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(54) **An interface portion for a siphonic system**

(57) An interface portion (1), for a siphonic system (6) which siphonic system (6) has an upstream portion (2) and a downstream portion (3), the interface portion (1) having an inlet end (10), to be in connection with the upstream portion (2), a discharge end (11), to be in connection with the downstream portion (3), the interface portion (1) being arranged to bring, in use, the upstream portion (2) in liquid connection with the downstream por-

tion (3). The interface portion is distinguished by the inner cross section area of the interface portion (1) increasing continuously from the inlet end (10) to the discharge end (11) for a length (L) of the interface portion (1) that is at least 0.3 times the inner diameter (D) of the discharge end (11), so that the interface portion counteracts an accumulation of a gas downstream of the upstream portion (2), to facilitate priming of the system.

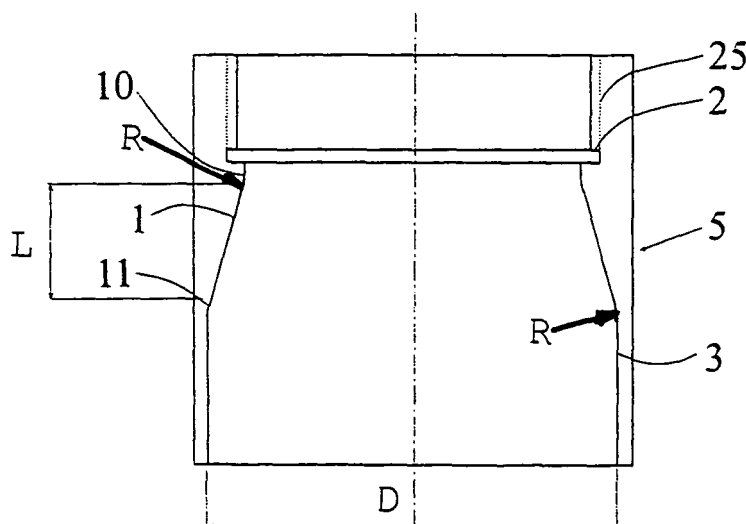


Fig. 5

Description

Field of the invention

[0001] The present invention concerns siphonic systems and in particular it concerns an interface portion according to the preamble of claim 1.

Prior art

[0002] In siphonic systems, where a liquid is driven through a pipe by means of the surrounding atmospheric pressure, it is important that the whole length of the pipe is filled with the liquid and that no gas gets trapped inside. In case a gas do gets trapped inside, the siphonic mechanism is compromised. Accordingly, when starting a siphonic system the full length of the pipe work must be filled with the liquid and all gas be removed. This is known as priming.

[0003] In siphonic drainage systems (full bore flow pipe systems), it is essential that the siphonic action (priming) commences immediately at the point in time when dimensional rainfalls occur. When priming starts, subatmospheric pressures appear in the pipe system and the drainage capacity increases dramatically. Such systems are useful for instance for the drainage of roofs of buildings.

[0004] Figure 1 shows schematically a known part of a siphonic drainage system. It includes a roof outlet 4 and pipes 23 connected to a horizontal collecting pipe 12, these pipes 23 are described as tailpipes 23. In the initial drainage process, correctly designed tailpipes 23 and their connected roof outlets 4 serve as small siphonic systems, capable of quickly filling up the collecting pipe 12 and downpipe (not shown) with rainwater. Hence, the total siphonic system will prime fast.

[0005] However, experience of priming is a mixed one. Some systems may prime fast while others seem to prime slower. For example, some roof outlet/tailpipe-systems may prime considerably slower than others. Hence, in the case of slow priming, the priming of the total pipe system will be delayed and the unfortunate result is unintentionally water storing on the roof. Large masses of water stored on the roof of a building may in a worst case scenario break the roof, with serious consequences for property and potentially human lives.

The object of the invention and its most important characteristics

[0006] It is an object of the present invention to propose a solution for or a reduction of the problems of prior art. A main object is consequently to solve the problem of reliably and more quickly prime a siphonic system.

[0007] According to the invention this is accomplished by an interface portion having the features of claim 1.

[0008] The invention stems from the insight that transitions in a siphonic system, such as vertical pipe work

of different diameters or vertical pipe work with constrictions, may act as traps of a gas, such as air. The entrapment of gas prevents siphonic action and prolongs the process of filling the system with liquid (priming).

5 [0009] The invention provides an interface portion with an inner cross section area that increases continuously from the inlet end to the discharge end for a length of the interface portion that is at least 0.3 times the inner diameter of the discharge end. Due to this continuous increase during the specified length, gas is effectively prevented from being trapped downstream of the upstream portion. Thus, the interface portion of the invention promotes a faster priming of the siphonic system.

10 [0010] Advantageously, a transition between the inlet end and the upstream portion is essentially in the form of a curve with a radius of at least 0.15 times the inner diameter of the discharge end. In this way, the liquid passing the transition can be made to more efficiently follow, at least partly, the interface portion.

15 [0011] Also, for a transition between the discharge end and the downstream portion, a similar transition as above is advantageous and having similar advantages.

[0012] The remaining dependent claims describe further advantageous embodiments of the invention.

20 [0013] The patent US 5 522 197 describes a throttling device for a roof outlet of a siphonic drainage system, said system comprising multiple roof outlets joined to the same tube system. It solves the problem of providing separate roof outlet branches with correct flow resistances. The device consists of a deformable annular element that is arranged in an outlet passage and that can be deformed to a varying degree, in order to throttle the passage to a corresponding degree. In an embodiment of the throttling device, a part of the throttling device may accidentally resemble the interface portion of the present application to the extent of having a portion with an inner cross section area that increases continuously. However, the length of the portion of the throttling device that has this increase is too short in order to attain the priming action of the interface portion of the present application and the transition radiiuses are non-existent. Further, the patent US 5 522 197 only address the problem of flow resistances and does not in any way, implicitly or explicitly, discuss the present problem of priming a siphonic system and there are no pointers to this problem or the solution according to the present invention at all.

