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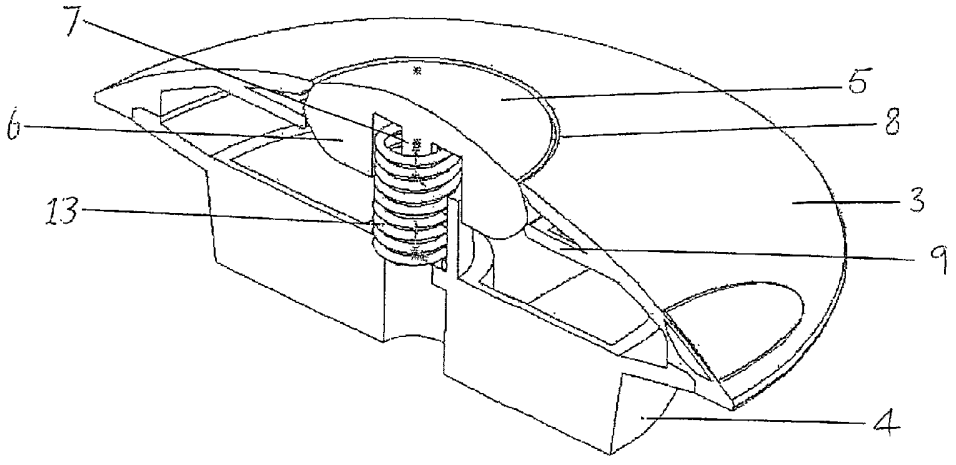
(54) Title: OVERFLOW PREVENTER



(57) Abstract: An overflow preventer comprising a plug body (1) receivable into, and fully removable from, a drain hole, the plug body (1) having a generally annular configuration surrounding an aperture (2) and a internal member (5) associated with the plug body (1) and movable between a first position in which the aperture (2) is closed and a second position in which the aperture (2) is open to allow fluid to drain through the aperture (2), the internal member (5) being resiliently biased to the first position, when the hydrostatic pressure acting on it in use is less than a predetermined value, by an interference fit with at least one projection on an internal surface of the plug body, the internal member (5) having an upper surface against which hydrostatic pressure bears in use, said surface being adapted for sealing abutment against a cooperating portion of the plug body surrounding the aperture (2) in said first, closed position.

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OVERFLOW PREVENTER

The present invention relates to an overflow preventer, and more particularly to an overflow preventer which comprises a plug body receivable into, and fully removable from, a drain hole of for example a bath, sink, basin, cistern or other installation in which water or other liquids are collected and which include a drain hole.

Overflow preventers are known, which comprise a plug body receivable into, and fully removable from, a drain hole of for example a bath or basin. Generally speaking, these devices include a valve which is normally closed, but which can open when a certain pre-determined depth of water is exceeded. The device can therefore function as a plug under normal circumstances, and as a water outlet when the water level approaches an overflow condition.

As is well known, a user may start to fill a bath or basin from for example a tap (faucet), and may then be distracted or called away while the filling continues. In such a situation, there exists a real danger of overflow of water. If, however, an overflow preventor is used in place of a conventional plug, the danger is avoided. In the initial rest position of the overflow preventer, the valve is biased closed to form a seal. When the bath or basin is filled with water, the hydrostatic pressure on the valve increases. As filling proceeds the hydrostatic pressure on the valve gradually increases until a point is reached whereby the pressure on the valve will overcome the bias and urge the valve to open. A flow passage will then be opened and water will drain away. Water will continue to drain away until the hydrostatic pressure of water no longer overcomes the bias. The bias will then act again to urge the valve closed, to prevent unnecessary loss of water through the drain hole.

International (PCT) Patent Application No. WO-A-95/18896 (Stewart et al), describes such an overflow preventer in which the plug body is provided with apertures between an outer and an inner region of the plug body, and a resiliently biased valve is disposed below the apertures and is arranged to open when the hydrostatic pressure above the apertures exceeds a pre-determined amount.

Australian Patent No. AU-B-700030 (Smartplug Pty Ltd), describes a generally similar overflow preventer (Figures 1 to 4), and also (Figures 5 to 8) a variant in which a manually actuable override mechanism is additionally present, and is provided with a locking device to lock the valve in the open condition.

United Kingdom Patent No. 2 338 184, describes another generally similar overflow preventer in which the inner member is biased into the sealing position by a spring acting between the inner member and a base member.

The prior art overflow preventers generally suffer from the disadvantages of a relatively restricted water outlet area, as well as no, or only an inconvenient, manually actuable override mechanism. Such an override mechanism could be very useful, to enable a user to drain the bath, basin or the like quickly and conveniently and without having to extract the device from the drain hole. Moreover, the construction of the prior art devices is generally somewhat elaborate, involving a large number of cooperating parts, leading to increased manufacturing costs, to undesirable bulk and weight of the complete devices, and to a likelihood of internal fungal growth as a result of water being trapped in the mechanisms.

