular groove 65 for an annular spring 50. The frame cylinder 63 is attached to an end plate 64, which meets the end plate 21 of the pillar.

[0025] Fig. 8 presents an alternative joint between reinforced concrete pillars 10a and 10b, where, before the joining, the annular spring 50 is placed in the groove 31 of rectangular cross-section of the projecting part 30. In this case, the mouth of the cavity 40 has a conical shape 43 that compresses the annular spring 50 as the pillars are being joined together. Once the projecting part 30 has been inserted all the way down into the cavity, the annular spring 50 will expand into the groove 41 in the cavity 40 and get wedged against the conical surface 44. As compared with the above-described other embodiments, the operation of the annular spring 50 is thus reversed. In this case, too, to allow the joint to be further tightened during impacts applied to the pillar, the inclined surface 44 of the groove 41 in the cavity 40 must be located on the opposite side.

ADDITIONAL REMARKS

[0026] It is obvious to the person skilled in the art that different embodiments of the invention may vary within the scope of the claims presented below.

REFERENCE NUMBERS

[0027]

10	reinforced concrete pillar
11	concrete
20	joining element
21	end plate
22	edge collar
23	anchor bars
30	projecting part
31	groove
32	bottom
33	conical end surface
34	conical wedge surface of groove
35	stop face
40	cavity
41	groove
42	bottom
43	cone
44	wedge
45	stop face
50	annular spring
51	screw
52	conical wedge surface of annular spring
60	rock shoe
61	shoe part
62	screw
63	cylinder
64	end plate
65	groove

Claims

1. Joint between two objects (10, 60) to be joined together, such as pillars, said joint comprising

   - a first connecting element (20a) at the end of a first object (10a) to be joined, such as a pillar, consisting of a projecting part (30), preferably a spigot having a circular cross-section and provided with an annular groove (31),
   - a second connecting element (20b) at the end of a second object (10b, 60) to be joined, such as a pillar or equivalent, said connecting element consisting of a cavity, preferably a dead hole having a circular cross-section and provided with an annular groove (41, 65),
   - a spring-like locking element (50), preferably an annular spring or a part of one, which locks the groove (31) of the first connecting element (21a) to the groove (41, 65) of the second connecting element (21b),

   characterized in that

   - the groove (31, 41) of the joining element (20a, 20b) of at least one of the objects (10a, 10b) to be joined is provided with a wedge-like part (34, 44) on which the spring-like locking element (50) is wedged.

2. Joint according to claim 1, **characterized in that** the annular groove (31) in the projecting part (30) of the first joining element (10a) has a wedge-shaped cross-section such that at least one (34) of the side walls of the groove forms an element, such as a conical surface, that produces a wedging effect on the spring-like locking element (50).

3. Joint according to claim 1 or 2, **characterized in that** the spring-like locking element (50) is a severed annular spring having a rectangular cross-section.

4. Joint according to claim 1,2 or 3, **characterized in that**

   - the spring-like locking element (50) is a severed annular spring having a wedge-shaped cross-section such that the conical wedge surface (52) of the annular spring mainly corresponds to the conical surface of the annular spring (31) of the joining element (30), and that
   - the conical wedge surface (52) of the annular spring (50) and the conical surface (34) of the annular groove (31) of the joining element (30) are fitted against each other.

5. Joint according to any one of claims 1-4, **characterized in that** the spring-like locking element (50) is a severed annular spring of circular cross-section.

6. Joint according to any one of claims 1-5, **characterized in that**

   - the first object (10) to be joined is a reinforced concrete pillar with a joining element at its end consisting of a projecting part (30) having a circular cross-section and provided with an annular groove (31), and
   - the second object (60) to be joined is a rock shoe with a joining element consisting of a cavity (63) of circular cross-section provided with an annular groove (65), and that
   - the joining elements (30, 63) of the reinforced concrete pillar (10) and the rock shoe (60) are locked together by means of an annular spring (50) fitted into the annular grooves (31, 65) of the joining elements, at least one of said grooves having a wedge-like shape.

7. Joint according to any one of claims 1-6, **characterized in that** the annular groove (41) in the cavity (40) of the joining element (20b) has a wedge-shaped cross-section such that at least one (44) of the side walls of the groove forms an element, such as a conical surface, that produces a wedging effect on the spring-like locking element (50).