Short description of the drawings

50 [0014] Embodiments exemplifying the invention will now be described, by means of the appended drawings, on which

fig. 1 illustrates schematically background art of the invention,

55 fig. 2 illustrates schematically a siphonic system, including an outlet connected to a tailpipe, having a slow priming behaviour,

fig. 3 illustrates an abrupt constricted interface portion of a connector for a prior art siphonic drainage system,

fig. 4 illustrates an interface portion of the invention in relation to a roof outlet,

fig. 5 illustrates a close-up of the interface portion of fig. 4,

fig. 6 illustrates another embodiment of the interface portion according to the invention in relation to a roof outlet,

fig. 7a and 7b illustrates a close-up of the interface portion of fig. 6 in two different views,

fig. 8 illustrates another embodiment of the interface portion according to the invention in relation to a roof outlet,

fig. 9 illustrates the interface portion of the invention contained in a sleeve insert,

fig. 10 illustrates the interface portion of the invention contained in roof outlet of a siphonic drainage system, and

fig. 11 illustrates the interface portion of the invention contained in a pipe of a siphonic system.

Detailed description of exemplary embodiments

[0015] Firstly, the insight of the invention, regarding the problem of priming a siphonic system, will be described. Fig. 2 illustrates a cause to the problem of slow priming of certain siphonic systems. In the figure, as an example of a siphonic system, a siphonic drainage system 6 is shown. The system 6 includes a roof outlet 4, having an outlet spigot 13, and a tailpipe 23 of larger diameter than the outlet spigot 13. In the event of a rainfall, rainwater 14 is collected in the outlet bowl 15 of the roof outlet 4. The water flows down through the outlet spigot 13 and in to the tailpipe 23. Since the tailpipe 23 in this case has a larger diameter than the outlet spigot 13 and the connector connecting them has an abrupt change in diameter, the water forms a jet 16 that has a smaller diameter than the tailpipe 23. This leads to air 17 being trapped inside the tailpipe 23. Because of this air, the system will not work siphonically. Instead, the system works purely by gravity and therefore has a considerably lower water transport capacity. In order for the siphonic action to start, the tailpipe 23 must (gravitationally) be filled up with water up to the outlet spigot 13, evacuating all air. This filling will be slow and sometimes does not take place at all, even after a substantial time.

[0016] The same problem can also occur in a special case of a siphonic drainage system. It is the case of a constricted connector 18. Such a constricted connector 18 of prior art is shown in fig. 3. Its function is to connect a tailpipe 23 directly to an outlet bottom 9 of the drainage system, with no spigot in between. The constriction 19 is in this case necessary in order to adapt the opening 7 in the outlet bowl 15 to the air baffle 20. If the opening 7 becomes too large in respect of the size of the air baffle 20 above, the function of the baffle 20, to only allow water

into the drainage system, may be compromised. This is due to that air may constantly be drawn into the pipe system at the side of the air baffle 20, and full bore flow will never be obtained at tolerable water depths on the roof. For example, the tailpipes 23 in figures 6 and 8, if connected directly to the outlet bowl 15 or baseplate, would possibly create this situation. The constriction 19 in fig. 3 remedies this, but unfortunately, because of the abrupt transition from a small cross section area to a large cross section area, the problem described in the previous paragraph may occur.

[0017] To conclude, abrupt transitions of pipe work diameters in siphonic systems may entail problems in priming. Further, in siphonic roof drainage designs there is frequently a need for tailpipes with larger inner diameters than the outlet spigots of roof outlets.

[0018] To cater for possible incompatibilities of different parts in a siphonic system, a new transition interface portion 1 design is suggested. To exemplify such an interface portion 1, a siphonic drainage system 6 is depicted in Figure 4. This siphonic drainage system includes a roof outlet 4, having an outlet spigot 13. The spigot 13 is connected to a connector 5, which in turn is connected to a tailpipe 23. The direction of water flowing is downwards in the figure; from the roof outlet 4 through the spigot 13, then through the connector 5 and in to the tailpipe 23. The inventive interface portion 1 is in this figure, as an example, contained in the connector 5. For the sake of definition, the siphonic system is said to have an upstream portion 2 and a downstream portion 3. In the example, the upstream portion 2 corresponds to the outlet spigot 13 and the downstream portion 3 corresponds to the lower part of the connector 5. The interface portion 1 extends between an inlet end 10 and a discharge end 11. The inlet end 10 is to be in connection with the upstream portion 2, the discharge end 11 is to be in connection with the downstream portion 3. Further, the interface portion 1 is arranged to bring, in use, the upstream portion 2 in liquid connection with the downstream portion 3. The inner cross section area of the interface portion 1 increases continuously from the inlet end 10 to the discharge end 11 for a length L of the interface portion 1 that is at least 0.3 times the inner diameter D of the discharge end 11 (see fig. 5). By this continuous increase, the interface portion counteracts an accumulation of a gas downstream of the upstream portion 2, that is in the interface portion 1 and downstream of the interface portion 1. This is due to that the water, instead of forming a jet as in fig. 2, at least partly follows the wall of the interface portion 1. In doing this, the water may form a kind of a lid that traps the air in the interface portion 1 and/or the downstream portion 3 and pushes the air out of the system 6, thus facilitating priming of the system 6.

[0019] Thus, the idea of the interface portion is to replace abrupt transition portions in siphonic systems. In this way, the interface portion enables at least some of the liquid in the siphonic system to follow the wall of the

interface portion. Examples of such abrupt portions, which could be replaced by the interface portion, are a change from a small to a large diameter pipe or a constriction in a pipe, as exemplified above. A transition from the interface portion 1 to the upstream portion 2 and/or the downstream portion 3 of the siphonic system should preferably be smooth and could advantageously be essentially in the form of a curve with a radius R of at least 0.15 times the inner diameter D of the discharge end 11, see for instance fig. 5.