A further disadvantage of the prior art overflow preventers arises due to the use of conventional compression springs to bias the valve in the closed position. This results in a valve which may open to varying degrees depending on the hydrostatic pressure. Since it is the aim of such overflow preventers to facilitate the release of water from a vessel into which they are fitted only when the hydrostatic pressure exerted upon the overflow preventer exceeds a certain predetermined value it would be preferable to have a valve which was either "open" or "closed". The nature of conventional compression springs means that as the hydrostatic pressure increases the valve will be allowed to open gradually until it is in the fully open position. Thus such overflow preventers are fairly imprecise and may allow leakage below the intended threshold value.

It is an object of the present invention to go at least some way towards overcoming the disadvantages present in the prior art devices, or at least to provide an acceptable alternative

to the prior art devices.

According to the present invention, there is provided an overflow preventer comprising:

a) a plug body receivable into, and fully removable from, a drain hole, the plug body having a generally annular configuration surrounding an aperture; and

b) a internal member associated with the plug body and movable between a first position in which the aperture is closed and a second position in which the aperture is open to allow fluid to drain through the aperture, the internal member being resiliently biased to the first position, when the hydrostatic pressure acting on it in use is less than a predetermined value, by an interference fit with at least one projection on an internal surface of the plug body, the internal member having an upper surface against which hydrostatic pressure bears in use, said surface being adapted for sealing abutment against a cooperating portion of the plug body surrounding the aperture in said first, closed position.

The internal member acts in cooperation with the plug body to define a valve.

The term "receivable into, and fully removable from, a drain hole" used herein refers to the requirement that the overflow preventer can be easily inserted into, and removed from, a drain hole, in the general manner of doing so, without the need for adjustment or tampering with the drain hole and associated installations. The plug body preferably has an external surface which is dimensioned and configured for fitting into the drain hole in the general manner of a conventional plug, and in particular has a tapering curved external surface.

It is preferred that the overflow preventer further comprises a return mechanism arranged to bear against the underside of the internal member and biased to return the internal member to the first position when the hydrostatic pressure acting on the surface of the internal member in use drops below the predetermined value.

It is preferred that the return mechanism comprises a spring and more preferred that the

spring is a helical compression spring.

In addition to acting as a return mechanism to return the internal member from the second position back to the first position, the return spring preferably exerts a biasing force on the underside of the internal member when it is in the first position. This biasing force acts in combination with the biasing force of the interference fit to keep the internal member in the first position and the valve closed.

The said predetermined value of the hydrostatic pressure, below which the internal member is biased to the closed position, can be selected during the manufacturing stage from within a range of values, by the selection of internal members of varying sizes and materials which will be biased to different extents, relative to the interference fit. Selection of return springs of varying strengths would also have the effect of altering the said predetermined value. It would therefore be possible to alter the hydrostatic pressure at which the overflow preventer operates.

It is preferred that the plug body and the internal member are arranged such that the internal member extends substantially unshielded across the entire aperture of the plug body. When this is the case the upwardly directed surface which occludes the aperture is presented to the entire water column above the entire aperture surrounded and defined by the annulus of the plug body with no, or negligible, shielding by overlying fixed parts of the overflow preventer (such as, for example, the "spider web" frame arrays which overlie the valve mechanisms in the prior art referred to above), whereby the valve can easily be opened by a user's finger or toe to override the biasing of the valve to the closed position. In numerical terms, it is preferred that the area of the internal member upper surface which in use directly supports a full column of water is equal to at least about 60% of the area within the annulus of the plug body. This surface is thereby accessible for the user to conveniently override the valve. The upper surface of the internal member may have any desired surface configuration. It is most preferred that the configuration of the upper surface is so shaped that, in use at a hydrostatic pressure lower than the predetermined automatic opening value, the valve can be conveniently opened by a depression action of the finger, heel or toe of a user of the bath,

sink or the like, to override the resilient biasing of the valve to the closed position. The configuration of the upper surface of the internal member may conveniently be convex, particularly domed.

It is most preferred that the internal member is resiliently biased to the first position by an interference fit with a substantially annular projection extending from an internal surface of the plug body.

The plug body and the internal member are each suitably formed of plastics material which may be the same or different as between the two parts. The internal member, for example, may be formed of a durable, flexible material. It is most preferred that the internal member is formed from a rubberised polymer.