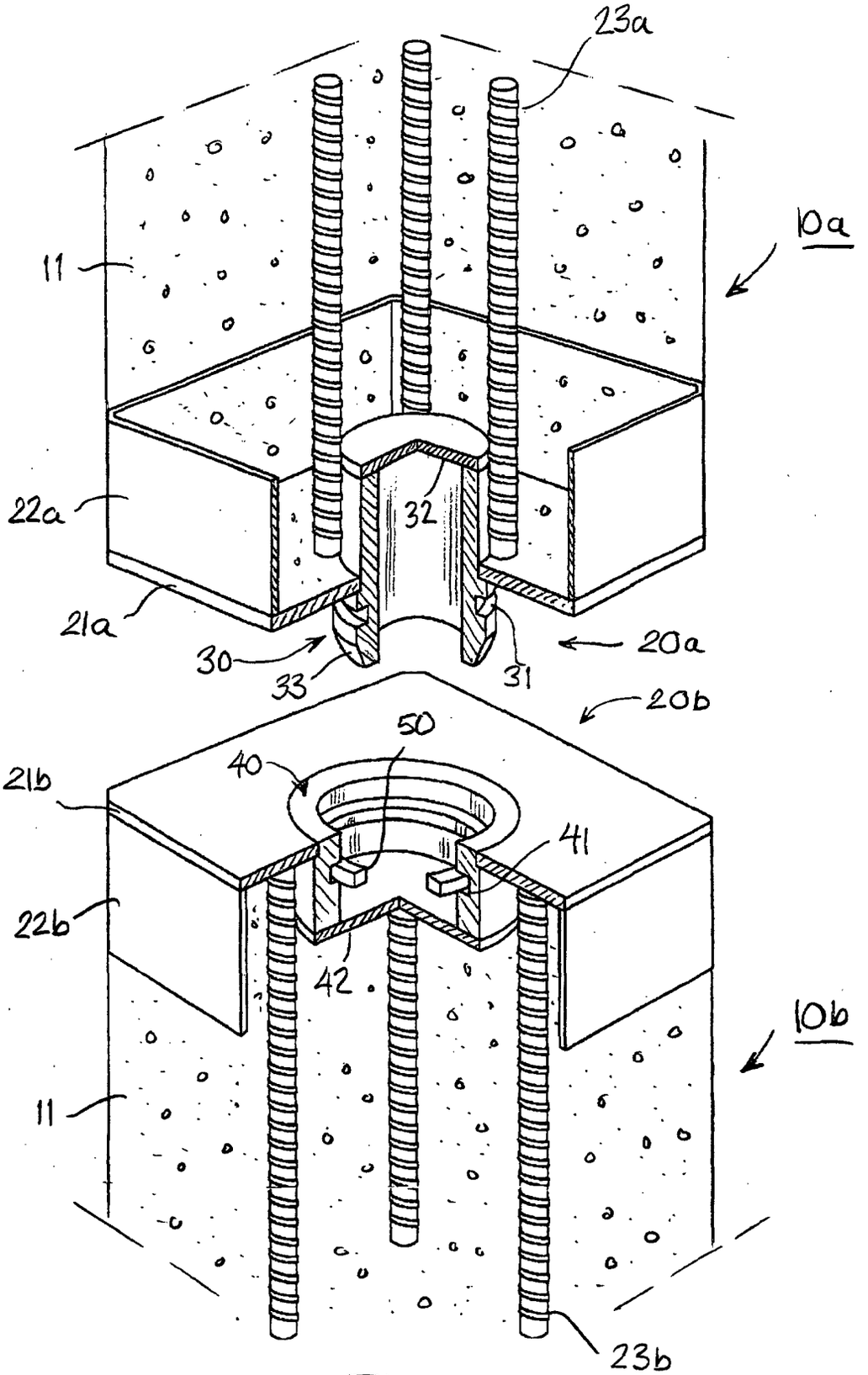

23a
10a
11
22a
32
21a