[0020] It can be realised that the interface portion can be provided in several ways. For instance it can be provided as an integral part of a building block of a siphonic system, such as an integral part of a roof outlet, a pipe or a connector. In fig. 10, the interface portion 1 is provided as an integral part of a roof outlet 4. Examples of connectors are given in figs. 4 through 8. It could also be provided as a sleeve insert 24 for a building block of a siphonic system, such as a pipe. An example of such a sleeve insert 24, inserted into a pipe, is depicted in fig. 9. An example of an interface portion 1 integral with a pipe is given in fig. 11.

[0021] When the interface portion is provided as an integral part of a building block of a siphonic system, either end of that building block can be provided, if needed, with arbitrary connections to connect the building block, including the interface portion, to other building blocks of the siphonic system. Such connections include threads 25, flanges 8 and other conventional connection means. Examples of threads 25 and flanges 8 can for instance be found in figs. 5 and 6. Connection by welding would of course also be possible.

[0022] In the specific case of the siphonic system being a siphonic drainage system, the upstream portion of the siphonic drainage system, to which the inlet end of the interface portion should be connected, could be a part of a roof outlet, such as an outlet spigot 13 or an outlet bottom 9. Such a part could be studied in for example figs. 4 and 6. For an outlet bottom, it is possible to adapt the inlet end either to be connected to the outside or to the inside of the outlet bottom. Such outlet bottoms 9 and inlet ends 10 are depicted in figs. 6 and 8. Figs. 7a and 7b are close-ups in different views of fig. 6. The discharge end 11 is similarly adapted to be connected to a downstream portion 3 being part of a tailpipe of a siphonic drainage system.

[0023] With reference to fig. 5, the length L of the interface portion 1 should, as has been mentioned, be at least 0.3 times the inner diameter D of the discharge end 11 for a beneficial priming effect beginning to occur. An increase of said length L from between 0.3 to 0.5 times said inner diameter D , yields an increased priming effect. Sometimes an even stronger priming effect can be observed, if the length L of the interface portion 1 is at least 0.5 times the inner diameter D of the discharge end 11.

[0024] The material in the building blocks containing the interface portions are chosen to match the material of other building blocks to which the interface portion

building block is to be connected. For example, welding or solvent welding of plastic materials, mechanical couplings, or welding of steel and other metals may be used for achieving a connection.

[0025] The wall of the interface portion 1 can be designed to be more or less smooth, the main requirement being that the water should be led to at least partly follow the same.

[0026] It should be observed that it is not necessary for the cross sections of the pipe work of the siphonic systems to be circular. Other cross sections, such as for instance quadratic, rectangular or elliptic are also applicable.

[0027] Even if the interface portion of the invention is particularly useful in siphonic roof drainage pipe systems, it may of course also be utilised in any siphonic pipe system where transitions between different diameters have to be performed.

Claims

1. An interface portion (1), for a siphonic system (6) which siphonic system (6) has an upstream portion (2) and a downstream portion (3), the interface portion (1) having an inlet end (10), to be in connection with the upstream portion (2), a discharge end (11), to be in connection with the downstream portion (3), the interface portion (1) being arranged to bring, in use, the upstream portion (2) in liquid connection with the downstream portion (3), **characterised in that** the inner cross section area of the interface portion (1) increases continuously from the inlet end (10) to the discharge end (11) for a length (L) of the interface portion (1) that is at least 0.3 times the inner diameter (D) of the discharge end (11), so that the interface portion counteracts an accumulation of a gas downstream of the upstream portion (2), to facilitate priming of the system.
2. An interface portion (1) according to claim 1, **characterised in that** a transition between the inlet end (10) and the upstream portion (2) is essentially in the form of a curve with a radius of at least 0.15 times the inner diameter of the discharge end (11).
3. An interface portion (1) according to claims 1 or 2, **characterised in that** a transition between the discharge end (11) and the downstream portion (3) is essentially in the form of a curve with a radius of at least 0.15 times the inner diameter of the discharge end (11).
4. An interface portion (1) according to claims any of claims 1-3, **characterised in that** the interface portion is contained in a roof outlet (4) of a siphonic drainage system.

5. An interface portion (1) according to any of claims 1-3, **characterised in that** the interface portion is contained in a sleeve insert for a pipe.
6. An interface portion (1) according to any of claims 1-3, **characterised in that** the interface portion is contained in a pipe. 5
7. An interface portion (1) according to any of claims 1-3, **characterised in that** the interface portion is contained in a connector. 10
8. An interface portion (1) according to any of claims 5-7, **characterised in that** the inlet end (10) is adapted to be connected to the upstream portion (2) by connective threads. 15
9. An interface portion (1) according to any of claims 5-8, **characterised in that** the inlet end (10) is adapted to be connected to the upstream portion (2) by a connective flange (8). 20
10. An interface portion (1) according to any of claims 5-9, **characterised in that** the inlet end (10) is adapted to be connected to an upstream portion (2) being part of a roof outlet (4) of a siphonic drainage system. 25
11. An interface portion (1) according to claim 10, **characterised in that** the inlet end (10) is adapted to be connected to an outlet spigot (13) of the roof outlet (4). 30
12. An interface portion (1) according to claim 10, **characterised in that** the inlet end (10) is adapted to be connected to an outlet bottom (9) of the roof outlet (4). 35
13. An interface portion (1) according to claim 12, **characterised in that** the inlet end (10) is adapted to be connected to the outside of the outlet bottom (9) of the roof outlet (4). 40
14. An interface portion (1) according to claim 12, **characterised in that** the inlet end (10) is adapted to be connected to the inside of the outlet bottom (9) of the roof outlet (4). 45
15. An interface portion (1) according to any of claims 1-14, **characterised in that** the discharge end (11) is adapted to be connected to a downstream portion (3) being part of a tailpipe of a siphonic drainage system. 50
16. An interface portion (1) according to any of claims 1-15, **characterised in that** the length (L) of the interface portion (1) is between 0.3 and 0.5 times the inner diameter (D) of the discharge end (11). 55
17. An interface portion (1) according to any of claims 1-15, **characterised in that** the length (L) of the interface portion (1) is at least 0.5 times the inner diameter (D) of the discharge end (11).