The overflow preventer may suitably be used in the drain hole of a conventional household pop-up waste system. When this is the case it is preferred that means are provided whereby the overflow preventer may be lifted out of, and returned into, the drain hole. Such means may take the form of a lever system or a cable operated system. This feature allows the user to release water from the bath or basin without the need to fully remove the overflow preventer from the system.

The plug body preferably has an attachment point on its upper surface to which a conventional plug chain may be attached.

The plug body of the overflow preventer may suitably be formed from an upper and a lower portion releasably coupled together. Preferably, the upper and lower portions are coupled together by means of a snap fit connection. This feature facilitates replacement of the internal components of the overflow preventer and allows for the components to be easily cleaned.

For a better understanding of the invention, and to show more clearly how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is a perspective view of a first embodiment of an overflow preventer;

Figure 2 is a sectional view of the overflow preventer of Fig. 1 taken along the diameter;

Figure 3 is an exploded sectional view of the overflow preventer of Fig 1 taken along the diameter;

Figure 4 is an exploded perspective view of a second embodiment of an overflow preventer; and

Figure 5 is a sectional view of the second embodiment of an overflow preventer taken along the diameter.

In the figures like parts are numbered the same.

The general dimensions of the overflow preventer correspond to the dimensions of a conventional plug, and the illustrated device is intended to be interchangeable with such a plug.

Referring firstly to Figs. 1-3, these show a first embodiment of an overflow preventer. The overflow preventer comprises a plug body 1 receivable into and fully removable from, a drain hole of for example a bath, sink, basin, cistern or other installation in which water or other liquids are collected and which include a drain hole. The plug body 1 is formed from a durable plastics material and comprises an upper portion 3 and a lower portion 4 which are releasably coupled together. The upper portion 3 has a generally annular configuration surrounding a circular central aperture 2. The upper surface of the upper portion 3 has a generally convex configuration such that such that in use the outer edge may lie substantially flush with the surface of the bath, basin or other installation to which it is fitted. The upper surface of the plug body is provided with an attachment point 14 to which a conventional plug chain may be attached. The lower portion 4 of the plug body 1 also has a generally annular configuration surrounding the central aperture 2 such that when the valve is opened

water may flow through the overflow preventer and through the drain hole.

The overflow preventer further includes an internal member 5 located within the space defined by the the upper portion 3 and the lower portion 4 of the plug body 1. The internal member 5 is formed from a durable, flexible material such as a rubberised polymer. The upper surface of the internal member 5 is substantially circular and has a diameter larger than that of the central aperture 2 on the upper surface 3 of the plug body 1. The edges of the internal member are rounded such that they form a lip 6 which extends downwardly into the plug body 1. The lip 6 defines a channel in the internal member 5. A projection 7, in the form of a generally cylindrical member, extends along the central axis of the internal member 5, substantially along the length of the channel.

The internal member 5 is resiliently biased into watertight sealing abutment with the inner periphery 8 of the annulus of the upper portion 3 by the combination of an interference fit between the internal member 5 and an internal boss 9 extending from the inner wall of the plug body 1, and a biasing force exerted upon the underside of the internal member 5 by a helical compression spring 13. Approximately 30% of the biasing force is created by the interference fit and approximately 70% is created by the spring 13. The internal boss 9, in the form of an annular member supported by four radially extending supports (not shown), extends inwards from the inner wall of the upper portion 3 of the plug body 1 and defines a central aperture having a diameter smaller than that of the internal member 5 such that an interference fit is created between the outer edge of the internal member 5 inner periphery of the internal boss 9. The strength of the interference fit between the internal member 5 and the internal boss 9 may be varied by varying the diameter of the aperture defined by the internal boss 9 and/or by varying the flexibility of the internal member 5. The more flexible and easily deformed then the less force will be required to force the internal member 5 through the internal boss 9. Conversely, a more rigid internal member 5 will require a greater force to force it through the internal boss 9.

In the first, or closed, position the internal member 5 is located between the internal boss 9 and the upper surface of the upper portion 3 such that a watertight seal is achieved between

the internal member 5 and the inner periphery 8 of the annulus of the upper portion 3. In order for this to occur the vertical distance between the inner periphery 8 of the annulus of the upper portion 3 and the inner periphery of the annulus of the internal boss 9 is slightly less then the thickness of the internal member 5.

The lower portion 4 of the plug body 1 has a cross member 10 extending from the inner wall of the lower portion 4 and traversing the central aperture 2. The branches 11 of the cross member 10 define four segments through which water may flow in use. The branches 11 although traversing the central aperture 2 are sufficiently thin that the flow of water is not impeded.

A tubular guide member 12 extends vertically upwards from the centre point of the cross member 10 such that in use at least a portion of the projection 7 on the internal member 5 is located within the tubular guide member 12.