30
33
31
20a
20b
50
40
21b
41
22b
42
10b
11
23b

FIG. 1

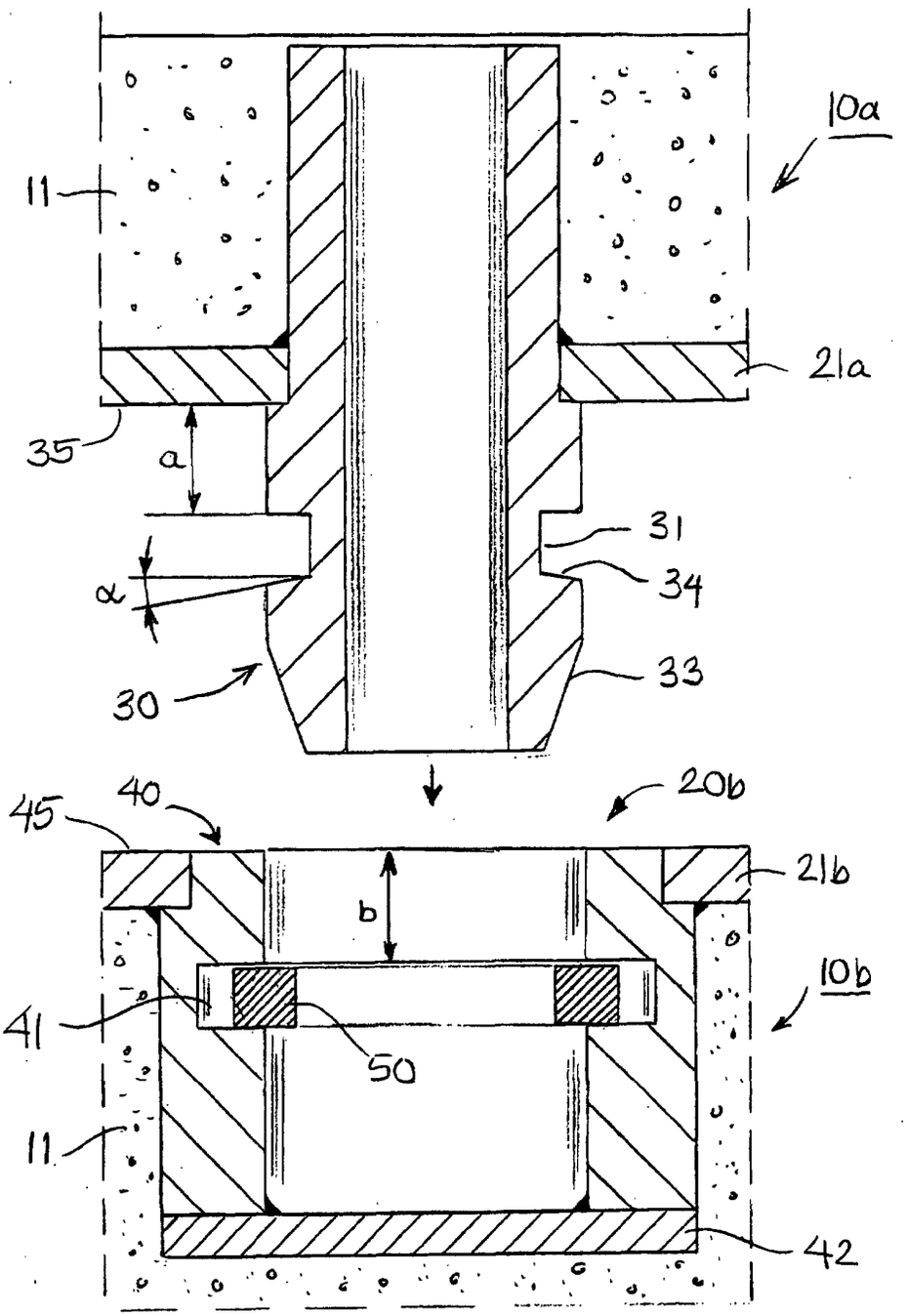


FIG. 2