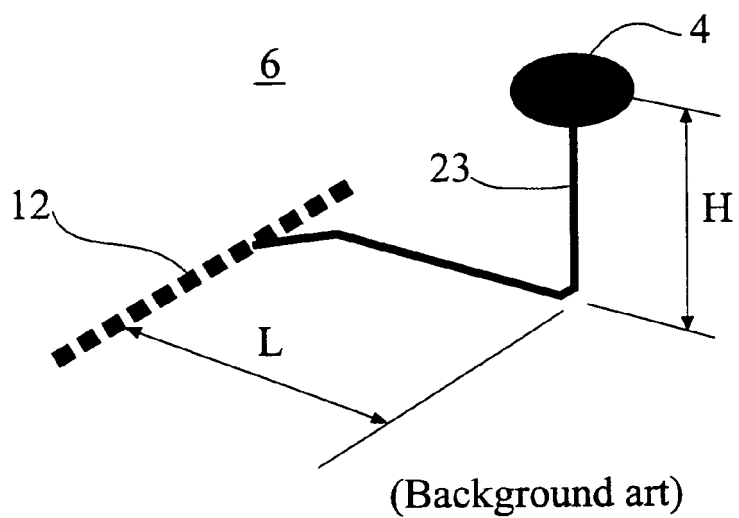


Fig. 1

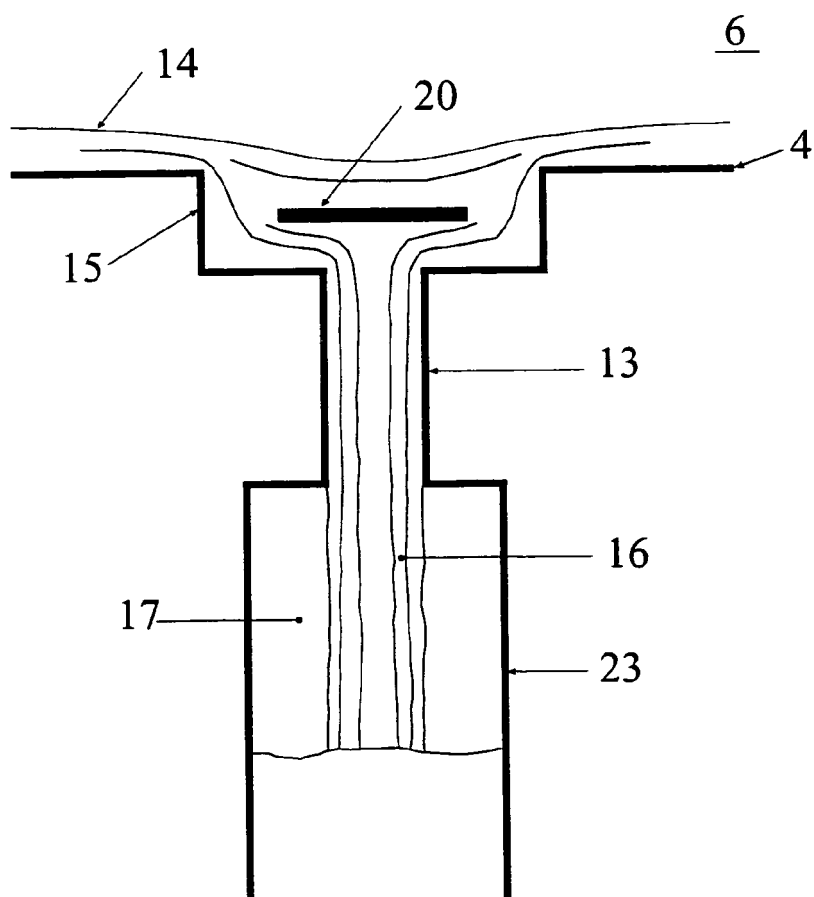
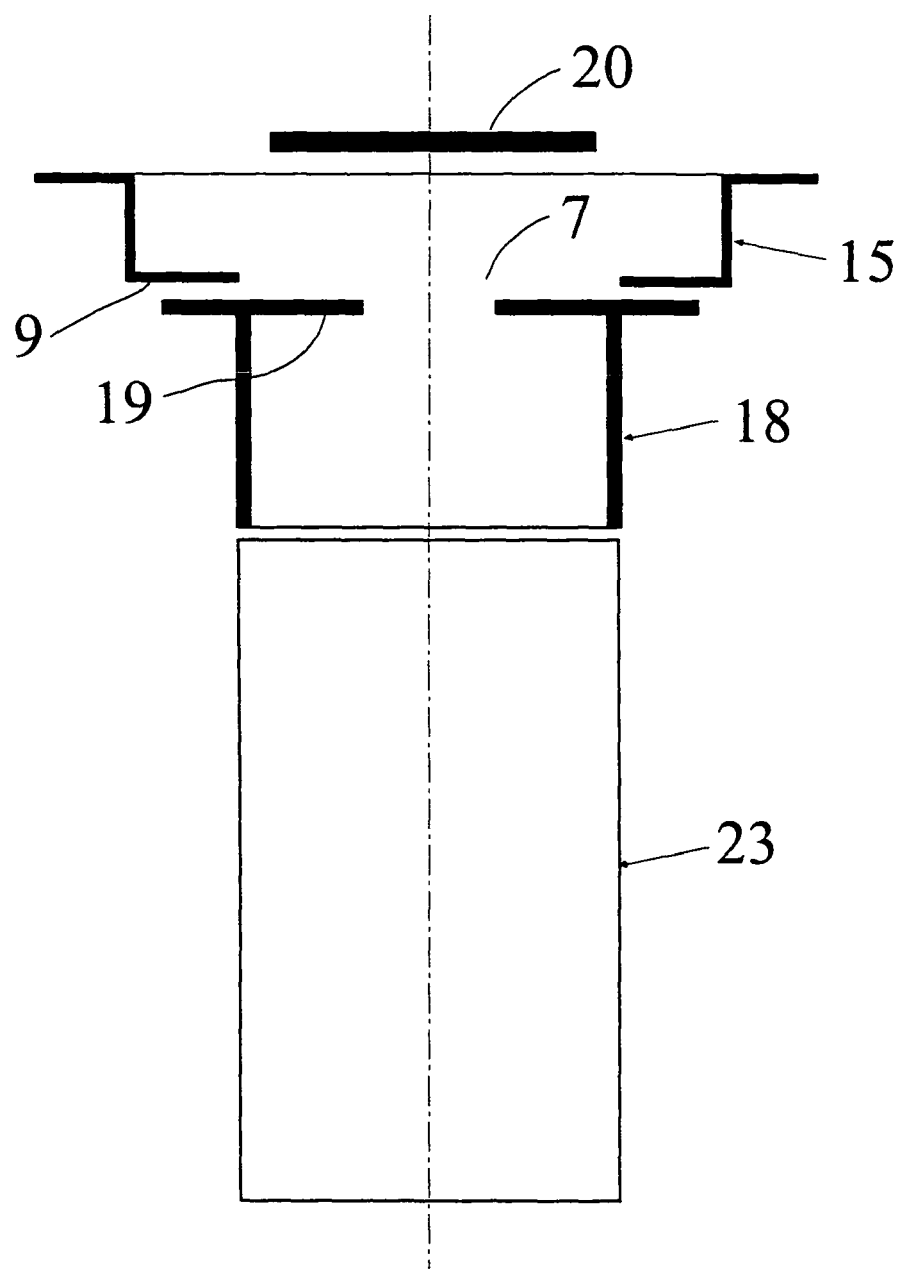