The helical compression spring 13 is located within the tubular guide member 12 between the cross member 10, at its lower end, and the internal member 5, at its upper end. The spring 13 is substantially longer than the tubular guide member 12 such that it extends out of the upper end of said guide member 12 and is in contact with the underside of the internal member 5.

Referring now to Figs. 4 and 5, these show a second embodiment of an overflow preventer. The general construction of the overflow preventer is the same as that of the overflow preventer shown in Figs. 1-3.

The overflow preventer comprises a plug body formed from an upper portion 3 and a lower portion 4 which are releasably coupled together. As can best be seen in Fig. 5, the lower portion 4 has a pronounced rim 20 around its periphery which is received in a groove 21 in the upper portion 3. This provides a "snap-fit" interaction between the upper portion 3 and the lower portion 4 which prevents them from coming apart when being removed from the drain hole, even under vacuum. A sealing rib 28 is provided on the underside face of the lower portion 4. This improves the seal with the drain hole and allows sealing with non-standard

waste outlets.

The main difference between the first and second embodiments is the shape of the internal member 5 and the fact that the interference is provided by projections on the lower portion 4 of the plug body rather than the upper portion 3.

The internal member 5 is flatter and resembles and operates more like a washer seal, deforming under force from the interference below, up against the underside of the top portion 3 around the periphery of the central aperture 2. The upper surface of the internal member 5 has a raised central circular portion surrounded by an annular skirt. The internal member 5 may be formed as a one or two piece construction and the raised central portion and annular skirt may be formed from the same or different materials. A central tubular stalk 22 depends downwardly from the underside of the internal member 5. The outer surface of the stalk 22 is provided with an annular ridge 23.

The lower portion 4 of the plug body 1 has a cross member 10 extending from the inner wall of the lower portion 4 and traversing the central aperture 2. The branches 11 of the cross member 10 define four segments through which water may flow in use. The branches 11 although traversing the central aperture are sufficiently thin that the flow of water is not impeded. A guide member 24 extends vertically upwardly from the cross member 10. The guide member 24 is in the form of two concentric substantially tubular projections, an inner projection 25 and an outer projection 26, which define a passageway therebetween. The outer projection 26 is provided with an interference boss 27 in the form of a plurality of interference knibs extending into the passageway defined by the inner 25 and outer 26 projections.

The stalk 22 of the internal member 5 is located within the passageway 27 such that, in the first position, the annular ridge 23 rests on the interference boss 27 as shown in Fig. 5. The internal member is resiliently biased into watertight sealing abutment with the inner periphery of the annulus of the upper portion 3 by the combination of an interference fit between the annular ridge 23 and the internal boss 27 and a biasing force exerted upon the underside of

the internal member 5 by a helical compression spring 13 (not shown in Fig. 5). The helical compression spring 13 is located within the inner tubular projection 25 between the cross member 10, at its lower end, and the internal member 5, at its upper end.

Referring now to Figs. 1-5, the operation of the overflow preventers will be explained. Although the construction of the overflow preventers is slightly different, the general concept is the same and the operation will be described with reference to both embodiments. When the overflow preventer is fitted into a drain hole, the internal member 5 may take up one of two positions within the plug body 1: a first position, in which the central aperture 2 is closed and a second position, in which the central aperture 2 is open to allow the flow of water through the plug body 1. The internal member 5 is biased into the first position by the combination of the interference fit between the internal member 5 and an internal boss 9, 27 and the force exerted on the underside of the internal member 5 by the compression spring 13. In the first embodiment the interference fit is between the outer edge of the internal member 5 and the internal boss 9 and in the second embodiment the interference fit is between the annular ridge 23 on the stalk 22 of the internal member 5 and an interference boss 27 on the guide member 24. Although in both cases it is the interference fit and the spring 13 which are responsible for resiliently biasing the internal member 5 into the closed position it is only once the interference fit has been broken that the valve is open. Consequently, the interaction between the internal members 5 internal bosses 9, 27 acts as a "trigger" for the operation of the overflow preventer allowing the overflow to be either fully closed or fully open, thus overcoming the problems of incremental valve opening associated with conventional overflow preventers in which the only biasing force is a helical spring.

As the hydrostatic pressure on the upper surface of the internal member 5 increases, due to the filling of the installation into which the overflow preventer is fitted, the force exerted by the internal member 5 at the point of interference increases. When the water pressure reaches a certain predetermined value the interference is broken and the internal member 5 is pushed through the internal boss 9, 27. The valve is now open and water is able to drain out of the installation through the central aperture 2. The rate of water flow through the overflow preventers and out the drain is equal to the normal flow of water through the drain.