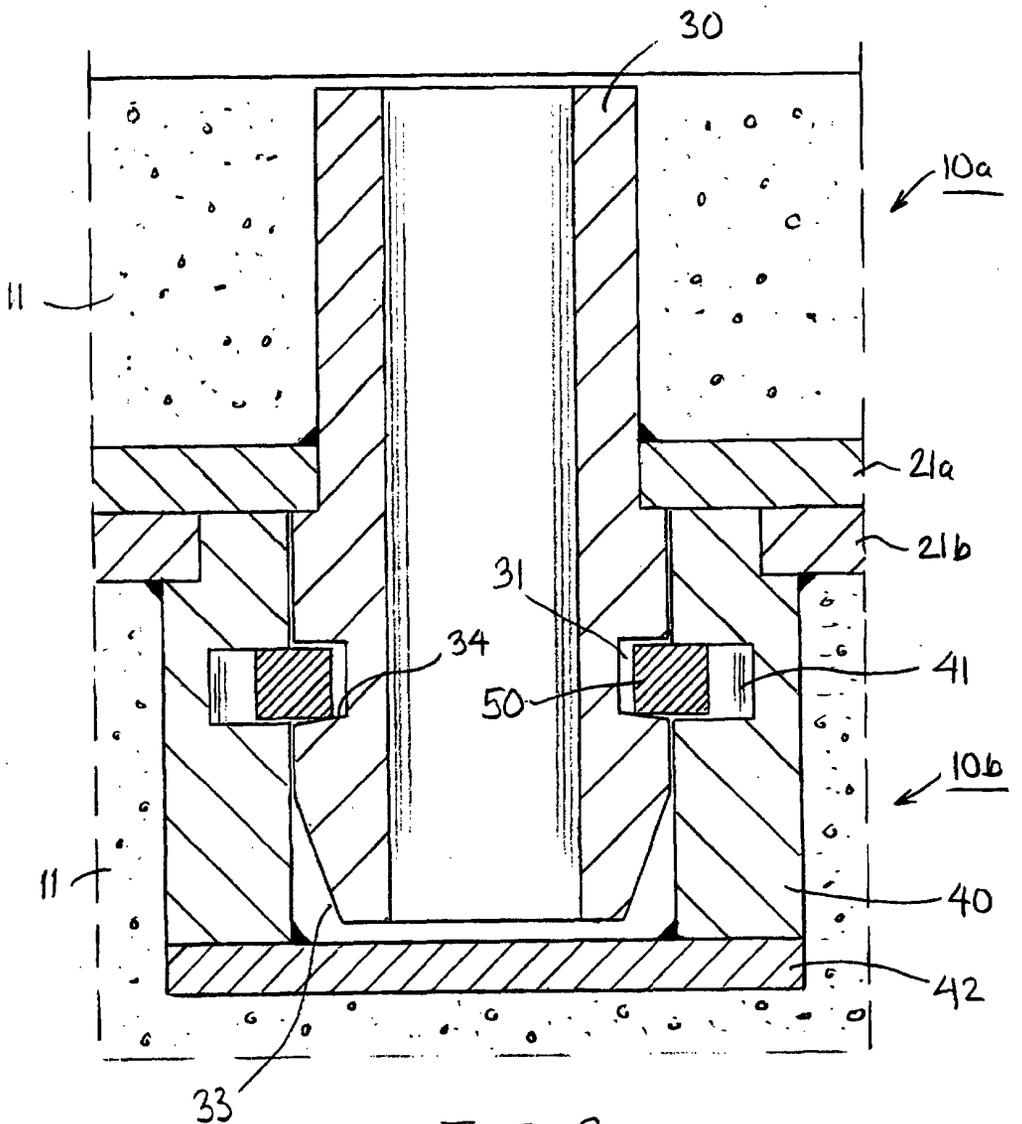
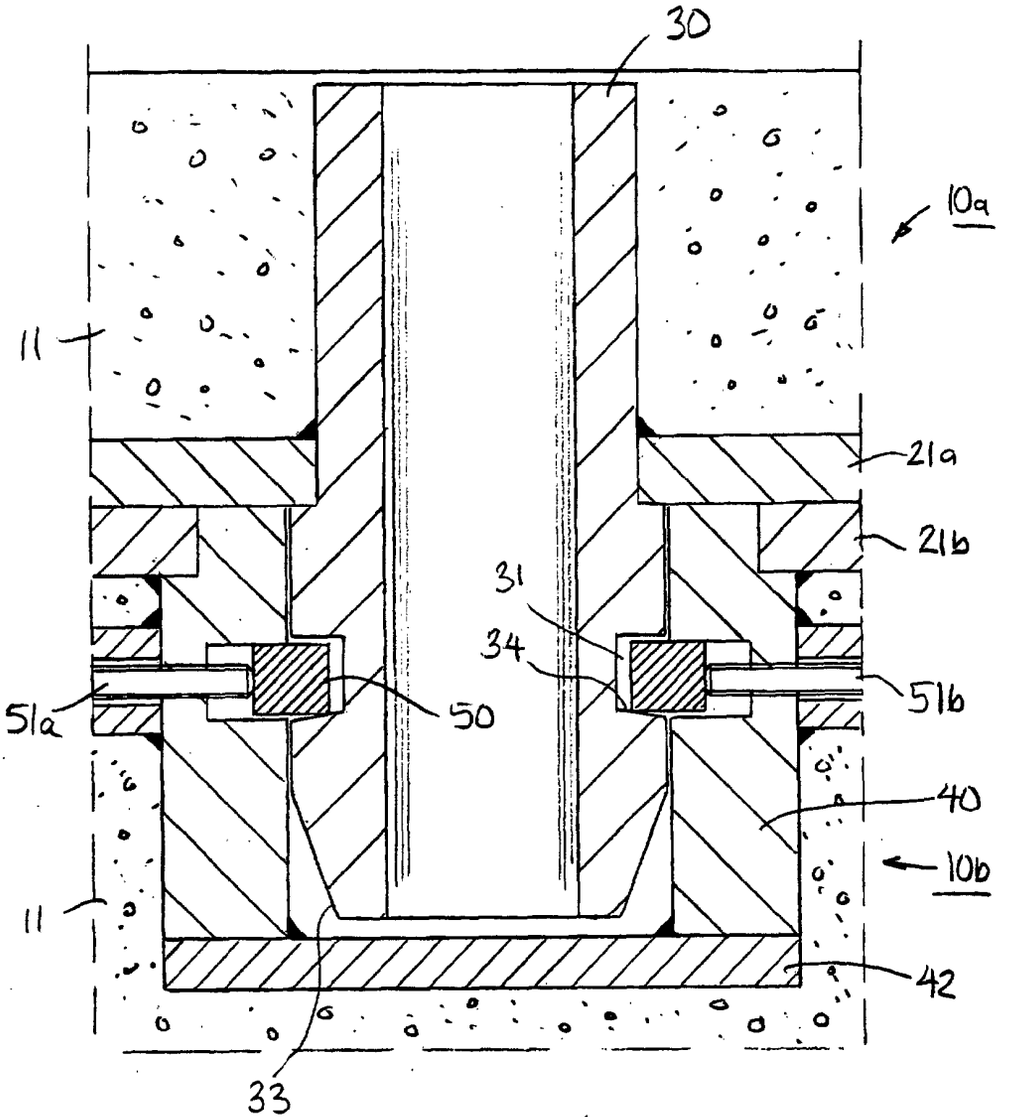