Fig. 2



(Prior art)

Fig. 3

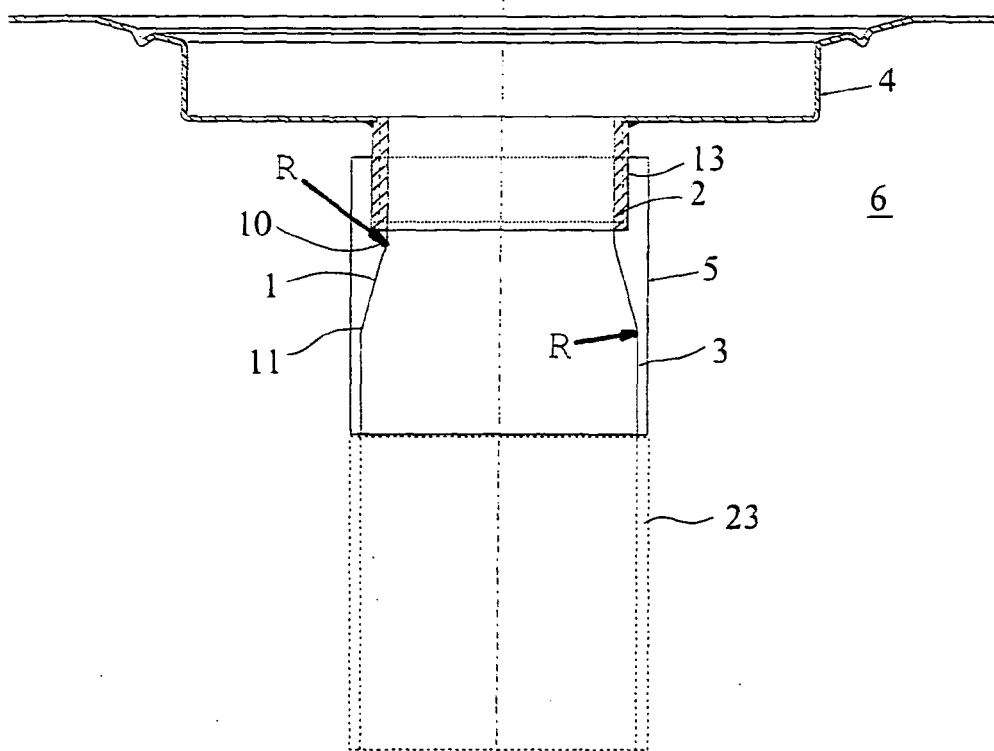


Fig. 4

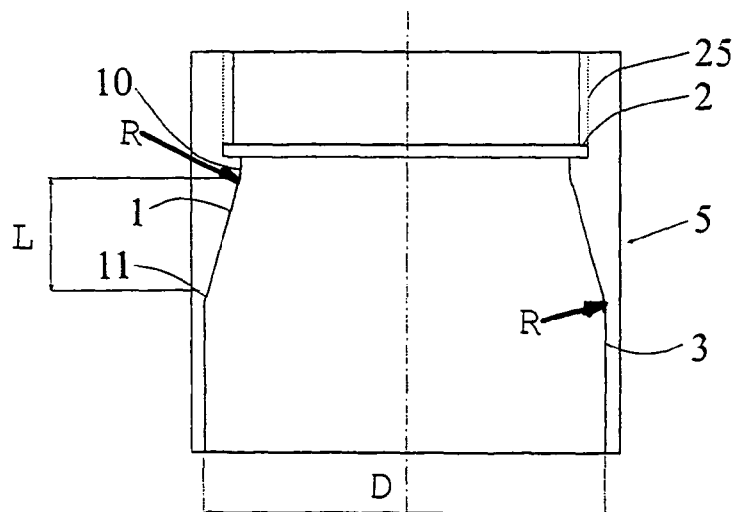


Fig. 5