In the case of the first embodiment, when the interference fit between the internal member 5 and the internal boss 9 is broken the internal member 5 is pushed downwards into the plug body 1. The spring 13 is compressed and water is allowed to flow through the aperture 2 and out the drain hole.

In the case of the second embodiment, when the interference fit between the annular ridge 23 on the stalk 22 of the internal member 5 and the interference boss 27 on the guide member 24 is broken the internal member 5 is pushed downwards into the plug body 1. The stalk 22 of the internal member 5 moves along the passageway defined by the inner 25 and outer 26 projections of the guide member 24 enabling the internal member 5 to compress the spring 13. Water is able to flow through the aperture 2 and out the drain hole as before.

Since the hydrostatic pressure at which the overflow preventer operates is determined by both the interference fit and the strength of the spring 13 it is possible to vary the pressures at which the valve opens by changing either one of these.

When the internal member 5 is forced through the internal boss 9, 27 and into the second position the force exerted on the underside of the internal member 5 by the spring 13 increases. The spring is biased such that when the hydrostatic pressure acting on the upper surface of the internal member 5 returns below the predetermined value the force of the spring 13 is sufficient to force the internal member 5 back through the internal boss 9, 27 and back into a watertight sealing abutment with the inner periphery 8 of the annulus of the upper portion 3.

The interference fit of the internal member 5 with the sealing boss 9, 27 and the return mechanism provided by the spring 13 work as a "trigger" allowing water to escape instantaneously when the hydrostatic pressure exceeds the predetermined value and preventing a gradual loss of water or loss through leakage. This also prevents water escaping with body movement that creates "waving" of the water and thus fluctuations in the head of water.

The mechanism operates passively and continuously, requiring no user intervention, opening and closing until the water supply is stopped.

CLAIMS

1. An overflow preventer comprising:

a) a plug body receivable into, and fully removable from, a drain hole, the plug body having a generally annular configuration surrounding an aperture; and

b) a internal member associated with the plug body and movable between a first position in which the aperture is closed and a second position in which the aperture is open to allow fluid to drain through the aperture, the internal member being resiliently biased to the first position, when the hydrostatic pressure acting on it in use is less than a predetermined value, by an interference fit with at least one projection on an internal surface of the plug body, the internal member having an upper surface against which hydrostatic pressure bears in use, said surface being adapted for sealing abutment against a cooperating portion of the plug body surrounding the aperture in said first, closed position.

2. An overflow preventer according to claim 1, further comprising a return mechanism arranged to bear against the underside of the internal member when in the second position and biased to return the internal member to the first position when the hydrostatic pressure acting on the surface of the internal member in use drops below a predetermined value.

3. An overflow preventer according to claim 2, wherein the return mechanism comprises a spring.

4. An overflow preventer according to claim 3, wherein the spring is a helical compression spring.

5. An overflow preventer according to claim 3 or claim 4, wherein the spring exerts a biasing force on the internal member when it is in the first position.

6. An overflow preventer according to any preceding claim, wherein the plug body and the internal member are arranged such that the internal member extends substantially

unshielded across the entire aperture of the plug body.

7. An overflow preventer according to any preceding claim, wherein the internal member is made from a flexible material.

8. An overflow preventer according to claim 7, wherein the flexible material is a rubberised polymer.

9. An overflow preventer according to any preceding claim, wherein the internal member is resiliently biased to the first position by an interference fit with a substantially annular projection extending form an internal surface of the plug body.

10. An overflow preventer according to any preceding claim, wherein the upper surface of the internal member is convex.

11. An overflow preventer according to any preceding claim, wherein the drain hole into which the overflow preventer is fitted forms part of a pop-up waste system.

12. An overflow preventer according to claim 11, wherein the pop-up waste system comprises means for moving the overflow preventer between a first position in which it is engaged with the drain hole and a second position in which is lifted clear of said drain hole.

13. An overflow preventer according to any preceding claim, wherein the upper surface of the plug body is provided with an attachment point to which a conventional plug chain may be attached.

14. An overflow preventer according to any preceding claim, wherein the plug body is formed from an upper and a lower portion coupled together.

15. An overflow preventer according to claim 14, wherein the upper and lower portions are coupled together by means of a snap fit connection.