FIG. 3



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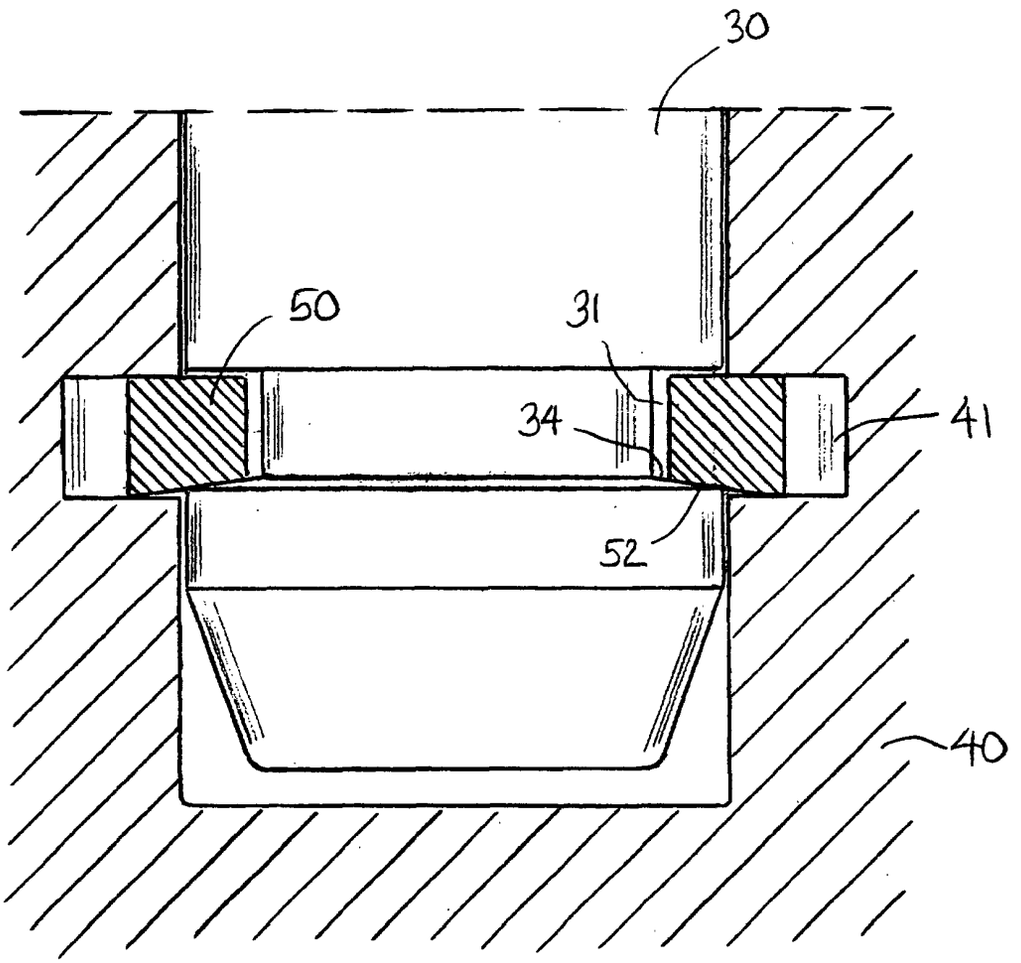