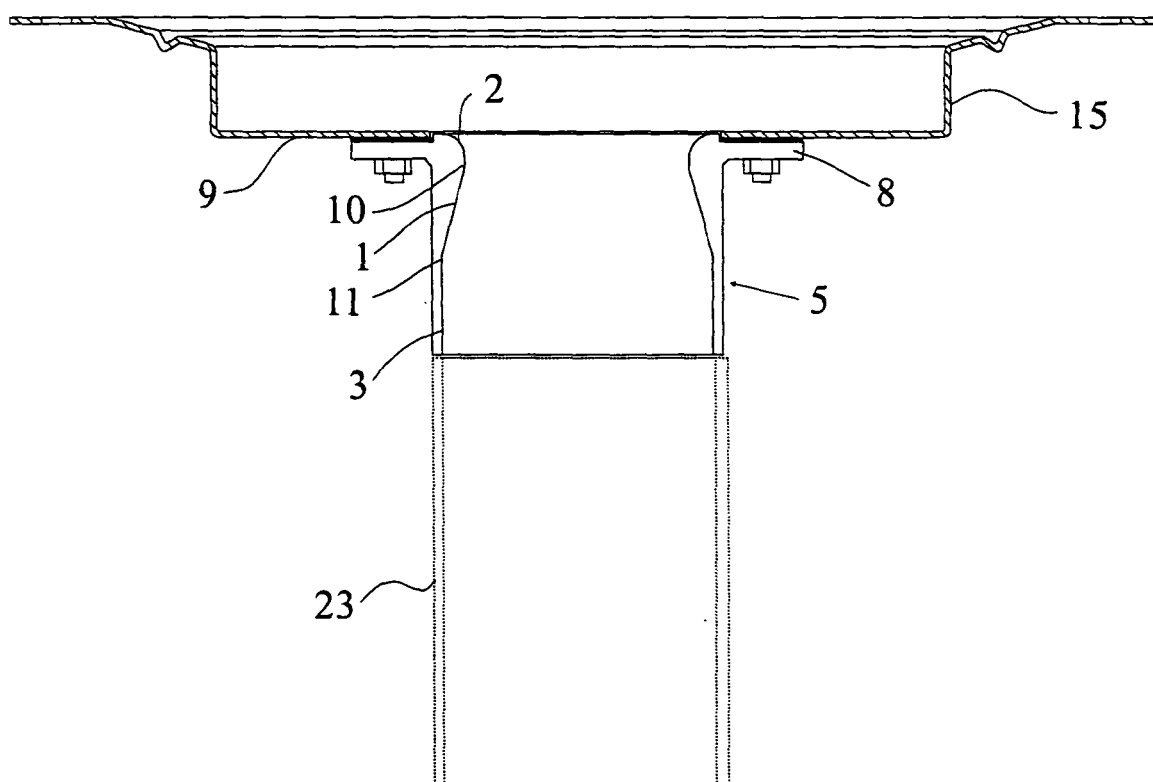


Fig. 6

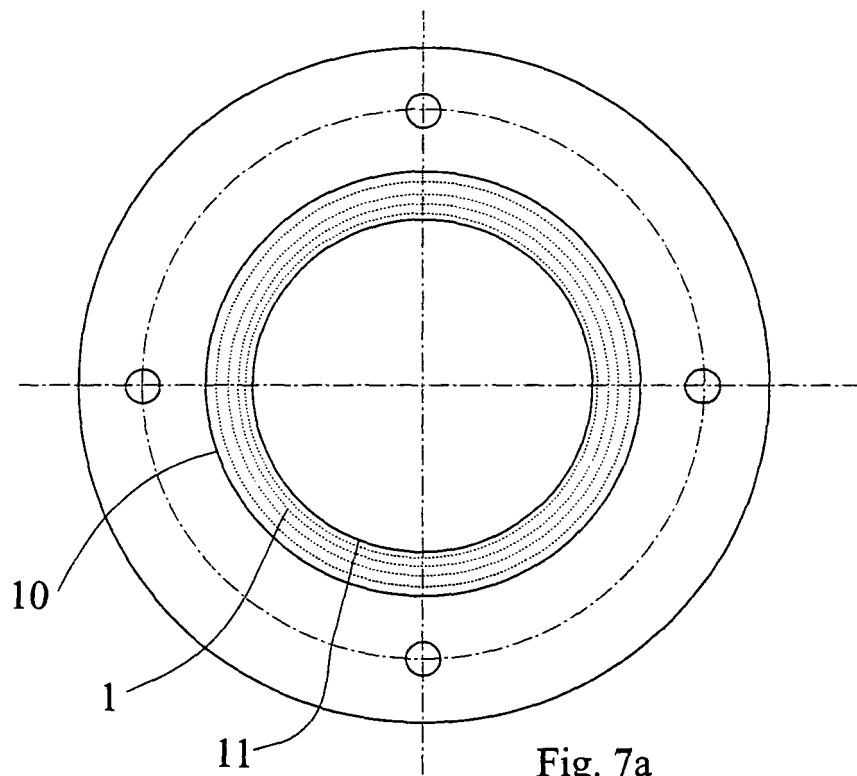


Fig. 7a

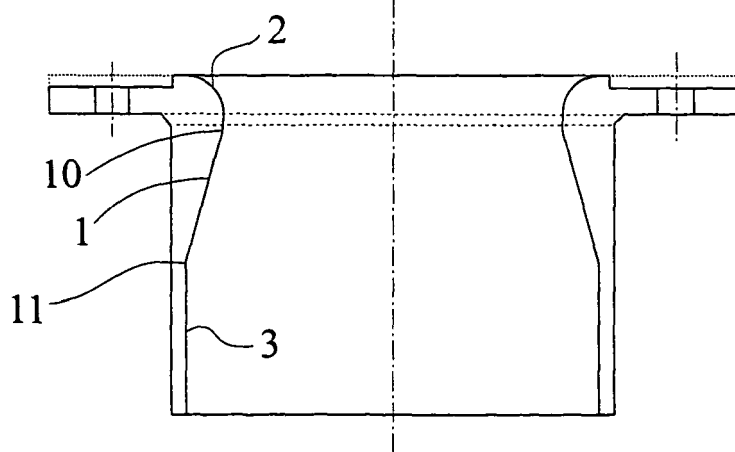


Fig. 7b