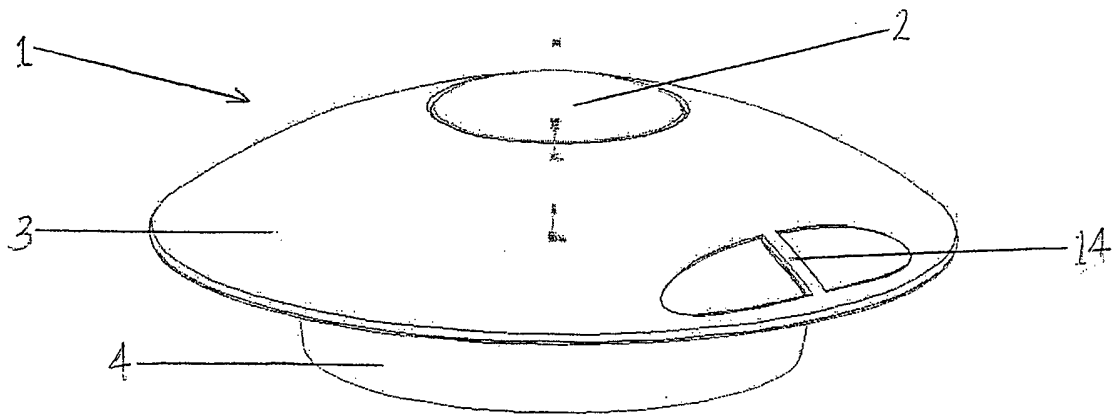

Fig. 1

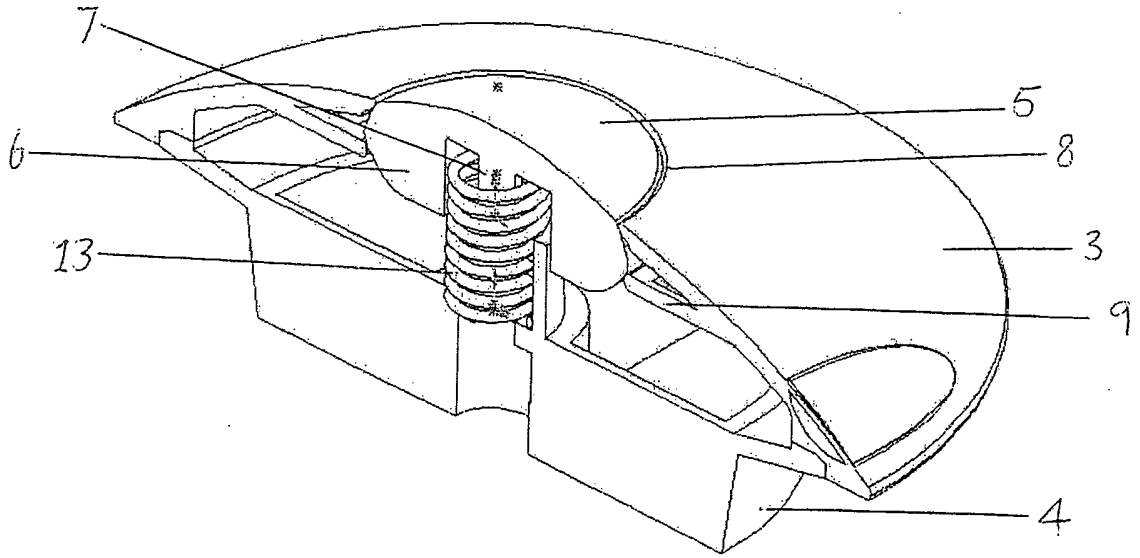

Fig. 2

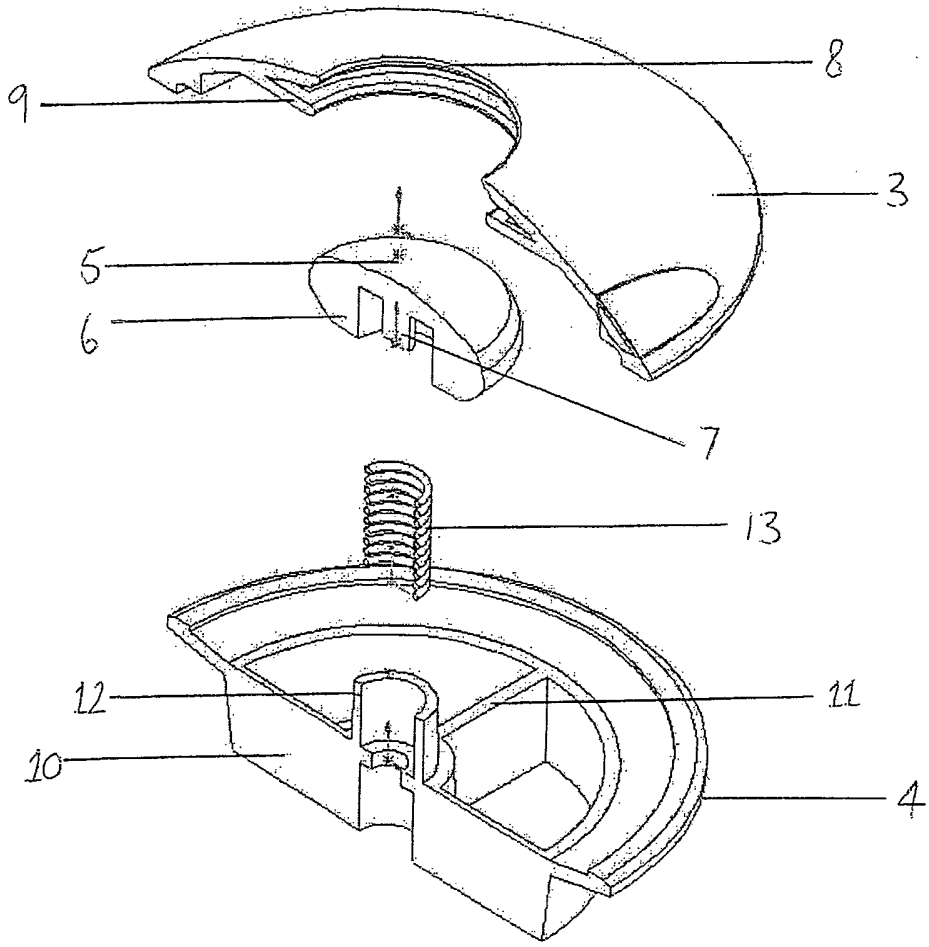

Fig. 3

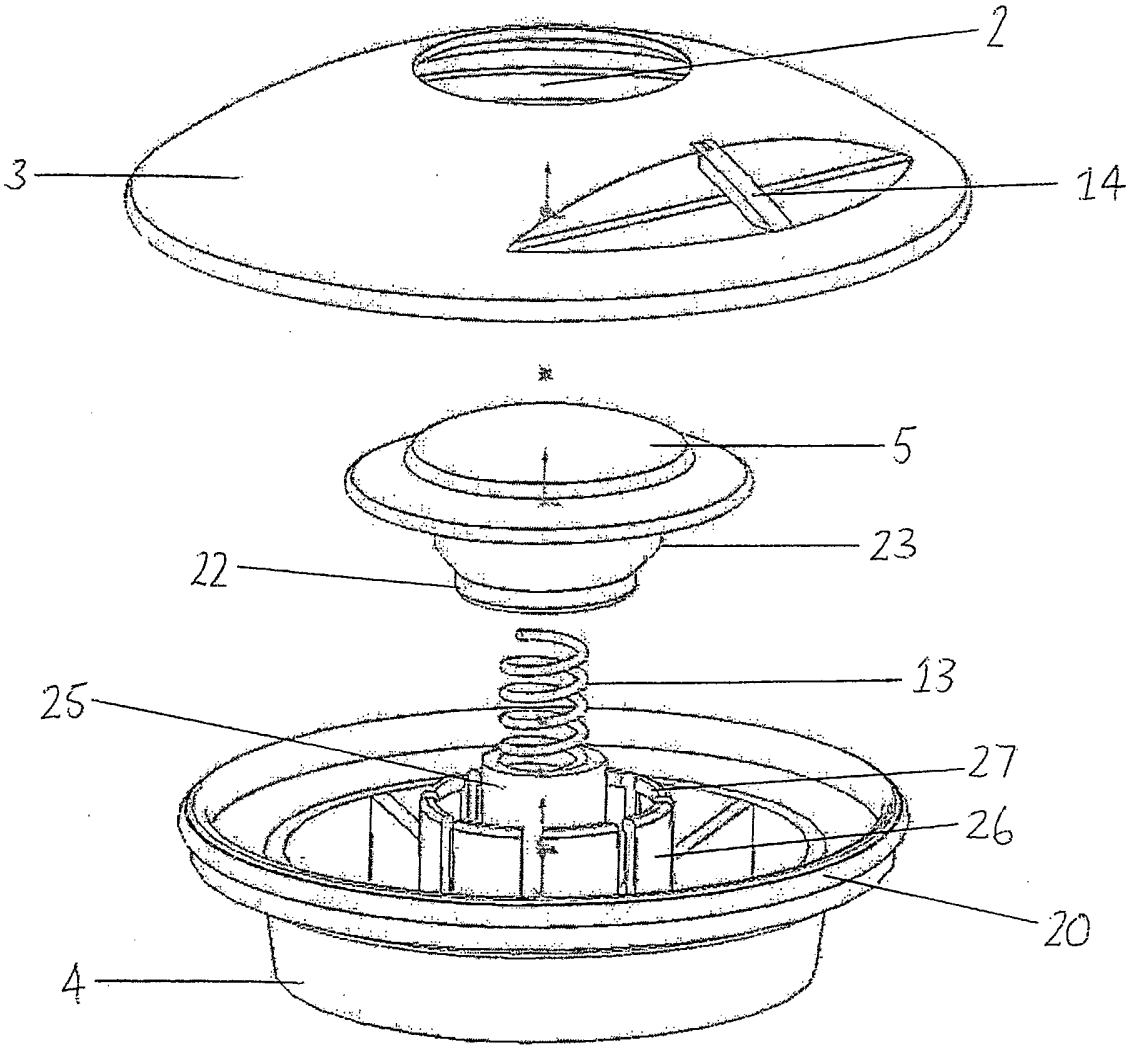

Fig. 4

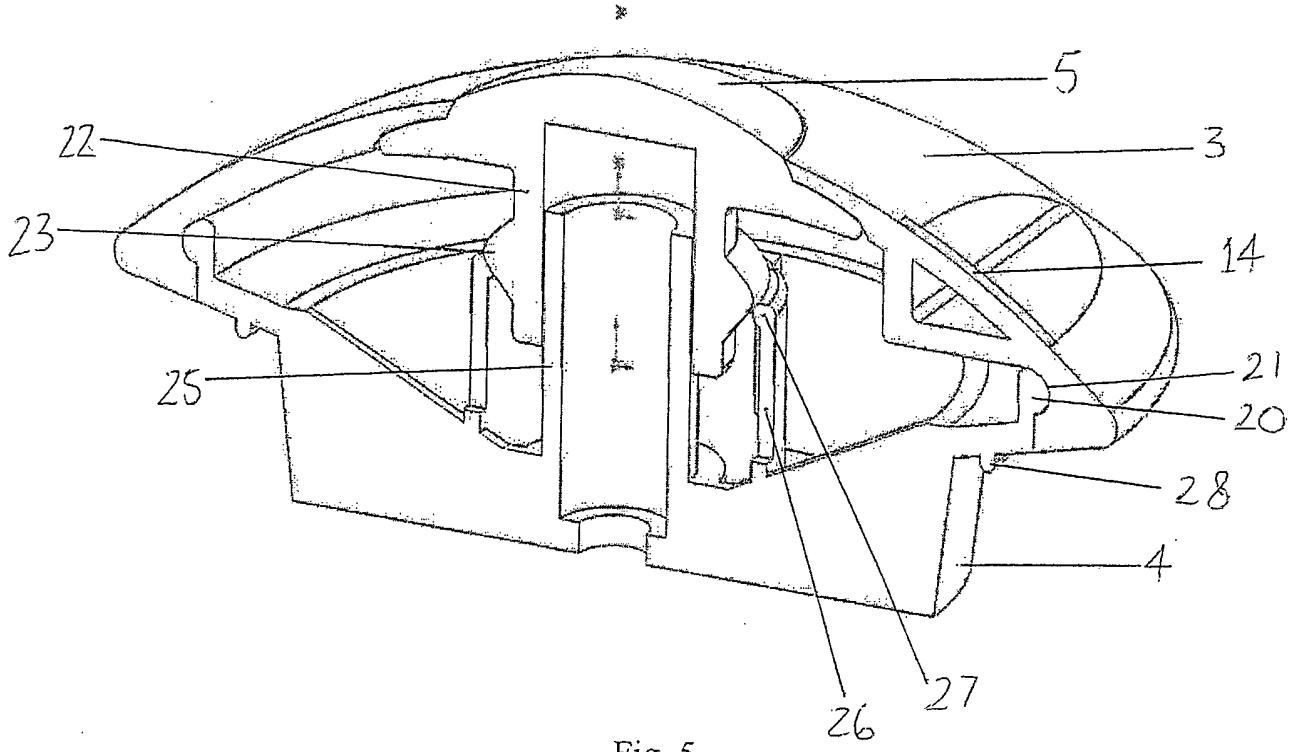

Fig. 5

INTERNATIONAL SEARCH REPORT

Internat[redacted]l Application No
PCT/GB 03/02343

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E03C1/242 A47K1/14 B65D90/26 F16K17/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E03C A47K B65D F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	AU 700 030 B (SMARTPLUG PTY LTD) 17 December 1998 (1998-12-17) cited in the application figures 2-4 ---	1-6, 13-15
A	GB 2 338 184 A (FORBES MARK CHARLES) 15 December 1999 (1999-12-15) cited in the application figures ---	1-6,10, 13-15
A	US 5 822 812 A (WORTHINGTON ALBERT EDWARD ET AL) 20 October 1998 (1998-10-20) abstract; figure 1 ---	11,12

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[X] Further documents are listed in the continuation of box C.

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20 August 2003	29/08/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Isailovski, M

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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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