FIG. 5

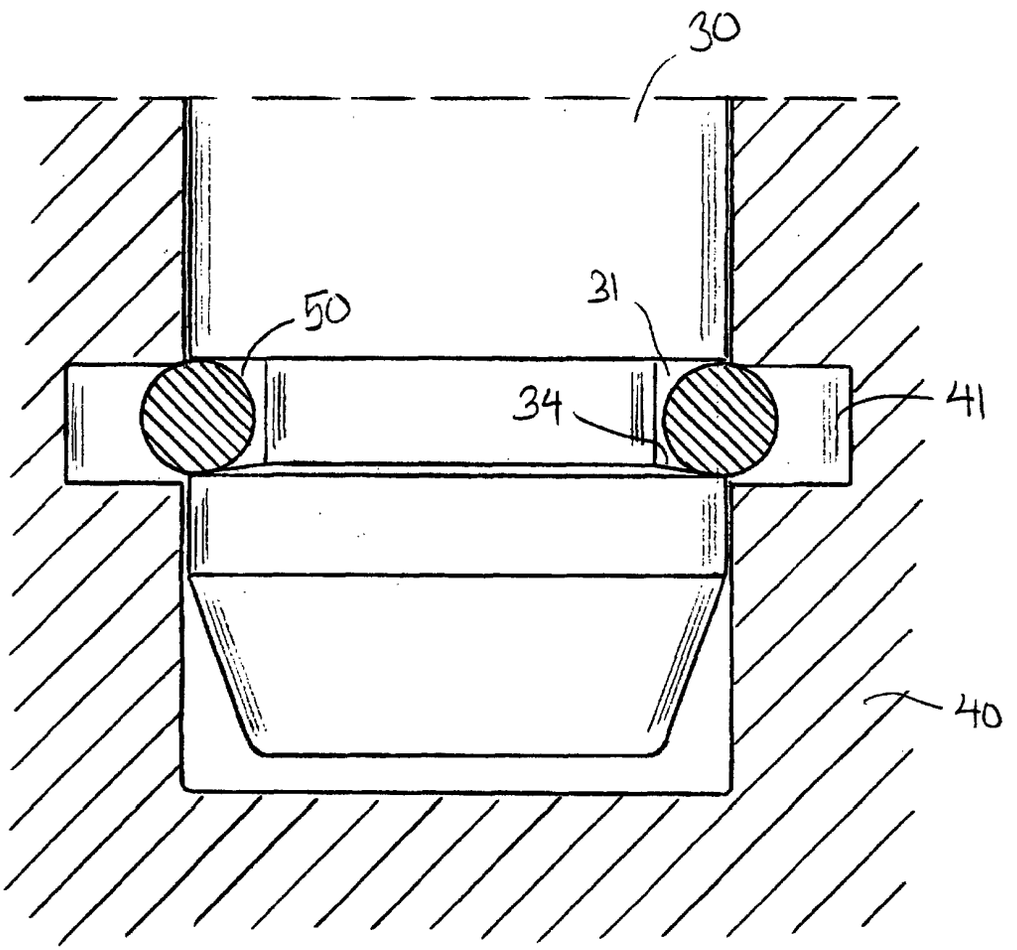

FIG. 6