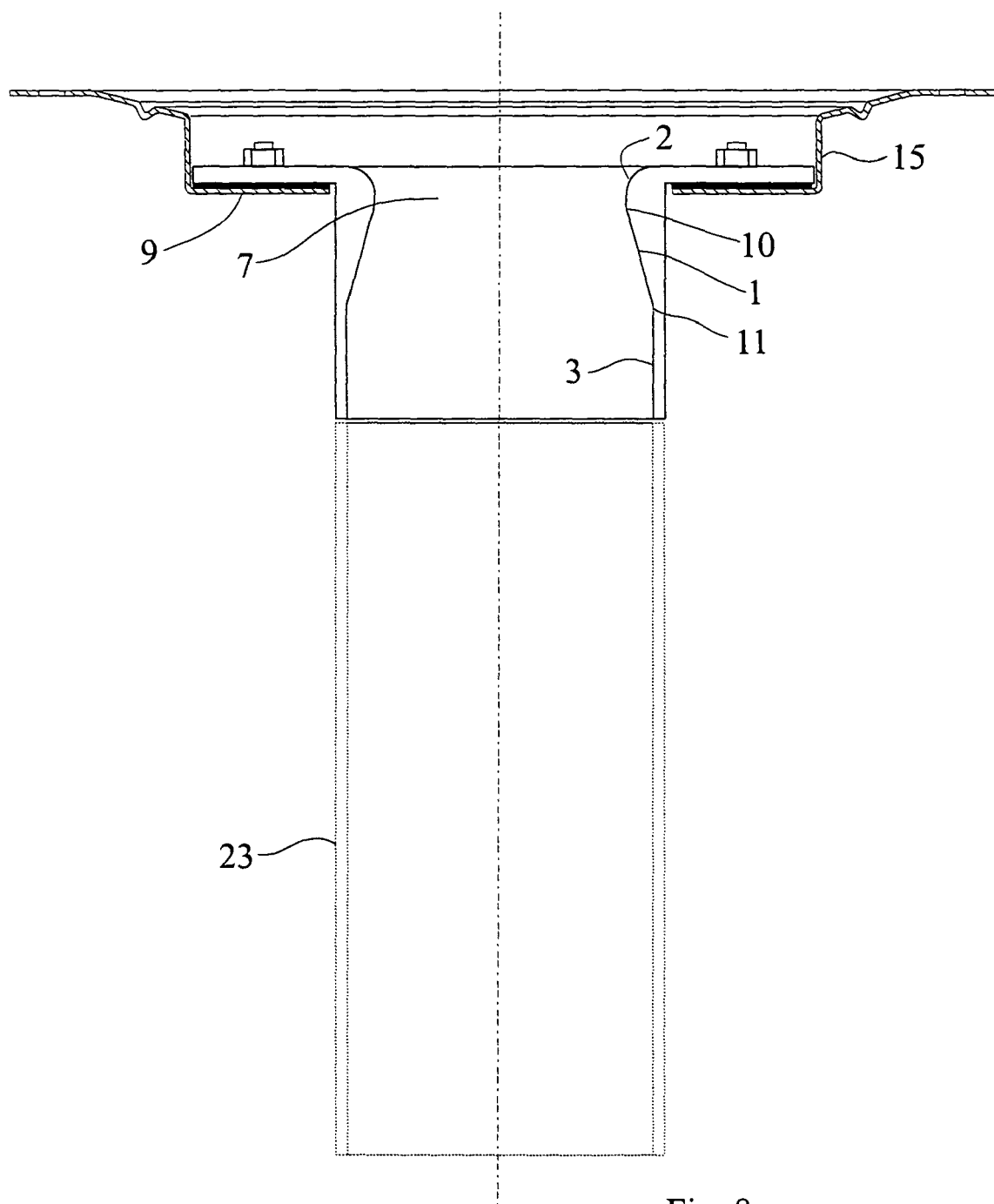


Fig. 8

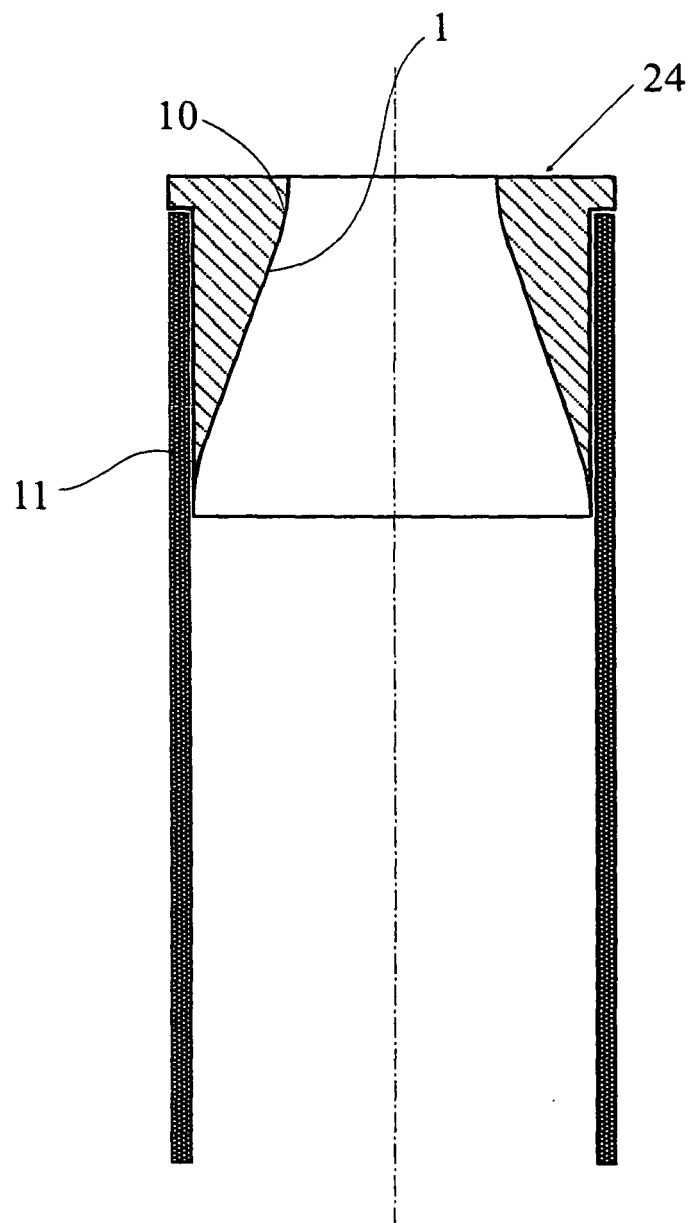


Fig. 9

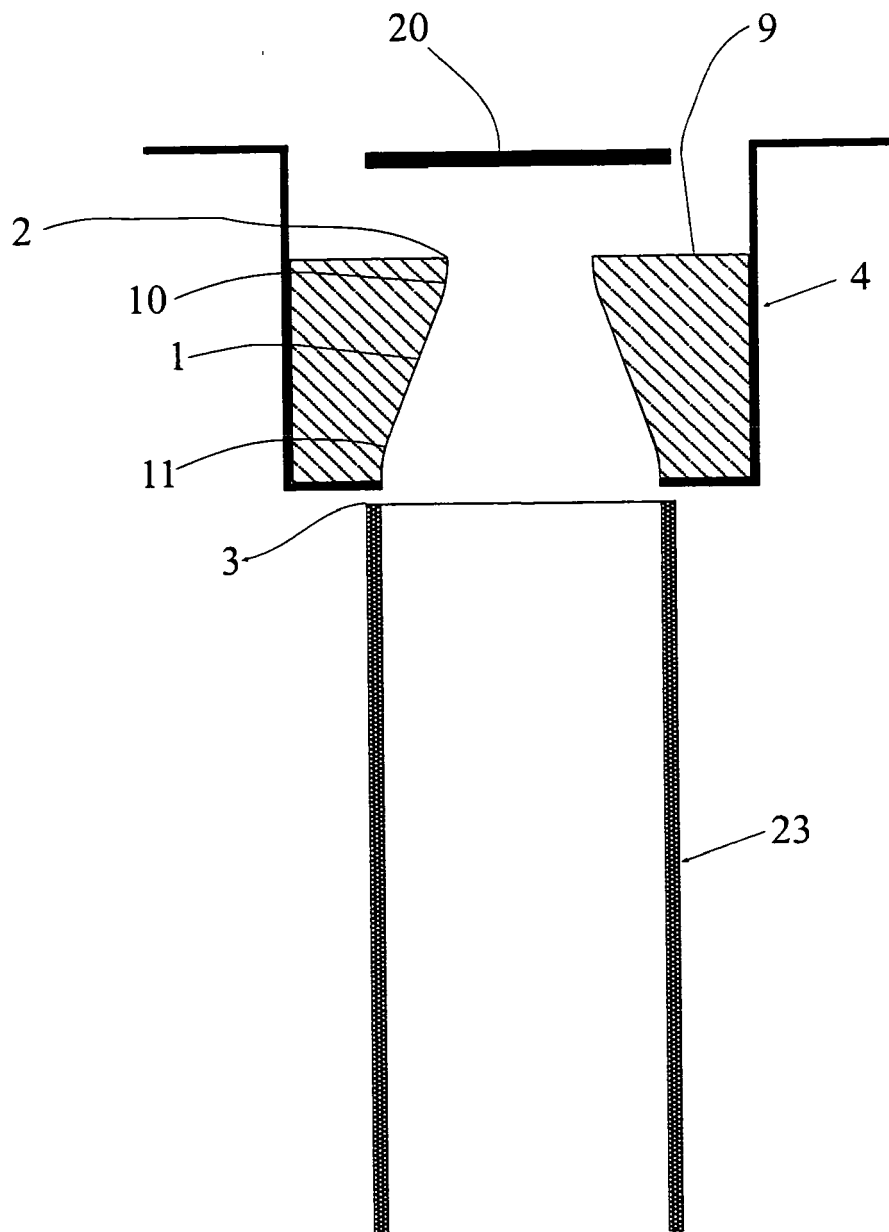


Fig. 10