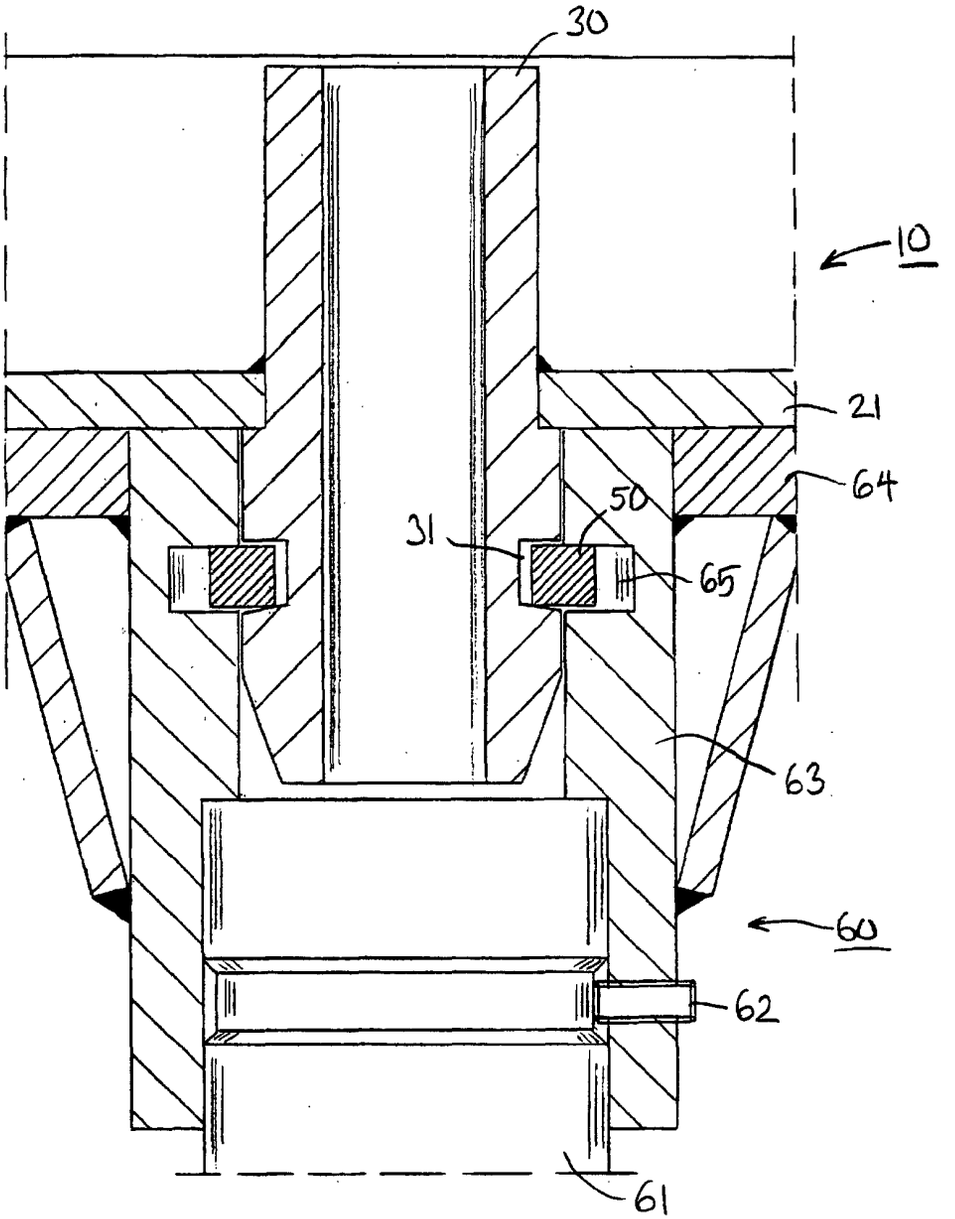

FIG. 7

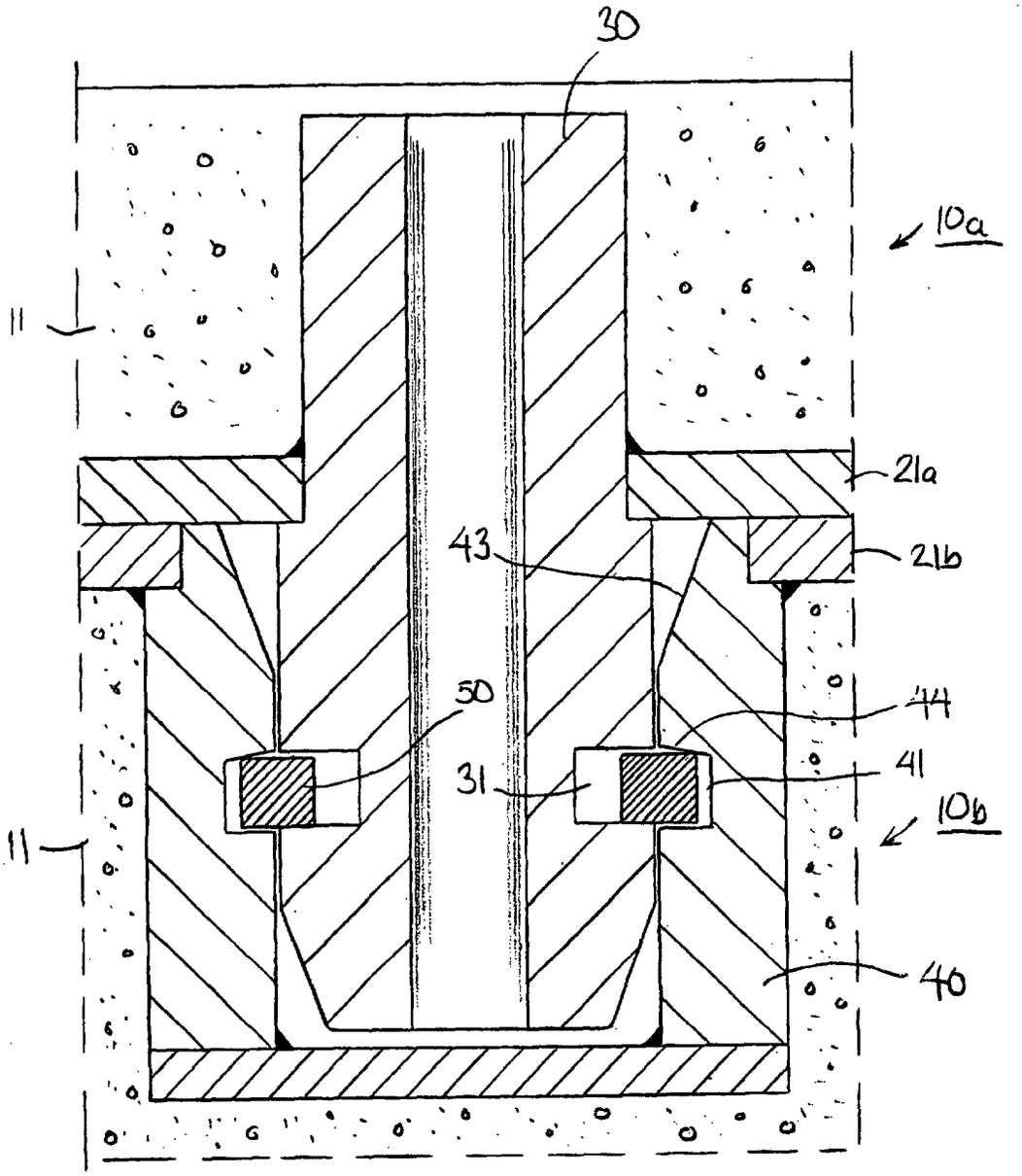

FIG. 8