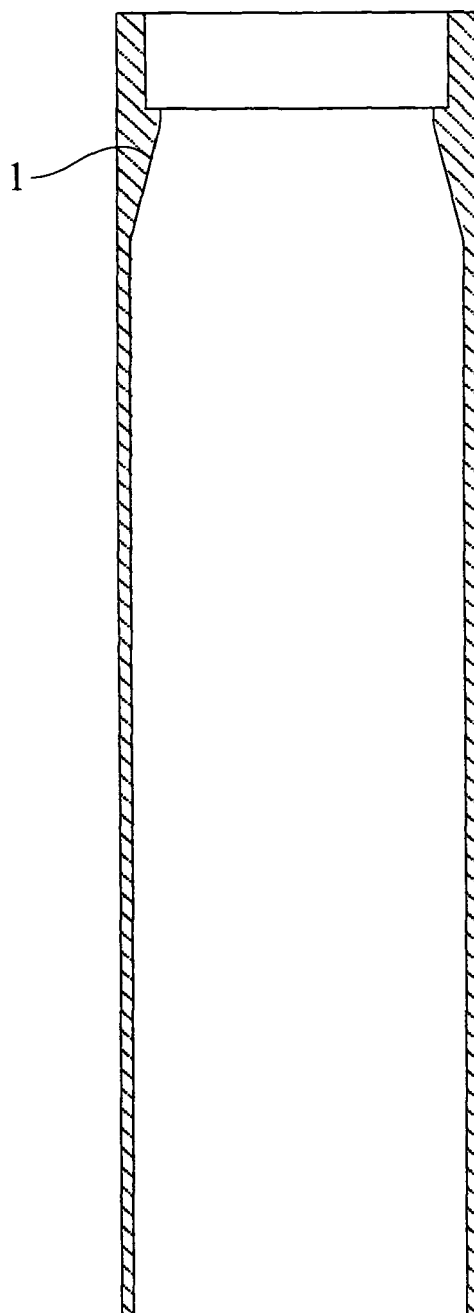


Fig. 11

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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